Motives to Virtue.

good minds, and some traces of which are found in the lowest, are seldom united with proportioned means or opportunities of exercising them: so that the *moral* spring, the noble energies and impulses of the mind, can hardly find proper scope even in the most fortunate condition; but are much depressed in some, and almost entirely restrained in the generality, by the numerous clogs of an indigent, sickly, or embarrassed life. Were such mighty powers, such godlike affections, planted in the human breast to be folded up in the narrow womb of our present existence, never to be produced into a more *perfect* life, nor to expatiate in the ample career of immortality?

236 Unsatisfied desires of existence and happiness.

Let it be considered, at the same time, that no possession, no enjoyment, within the round of mortal things, is commensurate to the desires, or adequate to the capacities, of the mind. The most exalted condition has its abatements; the happiest conjuncture of fortune leaves many wishes behind; and, after the highest gratifications, the mind is carried forward in pursuit of new ones without end. Add to all, the fond *desire* of *immortality*, the secret *dread* of *non-existence*, and the high unremitting *pulse* of the soul beating for *perfection*, joined to the improbability or the impossibility of attaining it *here*; and then judge whether this elaborate structure, this magnificent apparatus of inward powers and organs, does not plainly point out an *hereafter, and intimate eternity to man?* Does nature give the finishing touches to the lesser and ignoble instances of her skill, and raise every other creature to the maturity and perfection of his being; and shall she leave her principal workmanship unfinished? Does she carry the *vegetative* and *animal* life in *man* to their full vigour and highest destination; and shall she suffer his *intellectual*, his *moral*, his *divine* life, to fade away, and be for ever extinguished? Would such abortions in the *moral* world be congruous to that *perfection of wisdom and goodness* which upholds and adorns the *natural?*

237 Therefore man immortal.

We must therefore conclude from this detail, that the *present state*, even at its best, is only the WOMB of man's being, in which the noblest principles of his nature are in a manner fettered, or secluded from a correspondent sphere of action; and therefore destined for a future and unbounded state, where they shall emancipate themselves, and exert the fulness of their strength. The most accomplished mortal, in this low and dark apartment of nature, is only the *rudiments* of what he shall be when he takes his ethereal flight, and puts on immortality. Without a reference to that state, *man* were a mere abortion, a rude unfinished embryo, a monster in nature. But this being once supposed, he still maintains his rank of the masterpiece of the creation; his latent powers are all suitable to the *harmony* and *progression* of nature; his noble aspirations, and the pains of his dissolution, are his efforts towards a *second* birth, the pangs of his delivery into light, liberty, and perfection; and *death*, his discharge from gaol, his separation from his fellow prisoners, and introduction into the assembly of those heroic spirits who are gone before him, and of their great eternal Parent. The fetters of his mortal coil being loosened, and his prison walls broke down, he will be bare and open on every side to the admission of *truth* and *virtue*, and their fair attendant *happiness;* every *vital* and *intellectual* spring will evolve itself with a divine elasticity in the free air of heaven. He will not then peep at the universe and its glorious Author through a dark grate or a gross medium, nor receive the reflections of his glory through the strait openings of sensible organs: but will be *all eye, all ear, all ethereal and divine feeling* *. Let one part, however, of the analogy be attended to: That as in the womb we receive our original constitution, form, and the essential *stamina* of our being, which we carry along with us into the light, and which greatly affect the succeeding periods of our life; so our temper and condition in the *future* life will depend on the conduct we have observed, and the character we have formed, in the *present* life. We are *here* in *miniature* what we shall be at *full length hereafter*. The first *rude sketch* or *outlines* of *reason* and *virtue* must be drawn at present, to be afterwards enlarged to the *stature* and *beauty* of angels.

From the Immortality of the Soul.

* *Vide* Religion of Nature, § 9.

238 Immortality a guard and incentive to virtue.

This, if duly attended to, must prove not only a *guard*, but an admirable *incentive* to virtue. For he who faithfully and ardently follows the light of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that pursuit by a full conviction that the scene does not close with life—that his struggles, arising from the weakness of nature and the strength of habit, will be turned into triumphs—that his career in the track of wisdom and goodness will be both swifter and smoother—and those generous ardours with which he glows towards *heaven*, i. e. the *perfection* and *immortality of virtue*, will find their adequate object and exercise in a sphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpressible damp must it be to the good man, to dread the total extinction of that *light* and *virtue*, without which *life*, nay, *immortality* itself, were not worth a single wish?

239 Proof from the inequality of present distributions.

Many writers draw their proofs of the immortality of the soul, and of a future state of rewards and punishments, from the unequal distribution of these here. It cannot be dissembled that wicked men often escape the *outward* punishment due to their crimes, and do not feel the *inward* in that measure their demerit seems to require, partly from the callousness induced upon their nature by the habits of vice, and partly from the dissipation of their minds abroad by pleasure or business—and sometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeseen or unavoidable calamities in which they are involved. To the smallest reflection, however, it is obvious, that the natural tendency of virtue is to produce happiness; that if it were universally practised, it would, in fact, produce the greatest sum of happiness of which human nature is capable; and that this tendency is defeated only by numerous individuals, who, forsaking the laws of virtue, injure and oppress those who steadily adhere to them. But the natural tendency of virtue is the result of that constitution of things which was established by God at the creation of the world. This being the case, we must either conclude, that there will be a future state, in which all the moral obliquities of the present shall be made straight; or else admit, that the designs of infinite wisdom, goodness, and power, can be finally defeated by the perverse conduct of human weakness.—But this last supposition is so extravagantly absurd, that

Motives to Virtue.

that the reality of a future ſtate, the only other poſſible alternative, may be pronounced to have the evidence of perfect demonſtration.

240 Belief of immortality, &c. a great ſupport amidſt trials.

Virtue has preſent rewards, and *vice* preſent puniſhments annexed to it; ſuch rewards and puniſhments as make *virtue*, in moſt caſes that happen, far more eligible than *vice*: but, in the infinite variety of human contingencies, it may ſometimes fall out, that the inflexible practice of virtue ſhall deprive a man of conſiderable advantages to himſelf, his family, or friends, which he might gain by a well-timed piece of roguery; ſuppoſe by betraying his truſt, voting againſt his conſcience, ſelling his country, or any other crime where the ſecurity againſt diſcovery ſhall heighten the temptation. Or, it may happen, that a ſtrict adherence to his honour, to his religion, to the cauſe of liberty and virtue, ſhall expoſe him, or his family, to the loſs of every thing, nay, to poverty, ſlavery, death itſelf, or to torments far more intolerable. Now what ſhall ſecure a man's virtue in circumſtances of ſuch trial? What ſhall enforce the obligations of conſcience againſt the allurements of ſo many intereſts, the dread of ſo many and ſo terrible evils, and the almoſt unſurmountable averſion of human nature to exceſſive pain! The conflict is the greater, when the circumſtances of the crime are ſuch as eaſily admit a variety of alleviations from *neceſſity*, *natural affection*, *love to one's family* or *friends*, perhaps in indigence: theſe will give it even the air of virtue. Add to all, that the crime may be thought to have few bad conſequences,—may be eaſily concealed,—or imagined poſſible to be retrieved in a good meaſure by future good conduct. It is obvious to which ſide moſt men will lean in ſuch a caſe; and how much need there is of a balance in the oppoſite ſcale, from the conſideration of a *God*, of a *Providence*, and of an *immortal ſtate of retribution*, to keep the mind firm and uncorrupted in thoſe or like inſtances of ſingular trial or diſtreſs.

241 In the general courſe of life.

But without ſuppoſing ſuch peculiar inſtances, a ſenſe of a governing Mind, and a perſuaſion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards ſuitable to its nature, vaſt in themſelves, and immortal in their duration, muſt be not only a mighty ſupport and incentive to the practice of virtue, but a ſtrong barrier againſt vice. The thoughts of an Almighty Judge, and of an impartial future reckoning, are often alarming, inexpreſſibly ſo, even to the ſtouteſt offenders. On the other hand, how ſupporting muſt it be to the good man, to think that he acts under the eye of his friend, as well as judge! How improving, to conſider the *preſent ſtate* as connected with a *future* one, and every relation in which he ſtands as a *ſchool* of *diſcipline* for his *affections*; every *trial* as the *exerciſe* of ſome *virtue*; and the virtuous deeds which reſult from both, as introductory to higher ſcenes of *action* and *enjoyment*! Finally, How tranſporting is it to view *death* as his *diſcharge* from the *warfare* of *mortality*, and a triumphant *entry* into a ſtate of freedom, ſecurity, and perfection, in which knowledge and wiſdom ſhall break upon him from every quarter; where each faculty ſhall have its proper object: and his virtue, which was often damped or defeated here, ſhall be enthroned in undiſturbed and eternal empire?

From the Immortality of the Soul.

242 Advantages of the Chriſtian ſcheme, and its connexion with natural religion or morality.

On reviewing this ſhort *ſyſtem* of *morals*, and the *motives* which ſupport and enforce it, and comparing both with the CHRISTIAN *ſcheme*, what *light* and *vigour* do they borrow from thence! How clearly and fully does CHRISTIANITY lay open the *connexions* of our nature, both *material* and *immaterial*, and *future* as well as *preſent*! What an ample and beautiful detail does it preſent of the *duties* we owe to *God*, to *ſociety*, and *ourſelves*, promulgated in the moſt ſimple, intelligible, and popular manner; diveſted of every partiality of ſect or nation; and adapted to the general ſtate of mankind! With what bright and alluring *examples* does it illuſtrate and recommend the practice of thoſe duties: and with what mighty *ſanctions* does it enforce that practice! How ſtrongly does it deſcribe the *corruptions* of our nature; the *deviations* of our life from the *rule* of *duty*, and the *cauſes* of both! How marvellous and benevolent a plan of *redemption* does it unfold, by which thoſe corruptions may be remedied, and our *nature* reſtored from its *deviations* to tranſcendent heights of *virtue* and *piety*! Finally, What a fair and comprehenſive proſpect does it give us of the *adminiſtration* of *God*, of which it repreſents the *preſent ſtate* only as a *ſmall period*, and a *period* of *warfare* and *trial*! How ſolemn and unbounded are the ſcenes which it opens beyond it! the *reſurrection* of the *dead*, the *general judgement*, the *equal diſtribution* of *rewards* and *puniſhments* to the *good* and the *bad*; and the full *completion* of *divine wiſdom* and *goodneſs* in the *final eſtabliſhment* of *order*, *perfection*, and *happineſs*! How glorious then is that SCHEME of RELIGION, and how worthy of *affection* as well as of *admiration*, which, by making ſuch *diſcoveries*, and affording ſuch *aſſiſtances*, has diſcloſed the unfading fruits and triumphs of VIRTUE, and ſecured its intereſts beyond the power of TIME and CHANCE.

Moral || Moraſs.

MORAL Senſe, that whereby we perceive what is good, virtuous, and beautiful, in actions, manners, and characters. See *MORAL Philoſophy*.

MORALITY. See *MORAL Philoſophy*.

MORANT-Point, the moſt eaſterly point or promontory of the iſland of Jamaica, in America. W. Long. 75. 56. N. Lat. 17. 56.

MORASS, a marſh, fen, or low moiſt ground, which receives the waters from above without having any deſcent to carry them off again. Somner derives the word from the Saxon *merſe*, "lake;" Salmaſius from *mare*, "a collection of waters;" others from the German *maraſt*, "a muddy place;" and others from *mareſc*, of *maricetum*, *à mariſcis*, i. e. ruſhes. See DRAINING, AGRICULTURE *Index*.

In Scotland, Ireland, and the north of England, they have a peculiar kind of moraſſes called *moſſes* or *peat-moſſes*, whence the country people dig their peat or turf for firing. See MOSS.

Morat.

MORAT, or MURTEN, a conſiderable town of Switzerland, Morat, Morata. Switzerland, capital of a bailiwick of the ſame name, belonging to the cantons of Bern and Friburg. It is ſeated on the lake Morat, on the road from Avenche to Bern, 10 miles weſt of Bern and 10 miles north-eaſt of Friburg. The lake is about ſix miles long and two broad, and the country about it pleaſant and well cultivated. The lakes of Morat and Neufchatel are parallel to each other, but the latter is more elevated, diſcharging itſelf by means of the river Broye into the lake of Neufchatel. According to M. de Luc, the former is 15 French feet above the level of Neufchatel lake; and both theſe lakes, as well as that of Bienne, ſeem formerly to have extended conſiderably beyond their preſent limits, and from the poſition of the country appear to have been once united. Formerly the large fiſh named *ſilurus glanis*, or the ſaluth, frequented theſe lakes, but has not been caught in them for a long time paſt. The envirous of this town and lake were carefully examined by Mr Coxe, during his reſidence in Switzerland, who made ſeveral excurſions acroſs the lake to a ridge of hills ſituated betwixt it and Neufchatel. Here are many delightful proſpects; particularly one from the top of Mount Vuilly, which, he ſays, is perhaps the only central ſpot from which the eye can at once comprehend the vaſt amphitheatre formed on one ſide by the Jura ſtretching from the environs of Geneva as far as Baſle, and, on the other, by that ſtupendous chain of ſnowy Alps which extend from the frontiers of Italy to the confines of Germany, and is loſt at each extremity in the horizon. Morat is celebrated for the obſtinate defence it made againſt Charles the Bold, duke of Burgundy, and for the battle which afterwards followed on the 22d of June 1476, where the duke was defeated, and his army almoſt entirely deſtroyed *. Not far from the town, and adjoining to the high road, there ſtill remains a monument of this victory. It is a ſquare building, filled with the bones of Burgundian ſoldiers who were ſlain at the ſiege and in the battle; the number of which appears to have been very conſiderable. There are ſeveral inſcriptions in the Latin and German languages commemorating the victory.

* See *Hiſtory of France*.

MORATA, Olympia Fulvia, an Italian lady, diſtinguiſhed for her learning, was born at Ferrara, in 1526. Her father, after teaching the belles lettres in ſeveral cities of Italy, was made preceptor to the two young princes of Ferrara, the ſons of Alphonſus I. The uncommon abilities he diſcovered in his daughter determined him to give her all the advantages of education. Meanwhile the princeſs of Ferrara ſtudying polite literature, it was judged expedient that ſhe ſhould have a companion in the ſame purſuit; and Morata being called, ſhe was heard by the aſtoniſhed courtiers to declaim in Latin, to ſpeak Greek, and to explain the paradoxes of Cicero. Her father dying, ſhe was obliged to return home to take upon her the management of family affairs, and the education of her brother and three ſiſters; both which ſhe executed with the greateſt diligence and ſucceſs. In the mean time Andrew Grunthler, a young German phyſician, who had married her, and with him ſhe went to Germany, taking her brother along with her, whom ſhe inſtructed in the Latin and Greek tongues; and after ſtaying a ſhort time at Augſburg, went to Schweinfort in Franconia, where her huſband was born: but they had not been there long before that town was unhappily beſieged and burnt; however, eſcaping the flames, they fled in the utmoſt diſtreſs to Hammelburg. This place they were alſo obliged to quit, and were reduced to the laſt extremities, when the elector Palatine invited Grunthler to be profeſſor of phyſic at Heidelberg. He entered on his new office in 1554; but they no ſooner began to taſte the ſweets of repoſe, than a diſeaſe, occaſioned by the diſtreſſes and hardſhips they had ſuffered, ſeized upon Morata, who died in 1555, in the 29th year of her age; and her huſband and brother did not long ſurvive her. She compoſed ſeveral works, great part of which were burnt with the town of Schweinfort; the remainder, which conſiſt of orations, dialogues, letters, and tranſlations, were collected and publiſhed under the title of *Olympiæ Fulviæ Moratæ, fœminæ doctiſſimæ, et planè divinæ, opera omnia quæ hactenus inveniri potuerint; quibus Cælii ſecundi curionis epiſtolæ ac orationes acceſſerunt.*

MORAVIA, a river of Turkey in Europe, which riſes in Bulgaria, runs north through Servia by Niſſa, and falls into the Danube at Semendria, to the eaſtward of Belgrade.

Moravia. Moravia, a marquiſate of Germany, derives the name of *Mahern*, as it is called by the Germans, and of *Morawa*, as it is called by the natives, from the river of that name, which riſes in the mountains of the county of Glatz, and paſſes through the middle of it. It is bounded to the ſouth by Auſtria, to the north by Glatz and Sileſia, to the weſt by Bohemia, and to the eaſt by Sileſia and Hungary; being about 120 miles in length and 100 in breadth.

A great part of this country is overrun with woods and mountains, where the air is very cold, but much wholeſomer than in the low grounds, which are full of bogs and lakes. The mountains, in general, are barren; but the more champaign parts tolerably fertile, yielding corn, with plenty of hemp and flax, good ſaffron, and paſture. Nor is it altogether deſtitute of wine, red and white, fruits, and garden ſtuff. Moravia alſo abounds in horſes, black cattle, ſheep, and goats. In the woods and about the lakes there is plenty of wild fowl, game, veniſon, bees, honey, hares, foxes, wolves, beavers, &c. This country affords marble, alum, iron, ſulphur, ſaltpetre, and vitriol, with mineral waters, and warm ſprings; but ſalt is imported. Its rivers, of which the March, Morawa, or Morau, are the chief, abound with trout, crayfiſh, barbels, eels, perch, and many other ſorts of fiſh.

The language of the inhabitants is a dialect of the Sclavonic, differing little from the Bohemian; but the nobility and citizens ſpeak German and French.

Moravia was anciently inhabited by the Quadi, who were driven out by the Sclavi. Its kings, who were once powerful and independent, afterwards became dependent on, and tributary to, the German emperors and kings. At laſt, in the year 908, the Moravian kingdom was parcelled out among the Germans, Poles, and Hungarians. In 1086, that part of it properly called *Moravia* was declared a marquiſate by the German king Henry IV. and united with Bohemia, to whoſe dukes and kings it hath ever ſince been ſubject. Though it is not very populous, it contains about 42 greater or walled towns, 17 ſmaller or open towns, and 198 market towns, beſides villages, &c. The ſtates of the country conſiſt of the clergy, lords, knights, and burgeſſes; and the diets, when ſummoned by the regency, are held at Brunn. The marquiſate is ſtill governed by its own peculiar conſtitutions, under the *directorium in publicis et cameralibus*, and the ſupreme judicatory at Vienna. It is divided into ſix circles, each of which has its captain, and contributes to its ſovereign about one third of what is exacted of Bohemia. Towards the expences of the military eſtabliſhment of the whole Auſtrian hereditary countries, its yearly quota is 1,856,490 florins. Seven regiments of foot, one of cuiraſſiers, and one of dragoons, are uſually quartered in it.

Chriſtianity was introduced into this country in the 9th century; and the inhabitants continued attached to the church of Rome till the 15th, when they eſpouſed the doctrine of John Huſs, and threw off Popery: but after the defeat of the elector Palatine, whom they had choſen king, as well as the Bohemians, the emperor Ferdinand II. re-eſtabliſhed Popery; though there are ſtill ſome Proteſtants in Moravia. The biſhop of Olmutz, who ſtands immediately under the pope, is at the head of the eccleſiaſtics in this country. The ſupreme eccleſiaſtical juriſdiction, under the biſhop, is veſted in a conſiſtory.

The commerce of this country is inconſiderable. Of what they have, Brunn enjoys the principal part. At Iglau and Trebitx are manufactures of cloth, paper, gunpowder, &c. There are alſo ſome iron works and glaſs houſes in the country.

The inhabitants of Moravia in general are open-hearted, not eaſy to be provoked or pacified, obedient to their maſters, and true to their promiſes; but credulous of old prophecies, and much addicted to drinking, though neither ſuch ſots or bigots as they are repreſented by ſome geographers. The boors, indeed, upon the river Hank, are ſaid to be a thieviſh, unpoliſhed, brutal race. The ſciences now begin to lift up their heads a little among the Moravians, the univerſity of Olmutz having been put on a better footing; and a riding academy, with a learned ſociety, have been lately eſtabliſhed there.

MORAVIAN BRETHREN. See HERNHUTTERS, and UNITAS *Fratrum*.

MORAW, or MORAVA, a large river of Germany, which has its ſource on the confines of Bohemia and Sileſia. It croſſes all Moravia, where it waters Olmutz and Hradiſch, and receiving the Taya from the confines of Lower Hungary and Upper Auſtria, ſeparates theſe two countries as far as the Danube, into which it falls.

MORBID, among phyſicians, ſignifies "diſeaſed or corrupt;" a term applied either to an unſound conſtitution, or to thoſe parts or humours that are affected by a diſeaſe.

MORBUS COMITIALIS, a name given to the epilepſy; becauſe if on any day when the people were aſſembled in *comitia* upon public buſineſs, any perſon ſuddenly ſeized with this diſorder ſhould fall down, the aſſembly was diſſolved, and the buſineſs of the *comitia*, however important, was ſuſpended. See COMITIA.

Morbus Regius, the ſame with the JAUNDICE. See MEDICINE *Index*.

MORBUS, or *Diſeaſe*, in *Botany*. See VARIETAS.

MORDAUNT, CHARLES, earl of Peterborough, a celebrated commander both by ſea and land, was the ſon of John Lord Mordaunt Viſcount Avalon, and was born about the year 1658. In 1675 he ſucceeded his father in his honours and eſtate. While young he ſerved under the admirals Torrington and Narborough in the Mediterranean againſt the Algerines; and in 1680 embarked for Africa with the earl of Plymouth, and diſtinguiſhed himſelf at Tangier when it was beſieged by the Moors. In the reign of James II. he voted againſt the repeal of the teſt act; and diſliking the meaſures of the court, obtained leave to go to Holland to accept the command of a Dutch ſquadron in the Weſt Indies. He afterwards accompanied the prince of Orange into this kingdom; and upon his advancement to the throne, was ſworn of the privy-council, made one of the lords of the bedchamber to his majeſty, alſo firſt commiſſioner of the treaſury, and advanced to the dignity of earl of Monmouth. But in November 1690 he was diſmiſſed from his poſt in the treaſury. On the death of his uncle Henry earl of Peterborough in 1697, he ſucceeded to that title; and, upon the acceſſion of Queen Anne, was inveſted with the commiſſion of captain-general and governor of Jamaica. In 1705 he was ſworn of the privy-council; and the ſame year declared general and commander in chief of the forces ſent to Spain, and joint admiral of the fleet with Sir Cloudſley Shovel, of which the year following he had the ſole command. His taking Barcelona with a handful of men, and afterwards relieving it when greatly diſtreſſed by the enemy; his driving out of Spain the duke of Anjou, and the French army, which conſiſted of 25,000 men, though his own troops never amounted to 10,000; his gaining poſſeſſion of Catalonia, of the kingdoms of Valencia, Arragon, and the iſle of Majorca, with part of Murcia and Caſtile, and thereby giving the earl of Galway an opportunity of advancing to Madrid without a blow; are aſtoniſhing inſtances of his bravery and conduct. For theſe important ſervices his lordſhip was declared general in Spain by Charles III. afterwards emperor of Germany; and on his return to England he received the thanks of the houſe of lords. His lordſhip was afterwards employed in ſeveral embaſſies to foreign courts, inſtalled knight of the garter, and made governor of Minorca. In the reign of George I. he was general of all the marine forces in Great Britain, in which poſt he was continued by King George II. He died in his paſſage to Liſbon, where he was going for the recovery of his health, in 1735. His lordſhip was diſtinguiſhed by various ſhining qualities: for, to the greateſt perſonal courage and reſolution, he added all the arts and addreſs of a general; a lively and penetrating genius; and a great extent of knowledge upon almoſt every ſubject of importance within the compaſs of ancient and modern literature; hence his familar letters, inſerted among thoſe of his friend Mr Pope, are an ornament to that excellent collection.

MORDELLA, a genus of inſects of the coleoptera order. See ENTOMOLOGY *Index*.

MORE, SIR THOMAS, lord high chancellor of England, the ſon of Sir John More, knight, one of the judges of the King's Bench, was born in the year 1480,

in

More. in Milk-street London. He was first sent to a school at St Anthony's in Threadneedle street; and afterward introduced into the family of Cardinal Moreton, who in 1497 sent him to Canterbury college in Oxford. During his residence at the university he constantly attended the lectures of Linacre and Grocinus, on the Greek and Latin languages. Having in the space of about two years made considerable proficiency in academical learning, he came to New Inn in London, in order to study the law; whence, after some time, he removed to Lincoln's Inn, of which his father was a member. Notwithstanding his application to the law, however, being now about 20 years old, he was so bigotted to monkish discipline, that he wore a hair shirt next his skin, frequently fasted, and often slept on a bare plank. In the year 1503, being then a burgess in parliament, he distinguished himself in the house, in opposition to the motion for granting a subsidy and three fifteenths for the marriage of Henry VII.'s eldest daughter, Margaret, to the king of Scotland. The motion was rejected; and the king was so highly offended at this opposition from a beardless boy, that he revenged himself on Mr More's father, by sending him, on a frivolous pretence, to the Tower, and obliging him to pay 100l. for his liberty. Being now called to the bar, he was appointed law reader at Furnival's inn, which place he held about three years; but about this time he also read a public lecture in the church of St Lawrence, Old Jewry, upon St Austin's treatise *De civitate Dei*, with great applause. He had indeed formed a design of becoming a Franciscan friar, but was dissuaded from it; and, by the advice of Dr Colet, married Jane, the eldest daughter of John Colt, Esq. of Newhall in Essex. In 1508 he was appointed judge of the sheriff's court in the city of London, was made a justice of the peace, and became very eminent at the bar. In 1516 he went to Flanders in the retinue of Bishop Tonstal, and Dr Knight, who were sent by King Henry VIII. to renew the alliance with the archduke of Austria, afterwards Charles V. On his return, Cardinal Wolsey would have engaged Mr More in the service of the crown, and offered him a pension, which he refused. Nevertheless, it was not long before he accepted the place of master of the requests, was created a knight, admitted of the privy council, and in 1520 made treasurer of the exchequer. About this time he built a house on the bank of the Thames, at Chelsea, and married a second wife. This wife, whose name was *Middleton*, and a widow, was old, ill tempered, and covetous; nevertheless Erasmus says, he was as fond of her as if she were a young maid.

In the 14th year of Henry VIII. Sir Thomas More was made speaker of the house of commons: in which capacity he had the resolution to oppose the then powerful minister, Wolsey, in his demand of an oppressive subsidy; notwithstanding which, it was not long before he was made chancellor of the duchy of Lancaster, and was treated by the king with singular familiarity. The king having once dined with Sir Thomas at Chelsea, walked with him near an hour in the garden, with his arm round his neck. After he was gone, Mr Roper, Sir Thomas's son-in-law, observed how happy he was to be so familiarly treated by the king: to which Sir Thomas replied, "I thank our lord, son Roper, I find his grace my very good lord indeed, and believe he doth as singularly favour me as any subject within this realm: howbeit, I must tell thee, I have no cause to be proud thereof; for if my head would win him a castle in France, it would not fail to go off." From this anecdote at appears, that Sir Thomas knew his grace to be a villain.

In 1526 he was sent with Cardinal Wolsey and others, on a joint embassy to France, and in 1529 with Bishop Tonstal to Cambray. The king, it seems, was so well satisfied with his services on these occasions, that in the following year, Wolsey being disgraced, he made him chancellor; which seems the more extraordinary, when we are told that Sir Thomas had repeatedly declared his disapprobation of the king's divorce, on which the great *defensor fidei* was so positively bent. Having executed the office of chancellor about three years, with equal wisdom and integrity, he resigned the seals in 1533, probably to avoid the danger of his refusing to confirm the king's divorce. He now retired to his house at Chelsea; dismissed many of his servants; sent his children with their respective families to their own houses (for hitherto, he had, it seems, maintained all his children, with their families, in his own house, in the true style of an ancient patriarch; and spent his time in study and devotion: but the capricious tyrant would not suffer him to enjoy his tranquillity. Though now reduced to a private station, and even to indigence, his opinion of the legality of the king's marriage with Anne Boleyn was deemed of so much importance, that various means were tried to procure his approbation; but all persuasion proving ineffectual, he was, with some others, attainted in the house of lords of misprision of treason, for encouraging Elisabeth Barton, the nun of Kent, in her treasonable practices. His innocence in this affair appeared so clearly, that they were obliged to strike his name out of the bill. He was then accused of other crimes, but with the same effect; till, refusing to take the oath enjoined by the act of supremacy, he was committed to the Tower, and, after 15 months imprisonment, was tried at the bar of the King's Bench for high treason, in denying the king's supremacy. The proof rested on the sole evidence of Rich the solicitor general, whom Sir Thomas, in his defence, sufficiently discredited; nevertheless the jury brought him in guilty, and he was condemned to suffer as a traitor. The merciful Harry, however, indulged him with simple decollation; and he was accordingly beheaded on Tower hill, on the 5th of July 1535. His body, which was first interred in the Tower, was begged by his daughter Margaret, and deposited in the chancel of the church at Chelsea, where a monument, with an inscription written by himself, had been some time before erected. This monument with the inscription is still to be seen in that church. The same daughter, Margaret, also procured his head after it had remained 14 days upon London bridge, and placed it in a vault belonging to the Roper family, under a chapel adjoining to St Dunstan's church in Canterbury. Sir Thomas More was a man of some learning, and an upright judge; a very priest in religion, yet cheerful, and even affectedly witty

witty (A). He wanted not ſagacity, where religion was out of the queſtion; but in that his faculties were ſo enveloped, as to render him a weak and credulous enthuſiaſt. He left one ſon and three daughters; of whom Margaret, the eldeſt, was very remarkable for her knowledge of the Greek and Latin languages. She married a Mr Roper of Wellhall in Kent, whoſe life of Sir Thomas More was publiſhed by Mr Hearne at Oxford in 1716. Mrs Roper died in 1544; and was buried in the vault of St Dunſtan's in Canterbury, with her father's head in her arms.

Sir Thomas was the author of various works, though his *Utopia* is the only performance that has ſurvived in the eſteem of the world; owing to the reſt being chiefly of a polemic nature: his anſwer to Luther has only gained him the credit of having the beſt knack of any man in Europe, at calling bad names in good Latin. His Engliſh works were collected and publiſhed by order of Queen Mary, in 1557; his Latin, at Baſil, in 1563, and at Louvain, in 1566.

MOREA, formerly called the *Peloponneſus*, is a peninſula to the ſouth of Greece, to which it is joined by the iſthmus of Corinth. Its form reſembles a mulberry leaf, and its name is derived from the great number of mulberry trees which it produces. It is about 180 miles in length, and 130 in breadth. The air is temperate, and the land fertile, except in the middle, where it is full of mountains, and is watered by a great number of rivers. It is divided into three provinces; Scania, Belvedera, and Brazzo-di-Maina. It was taken from the Turks by the Venetians in 1687; but they loſt it again in 1715. The ſangiac of the Morea reſides at Modon. See GREECE and PELOPONNESUS.

MOREL, the name of ſeveral celebrated printers to the kings of France, who, like the Stephens, were alſo men of great learning.

Frederic MOREL, who was interpreter in the Greek and Latin tongues, as well as printer to the king, was heir to Vaſcoſan, whoſe daughter he had married.—He was born in Champagne, and he died in an advanced age at Paris, 1583. His ſons and grandſons trode in his ſteps; they diſtinguiſhed themſelves in literature, and maintained alſo the reputation which he had acquired by printing. The edition of *St Gregory of Nyſſa*, by his ſon Claude Morel, is held in great eſtimation by the learned.

MOREL, *Frederic*, ſon of the preceding, and ſtill more celebrated than his father, was profeſſor and interpreter to the king, and printer in ordinary for the Hebrew, Greek, Latin, and French languages. He was ſo devoted to ſtudy, that when he was told his wife was at the point of death, he would not ſtir till he had finiſhed the ſentence which he had begun. Before it was finiſhed, he was informed that ſhe was actually dead: *I am ſorry for it* (replied he coldly), *ſhe was an excellent woman.* This printer acquired great reputation from the works which he publiſhed, which were very numerous and beautifully executed. From the manuſcripts in the king's library, he publiſhed ſeveral treatiſes of St Baſil, Theodoret, St Cyrille; and he accompanied them with a tranſlation. His edition of the works of Œcumenius and Aretas, in 2 vols. folio, is much eſteemed. In ſhort, after diſtinguiſhing himſelf by his knowledge in the languages, he died June 27. 1630, at the age of 78. His ſons and grandſons followed the ſame profeſſion.

MOREL, *William*, regius profeſſor of Greek, and director of the king's printing houſe at Paris, died 1564. He compoſed a *Dictionnaire Grec-Latin François*, which was publiſhed in quarto in 1622, and ſome other works which indicate very extenſive learning. His editions of the Greek authors are exceedingly beautiful. This great ſcholar, who was of a different family from the preceding, had a brother named John, who died in priſon (where he had been confined for hereſy) at the age of 20, and whoſe body was dug out of the grave, and burnt Feb. 27. 1559. They were of the pariſh of Tilleul, in the county of Mortein, in Normandy.

MORENA, in *Ancient Geography*, a diſtrict or diviſion of Myſia, in the Hither Aſia. A part of which was occupied by Cleon, formerly at the head of a band of robbers, but afterwards prieſt of Jupiter Abrettenus, and enriched with poſſeſſions, firſt by Antony, and then by Cæſar.

MORESQUE, MORESK, or *Moriſko*, a kind of painting, carving, &c. done after the manner of the Moors; conſiſting of ſeveral groteſque pieces and compartiments promiſcuouſly intermingled, not containing any perfect figure of a man, or other animal, but a wild reſemblance of birds, beaſts, trees, &c. Theſe are alſo called *arabeſques*, and are particularly uſed in embroideries, damaſk work, &c.

MORESQUE *Dances*, vulgarly called *Morrice dances*, are thoſe altogether in imitation of the Moors, as ſarabands, chacons, &c. and are uſually performed with caſtanets, tambours, &c.

There are few country places in England where the morrice dance is not known. It was probably introduced about, or a little before, the reign of Henry VIII. and is a dance of young men in their ſhirts, with bells at their feet, and ribbands of various colours tied round their arms and flung acroſs their ſhoulders.

MORGAGNA. See FATA.

MORGAGNI, JOHN BAPTIST, doctor of medicine, firſt profeſſor of anatomy in the univerſity of Padua, and member of ſeveral of the moſt eminent ſocieties of learned men in Europe, was born in the year 1682, at Forli, a town in the diſtrict of *La Romagna* in Italy. His

(A) This laſt diſpoſition, we are told, he could not reſtrain even at his execution. The day being come, he aſcended the ſcaffold, which ſeemed ſo weak that it was ready to fall; whereupon, "I pray (ſaid he) ſee me ſafe up, and for my coming down let me ſhift for myſelf." His prayers being ended, he turned to the executioner, and with a cheerful countenance ſaid, "Pluck up thy ſpirits, man, and be not afraid to do thy office; my neck is very ſhort, take heed therefore thou ſtrike not awry for ſaving thy honeſty." Then laying his head upon the block, he bid him ſtay until he had put aſide his beard, ſaying, "That had never committed any treaſon."

Morgagni.

His parents, who were in easy circumstances, allowed him to follow that course in life his genius dictated. He began his studies at the place of his nativity; but soon after removed to Bologna, where he obtained the degree of Doctor of Medicine, when he had but just reached the 16th year of his age. Here his peculiar taste for anatomy found an able preceptor in Valsalva, who bestowed on him the utmost attention; and such was the progress he made under this excellent master, that at the age of 20 he himself taught anatomy with high reputation. Soon, however, the fame of his prelections, and the number of his pupils, excited the jealousy of the public professors, and gave rise to invidious persecutions. But his abilities and prudence gained him a complete triumph over his enemies; and all opposition to him was finally terminated from his being appointed by the senate of Bologna to fill a medical chair, which soon became vacant. But the duties of this office, although important, neither occupied the whole of his time, nor satisfied his anxious desire to afford instruction. He still continued to labour in secret on his favourite subject, and soon after communicated the fruits of these labours to the public in his *Adversaria Anatomica*, the first of which was published in the year 1706, the second and third in 1717, and the three others in 1719. The publication of this excellent work spread the fame of Morgagni far beyond the limits of the state of Bologna. Such was his reputation, that the wise republic of Venice had no hesitation in making him an offer of the second chair of the theory of medicine in the university of Padua, then vacant by the death of M. Molinetti; and, to ensure his acceptance, they doubled the emoluments of that appointment. While he was in this department, he published his treatise, entitled *Nova Institutionum medicarum idea*, which first appeared at Padua in the year 1712. From this work his former reputation suffered no diminution. And soon after he rose, by different steps, to be first professor of anatomy in that celebrated university. Although Morgagni was thus finally settled at Padua, yet he gave evident proofs of his gratitude and attachment to Bologna, which he considered as his native country with respect to the sciences. He exerted his utmost efforts in establishing the academy of Bologna, of which he was one of the first associates; and he enriched their publications with several valuable and curious papers. Soon after this, the Royal Societies of London and Paris received him among their number. Not long after the publication of his *Adversaria Anatomica*, he began, much upon the same plan, his *Epistolæ Anatomicæ*, the first of which is dated at Padua in the beginning of April 1726. The works of Morgagni which have already been mentioned, are to be considered, in a great measure, as strictly anatomical: but he was not more eminent as an anatomist, than as a learned and successful physician. In the year 1760, when he was not far distant from the 80th year of his age, he published his large and valuable work *De causis et sedibus morborum per anatomen indagatis*. This last and most important of all his productions will afford convincing evidence of his industry and abilities to latest posterity. Besides these works, he published, at different periods of his life, several miscellaneous pieces, which were afterwards collected into one volume, and printed under his own eye at Padua, in the year 1765. It does not appear that he had in view any future publications; but he intended to have favoured the world with a complete edition of all his works, which would probably have been augmented with many new observations. In this he was engaged when, on the fifth of December 1771, after he had nearly arrived at the 90th year of his age, death put a period to his long and glorious career in the learned world.

Morgana || Morison.

MORGANA, or MORGAGNA, *Fata*. See FATA.

MORGES, a town of Swisserland in the canton of Berne, a place of some trade, and situated on the lake of Geneva, five miles from Lausanne. E. Long. 6. 42. N. Lat. 46. 29.

MORGO, anciently *Amorgos*, an island in the Archipelago, which produces wine, oil, and corn. It is well cultivated, and the inhabitants are affable, and generally of the Greek church. The best parts belong to a monastery. The greatest inconvenience in this island is the want of wood. It is 30 miles in circumference. E. Long. 26. 15. N. Lat. 36. 30.

MORIAH, one of the eminences of Jerusalem; on which Abraham went to offer his son, and David wanted to build the temple, which was afterwards executed by Solomon: The threshing floor of Araunah; originally narrow, so as scarce to contain the temple, but enlarged by means of ramparts; and surrounded with a triple wall, so as to add great strength to the temple, (Josephus). It may be considered as a part of Mount Sion, to which it was joined by a bridge and gallery, (*Id.*).

MORILLES, a kind of mushroom, about the size of a walnut, pierced with holes like a honey-comb, and said to be good for creating an appetite. It is often used in sauces and ragouts.

MORINA, a genus of plants belonging to the diandria class; and in the natural method ranking under the 48th order, *Aggregatæ*. See BOTANY *Index*.

MORINORUM CASTELLUM, in *Ancient Geography*, simply Castellum (Antonine); situated on an eminence, with a spring of water on its top, in the territory of the Morini. Now *Mont Cassel*, in Flanders.

MORINDA, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 48th order, *Aggregatæ*. See BOTANY *Index*.

MORISON, ROBERT, physician and professor of botany at Oxford, was born at Aberdeen in 1620, bred at the university there, and taught philosophy for some time in it; but having a strong inclination to botany, made great progress in that science. The civil wars obliged him to leave his country; which, however, he did not do till he had first signalized his zeal for the interest of the king, and his courage, in a battle fought between the inhabitants of Aberdeen and the Presbyterian troops on the bridge of Aberdeen, in which he received a dangerous wound on the head. As soon as he was cured of it, he went into France; and fixing at Paris, he applied assiduously to botany and anatomy. He was introduced to the duke of Orleans, who gave him the direction of the royal gardens at Blois. He exercised the office till the death of that prince, and afterwards went over to England in 1660. Charles II. to whom the duke of Orleans had presented him at Blois, sent for him to London, and gave him the title of

Morisonia, Morlachia.

of his *physician*, and that of *professor royal of botany*, with a pension of 200l. per annum. The *Præludium Botanicum*, which he published in 1669, procured him so much reputation, that the university of Oxford invited him to the professorship of botany in 1669; which he accepted, and acquitted himself in it with great ability. He died at London in 1683, aged 63. He published a second and third part of his History of Plants, in 2 vols. folio; with this title, *Plantarum Historia Oxoniensis Universalis*. The first part of this excellent work has not been printed; and it is not known what has become of it.

MORISONIA, a genus of plants belonging to the monadelphia class, and in the natural method ranking under the 25th order, *Putamineæ*. See BOTANY *Index*.

MORLACHIA, a mountainous country of Dalmatia. The inhabitants are called *Morlacks* or *Morlacchi*; they inhabit the pleasant valleys of Koter, along the rivers Kerha, Cettina, Narenta, and among the inland mountains of Dalmatia. The inhabitants are by some said to be of Walachian extraction, as is indicated by their name; Morlachia being a contraction of *Mauro Walachia*, that is, *Black Walachia*: and the Walachians are said to be descendants of the ancient Roman colonies planted in these countries. This, however, is denied by the Abbé Fortis, who published a volume of travels into that country. He informs us, that the origin of the Morlacchi is involved in the darkness of barbarous ages, together with that of many other nations, resembling them so much in customs and language, that they may be taken for one people, dispersed in the vast tracts from the Adriatic sea to the Frozen ocean.

With regard to the etymology of the name, the Abbé observes, that the Morlacchi generally call themselves, in their own language, *Vlassi*; a national term, of which no vestige is found in the records of Dalmatia till the 13th century. It signifies *powerful men*, or *men of authority*; and the denomination of *Moro Vlassi*, corruptly *Morlacchi*, as they are now called, may perhaps point out the original of the nation. This word may possibly signify the *conquerors that came from the sea*; *moor*, in all the dialects of the Sclavonian language, signifying the *sea*.

With regard to the character of these people, we are informed that they are much injured by their maritime neighbours. The inhabitants of the sea coast of Dalmatia tell many frightful stories of their avarice and cruelty: but these, in our author's opinion, are all either of an ancient date, or if any have happened in latter times, they ought rather to be ascribed to the corruption of a few individuals, than to the bad disposition of the nation in general; and though thievish tricks are frequent among them, he informs us, that a stranger may travel securely through their country, where he is faithfully escorted, and hospitably treated.

As to the Morlacchi themselves, they are represented as open and sincere to such a degree, that they would be taken for simpletons in any other country; and by means of this quality they have been so often duped by the Italians, that *the faith of an Italian* and *the faith of a dog*, are synonymous among the Morlacchi. They are very hospitable to strangers; and their hospitality is equally conspicuous among the rich and poor. The rich prepares a roasted lamb or sheep, and the poor with equal cordiality offers whatever he has; nor is this generosity confined to strangers, but generally extends itself to all who are in want. When a Morlack is on a journey, and comes to lodge at a friend's house, the eldest daughter of the family, or the new married bride, if there happen to be one, receives and kisses him when he alights from his horse or at the door of the house: but a foreigner is rarely favoured with these female civilities; on the contrary, the women, if they are young, hide themselves, and keep out of his way.

Morlachia.

The Morlacchi in general have little notion of domestic economy, and readily consume in a week as much as would be sufficient for several months, whenever any occasion of merriment presents itself. A marriage, the holiday of the saint protector of the family, the arrival of relations or friends, or any other joyful incident, consumes of course all that there is to eat and to drink in the house. Yet the Morlack is a great economist in the use of his wearing apparel; for rather than spoil his new cap, he takes it off, let it rain ever so hard, and goes bareheaded in the storm. In the same manner he treats his shoes, if the road is dirty and they are not very old. Nothing but an absolute impossibility hinders a Morlack from being punctual; and if he cannot repay the money he borrowed at the appointed time, he carries a small present to his creditor, and requests a longer term.

Friendship is lasting among the Morlacchi. They have even made it a kind of religious point, and tie the sacred bond at the foot of the altar. The Sclavonian ritual contains a particular benediction for the solemn union of two male or two female friends in the presence of the congregation. The male friends thus united are called *Pobratimi*, and the female *Posestreme*, which mean half-brothers and half-sisters. From these consecrated friendships among the Morlacchi and other nations of the same origin, it should seem that the *sworn brothers* arose; a denomination frequent enough among the common people of Italy and in many parts of Europe. The difference between these and the Pobratimi of Morlachia consists not only in the want of the ritual ceremony, but in the design of the union itself. For, among the Morlacchi, the sole view is reciprocal service and advantage; but such a brotherhood among the Italians is generally commenced by bad men, to enable them the more to hurt and disturb society.

But as the friendships of the Morlacchi are strong and sacred, so their quarrels are commonly unextinguishable. They pass from father to son; and the mothers fail not to put their children in mind of their duty to revenge their father if he has had the misfortune to be killed, and to show them often the bloody shirt and arms of the dead. And so deeply is revenge rooted in the minds of this nation, that all the missionaries in the world would not be able to eradicate it. A Morlack is naturally inclined to do good to his fellow creatures, and is full of gratitude for the smallest benefit; but implacable if injured or insulted.

A Morlack who has killed another of a powerful family, is commonly obliged to save himself by flight,

and

Morlacchi.

and to keep out of the way for ſeveral years. If during that time he has been fortunate enough to eſcape the ſearch of his purſuers, and has got a ſmall ſum of money, he endeavours to obtain pardon and peace; and, that he may treat about the conditions in perſon, he aſks and obtains a ſafe conduct, which is faithfully maintained, though only verbally granted. Then he finds mediators; and, on the appointed day, the relations of the two hoſtile families are aſſembled, and the criminal is introduced, dragging himſelf along on his hands and feet, the muſket, piſtol, or cutlaſs, with which he committed the murder, hung about his neck; and while he continues in that humble poſture, one or more of the relations recites a panegyric on the dead, which ſometimes rekindles the flames of revenge, and puts the poor proſtrate in no ſmall danger.

The Morlacks, whether they happen to be of the Roman or of the Greek church, have very ſingular ideas about religion; and the ignorance of their teachers daily augments this monſtrous evil. They are as firmly perſuaded of the reality of witches, fairies, enchantments, nocturnal apparitions, and ſortileges, as if they had ſeen a thouſand examples of them. Nor do they make the leaſt doubt about the exiſtence of vampires; and attribute to them, as in Tranſylvania, the ſucking the blood of infants. Therefore, when a man dies ſuſpected of becoming a vampire, or *vukodlak*, as they call it, they cut his hams, and prick his whole body with pins; pretending, that after this operation he cannot walk about. There are even inſtances of Morlacchi, who, imagining that they may poſſibly thirſt for children's blood after death, entreat their heirs, and ſometimes oblige them to promiſe, to treat them as vampires when they die.

A moſt perfect diſcord reigns in Morlachia, as it generally does in other parts, between the Latin and Greek communion, which their reſpective prieſts fail not to foment, and tell a thouſand little ſcandalous ſtories of each other. The churches of the Latins are poor, but not very dirty; thoſe of the Greeks are equally poor, and ſhamefully ill kept. Our author has ſeen the curate of a Morlack village ſitting on the ground in the churchyard, to hear the confeſſion of women on their knees by his ſide: a ſtrange poſture indeed! but a proof of the innocent manners of thoſe good people, who have the moſt profound veneration for their ſpiritual paſtors, and a total dependence upon them; who, on their part, frequently make uſe of a diſcipline rather military, and correct the bodies of their offending flock with the cudgel.

Innocence, and the natural liberty of paſtoral ages, are ſtill preſerved among the Morlacchi, or at leaſt many traces of them remain in the places fartheſt diſtant from our ſettlements. Pure cordiality of ſentiment is not there reſtrained by other regards, and diſplays itſelf without any diſtinction of circumſtances. A young handſome Morlack girl, who meets a man of her diſtrict on the road, kiſſes him affectionately, without the leaſt imputation of impropriety; and M. Fortis has ſeen all the women and girls, all the young men and old, kiſſing one another as they came into the churchyard on a holiday; ſo that they looked as if they all belonged to one family. He often obſerved the ſame thing on the road, and at the fairs in the maritime towns, where the Morlacchi came to ſell their commodities.

The dreſs of the unmarried women is the moſt complex and whimſical, in reſpect to the ornaments of the head; for when married they are not allowed to wear any thing elſe but a handkerchief, either white or coloured, tied about it. The girls uſe a ſcarlet cap, to which they commonly hang a veil falling down on the ſhoulders, as a mark of their virginity. The better ſort adorn their caps with ſtrings of ſilver coins, among which are frequently ſeen very ancient and valuable ones; they have moreover ear rings of very curious work, and ſmall ſilver chains with the figures of half moons faſtened to the ends of them. But the poor are forced to content themſelves with plain caps; or if they have any ornaments, they conſiſt only of ſmall exotic ſhells, round glaſs beads, or bits of tin. The principal merit of theſe caps, which conſtitute the good taſte as well as vanity of the Morlack young ladies, is to attract and fix the eyes of all who are near them by the multitude of ornaments, and the noiſe they make on the leaſt motion of their heads.

Both old and young women wear about their necks large ſtrings of round glaſs beads, of various ſize and colour; and many rings of braſs, tin, or ſilver, on their fingers. Their bracelets are of leather covered with wrought tin or ſilver; and they embroider their ſtomachers, or adorn them with beads or ſhells. But the uſe of ſtays is unknown, nor do they put whalebone or iron in the ſtomacher. A broad woollen girdle ſurrounds their petticoat, which is commonly decked with ſhells, and of blue colour, and therefore called *modrina*. Their gown as well as petticoat, is of a kind of ſerge; and both reach near to the ancle: the gown is bordered with ſcarlet, and called *ſadak*. They uſe no modrina in ſummer, and only wear the ſadak without ſleeves over a linen petticoat or ſhift.—The girls always wear red ſtockings; and their ſhoes are like thoſe of the men, called *opanke*. The ſole is of undreſſed ox hide, and the upper part of ſheep's ſkin thongs knotted, which they call *apute;* and theſe they faſten above the ancles, ſomething like the ancient cothurnus. The unmarried women, even of the richeſt families, are not permitted to wear any other ſort of ſhoes; though after marriage, they may, if they will, lay aſide the opanke, and uſe the Turkiſh ſlippers. The girls keep their hair treſſed under their caps, but when married they let it fall diſhevelled on the breaſt; ſometimes they tie it under the chin; and always have medals, beads, or bored coins, in the Tartar or American mode, twiſted amongſt it.

Nothing is more common among the Morlacchi than marriages concluded between the old people of the reſpective families, eſpecially when the parties live at a great diſtance, and neither ſee nor know each other; and the ordinary motive of theſe alliances is the ambition of being related to a numerous and powerful family, famous for having produced valiant men. A denial in ſuch caſes is very rare; nor does the father of the maid inquire much into the circumſtances of the family that aſks her. Sometimes a daughter of the maſter is given in marriage to the ſervant or tenant, as was uſual in patriarchal times; ſo little are the women regarded in this country. But on theſe occaſions, the Morlacchi girls enjoy the privilege of refuſal. For he who

Morlacchi. who acts by proxy, having obtained his suit, is obliged to go and bring the bridegroom: and, if on seeing each other, the young people are reciprocally content, the marriage is concluded, but not otherwise. In some parts it is the custom for the bride to go to see the house and family of the proposed husband, before she gives a definitive answer; and if the place or persons are disagreeable to her, she is at liberty to annul the contract.

The bride is conducted to a church, veiled, and surrounded by the friends of the bridegroom, or *svati*, as they are called, on horseback; and the sacred ceremony is performed amidst the noise of muskets, pistols, barbaric shouts and acclamations, which continue till she return to her father's house or to that of her husband, if not far off. The first day's entertainment is sometimes made at the bride's house, but generally at the bridegroom's, whether the svati hasten immediately after the nuptial benediction; and at the same time three or four men run on foot to tell the good news; the first who gets to the house has a kind of a towel embroidered at the ends, as a premium. The domachin, or head of the house, comes out to meet his daughter-in-law; and a child is handed to her, before she alights, to caress it; and if there happen to be none in the house, the child is borrowed from one of the neighbours. When she alights, she kneels down, and kisses the threshold.—Then the mother-in-law, or in her place some other female relation, presents a corn sieve, full of different kinds of grain, nuts, almonds, and other small fruit, which the bride scatters upon the svati, by handfuls, behind her back. The bride does not sit at the great table the first day, but has one apart for herself, the two diveri, and the stacheo. The bridegroom sits at table with the svati; but in all that day, consecrated to the matrimonial union, he must neither unloosen nor cut any thing whatever. The knum carves his meat, and cuts his bread. It is the domachin's business to give the toasts; and the stari-svat is the first who pledges him. Generally the bukkara, a very large wooden cup, goes round, first to the saint protector of the family; next to the prosperity of the holy faith; and sometimes to a name the most sublime and venerable. The most extravagant abundance reigns at these feasts; and each of the svati contributes, by sending a share of provisions. The dinner begins with fruit and cheese; and the soup comes last, just contrary to our custom. All sorts of domestic fowls, kid, lamb, and sometimes venison, are heaped in prodigal quantities upon their tables.

These nuptial feasts, called *sdrave* by the ancient Huns, are by the Morlacchi called *sdravize*, from whence the Italian word *stravizzo* is undoubtedly derived. They continue three, six, eight, or more days, according to the ability or prodigal disposition of the family where they are held. The new married wife gets no inconsiderable profit in these days of joy; and it usually amounts to much more than all the portion she brings with her, which often consists of nothing but her own clothes and perhaps a cow; nay, it happens sometimes that the parents, instead of giving money with their daughter, get something from the bridegroom by way of price. The bride carries water every morning, to wash the hands of her guests as long as the feasting lasts; and each of them throws a small piece of money into the bason after performing that function, which is a very rare one among them, excepting on such occasions.

The Morlacchi pass their youth in the woods, attending their flocks and herds; and in that life of quiet and leisure they often become dextrous in carving with a simple knife: they make wooden cups, and whistles adorned with fanciful bass-reliefs, which are not void of merit, and at least show the genius of the people.

Mornay. MORNAY, Philippe de, seigneur du Plessis Marly, was born at Buhy or Bishuy in Upper Normandy in France, in 1549, and was educated at Paris. What was then thought a prodigy in a gentleman, he made a rapid progress in the belles lettres, in the learned languages, and in theology. He was at first destined for the church; but the principles of Calvinism, which he had imbibed from his mother, effectually excluded him from the ecclesiastical preferments to which he was entitled by his interest, abilities, and birth. After the horrible massacre of St Bartholomew, Philippe de Mornay made the tour of Italy, Germany, England, and the Low Countries; and he was equally improved and delighted by his travels. Mornay afterwards joined the king of Navarre, at that time leader of the Protestant party, and so well known since by the name of Henry IV. This prince sent Mornay, who employed his whole abilities, both as a soldier and a writer, in defence of the Protestant cause, to conduct a negotiation with Elizabeth queen of England; and left him wholly to his own discretion in the management of that business. He was successful in almost every negotiation, because he conducted it like an able politician, and not with a spirit of intrigue. He tenderly loved Henry IV. and spoke to him on all occasions as to a friend. When he was wounded at Aumale, he wrote to him in these words: "Sire, You have long enough acted the part of Alexander, it is now time you should act that of Cæsar. It is our duty to die for your majesty, &c. It is glorious for you, Sire, and I dare venture to tell you it is your duty, to live for us." This faithful subject did every thing in his power to raise Henry to the throne. But when he deserted the Protestant faith, he reproached him in the bitterest manner, and retired from court. Henry still loved him; and was extremely affected with an insult which he received in 1597 from one Saint Phal, who beat him with a cudgel, and left him for dead. Mornay demanded justice from the king; who gave him the following answer, a proof as well of his spirit as of his goodness of heart. "Monsieur Duplessis, I am exceedingly offended at the insult you have received; and I sympathize with you both as your sovereign and your friend. In the former capacity, I shall do justice to you and to myself; and had I sustained only the character of your friend, there are few perhaps who would have drawn their sword or sacrificed their life more cheerfully in your cause. Be satisfied, then, that I will act the part of a king, a master, and a friend," &c. Mornay's knowledge, probity, and valour, made him the soul of the Protestant party, and procured him the contemptuous appellation of the *Pope of the Huguenots*. He defended their doctrines both by speech and writing. One of his books on the Iniquity of the Mass, having stirred up all the Catholic divines, he refused

to

to make any reply to their cenſures and criticiſms except in a public conference. This was accordingly appointed to be held A. D. 1600, at Fountainbleau, where the court then was. The two champions were, Du Perron biſhop of Evreux, and Mornay. After a great many arguments and replies on both ſides, the victory was adjudged to Du Perron. He had boaſted that he would point out to the ſatisfaction of every one five hundred errors in his adverſary's book, and he partly kept his word. The Calviniſts did not fail to claim the victory on this occaſion, and they ſtill continue to do ſo. This conference, inſtead of putting an end to the differences, was productive of new quarrels among the controverſialiſts, and of much profane wit among the libertines. A Huguenot miniſter, who was preſent at the conference, obſerved with great concern to a captain of the ſame party,—"The biſhop of Evreux has already driven Mornay from ſeveral ſtrong holds." "No matter (replied the ſoldier), provided he does not drive him from Saumur." This was an important place on the river Loire, of which Dupleſſis was governor. Hither he retired, his attention being conſtantly occupied in defending the Huguenots, and in making himſelf formidable to the Catholics. When Louis XIII. was making preparations againſt the Proteſtants, Dupleſſis wrote him a letter, diſſuading him from ſuch a meaſure. After employing the moſt plauſible arguments, he concludes in the following manner: "To make war on the ſubject, is an indication of weakneſs in the government. Authority conſiſts in the quiet ſubmiſſion of the people, and is eſtabliſhed by the prudence and juſtice of the governor. Force of arms ought never to be employed except in repelling a foreign enemy. The late king would have ſent the new miniſters of ſtate to learn the firſt elements of politics, who like unſkilful ſurgeons would apply violent remedies to every diſeaſe, and adviſe a man to cut off an arm when his finger aches." Theſe remonſtrances produced no other effect than the loſs of the government of Saumur, of which he was deprived by Louis XIII. in 1621. He died two years after, November 11. 1623, aged 74, in his barony *de la Foret-ſur-Seure* in Poitou. The Proteſtant cauſe never had an abler ſupporter, or one who did it more credit by his virtues and abilities.

Cenſeur des courtiſans, mais à la cour aimé;
Fier ennemi de Rome, et de Rome eſtimé.—HENRIADE.

The following is a liſt of his works: 1. *Un Traité de l'Euchariſte*, 1604, in folio. 2. *Un Traité de la verité de la Religion Chretienne*, 8vo. 3. A book entitled *La Myſtere d'Iniquité*, 4to. 4. *Un diſcours ſur le droit pretendu par ceux de la maiſon de Guiſe*, 8vo. 5. Curious and intereſting *Memoirs* from the year 1572 to 1629, 4 vols, 4to, valuable. 6. *Letters;* which are written with great ſpirit and good ſenſe. David des Liques has given us his life in quarto; a book more intereſting for the matter than the manner.

MORNE-GAROU, a very remarkable volcanic mountain on the iſland of St Vincent's in the Weſt Indies. It was viſited by Mr James Anderſon ſurgeon in the year 1784. See St VINCENTS.

MOROC, or MAROC, a beautiful bird of Abyſſinia, deſcribed by Mr Bruce, who thinks its name is derived from *mar* "honey," though he ſays that he never heard it was further concerned in the honey than deſtroying bees. It ſeems to purſue thoſe inſects out of enmity or diverſion as well as for food, leaving great numbers dead on the ground, beſides thoſe which it devours for food.

The moroc reſembles the cuckoo in ſize and ſhape, but differs in other reſpects. Its mouth is very wide, the opening reaching almoſt to its eyes; the inſide of the mouth and throat yellow, the tongue ſharp-pointed, and capable of being drawn almoſt half its length out of the mouth beyond the point of its beak, and is very flexible. The head and neck are brown, without any mixture of other colours: there are likewiſe a number of very ſmall and ſcarcely viſible hairs at the root of the beak.

This ſeems to be the bird mentioned by Sparman under the name of *cuculus indicator*, which (he ſays) has the ſingular property of diſcovering the neſts of wild bees, and leading travellers by a certain cry to the place where the treaſure is depoſited. According to Sparman's account, it makes known theſe diſcoveries by the ſame cry to foxes as well as to the human ſpecies; but Jerome Lobo, who mentions the Abyſſinian bird, takes no notice of the foxes, though he mentions its ſinging melodiouſly when it arrives at the place where the honey is depoſited. Both theſe accounts are ſeverely criticiſed by Mr Bruce, who ſays, that honey is ſo abundant on every hillock and every tree, that a bird poſſeſſing this faculty could be of no uſe to man or to any other animal in that country, and that having never heard of ſuch a bird in Abyſſinia, he conſiders the account of it as a fiction.

MORNING, the beginning of the day, or the time of the ſun riſing. The aſtronomers reckon morning, *mane*, from the time of midnight to that of mid-day. Thus an eclipſe is ſaid to begin at 11 o'clock in the morning, &c.

MORNING ſtar, is the planet Venus, when a little to the weſtward of the ſun; that is, when ſhe riſes a little before. In this ſituation ſhe is called by the Greeks *Phoſphorus;* by the Latins *Lucifer*, &c.

MOROCCO, an empire of Africa, comprehending a conſiderable part of the ancient Mauritania, is bounded on the weſt by the Atlantic ocean; on the eaſt by the river Mulvya, which ſeparates it from Algiers; on the north by the Mediterranean; and on the ſouth by Mount Atlas, or rather by the river Sus, which divides it from the kingdom of Tafilet. Its greateſt length is from the north-eaſt to the ſouth-weſt, amounting to above 590 miles; its breadth is not above 260 where broadeſt, and in the narroweſt places it is not above half that breadth. 1 Situation and boundaries.

The ancient hiſtory of Morocco has been already given under the article MAURITANIA. It continued under the dominion of the Romans upwards of 400 years. On the decline of that empire it fell under the Goths, who held it till about the year 600, when the Goths were driven out by the Vandals, the Vandals by the Greeks, and they in their turn by the Saracens, who conquered not only this empire, but we may ſay the whole continent of Africa; at leaſt their religion, one way or other, is to be found in all parts of it. The Saracen empire did not continue long united under one head, and many princes ſet up for themſelves in Africa as well as elſewhere, through whoſe diſſenſions the Almoravides were at length raiſed 2 Hiſtory.

Morocco. raiſed to the ſovereignty, as related under the article ALGIERS, N° 2. Yuſef, or Joſeph, the ſecond monarch of that line, built the city of Morocco, conquered the kingdom of Fez, and the Mooriſh dominions in Spain; all which were loſt by his grandſon Abbu Hali, who was defeated and killed by the Spaniards. On this prince's death the crown paſſed to the Mohedians, or Almohedes, with whom it had not continued above three generations, when Mohammed the ſon of Al Manſur loſt the famous battle of Sierra Morena, in which 200,000 Moors were ſlain, and in conſequence of which Alphonſo X. retook a great many of the Mooriſh conqueſts immediately after.

Mohammed died ſoon after this diſgrace, and left ſeveral ſons, between whom a civil war enſued, during which the viceroys of Fez, Tunis, and Tremeſen, found means to eſtabliſh themſelves as independent princes. At length one of the princes of the royal blood of Tremeſen having defeated the Almohedes, made himſelf maſter of the kingdoms of Morocco and Fez, and entailed them on his own family. In a ſhort time, however, this family was expelled by the Merini, the Merini by the Oatazes, and theſe by the Sharifs of Haſcen, who have kept the government ever ſince.

3 Government. Nothing can be conceived more unjuſt and deſpotic than the government of Morocco, and nothing more degenerate than the character of the people. The emperor, is allowed to have not only an uncontrollable power over the lives and fortunes of his ſubjects, but in a great meaſure over their conſciences, in as much as he is the only perſon who, as the ſucceſſor of the prophet, has a right to interpret the Koran; and appoints all the judges under him, of whom thoſe of Morocco and Fez are the chief, whoſe buſineſs it is to explain and diſpenſe all matters relating to their religion; and who, being his creatures and dependents, dare not ſteer otherwiſe than as he directs. Whenever therefore the laws are enacted by him, and proclaimed by his governors in all the provinces, as is commonly done, that none may plead ignorance, they are everywhere received with an implicit and religious ſubmiſſion. On the other hand, the ſubjects are bred up with a notion, that thoſe who die in the execution of his command are entitled to an immediate admittance into paradiſe, and thoſe who have the honour to die by his hand to a ſtill greater degree of happineſs in it. After this we need not wonder at finding ſo much cruelty, oppreſſion, and tyranny on the one ſide, and ſo much ſubmiſſion, paſſiveneſs, and miſery on the other.

4 Account of the black troops. This latter, however, extends no farther than the Moors: for as to the mountaineers, the ſubjection and tribute they pay to thoſe tyrants was always involuntary; and as for the negroes, their zeal and attachment is owing merely to the great ſway and power which they have gained in the government, on various accounts. They were firſt introduced, or rather their importation increaſed, by the policy of Muley Iſhmael, a late emperor, at a period when there was a great decreaſe of population in the empire, occaſioned in ſome degree by the enormous cruelties exerciſed by its former ſovereigns, who have been known not unfrequently, through a ſlight diſguſt, to abandon a whole town or province to the ſword. In the character of Muley Iſhmael were found the moſt ſingular inconſiſtencies; for it is certain, that although a tyrant, yet in other reſpects, as if to repair the miſchief which he committed, he left nothing undone for the encouragement of population.—He introduced large colonies of negroes from Guinea; built towns for them, many of which are ſtill remaining; aſſigned them portions of land, and encouraged their increaſe by every poſſible means. He ſoon initiated them in the Mahometan faith; and had his plan been followed, the country by this time would have been populous, and probably flouriſhing. As the negroes are of a more lively, active and enterpriſing diſpoſition than the Moors, they might ſoon have been taught the arts of agriculture; and their ſingular ingenuity might have been directed to other uſeful purpoſes. It is true, Muley Iſhmael, when he adopted this plan, had more objects in view than that of merely peopling his dominions. He ſaw plainly that his own ſubjects were of too capricious a diſpoſition to form ſoldiers calculated for his tyrannical purpoſes. They had uniformly manifeſted an inclination to change their ſovereigns, though more from the love of variety than to reform the government, or reſtrain the abuſes of tyranny. Muley Iſhmael had diſcernment enough to ſee, that by forming an army of ſlaves, whoſe ſole dependence ſhould reſt upon their maſter, he could eaſily train them in ſuch a manner as to act in the ſtricteſt conformity to his wiſhes. He ſoon learnt that the great object with the negroes was plenty of money and liberty of plunder; in theſe he liberally indulged them, and the plan fully anſwered his expectations. Though, however, Muley Iſhmael had no great merit in introducing ſubjects for the purpoſes of tyranny, yet the good effects of this new colonization were very generally experienced. By intermarrying among themſelves, and intermixing among the Moors (for the Moors will keep negro women as concubines, though they ſeldom marry them), a new race of people ſtarted up, who became as uſeful ſubjects as the native inhabitants, and brought the empire into a much more flouriſhing ſtate than it had ever been in ſince their great revolution.

Sidi Mahomet, his grandſon and ſucceſſor, had different views, and was actuated by different motives. From his inordinate avarice, he ceaſed to act towards his black troops in the generous manner which had diſtinguiſhed his predeceſſor Muley Iſhmael; and they ſoon ſhowed themſelves diſcontented with his conduct. They offered to place his eldeſt ſon Muley Ali, on the throne; but this prince, not unmindful of the duty which he owed his father and ſovereign, declined their offer. They next applied to Muley Yazid, who at firſt accepted of the aſſiſtance they tendered, but in a ſhort time relinquiſhed the plan. Sidi Mahomet, diſguſted with this conduct of the negroes, determined to curb their growing power, by diſbanding a conſiderable part of theſe troops, and baniſhing them to diſtant parts of the empire.

A moſt flagrant ſpecies of deſpotiſm, which renders the emperors more formidable to their ſubjects, is their making themſelves their ſole heirs, and, in virtue of that, ſeizing upon all their effects, and making only ſuch proviſion for their families as they think proper; and often, on ſome frivolous pretence, leaving them deſtitute of any, according to the liking or diſlike they bear to the deceaſed; ſo that, upon the whole, they are the only makers, judges, and interpreters, and in many inſtances likewiſe the executioners, of their own laws, which have 5 Deſpotiſm of the emperors.

no

Morocco.

no other limits than their own arbitrary will. The titles which the emperors of Morocco aſſume, are thoſe of *Moſt glorious, mighty, and noble emperor of Afric; king of Fez and Morocco, Tafilet, Suz, Dorha, and all the Algarbe, and its territories in Afric; grand Sharif* (or, as others write it, *Xarif*, that is, ſucceſſor, or vicegerent), *of the great Prophet Mohammed, &c.*

6 Adminiſtration of juſtice.

The judges or magiſtrates who act immediately under the emperor are either ſpiritual or temporal, or rather eccleſiaſtical and military. The mufti and the cadis are judges of all religious and civil affairs; and the baſhaws, governors, alcaides, and other military officers, of thoſe that concern the ſtate or the army: all of them the moſt obſequious creatures and ſlaves of their prince, and no leſs the rapacious tyrants of his ſubjects, and from whom neither juſtice nor favour can be obtained but by mere dint of money and extortionate bribery, from the higheſt to the loweſt. Neither can it indeed be otherwiſe in ſuch an arbitrary government, where the higheſt poſts muſt not only be bought of the prince at a moſt extravagant price, and kept only by as exorbitant a tribute, which is yearly paid to him, but where no one is ſure to continue longer than he can bribe ſome of the courtiers to inſinuate to the monarch that he pays to the utmoſt of his power and much beyond what was expected from him. There are inſtances of the ſultan elevating at once a common ſoldier to the rank of a baſhaw, or making him a confidential friend; the following day he would perhaps impriſon him, or reduce him again to the ſtation of a private ſoldier. Yet ſuch is the diſpoſition of theſe people, that they have an unbounded thirſt for rank and power with all their uncertainties; and what is more extraordinary, when they have obtained a high ſtation, they ſeldom fail to afford their ſovereign a plea for ill treating them, by abuſing in ſome way or other their truſt.

7 Royal revenues.

From what has been ſaid, it may be reaſonably concluded that the revenue ariſing to the emperor from the laſt mentioned ſource, that of bribery, extortion, and confiſcation, muſt be very conſiderable, though there is no poſſibility to make any other conjecture of its real amount than that it muſt be an immenſe one. Another conſiderable branch is the piratical trade, which brings the greater income into his treaſury, as he is not at any expence either for fitting out of corſair veſſels, or maintaining their men; and yet has the tenth of all the cargo and of all the captives; beſides which, he appropriates to himſelf all the reſt of them, by paying the captors 50 crowns per head, by which means he engroſſes all the ſlaves to his own ſervice and advantage. This article is indeed a very conſiderable addition to his revenue, not only as he ſells their ranſom at a very high rate, but likewiſe as he has the profit of all their labour, without allowing them any other maintenance than a little bread and oil, or any other aſſiſtance when ſick, than what medicines a Spaniſh convent, which he tolerates there, gives them gratis; and which, nevertheleſs, is forced to pay him an annual preſent for that toleration, beſides furniſhing the court with medicines, and the ſlaves with lodging and diet when they are not able to work. Another branch of his revenue conſiſts in the tenth part of all cattle, corn, fruits, honey, wax, hides, rice, and other products of the earth, which is exacted of the Arabs and Brebes, as well as of the natives; and theſe are levied, or rather farmed, by the baſhaws, governors, alcaides, &c. with all poſſible ſeverity. The Jews and Chriſtians likewiſe pay an income or capitation, the former of ſix crowns *per* head on all males from 15 years and upwards, beſides other arbitrary impoſts, fines, &c. That on the Chriſtians, for the liberty of trading in his dominions, riſes and falls according to their number, and the commerce they drive; but which, whatever it may bring yearly into his coffers, is yet detrimental to trade in general, ſeeing it diſcourages great numbers from ſettling there, notwithſtanding the artful invitations which the emperors and their miniſters make uſe of to invite them to it; for, beſides thoſe arbitrary exactions, there is ſtill another great hardſhip attending them, viz. that they cannot leave the country without forfeiting all their debts and effects to the crown. The duties on all imports and exports is another branch of his income, the amount of which, it is ſaid, does not exceed 165,000l. per annum.

8 Climate of Morocco.

The climate of the empire of Morocco is in general ſufficiently temperate, healthy, and not ſo hot as its ſituation might lead us to ſuppoſe. The chain of mountains which form Atlas, on the eaſtern ſide, defends it from the eaſt winds, that would ſcorch up the earth were they frequent. The ſummit of theſe mountains is always covered with ſnow; and their abundant deſcending ſtreams ſpread verdure through the neighbourhood, make the winter more cold, and temper the heats of ſummer. The ſea on the weſt ſide, which extends along the coaſt from north to ſouth, alſo refreſhes the land with regular breezes, that ſeldom vary according to their ſeaſons. At a diſtance from the ſea, within land, the heat is ſo great, that the rivulets become dry in ſummer; but as in hot countries dews are plentiful, the nights are there always cool. The rains are tolerably regular in winter; and are even abundant, though the atmoſphere is not loaded with clouds as in northern latitudes. Thoſe rains which fall by intervals are favourable to the earth, and increaſe its fecundity. In January the country is covered with verdure, and enamelled with flowers. Barley is cut in March, but the wheat harveſt is in June. All fruits are early in this climate; and in forward years the vintage is over in the beginning of September. Though in general there is more uniformity and leſs variation in hot than in northern climates, the firſt are nevertheleſs expoſed to the intemperance of weather: too heavy rains often impede the harveſt; and drought has ſtill greater inconveniences, for it enſures the propagation of locuſts.

9 Soil, and

The ſoil of Morocco is exceedingly fertile. It is moſt ſo in the inland provinces. On the weſtern coaſt it is in general light and ſtony, and is better adapted to the vine and olive than the culture of wheat. They annually burn, before the September rains, the ſtubble, which is left rather long; and this and the dung of cattle, every day turned to paſture, form the ſole manure the land receives. The ſoil requires but little labour, and the ploughing is ſo light that the furrows are ſcarcely ſix inches deep; for which reaſon, in ſome provinces, wooden ploughſhares are uſed for cheapneſs.

10 productions.

The empire of Morocco might ſupply itſelf with all neceſſaries, as well from the abundance and nature of its products, as from the few natural or artificial wants of the Moors occaſioned by climate or education. Its wealth conſiſts in the fruitfulneſs of its ſoil: its corn, fruits, Morocco. fruits, flocks, flax, ſalt, gums, and wax, would not only ſupply its neceſſities, but yield a ſuperflux, which might become an object of immenſe trade and barter with other nations. Such numerous exports might return an inexhauſtible treaſure, were its government fixed and ſecure, and did ſubjects enjoy the fruits of their labour and their property in ſafety. The increaſe of corn in Morocco is often as ſixty to one, and thirty is held to be but an indifferent harveſt.

The Moors, naturally indolent, take little care of the culture of their fruits. Oranges, lemons, and thick ſkinned fruits, the trees of which require little nurture, grow in the open fields; and there are very large plantations of them found, which they take the trouble to water in order to increaſe their product. Their vines, which yield excellent grapes, are planted as far as the 33d degree, as in the ſouthern provinces of France, and are equally vigorous. But at Morocco, where they yield a large and delicious grape, they are ſupported by vine poles five and ſix feet above ground; and as they are obliged to be watered, the little wine made there is ſeldom preſerved. Figs are very good in ſome parts of the empire, but toward the ſouth they are ſcarcely ripe before they are full of worms; the heats and night dews may, perhaps, contribute to this ſpeedy decay. Melons, for the ſame reaſon, are rarely eatable; they have but a moment of maturity; which paſſes ſo rapidly that it is with difficulty ſeized. Water melons are everywhere reared, and in ſome provinces are excellent. Apricots, apples, and pears, are in tolerable plenty in the neighbourhood of Fez and Mequinez, where water is leſs ſcarce and the climate more temperate. But in the plain, which extends along the weſtern coaſt, theſe delicate fruits are very indifferent, have leſs juice or taſte, and the peaches there do not ripen. The tree called the prickly pear, or the Barbary fig, is plentifully found in the empire of Morocco; and is planted round vineyards and gardens, becauſe its thick and thorny leaves, which are wonderfully prolific, form impenetrable hedges. From theſe leaves a fruit is produced, covered with a thorny ſkin, that muſt be taken off with care. This fruit is mild, and full of very hard, ſmall kernels. The olive is everywhere found along the coaſt, but particularly to the ſouth.

In the province of Suz, between the 25th and 30th degrees, the inhabitants have an almond harveſt, which varies little becauſe of the mildneſs of the climate; but the fruit is ſmall, for which reaſon they take little care of the trees, and they degenerate with time. The palm tree is common in the ſouthern provinces of Morocco; but dates ripen there with difficulty, and few are good except in the province of Suz and toward Tafilet. On the coaſt of Sallee and Mamora there are foreſts of oak, which produce acorns near two inches long. They taſte like cheſnuts, and are eaten raw and roaſted. Salt abounds in the empire, and in ſome places on the coaſt requires only the trouble of gathering. Independent of the ſalt pits formed by the evaporation of the ſoft water, there are pits and lakes in the country whence great quantities are obtained. It is carried even as far as Tombut, whence it paſſes to the interior parts of Africa.

The Moors cultivate their lands only in proportion to their wants; hence two-thirds of the empire at leaſt lie waſte. Here the *doum*, that is, the fan or wild palm tree, grows in abundance; and from which thoſe people, when neceſſity renders them induſtrious, find great advantage. The ſhepherds, mule drivers, camel drivers, and travellers, gather the leaves, of which they make mats, fringes, baſkets, hats, *ſhoaris* or large wallets to carry corn, twine, ropes, girths, and covers for their pack ſaddles. This plant, with which alſo they heat their ovens, produces a mild and reſinous fruit that ripens in September and October. It is in form like the raiſin, contains a kernel, and is aſtringent and very proper to temper and counteract the effects of the watery and laxative fruits, of which theſe people in ſummer make an immoderate uſe.

11 Mines. Unacquainted with the ſources of wealth of which their anceſtors were poſſeſſed, the Moors pretend there are gold and ſilver mines in the empire, which the emperors will not permit to be worked, leſt their ſubjects ſhould thus find means to ſhake off their yoke. It is not improbable but that the mountains of Atlas may contain unexplored riches; but there is no good proof that they have ever yielded gold and ſilver. There are known iron mines in the ſouth; but the working of them has been found ſo expenſive, that the natives would rather uſe imported iron, notwithſtanding the heavy duty it pays, by which its price is doubled. There are copper mines in the neighbourhood of Santa Cruz, which are not only ſufficient for the ſmall conſumption of the empire, where copper is little uſed, but are alſo an object of exportation, and would become much more ſo were the duties leſs immoderate.

12 Animals. Neither the elephant nor the rhinoceros is to be found either in this or the other ſtates of Barbary; but the deſerts abound with lions, tigers, leopards, hyænas, and monſtrous ſerpents. The Barbary horſes were formerly very valuable, and thought equal to the Arabian. Though the breed is now ſaid to be decayed, yet ſome very fine ones are occaſionally imported into England. Camels and dromedaries, aſſes, mules, and kumrahs (a moſt ſerviceable creature, begot by an aſs upon a cow), are their beaſts of burden. Their cows are but ſmall, and barren of milk. Their ſheep yield but indifferent fleeces, but are very large, as are their goats. Bears, porcupines, foxes, apes, hares, rabits, ferrets, weaſels, moles, chameleons, and all kinds of reptiles, are found here. Partridges and quails, eagles, hawks, and all kinds of wild fowl, are frequent on the coaſt.

13 Mountains, &c. The principal mountains form the chain which goes under the name of *Mount Atlas*, and runs the whole length of Barbary from eaſt to weſt, paſſing through Morocco, and abutting upon that ocean which ſeparates the eaſtern from the weſtern continent, and is from this mountain called the *Atlantic Ocean*. See ATLAS. The principal rivers, beſides the Malva or Mulvya above mentioned, which riſes in the deſerts, and running from ſouth to north divides Morocco from the kingdom of Algiers, are the Suz, Ommirabih, Rabbata, Larache, Darodt, Sebon, Gueron, and Tenſift, which riſe in Mount Atlas, and fall into the Atlantic ocean.

14 Inland traffic. The traffic of the empire by land is either with Arabia or Negroland: to Mecca they ſend caravans, conſiſting of ſeveral thouſand camels, horſes, and mules, twice every year, partly for traffic, and partly on a religious account; for numbers of pilgrims take that opportunity of paying their devotions to their great prophet. The goods they carry to the eaſt are woollen manufactures,

Morocco. manufactures, leather, indigo, cochineal, and oſtrich feathers; and they bring back from thence, ſilk, muſlins, and drugs. By their caravans to Negroland, they ſend ſalt, ſilk, and woollen manufactures, and bring back gold and ivory in return, but chiefly negroes.

15 Traffic. The caravans always go ſtrong enough to defend themſelves againſt the wild Arabs in the deſerts of Africa and Aſia; though, notwithſtanding all their vigilance, ſome of the ſtragglers and baggage often fall into their hands: they are alſo forced to load one half of their camels with water, to prevent their periſhing with drought and thirſt in thoſe inhoſpitable deſerts. And there is ſtill a more dangerous enemy, which is the ſand itſelf: when the winds riſe, the caravan is perfectly blinded with duſt; and there have been inſtances both in Africa and Aſia, where whole caravans, and even armies, have been buried alive in the ſands.

16 Foreign commerce. The natives have hardly any trading veſſels, but are ſeldom without ſome corſairs. Theſe, and European merchant ſhips, bring them whatever they want from abroad; as linen and woollen cloth, ſtuffs, iron wrought and unwrought, arms, gunpowder, lead and the like: for which they take in return, copper, wax, hides, Morocco leather, wool (which is very fine), gums, ſoap, dates, almonds, and other fruits. The duties paid by the Engliſh in the ports of Morocco are but half thoſe paid by other Europeans. It is a general obſervation, that no nation is fond of trading with theſe ſtates, not only on account of their capricious depotiſm, but the villany of their individuals, both natives and Jews, many of whom take all opportunities of cheating, and when detected are ſeldom puniſhed.

17 Land forces. The land forces of the emperor of Morocco conſiſt principally of black troops, and ſome few white; amounting altogether to an army of about 36,000 men upon the eſtabliſhment, two thirds of which are cavalry. This eſtabliſhment, however, upon occaſion, admits of a conſiderable increaſe, as every man is ſuppoſed to be a ſoldier, and when called upon is obliged to act in that capacity. About 6000 of the ſtanding forces form the emperor's body guard, and are always kept near his perſon; the remainder are quartered in the different towns of the empire, and are under the charge of the baſhaws of the provinces. They are all clothed by the emperor, and receive a trifling pay; but their chief dependence is on plunder, which they have frequent opportunities of acquiring.

The black troops are naturally of a very fiery diſpoſition, capable of enduring great fatigue, hunger, thirſt, and every difficulty to which a military life is expoſed. They appear well calculated for ſkirmiſhing parties, or for the purpoſe of haraſſing an enemy; but were they obliged to undergo a regular attack, from their total want of diſcipline they would ſoon be routed. In all their manœuvres they have no notion whatever of order and regularity, but have altogether more the appearance of a rabble than of an army.

18 Navy. The emperor's navy conſiſts of about 15 ſmall frigates, a few xebecks, and between 20 and 30 row-galleys. The whole is commanded by one admiral; but as theſe veſſels are principally uſed for the purpoſes of piracy, they ſeldom unite in a fleet. The number of the ſeamen in ſervice is computed at 6000.

The coins of this empire are a fluce, a blanquil, and ducat. The fluce is a ſmall copper coin, 20 whereof make a blanquil, of the value of twopence ſterling. 19 Coins. The blanquil is of ſilver, and the ducat of gold, not unlike that of Hungary, and worth about nine ſhillings. Both theſe pieces are ſo liable to be clipped and filed by the Jews, that the Moors always carry ſcales in their pockets to weigh them; and when they are found to be much diminiſhed in their weight, they are recoined by the Jews, who are maſters of the mint, by which they gain a conſiderable profit; as they do alſo by exchanging the light pieces for thoſe that are full weight. Merchants accounts are kept in ounces, 10 of which make a ducat; but in payments to the government, it is ſaid they reckon 17 one-half for a ducat.

With reſpect to religion, the inhabitants of Morocco are Mohammedans, of the ſect of Ali; and have a mufti or high-prieſt, who is alſo the ſupreme civil magiſtrate, and the laſt reſort in all cauſes eccleſiaſtical and civil. 20 Religion and They have a great veneration for their hermits, and for idiots and madmen; as well as for thoſe who by their tricks have got the reputation of wizzards: all whom they look upon as inſpired perſons, and not only honour as ſaints while they live, but build tombs and chapels over them when dead; which places are not only religiouſly viſited by their devotees far and near, but are eſteemed inviolable ſanctuaries for all ſorts of criminals except in caſes of treaſon.

Notwithſtanding the natives are zealous Mohammedans, they allow foreigners the free and open profeſſion of their religion, and their very ſlaves have their prieſts and chapels in the capital city; though it muſt be owned that the Chriſtian ſlaves are here treated with the utmoſt cruelty. Here, as in all other Mohammedan countries, the Alcoran and their comments 21 Laws. upon it are their only written laws; and though in ſome inſtances their cadis and other civil magiſtrates are controlled by the arbitrary determinations of their princes, baſhaws, generals, and military officers, yet the latter have generally a very great deference and regard for their laws. Murder, theft, and adultery, are commonly puniſhed with death: and their puniſhments for other crimes, particularly thoſe againſt the ſtate, are very cruel; as impaling, dragging the priſoner through the ſtreets at a mule's heels till all his fleſh is torn off, throwing him from a high tower upon iron hooks.

The inhabitants of the empire of Morocco, known by the name of *Moors*, are a mixture of Arabian and African nations formed into tribes; with the origin of whom we are but imperfectly acquainted. 22 Inhabitants of the empire of Morocco. Theſe tribes, each ſtrangers to the other, and ever divided by traditional hatred or prejudice, ſeldom mingle. It ſeems probable that moſt of the caſts who occupy the provinces of Morocco have been repulſed from the eaſtern to the weſtern Africa, during thoſe different revolutions by which this part of the world has been agitated; that they have followed the ſtandard of their chiefs, whoſe names they have preſerved; and that by theſe they, as well as the countries they inhabit, are diſtinguiſhed. At preſent theſe tribes are called *caſiles* or *cabiles*, from the Arabic word *kobeila*; and they are ſo numerous, that it is impoſſible to have a knowledge of them all.

The

Morocco.

The native subjects of the empire of Morocco may be divided into two principal classes; the *Brebes* and the *Moors*.

23
The Brebes, or Mountaineers.

The etymology of the name, and the origin of the people, of the first class, are equally unknown. Like the Moors, at the time of the invasion by the Arabs, they may have adopted the Mahometan religion, which is consonant to their manners and principal usages; but they are an ignorant people, and observe none of the precepts of that religion, but the aversion it enjoins against other modes of worship.

Confined to the mountains, the Brebes preserve great animosity against the Moors, whom they confound with the Arabs, and consider as usurpers.—They thus contract in their retreats a ferocity of mind, and a strength of body, which makes them more fit for war and every kind of labour than the Moors of the plain in general are. The independence they boast of gives even a greater degree of expression to their countenance. The prejudices of their religion make them submit to the authority of the emperors of Morocco; but they throw off the yoke at their pleasure, and retire into the mountains, where it is difficult to attack or overcome them. The Brebes have a language of their own, and never marry but among each other. They have tribes or cafiles among them who are exceedingly powerful both by their number and courage.

The *Moors* of the plains may be distinguished into those who lead a pastoral life, and those who inhabit the cities.

24
The Moors of the country.

The former live in tents; and that they may allow their ground a year's rest, they annually change the place of their encampments, and go in search of fresh pasturage; but they cannot take this step without acquainting their governor. Like the ancient Arabs, they are entirely devoted to a pastoral life: their encampments, which they call *douchars*, are composed of several tents, and form a crescent; or they are ranged in two parallel lines, and their flocks, when they return from pasture, occupy the centre.

The tents of the Moors, viewed in front, are of a conical figure; they are from 8 to 10 feet high, and from 20 to 25 feet long; like those of high antiquity, they resemble a boat reversed. They are made of cloth composed of goats and camels hair, and the leaves of the wild palm, by which they are rendered impervious to water; but at a distance their black colour gives them a very disagreeable look.

25
Their simple way of life.

The Moors, when encamped, live in the greatest simplicity, and exhibit a faithful picture of the inhabitants of the earth in the first ages of the world. The nature of their education, the temperature of the climate, and the rigour of the government, diminish the wants of the people, who find in their plains, in the milk and wool of their flocks, every thing necessary for food and clothing. Polygamy is allowed among them; a luxury so far from being injurious to a people who have few wants, that it is a great convenience in the economy of those societies, because the women are intrusted with the whole care of the domestic management.

26
Occupations of the women, &c.

In their half-closed tents, they are employed in milking the cows for daily use; and when the milk abounds, in making butter, in picking their corn, their barley, and pulse, and grinding their meal, which they do daily in a mill composed of two stones about 18 inches in diameter, the uppermost having a handle, and turning on an axis fixed in the under one: they make bread likewise every day, which they bake between two earthen plates, and often upon the ground after it has been heated by fire. Their ordinary food is the coofcoofoo; which is a paste made with their meal in the form of small grains like Italian paste. This coofcoofoo is dressed in the vapour of boiling soup, in a hollow dish perforated with many small holes in the bottom, and the dish is enclosed in a kettle where meat is boiled; the coofcoofoo, which is in the hollow dish, grows gradually soft by the vapour of the broth, with which it is from time to time moistened. This simple food is very nourishing, and even agreeable when one has got the better of the prejudices which every nation entertains for its own customs. The common people eat it with milk or butter indifferently; but those of higher rank, such as the governors of provinces and lieutenants, who live in the centre of the encampments, add to it some succulent broth, made with a mixture of mutton, poultry, pigeons, or hedgehogs, and then pour on it a sufficient quantity of fresh butter.

The women in their tents spin wool, and weave it into cloth on looms suspended the whole length of the tent. Each piece is about five ells long, and one and a half broad; it is neither dressed nor dyed, and it has no seam; they wash it when it is dirty; and as it is the only habit of the Moors, they wear it night and day. It is called *haick*, and is the true model of the ancient draperies.

The Moors of the plain wear nothing but their woollen stuff; they have neither shirts nor drawers. 27 Dress, &c.
Linen among these people is a luxury known only to those of the court or the city. The whole wardrobe of a country Moor in easy circumstances consists in a haick for winter, another for summer, a red cap, a hood, and a pair of slippers. The common people both in the country and in towns wear a kind of tunick of woollen cloth, white, gray, or striped, which reaches to the middle of the leg, with great sleeves and a hood; it resembles the habit of the Carthusians.

The women's dress in the country is likewise confined to a haick, which covers the neck and the shoulders, and is fastened with a silver clasp. The ornaments they are fondest of are ear rings, which are either in the form of rings or crescents, made of silver, bracelets, and rings for the small of the leg; they wear these trinkets at their most ordinary occupations; less out of vanity than because they are unacquainted with the use of caskets or cabinets for keeping them. They also wear necklaces made of coloured glass beads or cloves strung on a cord of silk.

The Moors consider their wives less in the light of companions than in that of slaves destined to labour. Except in the business of tillage, they are employed in every servile operation; nay, in some of the poorer quarters a woman is often seen yoked in a plough along with a mule, an ass, or some other animal. When the Moors remove their douchars, all the men seat themselves in a circle on the ground; and with their elbows resting on their knees, pass the time in conversation, while the women strike the tents, fold them up into bundles, and place them on the backs of their camels or oxen. The old women are then each loaded with a parcel, and the young carry the children on their shoulders

Morocco.

ſhoulders ſuſpended in a cloth girt round their bodies. In the more ſouthern parts the women are likewiſe employed in the care of the horſes: the huſband, who in theſe climates is always a deſpot, iſſues his orders, and ſeems only made to be obeyed.

28 Marriages, &c.

The marriage ceremonies of the Moors that live in tents pretty much reſemble thoſe of the ſame people that live in the cities. In the douchars they are generally moſt brilliant and gay; the ſtrangers that paſs along are invited, and made to contribute to the feaſt; but this is done more from politeneſs than from any mercenary motive.

The tribes of the plain generally avoid mixing by marriage with one another: the prejudices that divide theſe people are commonly perpetuated; or, if they are partially healed, they never fail to revive upon trifling occaſions, ſuch as a ſtrayed camel, or the preference of a paſture or a well. Marriages have ſometimes taken place among them, that, ſo far from cementing their differences, have occaſioned the moſt tragical ſcenes. Huſbands have been known to murder their wives, and women their huſbands, to revenge national quarrels.

Parents are not encumbered with their children, however numerous they may be, for they are very early employed in domeſtic affairs; they tend the flocks, they gather wood, and they aſſiſt in ploughing and reaping. In the evening, when they return from the field, all the children of the douchar aſſemble in a common tent, where the iman, who himſelf can hardly ſpell, makes them read a few ſentences from the Koran written on boards, and inſtructs them in their religion by the light of a fire made of ſtraw, of buſhes, and cow dung dried in the ſun. As the heat is very great in the inland parts of the country, children of both ſexes go quite naked till the age of nine or ten.

29 Entertainment of travellers.

The douchars diſperſed over the plains are always in the neighbourhood of ſome rivulet or ſpring, and they are a kind of inns for the reception of travellers. There is generally a tent erected for their uſe, if they have not brought one along with them, where they are accommodated with poultry, milk, and eggs, and with whatever is neceſſary for their horſes. Inſtead of wood for fuel, they have the cow dung, which, when mixed with charcoal, makes a very briſk fire. A guard is always ſet on the tents of travellers, eſpecially if they are Europeans, becauſe the opinion of their wealth might tempt the avidity of the Moors, who are naturally inclined to thieving.

With reſpect to the roads, a very judicious policy is eſtabliſhed, which is adapted to the character of the Moors, and to their manner of life. The douchars are reſponſible for robberies committed in their neighbourhood and in ſight of their tents: they are not only obliged to make reſtitution, but it gives the ſovereign a pretence for exacting a contribution proportioned to the abilities of the douchar. In order to temper the rigour of this law, they are made reſponſible only for ſuch robberies as are committed during the day; thoſe that happen after ſunſet are not imputed to them, as they could neither ſee nor prevent them: on this account, people here travel only from ſunriſing to ſunſetting.

30 Markets.

To facilitate the exchange of neceſſaries, there is in the fields every day, except Friday, which is a day of prayer, a public market in the different quarters of each province. The Moors of the neighbourhood aſſemble to ſell and buy cattle, corn, pulſe, dried fruits, carpets, haicks, and in ſhort all the productions of the country. This market, which is called *Soc*, reſembles our fairs. The buſtle of the people who go and come, gives a better idea of the manner of life of the Moors than can be had in the cities. The alcaides, who command in the neighbourhood, always attend theſe markets with ſoldiers to keep the peace; as it frequently happens that the grudges which theſe tribes harbour againſt one another break out upon ſuch occaſions into open violence.

31 Of the Moors who dwell in cities.

The Moors who inhabit the cities differ from the others only in having a little more urbanity and a more eaſy deportment. Though they have the ſame origin with thoſe of the plains, they affect to decline all intercourſe with them. Some writers, without any foundation, have given the name of *Arabs* to the inhabitants of the towns, and that of *Moors* to thoſe of the plains. But the greater part of the cities of this empire are more ancient than the invaſion of the Arabs, who themſelves lived in tents.

32 Their houſes and furniture.

The houſes in moſt of the towns in this empire appear at a little diſtance like vaulted tombs in a churchyard; and the entrance into the beſt of them has but a mean appearance. The rooms are generally on the ground floor, and whitened on the outſide. As the roofs are quite flat, they ſerve as *verandas*, where the Mooriſh women commonly ſit for the benefit of the air; and in ſome places it is poſſible to paſs nearly over the whole town without having occaſion to deſcend into the ſtreet.

As the beſt apartments are all backwards, a ſtable, or perhaps ſomething worſe, is the place to which viſitors are firſt introduced. Upon entering the houſe, the ſtranger is either detained in this place, or in the ſtreet, till all the women are deſpatched out of the way; he is then allowed to enter a ſquare court, into which four narrow and long rooms open by means of large folding doors, which, as they have no windows, ſerve likewiſe to introduce light into the apartments. The court has generally in its centre a fountain; and if it is the houſe of a Moor of property, it is floored with blue and white chequered tiling. None of the chambers have fire places; and their victuals are always dreſſed in the court-yard in an earthen ſtove heated with charcoal. When the viſitor enters the room, where he is received by the maſter of the houſe, he finds him ſitting croſs-legged and barefooted on a mattreſs, covered with fine white linen, and placed on the floor or elſe on a common mat. This, with a narrow piece of carpeting, is in general the only furniture he will meet with in Mooriſh houſes, though they are not deſtitute of other ornaments.

33 Dreſs of the men.

The wardrobe of the inhabitants of cities is but little different from that of thoſe who live in tents.—Like the latter, they have a haick, and a hood more or leſs fine, and have alſo a hood of coarſe European cloth of dark blue for the winter. What farther diſtinguiſhes them from the country Moors is, that they wear a ſhirt and linen drawers, and an upper garment of cotton in ſummer, and of cloth in winter, which they call a *caftan*. The white or blue hood, the purpoſe of which ſeems to be to guard againſt bad weather, and which is called *bernus*,

Morocco.

bernus, is likewiſe a ceremonial part of dreſs; without which, together with ſabre and canjer (or dagger) worn in a bandelier, perſons of condition never appear before the emperor.

34 Dreſs of the ladies.

The Mooriſh women who live in cities are, as in other nations, more addicted to ſhow and finery in dreſs than thoſe of the country; but as they generally leave the houſe only one day in the week, they ſeldom dreſs themſelves. Not allowed to receive male viſitors, they remain in their houſes employed in their families, and ſo totally in deſhabile that they often wear only a ſhift, and another coarſer ſhift over the firſt, tied round their waiſt, with their hair plaited, and ſometimes with, though often without, a cap. When dreſſed, they wear an ample and fine linen ſhift, the boſom embroidered in gold; a rich caftan of cloth, ſtuff, or velvet, worked in gold; and one or two folds of gauze, ſtreaked with gold and ſilk, round the head, and tied behind ſo as that the fringes, intermingled with their treſſes, deſcend as low as the waiſt; to which ſome add a ribband of about two inches broad, worked in gold or pearls, that encircles the forehead in form of a diadem. Their caftan is bound round their waiſt by a crimſon velvet girdle, embroidered in gold, with a buckle of gold or ſilver, or elſe a girdle of tamboured ſtuff, manufactured at Fez.

The women have yellow ſlippers, and a cuſtom of wearing a kind of ſtocking of fine cloth ſomewhat large, which is tied below the knee and at the ankle, over which it falls in folds. This ſtocking is leſs calculated to ſhow what we call a handſome leg, than to make it appear thick; for to be fat is one of the rules of beauty among the Mooriſh women. To obtain this quality, they take infinite pains, feed when they become thin on a diet ſomewhat like forced meat balls, a certain quantity of which is given them daily; and in fine, the ſame care is taken among the Moors to fatten young women as is in Europe to fatten fowls.

35 Negroes.

The *Negroes*, who conſtitute a large proportion of the emperor's ſubjects, are better formed than the Moors; and as they are more lively, daring, and active, they are intruſted with an important ſhare in the executive part of government. They conſtitute in fact the moſt conſiderable part of the emperor's army, and are generally appointed to the command of provinces and towns. This circumſtance naturally creates a jealouſy between them and the Moors, the latter conſidering the negroes as uſurpers of a power which they have no right to aſſume. Beſides thoſe negroes which form the emperor's army, there are a great many others in the country, who either are or have been ſlaves to private Moors: every Moor of conſequence, indeed, has his proportion of them in his ſervice. To the diſgrace of Europe, the Moors treat their ſlaves with humanity, employing them in looking after their gardens, and in the domeſtic duties of their houſes. They allow them to marry among themſelves; and after a certain number of years, ſpontaneouſly preſent them with the invaluable boon of liberty. They ſoon are initiated in the Mahometan perſuaſion, though they ſometimes intermix with it a few of their original ſuperſtitious cuſtoms. In every other reſpect they copy the dreſs and manners of the Moors.

36 Renegadoes.

Among the inhabitants of Morocco there is another claſs, of whom we muſt not omit to make mention. Theſe are the *Renegadoes*, or foreigners, who have renounced their religion for the faith of Mahomet. Of theſe there are a great number who have been originally Jews: they are held in little eſtimation by the Moors; and would be held in abhorrence by the Jews, if they durſt freely expreſs their averſion. The families of theſe apoſtates are called *Toornadis*: not having at any time married with the Moors, they ſtill preſerve their ancient characteriſtics, and are known almoſt at ſight to be the progeny of thoſe who formerly embraced the Mahometan religion. The Chriſtian renegadoes are but few; and generally are fugitive peculators of Spain, or men fallen from power, who becauſe of their miſconduct, or in deſpair, quit one unfortunate ſituation for another much more deplorable.

The *Jews* were formerly very numerous in this empire. After being proſcribed in Spain and Portugal, multitudes of them paſſed over to Morocco, and ſpread themſelves through the towns and over the country. By the relations they themſelves give, and by the extent of the places aſſigned them to dwell in, it would appear there were more than 30,000 families, of whom at preſent there is ſcarcely a reſidue of one-twelfth; the remainder either having changed their religion, ſunk under their ſufferings, or fled from the vexations they endured, and the arbitrary taxes and tolls impoſed upon them. The Jews poſſeſs neither lands nor gardens, nor can they enjoy their fruits in tranquillity: they muſt wear only black; and are obliged, when they paſs near moſques, or through ſtreets in which there are ſanctuaries, to walk barefoot. The loweſt among the Moors imagines he has a right to ill-treat a Jew; nor dares the latter defend himſelf, becauſe the Koran and the judge are always in favour of the Mahometan.—Notwithſtanding this ſtate of oppreſſion, the Jews have many advantages over the Moors: they better underſtand the ſpirit of trade; they act as agents and brokers, and profit by their own cunning and the ignorance of the Moors. 37 Jews.

38 State of knowledge among the Moors.

The Moors, who derive their language and religion from the Arabs, ſeem not in any manner to have participated of their knowledge. United and confounded as thoſe of Morocco have been with the Moors of Spain, the latter of whom cultivated the arts and gave birth to Averroes, and many other great men, the Moors of this empire have preſerved no traces of the genius of their anceſtors. They have no conception of the ſpeculative ſciences. Education conſiſts merely in learning to read and write; and as the revenues of the learned are derived from theſe talents, the prieſts and talbes among them are the ſole depoſitories of thus much knowledge: the children of the Moors are taught in their ſchools to read and repeat ſome ſixty leſſons, ſelected from the Koran, which for the ſake of economy are written upon ſmall boards.

The Moors who formerly inhabited Spain gave great application to phyſic and aſtronomy; and they have left manuſcripts behind them which ſtill remain monuments of their genius. The modern Moors are infinitely degenerate; they have not the leaſt inclination to the ſtudy of ſcience; they know the properties of ſome ſimples; but as they do not proceed upon principle, and are ignorant of the cauſes and effects of diſeaſes, they generally make a wrong application of their remedies. Their moſt uſeful phyſicians are their talbes, their fa-

kirs,

kirs, and their ſaints, in whom they place a ſuperſtitious confidence.

Notwithſtanding the Moors have occupied themſelves little in the ſtudy of aſtronomy, they have been eager after aſtrology. This imaginary ſcience, which made ſo rapid a progreſs at Rome in ſpite of the edicts of the emperors, may be conceived to make ſtill greater advances among a people wholly ſtupid and ignorant, and ever agitated by the dread of preſent evils, or the hope of a more happy futurity. Magic, the companion of aſtrology, has here alſo found its followers, and is particularly ſtudied by the talbes in the ſouthern parts, who ſucceſsfully uſe it in impoſing upon Mooriſh credulity with ſtrange dreams and ambiguous forebodings and prophecies.

39 Manufactures and trades.

The Mooriſh manufactures are—The haick, which, as was before obſerved, is a long garment compoſed of white wool and cotton, or cotton and ſilk woven together, and is uſed by the Moors for the purpoſe of covering their under dreſs when they go abroad, which they do by totally wrapping themſelves in it in a careleſs but eaſy manner; ſilk handkerchiefs of a particular kind, prepared only at Fez; ſilks checkered with cotton; carpeting, little inferior to that of Turkey; beautiful matting, made of the palmetto or wild palm tree; paper of a coarſe kind; cordovan, commonly called *Morocco leather*; gunpowder of an inferior nature; and long-barrelled muſkets, made of Biſcay iron. The Moors are unacquainted with the mode of caſting cannon: and therefore thoſe few which are now in the country are obtained from Europeans.—The manufacture of glaſs is likewiſe unknown to them; as indeed they make great uſe of earthen ware, and have few or no windows to their houſes, this commodity may be of leſs importance to them than many others. They make butter, by putting the milk into a goat ſkin, with its outward coat turned inwards, and ſhaking it till the butter collects on the ſides, when it is taken out for uſe. From this operation it proves always full of hairs, and has an inſipid flavour. Their cheeſe conſiſts merely of curds hardened and dried, and has uniformly a diſagreeable taſte. The bread in ſome of the principal towns, particularly at Tangier and Sallee, is remarkably good, but in many other places it is coarſe, black, and heavy.

Their looms, forges, ploughs, carpenters tools, &c. are much upon the ſame conſtruction with the unimproved inſtruments of the ſame kind which are uſed at this time in ſome parts of Europe, only ſtill more clumſily finiſhed. In their work, they attend more to ſtrength than neatneſs or convenience; and, like all other ignorant people, they have no idea that what they do is capable of improvement. It is probable, indeed, that the Moors have undergone no very material change ſince the revolution in their arts and ſciences, which took place ſoon after their expulſion from Spain. Previous to that period, it is well known they were an enlightened people, at a time when the greater part of Europe was involved in ignorance and barbariſm; but owing to the weakneſs and tyranny of their princes, they gradually ſunk into the very oppoſite extreme, and may now be conſidered as but a few degrees removed from a ſavage ſtate.

Their moſques or places of public worſhip are uſually large ſquare buildings, compoſed of the ſame materials as the houſes. The building conſiſts of broad and lofty piazzas, opening into a ſquare court, in a manner in ſome degree ſimilar to the Royal Exchange of London. In the centre of the court is a large fountain, and a ſmall ſtream ſurrounds the piazzas, where the Moors perform the ceremony of ablution. The court and piazzas are floored with blue and white checquered tiling; and the latter are covered with matting, upon which the Moors kneel while repeating their prayers. In the moſt conſpicuous part of the moſque fronting the eaſt, ſtands a kind of pulpit, where the talbe or prieſt occaſionally preaches. The Moors always enter this place of worſhip barefooted, leaving their ſlippers at the door. On the top of the moſque, is a ſquare ſteeple with a flag ſtaff, whither at ſtated hours the talbe aſcends, hoiſts a white flag, and calls the people to prayers, for they have no bells. From this high ſituation the voice is heard at a conſiderable diſtance; and the talbes have a monotonous mode of enunciation, the voice ſinking at the end of every ſhort ſentence, which in ſome meaſure reſembles the ſound of a bell. The moment the flag is diſplayed, every perſon forſakes his employment, and goes to prayers. If they are near a moſque, they perform their devotions within it, otherwiſe immediately on the ſpot where they happen to be, and always with their faces towards the eaſt, in honour of their prophet Mahomet, who it is well known was buried at Medina.

40 Religious ceremonies.

Their Sabbath is on our Friday, and commences from ſix o'clock the preceding evening. On this day they uſe a blue flag inſtead of the white one. As it has been propheſied that they are to be conquered by the Chriſtians on the Sabbath day, the gates of all the towns and of the emperor's palaces are ſhut when at divine ſervice on that day, in order to avoid being ſurpriſed during that period. Their talbes are not diſtinguiſhed by any particular dreſs.

The Moors have three ſolemn devotional periods in the courſe of the year. The firſt, which is named *Aid de Cabier*, is held in commemoration of the birth of Mahomet. It continues ſeven days; during which period, every perſon who can afford the expence kills a ſheep as a ſacrifice, and divides it among his friends. The ſecond is the *Ramadam*. This is held at the ſeaſon when Mahomet diſappeared in his flight from Mecca to Medina. Every man is obliged at that period to faſt (that is, to abſtain from animal food from ſunriſe to ſunſet each day) for 30 days; at the expiration of which time a feaſt takes place, and continues a week. The third is named *Llaſhore*, and is a day ſet apart by Mahomet for every perſon to compute the value of his property, in order for the payment of *zakat*, that is, one-tenth of their income to the poor, and other pious uſes. Although this feaſt only laſts a ſingle day, yet it is celebrated with far greater magnificence than either of the others.

The Moors compute time by lunar months, and count the days of the week by the firſt, ſecond, third, &c. beginning from our Sunday. They uſe a common reed for writing, and begin their manuſcripts from right to left.

41 Language of the Moors.

The Moors of the empire of Morocco, as well as thoſe to the northern limits of Africa, ſpeak Arabic; but this language is corrupted in proportion as we retire farther from Aſia, where it firſt took birth; the

Morocco. intermixture which has happened among the African nations, and the frequent transmigrations of the Moors, during a succession of ages, have occasioned them to lose the purity of the Arabic language; its pronunciation has been vitiated, the use of many words lost, and other foreign words have been introduced without thereby rendering it more copious; the pronunciation of the Africans, however, is softer to the ear and less guttural than that of the Egyptians. The language, when written, is in effect much the same at Morocco as at Cairo, except that there are letters and expressions among the Moors which differ from those of the Oriental Arabs, who, however, understand the Moors in conversation, notwithstanding their vitiated manner of pronouncing. They mutually read each others writings with some difficulty.

42 Their temper and disposition. The Moors are naturally of a grave and pensive disposition, fervid in professions of friendship, but very insincere in their attachments. They have no curiosity, no ambition of knowledge; an indolent habit, united to the want of mental cultivation, renders them perhaps even more callous than other unenlightened people to every delicate sensation; and they require more than ordinary excitement to render them sensible of pleasure or of pain. This languor of sentiment is, however, unaccompanied with the smallest spark of courage or fortitude. When in adversity, they manifest the most abject submission to their superiors; and in prosperity their tyranny and pride are insupportable.

43 Mode of living, manners, &c. Personal cleanliness has been considered as one of those circumstances which serve to mark and determine the civilization of a people. It was in vain that Mahomet enjoined the frequency of ablution as a religious duty to the Moors. Their dress, which should be white, is but seldom washed; and their whole appearance evinces that they perform this branch of their religious ceremonies in but a slovenly manner. With this degree of negligence as to their persons, we may be justly surprised to find united a most scrupulous nicety in their habitations and apartments. They enter their chambers barefooted, and cannot bear the slightest degree of contamination near the place where they are seated. This delicacy again is much confined to the insides of their houses. The streets receive the whole of their rubbish and filth; and by these means the ground is so raised in most parts of the city of Morocco, that the new buildings always stand considerably higher than the old.

With respect to the hours for eating, the people of this country are remarkably regular. Very soon after daybreak they take their breakfast, which is generally a composition of flour and water boiled thin, together with an herb which gives it a yellow tinge. The male part of the family eat in one apartment and the female in another. The children are not permitted to eat with their parents, but take their meals afterwards with the servants; indeed in most other respects they are treated exactly as servants or slaves by their parents. The mess is put into an earthen bowl, and brought in upon a round wooden tray. It is placed in the centre of the guests, who sit cross-legged either on a mat or on the floor, and who form a circle for the purpose. Having previously washed themselves, a ceremony always performed before and after meals, each person with his spoon attacks vigorously the bowl, while they diversify the entertainment by eating with it fruit or bread. At twelve o'clock they dine, performing the same ceremonies as at breakfast. For dinner, from the emperor down to the peasant, their dish is universally *cooscoosoo*, the mode of preparing which has been already described. The dish is brought in upon a round tray and placed on the floor, round which the family sit as at breakfast, and with their fingers commit a violent assault on its contents: they are at the same time, however, attended by a slave or domestic, who presents them with water and a towel occasionally to wash their hands. From the want of the simple and convenient invention of knives and forks, it is not uncommon in this country to see three or four people pulling to pieces the same piece of meat, and afterwards with their fingers stirring up the paste or *cooscoosoo*, of which they often take a whole handful at once into their mouth. At sunset they sup upon the same dish; and indeed supper is their principal meal.

But the common people must content themselves with a little bread and fruit instead of animal food, and sleep in the open streets. This kind of existence seems ill calculated to endure even in an inactive state; far more severe must it therefore be to those who exercise the laborious employment of couriers in this country, who travel on foot a journey of three hundred or four hundred miles at the rate of between thirty or forty miles a-day, without taking any other nourishment than a little bread, a few figs, and some water, and who have no better shelter at night than a tree. It is wonderful with what alacrity and perseverance these people perform the most fatiguing journeys at all seasons of the year. There is a regular company of them in every town, who are ready to be despatched at a moment's warning to any part of the country their employers may have occasion to send them.

As the Moors are not fond of admitting men into their houses except upon particular occasions, if the weather be fine they place a mat, and sometimes a carpet, on the ground before their door, seat themselves upon it cross-legged, and receive their friends, who form a circle, sitting in the same manner, with their attendants on the outside of the groupe. Upon these occasions they either drink tea or smoke and converse. The streets are sometimes crowded with parties of this kind; some engaged in playing at an inferior kind of chess or draughts, at which they are very expert; but the majority in conversation. The people of this country, indeed, are so decidedly averse to standing up, or walking about, that if only two or three people meet, they squat themselves down in the first clean place they can find, if the conversation is to hold but for a few minutes.

The Moors have in general but few amusements; the sedentary life they lead in cities is little variegated except by the care they take of their gardens, which are rather kept for profit than pleasure. Most of these gardens are planted with the orange, the lemon tree, and the cedar, in rows, and in such great quantities, that the appearance is rather that of a forest than that of a garden. The Moors sometimes, though rarely, have music in these retreats: a state of slavery but ill agrees with the love of pleasure: the people of Fez alone, either from a difference in education, or because their organs and sensibility are more delicate, make 44 Their amusements.

Morocco. make music a part of their amusements. There are not in Morocco, as in Turkey, public coffee-houses, where people meet to inquire the news of the day; but instead of these, the Moors go to the barbers shops, which in all countries seem to be the rendezvous of newsmongers. These shops are surrounded by benches; on which the customer, the inquisitive, and the idle, seat themselves, and when there are no more places vacant, they crouch on the ground like monkeys.

A common diversion in the towns where there are soldiers, as well as in the country, is what the Moors call the game of gunpowder; a kind of military exercise, that is the more pleasing to these people, inasmuch as, by the nature of their government, they all are, or are liable to become, soldiers, therefore all have arms and horses. By explosions of powder, too, they manifest their festivity on their holidays. Their game of gunpowder consists in two bodies of horse, each at a distance from the other, galloping in successive parties of four and four, and firing their pieces charged with powder. Their chief art is in galloping up to the opposite detachment, suddenly stopping, firing their muskets, facing about, charging, and returning to the attack; all which manœuvres are imitated by their opponents. The Moors take great pleasure in this amusement, which is only an imitation of their military evolutions.

45 Management of horses. The common topics for conversation among the Moors, are the occurrences of the place, religion, their women, but above all their horses. This last topic, indeed appears to occupy by far the greatest portion of their attention. These animals are seldom kept in stables in Morocco. They are watered and fed only once a-day, the former at one o'clock at noon, and the latter at sunset: and the only one mode which they use to clean them is by washing them all over in a river two or three times a-week, and suffering them to dry themselves.

46 Love of music. Like all barbarous nations, the Moors are passionately fond of music, and some few have a taste for poetry. Their slow airs, for want of that variety which is introduced when the science has attained a degree of perfection, have a very melancholy sameness; but some of their quick tunes are beautiful and simple, and partake in some degree of the characteristic melody of the Scotch airs. The poetry of their songs, the constant subject of which is love, though there are few nations perhaps who are less sensible of that passion, has certainly less merit than the music.

Their instruments are a kind of hautboy, which differs from ours only in having no keys; the mandoline, which they have learnt to play upon from their neighbours the Spaniards; another instrument, bearing some resemblance to a violin, and played upon in a similar manner, but with only two strings; the large drum, the common pipe, and the tabor. These united, and accompanied with a certain number of voices, upon many occasions form a band, though solo music is more common in this unsocial country.

The Moors marry very young, many of their females not being more than 12 years of age at their nuptials. As Mahometans, it is well known that their religion admits of polygamy to the extent of four wives, and as many concubines as they please; but if we except the very opulent, the people seldom avail themselves of this indulgence, since it entails on them a vast additional expence in house keeping, and in providing for a large family. In contracting marriage, the parents of both parties are the only agents; and the intended bride and bridegroom never see each other till the ceremony is performed. The marriage settlements are made before the cadi; and then the friends of the bride produce her portion, or if not, the husband agrees to settle a certain sum upon her in case he should die, or divorce her on account of barrenness, or any other cause. The children of the wives have all an equal claim to the effects of the father and mother, but those of the concubines can each only claim half a share. 47 Marriage ceremonies.

When the marriage is finally agreed upon, the bride is kept at home eight days, to receive her female friends, who pay congratulatory visits every day. At the same time a talbe attends upon her, to converse with her relative to the solemn engagement on which she is about to enter: on these occasions he commonly accompanies his admonitions with singing a pious hymn, which is adapted to the solemnity. The bridegroom, on the other hand, receives visits from his male friends in the morning, and in the evening rides through the town accompanied by them, some playing on hautboys and drums, while others are employed in firing volleys of musketry. In all their festivals, the discharge of musketry indeed forms a principal part of the entertainment. Contrary to the European mode, which particularly aims at firing with exactness, the Moors discharge their pieces as irregularly as possible, so as to have a continual succession of reports for a few minutes.

On the day of the marriage, the bride in the evening is put into a square or octagonal cage about 12 feet in circumference, which is covered with fine white linen, and sometimes with gauzes and silks of various colours. In this vehicle, which is placed on a mule, she is paraded round the streets, accompanied by her relations and friends, some carrying lighted torches, others playing on the hautboys, and a third party again firing volleys of musketry. In this manner she is carried to the house of her intended husband, who returns about the same time from performing similar ceremonies. On her arrival, she is placed in an apartment by herself, and her husband is introduced to her alone for the first time, who finds her sitting on a silk or velvet cushion (supposing her to be a person of consequence), with a small table before her, upon which are two wax candles lighted. Her shift, or more properly shirt, hangs down like a train behind her, and over it is a silk or velvet robe with close sleeves, which at the breast and wrists is embroidered with gold; this dress reaches something lower than the calf of the leg. Round her head is tied a black silk scarf, which hangs behind as low as the ground. Thus attired, the bride sits with her hands over her eyes, when her husband appears, and receives her as his wife without any further ceremony: for the agreement made by the friends before the cadi is the only specific contract which is thought necessary.

If the husband should have any reason to suspect that his wife has not been strictly virtuous, he is at liberty to divorce her and take another. For some time after marriage, the family and the friends are engaged in much

much feaſting, and a variety of amuſements, which laſt a longer or ſhorter time according to the circumſtances of the parties. It is uſually cuſtomary for the man to remain at home eight days and the woman eight months after they are firſt married; and the woman is at liberty to divorce herſelf from her huſband, if ſhe can prove that he does not provide her with a proper ſubſiſtence.

Women ſuffer but little inconvenience in this country from child-bearing; they are frequently up the
48 Circumciſion. next day, and go through all the duties of the houſe with the infant upon their backs. In celebrating the rite of circumciſion, the child is dreſſed very ſumptuouſly, and carried on a mule, or, if the parents are in poor circumſtances, on an aſs, accompanied with flags flying and muſicians playing on hautboys and beating
49 Education of children. drums. In this manner they proceed to the moſque, where the ceremony is performed. Children, as ſoon as they can be made in the leaſt degree uſeful, are put to the various kinds of labour adapted to their age and ſtrength. Others, whoſe parents are in better circumſtances, are ſometimes ſent to ſchool; and thoſe who are intended for the church, uſually continue their ſtudies till they have nearly learnt the Koran by rote. In that caſe they are enrolled among the talbes, or learned men of the law; and upon leaving ſchool are paraded round the ſtreets on a horſe, accompanied by muſic and a large concourſe of people.

50 Funeral rites. When any perſon dies, a certain number of women are hired for the purpoſe of lamentation; in the performance of which, nothing can be more grating to the ear, or more unpleaſant, than their frightful moans, or rather howlings: at the ſame time, theſe mercenary mourners beat their heads and breaſts, and tear their cheeks with their nails. The bodies are uſually buried a few hours after death. Previous to interment, the corpſe is waſhed very clean, and ſewed up in a ſhroud, with the right hand under the head, which is pointed towards Mecca: it is carried on a bier ſupported upon men's ſhoulders, to the burying place, which is always, with great propriety, on the outſide of the town, for they never bury their dead in the moſques, or within the bounds of an inhabited place.

Morocco, a city of the kingdom of Morocco in Barbary, lying about 120 miles to the north of Tarudant, 90 to the eaſt of Mogodore, and 350 to the ſouth of Tangier. It is ſituated in a beautiful valley, formed by a chain of mountains on the northern ſide, and thoſe of Atlas, from which it is diſtant about 20 miles, on the ſouth and eaſt. The country which immediately ſurrounds it is a fertile plain, beautifully diverſified with clumps of palm trees and ſhrubs, and watered by ſmall and numerous ſtreams which deſcend from Mount Atlas. The emperor's out gardens, which are ſituated at the diſtance of about five miles to the ſouth of the city, and are large plantations of olives walled in, add conſiderably to the beauty of the ſcene.

Morocco, though one of the capitals of the empire (for there are three, Morocco, Mequinez, and Fez), has nothing to recommend it but its great extent and the royal palace. It is encloſed by remarkably ſtrong walls built of tabby, the circumference of which is about eight miles. On theſe walls there are no guns mounted; but they are flanked with ſquare towers, and ſurrounded by a wide and deep ditch. The city has a number of entrances, conſiſting of large double porches of tabby in the Gothic ſtyle, the gates of which are regularly ſhut every night at certain hours. As polygamy is allowed by the Mahometan religion, and is ſuppoſed in ſome degree to affect population, it would be difficult to form any computation near the truth with reſpect to the number of inhabitants which this city may contain. The moſques, which are the only public buildings except the palace worth noticing at Morocco, are more numerous than magnificent; one of them is ornamented with a very high and ſquare tower, built of cut ſtone, which is viſible at a conſiderable diſtance from the city. The ſtreets are very narrow, dirty, and irregular, and many of the houſes are uninhabited and falling to ruin. Thoſe which are decent and reſpectable in their appearance are built of tabby, and encloſed in gardens. That of the effendi or prime miniſter (according to Mr Lempriere, from whoſe *Tour* * this account is tranſcribed), was among the beſt in Morocco. This houſe, which conſiſted of two ſtories, had elegant apartments both above and below, furniſhed in a ſtyle far ſuperior to any thing our author ever ſaw in that country. The court, into which the lower apartments opened, was very neatly paved with glazed blue and white tiling, and had in its centre a beautiful fountain. The upper apartments were connected together by a broad gallery, the balluſters of which were painted of different colours. The hot and cold baths were very large, and had every convenience which art could afford. Into the garden, which was laid out in a tolerably neat ſtyle, opened a room adjoining to the houſe, which had a broad arched entrance but no door, beautifully ornamented with chequered tiling; and at both ends of the apartment the walls were entirely covered with looking glaſs. The flooring of all the rooms was covered with beautiful carpeting, the walls ornamented with a large and valuable looking glaſſes, intermixed with watches and clocks in glaſs caſes. The ceiling was carved woodwork, painted of different colours; and the whole was in a ſuperior ſtyle of Mooriſh grandeur. This and a few others are the only decent habitations in Morocco. The generality of them ſerve only to impreſs the traveller with the idea of a miſerable and deſerted city.

* Publiſhed in 1791.

The Elcaiſſeria is a particular part of the town where ſtuffs and other valuable articles are expoſed to ſale. It conſiſts of a number of ſmall ſhops, formed in the walls of the houſes, about a yard from the ground, of ſuch a height within as juſt to admit a man to ſit in one of them croſs-legged. The goods and drawers are ſo arranged round him, that when he ſerves his cuſtomers, who are ſtanding all the time out in the ſtreet, he can reach down any article he wants without being under the neceſſity of moving. Theſe ſhops, which are found in all the other towns of the empire, are ſufficient to afford a ſtriking example of the indolence of the Moors. There are three daily markets in different parts of the town of Morocco where proviſions are ſold, and two weekly fairs or markets for the diſpoſal of cattle. The city is ſupplied with water by means of wooden pipes connected with the neighbouring ſtreams, which empty themſelves into reſervoirs placed for the purpoſe in the ſuburbs, and ſome few in the centre of the town.

The caſtle is a large and ruinous building, the outer walls

walls of which enclose a ſpace of ground about three miles in circumference. It has a moſque, on the top of which are three large balls, formed, as the Moors allege, of ſolid gold. The caſtle is almoſt a town of itſelf; it contains a number of inhabitants, who in ſome department or other are in the ſervice of the emperor, and all under the direction of a particular alcaide, who is quite independent of the governor of the town. On the outſide of the caſtle, between the Mooriſh town and the Jewdry, are ſeveral ſmall diſtinct pavilions, encloſed in gardens of orange trees, which are intended as occaſional places of reſidence for ſuch of the emperor's ſons or brothers as happen to be at Morocco. As they are covered with coloured tiling, they have at a ſmall diſtance rather a neat appearance; but upon approaching or entering them, that effect in a great meaſure ceaſes.

The Jews, who are at this place pretty numerous, have a ſeparate town to themſelves, walled in, and under the charge of an alcaide, appointed by the emperor. It has two large gates, which are regularly ſhut every evening about nine o'clock; after which time no perſon whatever is permitted to enter or go out of the Jewdry till they are opened again the following morning. The Jews have a market of their own; and when they enter the Mooriſh town, caſtle, or palace, they are always compelled to be barefooted.

The palace is an ancient building, ſurrounded by a ſquare wall, the height of which nearly excludes from the view of the ſpectator the other buildings. Its principal gates are conſtructed with Gothic arches, compoſed of cut ſtone, which conduct to ſeveral open and ſpacious courts; through theſe it is neceſſary to paſs before we reach any of the buildings. Theſe open courts were uſed by the late emperor for the purpoſes of tranſacting public buſineſs and exerciſing his troops. The habitable part conſiſts of ſeveral irregular ſquare pavilions, built of tabby, and whitened over; ſome of which communicate with each other, others are diſtinct, and moſt of them receive their names from the different towns of the empire. The principal pavilion is named by the Moors the *Douhar*, and is more properly the palace or ſeraglio than any of the others. It conſiſts of the emperor's place of reſidence and the harem, forming altogether a building of conſiderable extent. The other pavilions are merely for the purpoſes of pleaſure or buſineſs, and are quite diſtinct from the douhar. The *Mogodore* pavilion, ſo named from the late emperor's partiality to that town, has by far the faireſt claim to grandeur and magnificence. This apartment was the work of Sidi Mahomet, and is lofty and ſquare. It is built of cut ſtone, handſomely ornamented with windows, and covered with varniſhed tiles of various colours; and its elegance and neatneſs, contraſted altogether with the ſimplicity and irregularity of the other buildings, produce a moſt ſtriking effect. In the inſide, beſides ſeveral other apartments, we find in the pavilion a ſpacious room floored with blue and white chequered tiling, its ceiling covered with curiouſly carved and painted wood, and its ſtuccoed walls variouſly ornamented with looking glaſſes and watches, regularly diſpoſed in glaſs caſes. To this pavilion the late emperor manifeſted an excluſive preference, frequently retiring to it both for the purpoſe of buſineſs and of recreation. The apartments of the emperor have in general a much ſmaller complement of furniture than thoſe of the Moors in the inferior walks of life. Handſome carpeting, a mattreſs on the ground covered with fine linen, a couch, and a couple of European bedſteads, are the principal articles they contain. The gardens within the walls of the palace, of which he has ſeveral, are very neat; they contain orange and olive trees, variouſly diſpoſed and arranged, and interſected with ſtreams of water, fountains, and reſervoirs. Thoſe on the outſide are nothing more than large tracts of ground, irregularly planted with olives; having four ſquare walks, and ſurrounded by walls.

Morocco, or *Marroquin*, the ſkin of a goat, or ſome other animal reſembling it, dreſſed in ſumach or galls, and coloured at pleaſure; much uſed in bookbinding, &c. The name is commonly derived from the kingdom of Morocco, whence it is ſuppoſed the manner of preparing theſe ſkins was firſt borrowed. We have Morocco ſkins brought from the Levant, Barbary, Spain, Flanders, and France; red, black, yellow, blue, &c. For the manner of preparing them, ſee Leather.

MORON, a town of Spain, in Andaluſia, ſeated in a fertile plain about 30 miles ſouth-eaſt of Seville. W. Long. 5. 20. N. Lat. 37. 0.

MORPETH, a handſome town of Northumberland, 14 miles from Newcaſtle, 286 miles from London, is an ancient borough by preſcription, with a bridge over the Wanſbeck. It had once an abbey and a caſtle, now in ruins, ſituated about a quarter of a mile ſouth of the town and river Wanſbeck, on an eminence which overlooks both. The market-place is conveniently ſituated near the centre of the town; and an elegant townhouſe was built by the Carliſle family in 1714, in which the quarter-ſeſſions is held for the county. It is built of hewn ſtone, with a piazza. The church being a quarter of a mile diſtant from the town, a tower containing a good ring of bells ſtands near the market place. Near the bridge is the county gaol, a modern ſtructure. Here are a free grammar ſchool, a chapel near the river, on the ſite of a chantry that was granted for the ſupport of the foundation of the ſchool, which was part of the old ſtructure, and an hoſpital for infirm people. In 1215, the townſmen themſelves burnt their town, out of pure hatred to King John, that he might find no ſhelter there. Here is a good market on Saturday for corn, cattle, and all neceſſary proviſions; and there is another on Wedneſday, the greateſt in England except Smithfield, for live cattle. This is a poſt town and a thoroughfare, with many good inns, and plenty of fiſh; and here are ſeveral mills.—The earl of Carliſle's ſteward holds a court here twice a year, one of them the Monday after Michaelmas, when four perſons are choſen by the free burgeſſes, who are about 107, and preſented to the ſteward, who names two of them to the bailiffs, who, with ſeven aldermen, are its governors for the year enſuing. Its fairs are on Wedneſday, Thurſday, and Friday before Whitſunday, and the Wedneſday before July 22. It ſends two members to parliament.

MORPHEUS, in *Fabulous Hiſtory*, the god of ſleep, or, according to others, one of the miniſters of Somnus. He cauſed ſleepineſs, and repreſented the

forms

forms of dreams. Ovid ftyles him the kindeft of the deities; and he is ufually defcribed in a recumbent pofture, and crowned with poppies.

MORRERI, Lewis, author of the Hiftorical Dictionary, was born at Barge-mont in Provence, 1643. He learned rhetoric and philofophy at Aix, and divinity at Lyons. At 18 years of age he wrote a fmall piece, entitled *Le Pays d'Amour*, and a collection of the fineft French poems entitled *Doux plaifirs de la Poefie*. He learned Spanifh and Italian; and tranflated out of Spanifh into French the book entitled *La Perfection Chretienne de Rodriguez*. He then refined the Saints Lives to the purity of the French tongue. Being ordained prieft, he preached at Lyons, and undertook, when he was but 30 years of age, a new Hiftorical Dictionary, printed at Lyons in one vol. folio, 1673. But his continual labour impaired his health; fo that he died in 1680, aged 37. His fecond volume was publifhed after his death; and four more volumes have fince been added. He left fome other works behind him.

MORRHINA vasa, were a fort of cups or vafes made ufe of by the ancients for drinking out of, and other purpofes. Authors are not agreed as to the fubftance of which they were made. Some fay it was a ftone; fome affert that it was a fluid condenfed by being buried under ground. All that we know concerning it is, that it was known by the name of *murrha*, and that Heliogabalus's chamber pot was made of it. The word is fometimes written *myrrhina*.

MORRISE-dances. See *Moresque-Dances*.

MORS, Death, one of the infernal deities, born of Night without a father. She was worfhipped by the ancients with great folemnity. She was not reprefented as an actually exifting power, but as an imaginary being. Euripides introduces her in one of his tragedies on the ftage. The moderns reprefent her as a fkeleton armed with a fcythe and a fcimitar.

MORSE. See Trichecus, Mammalia *Index*.

MORTALITY, a term frequently ufed to fignify a contagious difeafe, which deftroys great numbers of either men or beafts.

Bills of Mortality, are accounts or regifters fpecifying the numbers born, married, and buried in any parifh, town, or diftrict. In general they contain only thefe numbers; and, even when thus limited, are of great ufe, by fhowing the degrees of healthinefs and prolificknefs, and the progrefs of population in the places where they are kept. It is therefore much to be wifhed, that fuch accounts had been always correctly kept in every kingdom, and regularly publifhed at the end of every year. We fhould then have had under our infpection the comparative ftrength of every kingdom, as far as it depends on the number of inhabitants, and its increafe or decreafe at different periods. But fuch accounts are rendered more ufeful, when they include the ages of the dead, and the diftempers of which they have died. In this cafe they convey fome of the moft important inftructions, by furnifhing us with the means of afcertaining the law which governs the wafte of human life, the values of annuities dependent on the continuance of any lives, or any furvivorfhips between them, and the favourablenefs and unfavourablenefs of different fituations to the duration of human life. There are but few regifters of this kind; nor has this fubject, though fo interefting to mankind, ever engaged much attention till lately. The firft bills containing the ages of the dead were thofe for the town of Breflaw in Silefia. It is well known what ufe has been made of thefe by Dr Halley, and after him by De Moivre. A table of the probabilities of the duration of human life at every age, deduced from them by Dr Halley, has been publifhed in the Philofophical Tranfactions, (fee the Abridgement, vol. iii. p. 699.) and is the firft table of that fort that has been ever publifhed. Since the publication of this table, fimilar bills have been eftablifhed in a few towns of this kingdom; and particularly in London, in the year 1728, and at Northampton in 1735.

Two improvements of thefe regifters have been propofed: the firft is, That the fexes of all that die in every period of life fhould be fpecified in them, under the denomination of *boys*, *married men*, *widowers*, and *bachelors*; and of *girls*, *married women*, *widows*, and *virgins*. The fecond is, That they fhould fpecify the number of both fexes dying of every diftemper in every month, and at every age. See the end of the 4th effay in Dr Price's Treatife on Reverfionary Payments. Regifters of mortality thus improved, when compared with records of the feafons, and with the circumftances that difcriminate different fituations, might contribute greatly to the increafe of medical knowledge; and they would afford the neceffary data for determining the difference between the duration of human life among males and females; for fuch a difference there certainly is much in favour of females, as will appear from the following facts.

At Northampton, though more males are born than females, and nearly the fame number die; yet the number of living females appeared, by an account taken in 1746, to be greater than the number of males, in the proportion of 2301 to 1770, or 39 to 30.

At Berlin it appeared, from an accurate account which was taken of the inhabitants in 1747, that the number of female citizens exceeded the number of male citizens in the proportion of 459 to 391. And yet out of this fmaller number of males, more had died for 20 years preceding 1751, in the proportion of 19 to 17.

At Edinburgh, in 1743, the number of females was to the number of males as 4 to 3. (See Maitland's Hiftory of Edinburgh, p. 220.) But the females that died annually from 1749 to 1758, were to the males in no higher proportion than $3\frac{1}{3}$ to 3.

He that will take the pains to examine the accounts in Phil. Tranf. Abr. vol. vii. part iv. p. 46, &c. will find, that though in the towns there enumerated, the proportion of males and females born is no higher than 19 to 18, yet the proportion of boys and girls that die is 8 to 7; and that, in particular, the ftill-born and chryfom males are to the ftill-born and chryfom females as 3 to 2.

In 39 parifhes of the diftrict of Vaud in Switzerland, the number of males that died during ten years before 1766 was 8170; of females 8167; of whom the numbers that died under one year of age were 1817 males and 1305 females; and under ten years of age, 3099 males and 2598 females. In the beginning of life, therefore, and before any emigrations can take place, the rate of mortality among males appears to be

Mortality. be greater than among females. And this is rendered yet more certain by the following accounts. At Vevey, in the district of Vaud just mentioned, there died in the course of 20 years, ending at 1764, in the first month after birth, of males 135 to 89 females; and in the first year 225 to 162. To the same effect it appears from a table given by Susmilch, in his Gottliche Ordnung, vol. ii. p. 317, that in Berlin 203 males die in the first month, and but 168 females; and in the first year, 489 to 395; and also, from a table of Struyck's, that in Holland 396 males die in the first year to 306 females.

The authorities for the facts here mentioned, and much more on this subject, may be found in the 4th essay in Dr Price's Treatise on Reversionary Payments, and in the supplement at the end of that treatise.

We shall here only add the following table, taken from a memoir of Mr Wargentin's, published in the collection of the Memoirs of the Royal Academy of Sciences at Stockholm, printed at Paris in 1772.

In all Sweden for nine years, ending in 1763, the proportion of females to males that died out of a given number living, was

Under the age of one year,	1000 to	1099
From 1 to 3 years of age,	1000 —	1022
3—5	— —	1042
5—10	— —	1074
10—15	— —	1080
15—20	— —	1097
20—25	— —	1283
25—30	— —	1161
30—35	— —	993
35—40	— —	1159
40—45	— —	1115
45—50	— —	1340
50—55	— —	1339
55—60	— —	1292
60—65	— —	1115
65—70	— —	1080
70—80	— —	1022
80—90	— —	1046
Above 90	— —	1044

Registers of mortality on the improved plan before mentioned, were established in 1772 at Chester, and also in 1773 at Warrington in Lancashire; and they are so comprehensive and correct, that there is reason to expect they will afford much instruction on the subject of human mortality, and the values of lives.

But the country most distinguished in this respect is Sweden: for in that kingdom exact accounts are taken of the births, marriages, and burials, and of the numbers of both sexes that die at all ages in every town and district, and also at the end of every period of five years, of the numbers living at every age: and at Stockholm a society is established, whose business it is to superintend and regulate the enumerations, and to collect from the different parts of the kingdom the registers, in order to digest them into tables of observation. These regulations were begun in Sweden in 1755; and tables, containing the result of them from 1755 to 1763, have been published in Mr Wargentin's memoir just referred to; and the most material parts of them may be found in an essay by Dr Price on the Difference between the Duration of Human Life in Towns and in Country Parishes, printed in the 65th volume of the Philosoph. Trans. Part II. Mortality.

In the fourth essay in Dr Price's Treatise on Reversionary Payments and Life Annuities, the following account is given of the principles on which tables of observation are formed from registers of mortality; and of the proper method of forming them, so as to render them just representations of the number of inhabitants, and the probabilities of the duration of human life in a town or country.

In every place which just supports itself in the number of its inhabitants, without any recruits from other places; or where, for a course of years, there has been no increase or decrease; the number of persons dying every year at any particular age, and above it, must be equal to the number of the living at that age. The number, for example, dying every year at all ages from the beginning to the utmost extremity of life, must, in such a situation, be just equal to the whole number born every year. And for the same reason, the number dying every year at one year of age and upwards, at two years of age and upwards, at three and upwards, and so on, must be equal to the numbers that attain to those ages every year; or, which is the same, to the numbers of the living at those ages. It is obvious, that unless this happens, the number of inhabitants cannot remain the same. If the former number is greater than the latter, the inhabitants must decrease; if less, they must increase. From this observation it follows, that in a town or country where there is no increase or decrease, bills of mortality which give the ages at which all die, will show the exact number of inhabitants, and also the exact law according to which human life wastes in that town or country.

In order to find the number of inhabitants, the mean numbers dying annually at every particular age and upwards must be taken as given by the bills, and placed under one another in the order of the second column of the following tables. These numbers will, it has appeared, be the numbers of the living at 1, 2, 3, &c. years of age; and consequently the sum diminished by half the number born annually will be the whole number of inhabitants.

This subtraction is necessary, for the following reason. In a table formed in the manner here directed, it is supposed that the numbers in the second column are all living together at the beginning of every year. Thus the number in the second column opposite to 0 in the first column, the table supposes to be all just born together on the first day of the year. The number, likewise, opposite to 1, it supposes to attain to one year of age just at the same time that the former number is born. And the like is true of every number in the second column. During the course of the year, as many will die at all ages as were born at the beginning of the year, and consequently, there will be an excess of the number alive at the beginning of the year above the number alive at the end of the year, equal to the whole number of the annual births; and the true number constantly alive together, is the arithmetical mean between these two numbers; or agreeably

Mortality.

greeably to the rule here given, the ſum of the numbers in the ſecond column of the table leſſened by half the number of annual births.

In ſuch a ſeries of numbers, the exceſs of each number above that which immediately follows it will be the number dying every year out of the particular number alive at the beginning of the year; and theſe exceſſes ſet down regularly as in the third column of the table to which we have referred, will ſhow the different rates at which human life waſtes through all its different periods, and the different probabilities of life at all particular ages.

It muſt be remembered, that what has been now ſaid goes on the ſuppoſition, that the place whoſe bills of mortality are given, ſupports itſelf, by procreation only, in the number of its inhabitants. In towns this very ſeldom happens, on account of the luxury and debauchery which generally prevail in them. They are, therefore, commonly kept up by a conſtant acceſſion of ſtrangers, who remove to them from country pariſhes and villages. In theſe circumſtances, in order to find the true number of inhabitants, and probabilities of life, from bills of mortality containing an account of the ages at which all die, it is neceſſary that the proportion of the annual births to the annual ſettlers ſhould be known, and alſo the period of life at which the latter remove. Both theſe particulars may be diſcovered in the following method.

If for a courſe of years there have been no ſenſible increaſe or decreaſe in a place, the number of annual ſettlers will be equal to the exceſs of the annual burials above the annual births. If there be an increaſe, it will be greater than this exceſs. If there be a decreaſe, it will be leſs.

The period of life at which theſe ſettlers remove, will appear in the bills by an increaſe in the number of deaths at that period and beyond it. Thus in the London bills the number of deaths between 20 and 30 is generally above double; and between 30 and 40 near triple the number of deaths between 10 and 20; and the true account of this is, that from the age of 18 or 20 to 35 or 50, there is an afflux of people every year to London from the country, which occaſions a great increaſe in the number of inhabitants at theſe ages; and conſequently raiſes the deaths for all ages above 20 conſiderably above their due proportion when compared with the number of deaths before 20. This is obſervable in all the bills of mortality for towns with which we are acquainted, not even excepting the Breſlaw bills. Dr Halley takes notice, that theſe bills gave the number of deaths between 10 and 20 too ſmall. This he conſidered as an irregularity in them owing to chance; and, therefore, in forming his table of obſervations, he took the liberty ſo far to correct it, as to render the proportion of thoſe who die to the living in this diviſion of life nearly the ſame with the proportion which, he ſays, he had been informed die annually of the young lads in Chriſt Church hoſpital. But the truth is, that this irregularity in the bills was derived from the cauſe we have juſt aſſigned. During the five years for which the Breſlaw bills are given by Dr Halley, the births did indeed a little exceed the burials; but it appears that this was the effect of ſome peculiar cauſes that happened to operate juſt at that time; for during a complete century, from 1633 to 1734, the annual medium of births was 1089, and of burials 1256. This town, therefore, muſt have been all along kept up by a number of yearly recruits from other places, equal to about a ſeventh part of the yearly births.

Mortality.

It appears from the account in the Philoſophical Tranſactions (Abridgement, vol. vii. N° 382, p. 46, &c.), that from 1717 to 1725, the annual medium of births at Breſlaw was 1252, of burials 1507; and alſo that much the greateſt part of the births died under 10 years of age. From a table in Suſmilch's works, vol. i. p. 38. it appears that in reality the greater part of all that die in this town are children under five years of age.

What has been now obſerved concerning the period of life at which people remove from the country to ſettle in towns, would appear ſufficiently probable were there no ſuch evidence for it as has been mentioned; for it might well be reckoned that theſe people in general muſt be ſingle perſons in the beginning of mature life, who not having yet obtained ſettlements in the places where they were born, migrate to towns in queſt of employments.

Having premiſed theſe obſervations, it will be proper next to endeavour to explain diſtinctly the effect which theſe acceſſions to towns muſt have on tables of obſervation formed from their bills of mortality. This is a ſubject proper to be inſiſted on, becauſe miſtakes have been committed about it; and becauſe alſo the diſcuſſion of it is neceſſary to ſhow how near to truth the value of lives comes as deduced from ſuch tables.

The following general rule may be given on this ſubject. If a place has for a courſe of years been maintained in a ſtate nearly ſtationary, as to number of inhabitants, by recruits coming in every year, to prevent the decreaſe that would ariſe from the exceſs of burials above the births, a table formed on the principle, "that the number dying annually after every particular age, is equal to the number living at that age," will give the number of inhabitants, and the probabilities of life, too great, for all ages preceding that at which the recruits ceaſe: and after this it will give them right. If the acceſſions are ſo great as to cauſe an increaſe in the place, ſuch a table will give the number of inhabitants and the probabilities of life too little after the age at which the acceſſions ceaſe; and too great if there is a decreaſe. Before that age it will in both caſes give them too great; but moſt conſiderably ſo in the former caſe, or when there is an increaſe.

Agreeably to theſe obſervations, if a place increaſes not in conſequence of acceſſions from other places, but of a conſtant exceſs of the births above the deaths, a table conſtructed on the principle that has been mentioned will give the probabilities of life too low through the whole extent of life; becauſe in ſuch circumſtances the number of deaths in the firſt ſtages of life muſt be too great in compariſon of the number of deaths in the latter ſtages; and more or leſs ſo as the increaſe is more or leſs rapid. The contrary in all reſpects takes place where there is a decreaſe ariſing from the exceſs of the deaths above the births.

For example: Let us ſuppoſe that 244 of thoſe born in a town attain annually to 20 years of age, and

Mortality.

and that 250 more, all likewiſe 20 years of age, come into it annually from other places, in conſequence of which it has for a courſe of years been juſt maintained in the number of its inhabitants, without any ſenſible increaſe or decreaſe: in theſe circumſtances, the number of the living in the town of the age of 20 will be always 244 natives, and 250 ſettlers, or 494 in all; and ſince theſe are ſuppoſed all to die in the town, and no more recruits are ſuppoſed to come in, 494 will be likewiſe the number dying annually at 20 and upwards. In the ſame manner it will appear, on theſe ſuppoſitions, that the number of the living at every age ſubſequent to 20 will be equal to the number dying annually at that age and above it; and conſequently that the number of inhabitants and the decrements of life, for every ſuch age, will be given exactly by the table. But for all ages before 20, they will be given much too great. For let 280 of all born in the town reach 10; in this caſe, 280 will be the true number of the living in the town at the age of 10; and the recruits not coming in till 20, the number given by the bills as dying between 10 and 20 will be the true number dying annually of the living in this diviſion of life. Let this number be 36; and it will follow that the table ought to make the numbers of the living at the ages between 10 and 20, a ſeries of decreaſing means between 280 and (280 diminiſhed by 36, or) 244. But in forming the table on the principle juſt mentioned, 250 (the number above 20 dying annually in the town who were not born in it) will be added to each number in this ſeries; and therefore the table will give the numbers of the living, and the probabilities of life in this diviſion of life, almoſt twice as great as they really are. This obſervation, it is manifeſt, may be applied to all the ages under 20.

It is neceſſary to add, that ſuch a table will give the number of inhabitants and the probabilities of life equally wrong before 20, whether the recruits all come in at 20, agreeably to the ſuppoſition juſt made, or only begin then to come in. In this laſt caſe, the table will give the number of inhabitants and probabilities of life too great throughout the whole extent of life, if the recruits come in at all ages above 20. But if they ceaſe at any particular age, it will give them right only from that age; and before, it will err all along on the ſide of exceſs; but leſs conſiderably between 20 and that age than before 20. For example: if, of the 250 ſuppoſed to come in at 20, only 150 then come in, and the reſt at 30; the number of the living will be given 100 too high at every age between 20 and 30; but, as juſt ſhown, they will be given 250 too high at every age before 20. In general, therefore, the number of the living at any particular age muſt be given by the ſuppoſed table as many too great as there are annual ſettlers after that age; and if theſe ſettlers come in at all ages indiſcriminately, during any certain interval of life, the number of inhabitants and the probabilities of life will be continually growing leſs and leſs wrong, the nearer any age is to the end of that interval. Theſe obſervations prove, that tables of obſervation formed in the common way, from bills of mortality for places where there is an exceſs of the burials above the births, muſt be erroneous for a great part of the duration of life, in proportion to the degree of that exceſs. They ſhow likewiſe at what parts of life the errors in ſuch tables are moſt conſiderable, and how they may be in a great meaſure corrected.

All this ſhall be exemplified in the particular caſe of London.

The number of deaths between the ages of 10 and 20 is always ſo ſmall in the London bills, that it ſeems certain few recruits come to London under 20, or at leaſt not ſo many as before this age are ſent out for education to ſchools and univerſities. After 20 great numbers come in till 30, and ſome perhaps till 40 or 50: but at every age after 50, it is probable that more retire from London than come to it. The London tables of obſervation, therefore, being formed on the principle already mentioned, cannot give the probabilities of life right till 40. Between 30 and 40 they muſt be a little too high; but more ſo between 20 and 30, and moſt of all ſo before 20. It follows alſo that theſe tables muſt give the number of inhabitants in London much too great.

The firſt of the following tables is formed in the manner here explained, from the London bills for 10 years, from 1759 to 1768, and adapted to 1000 born as a radix. The ſum of the numbers in the ſecond column, diminiſhed by half the number born, is 25.757. According to this table, then, for every 1000 deaths in London there are $25\frac{3}{4}$ as many inhabitants; or, in other words, the expectation of a child juſt born is $25\frac{3}{4}$; and the inhabitants are to the annual burials as $25\frac{3}{4}$ to 1. But it has appeared, that the numbers in the ſecond column, being given on the ſuppoſition that all thoſe who die in London were born there, muſt be too great; and we have from hence a demonſtration, that the probabilities of life are given in the common tables of London obſervations too high for at leaſt the firſt 30 years of life; and alſo, that the number of inhabitants in London muſt be leſs than $25\frac{3}{4}$ multiplied by the annual burials. The common tables, therefore, of London obſervations undoubtedly need correction, as Mr Simpſon ſuggeſted, and in ſome meaſure performed; though too imperfectly, and without going upon any fixed principles, or ſhowing particularly how tables of obſervation ought to be formed, and how far in different circumſtances, and in different ages, they are to be depended on. The way of doing this, and in general the right method of forming genuine tables of obſervation for towns, may be learned from the following rule:

"From the ſum of all that die annually, after any given age, ſubtract the number of annual ſettlers after that age; and the remainder will be the number of the living at the given time."

This rule can want no explication or proof after what has been already ſaid.

If, therefore, the number of annual ſettlers in a town at every age could be aſcertained, a perfect table of obſervations might be formed for that town from bills of mortality, containing an account of the ages at which all die in it. But no more can be learned in this inſtance from any bills, than the whole number of annual ſettlers, and the general diviſion of life in which they enter. This, however, may be ſufficient to enable us to form tables that ſhall be tolerably exact. For inſtance: Suppoſe the annual deaths in a town which has not increaſed or decreaſed, to have been

Mortality. been for many years in the proportion of 4 to 3 to the annual births. It will hence follow, that $\frac{1}{4}$ of the perfons who die in fuch a town are fettlers, or emigrants from other places, and not natives; and the fudden increafe in the deaths after 20 will alfo fhow, agreeably to what was before obferved, that they enter after this age. In forming, therefore, a table for fuch a town, a quarter of all that die at all ages throughout the whole extent of life muft be deducted from the fum of all that die after every given age before 20; and the remainder will be the true number living at that given age. And if at 20, and every age above it, the deduction is omitted, or the number of the living at every fuch age is taken the fame with the fum of all that die after it, the refult will be (fuppofing moft of the fettlers to come in before 30, and all before 40) a table exact till 20; too high between 20 and 30; but nearly right for fome years before 40; and after 40 exact again. Such a table, it is evident, will be the fame with the table laft defcribed at all ages above 20, and different from it only under 20. It is evident alfo, that on account of its giving the probabilities of life too great for fome years after 20, the number of inhabitants deduced from it may be depended on as fomewhat greater than the truth; and more or lefs fo, as the annual recruits enter in general later or fooner after 20.

Let us now confider what the refult of thefe remarks will be, when applied particularly to the London bills.

It muft be here firft obferved, that at leaft one quarter of all that die in London are fupplies or fettlers from the country, and not natives. The medium of annual burials for 10 years, from 1759 to 1768, was 22,956; of births 15,710. The excefs is 7246, or near a third of the burials. The fame excefs during 10 years before 1750 was 10,500, or near half the burials. London was then decreafing. For the laft 12 or 15 years it has been increafing. This excefs, therefore, agreeably to the foregoing obfervations, was then greater than the number of annual fettlers, and it is now lefs. It is however here fuppofed, that the number of annual fettlers is now no more than a quarter of the annual burials, in order to allow for more omiffions in the births than the burials; and alfo, in order to be more fure of obtaining refults that fhall not exceed the truth.

Of every 1000 then who die in London only 750 are natives, and 250 are recruits who come to it after 18 or 20 years of age; and, confequently, in order to obtain from the bills a more correct table than the firft of the following tables, 250 muft be fubtracted from every one of the numbers in the fecond column till 20; and the numbers in the third column muft be kept the fame, the bills always giving thefe right. After 20, the table is to be continued unaltered; and the refult will be, a table which will give the numbers of the living at all ages in London much nearer the truth but ftill fomewhat too high. Such is the fecond of the following tables. The fum of all the numbers in the fecond column of this table, diminifhed by 500, is 20,750. For every 1000 deaths, therefore, in London, there are, according to this table, 20,750 living perfons in it; or for every fingle death $20\frac{3}{4}$ inhabitants. It was before fhown, that the number of inhabitants in London could not be fo great as $25\frac{3}{4}$ times the deaths. It now appears (fince the numbers in the fecond column of this table are too high) that the number of inhabitants of London cannot be fo great as even $20\frac{3}{4}$ times the deaths. And this is a conclufion which every one, who will beftow due attention on what has been faid, will find himfelf forced to receive. It will not be amifs, however, to confirm it by the following fact, the knowledge of which is derived from the particular inquiry and information of Mr Harris, the late ingenious mafter of the royal mathematical fchool in Chrift-Church hofpital. The average of lads in this fchool has, for 30 years paft, been 831. They are admitted at all ages between 7 and 11; and few ftay beyond 16: they are therefore in general, lads between the age of 8 and 16. They have better accommodations than it can be fuppofed children commonly have; and about 300 of them have the particular advantage of being educated in the country. In fuch circumftances, it may be well reckoned, that the proportion of children dying annually muft be lefs than the general proportion of children dying annually at the fame ages in London. The fact is, that for the laft 30 years $11\frac{4}{5}$ have died annually, or one in $70\frac{2}{5}$.

According to Table II. one in 73 dies between 10 and 20, and one in 70 between 8 and 16. That table, therefore, probably gives the decrements of life in London, at thefe ages, too little, and the numbers of the living too great: and if this is true of thefe ages, it muft be true of all other ages under 20; and it follows demonftrably, in conformity to what was before fhown, that more people fettle in London after 20 than the fourth above fuppofed; and that from 20 to at leaft 30 or 35, the numbers of the living are given too great, in proportion to the decrements of life.

In this table the numbers in the fecond column are doubled at 20, agreeably to what really happens in London; and the fum of the numbers in this column diminifhed by half the whole number of deaths, gives the expectation of life, not of a child juft born, as in other tables, but of all the inhabitants of London at the time they enter it, whether that be at birth or at 20 years of age. The *expectations*, therefore, and the *values* of London lives under 20, cannot be calculated from this table. But it may be very eafily fitted for this purpofe, by finding the number of births which, according to the given decrements of life, will leave 494 alive at 20; and then adapting the intermediate numbers in fuch a manner to this radix, as to preferve all along the number of the living in the fame proportion to the numbers of the dead. This is done in the third of the following tables; and this table may be recommended as better adapted to the prefent ftate of London than any other table. The values of lives, however, deduced from it, are in general nearly the fame with thofe deduced by Mr Simpfon from the London bills as they ftood forty years ago; the main difference is, that after 52, and in old age, this table gives them fomewhat lower than Mr Simpfon's table. The fourth and fifth of the following tables, compared with the two laft, will give a diftinct and full view of the difference between the rate of human mortality in great towns and in country parifhes and villages.

TABLE

Mortality.

TABLE I.

Showing the Probabilities of Life in London, on the suppofition that all who die in London were born there. Formed from the Bills for 10 years, from 1759 to 1768.

Ages.	Perfons living.	Decr. of Life	Ages.	Perfons living.	Decr. of Life	Ages.	Perfons living.	Decr. of Life
0	1000	240	31	404	9	62	132	7
1	760	99	32	395	9	63	125	7
2	661	42	33	386	9	64	118	7
3	619	29	34	377	9	65	111	7
4	590	21	35	368	9	66	104	7
5	569	11	36	359	9	67	97	7
6	558	10	37	350	9	68	90	7
7	548	7	38	341	9	69	83	7
8	541	6	39	332	10	70	76	6
9	535	5	40	322	10	71	70	6
10	530	4	41	312	10	72	64	6
11	526	4	42	302	10	73	58	5
12	522	4	43	292	10	74	53	5
13	518	3	44	282	10	75	48	5
14	515	3	45	272	10	76	43	5
15	512	3	46	262	10	77	38	5
16	509	3	47	252	10	78	33	4
17	506	3	48	242	9	79	29	4
18	503	4	49	233	9	80	25	3
19	499	5	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

TABLE II.

Showing the true Probabilities of Life in London till the age of 19.

Ages.	Perfons living.	Decr. of Life	Ages.	Perfons living.	Decr. of Life	Ages	Perfons living.	Decr. of Life
0	750	240	9	285	5	18	253	4
1	510	99	10	280	4	19	249	
2	411	42	11	276	4	20	494	
3	369	29	12	272	4	21	487	
4	340	21	13	268	3	&c.	&c.	
5	319	11	14	265	3			
6	308	10	15	262	3			
7	298	7	16	259	3			
8	291	6	17	256	3			

The numbers in the fecond column to be continued as in the laft table.

Mortality.

TABLE III.

Showing the true Probabilities of Life in London for all ages. Formed from the Bills for 10 years, from 1759 to 1768.

Ages.	Perfons living.	Decr. of Life	Ages.	Perfons living.	Decr. of Life	Ages	Perfons living.	Decr. of Life
0	1518	486	31	404	9	62	132	7
1	1032	200	32	395	9	63	125	7
2	832	85	33	386	9	64	118	7
3	747	59	34	377	9	65	111	7
4	688	42	35	368	9	66	104	7
5	646	23	36	359	9	67	97	7
6	623	20	37	350	9	68	90	7
7	603	14	38	341	9	69	83	7
8	589	12	39	332	10	70	76	6
9	577	10	40	322	10	71	70	6
10	567	9	41	312	10	72	64	6
11	558	9	42	302	10	73	58	5
12	549	8	43	292	10	74	53	5
13	541	7	44	282	10	75	48	5
14	534	6	45	272	10	76	43	5
15	528	6	46	262	10	77	38	5
16	522	7	47	252	10	78	33	4
17	515	7	48	242	9	79	29	4
18	508	7	49	233	9	80	25	3
19	501	7	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

All the bills, from which the following tables are formed, give the numbers dying under 1 as well as under 2 years; and in the numbers dying under 1 are included, in the country parifh in Brandenburg and at Berlin, all the ftillborns. All the bills alfo give the numbers dying in every period of five years.

TABLE

Mortality.

TABLE IV.

Showing the Probabilities of Life in the District of Vaud, Switzerland, formed from the Registers of 43 Parishes, given by Mr Muret, in the First Part of the Bern Memoirs for the Year 1766.

Age.	Living	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr
0	1000	189	31	558	5	62	286	12
1	811	46	32	553	5	63	274	12
2	765	30	33	548	4	64	262	12
3	735	20	34	544	5	65	250	14
4	715	14	35	539	6	66	236	16
5	701	13	36	533	6	67	220	18
6	688	11	37	527	7	68	202	18
7	677	10	38	520	7	69	184	16
8	667	8	39	513	7	70	168	15
9	659	6	40	506	6	71	153	13
10	653	5	41	500	6	72	140	11
11	648	5	42	494	6	73	129	10
12	643	4	43	488	6	74	119	10
13	639	4	44	482	6	75	109	11
14	635	4	45	476	7	76	98	13
15	631	5	46	469	8	77	85	14
16	626	4	47	461	10	78	71	13
17	622	4	48	451	10	79	58	12
18	618	4	49	441	10	80	46	10
19	614	4	50	431	9	81	36	7
20	610	4	51	422	8	82	29	5
21	606	4	52	414	8	83	24	4
22	602	5	53	406	9	84	20	3
23	597	5	54	397	9	85	17	3
24	592	5	55	388	11	86	14	3
25	587	5	56	377	13	87	11	2
26	582	5	57	364	16	88	9	2
27	577	5	58	348	17	89	7	2
28	572	5	59	331	17	90	5	1
29	567	4	60	314	15			
30	563	5	61	299	13			

Mortality

TABLE V.

Showing the Probabilities of Life in a Country Parish in Brandenburg, formed from the Bills for 50 Years, from 1710 to 1759, as given by Mr Susmilch, in his Gottliche Ordnung.

Age.	Living	Decr.	Age.	Living.	Decr.	Age.	Living	Decr.
0	1000	225	31	482	5	62	260	12
1	775	57	32	477	5	63	248	12
2	718	31	33	472	5	64	236	12
3	687	23	34	467	5	65	224	11
4	664	22	35	462	6	66	213	11
5	642	20	36	456	6	67	202	12
6	622	15	37	450	6	68	190	12
7	607	12	38	444	6	69	178	12
8	595	10	39	438	6	70	166	13
9	585	8	40	432	5	71	153	15
10	577	7	41	427	5	72	138	16
11	570	6	42	422	5	73	122	15
12	564	5	43	417	5	74	107	14
13	559	5	44	412	6	75	93	13
14	554	5	45	407	6	76	80	12
15	549	5	46	400	6	77	68	9
16	544	5	47	394	6	78	59	8
17	539	4	48	388	7	79	51	7
18	535	4	49	381	7	80	44	6
19	531	4	50	374	7	81	38	6
20	527	5	51	367	8	82	32	6
21	522	5	51.	359	8	83	25	6
22	517	5	53	351	8	84	21	5
23	512	5	54	343	9	85	15	4
24	507	5	55	334	10	86	11	3
25	502	4	56	324	10	87	8	2
26	498	3	57	314	10	88	6	2
27	495	3	58	304	11	89	4	1
28	492	3	59	293	11	90	3	1
29	489	3	60	282	11	91	2	1
30	486	4	61	271	11	92	1	1

TABLE

TABLE VI.

Showing the Probabilities of Life at Vienna, formed from the Bills for Eight Years, as given by Mr Susmilch, in his Gottliche Ordnung, page 32, Tables.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living	Decr.
0	1495	682	32	358	5	64	116	7
1	813	107	33	353	6	65	109	8
2	706	61	34	347	7	66	101	8
3	645	46	35	340	8	67	93	8
4	599	33	36	332	8	68	85	7
5	566	30	37	324	8	69	78	7
6	536	20	38	316	9	70	71	6
7	516	11	39	307	9	71	65	5
8	505	9	40	298	8	72	60	5
9	496	7	41	290	7	73	55	4
10	489	6	42	283	6	74	51	4
11	483	5	43	277	6	75	47	5
12	478	5	44	271	7	76	42	5
13	473	6	45	264	8	77	37	5
14	467	6	46	256	9	78	32	5
15	461	6	47	247	9	79	27	4
16	455	7	48	238	9	80	23	3
17	448	6	49	229	9	81	20	2
18	442	6	50	220	8	82	19	2
19	436	6	51	212	7	83	16	2
20	430	5	52	205	7	84	14	2
21	425	5	53	198	7	85	1	2
22	420	5	54	191	7	86	10	2
23	415	6	55	184	8	87	8	2
24	409	6	56	176	8	88	6	2
25	403	6	57	168	9	89	4	1
26	397	6	58	159	8	90	3	1
27	391	7	59	151	8	91	2	1
28	381	7	60	143	7	92	1	1
29	377	7	61	136	7			
30	370	6	62	129	6			
31	364	6	63	123	7			

TABLE VII.

Showing the Probabilities of Life at Berlin, formed from the Bills for Four Years, from 1752 to 1755, given by Mr Susmilch in his Gottliche Ordnung, vol. ii. page 37, Tables.

Age.	Living.	Decr.	Age.	Living	Decr.	Age.	Living.	Decr.
0	1427	524	32	368	7	64	118	6
1	903	151	33	361	7	65	112	6
2	752	61	34	354	7	66	106	7
3	691	73	35	347	8	67	99	7
4	618	45	36	339	8	68	92	6
5	573	21	37	330	10	69	86	6
6	552	15	38	320	10	70	80	6
7	536	13	39	310	10	71	74	6
8	523	9	40	300	10	72	68	6
9	514	7	41	290	9	73	62	5
10	507	5	42	281	8	74	57	5
11	502	4	43	274	7	75	52	5
12	498	4	44	266	7	76	47	5
13	494	4	45	259	7	77	42	5
14	490	4	46	252	7	78	37	5
15	486	4	47	245	7	79	32	4
16	482	5	48	238	7	80	28	4
17	477	5	49	231	7	81	24	3
18	472	5	50	224	7	82	21	2
19	467	6	51	217	7	83	19	2
20	461	6	52	210	7	84	17	2
21	455	6	53	203	8	85	15	2
22	449	6	54	195	8	86	13	2
23	443	7	55	187	8	87	11	2
24	436	8	56	179	8	88	9	2
25	428	9	57	171	8	89	7	1
26	421	9	58	163	9	90	6	1
27	412	9	59	154	9	91	5	1
28	403	9	60	145	8	92	4	1
29	394	9	61	137	7	93	3	1
30	385	9	62	130	6	94	2	1
31	376	8	63	124	6			

BRIEF *of* MORTANCESTRY, in *Scots Law;* anciently the ground of an action at the instance of an heir, in the special case where he had been excluded from the possession of his ancestor's estate by the superior, or other person pretending right.

MORTAR, a preparation of lime and sand mixed with water, which serves as a cement, and is used by masons and bricklayers in building walls of stone and brick. See LIME, CHEMISTRY *Index*.

MORTAR, a chemical utensil, very useful for the division of bodies, partly by percussion and partly by grinding. Mortars have the form of an inverted bell. The matter intended to be pounded is to be put into them, and there it is to be struck and bruised by a long instrument called a *pestle.* The motion given to the pestle ought to vary according to the nature of the substances to be pounded. Those which are easily broken, or which are apt to fly out of the mortar, or which are hardened by the stroke of the pestle, require that this instrument should be moved circularly, rather by grinding or bruising than by striking. Those substances which are softened by the heat occasioned by rubbing

rubbing and percussion, require to be pounded very ſlowly. Laſtly, Thoſe which are very hard, and which are not capable of being ſoftened, are eaſily pounded by repeated ſtrokes of the peſtle. They require no bruiſing but when they are brought to a certain degree of fineneſs. But theſe things are better learned by habit and practice than by any directions.

As mortars are inſtruments which are conſtantly uſed in chemiſtry, they ought to be kept of all ſizes and materials; as of marble, copper, glaſs, iron, gritſtone, and agate. The nature of the ſubſtance to be pounded determines the choice of the kind of mortar. The hardneſs and diſſolving power of that ſubſtance are particularly to be attended to. As copper is a metal, which is ſoluble by almoſt all menſtrua, and hurtful to health, this metal is rarely or never employed for the purpoſe of making mortars.

One of the principal inconveniences of pulverization in a mortar proceeds from the fine powder which riſes abundantly from ſome ſubſtances during the operation. If theſe ſubſtances be precious, the loſs will be conſiderable; and if they be injurious to health, they may hurt the operator. Theſe inconveniences may be remedied, either by covering the mortar with a ſkin, in the middle of which is a hole, through which the peſtle paſſes; or by moiſtening the matter with a little water when this addition does not injure it; or, laſtly, by covering the mouth and noſe of the operator with a fine cloth, to exclude this powder. Some ſubſtances, as corroſive ſublimate, arſenic, calces of lead, cantharides, euphorbium, &c. are ſo noxious, that all theſe precautions ought to be uſed, particularly when a large quantity is pounded.

Large mortars ought to be fixed upon a block of wood, ſo high, that the mortar ſhall be level with the middle of the operator. When the peſtle is large and heavy, it ought to be ſuſpended by a cord or chain fixed to a moveable pole placed horizontally above the mortar: this pole conſiderably relieves the operator, becauſe its elaſticity aſſiſts the raiſing of the peſtle.

MORTAR-PIECE, in the military art, a ſhort piece of ordnance, thick and wide, proper for throwing bombs, carcaſes, ſhells, ſtones, bags filled with grape-ſhot, &c. See GUNNERY, N° 50.

Land Mortars, are thoſe uſed in ſieges, and of late in battles, mounted on beds made of ſolid timber, conſiſting generally of four pieces, thoſe of the royal and cohorn excepted, which are but one ſingle block; and both mortar and bed are tranſported on block-carriages. There is likewiſe a kind of land mortars, mounted on travelling carriages, invented by Count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes. The following table ſhows the weight of land mortars and ſhells; together with the quantity of powder the chambers hold when full; the weight of the ſhells, and powder for loading them.

Diameter of mortars.	13-inch.			10-inch.			8-inch.			5.8-inch. royal.			4.6-inch cohorn.		
	C.	qr.	lb.	C.	qr.	lb	C.	qr.	lb.	C.	qr.	lb	C.	qr.	lb.
Mortar's weight.	25	0	0	10	2	18	4	0	20	1	1	0	0	3	0
Shell's weight.	1	2	15	0	2	25	0	1	15	0	0	12	0	0	7
	lb.	oz.	gr	lb.	oz.	gr	lb.	oz.	gr.	lb.	oz.	gr.	lb.	oz.	gr.
Shell's cont. of powder.	9	4	8	4	14	12	2	3	8	1	1	8	0	8	0
Chamber's cont. of powder.	9	1	8	4	0	0	2	0	10	1	0	0	0	8	0

Sea Mortars, are thoſe which are fixed in bomb veſſels for bombarding places by ſea: and as they are generally fired at a much greater diſtance than that which is required by land, they are made ſomewhat longer and much heavier than the land mortars. The following table exhibits the weight of the ſea mortars and ſhells, and alſo of their full charges.

Nature of the mortar.	Powder contained in the chamber when full.		Weight of the mortar.			Weight of the ſhell when fixed.	Weight of powder contained in the ſhell.	
	lb.	oz.	C.	qr.	lb.	lb.	lb.	oz.
10-inch howitzer.	12	0	31	2	26			
13-inch mortar.	30	0	81	2	1	198	7	0
10-inch mortar.	12	0	34	2	11	93		

To Charge or Load a Mortar, the proper quantity of gunpowder is put into the chamber, and if there be any vacant ſpace they fill it up with hay; ſome chooſe a wooden plug: over this they lay a turf, ſome a wooden tompion fitted to the bore of the piece; and laſtly the bomb; taking care that the fuſe be in the axis thereof, and the orifice be turned from the muzzle of the piece: what ſpace remains is to be filled up with hay, ſtraw, turf, &c. ſo as the load may not be exploded without the utmoſt violence.

2

The

Mortar.

The quantity of gunpowder to be ufed is found by dividing the weight of the bomb by 30; though this rule is not always to be ftrictly obferved.

When the proper quantity of powder neceffary to charge a fea mortar is put into the chamber, it is covered with a wad well beat down with the rammer. After this the fixed fhell is placed upon the wad, as near the middle of the mortar as poffible, with the fufe hole uppermoft, and another wad preffed down clofe upon it, fo as to keep the fhell firm in its pofition. The officer then points the mortar according to the propofed inclination.—When the mortar is thus fixed, the fufe is opened; the priming iron is alfo thruft into the touch-hole of the mortar to clear it, after which it is primed with the fineft powder. This done, two of the matroffes or failors, taking each one of the matches, the firft lights the fufe, and the other fires the mortar. The bomb, thrown out by the explofion of the powder, is carried to the place intended: and the fufe, which ought to be exhaufted at the inftant of the fhell's falling, inflames the powder contained in it, and burfts the fhell in fplinters; which, flying off circularly, occafion incredible mifchief wherefoever they reach.

If the fervice of mortars fhould render it neceffary to ufe pound fhots, 200 of them with a wooden bottom are to be put into the 13 inch mortar, and a quantity of powder not exceeding 5 pounds; and 100 of the above fhot with $2\frac{1}{4}$ pounds of powder, for the 10 inch mortar, or three pounds at moft.

To Elevate the MORTAR fo as its axis may make any given angle with the horizon, they apply the artillery level or gunner's quadrant. An elevation of 70 or 80 degrees is what is commonly chofen for rendering mortars moft ferviceable in cafting fhells into towns, forts, &c. though the greateft range be at 45 degrees.

All the Englifh mortars are fixed to an angle of 45 degrees, and lafhed ftrongly with ropes at that elevation. Although in a fiege there is only one cafe in which fhells fhould be thrown with an angle of 45 degrees; that is, when the battery is fo far off that they cannot otherwife reach the works; for when fhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they fhould have as little elevation as poffible, in order to roll along, and not bury themfelves; whereby the damage they do, and the terror they occafion, are much greater than if they fink into the ground. On the contrary, when fhells are thrown upon magazines or any other buildings, with an intention to deftroy them, the mortars fhould be elevated as high as poffible, that the fhells may acquire a greater force in their fall, and confequently do greater execution.

If all mortar pieces were, as they ought to be, exactly fimilar, and their requifites of powder as the cubes of the diameters of their feveral bores, and if their fhells, bombs, carcaffes, &c. were alfo fimilar; then, comparing like with like, their ranges on the plane of the horizon, under the fame degree of elevation, would be equal; and confequently one piece being well proved, i. e. the range of the grenado, bomb, carcafs, &c. being found to any degree of elevation, the whole work of the mortar piece would become very eafy and exact.

But fince mortars are not thus fimilar, it is required, that the range of the piece, at fome known degree of elevation, be accurately found by meafuring; and from hence all the other ranges may be determined.

Mortar.

Thus, to find the range of the piece at any other elevation required; fay, As the fine of double the angle under which the experiment was made, is to the fine of double the angle propofed, fo is the range known to the range required.

Suppofe, for inftance, it be found, that the range of a piece, elevated to 30°, is 2000 yards: to find the range of the fame piece with the fame charge when elevated to 45°; take the fine of 60°, the double of 30°, and make it the firft term of the rule of three; the fecond term muft be the fine of 90°, the double of 45°, and the third the given range 2000; the fourth term will be 2310, the range of the piece at 45°. If the elevation be greater than 45°, inftead of doubling it, take the fine of double its complement to 90°. As fuppofe the elevation of a piece be 50°, take the fine of 80°, the double of 40°. Again, If a determinate diftance to which a fhot is to be caft, be given, and the angle of elevation to produce that effect be required; the range known muft be the firft term in the rule of three, which fuppofe 2000 yards; the range propofed, which we fuppofe 1600 yards, the fecond term; and the fine of 60 double of the elevation for the range of 2000 yards, the third term. The fourth term will be found the fine of 43° 52′, whofe half 21° 56′ is the angle of elevation the piece muft have to produce the defired effect. And if 21° 56′ be taken from 90°, you will have 68° 4′ for the other elevation of the piece, with which the fame effect will likewife be produced.

Note, To avoid the trouble of finding fines of double the angles of the propofed elevations, Galileo and Torricelli give us the following table, wherein the fines of the angles fought are had by infpection.

Degrees.	Degrees.	Ranges.	Degrees.	Degrees.	Ranges.
90	0	0	0	0	0
89	1	349	66	24	7431
88	2	698	65	25	7660
87	3	1045	64	26	7880
86	4	1392	63	27	8090
85	5	1736	62	28	8290
84	6	2709	61	29	8480
83	7	2419	60	30	8660
82	8	2556	59	31	8829
81	9	3090	58	32	8988
80	10	3420	57	33	9135
79	11	3746	56	34	9272
78	12	4067	55	35	9397
77	13	4384	54	36	9511
76	14	4695	53	37	9613
75	15	5000	52	38	9703
74	16	5299	51	39	9781
73	17	5592	50	40	9841
72	18	5870	49	41	9903
71	19	6157	48	42	9945
70	20	6428	47	43	9976
69	21	6691	46	44	9994
68	22	6947	45	45	10000
67	23	7193			

Mortgage.

The uſe of the table is obvious. Suppoſe, for inſtance, it be known by experiment, that a mortar elevated 15°, charged with three pounds of powder, will throw a bomb to the diſtance of 350 fathoms; and it be required, with the ſame charge, to throw a bomb 100 fathoms farther; ſeek in the table the number anſwering to 15 degrees, and you will find it 5000. Then as 350 is to 450, ſo is 5000 to a fourth number, which is 6428. Find this number, or the neareſt to it, in the table, and againſt it you will find 20° or 70°; the proper angles of elevation.

MORTGAGE, in *Law*, (*mortuum vadium*, or dead pledge), is where a man borrows of another a ſpecific ſum (e. g. 200l.), and grants him an eſtate in fee, on condition that if he, the mortgager, ſhall pay the mortgagee the ſaid ſum of 200l. on a certain day mentioned in the deed, that then the mortgager may re-enter on the eſtate ſo granted in pledge; or, as is now the more uſual way, that the mortgagee ſhall re-convey the eſtate to the mortgager: in this caſe the land which is ſo put in pledge, is by law, in caſe of nonpayment, at the time limited, for ever dead and gone from the mortgager; and the mortgagee's eſtate in the lands, is then no longer conditional, but abſolute. But ſo long as it continues conditional, that is, between the time of lending the money and the time allotted for payment, the mortgagee is called *tenant in mortgage.* But as it was formerly a doubt, whether, by taking ſuch eſtate in fee, it did not become liable to the wiſe's dower, and other encumbrances of the mortgage (though that doubt has been long ago overruled by our courts of equity), it therefore became uſual to grant only a long term of years, by way of mortgage; with condition to be void on repayment of the mortgage money: which courſe has been ſince continued, principally becauſe on the death of the mortgagee ſuch term becomes veſted in his perſonal repreſentatives, who only are entitled in equity to receive the money lent, of whatever nature the mortgage may happen to be.

As ſoon as the eſtate is created, the mortgagee may immediately enter on the lands; but is liable to be diſpoſſeſſed, upon performance of the condition by payment of the mortgage money at the day limited. And therefore the uſual way is to agree that the mortgager ſhall hold the land till the day aſſigned for payment: when, in caſe of failure, whereby the eſtate becomes abſolute, the mortgagee may enter upon it, and take poſſeſſion, without any poſſibility at law of being afterwards evicted by the mortgager, to whom the land is now for ever dead. But here again the courts of equity interpoſe; and though a mortgage be thus forfeited, and the eſtate abſolutely veſted in the mortgagee at the common law, yet they will conſider the real value of the tenements compared with the ſum borrowed. And if the eſtate be of greater value than the ſum lent thereon, they will allow the mortgager at any reaſonable time to recal or redeem his eſtate; paying to the mortgagee his principal, intereſt, and expences: for otherwiſe, in ſtrictneſs of law, an eſtate worth 1000l. might be forfeited for non-payment of 100l. or a leſs ſum. This reaſonable advantage, allowed to mortgagers, is called the *equity of redemption;* and this enables a mortgager to call on the mortgagee, who has poſſeſſion of his eſtate, to deliver it back, and account for the rents and profits received on payment of his whole debt and intereſt, thereby turning the *mortuum* into a kind of *vivum vadium;* (ſee VADIUM). But, on the other hand, the mortgagee may either compel the ſale of the eſtate, in order to get the whole of his money immediately; or elſe call upon the mortgager to redeem his eſtate preſently, or, in default thereof, to be for ever foreclosed from redeeming the ſame; that is, to loſe his equity of redemption without poſſibility of recal. And alſo, in ſome caſes of fraudulent mortgages, the fraudulent mortgager forfeits all equity of redemption whatſoever. It is not, however, uſual for mortgagees to take poſſeſſion of the mortgaged eſtate, unleſs where the ſecurity is precarious, or ſmall; or where the mortgager neglects even the payment of intereſt: when the mortgagee is frequently obliged to bring an ejectment, and take the land into his own hands, in the nature of a pledge, or the *pignus* of the Roman law: whereas, while it remains in the hands of the mortgager, it more reſembles their hypotheca, which was where the poſſeſſion of the thing pledged remained with the debtor. But by ſtatute 7 Geo. II. c. 20. after payment or tender by the mortgager of principal, intereſt, and coſts, the mortgagee can maintain no ejectment; but may be compelled to re-aſſign his ſecurities. In Glanvil's time, when the univerſal method of conveyance was by livery of ſeiſin or corporal tradition of the lands, no gage or pledge of lands was good unleſs poſſeſſion was alſo delivered to the creditor; *ſi non ſequatur ipſius vadii traditio, curia domini regis hujuſmodi privatas conventiones tueri non ſolet:* for which the reaſon given is, to prevent ſubſequent and fraudulent pledges of the ſame land; *cum in tali caſu poſſit eadem res pluribus aliis creditoribus tum prius tum poſterius invadiari.* And the frauds which have ariſen, ſince the exchange of theſe public and notorious conveyances for more private and ſecret bargains, have well evinced the wiſdom of our ancient law.

Mortier ‖ Mortmain.

MORTIER, an enſign of dignity, which was borne by the chancellor and grand preſidents of the parliament of France. That borne by the chancellor was a piece of cloth of gold, edged and turned up with ermine; and that of the firſt preſident was a piece of black velvet edged with a double row of gold lace.

MORTIFICATION, or GANGRENE. See MEDICINE and SURGERY *Index.*

MORTIFICATION, in religion, any ſevere penance obſerved on a religious account. See FAST.

MORTISE, or MORTOISE, in carpentry, &c. a kind of joint wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a *tenon.*

MORTMAIN, or ALIENATION *in Mortmain* (*in mortua manu*), is an alienation of lands or tenements to any corporation, ſole or aggregate, eccleſiaſtical or temporal *: but theſe purchaſes having been chiefly made by religious houſes, in conſequence whereof the lands became perpetually inherent in one dead hand, this hath occaſioned the general appellation of *mortmain* to be applied to ſuch alienations, and the religious houſes themſelves to be principally conſidered in forming the ſtatutes of mortmain: in deducing the hiſtory of which ſtatutes, it will be matter of curioſity to obſerve the great addreſs and ſubtle contrivance of the eccleſiaſtics, in eluding from time to time the laws in being, and the zeal with which ſucceſſive parliaments have purſued them

* See Corporation.

Mortmain. them through all their fineſſes: how new remedies were ſtill the parents of new evaſions; till the legiſlature at laſt, though with difficulty, hath obtained a deciſive victory.

By the common law any man might diſpoſe of his lands to any other private man at his own diſcretion, eſpecially when the feodal reſtraints of alienation were worn away. Yet in conſequence of theſe it was always, and is ſtill neceſſary, for corporations to have a licenſe of mortmain from the crown, to enable them to purchaſe lands: for as the king is the ultimate lord of every fee, he ought not, unleſs by his own conſent, to loſe his privilege of eſcheats and other feodal profits, by the veſting of lands in tenants that can never be attainted or die. And ſuch licenſes of mortmain ſeem to have been neceſſary among the Saxons above 60 years before the Norman conqueſt. But, beſides this general licenſe from the king as lord paramount of the kingdom, it was alſo requiſite, whenever there was a meſne or intermediate lord between the king and the alienor, to obtain his licenſe alſo (upon the ſame feodal principles) for the alienation of the ſpecific land. And if no ſuch licenſe was obtained, the king or other lord might reſpectively enter on the lands ſo alienated in mortmain, as a forfeiture. The neceſſity of this licenſe from the crown was acknowledged by the Conſtitutions of Clarendon, in reſpect of advowſons, which the monks always greatly coveted, as being the groundwork of ſubſequent appropriations. Yet ſuch were the influence and ingenuity of the clergy, that (notwithſtanding this fundamental principle) we find that the largeſt and moſt conſiderable donations of religious houſes happened within leſs than two centuries after the Conqueſt. And (when a licenſe could not be obtained) their contrivance ſeems to have been this: That as the forfeiture for ſuch alienations accrued in the firſt place to the immediate lord of the fee, the tenant who meant to alienate firſt conveyed his lands to the religious houſe, and inſtantly took them back again to hold as tenant to the monaſtery; which kind of inſtantaneous ſeiſin was probably held not to occaſion any forfeiture: and then, by pretext of ſome other forfeiture, ſurrender, or eſcheat, the ſociety entered into thoſe lands in right of ſuch their newly acquired ſigniory, as immediate lords of the fee. But when theſe donations began to grow numerous, it was obſerved that the feodal ſervices, ordained for the defence of the kingdom, were every day viſibly withdrawn; that the circulation of landed property from man to man began to ſtagnate; and that the lords were curtailed of the fruits of their ſigniories, their eſcheats, wardſhips, reliefs, and the like: and therefore, in order to prevent this, it was ordained by the ſecond of King Henry's III.'s great charters, and afterwards by that printed in our common ſtatute books, that all ſuch attempts ſhould be void, and the land forfeited to the lord of the fee.

Blackſt. Comment.

But as this prohibition extended only to religious houſes, biſhops and other ſole corporations were not included therein; and the aggregate eccleſiaſtical bodies (who, Sir Edward Coke obſerves, in this were to be commended, that they ever had of their counſel the beſt learned men that they could get) found many means to creep out of this ſtatute, by buying in lands that were *bona fide* holden of themſelves as lords of the fee, and thereby evading the forfeiture; or by taking long leaſes for years, which firſt introduced thoſe extenſive terms, for a thouſand or more years, which are now ſo frequent in conveyances. This produced the ſtatute *de religioſis*, 7 Edw. I.; which provided, that no perſon, religious or other whatſoever, ſhould buy, or ſell, or receive under pretence of a gift, or term of years, or any other title whatſoever, nor ſhould by any art or ingenuity appropriate to himſelf, any lands or tenements in mortmain; upon pain that the immediate lord of the fee, or, on his default for one year, the lords paramount, and in default of all of them, the king, might enter thereon as a forfeiture.

This ſeemed to be a ſufficient ſecurity againſt all alienations in mortmain: but as theſe ſtatutes extended only to gifts and conveyances between the parties, the religious houſes now began to ſet up a fictitious title to the land, which it was intended they ſhould have, and to bring an action to recover it againſt the tenant; who, by fraud and colluſion, made no defence, and thereby judgement was given for the religious houſe, which then recovered the land by a ſentence of law upon a ſuppoſed prior title. And thus they had the honour of inventing thoſe fictitious adjudications of right, which are ſince become the great aſſurance of the kingdom, under the name of *common* RECOVERIES. But upon this the ſtatute of Weſtminſter the ſecond, 13 Edw. I. c. 32. enacted, that in ſuch caſes a jury ſhall try the true right of the demandants or plaintiffs to the land; and if the religious houſe or corporation be found to have it, they ſhall ſtill recover ſeiſin; otherwiſe it ſhall be forfeited to the immediate lord of the fee, or elſe to the next lord, and finally to the king, upon the immediate or other lord's default. And the like proviſion was made by the ſucceeding chapter, in caſe the tenants ſet up croſſes upon their lands (the badges of knights templars and hoſpitallers) in order to protect them from the feudal demands of their lords, by virtue of the privileges of thoſe religious and military orders. And ſo careful was this provident prince to prevent any future evaſions, that when the ſtatute of *quia emptores*, 18 Edw. I. aboliſhed all ſub-infeudations, and gave liberty for all men to alienate their lands to be holden of their next immediate lord, a proviſo was inſerted that this ſhould not extend to authorize any kind of alienation in mortmain. And when afterwards the method of obtaining the king's licenſe by writ of *ad quod damnum* was marked out by the ſtatute 27 Edward I. ſt. 2. it was farther provided by ſtatute 34 Edward I. ſt. 3. that no ſuch licenſe ſhould be effectual without the conſent of the meſne or intermediate lords.

Yet ſtill it was found difficult to ſet bounds to eccleſiaſtical ingenuity: for when they were driven out of all their former holds, they deviſed a new method of conveyance, by which the lands were granted, not to themſelves directly, but to nominal feoffees to the uſe of the religious houſes; thus diſtinguiſhing between the poſſeſſion and the uſe, and receiving the actual profits, while the ſeiſin of the land remained in the nominal feoffee; who was held by the courts of equity (then under the direction of the clergy) to be bound in conſcience to account to his *ceſtuy que uſe* for the rents and emoluments of the eſtate And it is to theſe inventions that our practiſers are indebted for the introduction of uſes and truſts, the founda-

Mortmain. tion of modern conveyancing. But, unfortunately for the inventors themselves, they did not long enjoy the advantage of their new device; for the statute 15 Richard II. c. 5. enacts, that the lands which had been so purchased to uses should be admortised by license from the crown, or else be sold to private persons; and that, for the future, uses shall be subject to the statutes of mortmain, and forfeitable like the lands themselves. And whereas the statutes had been eluded by purchasing large tracts of land adjoining to churches, and consecrating them by the name of *churchyards*, such subtile imagination is also declared to be within the compass of the statutes of mortmain. And civil or lay corporations, as well as ecclesiastical, are also declared to be within the mischief, and of course within the remedy provided by those salutary laws. And lastly, As during the times of popery lands were frequently given to superstitious uses, though not to any corporate bodies; or were made liable in the hands of heirs and devisees to the charge of obits, chauntries, and the like, which were equally pernicious in a well-governed state as actual alienations in mortmain; therefore at the dawn of the Reformation, the statute 23 Hen. VIII. c. 10. declares, that all future grants of lands for any of the purposes aforesaid, if granted for any longer term than 20 years, shall be void.

But, during all this time, it was in the power of the crown, by granting a license of mortmain, to remit the forfeiture, so far as related to its own rights; and to enable any spiritual or other corporation to purchase and hold any lands or tenements in perpetuity: which prerogative is declared and confirmed by the statute 18 Edw. III. st. 3. c. 3. But as doubts were conceived at the time of the Revolution how far such license was valid, since the king had no power to dispense with the statutes of mortmain by a clause of *non obstante*, which was the usual course, though it seems to have been unnecessary; and as, by the gradual declension of mesne signiories through the long operation of the statute of *quia emptores*, the rights of intermediate lords were reduced to a very small compass; it was therefore provided by the statute 7 & 8 W. III. c. 37. that the crown for the future at its own discretion may grant licenses to alienate or take in mortmain, of whomsoever the tenements may be holden.

After the dissolution of monasteries under Hen. VIII. though the policy of the next popish successor affected to grant a security to the possessors of abbey lands, yet, in order to regain so much of them as either the zeal or timidity of their owners might induce them to part with, the statutes of mortmain were suspended for 20 years by the statute 1 & 2 P. & M. c. 8. and during that time any lands or tenements were allowed to be granted to any spiritual corporation without any license whatsoever. And long afterwards, for a much better purpose, the augmentation of poor livings, it was enacted by the statute 17 Car. II. c. 3. that appropriators may annex the great tithes to the vicarages, and that all benefices under 100l. per annum may be augmented by the purchase of lands, without license of mortmain in either case; and the like provision hath been since made in favour of the governors of Queen Anne's bounty. It hath also been held, that the statute 13 Hen. VIII. before-mentioned, did not extend to any thing but superstitious uses; and that therefore a man may give lands for the maintenance of a school, an hospital, or any other charitable uses. But as it was apprehended from recent experience, that persons on their deathbeds might make large and improvident dispositions even for these good purposes, and defeat the political ends of the statutes of mortmain; it is therefore enacted by the statute 9 Geo. II. c. 36. that no lands or tenements, or money to be laid out thereon, shall be given for or charged with any charitable uses whatsoever, unless by deed indented, executed in the presence of two witnesses 12 kalender months before the death of the donor, and enrolled in the court of chancery within six months after its execution (except stocks in the public funds, which may be transferred within six months previous to the donor's death), and unless such gift be made to take effect immediately, and be without power of revocation; and that all other gifts shall be void. The two universities, their colleges, and their scholars upon the foundation of the colleges of Eton, Winchester, and Westminster, are excepted out of this act: but such exemption was granted with this proviso, that no college shall be at liberty to purchase more advowsons than are equal in number to one moiety of the fellows or students upon the respective foundations.

MORTUARY, in *Law*, is a sort of ecclesiastical heriot*, being a customary gift claimed by and due to the minister in very many parishes on the death of his parishioners. They seem originally to have been only a voluntary bequest to the church; being intended, as Lyndewode informs us from a constitution of Archbishop Langham, as a kind of expiation and amends to the clergy for the personal tithes, and other ecclesiastical duties, which the laity in their life time might have neglected or forgotten to pay. For this purpose, after the lord's heriot or best good was taken out, the second best chattel was reserved to the church as a mortuary. And therefore in the laws of King Canute, this mortuary is called *soul-scot*, or *symbolum animæ*. And, in pursuance of the same principle, by the laws of Venice, where no personal tithes have been paid during the life of the party, they are paid at his death out of his merchandise, jewels, and other moveables. So also, by a similar policy in France, every man that died without bequeathing a part of his estate to the church, which was called *dying without confession*, was formerly deprived of Christian burial; or, if he died intestate, the relations of the deceased, jointly with the bishop, named proper arbitrators to determine what he ought to have given to the church, in case he had made a will. But the parliament, in 1409, redressed this grievance.

* See *Heriot*.

It was anciently usual in England to bring the mortuary to church along with the corpse when it came to be buried; and thence it is sometimes called a *corpse-present*: a term which bespeaks it to have been once a voluntary donation. However, in Bracton's time, so early as Henry III. we find it rivetted into an established custom; insomuch that the bequests of heriots and mortuaries were held to be necessary ingredients in every testament of chattels. *Imprimis autem debet quilibet, qui testamentum fecerit, dominum suum de meliori re quam habuerit recognoscere; et postea ecclesiam de alia meliore*: the lord must have the best good left him as a heriot; and the church the second best as a mortuary.

Mortuary.

tuary. But yet this custom was different in different places: *in quibusdam locis habet ecclesia melius animal de consuetudine; in quibusdam secundum, vel tertium melius; et in quibusdam nihil: et ideo consideranda est consuetudo loci.* This custom still varies in different places, not only as to the mortuary to be paid, but the person to whom it is payable. In Wales a mortuary or corse-present was due upon the death of every clergyman to the bishop of the diocese; till abolished, upon a recompense given to the bishop, by the statute, 12 Ann. st. 2. c. 6. And in the archdeaconry of Chester a custom also prevailed, that the bishop, who is also archdeacon, should have, at the death of every clergyman dying therein, his best horse or mare, bridle, saddle, and spurs; his best gown or cloak, hat, upper garment under his gown, and tippet, and also his best signet or ring. But by statute 28 Geo. II. c. 6. this mortuary is directed to cease, and the act has settled upon the bishop an equivalent in its room. The king's claim to many goods, on the death of all prelates in England, seems to be of the same nature; though Sir Edward Coke apprehends, that this is a duty upon death, and not a mortuary: a distinction which seems to be without a difference. For not only the king's ecclesiastical character, as supreme ordinary, but also the species of the good claimed, which bear so near a resemblance to those in the archdeaconry of Chester, which was an acknowledged mortuary, puts the matter out of dispute. The king, according to the record vouched by Sir Edward Coke, is entitled to six things; the bishop's best horse or palfrey, with his furniture; his cloak or gown, and tippet; his cup and cover; his bason and ewer; his gold ring; and lastly, his *muta canum*, his mew or kennel of hounds.

This variety of customs with regard to mortuaries, giving frequently a handle to exactions on the one side, and frauds or expensive litigations on the other, it was thought proper by statute 21 Henry VIII. c. 6. to reduce them to some kind of certainty. For this purpose it is enacted, that all mortuaries, or corse-presents to parsons of any parish, shall be taken in the following manner, unless where by custom less or none at all is due; viz. for every person who does not leave goods to the value of ten marks, nothing; for every person who leaves goods to the value of ten marks and under 30 pounds, 3s. 4d.; if above 30 pounds, and under 40 pounds, 6s. 8d.; if above 40 pounds, of what value soever they may be, 10s. and no more. And no mortuary shall throughout the kingdom be paid for the death of any feme-covert; nor for any child; nor for any one of full age, that is not a housekeeper; nor for any wayfaring man; but such wayfaring man's mortuary shall be paid in the parish to which he belongs. And upon this statute stands the law of mortuaries to this day.

Morus || Mosaic Law.

MORUS, the MULBERRY TREE, a genus of plants belonging to the monœcia class, and in the natural method ranking under the 53d order, *Scabridæ*. See BOTANY *Index*.

MOSA, in *Ancient Geography*, a river of Belgica, rising in Mount Vogesus on the borders of the Lingones, and which, after receiving a part of the Rhine called *Vahalis*, forms the island of the Batavi, and passes off into the sea, at the distance of 80 miles. Now called the *Maese*, or *Meuse*; rising in Champagne, on the borders of the county of Burgundy, or Franche Compté, at a village called *Meuse*, whence the appellation; and running north through Lorrain and Champagne into the Netherlands: it afterwards directs its course north-east and then west; and joining the Waal, runs to Dort, and falls into the German sea, a little below the Briel.

MOSÆ PONS, in *Ancient Geography*, supposed to be Maestricht, situated on the Maese. E. Long. 5. 40. N. Lat. 50. 55.

MOSAIC LAW, or the *Law of Moses*, is the most ancient that we know of in the world, and is of three kinds; the moral law, the ceremonial law, and the judicial law. The different manner in which each of these was delivered, may perhaps suggest to us a right idea of their different natures. The moral law, or ten commandments, for instance, was delivered on the top of the mountain, in the face of the whole world, as being of universal influence, and obligatory on all mankind. The ceremonial was received by Moses in private in the tabernacle, as being of peculiar concern, belonging to the Jews only, and destined to cease when the tabernacle was down, and the vail of the temple rent. As to the judicial law, it was neither so publicly nor so audibly given as the moral law, nor yet so privately as the ceremonial; this kind of law being of an indifferent nature, to be observed or not observed, as its rites suit with the place and government under which we live. The five books of Moses called the *Pentateuch*, are frequently styled, by way of emphasis *the Law*. This was held by the Jews in such veneration, that they would not allow it to be laid upon the bed of any sick person, lest it should be polluted by touching the dead.

Wilson's *Archæol. Dict.*

A TABLE or HARMONY of the MOSAIC LAW, digested into proper HEADS, with REFERENCES to the several Parts of the PENTATEUCH where the respective Laws occur.

CLASS I. The Moral Law written on the two Tables, containing the Ten Commandments.	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The *first table*, which includes				
The first commandment	20. 23.	—	—	5. 6. 13.
The second commandment,	20. 23. 34.	19. 20. 26.	—	4. 5. 6. 7. 8. 10. 11. 12. 13.
The third commandment,	20. 23.	—	—	5.

The

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The fourth commandment, - -	20. 23. 31. 34. 35.	19. 23. 26.	—	—
The *second table* includes				
The fifth commandment, - -	20. 22.	19.	—	5.
The sixth commandment, - -	20.	19.	—	5.
The seventh commandment, - -	20.	18. 19.	—	5. 23.
The eighth commandment, - -	20. 23.	19.	—	5.
The ninth commandment, - -	20. 23.	19.	—	5.
The tenth commandment, - -	20.	—	—	5.
The sum of both tables, - -	—	19.	—	6.
Class II. The Ceremonial Law may be fitly reduced to the following heads, viz.				
Of the holy place, - - -	20.	17.	—	12.
Of the matter and structure of the tabernacle. -	25. 26. 27. 35.	—	—	—
Of the instruments of the same, viz. - -				
The laver of brass, - -	30.	—	—	—
The altar of burnt offering, - -	27.	—	—	—
The altar of incense, - - -	30.	—	—	—
The candlestick of pure gold, - -	25.	—	—	—
The table of shew-bread, - -	25. 26.	—	—	—
Of the priests and their vestments for glory and beauty, -	28.	—	—	—
Of the choosing of the Levites, - -	—	—	18. 3. 8.	—
Of the priests office in general, - -	—	—	3. 18.	—
Of their office in teaching, - -	—	19. 10.	—	18. 12. 17. 31.
Of their office in blessing, - -	—	—	6.	—
Of their office in offering; which function largely spreading itself, is divided into these heads, viz.				
What the sacrifice ought to be, - -	—	22.	—	15. 17.
Of the continual fire, - -	—	6.	—	—
Of the manner of the burnt offerings, - -	—	6. 7.	—	—
———————— the peace offerings, -	—	3. 7.	—	—
Of the manner of the sacrifices according to their several kinds, viz.				
For sin committed through ignorance of the law, -	—	4.	5.	—
For sin committed through ignorance of the fact, -	—	5. 7.	—	—
For sin committed wittingly, yet not through impiety, -	—	6.	5.	—
The special law of sacrifices for sin,	—	6. 7.	—	—
Of things belonging to the sacrifices, - -	—	2. 6. 7.	15.	—
Of the shew-bread, - - -	—	24.	—	—
Of the lamps, - - -	27.	24.	8.	—
Of the sweet incense,	30.	—	—	—
Of the use of ordinary oblations, whereof there were several kinds observed by the priests,				
Of the consecration of the high priests and other priests,	29. 30.	6. 8.	—	—
Of the consecration and office of the Levites,	—	—	8.	—
Of the dwelling of the Levites, - -	—	—	35.	—
Of the anointing the altar, and all the instruments of the tabernacle,	29. 30.	—	—	—
Of the continual daily sacrifices,	29.	—	28.	—
Of the continual Sabbath day's sacrifices,	—	—	28.	—
Of the solemn sacrifice for feast days, which were diverse, and had peculiar rites, distinguished into these, viz.				
Of trumpets, - - -	—	—	10.	—
Of beginning of months, - -	—	—	28.	—
Of the three most solemn feasts in general, -	23. 34.	23.	—	16.
Of the feast of passover, - -	12. 13. 25. 34.	23.	9. 28.	16.
Of the feast of pentecost, - -	23. 24.	23.	28.	16.
Of the feast of tabernacles, - -	23. 34.	23.	29.	16.
Of the feast of blowing the trumpets, - -	—	23.	29.	—

Moſaic Law.		Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of the feaſt of expiation,		30.	16. 13.	29.	—
Of the firſt fruits,		22. 23. 34.	2.	15.	26.
Of tythes,		—	21.	18.	12. 14. 26.
Of fruits growing and not eaten of,		—	19.	—	—
Of the firſt born,		13. 22. 34.	—	—	15.
Of the ſabbatical year,		23.	25.	—	—
Of the year of jubilee,		—	25.	—	—
Of vows in general,		—	27.	30.	13.
What perſons ought not to make vows,		—	—	30.	—
What things cannot be vowed,		—	27.	—	23.
Of redemption of vows,		—	27.	—	—
Of the vows of the Nazarites,		—	—	6.	—
Of the laws proper for the prieſts, viz.					
Of pollutions,		—	22.	—	—
Of the high prieſt's mourning,		—	21.	—	—
Of his marriage,		—	21.	—	—
Of the mourning of the ordinary prieſts,		—	21.	—	—
Of their marriage,		—	21.	—	—
Of their being forbidden the uſe of wine, &c.		—	10.	—	—
Of ſanctified meats,		—	6. 17. 19. 20.	5. 18.	12. 15. 18.
Of the office of the Levites, viz.					
Teaching,		—	—	—	17. 27. 31.
Offering,		—	—	3. 4. 18.	10.
Other promiſcuous ceremonial laws, viz.					
Of uncleanneſs in general,		—	15. 19.	5.	—
Of uncleanneſs in meats, *viz.*					
Of blood,	Gen. ix.	23.	7.17.19.	—	12.
Of fat,		—	3. 7.	—	—
Of dead carcaſes,		22.	17.	—	14.
Other meats, and diverſe living creatures,		—	11. 20.	—	14.
Of uncleanneſs in the iſſue of ſeed and blood,		—	15. 12.	—	23.
In the dead bodies of men,		—	—	19.	—
In the leproſy,		—	13. 14	5.	—
Of circumciſion,	Gen. xvii.	—	12.	—	—
Of the water of expiation,		—	—	19.	—
Of the mourning of the Iſraelites,		—	19.	—	14.
Of mixtures,		—	19.	—	14.
Of their garments, and writing the law privately,		—	—	15.	6. 11. 22.
Of young birds not to be taken with the dam,		—	—	—	22.
Of their paddle ſtaves,		—	—	—	23.

Class III. The Political Law.

N. B. The Magiſtrate is the keeper of the precepts of both Tables, and to have reſpect to human ſociety ;—therefore the Political Laws of the Iſraelites are referred to both the Tables, and are to be reduced to the ſeveral precepts of the Moral Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Laws referred to the firſt table, namely,				
1ſt, To the firſt and ſecond commandments, *viz.*				
Of idolaters and apoſtates,	22.	20.	—	13. 17.
Of aboliſhing idolatry,	23. 24	—	33	7. 12.
Of diviners and falſe prophets,	22.	19.20	—	18.
Of covenants with other gods,	23. 24	—	—	7.
2d, To the third commandment, viz.				
Of blaſphemies.	—	24.	15.	—
3d, To the fourth commandment, viz.				
Of breaking the Sabbath,	31. 35	—	15.	—
Political laws referred to the ſecond table,				

1ſt, To

Mosaic Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
1st, To the fifth commandment, viz.				
Of magistrates and their authority,	18.30	—	11.	1. 13. 17 23.
Of the power of fathers,				
2d, To the sixth commandment, viz.				
Of capital punishments,	—	—	—	21. 24.
Of wilful murder,	21.	24.	35.	19.
Of manslaughter unwittingly committed, and of the cities of refuge,	21.	—	35.	19.21.22.
Of heinous injury,	21.	24.	—	25.
Of punishments not capital,	—	—	—	25.
Of the law of war,	—	—	—	25.
3d, To the seventh commandment, viz.				
Of unlawful marriages,	—	18.20	—	7. 21.
Of fornication,	—	19.	—	23.
Of whoredom,	22.	21.	—	22.
Of adultery and jealousy,	—	19.20	—	—
Of copulation against nature,	22.	18.20.	—	—
Of divorcements,	—	—	—	24.
Other matrimonial laws,	21.	18.20.	—	21.22.24. 25.
4th, To the eighth commandment, viz.				
Of the punishment of thefts,	22.	—	5.	—
Of sacrilege,	—	—	—	—
Of not injuring strangers,	22. 23.	19.	—	10.
Of not defrauding hirelings,	—	19.	—	26. 25.
Of just weights,	—	19.	—	25.
Of removing the land-mark,	—	—	—	19.
Of lost goods,	22.	—	—	—
Of strayed cattle,	22. 23	—	—	22.
Of corrupted judgements,	23.	19.	—	16. 24
Of fire breaking out by chance,	22.	—	—	—
Of manstealing,	—	—	—	24.
Of the fugitive servant,	—	—	—	23.
Of gathering fruits,	—	19. 23.	—	23. 24
Of contracts, viz.				
Borrowing,	—	—	—	15.
Of the pledge,	22.	—	—	24.
Of usury,	22.	25.	—	23.
Of selling,	21.	25.	—	15.
Of the thing lent,	22.	—	—	—
Of a thing committed to be kept,				
Of heirs,				
5th, To the ninth commandment, viz.				
Of witnesses,	—	5.	—	17. 19.
The establishing the political law,	—	—	—	4.
The establishing the divine law in general,	—	—	—	6. 11. 29. 30. 31
From the dignity of the lawgiver,	—	19.20.22.	15.	4. 5. 6. 7. 8 10.26.27.
From the excellency of the laws,	—	—	—	4.26.
From the promises,	15.19.23. 24.	18. 26	—	4. 5. 6. 7. 10.11.12. 28.
From the threatenings,	23.	26.	—	4. 7. 11 27.28.29. 30.

MOSAIC, or MOSAIC WORK, an assemblage of little pieces of glass, marble, precious stones, &c. of various colours, cut square, and cemented on a ground of stucco, in such a manner as to imitate the colours and gradations of painting. The critics are divided as to the origin and reason of the name. Some derive it it from *mosaicum*, a corruption of *musaicum*, as that is of *musivum*, as it was called among the Romans. Scaliger derives it from the Greek μυσα, and imagines the name was given to this sort of works as being very fine and ingenious. Nebricensis is of opinion it was so called, because *ex illis picturis ornabantur musea.*

1. Method of performing mosaic work of glass is this: They provide little pieces of glass, of as many different colours and sizes as possible.

Now, in order to apply these several pieces, and out of them to form a picture, they in the first place procure a cartoon or design to be drawn; this is transferred to the ground or plaster by chalking as in painting in fresco. See FRESCO.

As this plaster is to be laid thick on the wall, and therefore will continue fresh and soft a considerable time, so there may be enough prepared at once to serve for as much work as will take up three or four days.

This plaster is composed of lime made of hard stone, with brick dust very fine, gum tragacanth, and whites of eggs; when this plaster has been thus prepared and laid on the wall, and made the design of what is to be represented, they take out the little pieces of glass with a pair of plyers, and range them one after another, still keeping strictly to the light, shadow, different teints, and colours represented in the design before; pressing or flatting them down with a ruler, which serves both to sink them within the ground and to render the surface even.

Thus, in a long time, and with a great deal of labour, they finish the work, which is still the more beautiful, as the pieces of glass are more uniform, and ranged at an even height.

Some of these pieces of mosaic work are performed with that exactness, that they appear as smooth as a table of marble, and as finished and masterly as a painting in fresco; with this advantage, that they have a fine lustre, and will last ages.

The finest works of this kind that have remained till our time, and those by whom the moderns have retrieved the art, which was in a manner lost, are those in the church of St Agnes, formerly the temple of Bacchus, at Rome; and some at Pisa, Florence, and other cities of Italy. The most esteemed among the works of the moderns are those of Joseph Pine and the Chevalier Lanfranc, in the church of St Peter at Rome: there are also very good ones at Venice.

2. The method of performing mosaic work of *marble* is this: The ground of mosaic works, wholly marble, is usually a massive marble, either white or black. On this ground the design is cut with a chisel, after it has been first chalked. After it has been cut of a considerable depth, i. e. an inch or more, the cavities are filled up with marble of a proper colour, first fashioned according to the design, and reduced to the thickness of the indentures with various instruments. To make the piece thus inserted into the indentures cleave fast, whose several colours are to imitate those of the design, they use a stucco, composed of lime and marble dust; or a kind of mastich, which is prepared by each workman, after a different manner peculiar to himself. The figures being marked out, the painter or sculptor himself draws with a pencil the colours of the figures not determined by the ground, and in the same manner makes strokes or hatchings in the place where shadows are to be: and after he has engraven with the chisel all the strokes thus drawn, he fills them up with a black mastich, composed partly of Burgundy pitch poured on hot; taking off afterwards what is superfluous with a piece of soft stone or brick, which, together with water and beaten cement, takes away the mastich, polishes the marble, and renders the whole so even that one would imagine it only consisted of one piece. This is the kind of mosaic work that is seen in the pompous church of the invalids at Paris, and the fine chapel at Versailles, with which some entire apartments of that palace are incrustated.

3. As for mosaic work of precious stones, other and finer instruments are required than those used in marble; as drills, wheels, &c. used by lapidaries and engravers on stone. As none but the richest marbles and stones enter this work, to make them go the farther, they are sawn into the thinnest leaves imaginable, scarcely exceeding half a line in thickness; the block to be sawn is fastened firmly with cords on the bench, and only raised a little on a piece of wood, one or two inches high. Two iron pins, which are on one side the block, and which serve to fasten it, are put into a vice contrived for the purpose; and with a kind of saw or bow, made of fine brass wire, bent on a piece of spongy wood, together with emery steeped in water, the leaf is gradually fashioned by following the stroke of the design made on paper, and glued on the piece. When there are pieces enough fastened to form an entire flower, or some other part of the design, they are applied to the ground.

The ground which supports this mosaic work is usually of freestone. The matter with which the stones are joined together is a mastich, or kind of stucco, laid very thin on the leaves as they are fashioned; and this being done, the leaves are applied with plyers.

If any contour, or side of a leaf, be not either squared or rounded sufficiently, so as to fit the place exactly into which it is to be inserted, when it is too large, it is to be brought down with a brass file or rasp; and if it be too little, it is managed with a drill and other instruments used by lapidaries.

Mosaic work of marble is used in large works, as in pavements of churches, basilics, and palaces; and in the incrustation and vaneering of the walls of the same edifices.

As for that of precious stones, it is only used in small works, as ornaments for altar pieces, tables for rich cabinets, precious stones being so very dear.

4. Manner of performing mosaic work of *gypsum*. Of this stone calcined in a kiln, beaten in a mortar, and sifted, the French workmen make a sort of artificial marbles, imitating precious stones; and of these they compose a kind of mosaic work, which does not come far short either of the durableness or the vivacity of the natural stones; and which besides has this advantage, that it admits of continued pieces or paintings of entire compartments without any visible joining.

Some make the ground of plaster of Paris, others of freestone. If it be of plaster of Paris, they spread it in a wooden frame, of the length and breadth of the work intended, and in thickness about an inch and a half. This frame is so contrived, that the tenons being only

Mosaic. only joined to the mortises by single pins, they may be taken asunder, and the frame be dismounted when the plaster is dry. The frame is covered on one side with a strong linen cloth, nailed all round; which being placed horizontally with the linen at the bottom, is filled with plaster passed through a wide sieve. When the plaster is half dry, the frame is set up perpendicularly, and left till it is quite dry; then it is taken out, by taking the frame to pieces.

In this mosaic, the ground is the most important part. Now in order to the preparation of this sifted gypsum, which is to be applied on this ground, it is dissolved and boiled in the best English glue, and mixed with the colour that it is to be of; then the whole is worked up together into the usual consistence of plaster, and then is taken and spread on the ground five or six inches thick. If the work be such, as that mouldings are required, they are formed with gouges and other instruments.

It is on this plaster, thus coloured like marble or precious stone, and which is to serve as a ground to a work, either of lapis, agate, alabaster, or the like, that the design to be represented is drawn: having been first pounced or chalked. To hollow or impress the design, they use the same instruments that sculptors do; the ground whereon they are to work not being much less hard than the marble itself. The cavities being thus made in the ground, are filled with the same gypsum boiled in glue, only differently coloured, and thus are the different colours of the original represented. In order that the necessary colours and teints may be ready at hand, the quantities of the gypsum are tempered with the several colours in pots. After the design has been thus filled and rendered visible, by half polishing it with brick and soft stone, they go over it again, cutting such plates as are either to be weaker or more shadowed, and filling them with gypsum; which work they repeat till all the colours being added one after the other, represent the original to the life. When the work is finished, they scour it with soft stone, sand, and water; after that with a pumice stone; and in the last place polish it with a wooden mullet and emery. Lastly, They give it a lustre, by smearing it over with oil, and rubbing it a long time with the palm of the hand, which gives it a lustre nowise inferior to that of natural marble.

5. In Clavigero's history of Mexico is described a curious kind of mosaic work, made by the ancient Mexicans of the most delicate and beautiful *feathers* of birds. They raised for this purpose various species of birds of fine plumage with which that country abounds, not only in the palaces of the king, where there were all sorts of animals, but likewise in private houses; and at certain seasons they carried off their feathers to make use of them on this kind of work, or to sell them at market. They set a high value on the feathers of those wonderful little birds which they call *Huitzitzilin*, and the Spaniards *Picaflores*, on account of the smallness, the fineness, and the various colours of them. In these and other beautiful birds, nature supplied them with all the colours which art can produce, and also some which art cannot imitate. At the undertaking of every mosaic work several artists assembled: After having agreed upon a design, and taken their measures and proportions, each artist charged himself with the execution of a certain part of the image, and exerted himself so diligently in it, with such patience and application, that he frequently spent a whole day in adjusting a feather; first trying one, then another, viewing it sometimes one way, then another, until he found one which gave his part that ideal perfection proposed to be attained. When the part which each artist undertook was done, they assembled again to form the entire image from them.— If any part was accidentally the least deranged, it was wrought again until it was perfectly finished. They laid hold of the feathers with small pinchers, that they might not do them the least injury, and pasted them on the cloth with *tzauhtli*, or some other glutinous matter; then they united all the parts upon a little table, or a plate of copper, and flattened them softly until they left the surface of the image so equal and smooth that it appeared to be the work of a pencil.

Mosaic, Mosambique.

These were the images so much celebrated by the Spaniards and other European nations. Whoever beheld them was at a loss whether he ought to have praised most the life and beauty of the natural colours, or the dexterity of the artist and the ingenious disposition of art. "These images (says Acosta) are deservedly admired; for it is wonderful how it was possible, with the feathers of birds, to execute works so fine and so equal, that they appear the performance of the pencil; and, what neither the pencil nor the colours in painting can effect, they have, when viewed from a side, an appearance so beautiful, so lively, and animated, that they give delight to the sight. Some Indians, who are able artists, copy whatever is painted with a pencil so perfectly with plumage, that they rival the best painters of Spain." These works of feathers were even so highly esteemed by the Mexicans as to be valued more than gold. Cortes, Bernal Diaz, Gomara, Torquemada, and all the other historians who saw them, were at a loss for expressions sufficient to praise their perfection. Several works of this kind, our author says, are still preserved in the museums of Europe, and many in Mexico; but few, he apprehends, belong to the sixteenth century, and still fewer, if any, are of those made before the conquest. The mosaic works also which the Mexicans made of broken shells were extremely curious: this art is still practised in Guatimala.

MOSAMBIQUE, a kingdom of Africa, lying south of Quiloa, and taking its name from the chief town, which is situated on an island, at the mouth of a river of the same name, in 15 deg. S. Lat. The island is 30 miles in circumference, and very populous, though the air is said to be very hot, and the soil in general dry, sandy, and barren; yet they have most of the tropical fruits, with black cattle, hogs, and sheep. There is a kind of fowl here, both the feathers and flesh of which are black, insomuch that, when they are boiled, the broth looks like ink; and yet their flesh is very delicate and good food. The town of Mosambique is regularly fortified, and has a good harbour, defended by a citadel, with several churches and monasteries. The Portuguese shipping to and from India touch here for refreshments. As the island abounds in cattle, the Portuguese slaughter and salt up a great deal of beef, which they afterwards send to the Brazils, or sell to the European shipping. They also

also barter European goods with the natives for gold, elephants teeth, and slaves. There is another town, called *Mongale*, situated also on an island, and garrisoned by the Portuguese, being their chief magazine for European goods. The gold they receive from the natives is found near the surface of the earth, or in the sands of rivers; no gold mines, or at least very few, being at present wrought in Africa.

MOSCHION, a name common to four different writers, whose compositions, character, and native place, are unknown. Some fragments of their writings remain, some few verses, and a treatise *De mulierum affectibus*.

MOSCHUS, a Grecian poet of antiquity, usually coupled with Bion; and they were both of them cotemporaries with Theocritus. In the time of the latter Grecians, all the ancient idylliums were collected and attributed to Theocritus; but the claims of Moschus and Bion have been admitted to some few little pieces; and this is sufficient to make us inquisitive about their characters and story; yet all that can be known about them must be collected from their own remains. Moschus, by composing his delicate elegy on Bion, has given the best memorials of Bion's life. See BION. Moschus and Theocritus have by some critics been supposed the same person; but there are irrefragable evidences against it: others will have him as well as Bion to have lived later than Theocritus, upon the authority of Suidas: while others again suppose him to have been the scholar of Bion, and probably his successor in governing the poetic school; which, from the elegy of Moschus, does not seem unlikely. Their remains are to be found in all the editions of the *Poetæ Minores*.

MOSCHUS, a genus of quadrupeds of the order of pecora, having no horns. See MAMMALIA *Index*.

MOSCOW, the chief province of the empire of Russia, deriving its name from the river Muscova, or Moskva, on which the capital is situated. It was from this duchy that the czars of old took the title of *dukes of Muscovy*. The province is bounded on the north by the duchies of Twere, Rostow, Susdal, and Wolodimer; on the south by Rezan, from which it is separated by the river Occa; on the east by the principality of Cachine, and the same river Occa parting it from Nisi-Novogorod; and on the west by the duchies of Rzeva, Bielar and Smolensko. It extends about 200 miles in length, and about 100 in breadth; and is watered by the Moskva, Occa, and Clesma, which fall into the Wolga: nevertheless, the soil is not very fertile. The air, however, though sharp, is salubrious; and this consideration, with the advantage of its being situated in the midst of the best provinces in the empire, induced the czars to make it their chief residence. In the western part of Moscow is a large forest, from whence flows the celebrated river Dnieper, or Borysthenes, which, traversing the duchy of Smolensko, winds in a serpentine course to Ukraine, Lithuania, and Poland.

MOSCOW, the capital of the above province, and till the beginning of the present century the metropolis of all Russia, is situated in a spacious plain on the banks of the river Moskva. E. Long. 37. 31. N. Lat. 55. 45. The Russian antiquaries differ considerably in their opinions concerning the first foundation of Moscow; the following relation, Mr Coxe says, is generally esteemed by the best authors the most probable account.

Kiof was the metropolis, when George son of Vladimir Monomaka ascended in 1154 the Russian throne. That monarch, being insulted in a progress through his dominions by a rich and powerful nobleman named Stephen Kutchko, put him to death, and confiscated his domains, which consisted of the lands now occupied by the city of Moscow and the adjacent territory. Pleased with the situation of the ground lying at the conflux of the Moskva and Neglina, he laid the foundation of a new town, which he called Moskva from the river of that name. Upon the demise of George, the new town was not neglected by his son Andrew, who transferred the seat of empire from Kiof to Vladimir; but it fell into such decay under his immediate successors, that when Daniel, son of Alexander Nevski, received, in the division of the empire, the duchy of Muscovy as his portion, and fixed his residence upon the conflux of the Moskva and Neglina, he may be said to have new founded the town. The spot now occupied by the Kremlin was at that time overspread with a thick wood and a morass, in the midst whereof was a small island containing a single wooden hut. Upon this part Daniel constructed churches and monasteries, and various buildings, and enclosed it with wooden fortifications: he first assumed the title of duke of Moscow; and was so attached to this situation, that when in 1304 he succeeded his brother Andrew Alexandrovich in the great duchy of Vladimir, he did not remove his court to Vladimir, but continued his residence at Moscow, which then became the capital of the Russian dominions. His successors followed his example; among whom his son Ivan considerably enlarged the new metropolis, and in 1367 his grandson Demetrius Ivanovitch Donski surrounded the Kremlin with a brick wall. These new fortifications, however, were not strong enough to prevent Tamerlane in 1382, from taking the town after a short siege. Being soon evacuated by that desultory conqueror, it again came into the possession of the Russians; but was frequently invaded and occupied by the Tartars, who in the 14th and 15th centuries overran the greatest part of Russia, and who even maintained a garrison in Moscow until they were finally expelled by Ivan Vassilievitch I. To him Moscow is indebted for its principal splendour, and under him it became the principal and most considerable city of the Russian empire.

Moscow continued the metropolis of Russia until the beginning of the 18th century, when, to the great dissatisfaction of the nobility, but with great advantage probably to the state, the seat of empire was transferred to Petersburgh.

Notwithstanding the predilection which Peter conceived for Petersburgh, in which all the succeeding sovereigns excepting Peter the II. have fixed their residence, Moscow, according to Mr Coxe, is still the most populous city of the Russian empire. Here the chief nobles who do not belong to the court reside: they here support a larger number of retainers; they love to gratify their taste for a ruder and more expensive magnificence in the ancient style of feudal grandeur; and are not, as at Petersburgh, eclipsed by the superior splendour of the court.

Moscow.

Moſcow is repreſented as the largeſt town in Europe; its circumference within the rampart, which encloſes the ſuburbs, being exactly 39 verſts or 26 miles; but it is built in ſo ſtraggling and disjointed a manner, that its population in no degree correſponds to its extent. Some Ruſſian authors ſtate its inhabitants at 500,000 ſouls, a number evidently exaggerated. According to a computation, which Mr Coxe ſays may be depended upon, Moſcow contains within the ramparts 250,000 ſouls, and in the adjacent villages 50,000. The ſtreets of Moſcow are in general exceedingly long and broad; ſome of them are paved; others, particularly thoſe in the ſuburbs, are formed with trunks of trees, or are boarded with planks like the floor of a room; wretched hovels are blended with large palaces; cottages of one ſtory ſtand next to the moſt ſuperb and ſtately manſions. Many brick ſtructures are covered with wooden tops; ſome of the wooden houſes are painted; others have irons doors and roofs. Numerous churches preſent themſelves in every quarter, built in a peculiar ſtyle of architecture; ſome with domes of copper, others of tin, gilt or painted green, and many roofed with wood. In a word, ſome parts of this vaſt city have the look of a ſequeſtered deſert, other quarters of a populous town; ſome of a contemptible village, others of a great capital.

Moſcow may be conſidered as a town built upon the Aſiatic model, but gradually becoming more and more European, and exhibiting in its preſent ſtate a motley mixture of diſcordant architecture. It is diſtributed into the following diviſions. 1. The Kremlin. This ſtands in the central and higheſt part of the city; is of a triangular form, and about two miles in circumference; and is ſurrounded by high walls of ſtone and brick; which were conſtructed in the year 1491, under the reign of Ivan Vaſſilievitch I. It contains the ancient palace of the czars, ſeveral churches, two convents, the patriarchal palace, the arſenal now in ruins, and one private houſe, which belonged to Boris Godunof before he was raiſed to the throne. 2. Khitaigorod, or the Chineſe town, is encloſed on one ſide by that wall of the Kremlin which runs from the Moſkva to the Neglina; and on the other ſide by a brick wall of inferior height. It is much larger than the Kremlin, and contains the univerſity, the printing-houſe and many other public buildings, and all the tradeſmen's ſhops. The edifices are moſtly ſtuccoed or white waſhed, and it has the only ſtreet in Moſcow in which the houſes ſtand cloſe to one another without any intervals between them. 3. The Bielgorod, or White Town, which runs quite round the two preceding diviſions, is ſuppoſed to derive its name from a white wall with which it was formerly encloſed, and of which ſome remains are ſtill to be ſeen. 4. Semlainogorod, which environs all the three other quarters, takes its denomination from a circular rampart of earth with which it is encompaſſed. Theſe two laſt mentioned diviſions exhibit a groteſque groupe of churches, convents, palaces, brick and wooden houſes, and mean hovels, in no degree ſuperior to peaſants cottages. 5. The Sloboda, or ſuburbs, form a vaſt exterior circle round all the parts already deſcribed, and are inveſted with a low rampart and ditch. Theſe ſuburbs contain, beſide buildings of all kinds and denominations, corn fields, much open paſture, and ſome ſmall lakes, which give riſe to the Neglina. The river *Moſkva*, from which the city takes its name, flows through it in a winding channel; but excepting in ſpring is only navigable for rafts. It receives the Yauſa in the Semlainogorod, and the Neglina at the weſtern extremity of the Kremlin; the beds of both theſe laſt mentioned rivulets are in ſummer little better than dry channels.

Moſcow.

The places of divine worſhip at Moſcow are exceedingly numerous; including chapels, they amount to above 1000: there are 484 public churches, of which 199 are of brick; and the others of wood; the former are commonly ſtuccoed or white-waſhed, the latter painted of a red colour. The moſt ancient churches of Moſcow are generally ſquare buildings, with a cupola and four ſmall domes, ſome whereof are of copper or iron gilt; others of tin, either plain or painted green. Theſe cupolas and domes are for the moſt part ornamented with croſſes entwined with thin chains or wires. The church of the Holy Trinity, ſometimes called the church of Jeruſalem, which ſtands in the Khitaigorod, cloſe to the gate leading into the Kremlin, has a kind of high ſteeple and nine or ten domes: it was built in the reign of Ivan Vaſſilievitch II. The inſide of the churches is moſtly compoſed of three parts; that called by the Greeks ωδονικος, by the Ruſſians trapeza; the body; and the ſanctuary or ſhrine. Over the door of each church is the portrait of the ſaint to whom it is dedicated, to which the common people pay their homage as they paſs along, by taking off their hats, croſſing themſelves, and occaſionally touching the ground with their heads. The bells, which form no inconſiderable part of public worſhip in this country, as the length or ſhortneſs of their peals aſcertains the greater or leſſer ſanctity of the day, are hung in belfrys detached from the church: they do not ſwing like our bells; but are fixed immoveably to the beams, and are rung by a rope tied to the clapper and pulled ſidewiſe. Some of theſe bells are of a ſtupendous ſize; one in the tower of St Ivan's church weighs 3551 Ruſſian poods, or 127,836 Engliſh pounds. It has always been eſteemed a meritorious act of religion to preſent a church with bells; and the piety of the donor has been meaſured by their magnitude. According to this mode of eſtimation, Boris Godunof, who gave a bell of 288,000 pounds to the cathedral of Moſcow, was the moſt pious ſovereign of Ruſſia, until he was ſurpaſſed by the empreſs Anne, at whoſe expence a bell was caſt weighing 432,000 pounds, and which exceeded in bigneſs every bell in the known world. The height of this enormous bell is 19 feet, its circumference at the bottom 21 yards 11 inches; its greateſt thickneſs 23 inches. The beam to which this vaſt machine was faſtened being accidentally burnt, the bell fell down, and a fragment was broken off towards the bottom, which left an aperture large enough to admit two perſons abreaſt without ſtooping.

The palace, inhabited by the ancient czars, ſtands at the extremity of the Kremlin. Part of this palace is old, and remains in the ſame ſtate in which it was built under Ivan Vaſſilievitch I. The remainder has been ſucceſſively added at different intervals, without any plan, and in various ſtyles of architecture, which has produced a motley pile of building, remarkable for nothing but the incongruity of the ſeveral ſtructures. The top is thickly ſet with numerous little gilded ſpires and globes; and a large portion of the front is decorated with the arms

of

of all the provinces which compofe the Ruffian empire. The apartments are in general exceedingly fmall, excepting one fingle room called the council chamber, in which the ancient czars ufed to give audience to foreign ambaffadors, and which has been repeatedly defcribed by feveral Englifh travellers who vifited Mofcow before the imperial refidence was transferred to Peterfburgh. The room is large and vaulted, and has in the centre an enormous pillar of ftone which fupports the ceiling. In this palace Peter the Great came into the world, in the year 1672. In that part called the treafury are depofited the crown, jewels, and royal robes, ufed at the coronation of the fovereign, befides feveral curiofities relative to the hiftory of the country. Of the great number of churches contained in this city, two in particular, namely, that of St Michael and that of the Affumption of the Virgin Mary, are remarkable; the one for being the place where the fovereigns of Ruffia were formerly interred, and the other where they are crowned. Thefe edifices, which are fituated in the Kremlin, are both in the fame ftyle of architecture; and their exterior form, though modelled according to the ancient ftyle of the country, is not abfolutely inelegant. In the cathedral of St Michael, which contains the tombs of the Ruffian fovereigns, the bodies are not, as with us, depofited in vaults, or beneath the pavement, but are entombed in raifed fepulchres, moftly of brick, in the fhape of a coffin, and about two feet in height. When Mr Coxe vifited the cathedral, the moft ancient were covered with palls of red cloth, others of red velvet, and that of Peter II. with gold tiffue, bordered with filver fringe and ermine. Each tomb has at its lower extremity a fmall filver plate, upon which is engraved the name of the deceafed fovereign, and the era of his death.

The cathedral of the Affumption of the Virgin Mary, which has long been appropriated to the coronation of the Ruffian fovereigns, is the moft fplendid and magnificent in Mofcow. The fcreen is in many parts covered with plates of folid filver and gold richly worked. From the centre of the roof hangs an enormous chandelier of maffy filver, weighing 2940 pounds: it was made in England, and was a prefent from Morofof, prime minifter and favourite of Alexey Michaelovitch. The facred utenfils and epifcopal veftments are extraordinarily rich, but the tafte of the workmanfhip is in general rude, and by no means equal to the materials. Many of the paintings which cover the infide walls are of a coloffal fize: fome are very ancient, and were executed fo early as in the latter end of the 15th century. It contains, amongft the reft a head of the Virgin, fuppofed to have been delineated by St Luke, and greatly celebrated in this country for its fanctity and the power of working miracles. Its face is almoft black; its head is ornamented with a glory of precious ftones, and its hands and body are gilded, which gives it a moft grotefque appearance. It is placed in the fkreen, and enclofed within a large filver covering, which is only taken off on great feftivals, or for the curiofity of ftrangers. In this cathedral are depofited the remains of the Ruffian patriarchs.

The place in the Khitaigorod, where the public archives are depofited, is a ftrong brick building, containing feveral vaulted apartments with iron floors. Thefe archives, confifting of a numerous collection of ftate papers, were crowded into boxes and thrown afide like common lumber, until the emprefs Catharine ordered them to be revifed and arranged. In conformity to this mandate, Mr Muller has difpofed them in chronological order with fuch perfect regularity, that any fingle document may be infpected with little trouble. They are enclofed in feparate cabinets with glafs doors: thofe relative to Ruffia are all claffed according to the feveral provinces which they concern; and over each cabinet is infcribed the name of the province to which it is appropriated. In the fame manner the manufcripts relative to foreign kingdoms are placed in feparate divifions under the refpective titles of Poland, Sweden, England, France, Germany, &c.

The univerfity of Mofcow, all fituated in the Khitaigorod, was founded, at the inftance of Count Shuvalof, by the emprefs Elizabeth, for 600 ftudents; who are clothed, boarded, and inftructed, at the expence of the crown. Befides this inftitution, there are two gymnafia or feminaries for the education of youth, endowed alfo by Elizabeth; in which are taught, by twenty-three profeffors, divinity, claffics, philofophy, the Greek, Latin, Ruffian, German, French, Italian, and Tartar languages; hiftory, geography, mathematics, architecture, fortification, artillery, algebra, drawing and painting, mufic, fencing, dancing, reading and writing.

Mofcow is the centre of the inland commerce of Ruffia, and particularly connects the trade between Europe and Siberia. The only navigation to this city is formed by the Mofkva, which falling into the Occa near Columna, communicates by means of that river with the Volga. But as the Mofkva is only navigable in fpring upon the melting of the fnows, the principal merchandife is conveyed to and from Mofcow upon fledges in winter. The whole of the retail trade is carried on in the Khitaigorod; where, according to a cuftom common in Ruffia, as well as in moft kingdoms of the Eaft, all the fhops are collected together in one fpot. The place is like a kind of fair, confifting of many rows of low brick buildings; the interval between them refembling alleys. Thefe fhops or booths occupy a confiderable fpace; they do not, as with us, make part of the houfes inhabited by the tradefmen, but are quite detached from their dwellings, which for the moft part are at fome diftance in another quarter of the town. The tradefman comes to his fhop in the morning, remains there all day, and returns home to his family in the afternoon. Every trade has its feparate department; and they who fell the fame goods have booths adjoining to each other. Furs and fkins form the moft confiderable article of commerce in Mofcow; and the fhops which vend thofe commodities occupy feveral ftreets.

Amongft the curiofities of Mofcow, the market for the fale of houfes is not the leaft remarkable. It is held in a large open fpace in one of the fuburbs; and exhibits a great variety of ready made houfes, thickly ftrewed upon the ground. The purchafer who wants a dwelling, repairs to this fpot, mentions the number of rooms he requires, examines the different timbers, which are regularly numbered, and bargains for that which fuits him. The houfe is fometimes paid for on the fpot, and taken away by the purchafer; or fometimes the vender contracts to tranfport and erect it upon the place where it is defigned to ftand. It may appear incredible to affert, that a dwelling may be thus bought

Moscow. bought, removed, raised and inhabited, within the space of a week; but we shall conceive it practicable by considering that these ready made houses are in general merely collections of trunks of trees tenoned and mortised at each extremity into one another, so that nothing more is required than the labour of transporting and adjusting them. But this summary mode of building is not always peculiar to the meaner hovels; as wooden structures of very large dimensions and handsome appearance are occasionally formed in Russia with an expedition almost inconceivable to the inhabitants of other countries. A remarkable instance of this despatch was displayed the last time the empress came to Moscow. Her majesty proposed to reside in the mansion of Prince Galitzin, which is esteemed the completest edifice in this city; but as it was not sufficiently spacious for her reception, a temporary addition of wood, larger than the original house, and containing a magnificent suite of apartments, was begun and finished within the space of six weeks. This meteor-like fabric was so handsome and commodious, that the materials which were taken down at her majesty's departure, were to be re-constructed as a kind of imperial villa upon an eminence near the city. Mr Coxe mentions an admirable police in this city for preventing riots, or for stopping the concourse of people in case of fires, which are very frequent and violent in those parts, where the houses are mostly of wood, and the streets are laid with timber. At the entrance of each street there is a chevaux-de-frize gate, one end whereof turns upon a pivot, and the other rolls upon a wheel; near it is a centry box in which a man is occasionally stationed. In times of riot or fire the centinel shuts the gate, and all passage is immediately stopped.

Among the public institutions of Moscow, the most remarkable is the Foundling Hospital, endowed in 1764 by the empress Catharine, and supported by voluntary contributions and legacies, and other charitable gifts. In order to encourage donations, her majesty granted to all benefactors some valuable privileges, and a certain degree of rank in proportion to the extent of their liberality. Among the principal contributors must be mentioned a private merchant named *Dimidof*, a person of great wealth, who has expended in favour of this charity above 100,000l. The hospital, which is situated in a very airy part of the town upon a gentle ascent near the river Moskva, is an immense pile of building of a quadrangular shape, part of which was only finished when Mr Coxe (whose account we are transcribing) was at Moscow. It contained, at that time, three thousand foundlings; and, when the whole is completed, will receive eight thousand. The children are brought to the porter's lodge, and admitted without any recommendation. The rooms are lofty and large; the dormitories, which are separate from the work rooms, are very airy, and the beds are not crowded: each foundling, even each infant, has a separate bed. The children remain two years in the nursery, when they are admitted into the lowest class; the boys and girls continue together until they are seven years of age, at which time they are separated. They all learn to read, write, and cast accounts. The boys are taught to knit; they occasionally card hemp, flax, and wool, and work in the different manufactures. The girls learn to knit, net, and all kinds of needle work; they spin and weave lace; they are employed in cookery, baking, and house work of all sorts. At the age of fourteen the foundlings enter into the first class; when they have the liberty of choosing any particular branch of trade; and for this purpose there are different species of manufactures established in the hospital, of which the principal are embroidery, silk stockings, ribbands, lace, gloves, buttons, and cabinet work. A separate room is appropriated to each trade. Some boys and girls are instructed in the French and German languages, and a few boys in the Latin tongue; others learn music, drawing, and dancing.

Moselle, Moses.

MOSELLE, a river of Germany, which rises in the mountains of Vosges in Lorraine, and falls into the Rhine at Coblentz.

MOSELLE is also the name of a department of France, which includes part of the late province of Lorraine.

MOSES, the son of Amram and Jochebed, was born in the year 1571 before Christ. Pharaoh king of Egypt, perceiving that the Hebrews were become a formidable nation, issued forth an edict commanding all the male children to be put to death. To avoid this cruel edict, Jochebed, the mother of Moses, having concealed her son for three months, at length made an ark or basket of bulrushes, daubed it with pitch, laid the child in it, and exposed him on the banks of the Nile. Thermuthis the king's daughter, who happened to be walking by the river's side, perceived the floating cradle, commanded it to be brought to her, and struck with the beauty of the child, determined to preserve his life. In three years afterwards the princess adopted him for her own son, called his name *Moses*, and caused him be diligently instructed in all the learning of the Egyptians. But his father and mother, to whom he was restored by a fortunate accident, were at still greater pains to teach him the history and religion of his fathers. Many things are related by historians concerning the first period of Moses's life, which are not to be found in the Old Testament. According to Josephus and Eusebius, he made war on the Ethiopians, and completely defeated them. They add, that the city Saba, in which the enemy had been forced to take refuge, was betrayed into his hands by the king's daughter, who became deeply enamoured of him, when she beheld from the top of the walls his valorous exploits at the head of the Egyptian army. But as the truth of this expedition is more than doubtful, we shall therefore confine ourselves to the narrative of sacred writ, which commences at the fortieth year of Moses's life. He then left the court of Pharaoh, and went to visit his countrymen the Hebrews, who groaned under the ill usage and oppression of their unfeeling masters. Having perceived an Egyptian smiting a Hebrew, he slew the Egyptian, and buried him in the sand. But he was obliged, in consequence of this murder, to fly into the land of Midian, where he married Zipporah, daughter of the priest Jethro, by whom he had two sons, Gershom and Eliezar. Here he lived 40 years; during which time his employment was to tend the flocks of his father-in-law. Having one day led his flock towards Mount Horeb, God appeared to him in the midst of a bush which burned with fire but was not consumed, and commanded him to go and deliver his brethren from their bondage. Moses at first refused to go; but was at length prevailed on by two miracles

Mofes. racles which the Almighty wrought for his conviction. Upon his return to Egypt, he, together with his brother Aaron, went to the court of Pharaoh, and told him that God commanded him to let the Hebrews go to offer facrifices in the defert of Arabia. But the impious monarch difregarded this command, and caufed the labour of the Ifraelites to be doubled. The meffengers of the Almighty again returned to the king, and wrought a miracle in his fight, that they might move his heart, and induce him to let the people depart. Aaron having caft down his miraculous rod, it was immediately converted into a ferpent: but the fame thing being performed by the magicians, the king's heart was hardened more and more; and his obftinacy at laft drew down the judgements of the Almighty on his kingdom, which was afflicted with ten dreadful plagues. The firft was the changing of the waters of the Nile and of all the rivers into blood, fo that the Egyptians died of thirft. In confequence of the fecond plague, the land was covered with innumerable fwarms of frogs, which entered even into Pharaoh's palace. By the third plague, the duft was converted into lice, which cruelly tormented both man and beaft. The fourth plague was a multitude of deftructive flies which fpread throughout Egypt, and infefted the whole country. The fifth was a fudden peftilence, which deftroyed all the cattle of the Egyptians, without injuring thofe of the Ifraelites. The fixth produced numberlefs ulcers and fiery boils upon man and upon beaft. The feventh was a dreadful ftorm of hail, accompanied with thunder and lightning, which deftroyed every thing that was in the field, whether man or beaft, and fpared only the land of Gofhen, where the children of Ifrael dwelt. By the eighth plague fwarms of locufts were brought into the country, which devoured every green herb, the fruit of the trees and the produce of the harveft. By the ninth plague thick darknefs covered all the land of Egypt, except the dwellings of the children of Ifrael. The tenth and laft plague was the death of the firftborn in Egypt, who were all in one night cut off by the deftroying angel, from the firftborn of the king to the firftborn of the flaves and of the cattle. This dreadful calamity moved the heart of the hardened Pharaoh, and he at length confented to allow the people of Ifrael to depart from his kingdom.

Profane authors who have fpoken of Mofes, feem to have been in part acquainted with thefe mighty wonders. That he performed miracles, muft have been allowed by many, by whom he was confidered as a famous magician; and he could fcarcely appear in any other light to men who did not acknowledge him for the meffenger of the Almighty. Both Diodorus and Herodotus mention the diftreffed ftate to which Egypt was reduced by thefe terrible calamities. The Hebrews, amounting to the number of 600,000 men, without reckoning women and children, left Egypt on the 15th day of the month Nifan, which, in memory of this deliverance, was thenceforth reckoned the firft month of their year. Scarcely had they reached the fhore of the Red fea when Pharaoh with a powerful army fet out in purfuit of them. On this occafion Mofes ftretched forth his rod upon the fea; and the waters thereof being divided, remained fufpended on both fides till the Hebrews paffed through dry-footed.—The Egyptians determined to follow the fame courfe; but God caufed a violent wind to blow, which brought back the waters to their bed, and the whole army of Pharaoh perifhed in the waves. Mofes.

After the miraculous paffage of the Red fea, the army proceeded towards Mount Sinai, and arrived at Marah, where the waters were bitter; but Mofes, by cafting a tree into them, rendered them fit for drinking. Their tenth encampment was at Rephidim; where Mofes drew water from the rock in Horeb, by fmiting it with his rod. Here likewife Amalek attacked Ifrael. While Jofhua fought againft the Amalekites, Mofes ftood on the top of a hill, and lifted up his hands; in confequence of which the Ifraelites prevailed, and cut their enemies in pieces. They at length arrived at the foot of Mount Sinai on the third day of the ninth month after their departure from Egypt. Mofes having afcended feveral times into the mount, received the law from the hand of God himfelf in the midft of thunders and lightnings, and concluded the famous covenant betwixt the Lord and the children of Ifrael. When he defcended from Sinai, he found that the people had fallen into the idolatrous worfhip of the golden calf. The meffenger of God, fhocked at fuch ingratitude, broke in pieces the tables of the law which he carried in his hands, and put 23,000 of the tranfgreffors to the fword. He afterwards reafcended into the mountain, and there obtained new tables of ftone on which the law was infcribed. When Mofes defcended, his face fhone fo that the Ifraelites dared not to come nigh unto him, and he was obliged to cover it with a veil. The Ifraelites were here employed in conftructing the tabernacle according to a pattern fhown them by God. It was erected and confecrated at the foot of the Mount Sinai on the firft day of the firft month of the fecond year after their departure from Egypt; and it ferved the Ifraelites inftead of a temple till the time of Solomon, who built a houfe for the God of his fathers after a model fhown him by David.

Mofes having dedicated the tabernacle, he confecrated Aaron and his fons to be its minifters, and appointed the Levites to its fervice. He likewife gave various commandments concerning the worfhip of God and the political government of the Jews. This was a *theocracy* in the full extent of the word. God himfelf governed them immediately by means of his fervant Mofes, whom he had chofen to be the interpreter of his will to the people; and he required all the honours belonging to their king to be paid unto himfelf. He dwelt in his tabernacle, which was fituated in the middle of the camp, like a monarch in his palace. He gave anfwers to thofe who confulted him, and himfelf denounced punifhments againft the tranfgreffors of his laws. This properly was the time of the theocracy, taken in its full extent; for God was not only confidered as the divinity who was the object of their religious worfhip, but as the fovereign to whom the honours of fupreme majefty were paid. The cafe was nearly the fame under Jofhua; who, being filled with the fpirit of Mofes, undertook nothing without confulting God. Every meafure, both of the leader and of the people, was regulated by the direction of the Almighty, who rewarded their fidelity and obedience by a feries of miracles, victories, and fucceffes. After Mofes had regulated every thing regarding the civil adminiftration, Moses, Mosheim.

tion, and the marching of the troops, he led the Israelites to the confines of Canaan, to the foot of Mount Nebo. Here the Lord commanded him to ascend into the mountain; whence he showed him the promised land, whereinto he was not permitted to enter. He immediately after yielded up the ghost, without sickness or pain, in the 120th year of his age, and 1451 years before Jesus Christ.

Moses is incontestably the author of the first five books of the Old Testament, which go by the name of the *Pentateuch;* and which are acknowledged to be inspired, by the Jews and by Christians of every persuasion. Some, however, have denied that Moses was the author of these books; and have founded their opinion on this, that he always speaks of himself in the third person. But this manner of writing is by no means peculiar to Moses: it occurs also in several ancient historians; such as Xenophon, Cæsar, Josephus, &c. who possessed of more modesty or good sense than some modern historians, whose egotism is altogether disgusting, have not like them left to posterity a spectacle of ridiculous vanity and self-conceit. After all, it is proper to observe, that profane authors have related many falsehoods and absurdities concerning Moses, and concerning the origin and the religion of the Jews, with which they were but little acquainted. Plutarch, in his book concerning Isis and Osiris, says that Judæus and Hierosolymus were brothers, and descended from Typhon; and that the former gave his name to the country and its inhabitants, and the latter to the capital city. Others say that they came from Mount Ida in Phrygia. Strabo is the only author who speaks any thing like reason and truth concerning them; though he too says that they were descended from the Egyptians, and considers Moses their legislator as an Egyptian priest. He acknowledges, however, that they were a people strictly just and sincerely religious. Other authors by whom they are mentioned, seem not to have had the smallest acquaintance either with their laws or their worship. They frequently confound them with the Christians, as is the case with Juvenal, Tacitus, and Quintilian.

MOSHEIM, John Laurence, an illustrious German divine, was born in 1695, of a noble family, which might seem to open to his ambition a fair path to civil promotion; but his zeal for the interests of religion, his thirst after knowledge, and particularly his taste for sacred literature, induced him to consecrate his talents to the service of the church. The German universities loaded him with literary honours; the king of Denmark invited him to settle at Copenhagen; the duke of Brunswick called him thence to Helmstadt, where he filled the academical chair of divinity; was honoured with the character of ecclesiastical counsellor to the court; and presided over the seminaries of learning in the duchy of Wolfenbuttle and the principality of Blackenburgh. When a design was formed of giving an uncommon degree of lustre to the universities of Gottingen, by filling it with men of the first rank in letters, Dr Mosheim was deemed worthy to appear at the head of it, in quality of chancellor; and here he died, in 1755, universally lamented. In depth of judgement, in extent of learning, in purity of taste, in the powers of eloquence, and in a laborious application to all the various branches of erudition and philosophy, he had certainly very few superiors. His Latin translation of Cudworth's Intellectual System, enriched with large annotations, discovered a profound acquaintance with ancient learning and philosophy. His illustrations of the Scriptures, his labours in defence of Christianity, and the light he cast upon religion and philosophy, appear in many volumes of sacred and profane literature; and the Ecclesiastical History, from the birth of Christ to the beginning of the 18th century, is unquestionably the best that is extant. This work, written in Latin, has been translated into English, and accompanied with notes and chronological tables by Archibald Maclaine, D. D. and from this translator's preface to the second edition, 1758, in 5 vols. 8vo, this short account is taken.

Moskito, Mosque.

MOSKITO, or Mosquito country, is situated in North America, between 85 and 88 degrees of west longitude, and between 13 and 15 degrees of north latitude; having the north sea on the north and east, Nicaragua on the south, and Honduras on the west; and indeed the Spaniards esteem it a part of the principality of Honduras, though they have no colonies in the Moskito country. When the Spaniards first invaded this part of Mexico, they massacred the greatest part of the natives, which gave those that escaped into the inaccessible part of the country an insuperable aversion to them; and they have always appeared ready to join any Europeans that come upon their coasts against the Spaniards, and particularly the English, who frequently come hither; and the Moskito men being excellent marksmen, the English employ them in striking the manati fish, &c. and many of the Moskito Indians come to Jamaica, and sail with the English in their voyages.

These people are so situated between morasses and inaccessible mountains, and a coast full of rocks and shoals, that no attempts against them by the Spaniards, whom they mortally hate, could ever succeed. Nevertheless, they are a mild inoffensive people, of great morality and virtue, and will never trust a man who has once deceived them. They have so great a veneration towards the English, that they have spontaneously put themselves and their lands under the protection and dominion of the crown of England. This was first done when the duke of Albermarle was governor of Jamaica, and the king of the Moskitos received a commission from his grace, under the seal of that island; and since this time they have been steady in their alliance with the English. But in the year 1786, this country was ceded to Spain, and consequently became a Spanish province.

MOSQUE, a temple or place of religious worship among the Mahometans.

All mosques are square buildings, generally constructed of stone. Before the chief gate there is a square court paved with white marble; and low galleries round it, whose roof is supported by marble pillars. In these galleries the Turks wash themselves before they go into the mosque. In each mosque there is a great number of lamps; and between these hang many crystal rings, ostriches eggs, and other curiosities, which, when the lamps are lighted, make a fine show. As it is not lawful to enter the mosque with stockings or shoes on, the pavements are covered with pieces of stuff sewed together, each being wide enough to hold a row of men kneeling, sitting, or prostrate. The women are not

not allowed to enter the mofque, but ftay in the porches without. About every mofque there are fix high towers, called *minarets*, each of which has three little open galleries, one above another: thefe towers, as well as the mofques, are covered with lead, and adorned with gilding and other ornaments; and from thence, inftead of a bell, the people are called to prayers by certain officers appointed for that purpofe. Moft of the mofques have a kind of hofpital belonging to them, in which travellers of what religion foever, are entertained three days. Each mofque has alfo a place called *tarbe*, which is the burying-place of its founders; within which is a tomb fix or feven feet long, covered with green velvet or fatin; at the ends of which are two tapers, and round it feveral feats for thofe who read the Koran and pray for the fouls of the deceafed.

MOSS, or Mosses. See Musci, Botany *Index*.

Moss on Trees, in gardening. The growth of large quantities of mofs on any kind of tree is a diftemper of very bad confequence to its increafe, and much damages the fruit of the trees of our orchards.

The prefent remedy is the fcraping it off from the body and large branches by means of a kind of wooden knife that will not hurt the bark, or with a piece of rough hair cloth, which does very well after a foaking rain. But the moft effectual cure is the taking away the caufe. This is to be done by draining off all the fuperfluous moifture from about the roots of the trees, and may be greatly guarded againft in the firft planting of the trees, by not fetting them too deep.

If trees ftand too thick in a cold ground, they will always be covered with mofs; and the beft way to remedy the fault is to thin them. When the young branches of trees are covered with a long and fhaggy mofs, it will utterly ruin them; and there is no way to prevent it but to cut off the branches near the trunk, and even to take off the head of the tree if neceffary; for it will fprout again; and if the caufe be in the mean time removed by thinning the plantation, or draining the land and ftirring the ground well, the young fhoots will continue clear after this.

If the trees be covered with mofs in confequence of the ground's being too dry, as this will happen from either extreme in the foil, then the proper remedy is the laying mud from the bottom of a pond or river pretty thick about the root, opening the ground to fome diftance and depth to let it in; this will not only cool it, and prevent its giving growth to any great quantity of mofs, but it will alfo prevent the other great mifchief which fruit-trees are liable to in dry grounds, which is the falling off of the fruit too early.

The moffes which cover the trunks of trees, as they always are frefheft and moft vigorous on the fide which points to the north, if only produced on that, ferve to preferve the trunk of the tree from the feverity of the north winds, and direct the traveller in his way, by always plainly pointing out that part of the compafs.

Moss is alfo a name given to boggy ground in many parts of England, otherwife called a *fen* and *bog*.

In many of thefe grounds, as well in England and Ireland as in other parts of the world, there are found vaft numbers of trees ftanding with their ftumps erect, and their roots piercing the ground in a natural pofture as when growing. Many of thofe trees are broken or cut off near the roots, and lie along, and this ufually in a north-eaft direction. People who have been willing to account for this, have ufually refolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved falfe by many unanfwerable arguments. The waters of this deluge might indeed have wafhed together a great number of trees, and buried them under loads of earth; but then they would have lain irregularly and at random; whereas they all lie lengthwife from fouth-weft to north-eaft, and the roots all ftand in their natural perpendicular pofture, as clofe as the roots of trees in a foreft.

Befides, thefe trees are not all in their natural ftate, but many of them have the evident marks of human workmanfhip upon them, fome being cut down with an axe, fome fplit, and the wedges ftill remaining in them; fome burnt in different parts, and fome bored through with holes. Thefe things are alfo proved to be of a later date than the deluge, by other matters found among them, fuch as utenfils of ancient people, and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this foffile ftate, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elfewhere. It may appear indeed an objection to this opinion, that moft of thefe foffile trees are of the fir kind; and that Cæfar fays exprefsly, that no firs grew in Britain in his time; but this is eafily anfwered, by obferving, that thefe trees, though of the fir kind, yet are not the fpecies ufually called the *fir*, but pitch-tree; and Cæfar has no where faid that pitch-trees did not grow in England. Norway and Sweden yet abound with thefe trees; and there are at this time whole forefts of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordfhire to this day.

In Hatfield marfh, where fuch vaft numbers of the foffile trees are now found, there has evidently once been a whole foreft of them growing. The laft of thefe was found alive, and growing in that place within 70 years laft paft, and cut down for fome common ufe.

It is alfo objected by fome to the fyftem of the firs growing where they are found foffile, that thefe countries are all bogs and moors, whereas thefe forts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and fome other cold countries, the fir kinds all grow upon barren and dry rocky mountains, yet in warmer places they are found to thrive as well on wet plains. Such are found plentifully in Pomerania, Livonia, and Courland, &c. and in the weft parts of New England there are vaft numbers of fine ftately trees of them in low grounds. The whole truth feems to be, that thefe trees love a fandy foil; and fuch as is found at the bottoms of all the moffes where thefe trees are found foffile. The roots of the fir kind are always found fixed in thefe; and thofe of oaks, where they are found foffile in this manner, are ufually found fixed in clay; fo that each kind of tree is always found rooted in the places where they ftand in their proper foil; and there is no doubt to be made but that they originally

Moss.

ginally grew there. When we have thus found that all the fossile trees we meet with once grew in the places where they are now buried, it is plain that in these places there were once noble forests, which have been destroyed at some time; and the question only remains how and by whom they were destroyed. This we have reason to believe, by the Roman coins found among them, was done by the people of that empire, and that at the time when they were established or establishing themselves here.

Their own historian tells us, that when their armies pursued the wild Britons, these people always sheltered themselves in the miry woods and low watery forests. Cæsar expressly says this; and observes, that Cassibelanus and his Britons, after their defeat, passed the Thames, and fled into such low morasses and woods, that there was no pursuing them: and we find that the Silures secured themselves in the same manner when attacked by Ostorius and Agricola. The same thing is recorded of Venutius king of the Brigantes, who fled to secure himself into the boggy forests of the midland part of this kingdom: and Herodian expressly says, that in the time of the Romans pushing their conquests in these islands, it was the custom of the Britons to secure themselves in the thick forests which grew in their boggy and wet places, and when opportunity offered, to issue out thence and fall upon the Romans. The consequence of all this was the destroying all these forests; the Romans finding themselves so plagued with parties of the natives issuing out upon them at times from these forests, that they gave orders for the cutting down and destroying all the forests in Britain which grew on boggy and wet grounds. These orders were punctually executed; and to this it is owing that at this day we can hardly be brought to believe that such forests ever grew with us as are now found buried.

The Roman historians all agree, that when Suetonius Paulinus conquered Anglesea, he ordered all the woods to be cut down there, in the manner of the Roman generals in England: and Galen tells us, that the Romans, after their conquest in Britain, kept their soldiers constantly employed in cutting down forests, draining of marshes, and paving of bogs. Not only the Roman soldiers were employed in this manner, but all the native Britons made captives in the wars were obliged to assist in it: and Dion Cassius tells us, that the emperor Severus lost no less than 50,000 men in a few years time in cutting down the woods and draining the bogs of this island. It is not to be wondered at, that such numbers executed the immense destruction which we find in these buried forests. One of the greatest subterranean treasures of wood is that near Hatfield; and it is easy to prove, that these people, to whom this havock is thus attributed, were upon the spot where these trees now lie buried. The common road of the Romans out of the south into the north, was formerly from Lindum (Lincoln), to Segelochum (Little Burrow upon Trent), and from thence to Danum (Doncaster), where they kept a standing garrison of Crispinian horse. A little off on the east, and north-east of their road, between the two last named towns, lay the borders of the greatest forest, which swarmed with wild Britons, who were continually making their sallies out, and their retreats into it again, intercepting their provisions, taking and destroying their carriages, killing their allies and passengers, and disturbing their garrisons. This at length so exasperated the Romans, that they were determined to destroy it; and to do this safely and effectually, they marched against it with a great army, and encamped on a great moor not far from Finningly: this is evident from their fortifications yet remaining.

There is a small town in the neighbourhood called *Osterfield*; and as the termination *field* seems to have been given only in remembrance of battles fought near the towns whose names ended with it, it is not improbable that a battle was fought here between all the Britons who inhabited this forest and the Roman troops under Ostorius. The Romans slew many of the Britons, and drove the rest back into this forest, which at that time overspread all this low country. On this the conquerors taking advantage of a strong south-west wind, set fire to the pitch-trees, of which this forest was principally composed; and when the greater part of the trees were thus destroyed, the Roman soldiers and captive Britons cut down the remainder, except a few large ones which they left standing as remembrances of the destruction of the rest. These single trees, however, could not stand long against the winds, and these falling into the rivers which ran through the country, interrupted their currents; and the water then overspreading the level country, made one great lake, and gave origin to the mosses or moory bogs, which were afterwards formed there, by the workings of the waters, the precipitation of earthy matter from them, and the putrefaction of rotten boughs and branches of trees, and the vast increase of water-moss and other such plants which grow in prodigious abundance in all these sorts of places. Thus were these burnt and felled trees buried under a new-formed spongy and watery earth, and afterwards found on the draining and digging through this earth again.

Hence it is not strange that Roman weapons and Roman coins are found among these buried trees; and hence it is that among the buried trees some are found burnt, some chopped and hewn; and hence it is that the bodies of the trees all lie by their proper roots, and with their tops lying north-east, that is, in that direction in which a south-west wind would have blown them down: hence also it is, that some of the trees are found with their roots lying flat, these being not cut or burned down, but blown up by the roots afterwards when left single; and it is not wonderful, that such trees as these should have continued to grow even after their fall, and shoot up branches from their sides which might easily grow into high trees. Phil. Transf. N° 275.

By this system it is also easily explained why the moor soil in the country is in some places two or three yards thicker than in others, or higher than it was formerly, since the growing up of peat-earth or bog-ground is well known, and the soil added by overflowing of waters is not a little.

As the Romans were the destroyers of this great and noble forest, so they were probably also of the several other ancient forests; the ruins of which furnish us with the bog-wood of Staffordshire, Lancashire, Yorkshire, and other counties. But as the Romans were not much in Wales, in the Isle of Man, or in in Ireland, it is not to be ſuppoſed that foreſts cut down by theſe people gave origin to the foſſil wood found there; but though they did not cut down theſe foreſts, others did; and the origin of the bog-wood is the ſame with them and with us. Holingſhead informs us, that Edward I. being not able to get at the Welſh becauſe of their hiding themſelves in boggy woods, gave orders at length that they ſhould all be deſtroyed by fire and by the axe; and doubtleſs the roots and bodies of trees found in Pembrokeſhire under ground, are the remains of the execution of this order. The foſſile wood in the bogs of the iſland of Man is doubtleſs of the ſame origin, though we have not any accounts extant of the time or occaſion of the foreſts there being deſtroyed; but as to the foſſile trees of the bogs of Ireland, we are expreſsly told, that Henry II. when he conquered that country, ordered all the woods to be cut down that grew in the low parts of it, to ſecure his conqueſts, by cutting away the places of reſort of rebels. For a fuller detail of the natural hiſtory of moſſes, ſee Eſſays on this ſubject by the Rev. Mr Rennie of Kilſyth.

Moving-MOSS. We have an account in the Philoſophical Tranſactions of a moving moſs near Churchtown in Lancaſhire, which greatly alarmed the neighbourhood as miraculous. The moſs was obſerved to riſe to a ſurpriſing height, and ſoon after ſunk as much below the level, and moved ſlowly towards the ſouth.

A very ſurpriſing inſtance of a moving moſs is that of Solway in Scotland, which happened in the year 1771, after ſevere rains which had produced terrible inundations of the rivers in many places. For the better underſtanding of this event, we ſhall give the following deſcription of the ſpot of ground where it happened. Along the ſide of the river Eſk there is a vale, about a mile broad, leſs or more in different places. It is bounded on the ſouth-eaſt by the river Eſk, and on the north-weſt by a ſteep bank 30 feet in height above the level of the vale. From the top of the bank the ground riſes in an eaſy aſcent for about a quarter of a mile, where it is terminated by the moſs; which extends about two miles north and ſouth, and about a mile and a half eaſt and weſt, and is bounded on the north-weſt by the river Sark. It is probable that the ſolid ground from the top of the bank above the vale was continued in the ſame direction under the moſs, before its eruption, for a conſiderable ſpace; for the moſs at the place where the eruption happened, was inclined towards the ſloping ground. From the edge of the moſs there was a gully or hollow, called by the country people *the gap*, and ſaid to be 30 yards deep where it entered the vale; down which ran a ſmall rill of water, which was often dry in ſummer, having no ſupply but what filtered from the moſs. The eruption happened at the head of this gap, on Saturday November 16. 1771, about ten or eleven at night, when all the neighbouring rivers and brooks were prodigiouſly ſwelled by the rains. A large body of the moſs was forced, partly by the great fall of rain, and partly by ſome ſprings below it, into a ſmall beck or burn, which runs within a few yards of its border to the ſouth-eaſt. By the united preſſure of the water behind it, and of this beck, which was then very high, it was carried down a narrow glen between two banks about 300 feet high, into a wide and ſpacious plain, over part of which it ſpread with great rapidity. The moſs continued for ſome time to ſend off conſiderable quantities; which, being borne along by the torrent on the back of the firſt great body, kept it for many hours in perpetual motion, and drove it ſtill farther on. This night at leaſt 400 acres of fine arable land were covered with moſs from 3 to 12 or 15 feet deep. Several houſes were deſtroyed, a good deal of corn loſt, &c. but all the inhabitants eſcaped. When the waters ſubſided, the moſs alſo ceaſed to flow; but two pretty conſiderable ſtreams continued to run from the heart of it, and carried off ſome pieces of moſſy matter to the place where it burſt. There they joined the beck already mentioned; which, with this addition, reſumed its former channel; and, with a little aſſiſtance from the people of the neighbourhood, made its way to the Eſk, through the midſt of that great body of moſs which obſtructed its courſe. Thus, in a great meaſure drained, the new moſs fell ſeveral feet, when the fair weather came in the end of November, and ſettled in a firmer and more ſolid body on the lands it had overrun. By this inundation about 800 acres of arable ground were overflowed before the moſs ſtopped, and the habitations of 27 families deſtroyed. Tradition has preſerved the memory of a ſimilar inundation in Monteith in Scotland. A moſs there altered its courſe in one night, and covered a great extent of ground.

Moss Troopers, a rebellious ſort of people in the north of England, who lived by robbery and rapine, not unlike the tories in Ireland, the bucaniers in Jamaica, or banditti of Italy. The counties of Northumberland and Cumberland were formerly charged with a yearly ſum, and a command of men, to be appointed by juſtices of the peace, to apprehend and ſuppreſs them.

MOSTRA, in the Italian muſic, a mark at the end of a line or ſpace, to ſhow that the firſt note of the next line is in that place: and if this note be accompanied with a ſharp or flat, it is proper to place theſe characters along with the moſtra.

MOSUL, or mousul. See Mousul.

MOTACILLA, the Wagtail and Warbler; a genus of birds of the order of paſſeres. See Ornithology *Index*.

MOTE, in law books, ſignifies court or convention; as ward mote, burgh mote, ſwain mote, &c.

Mote was alſo uſed for a fortreſs or caſtle; as *mota de Windſor*, &c.

Mote alſo denoted a ſtanding water to keep fiſh in; and ſometimes a large ditch encompaſſing a caſtle or dwelling houſe.

Mote-Bell, or *Mot-Bell*, the bell ſo called, which was uſed by the Engliſh Saxons to call people together to the court. See Folkmote.

MOTH. See Phalæna, Entomology *Index*.

MOTHER, a term of relation, denoting a woman who hath born a child.

Mother-of-Pearl. See Mytilus, Conchology *Index*.

MOTION is now generally conſidered as incapable of definition, being a ſimple idea or notion received by the ſenſes. The ancients, however, thought differently. Some of them defined it to be a paſſage out of one *ſtate* into another; which conveys no idea to him who Motion,

Motion. who is ignorant of the nature of motion.—The Peripatetic definition has been mentioned elsewhere and shown to be wholly unintelligible, as well as their celebrated division of motion into four classes, belonging to the three categories, *quality*, *quantity*, and *where*; (see METAPHYSICS, N° 188, 189, 190.). The Cartesians, too, among the moderns, pretend to define motion, by calling it a passage or removal of one part of matter, out of the neighbourhood of those parts to which it is immediately contiguous, into the neighbourhood of others. Borelli defines motion to be the successive passage of a body from place to place. Others say that it is the application of a body to different parts of infinite and immoveable space; and a late writer * of uncommon acuteness has given as a definition of motion—*change of place*.

2 Several definitions of.

* See *An Essay on the Powers and Mechanism of Nature*, by Robert Young.

We have elsewhere offered our opinion of every possible attempt to define motion: but as the author of the last quoted definition has endeavoured to obviate such objections as ours, candour requires that he be heard for himself. "It is said (he observes) by some, that change implies motion, and therefore cannot be a part of its definition, being the very thing defined. To this I answer, We are speaking of the sensible idea of motion, as it appears to our sight; now changes do appear to our view, and to all our senses, which give us no idea of motion. Changes in heat or cold; in colour, flavour, smell, sound, hardness, softness, pain, pleasure; in these, and many other ideas, changes do not produce ideas like that produced by a ball rolling or a stone falling. We may perhaps ultimately trace them to motion, but to insensible motions; to motions which arise only in reflection, and constitute no part of the actual idea of change. We can therefore conceive of change, without conceiving at the same time of motion.—Change is a generic idea, including many species; motion, as a sensible idea, is a species of that genus. Change is therefore a necessary part of the definition of motion; it marks the genus of the thing defined. Motion is a change; but as there are many species of change, which of those species is motion? The answer is, It is a change of place. This marks the species; and distinguishes it from change of colour, of temperament and figure."

This is the ablest defence of an attempt to define motion that we have ever seen; and at first view the definition itself appears to be perfect. Aristotle, the prince of definers, "considers a definition † as a speech declaring what a thing is. Every thing essential to the thing defined, and nothing more, must be contained in the definition. Now the essence of a thing consists of these two parts: first, what is *common* to it with other things of the same kind; and secondly, what *distinguishes* it from other things of the same kind. The first is called the *genus* of the thing; the second, its *specific difference*. The definition, therefore, consists of these two parts."

† See Dr Reid's account of Aristotle's logic, in Lord Kames's *Sketches of Man*.

3 Shown not to declare what the thing is; and therefore to be no definition.

In obedience to this rule, the definition under consideration seems to consist of the *genus*, signified by the word *change*; and of the *specific difference*, denoted by the words *of place*. But does the speech *change of place* really declare what motion is? We cannot admit that it does; as, in our apprehension, a *change of place* is the *effect* of motion, and not *motion itself*. Suppose a lover of dialectic undertaking to define the stroke by which he saw his neighbour wounded with a bludgeon; what should we think of his art were he to call it a contusion on the head? He might say that *contusion* is a general term, as contusions may be produced on the arms, on the legs, and on various parts of the body; and as there are many species of contusion, if he were asked which of those species was the stroke to be defined, he might answer, "a contusion on the head." Here would be apparently the *genus* and *specific difference*; the former denoted by *contusion*, and the latter by the words *on the head*. But would this be a definition of a stroke? No, surely: a contusion on the head may be the *effect* of a stroke; but it can no more be the *stroke itself*, than a blow can be a bludgeon, or a flesh wound the point of a sword. Equally evident it is, that a change of place cannot be motion; because every body must have been actually moved before we can discern, or even conceive, a change of its place.

The *act of changing the place* would perhaps come nearer to a definition of motion; but so far would it be from "a speech declaring what motion is," that we are confident a man who had never by any of his senses perceived a body in actual motion, would acquire no ideas whatever from the words "act of changing place." He might have experienced changes in heat, cold, smell, and sound; but he could not possibly combine the ideas of such changes with the signification of the word *place*, were he even capable of understanding that word, which to us appears to be more than doubtful. (See METAPHYSICS, N° 40, 41.)

4 The distinctions of motion into different kinds insignificant.

The distinctions of motion into different kinds have been no less various, and no less insignificant, than the several definitions of it. The moderns who reject the Peripatetic division of motion into four classes, yet consider it themselves as either *absolute* or *relative*. Thus we are told, that "*absolute motion* is the change of absolute *place*, and that its celerity must be measured by the quantity of *absolute space* which the moving body runs through in a given time." "*Relative motion*, on the other hand, is a mutation of the *relative* or *vulgar place* of the moving body, and has its celerity estimated by the quantity of *relative space* run through."

Now it is obvious, that this distinction conveys no ideas without a farther explanation of the terms by which it is expressed; but that explanation is impossible to be given. Thus, before we can understand what *absolute motion* is, we must understand what is meant by *absolute place*. But absolute place is a contradiction; for all *place* is *relative*, and consists in the positions of different bodies with regard to one another. Were a globe in the regions of empty space to be put in motion by Almighty Power, and all the rest of the corporeal world to be soon afterwards annihilated, the motion would undoubtedly continue unchanged; and yet, according to this distinction, it would be at first *relative*, and afterwards *absolute*. That the beginning of such a motion would be *perceptible*, and the remainder of it *imperceptible*, is readily granted; but on this account to consider it as of two kinds, is as absurd as to suppose the motion of the minute hand of a clock to be affected by our looking at it.

5 The opinions of the Cartesians and of Newton respecting the source of motion.

Leaving therefore these unintelligible distinctions, we now come to consider a question still of a very abstruse nature, but much agitated among philosophers, viz.

Motion

viz. What is the original ſource of motion in the creation: Is it natural to matter? or are we to aſcribe it to the immediate and continual agency of ſome *immaterial* being? The former has been ſtrenuouſly argued by the Carteſians, and the latter by the Newtonians. The arguments of the former, founded upon the chimerical hypotheſis of vortices and the original conſtruction of matter, were evidently inconcluſive; and the hypotheſis of Sir Iſaac Newton, who aſſerted that it was naturally *incapable* of motion, appeared more probable. To account for the quantity of motion in the univerſe, therefore, it became neceſſary to have recourſe either to the Deity, or to ſome ſubordinate ſpiritual agent; and this became the more neceſſary, as the doctrine of an abſolute vacuum in the celeſtial ſpaces, that is, throughout the incomparably greateſt part of the creation, was one of the fundamental maxims of the ſyſtem. As it was abſolutely denied that matter exiſted in theſe ſpaces, and it was plain that the celeſtial bodies affected one another at immenſe diſtances, the powers of attraction and repulſion were naturally called in as the ſources of motion by their impulſe upon inert and ſluggiſh matter. Theſe being admitted, a ſpeculation enſued concerning their nature. *Spiritual*, it was confeſſed, they were; but whether they were to be accounted the immediate action of the divine Spirit himſelf, or that of ſome ſubordinate and inferior ſpirit, was a matter of no little diſpute. Sir Iſaac Newton, towards the latter part of his life, began to relax ſomewhat of the rigidity of his former doctrine; and allowed that a very ſubtile medium, which he called *æther*, might be the cauſe of attraction and repulſion, and thus of the whole phenomena of nature. Since his time the multitude of diſcoveries in electricity, the ſimilarity of that fluid to fire and light, with the vaſt influence it has on every part of the creation with which we are acquainted, have rendered it very probable that the æther mentioned by Sir Iſaac is no other than the element of fire, "the moſt ſubtile † and elaſtic of all bodies, which ſeems to pervade and expand itſelf throughout the whole univerſe. Electrical experiments ſhow that this mighty agent is everywhere preſent, ready to break forth into action if not reſtrained and governed with the greateſt wiſdom. Being always reſtleſs and in motion, it actuates and enlivens the whole viſible maſs; is equally fitted to produce and to deſtroy; diſtinguiſhes the various ſtages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which it conſtantly ſends forth and reſorbs. So quick in its motions, ſo ſubtle and penetrating in its nature, ſo extenſive in its effects, it ſeemeth no other than the vegetative ſoul or vital ſpirit of the world.

6 A ſubtle æther the probable cauſe of attraction and repulſion.

† *Siris*, Nº 153, &c.

7 The opinions of the ancients on this ſubject.

"The animal ſpirit in man is the inſtrument both of ſenſe and motion. To ſuppoſe ſenſe in the corporeal world would be groſs and unwarranted; but locomotive faculties are evident in all its parts. The Pythagoreans, Platoniſts, and Stoics, held the world to be an animal; though ſome of them have choſen to conſider it as a vegetable. However, the phenomena do plainly ſhow, that there is a ſpirit that moves, and a mind or providence that preſides. This providence, Plutarch ſaith, was thought to be in regard to the world what the ſoul is in regard to man. The order and courſe of things, and the experiments we daily make, ſhow that there is a mind which governs and actuates this mundane ſyſtem as the proper and real agent and cauſe; and that the inferior inſtrumental cauſe is pure æther, fire, or the ſubſtance of light, which is applied and determined by an infinite mind in the macrocoſm or univerſe, with unlimited power, and according to ſtated rules, as it is in the microcoſm with limited power and ſkill by the human mind. We have no proof either from experiment or reaſon of any other agent or efficient cauſe than the mind or ſpirit. When, therefore, we ſpeak of corporeal agents, or corporeal cauſes, this is to be underſtood in a different, ſubordinate, and improper ſenſe; and ſuch an agent we know light or elementary fire to be."

8 Experiments proving that a ſubtle æther may be the immediate cauſe of the planetary motions, &c.

That this elementary fire, abſorbed and fixed in all bodies, *may* be the cauſe of the univerſal principle of gravity, is made ſufficiently evident by numberleſs experiments. Homberg having calcined in the focus of a burning glaſs ſome regulus of antimony, found that it had gained one-tenth in weight, though the regulus, during the whole time of the operation, ſent up a thick ſmoke, and thereby loſt a conſiderable part of its own ſubſtance. It is vain to allege that any heterogeneous matter floating in the air, or that the air itſelf, may have been hurried into the maſs by the action of the fire, and that by this additional matter the weight was increaſed; for it is known experimentally, that if a quantity of metal be even hermetically ſecured within a veſſel of glaſs to keep off the air and all foreign matter, and the veſſel be placed for ſome time in a ſtrong fire, it will exhibit the ſame effect. "I have ſeen the operation performed (ſays Mr Jones †) on two ounces of pewter filings, hermetically ſealed up in a Florence flaſk, which in two hours gained 55 grains, that is nearly one 17th. Had it remained longer in the fire, it might probably have gained ſomething more; as, in one of Mr Boyle's experiments, ſteel filings were found to have gained a fourth.

† *Eſſay on the Firſt Principles of Natural Philoſophy.*

"Of accounting for theſe effects there are but two poſſible ways: 1. If the quantity of matter be the ſame, or, in the caſe of calcination, be ſomewhat leſs, after being expoſed to the action of the fire, while the gravity of the whole is become greater; then does it follow, that gravity is not according to the quantity of matter, and of courſe is not one of its properties. 2. If there be an increaſe of the maſs, it can be imputed to nothing but the matter of light or fire entangled in its paſſage through the ſubſtance, and ſo fixed in its pores, or combined with its ſolid parts, as to gravitate together with it. Yet it is certain, from the phenomenon of light darting from the ſun, that this elementary fire does not gravitate till it is fixed in metal, or ſome other ſolid ſubſtance.—Here then we have a fluid which gravitates, if it gravitate at all, in ſome caſes and not in others. So that which way ſoever the experiment be interpreted, we are forced to conclude that elementary or ſolar fire may be the cauſe of the law of gravitation."

That it is likewiſe in many caſes the cauſe of repulſion, is known to every one who has ſeen it fuſe metals, and convert water and mercury into elaſtic vapour. But there is a fact recorded by Mr Jones, which ſeems to evince that the ſame fluid, which as it iſſues from the ſun exhibits itſelf in the form of light and heat, is in other circumſtances converted into a very fine air,

or

Motion.

or cold æther, which ruſhes very forcibly towards the body of that luminary. "As a ſequel to what has been obſerved (ſays he) concerning the impregnation of ſolid ſubſtances with the particles of fire, give me leave to ſubjoin an experiment of M. de Stair. He tells us, that upon heating red lead in a glaſs, whence the air was exhauſted by the rays of the ſun collected in a burning glaſs, the veſſel in which the ſaid red lead was contained burſt in pieces with a great noiſe. Now, as all exploſions in general muſt be aſcribed either to an admiſſion of the air into a rarefied ſpace, or to what is called the *generation* of it; and as air was not admitted upon this occaſion, it muſt have been generated from the calx within the veſſel; and certainly was ſo, becauſe Dr Hales has made it appear that this ſubſtance, like crude tartar and many others, will yield a conſiderable quantity of *air* in diſtillation. What went into the metal therefore as *fire*, came out of it again as *air;* which in a manner forces upon us concluſions of ineſtimable value in natural philoſophy, and ſuch as may carry us very far into the moſt ſublime part of it."

One of the concluſions which the ingenious author thinks thus forced upon us, is, that the motion of the planets round the ſun, as well as round their own axes, is to be attributed to the continual agency of this fluid, under its two forms of elementary fire and pure air. As fire and light, we know that it ruſhes with inconceivable rapidity from the body of the ſun, and penetrates every corporeal ſubſtance, exerting itſelf ſometimes with ſuch force as nothing with which we are acquainted is able to reſiſt. If it be indeed a fact, that this elementary fire, or principle of light and heat, afterwards cools, and becomes pure air, there cannot be a doubt, but that under ſuch a form it will return with great force, though ſurely in a ſomewhat different direction, towards the ſun, forming a vortex, in which the planets are included, and by which they muſt of courſe be carried round the centre. Mr Jones does not ſuppoſe that the air into which the principle of light and heat is converted, is of ſo groſs a nature as our atmoſphere. He rather conſiders it as cool æther, juſt as he repreſents light to be æther heated: but he maintains, that this æther, in its aërial form, though not fit for human reſpiration, is a better *pabulum* of fire than the air which we breathe.

This theory is exceedingly plauſible; and the author ſupports it by many experiments. He has not, indeed, convinced us that the ſolar light is converted or convertible into pure air; but he has, by juſt reaſoning from undoubted facts, proved that the whole expanſe of heaven, as far as comets wander, is filled not only with light, which is indeed obvious to the ſenſes, but alſo with a fluid, which, whatever it may be called, ſupplies the place of the air in feeding the fire of theſe ignited bodies.

9
The exiſtence of ſuch an æther, however, does not completely ſolve the phenomena.

That the motion of the heavenly bodies ſhould reſult from the perpetual agency of ſuch a medium, appears to us a much more rational hypotheſis, than that which makes them act upon each other at immenſe diſtances through empty ſpace. But the hypotheſis is by no means ſo complete a ſolution of the phenomena as ſome of its fond admirers pretend to think it. This fluid, whether called æther, heat, light, or air, is ſtill material; and the queſtion returns upon him who imagines that it is ſufficient to account for gravitation, repulſion, magnetiſm, and coheſion, &c. "What moves the fluid itſelf, or makes the parts of which it is compoſed cohere together?" However widely it may be extended, it is incapable of poſitive infinity; and therefore *may be* divided into parts ſeparated from each other; ſo that it muſt be held together by a foreign force, as well as a ball of lead, or a piece of wax. As matter is not eſſentially active, the motion of this æther, under both its forms, muſt likewiſe be conſidered as an effect, for which we do not think that any propelling power in the body of the ſun can be admitted as a ſufficient cauſe. For how comes the ſun to poſſeſs that power, and what makes the fluid return to the ſun? We have no notion of power, in the proper ſenſe of the word, but as intelligence and volition; and, by the pious and excellent author of the Eſſay on the Firſt Principles of Natural Philoſophy, we are certain that the ſun was never ſuppoſed to be intelligent.

10
It is therefore by ſome ſuppoſed to be animated.

Biſhop Berkeley, who admits of light or æther as the inſtrumental cauſe of all corporeal motion, gets rid of this difficulty, by ſuppoſing, with the ancients, that this powerful agent is animated. "According to the Pythagoreans and Platoniſts (ſays his Lordſhip*), there is a life infuſed throughout all things; the πυρ νοερον, πυρ τεχνικον, an intellectual and artificial fire, an inward principle, animal ſpirit, or natural life, producing and forming within, as art doth without; regulating, moderating, and reconciling the various motions, qualities, and parts of this mundane ſyſtem. By virtue of this life, the great maſſes are held together in their ordinary courſes, as well as the minuteſt particles governed in their natural motions, according to the ſeveral laws of attraction, gravity, electricity, magnetiſm, and the reſt. It is this gives inſtincts, teaches the ſpider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and cortical veſſels to ſeparate and attract ſuch particles of air and elementary fire as ſuit their reſpective natures."

* *Siris*, N° 277.

This life or animal ſpirit ſeems to be the ſame thing which Cudworth calls plaſtic nature, and which has been conſidered elſewhere. (See METAPHYSICS, N° 200, and *PLASTIC Nature*). We ſhall therefore diſmiſs it at preſent, with juſt admitting the truth of the biſhop's poſition, "that if nature be ſuppoſed the life of the world, animated by one ſoul, compacted into one frame, and directed or governed in all its parts by one ſupreme and diſtinct intelligence, this ſyſtem cannot be accuſed of atheiſm, though perhaps it may of miſtake or impropriety."

11
A new theory of motion.

A theory of motion ſomewhat ſimilar to that of Berkeley, though in ſeveral reſpects different from it, was not many years ago ſtated with great clearneſs, and ſupported with much ingenuity, in An Eſſay on the Powers and Mechaniſm of Nature, intended to improve, and more firmly eſtabliſh, the grand ſuperſtructure of the Newtonian ſyſtem. Mr Young, the author of the eſſay, admits with moſt other philoſophers of the preſent age, that body is compoſed of atoms which are impenetrable to each other, and may be denominated ſolid. Theſe atoms, however, he does not conſider as primary and ſimple elements, incapable of reſolution into principles:

Motion.

ciples; but thinks that they are formed by certain motions of the parts of a substance immaterial and essentially active.

12
by supposing that a substance essentially active pervades the universe.

As this notion is uncommon, and the offspring of a vigorous mind, we shall consider it more attentively under the article *Plastic Nature.* It is mentioned at present as a necessary introduction to the author's theory of motion, of which he attributes both the origin and the continuance to the agency of this elementary substance pervading the most solid atoms of the densest bodies. Of every body and every atom he holds the constituent principles to be essentially active: but those principles act in such a manner as to counterbalance each other; so that the atom or body considered as a whole is inert, unless in so far as it resists the compression or separation of its parts. No body or atom can of itself begin to move, or continue in motion for a single instant: but being pervious to the active substance, and coalescing with it, that substance, when it enters any body, it carries it along with it, till, meeting some other body in the way, either the whole of the active substance lodged in the former body passes into the obstacle, in which case the impelling body instantly ceases to move: or else part of that substance passes into the obstacle, and part remains in the impelling body; and in this case both bodies are moved with a velocity in proportion to the quantity of matter which each contains, combined with the quantity of active substance by which they are respectively penetrated.

13
Proofs of the existence of such a substance.

In order to pave the way for his proof of the existence of one uniform active substance, he observes, that "*change* being an essentially constituent part of motion, and change implying action, it follows that *all motion implies action, and depends on an active cause.* Every motion (he continues) has a beginning, a middle, and an end. The beginning is a change from rest to motion; the middle is a continuance in motion; the end is a change from motion to rest." He then proceeds to show, that the beginning of motion is by an action begun; the continuance of motion by an action continued; and the end of motion by a cessation of action.

"The first of these positions is admitted by every body. That the *continuance* of motion is by an action *continued*, will be proved, if it shall be shown that the continuance of a motion is nothing different from its beginning, in regard to any point of time assumed in the continued motion. Now the beginning of motion (he says) consists in the beginning of change of place. But if any given portions of time and of space are assumed, a body beginning to move in the commencement of that time, and in the first portion of the space assumed, then and there begins that particular motion: and whether before the body began to move in that space it was moving in other spaces and times, has no relation to the motion in question; for this being in a space and time altogether distinct, is a distinct motion from any which might have preceded it immediately, as much as from a motion which preceded it a thousand years before. It is therefore a new motion begun; and so it may be said of every assumable point in the continued motion. The term *continued* serves only to connect any two distinct motions, the end of one with the beginning of the other; but does not destroy their distinctness."

Motion.

He then proceeds to combat, which he does very successfully, the arguments by which the more rigid Newtonians endeavour to prove that a body in motion will continue to be moved by its own *inertia*, till stopt by some opposite force. Having done this, he establishes the contrary conclusion by the following syllogisms:

"I. Whatever requires an active force to stop its motion, is disposed to move.
Every body in motion requires an active force to stop its motion:
Therefore every body in motion is disposed to move.

"II. Whatever is disposed to motion is possessed of action.
But a body in motion is disposed to continue in motion:
Therefore a body in motion is possessed of action.

Thus it appears, that the middle part of any motion is action equally with the beginning.

"The last part of motion is its *termination.* It is admitted that all motion is terminated by an action contrary to the direction of the motion. It is admitted, too, that the moving body *acts* at the time its motion is destroyed. Thus the *beginning* and the *end* of any uniform motion are confessed to be actions; but all the intermediate *continuation* which connects the beginning with the end is denied to be action. What can be more unaccountable than this denial? Is it not more consonant to reason and analogy, to ascribe to the whole continued motion one uninterrupted action? Such a conclusion true philosophy, we think, requires us to make.

"To move or act, is an attribute which cannot be conceived to exist without a substance. The *action of a body in motion* is indeed the attribute of the body, and the body relatively to its own motion is truly a substance, having the attribute or quality of motion. But the body being a name signifying a combination of certain ideas, which ideas are found to arise from action (see *Plastic Nature*), that action which is productive of those ideas whose combination we denominate body, is of the nature of an attribute so long as it is considered as constituted of action.—To this attribute we must necessarily assign its substance. The actions which constitute body must be actions of something, or there must be something which acts. What then is this ACTIVE SOMETHING from whose agency we get the idea of body, or whose actions constitute body? Is it not sufficient that it is something active? A name might be surely given it, but a name would not render the idea more clear. Its description may be found in every sensation; it is colour to the eye, flavour to the palate, odour to the nose, sound to the ear, and feeling to the touch; for all our sensations are but so many ways in which this ACTIVE SOMETHING is manifested to us. A substratum of solidity philosophers have imagined to exist, and have in vain sought to find. Our ACTIVE SUBSTANCE is the substratum so long sought for, and with so little success. We give it a quality by which it may be perceived; it ACTS. One modification of *action* produces MATTER, another generates MOTION. These modifications of action are modes of the active substance, whose presence is action: matter and motion constitute

Motion.

constitute the whole of nature. THERE IS THEREFORE THROUGHOUT NATURE AN ACTIVE SUBSTANCE, THE CONSTITUENT ESSENCE OF MATTER, AND IMMEDIATE NATURAL AGENT IN ALL EFFECTS."

14 Which is unintelligent,

By an argument which we do not think very conclusive, our author determines this active substance to be unintelligent. "In our sensations individually, not discovering (says he) the traces, not seeing the characters of intelligence, but finding only action present and necessary, our inferences go no farther than our observations warrant us to do; and we conclude in all these things an action only, and that action unintelligent." Having given our opinion of real agency elsewhere (see METAPHYSICS, N° 118.), we shall not here stop to examine this reasoning.—We may however ask, Whether all our sensations individually be not excited for a *certain end?* If they be, according to our author's mode of arguing in another place, the exciting agent should be an intelligent being. By this we are far from meaning to deny the reality of a secondary or instrumental cause of sensation which is destitute of intelligence. We are strongly inclined to think that there is such a cause, though our persuasion results not from this argument of our author's. In our opinion, he reasons better when he says, "that a subordinate agent constructed as the matter of creation, invested with perpetual laws, and producing agreeably to those laws all the forms of being, through the varieties of which inferior intelligences can, by progressive steps, arrive ultimately at the supreme contriver, is more agreeable to our ideas of dignity, and tends to impress us with more exalted sentiments, than viewing the Deity directly in all the individual impressions we receive, divided in the infinity of particular events, and unawful, by his continual presence in operations to our view insignificant and mean."

15 and neither matter nor mind.

This active substance, or secondary cause, our author concludes to be neither matter nor mind. "Matter (says he) is a being, as a whole quiescent and inactive, but constituted of active parts, which resist separation, or cohere, giving what is usually denominated solidity to the mass. Mind is a substance which thinks. A being which should answer to neither of these definitions, would be neither matter not mind; but an *immaterial*, and, if I may so say, an *immental* substance." Such is the active substance of Mr Young, which, considered as the cause of motion, seems not to differ greatly from the *plastic nature*, *hylarchical principle*, or *vis genitrix*, of others. The manner in which it operates is indeed much more minutely detailed by our author than by any other philosopher, ancient or modern, with whose writings we have any acquaintance.

16 The manner in which it is supposed to operate.

"Every thing (he says) must be in its own nature either disposed to rest or motion; consequently the ACTIVE SUBSTANCE must be considered as a being naturally either quiescent or motive. But it cannot be naturally quiescent; for then it could not be active, because activity, which is a tendency to motion, cannot originate in a tendency to rest. Therefore the ACTIVE SUBSTANCE is by nature motive, that is, tending to motion. The ACTIVE SUBSTANCE is not solid, and does not resist penetration. It is therefore incapable of impelling or of sustaining impulse. Whence it follows, that as it tends to move, and is incapable of having its motion impeded by impulse, it must actually and continually move: in other words, MOTION IS ESSENTIAL TO THE ACTIVE SUBSTANCE.

"In order that this substance may *act*, some other thing upon which it may produce a change is necessary; for whatever suffers an action, receives some change. The active substance, in acting on some other thing, must impart and unite itself thereto; for its *action* is communicating its *activity*. But it cannot communicate its activity without imparting its substance: because it is the substance alone which possesses activity, and the quality cannot be separated from the substance. THEREFORE THE ACTIVE SUBSTANCE ACTS BY UNITING ITSELF WITH THE SUBSTANCE ON WHICH IT ACTS. The union of this substance with bodies, is not to be conceived of as a junction of small parts intimately blended together and attached at their surfaces; but as an entire diffusion and incorporation of one substance with another in perfect coalescence. As bodies are not naturally active, whenever they become so, as they always do in motion, it must be by the accession of some part of the active substance. The active substance being imparted to a body, penetrates the most solid or resisting parts, and does not reside in the pores without, and at the surfaces of the solid parts. For the activity is imparted to the body itself; and not to its pores, which are no parts of the body: therefore if the active substance remained within the pores, the cause would not be present with its effect; but the cause would be in one place and the effect in another, which is impossible.

"Bodies by their impulse on others lose their activity in proportion to the impulse. This is matter of observation. Bodies which suffer impulse acquire activity in proportion to the impulse. This also is matter of observation. In impulse, therefore, the active substance passes out of the impelling body into the body impelled. For since bodies in motion are active, and activity consists in the presence of the active substance, and by impulse bodies lose their activity, therefore they lose their active substance, and the loss is proportional to the impulse. Bodies impelled acquire activity; therefore acquire active substance, and the acquisition is proportioned to the impulse. But the active substance lost by the impelling body ought to be concluded to be that found in the other; because there is no other receptacle than the impelled body to which the substance parted from can be traced, nor any other source than the active body whence that which is found can be derived. Therefore, in impulse, the active substance ought to be concluded to pass from the impelling body to the body impelled. The flowing of such a substance is a sufficient cause of the communication of activity, and no other rational cause can be assigned.

"The continued motion of a body depends not upon its *inertia*, but upon the continuance of the active substance within the body. The motion of a body is produced by the motion of the active substance in union with the body. It being evident, that since the active substance itself does always move, whatever it is united to will be moved along with it, if no obstacle prevent. In mere motion, the body moved is the patient, and the active substance the agent. In impulse,

impulſe, the body in motion may be conſidered as an agent, as it is made active by its active ſubſtance.—While the active ſubſtance is flowing out of the active body into the obſtacle or impelled body, the active body will preſs or impel the obſtacle. For while the active ſubſtance is yet within the body, although flowing through it, it does not ceaſe to impart to the body its own nature, nor can the body ceaſe to be active becauſe not yet deprived of the active ſubſtance. Therefore during its paſſing out of the body, ſuch portion of the active ſubſtance as is yet within, is urging and diſpoſing the body to move, in like manner as if the active ſubſtance were continuing in the body; and the body being thus urged to move, but impeded from moving, preſſes or impels the obſtacle.

17 produces impulſe,

"We ſee here (ſays our author) an obvious explanation of impulſe; it conſiſts in the flowing of the motive ſubſtance from a ſource into a receptacle;" and he thinks, that although the exiſtence of ſuch a ſubſtance had not been eſtabliſhed on any previous grounds, the communication of motion by impulſe does alone afford a ſufficient proof of its reality.

He employs the agency of the ſame ſubſtance to account for many other apparent activities in bodies, ſuch as thoſe of *fire*, *electricity*, *attraction*, *repulſion*, *elaſticity*, &c. All the apparent origins of corporeal activity ſerve, he ſays, to impart the active ſubſtance to bodies; "and where activity is without any *manifeſt* origin, the active ſubſtance is derived from an inviſible ſource."

Our limits will not permit us to attend him in his ſolution of all the apparent activities in bodies; but the orbicular motions of the planets have been accounted for in ſo many different ways by philoſophers ancient and modern, and each account has been ſo little ſatisfactory to him who can think, and wiſhes to trace effects from adequate cauſes, that we conſider it as our duty to furniſh our readers with the account of this phenomenon which is given by Mr Young.

18 and cauſes the motion of the heavenly bodies.

The queſtion which has been ſo long agitated, "Whence is the origin of motion?" our author conſiders as implying an abſurdity. "It ſuppoſes (ſays he) that reſt was the primitive ſtate of matter, and that motion was produced by a ſubſequent act. But this ſuppoſition muſt ever be rejected, as it is giving precedency to the inferior, and inverting the order of nature." The ſubſtance which he holds to be the baſis of matter is eſſentially active; and its action is motion. This motion, however, in the original element, was *power* without direction, agency without order, activity to no end. To this power it was neceſſary that a Law ſhould be ſuperadded; that its agency ſhould be guided to ſome regular purpoſe, and its motion conſpire to the production of ſome uniform effects. Our author ſhows, or endeavours to ſhow, by a proceſs of reaſoning which ſhall be examined elſewhere, that the primary atoms of matter are produced by the circular motion of the parts of this ſubſtance round a centre; and that a ſimilar motion of a number of theſe atoms around another centre common to them all, produces what in common language is called a *ſolid body*; a cannon ball, for inſtance, the terreſtrial globe, and the body of the ſun, &c. In a word, he labours to prove, and with no ſmall ſucceſs, that a principle of union is implied in the revolving or circulating movements of the active ſubſtance.

"But we may alſo aſſume (he ſays) *à priori*, that a principle of union is a general law of nature; becauſe we ſee in fact all the component parts of the univerſe are united ſyſtems, which ſucceſſively combine into larger unions, and ultimately form *one* whole." Let us then ſuppoſe the ſun with all his planets, primary and ſecondary, to be already formed for the purpoſe of making one ſyſtem, and the orbits of all of them, as well as theſe great bodies themſelves, to be pervaded by the active ſubſtance, which neceſſarily exiſts in a ſtate of motion, and is the cauſe of the motion of every thing corporeal. "If to this motion a principle of union be added, the effect of ſuch a principle would be a determination of all the parts of the active ſubſtance, and of courſe all the bodies to which it is united, towards a common centre, which would be at reſt, and void of any tendency in any direction. But this determination of all the parts of the ſyſtem towards a common centre, tends to the deſtruction both of the motion of the active ſubſtance and of the ſyſtem; for ſhould all the parts continually approximate from a circumference towards a centre, the ſun and planets would at laſt meet, and form one ſolid and quieſcent maſs. But to preſerve exiſtence, and conſequently motion, is the firſt law of the active ſubſtance, as of all being; and it cannot be doubted, that to preſerve diſtinct the ſeveral parts of the ſolar ſyſtem, is the firſt law given to the ſubſtance actuating that ſyſtem. The union of the ſyſtem is a ſubſequent law.

"When the *direct* tendency of any inferior law is obviated by a higher law, the inferior law will operate *indirectly* in the manner the neareſt to its direct tendency that the ſuperior law will permit. If a body in motion be obliquely obſtructed, it will move on in a direction oblique to its firſt motion. Now the law of union, which pervades the ſolar ſyſtem, being continually obſtructed by the law of ſelf-preſervation, the motion of the active ſubſtance, and of the bodies to which it is united, can be no other than a revolving motion *about* the common centre of approach, *towards* which all the parts have a determination. But when this revolution has actually taken place, it gives birth to a new tendency, which ſuperſedes the operation of the law of ſelf-preſervation. It has been ſhown, that the motion eſſential to the active ſubſtance, required to be governed by ſome law to give being to an orderly ſtate of things. Now, there are motions ſimple and motions complex; the more ſimple is in all things firſt in order, and out of the more ſimple the more complex ariſes in order poſterior. The moſt ſimple motion is rectilineal; therefore a rectilineal motion is to be conſidered as that which is the original and natural ſtate of things, and conſequently that to which *all things tend*. It will follow from hence, that when any portion of active ſubſtance in which the *law of union* operates, has in the manner above explained been compelled to aſſume a revolving motion, that is, a motion in ſome curve; a tendency to a rectilineal motion will continually exiſt in every part of the revolving portion, and in every point of the curve which it deſcribes during its revolution. And this rectilineal tendency will be a tendency to recede from the centre in every point

point of the revolving orbit, and to proceed in a tangent to the orbit at each point. These two tendencies, if not originally equal, muſt neceſſarily in all caſes arrive at an equality. For the tendency towards the centre, called the *centripetal* tendency, that is, the *law of union*, operating firſt, if we ſuppoſe the motion approaches the centre, the tendency to recede from it, called the *centrifugal* tendency, will have its proportion to the centripetal continually increaſed as the orbit of revolution grows leſs, ſo as ultimately to equal the centripetal tendency, and reſtrain the motion from its central courſe, at which point it will no longer ſeek the centre but revolve round it."

As our author holds that every atom of matter is formed by the motion of parts of the active ſubſtance, and every body formed by the motion of atoms; ſo he maintains, not only that the ſun, moon, earth, planets, and ſtars, are penetrated by the ſame ſubſtance, but that each is the centre of a vortex of that ſubſtance, and that of theſe vortices ſome are included within others. "The ſubtle revolving fluid, the centre of whoſe vortex the earth occupies, not only ſurrounds but pervades the earth, and other vortices their earths, to their centres; and the earth and planets are by its revolutions carried around on their own axes. The earth is an inactive maſs, and all its component maſſes are ſeverally as well as collectively inactive; but the earth and all its parts have various collective and ſeparate movements, imparted from the fluid which ſurrounds, pervades, and conſtitutes it. Being immerſed together with its proper ſurrounding ſphere or vortex in the larger ſphere or vortex of the ſun, it is carried thereby in a larger orbit about the ſun, at the ſame time that by the revolution of its proper ſphere it rotates on its own axis."

19 Objections to this theory.

Such is the moſt complete view which our limits will permit us to give of Mr Young's theory of motion. To the philoſopher who conſiders experiment as the only teſt of truth, and who in all his inquiries employs his hands more than his head, we are fully aware that it will appear in no better light than as "the baſeleſs fabric of a viſion." Even to the intellectual philoſopher who is not frightened at the word *metaphyſics*, we are afraid that ſuch an active ſubſtance as the author contends for, will appear as inadequate to the production of the phenomena of gravitation and repulſion as the material æther of Mr Jones and his followers. A being void of intelligence, whether it be material or immaterial, quieſcent or motive, cannot be the ſubject of law, in the proper ſenſe of the word. The laws of which Mr Young ſpeaks as neceſſary to regulate the motions of the active ſubſtance, muſt be mere *forces*, applied by ſome extrinſic and ſuperior power. And ſince "motion, as it is *eſſential* to the active ſubſtance, is power without direction, agency without order, activity to no end; ſince it is of ſuch a nature, that from its unguided agitations there could reſult neither connexion, order, nor harmony;" it follows that thoſe extrinſic forces muſt be *perpetually* applied, becauſe what is *eſſential* to any ſubſtance can never be deſtroyed or changed ſo long as the ſubſtance itſelf remains.

Forces producing order out of confuſion, can be applied only by a being poſſeſſed of intelligence; and if the immediate and perpetual agency of an intelligent being be neceſſary to regulate the motions of the active ſubſtance, that ſubſtance itſelf may be thought ſuperfluous, and its very exiſtence be denied. *Entia non ſunt multiplicanda abſque neceſſitate*, is a rule of philoſophizing which every man of ſcience acknowledges to be juſt. And it will hardly be denied, that the immediate and perpetual agency of an intelligent being upon Mr Jones's etherial fluid, or even upon the matter of ſolid bodies themſelves, would be capable of producing every kind of motion without the inſtrumentality of a ſubſtance which is neither mind nor matter.

Such, we conceive, are the objections which our metaphyſical readers may make to this theory. Part of their force, however, will perhaps be removed by the ingenious manner in which our author analyzes matter into an immaterial principle. But ſo much of it remains, that the writer of this article is inclined to believe that no mechanical account can be given of the motions of the heavenly bodies, the growth of plants, and various other phenomena which are uſually ſolved by attraction and repulſion. In the preſent age, philoſophers in general are ſtrangely averſe from admitting on any occaſion the agency of mind; yet as every effect muſt have a cauſe, it is ſurely not irrational to attribute ſuch effects as mechaniſm cannot produce to the operation either of intelligence or inſtinct. To ſuppoſe the Deity the immediate agent in the great motions of the univerſe, has been deemed impious; and it muſt be confeſſed that very impious concluſions have been deduced from that principle. But there is ſurely no impiety in ſuppoſing, with the excellent biſhop of Cloyne, that the fluid which is known to pervade the ſolar ſyſtem, and to operate with reſiſtleſs force, may be animated by a powerful mind, which acts inſtinctively for ends of which itſelf knows nothing. For the exiſtence of ſuch a mind, no other evidence, indeed, can be brought than what is afforded by a very ancient and very general tradition, and by the impoſſibility of accounting for the phenomena upon principles of mere mechaniſm. Perhaps ſome of our more pious readers may be inclined to think that the Supreme Being has committed the immediate government of the various planetary ſyſtems to powerful *intelligences*, or ANGELS, who, as his miniſters, direct their motions with wiſdom and foreſight. Such an opinion is certainly not abſurd in itſelf; and it ſeems to be countenanced by an ancient writer*, who, though not known by the name of a philoſopher, knew as much of the matter as any founder of the moſt celebrated ſchool.

20 Other theories more ancient and rational.

* *Pſal.* civ.

To object to either of theſe hypotheſes, as has been ſometimes done, that it repreſents the government of the world as a perpetual miracle, betrays the groſſeſt ignorance; for we might as well call the movements of the bodies of men and brutes, which are certainly produced by minds, miraculous. We do not affirm that either hypotheſis is certainly true; but they are both as probable and as ſatisfactory as the hypotheſis which attributes agency to attraction and repulſion to a ſubtle æther, or to a ſubſtance which is neither mind nor matter. Were the immediate agency of intellect to be admitted, there would be no room for many of thoſe diſputes which have been agitated among philoſophers, about the increaſe or diminution of motion in in the univerſe; becauſe an intelligent agent, which could begin motion as well as carry it on, might increaſe or diminiſh it as he ſhould judge proper. If inſtinctive agency, or ſomething ſimilar to it, be adopted, there is the ſame room for inveſtigation as upon the principles of mechaniſm; becauſe inſtinct works blindly, according to ſteady laws impoſed by a ſuperior mind, which may be diſcovered by obſervation of their effects. As we conſider this as by much the moſt probable hypotheſis of the two, we find ourſelves involved in the following queſtion: "If a certain quantity of motion was originally communicated to the matter of the univerſe, how comes it to paſs that the original quantity ſtill remains?" Conſidering the many oppoſite and contradictory motions which ſince the creation have taken place in the univerſe, and which have undoubtedly deſtroyed a great part of the original quantity, by what means has that quantity been reſtored?

21 The queſtion, Whether the original quantity of motion in the world remains unimpaired? anſwered by

If this queſtion can be ſolved by natural means, it muſt be upon the principles of Newton; for, "in every caſe * where quantities and relations of quantities are required, it is the province of mathematics to ſupply the information ſought; " and all philoſophers agree that Sir Iſaac's doctrine of the compoſition and reſolution of motion, though in what reſpects the heavenly bodies it may have no phyſical reality, is ſo mathematically juſt, as to be the only principle from which the quantity of motion, or the force of powers, can in any caſe be computed. If we chooſe to anſwer the queſtion, by ſaying that the motion left is reſtored by the interpoſition of the Deity, then we might as well have had recourſe to him at firſt, and ſay that he alone is the true principle of motion throughout the creation.

* *Young's Eſſay on the Powers and Mechaniſm, &c.*

22 The Carteſians, and

Before we are reduced to this dilemma, however, it is neceſſary, in the firſt place, to inquire whether there is or can be any real diminution of the quantity of motion throughout the univerſe? In this queſtion the Carteſians take the negative ſide; and maintain, that the Creator at the beginning impreſſed a certain quantity of motion on bodies, and that under ſuch laws as that no part of it ſhould be loſt, but the ſame portion of motion ſhould be conſtantly preſerved in matter: and hence they conclude, that if any moving body ſtrike on any other body, the former loſes no more of its motion than it communicates to the latter.

23 by Newton.

Sir Iſaac Newton takes the contrary ſide, and argues in the following manner: "From the various compoſitions of two motions, it is manifeſt there is not always the ſame quantity of motion in the world; for if two balls, joined together by a ſlender wire, revolve with an uniform motion about their common centre of gravity, and at the ſame time that centre be carried uniformly in a right line drawn in the plane of their circular motion, the ſum of the motions of the two balls, as often as they are in a right line, drawn from their common centre of gravity, will be greater than the ſum of their motions when they are in a line perpendicular to that other. Whence it appears, that motion may be both generated and loſt. But, by reaſon of the tenacity of fluid bodies, and the friction of their parts, with the weakneſs of the elaſtic power in ſolid bodies, nature ſeems to incline much rather to the deſtruction than the production of motion; and in reality, motion becomes continually leſs and leſs.—For bodies which are either ſo perfectly hard or ſo ſoft as to have no elaſtic power, will not rebound from each other; their impenetrability will only ſtop their motion. And if two ſuch bodies equal to one another be carried with equal but oppoſite motions, ſo as to meet in a void ſpace, by the laws of motion they muſt ſtop in the very place of concourſe, loſe all their motion, and be at reſt for ever, unleſs they have an elaſtic power to give them a new motion. If they have elaſticity enough to make them rebound with one-fourth, one-half, or three-fourths, of the force they meet with, they will loſe three-fourths, one-half, or one-fourth, of their motion. And this is confirmed by experiments: for if two equal pendulums be let fall from equal heights, ſo as to ſtrike full upon each other; if thoſe pendulums be of lead or ſoft clay, they will loſe all, or almoſt all, their motion; and if they be of any elaſtic matter, they will only retain ſo much motion as they receive from their elaſtic power."

Motion, therefore, being thus, in the opinion of our celebrated author, *loſt*, or *abſolutely deſtroyed*, it is neceſſary to find ſome cauſe by which it may be renewed. Such renovation Sir Iſaac attributes to *active* principles; for inſtance, "the cauſe of gravity, whereby the planets and comets preſerve their motions in their orbits, and all bodies acquire a great degree of motion in falling; and the cauſe of fermentation, whereby the heart and blood of animals preſerve a perpetual warmth and motion, the inner parts of the earth are kept perpetually warmed; many bodies burn and ſhine, and the ſun himſelf burns and ſhines, and with his light warms and cheers all things."

Elaſticity is another cauſe of the renovation of motion mentioned by Sir Iſaac. "We find but little motion in the world (ſays he), except what plainly flows either from theſe active principles, or from the command of the willer."

24 No power of motion ever loſt or deſtroyed,

With regard to the *deſtruction* or poſitive *loſs* of motion, however, we muſt obſerve, that notwithſtanding the authority of Sir Iſaac Newton, it is altogether impoſſible that any ſuch thing can happen. All moving bodies which come under the cognizance of our ſenſes are merely paſſive, and acted upon by ſomething which we call *powers* or *fluids*, and which are to us totally inviſible. Motion, therefore, cannot be loſt without a deſtruction or diminution of one of theſe *powers*, which we have no reaſon to think can ever happen. When two pendulums ruſh againſt each other, the motion is the mere effect of the action of gravity; and that action, which in this caſe is the *power*, continues to be the very ſame whether the pendulum moves or moves not. Could motion, therefore, be exhauſted in this caſe, we muſt ſuppoſe, that by ſeparating two pendulums to the ſame diſtance from each other, and then letting them come together for a great number of times, they would at laſt meet with leſs force than before. But there is certainly not the leaſt foundation for this ſuppoſition; and no rational perſon will take it into his head, that ſuppoſing the whole human race had employed themſelves in nothing elſe from the creation to the preſent day, but ſeparating pendulums and letting them ſtop each other's motion, they would now come together with leſs force than they did at firſt. *Power*, therefore, which is the cauſe of

Motion. of motion, is abſolutely indeſtructible. Powers may indeed counteract one another, or they may be made to counteract themſelves; but the moment that the obſtacle is removed, they ſhow themſelves in their priſtine vigour, without the leaſt ſymptom of abatement or decay.

Whether, therefore, we reckon the ultimate ſource of motion to be ſpiritual or material, it is plain that it muſt be to our conceptions *infinite;* neither will the phenomena of nature allow us to give any other explanation than we have done: for no power whatever can loſe more than its own quantity; and it ſeems abſurd to think that the Deity would create the world in ſuch a manner that it would ultimately become immoveable, and then have recourſe to unknown principles to remedy the ſuppoſed defect. On the principle we have now juſt laid down, however, the matter becomes exceedingly plain and obvious. The Creator at firſt formed two oppoſite powers, the action of which is varied according to the circumſtances of the bodies upon which they act; and theſe circumſtances are again varied by the action of the powers themſelves in innumerable ways upon one another, and the approach of one body to another, or their receding to a greater diſtance. Where theſe powers happen to oppoſe each other directly, the body on which they act is at reſt; when they act obliquely, it moves in the diagonal; or if the force acting upon one ſide is by any means leſſened, the body certainly muſt move towards that ſide, as is evident from the caſe of the atmoſphere, the preſſure of which, when removed from one ſide of a body, will make it move very violently towards that ſide; and if we could continually keep off the preſſure in this manner, the motion would aſſuredly be *perpetual.* We muſt not imagine that motion is *deſtroyed* becauſe it is *counteracted;* for it is impoſſible to deſtroy motion by any means but removing the cauſe; counteracting the effect is only a temporary obſtacle, and muſt ceaſe whenever the obſtacle is removed. Nature, therefore, having in itſelf an *infinite* quantity of motion, produces greater or leſſer motions, according to the various action of the moving powers upon different bodies or upon one another, without a poſſibility of the general ſtock being either augmented or diminiſhed, unleſs one of the moving powers was to be withdrawn by the Creator; in which caſe, the other would deſtroy the whole ſyſtem in an

25 The nature of the moving powers unknown.

inſtant. As to the nature of theſe great original powers, we muſt confeſs ourſelves totally ignorant; nor do we perceive any data from which the nature of them can be inveſtigated. The elements of light, air, &c. are the agents; but in what manner they act, or in what manner they received their action, can be known only to the Creator.

Perpetual Motion, in *Mechanics*, a motion which is ſupplied and renewed from itſelf, without the intervention of any external cauſe; or it is an uninterrupted communication of the ſame degree of motion from one part of matter to another, in a circle or other curve returning into itſelf, ſo that the ſame momentum ſtill returns undiminiſhed upon the firſt mover.

The celebrated problem of a perpetual motion conſiſts in the inventing a machine, which has the principle of its motion within itſelf. M. de la Hire has demonſtrated the impoſſibility of any ſuch machine, and finds that it amounts to this, viz. to find a body which is both heavier and lighter at the ſame time, or to find a body which is heavier than itſelf.

Animal Motion, that which is performed by animals at the command of the mind or will.

Though all the motions of animals, whether voluntary or involuntary, are performed by means of the muſcles and nerves, yet neither theſe nor the ſubtile fluid which reſides in them are to be accounted the ultimate ſources of animal motion. They depend entirely upon the mind for thoſe motions which are properly to be accounted *animal.* All the involuntary motions, ſuch as thoſe of the blood, the heart, muſcles, organs ſubſervient to reſpiration and digeſtion, &c. are to be claſſed with thoſe of vegetables; for though no vegetables have them in ſuch perfection as animals, there are yet traces of them to be found evidently among vegetables, and that ſo remarkably, that ſome have imagined the animal and vegetable kingdoms to approach each other ſo nearly that they could ſcarce be diſtinguiſhed by a philoſophic eye. See Muscle.

Though the motions of animals, however, depend on the action of the mind or of the will, external objects ſeem originally to have the command of the mind itſelf; for unleſs an animal perceive ſomething, it will not be inclined to act. By means of the ideas once received, indeed, and retained in the memory, it acquires a ſelf-moving power, independent of any object preſent at the time, which is not the caſe with vegetables; for however they may act from a preſent impulſe, their motions never appear to be derived from any ſource which may not be accounted ſtrictly mechanical.

According to ſome, motion is the cauſe of ſenſation itſelf; and indeed it ſeems very probable that the motions of that ſubtle fluid, called *light* or *electricity*, in our bodies always accompany our ſenſations; but whether theſe be the *cauſe*, or only the *medium*, of ſenſe, cannot be diſcovered.

Though all animals are endowed with a power of voluntary motion, yet there is a very great variety in the degrees of that power; to determine which no certain rules can be aſſigned; neither can we, from the ſituation and manner of life of animals, derive any probable reaſon why the motion of one ſhould differ ſo very much from that of another. This difference does not ariſe from their ſize, their ferocity, their timidity, nor any other property that we can imagine. The elephant, though the ſtrongeſt land animal, is by no means the ſloweſt in its motions; the horſe is much ſwifter than the bull, though there is not much difference in their ſize; a greyhound is much ſwifter than a cat, though the former be much larger, and though both live in the ſame manner, viz. by hunting. Among inſects the ſame unaccountable diverſity is obſervable. The louſe and flea are both vermine, are both nearly of the ſame ſize, and both feed on the bodies of animals; yet there is no compariſon between the ſwiftneſs of their motions: while the bug, which is much larger than either, ſeems to have a kind of medium ſwiftneſs between both.—This very remarkable circumſtance ſeems not even to depend on the range which animals are obliged to take in order to procure food for themſelves: the motion of a ſnail is ſlower than that of an earth worm; while that

Motion.

that of many caterpillars is much quicker than either; though we can ſcarce determine which of the three has the greateſt or the leaſt extenſive range for its food.

Of all animals the ſhell fiſh move the ſloweſt, inſomuch that ſome have ſuppoſed them to be entirely deſtitute of loco-motive powers; and muſcles particularly are denied to have any faculty of this kind. Every one knows that theſe animals can open and ſhut their ſhells at pleaſure; and it cannot eſcape obſervation, that in every muſcle there is a fleſhy protuberance of a much redder colour than the reſt. This has been thought to be a tongue or proboſcis, by which the animal takes in its food; but is in reality the inſtrument of its motion from place to place. This protuberance is divided into two lobes, which perform the office of feet. When the river muſcle is inclined to remove from its ſtation, it opens its ſhell, thruſts out this protuberance, and digs a furrow in the ſand; and into this furrow, by the action of the ſame protuberance, the ſhell is made to fall in a vertical poſition. It is recovered out of this into the former horizontal one, by puſhing back the ſand with the ſame tentacula, lengthening the furrow, and thus the animal continues its journey by a continual turning topſy-turvy.—Marine muſcles perform their motions in the ſame manner, and by ſimilar inſtruments. In general they are firmly attached to rocks or ſmall ſtones by threads about two inches long, which are ſpun from a glutinous ſubſtance in the protuberances already mentioned.

Other animals which inhabit bivalved ſhells, perform their motions by a kind of leg or foot; which, however, they can alter into almoſt any figure they pleaſe. By means of this leg they can not only ſink into the mud, or riſe out of it at pleaſure, but can even leap from the place where they are; and this can be done by the limpit, which people are apt to imagine one of the moſt ſluggiſh animals in nature.—When this creature is about to make a ſpring, it ſets its ſhell on edge, as if to diminiſh friction; then, ſtretching out the leg as far as poſſible, it makes it embrace a portion of the ſhell, and by a ſudden movement, ſimilar to that of a ſpring let looſe, it ſtrikes the earth with its leg, and actually leaps to a conſiderable diſtance.

The ſpout, or razor-fiſh, is ſaid to be incapable of moving forward horizontally on the ſurface; but it digs a hole ſometimes two feet deep in the ſand, in which it can aſcend or deſcend at pleaſure. The leg, by which it performs all its movements, is fleſhy, cylindrical, and pretty long; and the animal can at pleaſure make it aſſume the form of a ball. When lying on the ſurface of the ſand, and about to ſink into it, the leg is extended from the inferior end of the ſhell, and makes the extremity of it take on the form of a ſhovel, ſharp on each ſide, and terminating in a point. With this inſtrument the animal makes a hole in the ſand; after which it advances the leg ſtill farther into it, makes it aſſume the form of a hook, and with this, as a fulcrum, it obliges the ſhell to deſcend into the hole. This operation is continued until the whole ſhell be covered; and when the animal wiſhes to regain the ſurface, it makes the extremity of the leg to aſſume the form of a ball, and makes an effort to extend it. The ball, however, prevents any farther deſcent, and the reaction of the muſcular effort raiſes up the whole ſhell, which operation is continued until it reaches the ſurface; and it is ſurpriſing with what facility theſe motions are accompliſhed by an animal ſeemingly ſo little qualified to move at all. Another particularity in this fiſh is, that though it lives among ſalt water, it abhors ſalt ſo much, that when a little is thrown into its hole it inſtantly leaves it. But it is ſtill more remarkable, that if you once take hold of the ſpout-fiſh, and then allow it to retire into its hole, it cannot then be driven out by ſalt; though unleſs it be taken hold of by the hand, the application of ſalt will make it come to the ſurface as often as you pleaſe.

All other ſhell fiſh, even thoſe apparently the moſt ſluggiſh and deſtitute of any apparatus for motion, are found to be furniſhed with ſuch inſtruments as enable them to perform all thoſe movements for which they have any occaſion. Thus the ſcallop, a well-known animal inhabiting a bivalved ſhell, can both ſwim upon the ſurface of water and move upon land. When it happens to be deſerted by the tide, it opens its ſhell to the full extent, and ſhutting it again with a ſudden jerk, the reaction of the ground gives ſuch an impulſe to the whole, that it ſometimes ſprings five or ſix inches from the ground; and by a continued repetition of this action, it gradually tumbles forward until it regains the water. Its method of ſailing is ſtill more curious. Having attained the ſurface of the water by means unknown to us, it opens the ſhell, and puts one half above water, the other with the body of the animal in it remaining below. Great numbers of them are thus frequently ſeen ſailing in company with their ſhells ſticking up above water when the weather is fine, and the wind acting upon them as ſails; but on the leaſt alarm they inſtantly ſhut their ſhells, and all ſink to the bottom together.

The oyſter has generally been ſuppoſed one of the moſt ſluggiſh animals in nature, and totally incapable of voluntary motion; but from the reſearches of the Abbé Dicquemarre, this opinion ſeems to be erroneous. The oyſter, like many other bivalved ſhell-fiſh, has a power of ſquirting water out from its body; and this property may eaſily be obſerved by putting ſome of them into a plate with as much ſea water as will cover them. The water is ejected with ſo much force, as not only to repel the approach of ordinary enemies, but to move the whole animal backwards or ſidewiſe, in a direction contrary to that in which the water was ejected. It has been alſo ſuppoſed, that oyſters are deſtitute of ſenſation; but M. Dicquemarre has ſhown, that they not only poſſeſs ſenſation, but that they are capable of deriving knowledge from experience. When removed from ſuch places as are entirely covered with the ſea, when deſtitute of experience, they open their ſhells and die in a few days; but if they happen to eſcape this danger, and the water covers them again, they will not open their ſhells again, but keep them ſhut, as if warned by experience to avoid a danger ſimilar to what they formerly underwent.

The motions of the ſea-urchin are perhaps more curious and complicated than thoſe of any other animal. It inhabits a beautiful multivalved ſhell, divided into triangular compartments, and covered with great numbers of prickles; from which laſt circumſtance it receives the name of *ſea urchin* or *ſea hedgehog*. The

triangles

triangles are separated from one another by regular belts, and perforated by a great number of holes, from every one of which issues a fleshy horn similar to that of a snail, and capable of moving in a similar manner. The principal use of these horns seems to be to fix the animal to rocks or stones, though it likewise makes use of them in its progressive motion. By means of these horns and prickles, it is enabled to walk either on its back or its belly; but it most commonly makes use of those which are near the mouth. Occasionally it has a progressive motion by turning round like a wheel.

The animals called *sea-nettles* or *medusæ*, though extremely slow in their motions, are nevertheless evidently capable of moving at pleasure from place to place. The variety of their figure is such, that it is difficult to assign them any determinate figure whatever. In general, however, they resemble a truncated cone, the base of which is applied to the rock to which they adhere. Their colours are various, whitish, brown, red or greenish: the mouth is very large; and when opened appears surrounded with filaments resembling the horns of snails, which being disposed in three rows around it, give the animal the appearance of a flower; and through every one of these the animal has the power of squirting the sea water. The structure of these animals is extremely singular; they consisting all of one organ, viz. a stomach. When searching for food, they extend their filaments, and quickly entangle any small animals that come within their reach. The prey is instantly swallowed, and the mouth shut close upon it like a purse; in which state it remains for many days before the nutritive parts are extracted. The animal, though scarcely an inch or an inch and a half in diameter, is nevertheless so dilatable, that it can swallow large whelks and muscles, the shells of which are thrown out by the mouth after the nutritive parts have been exhausted. Sometimes the shell is too large to be voided this way; in which case the body of the animal splits, and the shell is voided through the opening, which in a short time heals up again. The progressive motion of this creature is so slow, that it resembles that of the hour hand of a clock, and is performed by means of innumerable muscles placed on the outside of the body. All these are tubular, and filled with a fluid, which makes them project like prickles. On occasion it can likewise loosen the base of the cone from the rock, and inverting its body, move by means of the filaments already mentioned, which surround the mouth; but even the motion performed in this manner is almost as slow as the other.

Some animals are capable of moving backwards, apparently with the same facility that they do forwards, and that by means of the same instruments which move them forward. The common house fly exhibits an instance of this, and frequently employs this retrograde motion in its ordinary courses; though we cannot know the reason of its employing such an extraordinary method. Another remarkable instance is given by Mr Smellie in the *mason-bee*. This is one of the solitary species, and has its name from the mode of constructing its nest with mud or mortar. Externally this nest has no regular appearance, but at first sight is taken for a quantity of dirt adhering to the wall; though the internal part be furnished with cells in the same regular manner with the nests of other insects of the bee kind. When this bee leaves its nest, another frequently takes possession of it; in which case a battle never fails to ensue on the return of the real proprietor. The dispute is decided in the air; and each party endeavours to get above the other, as birds of prey are wont to do in order to give a downward blow. The undermost one, to avoid the stroke, instead of flying forward or laterally, always flies backward. The encounter is so violent, that when they strike, both parties fall to the ground.

Vegetable MOTION. Though vegetables have not the power of moving from one place to another like animals, they are nevertheless capable of moving their different parts in such a manner as would lead us to suspect that they are actuated by a sort of instinct. Hence many have been induced to suppose, that the animal and vegetable kingdoms are in a manner indistinguishable from one another; and that the highest degree of vegetable life can hardly be known from the lowest degree of animal life. The essential and insuperable distinction, however, between the two, is the faculty of sensation, and loco-motion in consequence of it. Were it not, indeed, for the manifestation of sense by moving from one place to another, we should not be able to tell whether vegetables were possessed of sensation or not; but whatever motions they may be possessed of, it is certain that no vegetable has the faculty of moving from one place to another. Some have endeavoured to distinguish the two kingdoms by the digestion of food; alleging that plants have no proper organs, such as a stomach, &c. for taking in and digesting their aliment. But to this it has been replied, that the whole body of a vegetable is a stomach, and absorbs its food at every pore. This, however, seems not to be a sufficient answer. All animals take in their food at intervals, and there is not a single instance of one which eats perpetually. The food is also taken into the body of the animal, and application of the parts made by means of the *internal* organization of the viscus; but in vegetables, their whole bodies are immersed in their food, and absorb it by the surface, as animal bodies will sometimes absorb liquids when put into them. The roots of a tree indeed will change their direction when they meet with a stone, and will turn from barren into fertile ground; but this is evidently mere mechanism, without any proof of will or sensation; for the nourishment of the root comes not from the stone, but from the earth around it; and the increase in size is not owing to any expansion of the matter which the root already contains, but to the apposition of new matter; whence the increase of size must always take place in the direction from whence the nourishment proceeds. On this principle also may we explain the reason why the roots of a tree, after having arrived at the edge of a ditch, instead of shooting out into the air, will creep down the one side, along the bottom, and up the other.

In their other movements the vegetables discover nothing like sensation or design. They will indeed uniformly bend towards light, or towards water; but in the one case we must attribute the phenomenon to the action of the elements of light and air upon them; and in the latter, the property seems to be the same with what in other cases we call attraction. Thus, if a root be uncovered, and a wet ſponge placed near it in a direction different from that in which the root was proceeding, it will ſoon alter its poſition, and turn towards the ſponge; and thus we may vary the direction of the root as often as we pleaſe. The efforts of a plant to turn from darkneſs or ſhade into ſunſhine are very remarkable; as in order to accompliſh this, not only the leaves will be inclined, but even the ſtems and branches twiſted. When a wet ſponge is held under the leaves of a tree, they bend down in order to touch it. If a veſſel of water be put within ſix inches of a growing cucumber, in leſs than 24 hours the latter will alter its direction; the branches will bend towards the water, and never alter their courſe until they come in contact with it. The moſt remarkable inſtance of this kind of motion, however, is, that when a pole is brought near a vine, the latter will turn towards it, and never ceaſe extending its branches till it lays hold of the ſupport.

The motions of the ſenſitive plant, and others of the ſame kind, have been conſidered as very wonderful; but it is doubtful if any of them be really more ſo than that of the vine juſt mentioned. None of theſe ſhow any kind of propenſity to move without an actual touch. A very ſlight one, indeed, makes the ſenſitive plant contract, and the whole branch, together with the leaves, bend down towards the earth.—Theſe phenomena are by ſome aſcribed to electricity. Even the motions of the *hedyſarum gyrans*, which at firſt ſight ſeem ſo much more ſurpriſing than thoſe of the ſenſitive plant, may it is ſuppoſed admit of explanation upon the ſame principle. The American plant called *dionæa muſcipula*, or *Venus's fly-trap*, is another example of very wonderful mechaniſm in vegetables, though even this does not argue any degree of ſenſation in this plant more than in others. The leaves of the dionæa are jointed, and furniſhed with two rows of prickles. A number of ſmall glands upon the ſurface ſecrete a ſweet juice which entices flies to come and ſettle upon it; but the moment theſe inſects touch the fatal ſpot, the leaves fold up, and ſqueeze them to death between the prickles. The leaves fold up in the ſame manner when the plant is touched with a ſtraw or pin. The *droſera rotundifolia* and *longifolia*, round and long-leafed ſundew, plants of our own country, not uncommon in boggy ground, poſſeſs a ſimilar ſtructure, and perform ſimilar functions.

The folding up of the leaves of certain plants in the abſence of the ſun's light, called their *ſleep*, affords another very curious inſtance of vegetable motion.—Almoſt all vegetables, indeed, undergo ſuch a remarkable change in the night, that it is difficult to know exactly how many kinds do really ſleep. They fold up their leaves in many different ways; but all agree in diſpoſing of them in ſuch a manner as to afford the beſt protection to the young ſtems, flower buds or fruit. The leaves of the tamarind tree contract round the young fruit in order to protect it from nocturnal cold; and thoſe of ſenna, glycina, and many other papilionaceous plants, diſpoſe of their leaves in the ſame manner. The leaves of the chickweed, aſclepias atriplex, &c. are diſpoſed in oppoſite pairs. In the night time they riſe perpendicularly, and join ſo cloſe at the top that the flowers are concealed by them. In like manner do the leaves protect the flowers of the ſida or althæa theophraſti, œnothera, ſolanum, and the Egyptian vetch. All theſe are erected during the night; but thoſe of the white lupine, in time of ſleep, hang down.

The flowers of plants alſo have motions peculiar to themſelves. Many of them during the night are encloſed in their calyxes. Some, particularly thoſe of the German ſpurge, geranium ſtriatum, and common whitlow graſs, when aſleep, bend towards the earth; by which means the noxious effects of rain or dew are prevented. All theſe motions have been commonly aſcribed to the ſun's rays; and Mr Smellie informs us that in ſome of the examples above mentioned the effects were evidently to be aſcribed to heat: but plants kept in a hot-houſe, where the temperature of the day and night are alike, contract their leaves, and ſleep in the ſame manner as if they were expoſed to the open air; "whence it appears (ſays he), that the ſleep of plants, is owing rather to a peculiar law, than to a quicker or ſlower motion of the juices." He ſuſpects, therefore, that as the ſleep of plants is not owing to the mere abſence of heat, it may be occaſioned by the want of light; and to aſcertain this he propoſes an experiment of throwing upon them a ſtrong artificial light. If notwithſtanding this light (ſays he), the plants are not rouſed, but continue to ſleep as uſual, then it may be preſumed that their organs, like thoſe of animals, are not only irritable, but require the reparation of ſome invigorating influence which they have loſt while awake, by the agitations of the air and of the ſun's rays, by the act of growing, or by ſome other latent cauſe." On this, however, we muſt remark, that the throwing of artificial light upon plants cannot be attended with the ſame conſequences as that of the light of the ſun, unleſs the former were as ſtrong as the latter, which is impoſſible; and even granting that we could procure an artificial light as ſtrong as that of the ſun, a difference might be occaſioned by the different directions of the rays, thoſe of the ſun being very nearly parallel, while the rays of all artificial light diverge very greatly. If therefore, we are to make an experiment of this kind, the rays ſhould be rendered parallel by means of a burning mirror. Here again we would be involved in a difficulty? for the rays of the ſun proceed all in one direction; but as of neceſſity we muſt employ different mirrors in our experiment, the light muſt fall upon the plant in different directions, ſo that we could not reaſonably expect the ſame reſult as when the plants are directly expoſed to the rays of the ſun.

The motion of plants, not being deducible from ſenſation, as in animals, muſt be aſcribed to that property called *irritability*; and this property is poſſeſſed *inſenſibly* by the parts of animals in a greater degree than even by the moſt irritable vegetable. The muſcular fibres will contract on the application of any ſtimulating ſubſtance, even after they are detached from the body to which they belonged. The heart of a frog will continue to beat when pricked with a pin for ſeveral hours after it is taken out of the body. The heart of a viper, or of a turtle, beats diſtinctly from 20 to 30 hours after the death of theſe animals. When the inteſtines of a dog, or any other quadruped, are ſuddenly cut into different portions, all of them crawl about like worms, and contract upon the ſlighteſt touch. The heart, inteſtines, and diaphragm, are the moſt irritable

Motion. irritable parts of animal bodies; and to diſcover whether this quality reſides in all plants, experiments ſhould be made chiefly on leaves, flowers, buds, and the tender fibres of the roots.

The motions of plants are univerſally aſcribed by our author to *irritability*, to which alſo we have aſcribed them under the article ANIMAL. The term, however, requires an explanation; and to give this in an intelligible manner requires ſome attention. The moſt obvious compariſon is that of an electrified thread; which on the approach of any unelectrified ſubſtance, ſhows a variety of motions, equally ſurpriſing with thoſe of the parts of plants or the muſcular fibres cut out of the body. Could we ſuppoſe that the electricity of a thread might be preſerved after it was cut off from the electrifying ſubſtance, it would ſhow as much irritability as even the muſcular fibres, or portions of the inteſtines of animals. We know, from the hiſtory of the torpedo, electrical eel, &c. that there are animals in which the electric fluid acts in ſuch a manner as to produce a much more powerful effect than that of giving motion to the leaves of plants. The readineſs, therefore, with which this fluid is thrown into agitations when any ſubſtance in which it acts is touched, is without doubt the irritability in queſtion; but we have from thence no more reaſon to aſcribe ſenſation to theſe irritable bodies, than to an electrified bottle when it diſcharges itſelf, or makes a cork ball play around it.

In a paper read before the Academy of Sciences at Paris, by M. Brouſſonet, the author inclines to confound irritability and ſenſibility together. "The different parts of plants (ſays he) enjoy the faculty of motion; but the motions of a vegetable are very different in their nature from thoſe of an animal: the moſt ſenſible, thoſe that are produced with moſt rapidity in plants, are always influenced by ſome ſtimulating cauſe. Irritability, which is nothing but *ſenſibility* made manifeſt by motion, is a general law to which nature has ſubjected all living beings; and it is this that continually watches over their preſervation. Being more powerful in animals than in plants, it may be often confounded in theſe laſt with phenomena that depend on a quite different cauſe. In the vegetable it is only the organ which is expoſed to the action of the ſtimulating power that moves. Irritation in particular places never produces that prompt combination of ſenſations which we obſerve in animals; in conſequence of which certain parts are put in motion without being directly affected, and which otherwiſe might have been paſſive.

"The more perfect the organization in the different parts of animals is, the more apparent are the ſigns of irritability. The parts that come neareſt to thoſe of vegetables, and in which of conſequence the organization is moſt imperfect, are the leaſt irritable. The ſame law holds with regard to plants; but the reſult is oppoſite: the ſigns of irritability are moſt ſenſible in proportion to the analogy of the parts with thoſe of animals; and they are imperceptible in thoſe that are diſſimilar. This aſſertion is proved by what we obſerve in the organs deſtined in vegetables to perpetuate the ſpecies. Thoſe parts alone ſeem ſenſible to ſtimuli; the bark, leaves, ſtalks, and roots ſhowing no ſigns of irritability.

"The motions eſſentially vital, which have in plants the greateſt affinity with thoſe of animals, are the courſe of the ſap, the paſſage of the air in the trachea, the different poſitions which the flowers of certain plants take at certain hours of the day, &c. But if we attend to the manner in which all theſe motions in plants are performed, we ſhall find that they preſent a greater number of modifications than the analogous motions that take place in animals. The temperature of the atmoſphere, its agitation, light, &c. have great influence on the motions of plants, by accelerating or retarding the courſe of their fluids; and, as they cannot change their place, theſe variations produce in them changes more obvious and more uniform than in animals."

Our author now proceeds to inform us, that ſome of the motions of plants are occaſioned by the rarity of the juices in plants, and others by their abundance. Of the former kind are thoſe by which the capſules of ſome plants ſuddenly burſt with a ſpring, and throw their ſeeds to ſome diſtance. Of the other kind are the action of the ſtamina in the *parietaria*, the inflection of the peduncles of flowers, and of the piſtilla. "Thoſe motions (ſays he) which are particularly obſerved in the organs deſtined to the reproduction of the individual, not appearing except in circumſtances that render them abſolutely neceſſary, ſeem in ſome meaſure to be the effect of a particular combination: they are, however, merely mechanical; for they are always produced in the ſame way and in the ſame circumſtances. Thus the roſe of Jericho, and the dry fruit of ſeveral ſpecies of *meſembryanthemum*, do not open but when their veſſels are full of water.

"The ſudden diſengagement of fluids produces a kind of motion. To this cauſe we muſt attribute a great number of phenomena obſervable in the leaves of ſeveral plants, and which do not depend on irritability. The ſmall glands in each leaf of the *dionæa* are no ſooner punctured by an inſect, than it inſtantly folds up and ſeizes the animal: the puncture ſeems to operate a diſengagement of the fluid which kept the leaf expanded by filling its veſſels. This explanation is the more probable, that in the early ſtate of the vegetation of this plant, when the ſmall glands are hardly evolved, and when probably the juices do not run in ſufficient abundance, the leaves are folded up exactly as they appear when punctured by an inſect at a more advanced period. We obſerve a phenomenon ſimilar to this in both ſpecies of the *droſera* (ſun-dew), mentioned above. The mechaniſm here is very eaſily obſervable: the leaves are at firſt folded up; the juices are not yet propelled into the fine hairs with which they are covered; but after they are expanded, the preſence of the fluid is manifeſt by a drop ſeen at the extremity of each hair: it is by abſorbing this fluid that an inſect empties the veſſels of the leaf, which then folds up, and reſumes its firſt ſtate: the promptitude of the action is proportioned to the number of hairs touched by the inſect. This motion in ſome degree reſembles that which takes place in the limb of an animal kept in a ſtate of flexion by a tumor in the joint; when the matter which obſtructed the motion is diſcharged, the limb inſtantly reſumes its former poſition. The phenomena that depend on the abundance of fluids are particularly evident in plants which grow in wet ſoils; the *droſera* and *dionæa* are of this kind: and it is known by by the experiments of Meff. Du Fay and Du Hamel, that fenfitive plants are particularly fenfible when the fun is obfcured by clouds and the air warm and moift. The influence of external caufes fometimes fo modifies the vital motions in plants, that we would be tempted to afcribe them to volition, like thofe that depend entirely on that faculty in animals. If we fet a pole in the ground near a twining plant, it always lays hold of the pole for fupport, in whatever place we put it. The fame thing occurs in the tendrils of the vine; which always attach themfelves to the fupport prefented them, on whatever fide it may be placed, provided they can reach it: but thefe motions are entirely vital: the twining plants and the tendrils direct themfelves to every quarter, and confequently cannot fail of meeting with the bodies within their reach. Thefe motions are performed as long as the parts continue to grow; but when they ceafe to elongate, if they have not been able to reach any body on which they can fix, they bend back upon themfelves. This and other obfervations fhow how far the vital motions in plants may be modified by external caufes, and how effentially they differ from thofe that are the effect of volition in animals.

"Some plants appear endowed with no fort of motion: fome have leaves that can move in different directions: their motions are generally modified by different caufes; but none appear fo eminently poffeffed of this quality as the *hedyfarum gyrans* of Linnæus.—No part of this plant fhows any figns of irritability upon application of ftimuli: and the motion of its foliola ceafes when the leafets are agitated by the wind.—When the fun is warm, the little leaves of the hedyfarum are alfo immoveable; but when the weather is warm and moift, or when it rains, they move very freely. This motion feems indifpenfably neceffary to the plant; for it begins as foon as the firft leaves unfold, and continues even during the night; but in time it grows weaker. In our ftoves it is moft confiderable during the firft year; in the fecond, it is not very fenfible: in its native place all the leaves have a motion never obferved here. The moving leafets are moft agitated while the plants are in full flower, and the procefs of fructification goes on. The ofcillatory motion is fo natural to it, that it not only remains for three or four days in the leafets of a branch that has been cut off and put in water, but is even continued though the branch be expofed to the air. The leaves feem to perform the office of the heart in vegetables. When a plant is ftripped of its leaves, the progrefs of vegetation is arrefted; and fuch vegetables refemble thofe animals which have a periodical fleep, induced by a diminution of the action of the heart. Many plants hardly fhow any figns of motion; many feem alfo wholly cataleptic; which is rarely if ever found in animals. The footftalks of the flowers of dracocephalum, a Virginian plant, preferve themfelves in whatever pofition they are placed.

Mufcular MOTION. See MUSCLE.

MOTIVE, is fometimes applied to that faculty of the human mind, by which we purfue good and avoid evil. Thus Hobbes diftinguifhes the faculties of the mind into two forts, the cognitive and motive.

MOTOUALIS, a fmall nation of Syria, inhabiting to the eaft of the country of the DRUSES, in the valley which feparates their mountains from thofe of Damafcus; of which the following account is given by Volney in his Travels, vol. ii.

The characteriftic diftinction between them and the other inhabitants of Syria (fays our author) is, that they, like the Perfians, are of the fect of Ali, while all the Turks follow that of Omar or Moaouia. This diftinction, occafioned by the fchifm which in the 36th year of the Hegira arofe among the Arabs, refpecting the fucceffors of Mahomet, is the caufe of an irreconcilable hatred between the two parties. The fectaries of Omar, who confider themfelves as the only orthodox, affume the title of *Sonnites*, which has that fignification, and term their adverfaries *Shiites*, that is "fectaries of Ali." The word *Motouali* has the fame meaning in the dialect of Syria. The followers of Ali, diffatisfied with this name, fubftitute that of *Adlia*, which means "affertors of juftice," literally "Jufticiarians:" a denomination which they have affumed in confequence of a doctrinal point they advance in oppofition to the Sonnite faith. A fmall Arabic treatife, entitled Theological Fragments concerning the Sects and Religions of the World, has the following paffage:

"Thefe fectaries who pretend that God acts only on principles of juftice, conformable to human reafon, are called *Adlia* or *Jufticiarians*. God cannot (fay they) command an impracticable worfhip, nor ordain impoffible actions, nor enjoin men to perform what is beyond their ability; but wherever he requires obedience, will beftow the power to obey. He removes the caufe of evil, he allows us to reafon, and impofes only what is eafy, not what is difficult; he makes no man refponfible for the actions of another, nor punifhes him for that in which he has no part; he imputes not as a crime what himfelf was created in man; nor does he require him to avoid what deftiny has decreed.—This would be injuftice and tyranny, of which God is incapable, from the perfection of his being." To this doctrine, which diametrically oppofes the fyftem of the Sonnites, the Motoualis add certain ceremonies which increafe their mutual averfion. They curfe Omar and Moaouia as rebels and ufurpers; and celebrate Ali and Hofain as faints and martyrs. They begin their ablutions at the elbow, inftead of the end of the finger, as is cuftomary with the Turks; they think themfelves defiled by the touch of ftrangers; and, contrary to the general practice of the Eaft, neither eat nor drink out of a veffel which has been ufed by a perfon not of their fect, nor will they even fit with fuch at the fame table.

Thefe doctrines and cuftoms, by feparating the Motoualis from their neighbours, have rendered them a diftinct fociety. It is faid they have long exifted as a nation in this country, though their name has never been mentioned by any European writer before the 18th century; it is not even to be found in the maps of D'Anville: La Roque, who left their country not a hundred years ago, gives them the name of *Amediens*. Be this as it may, in later times their wars, robberies, fucceffes, and various changes of fortune, have rendered them of confequence in Syria. Till about the middle of this century, they only poffeffed Balbec their capital, and a few places in the valley, and Anti-Lebanon, which feems to have been their original

country.

country. At that period we find them under a like government with the Druzes, that is to ſay, under a number of Shaiks, with one principal chief of the family of Harfouſh. After the year 1750 they eſtabliſhed themſelves among the heights of Bekaa, and got footing in Lebanon, where they obtained lands belonging to the Maronites, almoſt as far as Beſharrai. They even incommoded them ſo much by their ravages, as to oblige the emir Youſef to attack them with open force and expel them; but on the other ſide, they advanced along the river even to the neighbourhood of Sour (Tyre). In this ſituation, Shaik Daher had the addreſs, in 1760, to attach them to his party.—The pachas of Saide and Damaſcus claimed tributes, which they had neglected paying, and complained of ſeveral robberies committed on their ſubjects by the Motoualis; they were deſirous of chaſtiſing them; but this vengeance was neither certain nor eaſy. Daher interpoſed; and by becoming ſecurity for the tribute, and promiſing to prevent any depredations, acquired allies who were able, as it is ſaid, to arm 10,000 horſemen, all reſolute and formidable troops. Shortly after they took poſſeſſion of Sour, and made this village their principal ſea port. In 1771 they were of great ſervice to Ali Bey and Daher againſt the Ottomans. But Emir Youſef having in their abſence armed the Druzes, ravaged their country. He was beſieging the caſtle of Djezin, when the Motoualis, returning from Damaſcus, received intelligence of this invaſion. At the relation of the barbarities committed by the Druzes, an advanced corps, of only 500 men, were ſo enraged, that they immediately ruſhed forward againſt the enemy, determined to periſh in taking vengeance. But the ſurpriſe and confuſion they occaſioned, and the diſcord which reigned between the two factions of Manſour and Youſef, ſo much favoured this deſperate attack, that the whole army, conſiſting of 25,000 men, was completely overthrown.

In the following year, the affairs of Daher taking a favourable turn, the zeal of the Motoualis cooled towards him, and they finally abandoned him in the cataſtrophe in which he loſt his life. But they have ſuffered for their imprudence under the adminiſtration of the pacha who ſucceeded him. Since the year 1777, Djezzar, maſter of Acre and Saide, has inceſſantly laboured to deſtroy them. His perſecution forced them in 1784 to a reconciliation with the Druzes, and to enter into an alliance with the emir Youſef. Though reduced to leſs than 700 armed men, they did more in that campaign than 15,000 or 20,000 Druzes and Maronites aſſembled at Dair-el-Kamar. They alone took the ſtrong fortreſs of Mar-Djebaa, and put to the ſword 50 or 60 Epirots who defended it. But the miſunderſtanding which prevailed among the chiefs of the Druzes having rendered abortive all their operations, the pacha has obtained poſſeſſion of the whole valley, and the city of Balbec itſelf. At this period not more that 500 families of the Motoualis remained, who took refuge in Anti-Lebanon, and the Lebanon of the Maronites; and, driven as they now are from their native ſoil, it is probable they will be totally annihilated, and even their very name become extinct.

MOTTO, in armoury, a ſhort ſentence or phraſe, carried in a ſcroll, generally under, but ſometimes over, the arms: ſometimes alluding to the bearing, ſometimes to the name of the bearer, and ſometimes containing whatever pleaſes the fancy of the deviſer.

MOVEABLE, in general, denotes any thing capable of being moved.

Moveable Feaſts, are ſuch as are not always held on the ſame day of the year or month; though they be on the ſame day of the week. See Feasts.

Thus, Eaſter is a moveable feaſt, being always held on the Sunday which falls upon or next after the firſt full moon following the 21ſt of March.

All the other moveable feaſts follow Eaſter, i. e. they keep their diſtance from it: ſo that they are fixed with reſpect thereto.

Such are Septuageſima, Sexageſima, Aſh Wedneſday, Aſcenſion day, Pentecoſt, Trinity Sunday, &c. which ſee under their proper articles, Septuagesima, &c.

Moveable Subject, in *Law*, any thing that moves itſelf, or can be moved; in contradiſtinction to immoveable or-heritable ſubjects, as lands, houſes, &c.

MOVEMENT, motion, a term frequently uſed in the ſame ſenſe with automaton.

The moſt uſual movements for keeping time are watches and clocks: the firſt are ſuch as ſhow the parts of time, and are portable in the pocket; the ſecond, ſuch as publiſh it by ſounds, and are fixed as furniture. See Horology.

Movement, in its popular uſe among us, ſignifies all the inner works of a watch, clock, or other engine, which move, and by that motion carry on the deſign of the inſtrument.

The movement of a clock or watch is the inſide, or that part which meaſures the time, ſtrikes, &c. excluſive of the frame, caſe, dial plate, &c.

The parts common to both of theſe movements are, the main-ſpring, with its appurtenances; lying in the ſpring box, and in the middle thereof lapping about the ſpring-arbor, to which one end of it is faſtened. A-top of the ſpring-arbor is the endleſs ſcrew and its wheel; but in ſpring clocks, this is a ratchet-wheel with its click, that ſtops it. That which the main-ſpring draws, and round which the chain or ſtring is wrapped, is called the *fuſy;* this is ordinarily taper; in large works, going with weights, it is cylindrical, and called the *barrel.* The ſmall teeth at the bottom of the fuſy or barrel, which ſtop it in winding up, is called the *ratchet;* and that which ſtops it when wound up, and is for that end driven up by the ſpring, the *garde-gut.* The wheels are various: the parts of a wheel are, the hoop or rim, the teeth, the croſs, and the collet or piece of braſs ſoldered on the arbor or ſpindle whereon the wheel is rivetted. The little wheels playing in the teeth of the larger are called *pinions;* and their teeth, which are 4, 5, 6, 8, &c. are called *leves;* the ends of the ſpindle are called *pivots;* and the guttered wheel, with iron ſpikes at bottom, wherein the line of ordinary clocks runs, the *pulley.* We need not ſay any thing of the hand, ſcrews, wedges, ſtops, &c. See Wheel, Fusy, &c.

Perpetual Movement. See *Perpetual Motion.*

MOUFET, Thomas, a celebrated Engliſh phyſician, was born at London, and practiſed medicine with great reputation. Towards the latter end of his life

life he retired to the country, and died about the year 1600. This phyfician is known by a work which was begun by Edward Wotton, and printed at London in 1634, folio, with the title of *Theatrum Infectorum.* A tranflation of it into Englifh was publifhed at London in 1658, folio. Martin Lifter gives a very unfavourable opinion of this book: "As Moufet (fays he) made ufe of Wotton, Gefner, &c. an excellent work might have been expected from him; and yet his *Theatrum* is full of confufion, and he has made a very bad ufe of the materials with which thefe authors have furnifhed him. He is ignorant of the fubject of which he treats, and his manner of expreffion is altogether barbarous. Befides this, he is extremely arrogant, to fay no worfe; for though he has copied Aldrovandus in innumerable places, he never once mentions his name." But Ray thinks that Lifter, by expreffing himfelf in this manner, has not done juftice to Moufet; and he maintains that the latter has rendered an effential fervice to the republic of letters.

MOUG-DEN, or CHEN-YANG; a city of Chinefe Tartary, and capital of the country of the Mantchews or Eaftern Tartars. Thefe people have been at great pains to ornament it with feveral public edifices, and to provide it with magazines of arms and ftorehoufes. They confider it as the principal place of their nation; and fince China has been under their dominion, they have eftablifhed the fame tribunals here as at Peking, excepting that called *Lii-pou:* thefe tribunals are compofed of Tartars only; their determination is final; and in all their acts they ufe the Tartar characters and language. The city is built on an eminence; a number of rivers add much to the fertility of the furrounding country. It may be confidered as a double city, of which one is enclofed within the other: the interior contains the emperor's palace, hotels of the principal mandarins, fovereign courts, and the different tribunals; the exterior is inhabited by the common people, tradefmen, and all thofe who by their employments or profeffions are not obliged to lodge in the interior. The latter is almoft a league in circumference; and the walls which enclofe both are more than three leagues round: thefe walls were entirely rebuilt in 1631, and repaired feveral times under the reign of Kang hi.

MOULD, or MOLD, in the mechanic arts, &c. a cavity artificially cut, with a defign to give its form or impreffion to fome fofter matter applied therein. Moulds are implements of great ufe in fculpture, foundery, &c. The workmen employed in melting the mineral or metallic ore dug out of mines, have their feveral moulds to receive the melted metal as it comes out of the furnace; but thefe are differeut according to the diverfity of metals and works. In gold mines, they have moulds for ingots; in filver mines, for bars; in copper and lead mines, for pigs or falmons; in tin mines, for pigs and ingots; and in iron mines, for fows, chimney backs, anvils, caldrons, pots, and other large utenfils and merchandifes of iron; which are here caft, as it were, at firft hand.

MOULDS of founders of large works, as ftatues, bells, guns, and other brazen works, are of wax, fupported within-fide by what we call a core, and covered without-fide with a cape or cafe. It is in the fpace which the wax took up, which is afterwards melted away to leave it free, that the liquid metal runs, and the work is formed; being carried thither through a great number of little canals, which cover the whole mould. See FOUNDERY.

MOULDS of moneyers are frames full of fand, wherein the plates of metal are caft that are to ferve for the ftriking of fpecies of gold and filver. See COINING.

A fort of concave moulds made of clay, having within them the figures and infcriptions of ancient Roman coins, are found in many parts of England, and fuppofed to have been ufed for the cafting of money. Mr Baker having been favoured with a fight of fome of thefe moulds found in Shropfhire, bearing the fame types and infcriptions with fome of the Roman coins, gave an account of them to the Royal Society. They were found in digging of fand, at a place called Ryton in Shropfhire, about a mile from the great Watling-ftreet-road. They are all of the fize of the Roman denarius, and of little more than the thicknefs of our halfpenny. They are made of a fmooth pot or brick clay, which feems to have been firft well cleanfed from dirt and fand, and well beaten or kneaded, to render it fit for taking a fair impreffion. There were a great many of them found together, and there are of them not unfrequently found in Yorkfhire; but they do not feem to have been met with in any other kingdom, except that fome have been faid to be once found at Lyons. They have been fometimes found in great numbers joined together fide by fide, on one flat piece of clay, as if intended for the cafting of a great number of coins at once; and both thefe, and all the others that have been found, feem to have been of the emperor Severus. They are fometimes found impreffed on both fides, and fome have the head of Severus on one fide and fome well known reverfe of his on the other. They feem plainly to have been intended for the coinage of money, though it is not eafy to fay in what manner they can have been employed for that purpofe, efpecially thofe which have impreffions on both fides, unlefs it may be fuppofed that they coined two pieces at the fame time by the help of three moulds, of which this was to be the middle one. If by difpofing thefe into fome fort of iron frame or cafe, as our letter-founders do the brafs moulds for cafting their types, the melted metal could be eafily poured into them, it would certainly be a very eafy method of coining, as fuch moulds require little time or expence to make, and therefore might be fupplied with new ones as often as they happen to break.

Thefe moulds feem to have been burnt or baked fufficiently to make them hard; but not fo as to render them porous like our bricks, whereby they would have loft their fmooth and even furface, which in thefe is plainly fo clofe, that whatever metal fhould be formed in them would have no appearance like the fand-holes by which counterfeit coins and metals are ufually detected.

MOULDS of founders of fmall works are like the frames of coiners: it is in thefe frames, which are likewife filled with fand, that their feveral works are fafhioned; into which, when the two frames of which the mould is compofed, are rejoined, the melted brafs is run.

MOULDS of letter founders are partly of fteel and partly of wood. The wood, properly fpeaking, ferves only to cover the real mould which is within, and to prevent the workman, who holds it in his hand, from being incommoded by the heat of the melted metal. Only one letter or type can be formed at once in each mould. See LETTER FOUNDERY.

MOULDS, in the manufacture of paper, are little frames composed of several brass or iron wires, fastened together by another wire still finer. Each mould is of the bigness of the sheet of paper to be made, and has a rim or ledge of wood to which the wires are fastened. These moulds are more usually called frames or forms. See *PAPER-Making*.

MOULDS, with furnace and crucible makers, are made of wood, of the same form with the crucibles; that is, in form of a truncated cone: they have handles of wood to hold and turn them with, when, being covered with the earth, the workman has a mind to round or flatten his vessel.

MOULDS for leaden bullets are little iron pincers, each of whose branches terminates in a hemispherical concave, which when shut form an entire sphere. In the lips or sides where the branches meet, is a little jet or hole, through which the melted lead is conveyed.

Laboratory MOULDS are made of wood, for filling and driving all sorts of rockets and cartridges, &c.

Glaziers MOULDS. The glaziers have two kinds of moulds, both serving to cast their lead: in the one they cast the lead into long rods or canes fit to be drawn through the vice, and the grooves formed therein; this they sometimes call ingot-mould. In the other, they mould those little pieces of lead a line thick and two lines broad, fastened to the iron bars. These may be also cast in the vice.

Goldsmiths MOULDS. The goldsmiths use the bones of the cuttle fish to make moulds for their small works; which they do by pressing the pattern between two bones, and leaving a jet or hole to convey the metal through, after the pattern has been taken out.

MOULD, among masons, is a piece of hard wood or iron, hollowed within side, answerable to the contours of the mouldings or cornices, &c. to be formed. This is otherwise called *caliber*.

MOULDS, among plumbers, are the tables on which they cast sheets of lead. These they sometimes call simply *tables*. Besides which they have other real moulds, wherewith they cast pipes without soldering. See each described under PLUMBERY.

MOULDS, among the glass grinders, are wooden frames, whereon they make the tubes wherewith they fit their perspectives, telescopes, and other optic machines. These moulds are cylinders, of a length and diameter according to the use they are to be applied to, but always thicker at one end than the other, to facilitate the sliding. The tubes made on these moulds are of two kinds; the one simply of pasteboard and paper; the other of thin leaves of wood joined to the pasteboard. To make these tubes to draw out, only the last or innermost is formed on the mould; each tube made afterwards serving as a mould to that which is to go over it, but without taking out the mould from the first. See GRINDING.

MOULDS used in basket-making are very simple, consisting ordinarily of a willow or osier turned or bent into an oval, circle, square, or other figure, according to the baskets, panniers, hampers, and other utensils intended. On these moulds they make, or more properly measure, all their work; and accordingly they have them of all sizes, shapes, &c.

MOULD, in ship-building, a thin flexible piece of timber, used by shipwrights as a pattern whereby to form the different curves of the timbers, and other compassing pieces in a ship's frame. There are two sorts of these, viz, the bend mould and hollow mould; the former of these determines the convexity of the timbers, and the latter their concavity on the outside, where they approach the heel, particularly towards the extremities of the vessel. The figure given to the timbers by this pattern is called their *bevelling*.

MOULDS, among tallow chandlers, are of two kinds: the first for the common dipped candles, being the vessel wherein the melted tallow is disposed, and the wick dipped. This is of wood, of a triangular form, and supported on one of its angles; so that it has an opening of near a foot a-top: the other, used in the fabric of mould candles, is of brass, pewter, or tin.—Here each candle has its several mould. See CANDLE.

MOULD, among gold-beaters, a certain number of leaves of vellum or pieces of gut, cut square, of a certain size, and laid over one another, between which they put the leaves of gold and silver which they beat on the marble with the hammer. See GOLD LEAF.

They have four kinds of moulds; two whereof are of vellum and two of gut: the smallest of those of vellum consists of 40 or 50 leaves; the largest contains 100: for the others, each contains 500 leaves. The moulds have all their several cases, consisting of two pieces of parchment, serving to keep the leaves of the mould in their place, and prevent their being disordered in beating.

MOULD, in *Agriculture*, a general name for the soft earthy substance with which the dry land is generally covered, and in which all kinds of vegetables take root and grow. It is far from being an homogeneous substance; being composed of decayed animal and vegetable matters, along with calcareous, argillaceous, and siliceous earths, mixed together in various proportions, and with the different degrees of moisture, constituting every variety of SOIL.

MOULDINESS, is a white down or lanugo, which is produced on the surface of animal or vegetable matters in a state of putrefaction; and which viewed through a microscope appears like a kind of meadow, out of which arise herbs and flowers. See MUCOR, BOTANY *Index*.

MOULDING, any thing cast in a mould, or that seems to have been so, though in reality it were cut with a chisel or the axe.

MOULDINGS, in *Architecture*, projectures beyond the naked wall, column, wainscot, &c. the assemblage of which forms corniches, door cases, and other decorations of ARCHITECTURE. See that article.

MOULINET is used, in *Mechanics*, to signify a roller, which, being crossed with two levers, is usually applied to cranes, capstans, and other sorts of engines of the like nature, to draw ropes, heave up stones, &c.

MOULINET is also a kind of turnstile, or wooden cross, which turns horizontally upon a stake fixed in the ground; usually placed in passages to keep out horses, and to oblige passengers to go and come one by one. These moulinets are often set near the outworks of of fortified places at the ſides of the barriers, through which people paſs on foot.

MOULINS, a town of France, in the department of Allier, and containing about 16,000 inhabitants. The houſes of the Chartreux, and that of the Viſitation, are magnificent. It has a conſiderable trade in cutlery ware, and is ſeated on the river Allier, in a pleaſant fertile plain, almoſt in the middle of France, 30 miles ſouth of Nevers, and 55 north of Clermont. E. Long. 3. 25. N. Lat. 46. 34.

MOULTON, North, a town of Devonſhire, on the river Moul.

Moulton, South, on the ſame ſtream, 182 miles from London. This, as well as the former, was anciently royal demeſne. It ſent members to parliament in the reign of Edward I. conſiſts of a mayor, 18 capital burgeſſes, a recorder, town clerk, and 2 ſerjeants at mace. Its chief manufactures are ſerges, ſhalloons, and felts; and a conſiderable market for wool.

MOULTING, or Molting, the falling off or change of hair, feathers, ſkins, horns, or other parts of animals, happening in ſome annually, in others only at certain ſtages of life.

The generality of animals moult in the ſpring. The moulting of a hawk is called *mewing*. The moulting of a deer is the quitting of his horns in February or March. The moulting of a ſerpent is the putting off his ſkin. See Exuviæ.

MOUND, a term uſed for a bank or rampart, or other fence, particularly that of earth.

Mound, in *Heraldry*, a ball or globe with a croſs upon it, ſuch as our kings are uſually drawn with, holding it in their left hand, as they do the ſceptre in the right.

MOUNT, an elevation of earth, called alſo *mountain*. See Mountain.

Mount Edgecumbe, a prodigious high peak, at the entrance of Cook's ſtrait, in New Zealand, on the weſt ſide. Its height is ſuppoſed not to be much inferior to that of the Peak of Teneriffe.

Mount Sorrel, a town in Leiceſterſhire, ſo named from a high mount or ſolid rock adjoining to the town, of a duſky red or ſorrel-coloured ſtone, extremely hard. Of rough ſtones hewn out of this rock the town is built. It has a market on Mondays. It was noted formerly for its caſtle, and is ſeated on the river Stour, over which there is a bridge. It is 20 miles ſouth-eaſt by ſouth of Derby, and 105 north-weſt by north of London. W. Long. 1. 9. N. Lat. 52. 45.

Mounts of Piety, certain funds or eſtabliſhments in Italy, where money is lent out on ſome ſmall ſecurity. There were alſo mounts of piety in England, raiſed by contribution for the benefit of people ruined by the extortions of the Jews.

MOUNTAIN (*Mons*), a conſiderable eminence of land, elevated above the ſurrounding country: It is commonly full of inequalities, cavities more or leſs expoſed, and ſtrata uncovered. For the natural hiſtory of mountains, ſee Mountain, Geology *Index*.

Attraction of Mountains. This is a late diſcovery, and a very conſiderable confirmation of Sir Iſaac Newton's theory of univerſal gravity. According to the Newtonian ſyſtem, an attractive power is not only exerted between thoſe large maſſes of matter which conſtitute the ſun and planets, but likewiſe between all comparatively ſmaller bodies, and even between the ſmalleſt particles of which they are compoſed. Agreeably to this hypotheſis, a heavy body, which ought to gravitate or tend toward the centre of the earth, in a direction perpendicular to its ſurface, ſuppoſing the ſaid ſurface to be perfectly even and ſpherical, ought likewiſe, though in a leſs degree, to be attracted and tend towards a mountain placed on the earth's ſurface; ſo that a plumb line, for inſtance, of a quadrant, hanging in the neighbourhood of ſuch a mountain, ought to be drawn from a perpendicular ſituation, in conſequence of the attractive power of the quantity of matter of which it is compoſed acting in a direction different from that exerted by the whole maſs of matter in the earth, and with a proportionably inferior degree of force.

Though Sir Iſaac Newton had long ago hinted at an experiment of this kind, and had remarked, that "a mountain of an hemiſpherical figure, three miles high and ſix broad, would not, by its attraction, draw the plumb line two minutes out of the perpendicular (E):" yet no attempt to aſcertain this matter by actual experiment was made till about the year 1738; when the French academicians, particularly Meſſrs Bouguer and Condamine, who were ſent to Peru to meaſure a degree under the equator, attempted to diſcover the attractive power of Chimboraco, a mountain in the province of Quito. According to their obſervations, which were however made under circumſtances by no means favourable to an accurate ſolution of ſo nice and difficult a problem, the mountain Chimboraco exerted an attraction equal to eight ſeconds. Though this experiment was not perhaps ſufficient to prove ſatisfactorily even the reality of an attraction, much leſs the preciſe quantity of it; yet it does not appear that any ſteps had been ſince taken to repeat it.

Through the munificence of his Britannic majeſty, the Royal Society were enabled to undertake the execution of this delicate and important experiment; the aſtronomer royal was choſen to conduct it. After various inquiries, the mountain Schehallien, ſituated nearly in the centre of Scotland, was pitched upon as the moſt proper for the purpoſe that could be found in this iſland. The obſervations were made by taking the meridian zenith diſtances of different fixed ſtars, near the zenith, by means of a zenith ſector of ten feet radius; firſt on the ſouth, and afterwards on the north ſide of the hill, the greateſt length of which extended in an eaſt and weſt direction.

It is evident, that if the maſs of matter in the hill exerted any ſenſible attraction, it would cauſe the plumb-line of the ſector, through which an obſerver viewed a ſtar in the meridian, to deviate from its perpendicular ſituation, and would attract it contrariwiſe at the

(E) By a very eaſy calculation it is found that ſuch a mountain would attract the plumb line 1′ 18″ from the perpendicular.

Mountains. the two ſtations, thereby doubling the effect. On the ſouth ſide the plummet would be drawn to the northward, by the attractive power of the hill placed to the northward of it: and on the north ſide, a contrary and equal deflection of the plumb line would take place in conſequence of the attraction of the hill now to the ſouthward of it. The apparent zenith diſtances of the ſtars would be affected contrariwiſe; thoſe being increaſed at the one ſtation which were diminiſhed at the other: and the correſpondent quantities of the deflection of the plumb line would give the obſerver the ſum of the contrary attractions of the hill, acting on the plummet at the two ſtations; the half of which will of courſe indicate the attractive power of the hill.

The various operations requiſite for this experiment laſted about four months; and from them it appears that the ſum of the two contrary attractions of the mountain Schehallien, in the two temporary obſervations which were ſucceſſively fixed half way up the hill (where the effect of its attraction would be greateſt), was equal to 11″.6.—From a rough computation, founded on the known law of gravitation, and on an aſſumption that the denſity of the hill is equal to the mean denſity of the earth, it appears that the attraction of the hill ſhould amount to about the double of this quantity. From thence it was inferred that the denſity of the hill is only about half the mean denſity of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely ſolid and denſe, and ſeemingly compoſed of an entire rock.

The inferences drawn from theſe experiments may be reduced to the following:

"1. It appears, that the mountain Schehallien exerts a ſenſible attraction; therefore, from the rules of philoſophizing, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the ſame property, in proportion to its quantity of matter.

"2. The law of the variation of this force, in the inverſe ratio of the ſquares of the diſtances, as laid down by Sir Iſaac Newton, is alſo confirmed by this experiment. For if the force of attraction of the hill had been only to that of the earth, as the matter in the hill to that of the earth, and had not been greatly increaſed by the near approach to its centre, the attraction thereof muſt have been wholly inſenſible. But now, by only ſuppoſing the mean denſity of the earth to be double to that of the hill, which ſeems very probable from other conſiderations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverſe duplicate ratio of the diſtances, as deduced by Sir Iſaac Newton from the compariſon of the motion of the heavenly bodies with the force of gravity at the ſurface of the earth; and the analogy of nature will be preſerved.

"3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean denſity of the earth is at leaſt double of that at the ſurface; and conſequently that the denſity of the internal parts of the earth is much greater than near the ſurface. Hence alſo, the whole quantity of matter in the earth will be at leaſt as great again, as if it had been all compoſed of matter of the ſame denſity with that at the ſurface; or will be about four or five times as great as if it were all compoſed of water.—This concluſion, Mr Maſkelyne adds, is totally contrary to the hypotheſis of ſome naturaliſts, 'who ſuppoſe the earth to be only a great hollow ſhell of matter; ſupporting itſelf from the property of an arch, with an immenſe vacuity in the midſt of it.' But, were that the caſe, the attraction of mountains, and even ſmaller inequalities in the earth's ſurface, would be very great, contrary to experiment, and would affect the meaſures of the degrees of the meridian much more than we find they do; and the variation of gravity, in different latitudes, in going from the equator to the poles, as found by pendulums, would not be near ſo regular as it has been found by experiment to be.

"4. As mountains are by theſe experiments found capable of producing ſenſible deflections of the plumb lines of aſtronomical inſtruments; it becomes a matter of great importance, in the menſuration of degrees in the meridian, either to chooſe places where the irregular attraction of the elevated parts may be ſmall; or where, by their ſituation, they may compenſate or counteract the effects of each other."

For meaſuring the heights of mountains, ſee BAROMETER.

Burning MOUNTAINS. See ÆTNA, HECLA, VESUVIUS; ſee alſo VOLCANO, GEOLOGY *Index*.

Marble MOUNTAINS. Of theſe there are great numbers in Egypt, from which, though immenſe quantities have been carried off for the multitude of great works erected by the ancient Egyptians: yet in the opinion of Mr Bruce, who paſſed by them in his journey to Abyſſinia, there is ſtill a ſufficient ſupply to build Rome, Athens, Corinth, Syracuſe, Memphis, Alexandria, and half a dozen more of ſuch cities.

The firſt mountain of this kind mentioned by Mr Bruce is one oppoſite to Terfowey, conſiſting partly of green marble, partly of granite, with a red bluſh upon a gray ground, and ſquare oblong ſpots. Here he ſaw a monſtrous obeliſk of marble very nearly ſquare, broken at the end, and nearly 30 feet long and 19 feet in the face. Throughout the plain there were ſcattered ſmall pieces of jaſper, with green, white, and red ſpots, called in Italy *diaſpro ſanguineo;* and all the mountains upon that ſide ſeemed to conſiſt of the ſame materials. From Mr Bruce's deſcription of theſe mountains, it would appear that they are compoſed of ſerpentine, and not of calcareous marble.

Written MOUNTAIN, *Mountain of Inſcriptions*, or *Jibel-al-Mokatteb*, a ſuppoſed mountain, or chain of mountains, in the wilderneſs of Sinai; on which, for a great extent of ſpace, the marble of which the mountain conſiſts is inſcribed with innumerable characters, reaching from the ground ſometimes to the height of 12 or 14 feet. Theſe were mentioned by a Greek author in the third century, and ſome of them have been copied by Pococke and other late travellers; but, after all, there is ſtill a very great uncertainty even of the *exiſtence* of ſuch mountain or mountains. The vaſt number of theſe inſcriptions, the deſert place in which they are found, and the length of time requiſite for executing the taſk, have induced a notion by no means unnatural, that they are the work of the Iſraelites during their forty years wandering in the wilderneſs. Others are of opinion that they contain nothing of any importance,

importance, but confift merely of the names of travellers and the dates of their journeys.

M. Niebuhr, who vifited this country during his travels in the eaft, made every attempt in his power, though without fuccefs, to obtain a fight of this celebrated mountain. On applying to fome Greeks at Suez, they all declared that they knew nothing of the written mountain: they, however, directed him to an Arabian fheik, who had paffed all his lifetime in travelling between Suez and Mount Sinai; but he knew no more of it than the former. Underftanding, however, that a confiderable reward would be given to any perfon who would conduct them thither, this Arab directed them to another; who pretended not only to know that mountain, but all others upon which there were any infcriptions throughout the defert. On inquiring particularly, however, our travellers found that he was not to be depended upon; fo that they were obliged to have recourfe to a fourth fheik, who by his converfation convinced them that he had feen mountains with infcriptions in unknown characters upon them. It does not appear, however, that this perfon was very capable, more than the reft, of leading them to the place they fo much wifhed for; though he conducted them to fome rocks upon which there were infcriptions in unknown characters. They are moft numerous in a narrow pafs between two mountains named *Om-er-ridftein;* and, fays M. Niebuhr, "the pretended Jibel-el-Mokatteb may poffibly be in its neighbourhood." Some of thefe infcriptions were copied by our author; but he does not look upon them to be of any confequence. "They feem (fays he) to have been executed at idle hours by travellers, who were fatisfied with cutting the unpolifhed rock with any pointed inftrument, adding to their names and the date of their journeys fome rude figures, which befpeak the hand of a people but little fkilled in the arts. When fuch infcriptions are executed with the defign of tranfmitting to pofterity the memory of fuch events as might afford inftructive leffons, greater care is generally taken in the preparation of the ftones, and the infcriptions are engraven with more regularity."

When M. Niebuhr arrived at laft at the mountain to which the fheik had promifed to conduct him, he did not find any infcriptions; but on climbing up to the top, he found out an Egyptian cemetery, the ftones of which were covered with hieroglyphics. The tomb ftones are from five to feven feet in length, fome ftanding on end and others lying flat; and "the more carefully they are examined (fays he), the more certainly do they appear to be fepulchral ftones, having epitaphs infcribed on them. In the middle of thefe ftones is a building, of which only the walls now remain; and within it are likewife a great many of the fepulchral ftones. At one end of the building feems to have been a fmall chamber, of which the roof ftill remains. It is fupported upon fquare pillars; and thefe, as well as the walls of the chamber, are covered with hieroglyphic infcriptions. Through the whole building are various bufts executed in the manner of the ancient Egyptians. The fepulchral ftones and the bufts are of hard and fine grained fand ftone." M. Niebuhr is of opinion that this cemetery was not the work of the Egyptians themfelves, but of fome colony which came from Egypt, and had adopted the manners and cuftoms of the people. He fuppofes that it might have been built by the Arabs, who had conquered Egypt under the fhepherd kings, and adopted the Egyptian manners during their refidence there. As it muft have belonged to an opulent city, however, he owns that there is a great difficulty in accounting for the exiftence of fuch a city in the midft of a defert.

The tranflator of Volney's travels afcribes thefe infcriptions to the pilgrims who vifit Mount Sinai. But to this, as well as to every other conjecture, there is this objection, that whether the infcriptions be well executed or not, whether they contain matters of importance or not, they ought to have been written in a language which *fomebody* could underftand; but from the copies that have been taken of them by Dr Pococke and others, it does not appear that they could be explained either by him or any other perfon.

When Dr Clayton, bifhop of Clogher, vifited this part of the world about the year 1723, he expreffed the greateft defire to have the matter concerning this written mountain or mountains afcertained, and even made an offer of 500l. fterling to any literary perfon who would undertake the journey and endeavour to decypher the infcriptions; but no fuch perfon has appeared, and the exiftence of the mountains is teftified only by the fuperior of a convent at Cairo, who gave that mentioned in the beginning of this article. Until that part of the world, therefore, become more acceffible to travellers, there is but little hope that we can come to any certainty in the matter. M. Niebuhr plainly, from his own accounts, had not influence enough with the Arabs to fhow him almoft any thing, as they refufed to conduct him even to the fummit of Mount Sinai.

White MOUNTAINS. See *New* HAMPSHIRE.

MOUNTAINS of the Moon, a chain of mountains in Africa, extending between Abyffinia and Monomotapa, and fo called from their great height.

MOUNTAINS of the Lions, alfo in Africa, divide Nigritia from Guinea, and extend as far as Ethiopia. They were ftyled by the ancients *the mountains of God*, on account of their being greatly fubject to thunder and lightning.

MOUNTAIN of Forty Days; a mountain of Judea, fituated in the plain of Jericho to the north of that city. According to the abbé Mariti's defcription, the fummit of it is covered neither with fhrubs, turf, nor earth; it confifts of a folid mafs of white marble, the furface of which is become yellow by the injuries of the air. "The path by which you afcend to it (fays our author) fills one with terror, as it rifes with a winding courfe between two abyffes, which the eye dares fcarcely behold. This path is at firft pretty broad, but it at length becomes fo confined, that one can with difficulty place both feet upon it at the fame time. When we had afcended a little higher, we found an Arab ftretched out on the path, who made us pay a certain toll for our paffage. Here the traveller requires courage. One of the parapets of the path being broke, we clung to the part which remained until we had reached a fmall grotto, fituated very commodioufly, as it gave us an opportunity of recovering our breath. When we had refted ourfelves a little, we purfued our courfe, which became ftill more dangerous. Sufpended almoft from the rock, and having before our eyes all the horror of the

Mourning. the precipice, we could advance only by dragging one foot after the other; ſo that had the ſmalleſt fragment given way under us, we ſhould have been hurried to the bottom of this frightful abyſs.

"This mountain is one of the higheſt in the province, and one of its moſt ſacred places. It takes its name from the rigorous faſt which Chriſt obſerved here after having triumphed over the vanities of the world and the power of hell. In remembrance of this miracle, a chapel was formerly conſtructed on the ſummit of the mountain. It may be ſeen from the plain, but we could not approach it, as the path was almoſt entirely deſtroyed. It, however, may be acceſſible on the other ſide of the mountain, which we did not viſit. A great many ſcattered grottos are ſeen here; in one of which, according to Quareſmius, were depoſited the bodies of ſeveral anchorets, which are ſtill entire. I have heard the ſame thing aſſerted in the country, but I could never meet with any perſon who had ſeen them. Here we enjoyed the moſt beautiful proſpect imaginable. This part of the mountain of Forty Days overlooks the mountains of Arabia, the country of Gilead, the country of the Ammonites, the plains of Moab, the plain of Jericho, the river Jordan, and the whole extent of the Dead ſea. It was here that the devil ſaid to the Son of God, 'All theſe kingdoms will I give thee, if thou wilt fall down and worſhip me."

MOURNING, a particular dreſs or habit worn to ſignify grief on ſome melancholy occaſion, particularly the death of friends or of great public characters.—The modes of mourning are various in various countries; as alſo are the colours that obtain for that end. In Europe, the ordinary colour for mourning is black; in China, it is white; in Turkey, blue or violet; in Egypt, yellow; in Ethiopia, brown. White obtained formerly in Caſtile on the death of their princes. Herrera obſerves, that the laſt time it was uſed was in 1498, at the death of Prince John. Each people pretend to have their reaſons for the particular colour of their mourning: white is ſuppoſed to denote purity; yellow, that death is the end of human hopes, in regard that leaves when they fall, and flowers when they fade, become yellow: brown denotes the earth, whither the dead return; black, the privation of life, as being the privation of light: blue expreſſes the happineſs which it is hoped the deceaſed does enjoy; and purple or violet, ſorrow on the one ſide, and hope on the other, as being a mixture of black and blue.

Mourning, among the ancients, was expreſſed various ways.

Amongſt the Jews, on the death of their relations or intimate friends, grief or mourning was ſignified by weeping, tearing their clothes, ſmiting their breaſts, or tearing them with their nails, pulling or cutting off their hair and beards, walking ſoftly, i. e. barefoot, lying upon the ground, faſting, or eating upon the ground. They kept themſelves cloſe ſhut up in their houſes, covered their faces, and abſtained from all work, even reading the law, and ſaying their uſual prayers. They neither dreſſed themſelves, nor made their beds, nor ſhaved themſelves, nor cut their nails, nor went into the bath, nor ſaluted any body: ſo that ſulkineſs ſeems to have been an indication of ſorrow; and dirtineſs, of diſtreſs. The time of mourning among the Jews was generally ſeven days: though this was lengthened or ſhortened according to circumſtances; but 30 days were thought ſufficient upon the ſevereſt occaſions. The different periods of the time of mourning required different degrees of grief, and different tokens of it. Mourning.

The Greeks, on the death of friends, ſhowed their ſorrow by ſecluding themſelves from all gaiety, entertainments, games, public ſolemnities, the enjoyment of wine, and the delights of muſic. They ſat in gloomy and ſolitary places, ſtripped themſelves of all external ornaments, put on a coarſe black ſtuff by way of mourning, tore their hair, ſhaved their heads, rolled themſelves in the duſt and mire, ſprinkled aſhes on their heads, ſmote their breaſts with their palms, tore their faces, and frequently cried out with a lamentable voice and drawling tone, reiterating the interjection ε, ε, ε, ε; hence funeral lamentations were called Ελεγοι. If they appeared in public during the time of mourning, they had a veil thrown over their faces and heads. During the funeral proceſſion, certain perſons called εξαρχοι θρηνων marched before, and ſung melancholy ſtrains called ολοφυρμοι Ιαλεμοι, Λινοι and Αιλινοι. Theſe vocal mourners ſung thrice during the proceſſion round the pile and round the grave. Flutes were alſo uſed to heighten the ſolemnity. At the funerals of ſoldiers, their fellow ſoldiers who attended, as a teſtimony of their affliction, held their ſhields, their ſpears, and the reſt of their armour, inverted.

The tokens of private grief among the Romans were the ſame as thoſe already obſerved as cuſtomary among the Greeks. Black or dark brown were the colours of the mourning habits worn by the men; they were alſo common to the women. The mourning of the emperors at firſt was black. In the time of Auguſtus, the women wore white veils, and the reſt of their dreſs black. From the time of Domitian they wore nothing but white habits, without any ornaments of gold, jewels, or pearls. The men let their hair and beards grow, and wore no wreaths of flowers on their heads while the days of mourning continued. The longeſt time of mourning was ten months: this was Numa's eſtabliſhment, and took in his whole year. For a widow to marry during this time was infamous. Mourning was not uſed for children who died under three years of age. From this age to ten they mourned as many months as the child was years old. A remarkable victory, or other happy event, occaſioned the ſhortening of the time of mourning: The birth of a child, or the attainment of any remarkable honour in the family, certain feaſts in honour of the gods, or the conſecration of a temple, had the ſame effect. After the battle of Cannæ, the commonwealth decreed that mourning ſhould not be worn for more than 30 days, that the loſs might be forgotten as ſoon as poſſible. When public magiſtrates died, or perſons of great note, alſo when any remarkable calamity happened, all public meetings were intermitted, the ſchools of exerciſe, baths, ſhops, temples, and all places of concourſe were ſhut up, and the whole city put on a face of ſorrow; the ſenators laid aſide the *laticlave*, and the conſuls ſat in a lower ſeat than ordinary. This was the cuſtom of Athens alſo, and was obſerved upon the death of Socrates not long after he had been ſentenced to death by their judges.

Præficæ, or mourning women, (by the Greeks called θρηνων εξαρχοι), went about the ſtreets: this was cuſtomary

mary among the Jews as well as the Greeks and Romans, (Jerem. ix. 17.)

MOUSE. See Mus, Mammalia *Index*.

Mouse-Ear. See Hieracium, } Botany *Index*.
Mouse-Tail. See Myosurus, } Botany *Index*.
Dor-Mouse. See Myoxus, } Mammalia *Index*.
Shrew-Mouse. See Sorex, } Mammalia *Index*.

MOUSELLE, the name of an East Indian tree, with white tubular flowers, which fall off every day in great plenty. They are of a ſweet agreeable ſmell, and the Gentoos are very fond of wearing them, ſtringing and hanging them about their necks and arms. The fruit is a pale red cherry, of the ſhape and ſize of our white heart cherry, but the footſtalk is not quite ſo long. This fruit has a ſtone in it, containing a bitter oily kernel. The Indians rub with this oil any part ſtung by a ſcorpion or bitten by a centipede, which it ſoon cures. The crows are very fond of the fruit.

MOUSUL, or Mosul, a large city of Turkey in Aſia, and capital of a beglerbegate, ſtands on the weſt bank of the Tigris, in the latitude, according to Mr Ives's obſervation, of 36° 30′ north. It is ſurrounded with ſtone walls, but has many of its ſtreets lying waſte. Tavernier ſpeaks of it as a ruined place, with only two blind markets and a ſorry caſtle; yet, he ſays, that it is much frequented by merchants, and that its baſha commands 3000 men. There is a bridge of boats over the Tigris; and the city is a thoroughfare from Perſia to Syria, which makes it a place of trade, and which is more augmented by a conſtant traffic from this place to Bagdad. The country on this ſide the river is ſandy and barren; but on the oppoſite ſide it is exceedingly fruitful, yielding good crops of corn and fruit in abundance. Mr Ives ſays it was the beſt built city he had ſeen in Turkey; but had nothing in it to attract the notice of an European. It was beſieged for near ſix months by Nadir Shah without ſucceſs. Breaches were frequently made in the walls, and aſſaults continued for three days ſucceſſively; but the aſſailants were conſtantly repulſed, and the breaches made in the day time repaired during the night. The beſieged had unanimouſly reſolved to die rather than to ſubmit. The Turks declared, that ſhould the place be forced to ſurrender, they were determined to put to death all their wives and daughters firſt, that they might not fall into the vile hands of the abhorred Perſians. The place was therefore defended with uncommon bravery; even the women and children exerted themſelves with the greateſt alacrity. The Chriſtians behaved in ſuch a manner as to gain the eſteem and admiration of the other inhabitants; and ſome of their churches being demoliſhed, they were afterwards repaired at the expence of government.

In this city there are a great many moſques, the largeſt and moſt ſtately of which is ornamented on the top with green tiles. At the doors of theſe houſes there are uſually inſcriptions in gilt letters, declaring the awfulneſs of the building, as being the houſe of God. One of them has a minaret which bends like thoſe of Bagdad. Some of the moſt bigotted Turks ſay, that Mahomet ſaluted this minaret as he paſſed; on which it bent its head in reverence to the prophet, and ever after continued in that ſituation. The manufacture of this city is *muſſolen* (muſlin), which is made very ſtrong and pretty fine. In the year 1757 this city and the country adjacent were viſited by a dreadful famine, owing to the preceding hard winter, and innumerable multitudes of locuſts, by which the fruits of the earth were deſtroyed. When Mr Ives was there in 1758, the country was comparatively depopulated. Almoſt all the brute creation had been deſtroyed for the ſubſiſtence of man. During the famine, the people had eaten dogs, and every kind of animal which is held in abhorrence at any other time, not ſparing even their own children; and the dead bodies lay in the ſtreets for want of people to bury them. Their fruit trees were alſo deſtroyed by the froſt; ſo that when our author was there ſcarcely any fruit could be had. The neighbouring mountains afford ſilver mines; and they would yield much quickſilver if the Turks had either the ſkill or inclination to work them to advantage. Lanza ſays, that ſome time ago an Engliſhman who travelled through this country got two or three bottles of it, which he preſented to the baſha as a ſpecimen of what might be done in that way: but no farther attempt was made. Here alſo are ſome lead mines, which ſupply as much of that metal as furniſhes them with bullets and ſome neceſſary utenſils.

MOU-TAN, or peony shrub of China: alſo called *hoa-ouang*, or "the king of flowers," and *peleang-kin*, "an hundred ounces of gold," in alluſion to the exceſſive price given formerly by ſome of the virtuoſi for certain ſpecies of this plant. The mou-tan ſeems to claim pre-eminence, not only on account of the ſplendour and number of its flowers, and of the ſweet odour which they diffuſe around, but alſo on account of the multitude of leaves which compoſe them, and of the beautiful golden ſpots with which they are interſperſed. This plant, which is of a ſhrubby nature, ſhoots forth a number of branches, which form a top almoſt as large as thoſe of the fineſt orange trees.

MOUTH, in *Anatomy*, a part of the face, conſiſting of the lips, the gums, the inſides of the cheeks, the palate, the ſalival glands, the os hyoides, the uvula, and the tonſils; which ſee under the article Anatomy.

Mr Derham obſerves, that the mouth in the ſeveral ſpecies of animals is nicely adapted to the uſes of ſuch a part, and well ſized and ſhaped for the formation of ſpeech, the gathering and receiving of food, the catching of prey, &c. In ſome creatures it is wide and large, in others little and narrow: in ſome it is formed with a deep inciſure into the head, for the better catching and holding of prey, and more eaſy comminution of hard, large, and troubleſome food; and in others with a ſhorter inciſure, for the gathering and holding of herbaceous food. In birds it is neatly ſhaped for piercing the air; hard and horny, to ſupply the want of teeth; hooked, in the rapacious kind, to catch and hold their prey; long and ſlender in thoſe that have their food to grope for in mooriſh places; and broad and long in thoſe that ſearch for it in the mud. Nor is the mouth leſs remarkable in inſects; in ſome it is forcipated, to catch, hold, and tear the prey; in others aculeated, to pierce and wound animals, and ſuck their blood; in others, ſtrongly rigid, with jaws and teeth, to gnaw and ſcrape out

out their food, carry burdens, perforate the earth, nay the hardeſt wood, and even ſtones themſelves, for houſes and neſts for their young.

MOWEE, one of the Sandwich iſlands, diſcovered by Captain Cook, is 162 miles in circumference. A low iſthmus divides it into two circular peninſulas, of which the eaſtern is double the ſize of the weſtern. The mountains in both riſe to a great height, and may be ſeen at the diſtance of more than 30 leagues. The northern ſhores, like thoſe of Owhyhee, afford no ſoundings, and the country preſents the ſame appearance of verdure and fertility. The number of inhabitants is computed at about 65,000. W. Long. 175. 56. N. Lat. 20. 53.

MOXA, or MUGWORT of China, is a ſoft lanuginous ſubſtance, prepared in Japan from the young leaves of a ſpecies of ARTEMISIA, by beating them together when thoroughly dried, and rubbing them betwixt the hands till only the fine fibres are left. The down on the leaves of mullein, cotton, hemp, &c. anſwers the ſame purpoſe.

In the Eaſtern countries it is uſed by burning it on the ſkin: a little cone of the moxa is laid upon the part, previouſly moiſtened, and ſet on fire at the top; it burns down with a temperate glowing heat, and produces a dark coloured ſpot, the exulceration of which is promoted by applying a little garlic; the ulcer is left to diſcharge, or is ſoon healed, according to the intention in uſing the moxa.

MOYRA. See MOIRA.

MUCILAGE, in *Pharmacy*, is in general any viſcid or glutinous liquor.

MUCILAGE alſo imports the liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations, and is ſupplied by the mucilaginous glands.

MUCOR, in *Botany*, a genus of the order of fungi, belonging to the cryptogamia claſs of plants. See BOTANY *Index*.

MUCUS, a mucilaginous liquor ſecreted by certain glands, and ſerving to lubricate many of the internal cavities of the body. In its natural ſtate it is generally limpid and colourleſs; but, from certain cauſes, aſſumes a thick conſiſtence and a whitiſh colour like pus. For the diſtinguiſhing characters between pus and mucus, ſee CHEMISTRY, N° 2769.

MUCK, or RUNNING A MUCK, is a practice that has prevailed time immemorial in Batavia. To run a muck, in the original ſenſe of the word, is to get intoxicated with opium, and then ruſh into the ſtreet with a drawn weapon, and kill any one that comes in the way, till the party is himſelf either killed or taken priſoner. If the officer take one of theſe *amocks* or *mohawks* (as they have been called by an eaſy corruption) alive, he has a conſiderable reward; and the unhappy wretch is always broken alive on the wheel: but ſuch is the fury of their deſperation, that three out of four are neceſſarily deſtroyed in attempting to ſecure them.

MUD-IGUANA. See MURÆNA, ICHTHYOLOGY *Index*.

MUFFLE, in *Chemiſtry*, a veſſel employed in ſome metallurgic operations. In figure it repreſents an oblong arch or vault, the hinder part of which is cloſed by a ſemicircular plane, and the lower part or floor of which is a rectangular plane. It is a little oven that is placed horizontally in aſſay and enamelling furnaces, ſo that its open ſide correſponds with the door of the fireplace of the furnace. Under this arched oven ſmall cupels or crucibles are placed; and the ſubſtances contained are thus expoſed to intenſe heat without contact of fuel, ſmoke, or aſhes.

MUFTI, the chief of the eccleſiaſtical order, or primate of the Muſſulman religion. The authority of the mufti is very great in the Ottoman empire; for even the ſultan himſelf, if he would preſerve any appearance of religion, cannot, without hearing his opinion, put any perſon to death, or ſo much as inflict any corporal puniſhment. In all actions, eſpecially criminal ones, his opinion is required, by giving him a writing in which the caſe is ſtated under feigned names; which he ſubſcribes with the words, *He ſhall*, or *ſhall not, be puniſhed*. Such outward honour is paid to the mufti, that the grand ſignior himſelf riſes up to him, and advances ſeven ſteps to meet him when he comes into his preſence. He alone has the honour of kiſſing the ſultan's left ſhoulder, whilſt the prime vizier kiſſes only the hem of his garment. When the grand ſignior addreſſes any writing to the mufti, he gives him the following titles: *To the Eſad, the wiſeſt of the wiſe, inſtructed in all knowledge, the moſt excellent of excellents, abſtaining from things unlawful, the ſpring of virtue and of true ſcience, heir of the prophetic doctrines, reſolver of the problems of faith, revealer of the orthodox articles, key of the treaſures of truth, the light to the doubtful allegories, ſtrengthened with the grace of the ſupreme Legiſlator of mankind, may the Moſt High God perpetuate thy virtues!* The election of the mufti is ſolely in the grand ſignior, who preſents him with a veſt of rich ſables, &c. If he is convicted of treaſon or any great crime, he is put into a mortar kept for that purpoſe in the Seven Towers at Conſtantinople, and pounded to death.

MUGGLETONIANS, a religious ſect which aroſe in England about the year 1657; ſo denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his aſſociate Reeves, ſet up for great prophets, pretending, as it is ſaid, to have an abſolute power of ſaving and damning whom they pleaſed; and giving out that they were the two laſt witneſſes of God that ſhould appear before the end of the world.

MUGIL, the MULLET, a genus of fiſhes belonging to the order of abdominales. See ICHTHYOLOGY *Index*.

MUGWORT, a ſpecies of ARTEMISIA; which ſee, BOTANY *Index*.

MUID, a large meaſure in uſe among the French, for things dry. The muid is no real veſſel uſed as a meaſure, but an eſtimation of ſeveral other meaſures; as the ſeptier, mine, minot, buſhel, &c.

MUID, is alſo one of the nine caſks, or regular veſſels uſed in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter-muids, and eight half-quarter muids, containing 36 ſeptiers.

MULATTO, a name given in the Indies to thoſe who are begotten by a negro man on an Indian or white woman, or by an Indian or white man on a negro woman.

MULBERRY. See MORUS, BOTANY *Index*.

MULBERRY-Cyder, a name given by the people of Devonſhire, and ſome other parts of England, to a sort of cyder rendered very palatable by an admixture of mulberry juice in the making; they choose for this purpose the ripest and blackest mulberries, and pressing out their juice, and mixing it with a full bodied cyder at the time of the grinding and pressing, give just so much of it as adds a perceptible flavour. It is very worthy the attention of people who live in other countries, where strong and good cyder is made, that this renders it a sort of wine much more agreeable than any other English liquor, and might be brought into general use, to the great advantage of the dealer. The colour of this liquor resembles that of the brightest red wine, and the flavour of the mulberry never goes off. Phil. Transf. N° 133.

MULCT, a fine of money laid upon a man who has committed some fault or misdemeanour.

MULE, a mongrel kind of quadruped, usually generated between an ass and a mare, and sometimes between a horse and a she ass; but the signification of the word is commonly extended to every kind of animal produced by a mixture of two different species. See Mammalia *Index*.

Mules, among gardeners, denote a sort of vegetable monsters produced by putting the farina fœcundans of one species of plant into the pistil or utricle of another.

The carnation and sweet-william being somewhat alike in their parts, particularly their flowers, the farina of the one will impregnate the other, and the seed so enlivened will produce a plant differing from either. An instance of this we first had in Mr Fairchild's garden at Hoxton; where a plant is seen neither sweet-william nor carnation, but resembling both equally: this was raised from the seed of a carnation that had been impregnated by the farina of the sweet-william. These couplings being not unlike those of the mare with the ass, which produce the mule, the same name is given them; and they are, like the others, incapable of multiplying their species.

This furnishes a hint for altering the property and taste of any fruit, by impregnating one tree with the farina of another of the same class; *e. gr.* a codlin with a pear-main, which will occasion the codlin so impregnated to last a longer time than usual, and to be of a sharper taste.

MULHAUSEN, an imperial and Hanseatic town of Germany, in Upper Saxony, and in Thuringia, under the protection of the elector of Saxony; seated in a fertile country, on the river Unstrutht, 15 miles north-east of Eisenach, and 45 east by south of Cassel. E. Long. 10. 49. N. Lat. 51. 13.

Mulhausen, a considerable town of Germany, in Alsace, and capital of a republic in alliance with the Swiss. It is populous, well built, and adorned with handsome public structures; seated in a pleasant fertile country, on an island formed by the river Ill, 15 miles north-west of Basle, and 20 east of Befort. E. Long. 7. 24. N. Lat. 47. 48.

MULIER, in *Law*, signifies the lawful issue born in wedlock, though begotten before. The mulier is preferred to an older brother born out of matrimony; as for instance, if a man has a son by a woman before marriage, which issue is a bastard, and afterwards marries the mother of the bastard, and they have another son, this second son is mulier and lawful, and shall be heir of the father; but the other can be heir to no person *. By the civil law, where a man has issue by a woman, if after that he marries her, the issue is mulier.

* See the article *Bastard*.

MULL, one of the Western islands of Scotland, about 25 miles long, and as much in breadth. It is in general rocky and barren, not producing a sufficient quantity of corn for the inhabitants; but a great number of cattle are annually exported, which with the fishings and a considerable quantity of kelp are the only articles of commerce. It is deeply indented with bays and creeks, forming in several parts good natural harbours. There are no villages except Tobermorey, near the northern point of the island, where a fishing station has been erected. The island was originally part of the dominions of the Lords of the Isles; but in aftertimes it became a part of the possessions of the ancient family of Macleans, who still retain a considerable part. The duke of Argyll is also a considerable proprietor. The ruins of several ancient castles are seen on this island. The population of Mull, in 1795, amounted to about 8000 persons.

Mull of Cantyre. See Cantyre.

Mull of Galloway. See Galloway.

MULLEIN. See Verbascum, Botany *Index*.

MULLER, or Regiomontanus, John, a celebrated astronomer of the 15th century, was born at Koningshoven in Franconia in 1436, and acquired great reputation by publishing an abridgement of Ptolemy's Almagest, which had been begun by Purback. He went to Rome to perfect himself in the Greek tongue, and to see the Cardinal Bassarion; but finding some faults in the Latin translation of George de Trebizond, that translator's son assassinated him in a second journey he made to Rome in 1476, where Pope Sixtus IV. had provided for him the archbishopric of Ratisbon, and had sent for him to reform the calendar. Others say that he died of the plague.

Muller, or *Mullar*, denotes a stone flat and even at bottom, but round atop; used for grinding of matters on a marble.—The apothecaries use mullers to prepare many of their testaceous powders; and painters for their colours, either dry or in oil.

Muller is an instrument used by the glass grinders; being a piece of wood, to one end whereof is cemented the glass to be ground, whether convex in a bason, or convave in a sphere or bowl.—The muller is ordinarily about six inches long, turned round: the cement they use is composed of ashes and pitch. See Grinding.

MULLERAS, a town of Germany, in the circle of Upper Saxony, and marquisate of Brandenburg, seated 38 miles south of Berlin, upon a canal which joins the Oder and the Spree. This canal is 15 miles in length, 10 yards in breadth, and seven feet in depth. It was eight years in making; and since that time the cities of Hamburg and Breslaw have carried on great trade by water. E. Long. 14. 50. N. Lat. 52. 21.

MULLET. See Mugil, Ichthyology *Index*.

Mullet, or *Mollet*, in *Heraldry*, a bearing in form of the rowel of a spur, which it originally represented.

MULLINGAR, the county town of Westmeath, and province of Leinster, in Ireland, 38 miles from Dublin.

Dublin. N. Lat. 53. 30. W. Long. 7. 50. Within a few miles of it are the ruins of a church, and also those of a castle. It is situated on the river Feyle. It holds a great wool fair, and is a place of good trade. In 1227, the priory of St Mary, formerly known by the name of *The House of God of Mullingar*, was founded here by Ralph de Petyt bishop of Meath, for regular canons of the order of St Augustin. A Dominican friary was also founded here in 1237 by the family of Nugent; some ruins of which still remain. In 1622, the friars of Multifarnham began to erect a house there for friars of the order of St Francis, but it was never completed.

MULLUS, the SURMULLET, a genus of fishes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

MULTIPLE, in *Arithmetic*, a number which comprehends some other several times; thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3; comprehending the first twice, the second thrice, &c.

ACTION of MULTIPLEPOINDING, in *Scots Law*. See LAW, N° clxxxiii. 24.

MULTIPLICAND, in *Arithmetic*, the number to be multiplied by another. See ARITHMETIC.

MULTIPLICATION, in general, the act of increasing the number of any thing.

MULTIPLICATION, in *Arithmetic*, is a rule by which any given number may be speedily increased, according to any proposed number of times. See ARITHMETIC.

MULTIPLICATION, in *Algebra*. See ALGEBRA.

MULTIPLICATOR, or MULTIPLIER, in *Arithmetic*, the number by which any other is multiplied, or the number of times it is supposed to be taken.

MULTIPLICATUS FLOS, a luxuriant flower, whose petals are multiplied so as to exclude a part or the whole of the stamina.

MULTIPLYING GLASS, in *Optics*, a glass wherewith objects appear increased in number. See OPTICS.

MULTURE, in *Scots Law*, a certain stipulated quantity of meal given as payment to the proprietor or tacksman of a mill for grinding the corn: and all corn ground on farms thirled to the mill is obliged to pay multure whether the corn be ground at that mill or elsewhere.

MULVIA, a river of Barbary in Africa, which rises in the mountains of Atlas, and divides the empire of Morocco from that of Algiers, and then falls into the Mediterranean, to the westward of Marsalquiver.

MUM, a kind of malt liquor much drunk in Germany, and chiefly brought from Brunswick, which is the place of most note for making it. The process of brewing mum, as recorded in the townhouse of that city, is as follows: Take 63 gallons of water that has been boiled till one third part is consumed, and brew it with seven bushels of wheaten malt, one bushel of oat meal, and one bushel of ground beans. When it is tunned, the hogshead must not be filled too full at first: as soon as it begins to work, put into it three pounds of the inner rind of fir, one pound of the tops of fir and beech, three handfuls of carduus benedictus, a handful or two of the flower of rosa solis: add burnet, betony, marjoram, avens, pennyroyal, and wild thyme, of each a handful and a half; of elder flowers, two handfuls or more; seeds of cardamom bruised, 30 ounces; barberries bruised, one ounce: when the liquor has worked a while, put the herbs and seeds into the vessel; and, after they are added, let it work over as little as possible; then fill it up: lastly, when it is stopped, put into the hogshead ten new-laid eggs unbroken; stop it up close, and use it at two years end. The English brewers, instead of the inner rind of fir, use cardamom, ginger, and sassafras; and also add elecampane, madder, and red sanders.

MUMMIUS, L. a Roman consul sent against the Achæans, whom he conquered B. C. 147. He destroyed Corinth, Thebes, and Chalcis, by order of the senate, and obtained the surname of *Achaicus* from his victories. He did not enrich himself with the spoils of the enemy, but returned home without any increase of fortune. He was so little acquainted with the value of the paintings and works of the most celebrated artists of Greece which were found in the plunder of Corinth, that he said to those who conveyed them to Rome, that if they lost or injured them, they should make others in their stead.

MUMMY, a body embalmed or dried, in the manner used by the ancient Egyptians; or the composition with which it is embalmed. There are two kinds of bodies denominated *mummies*. The first are only carcases dried by the heat of the sun, and by that means kept from putrefaction: these are frequently found in the sands of Libya. Some imagine, that these are the bodies of deceased people buried there on purpose to keep them entire without embalming; others think they are the carcases of travellers who have been overwhelmed by the clouds of sand raised by the hurricanes frequent in those deserts. The second kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians deposited their dead after embalming. See EMBALMING.

We have two different substances preserved for medicinal use under the name of *mummy*, though both in some degree of the same origin. The one is the dried and preserved flesh of human bodies, embalmed with myrrh and spices; the other is the liquor running from such mummies, when newly prepared, or when affected by great heat or damps. The latter is sometimes in a liquid, sometimes of a solid form, as it is preserved in vials well stopped, or suffered to dry and harden in the air. The first kind of mummy is brought to us in large pieces, of a lax and friable texture, light and spongy, of a blackish brown colour, and often damp and clammy on the surface: it is of a strong but disagreeable smell. The second kind of mummy, in its liquid state, is a thick, opaque, and viscous fluid, of a blackish colour, but not disagreeable smell. In its indurated state, it is a dry solid substance, of a fine shining black colour, and close texture, easily broken, and of a good smell; very inflammable, and yielding a scent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy used in the shops; but it is very scarce and dear; while the other is so cheap, that it will always be most in use.

All these kinds of mummies are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptian mummies, to sell them in pieces to the druggifts, as they make a much better market of them in Europe whole, when they can contrive to get them. What our druggifts are fupplied with, is the flefh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen, fo plentiful in that part of the world; and adding a little aloes, and two or three other cheap ingredients, fend them to be baked in an oven, till the juices are exhaled, and the embalming matter has penetrated fo thoroughly that the flefh will keep and bear tranfporting into Europe. Mummy has been efteemed refolvent and balfamic: but whatever virtues have been attributed to it, feem to be fuch as depend more upon the ingredients ufed in preparing the flefh than in the flefh itfelf; and it would furely be better to give thofe ingredients without fo fhocking an addition.

There are found in Poland a kind of natural mummies, or human bodies preferved without the affiftance of art. Thefe lie in confiderable numbers in fome of the vaft caverns in that country. They are dried with the flefh and fkin fhrunk up almoft clofe to the bones, and are of a blackifh colour. In the wars which feveral ages ago laid wafte that country, it was common for parties of the weaker fide to retire into thefe caves, where their enemies, if they found them out, fuffocated them by burning ftraw, &c. at the mouth of the cavern, and then left the bodies; which, being out of the way of injuries from common accidents, have lain there ever fince.

Mummy, among gardeners, a kind of wax ufed in grafting and planting the roots of trees, made in the following manner: Take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and fet them on fire in the open air, holding fomething in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the compofition is then to be fet by for ufe.

MUMPS. See Medicine *Index*.

MUNDA, an ancient town of Spain, in the kingdom of Granada, feated on the declivity of a hill, at the bottom of which runs a river. W. Long. 4. 13. N. Lat. 48. 15.

This city was anciently famous for a victory gained by Cæfar over the two fons of Pompey, who had collected an army in Spain after the defeat of their father at Pharfalia. See (*Hiftory of*) Rome.

The Pompeys pofted their army advantageoufly on a rifing ground, whereof one fide was defended by the city of Munda, and the other a fmall river which watered the plain, and by a marfh: fo that the enemy could not attack them but in front. Cæfar likewife drew up his troops with great art, and having advanced a little way from his camp, ordered them to halt, expecting the enemy would abandon their advantageous poft, and come to meet him. But as they did not ftir, Cæfar made as if he intended to fortify himfelf in that poft; which induced the young general, who looked upon this as a fign of fear, to advance into the plain, and attack the enemy before they could fecure themfelves with any works. Pompey's army was by far the moft numerous: for it confifted of 13 legions, 6000 horfe, and an incredible number of auxiliaries, among whom were all the forces of Bocchus king of Mauritania, commanded by his two fons, both youths of great valour and bravery. Cæfar had 80 cohorts, three legions, to wit, the third, the fifth, and the tenth, and a body of 8000 horfe. As the enemy drew near, Cæfar betrayed a great deal of uneafinefs and concern, as if he were doubtful of the fuccefs, knowing he was to engage men no way inferior in valour and experience to his own, and commanded by officers who had on many occafions given fignal proofs of their bravery and conduct. Cneius, the elder of the two brothers, was generally looked upon as an able commander; and Labienus, who had revolted, efteemed fcarce inferior to himfelf.

However, the dictator, defirous to put an end to the civil war, either by his own death or that of his rivals, gave the fignal for the battle, and fell upon the enemy with his ufual vigour and refolution. At the firft onfet, which was dreadful, the auxiliaries on both fides betook themfelves to flight, leaving the Romans to decide their quarrel by themfelves. Then the legionaries engaged with a fury hardly to be expreffed; Cæfar's men being encouraged by the hopes of putting an end to all their labours by this battle, and thofe of Pompey exerting themfelves out of neceffity and defpair, fince moft of them expected no quarter, as having been formerly pardoned. Never was victory more obftinately difputed. Cæfar's men, who had been always ufed to conquer, found themfelves fo vigoroufly charged by the enemy's legionaries, that they began to give ground; and though they did not turn their backs, yet it was manifeft that fhame alone kept them in their pofts. All authors agree, that Cæfar had never been in fo great danger; and he himfelf, when he came back to his camp, told his friends, that he had often fought for victory, but this was the firft time he had ever fought for life. Thinking himfelf abandoned by fortune, which had hitherto favoured him, he had fome thoughts of ftabbing himfelf with his own fword, and by a voluntary death preventing the difgrace of a defeat: but returning foon to himfelf, and concluding it would be more to his reputation to fall by the enemy's hand at the head of his troops, than, in a fit of defpair, by his own, he difmounted from his horfe, and fnatching a buckler from one of his legionaries, he threw himfelf like a man in defpair into the midft of the enemy; crying out to his men, *Are you not afhamed to deliver your general into the hands of boys?* At thefe words, the foldiers of the tenth legion, animated by the example of their general, fell upon the enemy with frefh vigour, and made a dreadful havock of them. But in fpite of their utmoft efforts, Pompey's men ftill kept their ground, and, though greatly fatigued, returned to the charge with equal vigour. Then the Cæfarians began to defpair of victory; and the dictator, running through the ranks of his difheartened legionaries, had much ado to keep them together. The battle had already lafted from the rifing to the fetting of the fun, without any confiderable advantage on either fide.

At length a mere accident decided the difpute in favour of the dictator. Bogud, a petty king of Mauritania, had joined Cæfar foon after his arrival in Spain, with fome fquadrons of Numidian horfe; but, in the very

very beginning of the battle, being terrified at the shouting of the soldiers, intermingled with groans, and the clashing of their arms, he had abandoned his post, and retired with the auxiliaries under his command to a rising ground at a small distance from the enemy's camp. There he continued the whole day an idle spectator of the battle that was fought in the plain. But towards the evening, partly out of shame and partly out of compassion for his friend Cæsar, he resolved to fall upon Pompey's camp; and accordingly flew thither with all the forces he had with him. Labienus, apprised of his design, hastened after him to the defence of the camp; which Cæsar observing, cried to his legionaries, *Courage, fellow soldiers! the victory at length is ours; Labienus flies.* This artifice had the desired effect: Cæsar's men, believing that Labienus was truly fled, made a last effort, and charged the wing he commanded so briskly, that after a most obstinate dispute they put them to flight.

Though the enemy's left wing was thus entirely defeated, the right wing, where the elder Pompey commanded, still kept their ground for some time. Pompey dismounting from his horse, fought on foot like a private man in the first line, till most of his legionaries being killed, he was forced to save himself by flight from falling into the enemy's hands. Part of his troops fled back to their camp, and part took shelter in the city of Munda. The camp was immediately attacked, and taken sword in hand; and as for the city, Cæsar, without loss of time, drew a line of circumvallation round it. This victory was gained on the 16th of the kalends of April, i. e. according to our way of counting, on the 17th day of March, when the Dionysian festival, or the Liberalia, were celebrated at Rome; the very day, as Plutarch observes, in which Pompey the Great, four years before, had set out for the war. In this action Pompey lost 30,000 men; among whom were the famous Labienus, Attius Varus, and 3000 Roman knights. Seventeen officers of distinction were taken, and all the enemy's eagles and ensigns, together with Pompey's fasces, which he had assumed as governor of Spain. On Cæsar's side, only 1000 men were killed and 500 wounded.

MUNDIC, or MARCASITE, an old name for pyrites of copper or iron. See *Ores of Copper and Iron*, MINERALOGY *Index*.

MUNDINGOES, the name of a people who live on the sides of the river Gambia in Africa, and who are of a jet black colour, strong, and well made. They have a priest sent over every year from one of the Cape de Verd islands to christen and marry.

MUNDUS PATENS, the open world, in Roman antiquity, a solemnity performed in a small temple, of a round form like the world, dedicated to *Dis* and the rest of the infernal gods. This temple was opened but three times in the year, viz. the 24th of August, the 4th of October, and the 7th of November. During these days, the Romans believed hell was open; on these days therefore they never offered battle, listed soldiers, put to sea, or married.

MUNICH, a town of Germany, capital of the whole duchy of Bavaria, and the residence of the elector. It stands on the Iser, 70 miles south of Ratisbon and 214 west of Vienna, being one of the most pleasant and populous cities of Germany for its bigness. The number of the inhabitants is said to be about 40,000. Having been built at first on a spot of ground belonging to a convent, it had from thence in German the name of *Munchen*, i. e. *Monk's town*, and a monk for its arms. The elector's palace here is a very grand structure, consisting of several courts, furnished and adorned in the most magnificent manner, with tapestry, gilding, sculpture, statues, and paintings. It contains an amazing collection of jewels, antiquities, and curiosities. The great hall is 118 feet long and 52 broad; and the staircase leading to it, from top to bottom, of marble and gold. In the hall of antiquities are 354 busts and statues of jasper and porphyry, brass and marble. In this palace is a library, containing a vast collection of books, and many valuable manuscripts, in most languages, ancient and modern; and a chamber of rarities, among which is the picture of a bravo or assassin, who is said to have committed 345 murders with his own hand, and to have been accomplice in, or privy to, 400 more. The treasury in the chapel contains also a vast number of pictures, precious stones, medals, vessels of gold and silver, &c. Among other curiosities, here is a cherry stone with 140 heads distinctly engraved upon it. The gardens of the palace are also very fine, and it is said a secret passage leads from it to all the churches and convents in the town. There is a great number of other fine buildings in this city, public and private, particularly the riding house, town house, opera room, the Jesuits college, the large edifice for tournaments, the churches, convents, fountains, &c. Its manufactures are those of silk, particularly velvet, woollen cloths, and tapestry; and it has two annual fairs, at which great quantities of salt, wine, &c. are sold. The streets are broad and regular; and most of the houses well built, and painted on the outside. The market place is extremely beautiful. Not far from Munich are four other palaces, with fine gardens, belonging to the elector, viz. those of Sleisheim, Nymphenburg, Dauchau, and Starenberg. The first and last are about three leagues from the capital; the second about half a league; and the third about two, at a market town of the same name. It was unsuccessfully attacked by the French in 1796.

MUNICH, *Count de*, was the favourite of the czarina Ann, and was concerned in all the events of her reign. Being appointed general of her armies, he gained great advantages over the Crim Tartars, beat the Turks, A. D. 1739, in an engagement near Choczim, and took that city together with Jassi the capital of Moldavia. He was afterwards prime minister to the czar Iwan VI. but in a short time after he was accused of employing the power which his office conferred on him to gratify his own ambition and private resentment. The empress Elizabeth brought him to trial, and he was condemned to lose his life, A. D. 1742. This sentence was mitigated to banishment into Siberia, whither many of the victims of his power had been exiled. He was recalled by Peter III. A. D. 1762, and declared field marshal. Upon the death of this prince, the empress Catharine II. appointed him director general of the ports of the Baltic. He died on the 8th of October 1767, at the age of 84.

MUNICIPAL, in the Roman civil law, an epithet which signifies invested with the rights and privileges of Roman citizens. See MUNICIPIUM.

Municipal, among us, is applied to the laws that obtain in any particular city or province. And those are called *municipal officers* who are elected to defend the interests of cities, to maintain their rights and privileges, and to preserve order and harmony among the citizens; such as mayors, sheriffs, consuls, &c.

MUNICIPES, an appellation given by the Romans to the inhabitants of the *municipia* or municipal cities. See Municipium.

MUNICIPIUM, in Roman antiquity, a corporation borough, or enfranchised city or town, where the inhabitants enjoyed their own laws and customs, and at the same time were honoured with the privileges of Roman citizens; but then this privilege generally reached no further than the bare title. Some indeed, by particular merit, obtained the liberty of votes, which occasioned that distinction of *municipium sine suffragio*, and *municipium cum suffragio*.—The inhabitants of the *municipium sine suffragio* were called barely *Romani*, but those of the *municipium cum suffragio* were called *cives Romani*.

The difference between proper citizens of Rome and the inhabitants of the municipium may be thus expressed. The proper citizens of Rome were, 1. Registered in the census; 2. Had the right of suffrage and of bearing honours; 3. Were assessed in the poll-tax; 4. Served in the legions; 5. Used the Roman laws and religion; 6. Were called *Quirites* and *populus Romanus*: Whereas the municipes enjoyed the three first of these privileges, but were denied the three last.

MUNITION, the provisions with which a place is furnished in order for defence; or that which follows a camp for its subsistence.

Munition Ships, are those that have stores on board in order to supply a fleet of men of war at sea. In an engagement, all the munition ships and victuallers attending the fleet take their station in the rear of all the rest; they are not to engage in the fight, but to attend to such directions as are sent them by the admiral.

Munster, in Latin *Monomia*, and in Irish *Moun*, the most southerly province of Ireland; bounded on the north by Leinster and Connaught, and on the east, west, and south, by the ocean. It contains the counties of Cork, Clare, Kerry, Limerick, Tipperary, and Waterford; and 3,289,932 Irish plantation acres, 740 parishes, 63 baronies, and 26 boroughs. It is about 125 miles long and 120 broad; and its principal town is Cork. Its ancient name was *Mumhan*; and in latter ages it was divided into *Desmond* or South Munster, *Ormond* or East Munster, and *Thomond* or North Munster. It lies between 51. 15. and 53. 0. N. Lat. and 7. 10. and 10. 40. W. Long.

Munster, a territory of Germany in the circle of Westphalia; bounded on the north by Embden and Oldenburg, on the south by the county of Mark and duchy of Westphalia, on the west by the county of Bentheim and the United Provinces, and on the east by the bishoprics of Osnaburg and Paderborn together with the county of Ravensberg. It is the largest of all the Westphalian bishoprics, being in length about 80 miles, and in breadth from 20 to 60. It is divided into 13 bailiwicks: and though in general but a barren country, has some fruitful plains, with woods, and quarries of stone. The inhabitants, excepting a few of the nobility and gentry, are all Roman Catholics; though Lutheranism had once a considerable footing here. The bishop, who is generally also elector of Cologne, has a revenue from hence of about 70,000 pounds, and can maintain 8000 men. In consequence of an unjust custom, unknown in the rest of the empire, he is heir to all strangers who die in the country without children. In the matricula he is rated at 30 foot and 118 horse; or 832 florins monthly in lieu of them. His chapter consists of 40 canons, who are all noble.

Munster, a city of Germany, capital of a bishopric of the same name and of all Westphalia, stands at the conflux of the river Aa with the Ems, in E. Long. 7. 49. N. Lat. 52. 0. It is of a circular form, large, and well fortified both by nature and art. It has a fine citadel called the *Brille*, erected by a bishop named *Bernard van Galen* in order to awe the burghers. The dean and chapter now elect the bishop; but till the beginning of the 13th century he was nominated by the emperor. This city has been rendered famous by three remarkable transactions. 1. By the peace concluded here in 1648, which put an end to a war of 30 years; occasioned by the persecuting spirit of bigotted Papists, who chose rather to plunge their country into all the calamities of war than allow liberty of conscience to the Protestants. By this peace, however, they consented, much against their inclinations, to grant them a toleration. 2. By the disorders and disturbances occasioned here in 1553, by a parcel of enthusiasts, headed by a taylor, called *John of Leyden* from the place of his birth, who turned out the magistrates, and took possession of the city, where they perpetrated the most horrid villanies and cruelties. 3. For the noble, though unsuccessful, efforts it made in defence of its liberties against the tyranny and oppression of the above mentioned turbulent and bloody-minded bishop, Bernard van Galen. In this city are a great number of convents and other religious houses, many of them stately piles, and surrounded with beautiful gardens.

MUNYCHIA, or *Munichius Portus*, in *Ancient Geography*, a village and port of Athens, nearer to the city, fortified in the same manner as the Piræus, to the east of which it lay, or between it and the promontory Sunium, at the mouth of the Ilissus. Strabo says it was an eminence in form of a peninsula, at the foot of which stood three harbours, anciently encompassed with a wall, taking within its extent the Piræus and other harbours, full of docks, with the temple of Diana Munychia; taking its name from *Mynichus*, the founder of the temple.

Munychia, an anniversary solemnity observed at Athens, in honour of Diana, on the 16th of the month Munychion. Cakes were offered on the occasion, called αμφιφωντες.

MUNYCHION, the tenth month of the Athenian year, containing 29 days, and answering to the latter part of our March and the beginning of April. It was so called from the festival Munychia, which was observed in this month. See Month and Munychia.

MUPHTI. See Mufti.

MURÆNA, or Eel; a genus of fishes, belonging to the order of apodes. See Ichthyology *Index*.

MURAL,

MURAL, ſomething belonging to a wall, which the Latins call *murus*.

Mural Crown, among the ancient Romans. See CROWN.

Mural arch, is a wall, or walled arch, placed exactly in the plane of the meridian, i. e. upon the meridian line, for the fixing of a large quadrant, ſextant, or other inſtrument, to obſerve the meridian altitudes, &c. of the heavenly bodies.

Tycho Brahe was the firſt who uſed a mural arch in his obſervations; after him Hevelius, Mr Flamſtead, De la Hire, &c. uſed the ſame means. See ASTRONOMY.

MURANUM, in *Ancient Geography*, a town on the confines of Lucania. Now *Morano*; a citadel in Calabria Citra, at the ſprings of the Sybaris, midway between the Sinus Tarentinus to the eaſt, and the Tuſcan ſea to the weſt. Suppoſed to have ariſen from the ruins of Syphæum, a town of the Bruttii mentioned by Livy.

MURATORI, LEWIS ANTHONY, a learned and celebrated Italian writer, born at Vignoles, in the territory of Bologna, in 1672. He early diſcovered an extreme fondneſs for the learned languages and ſciences; and this was ſeconded by an excellent education. After having completed his firſt ſtudies, he embraced the ſtate of an eccleſiaſtic; and applied himſelf to polite literature, philoſophy, theology, civil law, antiquities, and other ſciences; by which means he became in a manner univerſally learned. He was ſcarcely 22 years of age when he was made librarian of the Ambroſian library at Milan. In 1700 the duke of Modena, his ſovereign, recalled him, and made him his librarian, and keeper of the archives of his duchy. Muratori diſcharged this double employment during the reſt of his life, and had no other benefice than the provoſtſhip of Santa Maria del Pompoſa. The principal of his works are,—1. *Anecdota*, or a collection of pieces taken from the Ambroſian library, 2 vols. 4to, with learned notes and diſſertations. 2. A treatiſe on the perfection of the Italian poetry, 2 vols. 4to. 3. *Anecdota Græca*, 3 vols. 4to. 4. A genealogical hiſtory of the houſe of Modena, 2 vols. folio. 5. An excellent collection of the writers of the Italian hiſtory, 27 vols. folio, with learned notes. 6. Another collection, under the title of *Antiquitates Italicæ*. 7. A collection of ancient inſcriptions, under the title of *Novus Theſaurus*, 6 vols. folio. 8. The annals of Italy, 12 vols. 4to, in Italian, &c. 9. Letters, diſſertations, Italian poems, &c.

MURCIA, the Pagan goddeſs of idleneſs. The name is taken from *murcus* or *murcidus*, an obſolete word, ſignifying a dull, ſlothful, or lazy perſon.—The ſtatues of this goddeſs were always covered with duſt and moſs, to expreſs her idleneſs and negligence. She had a temple in Rome, at the foot of the Aventine mount.

MURCIA, a kingdom in Spain, bounded on the north by New Caſtile, on the eaſt by the kingdom of Valencia, on the weſt by Andaluſia and Granada, and on the ſouth by the Mediterranean ſea. It is about 62 miles in length, and 58 in breadth; and its principal river is the Segura. The ſoil is dry, becauſe it ſeldom rains, and therefore it produces little corn or wine; but there is plenty of oranges, citrons, lemons, olives, almonds, mulberries, rice, pulſe, and ſugar. It has alſo a great deal of ſilk. It was taken from the Moors in 1265. The air is very healthful.

MURCIA, a large, handſome, and populous town of Spain, capital of a kingdom of the ſame name. It is a biſhop's ſee, and contains ſix pariſhes. The cathedral is a moſt ſuperb edifice, with the ſtairs of the ſteeple ſo contrived that a man may ride up to the top, either on horſeback or in a coach. It is ſituated in a pleaſant plain, which abounds in fine gardens about the city, and in which are the beſt fruits in Spain. It is ſeated on the river Segura, in W. Long. 8. 36. N. Lat. 37. 48.

MURDER, or MURTHER, the act of killing another with violence and injuſtice. The word comes from the Saxon *morth* "death;" which ſome will have to ſignify a violent death; whence the barbarous Latin *murdrum* and *modrum*.

Among the number of popular errors, is the notion which has obtained, that the dead body would bleed in the preſence or upon the touch of the murderer.

The crime of murder is puniſhed with death in almoſt all nations.

MURDER, or *Murther*, in law, is thus defined, or rather deſcribed, by Sir Edward Coke: "When a perſon, of ſound memory and diſcretion, unlawfully killeth any reaſonable creature in being, and under the king's peace, with malice aforethought, either expreſs or implied." The beſt way of examining the nature of this crime will be by conſidering the ſeveral branches of this definition.

1. It muſt be committed by a perſon *of ſound memory and diſcretion*: for lunatics or infants are incapable of committing any crime; unleſs in ſuch caſes where they ſhow a conſciouſneſs of doing wrong, and of courſe a diſcretion or diſcernment between good and evil.

2. Next, it happens when a perſon of ſuch ſound diſcretion *unlawfully killeth*. The unlawfulneſs ariſes from the killing without warrant or excuſe: and there muſt alſo be an actual killing to conſtitute murder; for a bare aſſault, with intent to kill, is only a great miſdemeanor, though formerly it was held to be murder. The killing may be by poiſoning, ſtriking, ſtarving, drowning, and a thouſand other forms of death, by which human nature may be overcome. Of theſe the moſt deteſtable of all is poiſon; becauſe it can of all others be the leaſt prevented, either by manhood or forethought. And therefore, by the ſtat. 22 Hen. VIII. c. 9. it was made treaſon, and a more grievous and lingering kind of death was inflicted on it than the common law allowed; namely, *boiling to death*: but this act did not live long, being repealed by 1 Edw. VI. c. 12. There was alſo, by the ancient common law, one ſpecies of killing held to be murder, which may be dubious at this day, as there hath not been an inſtance wherein it has been held to be murder for many ages paſt, viz. bearing falſe witneſs againſt another, with an expreſs premeditated deſign to take away his life, ſo as the innocent perſon be condemned and executed. The Gothic laws puniſhed in this caſe both the judge, the witneſſes, and the proſecutor; and, among the Romans, the *lex Cornelia de ſicariis*, puniſhed the falſe witneſſes with death, as being guilty of a ſpecies of aſſaſſination. And there is no doubt but this is equally murder *in foro conſcientiæ*

Murder.

conſcientiæ as killing with a ſword; though the modern law (to avoid the danger of deterring witneſſes from giving evidence upon capital proſecutions, if it muſt be at the peril of their own lives) has not yet puniſhed it as ſuch. If a man, however, do ſuch an act, of which the probable conſequence may be, and eventually is, death; ſuch killing may be murder, although no ſtroke be ſtruck by himſelf, and no killing may be primarily intended: as was the caſe of the unnatural ſon who expoſed his ſick father to the air againſt his will, by reaſon whereof he died; and of the harlot, who laid her child under leaves in an orchard, where a kite ſtruck and killed it. So too, if a man have a beaſt that is uſed to do miſchief; and he, knowing it, *ſuffers* it to go abroad, and it kills a man; even this is manſlaughter in the owner; but if he have purpoſely *turned it looſe*, though barely to frighten people, and make what is called *ſport*, it is with us (as in the Jewiſh law) as much murder as if he had incited a bear or dog to worry them. If a phyſician or ſurgeon give his patient a potion or plaſter to cure him, which, contrary to expectation, kills him, this is neither murder nor manſlaughter, but miſadventure; and he ſhall not be puniſhed criminally, however liable he might formerly have been to a civil action for neglect or ignorance; but it hath been holden, that if it be not a *regular* phyſician or ſurgeon who adminiſters the medicine, or performs the operation, it is manſlaughter at the leaſt. Yet Sir Matthew Hale very juſtly queſtions the law of this determination; ſince phyſic and ſalves were in uſe before licenſed phyſicians and ſurgeons: wherefore he treats this doctrine as apocryphal, and fitted only to gratify and flatter licentiates and doctors in phyſic; though it may be of uſe to make people cautious and wary how they meddle too much in ſo dangerous an employment. In order alſo to make the killing murder, it is requiſite that the party die within a year and a day after the ſtroke received, or cauſe of death adminiſtered; in the computation of which the whole day upon which the hurt was done ſhall be reckoned the firſt.

3. Farther: The perſon killed muſt be "*a reaſonable creature in being, and under the king's peace*," at the time of the killing. Therefore to kill an alien, a Jew, or an outlaw, who are all under the king's peace or protection, is as much murder as to kill the moſt regular-born Engliſhman; except he be an alien-enemy, in the time of war. To kill a child in its mother's womb, is now no murder, but a great miſpriſion; but if the child be born alive, and dieth by reaſon of the potion or bruiſes it received in the womb, it ſeems, by the better opinion, to be murder in ſuch as adminiſtered or gave them. As to the murder of baſtard children, ſee Bastard.

4. Laſtly, The killing muſt be committed "*with malice aforethought*," to make it the crime of murder. This is the grand criterion which now diſtinguiſhes murder from other killing: and this malice prepenſe, *malitia præcogitata*, is not ſo properly ſpite or malevolence to the deceaſed in particular, as any evil deſign in general; the dictate of a wicked, depraved, and malignant heart; *un diſpoſition à faire une mal choſe:* and it may be either *expreſs*, or *implied*, in law. Expreſs malice is when one, with a ſedate deliberate mind and formed deſign, doth kill another, which formed deſign is evidenced by external circumſtances diſcovering that inward intention; as lying in wait, antecedent menaces, former grudges, and concerted ſchemes to do him ſome bodily harm. This takes in the caſe of deliberate duelling, where both parties meet avowedly with an intent to murder: thinking it their duty, as gentlemen, and claiming it as their right, to wanton with their own lives and thoſe of their fellow creatures; without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man; and therefore the law has juſtly fixed the crime and puniſhment of murder on them, and on their ſeconds alſo. Yet it requires ſuch a degree of paſſive valour to combat the dread of even undeſerved contempt, ariſing from the falſe notions of honour too generally received in Europe, that the ſtrongeſt prohibitions and penalties of the law will never be entirely effectual to eradicate this unhappy cuſtom, till a method be found out of compelling the original aggreſſor to make ſome other ſatisfaction to the affronted party, which the world ſhall eſteem equally reputable as that which is now given at the hazard of the life and fortune, as well of the perſon inſulted, as of him who hath given the inſult. Alſo, if even upon a ſudden provocation one beats another, in a cruel and unuſual manner, ſo that he dies, though he did not intend his death, yet he is guilty of murder by expreſs malice; i. e. by an expreſs evil deſign, the genuine ſenſe of *malitia:* As when a park-keeper tied a boy that was ſtealing wood to a horſe's tail, and dragged him along the park; when a maſter corrected his ſervant with an iron bar, and a ſchoolmaſter ſtamped on his ſcholar's belly, ſo that each of the ſufferers died; theſe were juſtly held to be murders, becauſe the correction being exceſſive, and ſuch as could not proceed but from a bad heart, it was equivalent to a deliberate act of ſlaughter. Neither ſhall he be guilty of a leſs crime who kills another in conſequence of ſuch a wilful act as ſhows him to be an enemy to all mankind in general; as going deliberately, and with an intent to do miſchief, upon a horſe uſed to ſtrike, or coolly diſcharging a gun among a multitude of people. So if a man reſolves to kill the next man he meets, and does kill him, it is murder, although he knew him not; for this is univerſal malice. And if two or more come together to do an unlawful act againſt the king's peace, of which the probable conſequence might be bloodſhed; as to beat a man, to commit a riot, or to rob a park, and one of them kills a man; it is murder in them all, becauſe of the unlawful act, the *malitia præcogitata*, or evil intended beforehand.

Alſo in many caſes where no malice is expreſſed, the law will imply it: as, where a man wilfully poiſons another, in ſuch a deliberate act the law preſumes malice, though no particular enmity can be proved. And if a man kills another ſuddenly, without any, or without a conſiderable provocation, the law implies malice; for no perſon, unleſs of an abandoned heart, would be guilty of ſuch an act upon a ſlight or no apparent cauſe. No affront, by words or geſtures only, is a ſufficient provocation, ſo as to excuſe or extenuate ſuch acts of violence as manifeſtly endanger the life of another. But if the perſon ſo provoked had unfortunately killed the other, by beating him in ſuch a manner as ſhowed only

only an intent to chastise and not to kill him, the law so far considers the provocation of contumelious behaviour, as to adjudge it only manslaughter, and not murder. In like manner, if one kills an officer of justice, either civil or criminal, in the execution of his duty, or any of his assistants endeavouring to conserve the peace, or any private person endeavouring to suppress an affray or apprehend a felon, knowing his authority or the intention with which he interposes, the law will imply malice, and the killer shall be guilty of murder. And if one intends to do another felony, and undesignedly kills a man, this is also murder. Thus if one shoots at A, and misses him, but kills B, this is murder; because of the previous felonious intent, which the law transfers from one to the other. The same is the case, where one lays poison for A, and B, against whom the prisoner had no malicious intent, takes it, and it kills him, this is likewise murder. So also, if one give a woman with child a medicine to procure abortion, and it operates so violently as to kill the woman, this is murder in the person who gave it. It were endless to go through all the cases of homicide, which have been adjudged, either expressly or impliedly, malicious: these therefore may suffice as a specimen; and we may take it for a general rule, that all homicide is malicious, and of course amounts to murder, unless where justified by the command or permission of the law; excused on a principle of accident or self-preservation; or alleviated into manslaughter, by being either the involuntary consequence of some act, not strictly lawful, or (if voluntary) occasioned by some sudden and sufficiently violent provocation. And all these circumstances of justification, excuse, or alleviation, it is incumbent upon the prisoner to make out, to the satisfaction of the court and jury, the latter of whom are to decide whether the circumstances alleged are proved to have actually existed; the former, how far they extend to take away or mitigate the guilt. For all homicide is presumed to be malicious, until the contrary appeareth upon evidence.

The punishment of murder, and that of man-slaughter, were formerly one and the same; both having the benefit of clergy; so that none but unlearned persons, who least knew the guilt of it, were put to death for this enormous crime. But now, by several statutes, the benefit of clergy is taken away from murderers through malice prepense, their abettors, procurers, and counsellors. In atrocious cases it was frequently usual for the court to direct the murderer, after execution, to be hung upon a gibbet in chains near the place where the fact was committed; but this was no part of the legal judgement; and the like is still sometimes practised in the case of notorious thieves. This, being quite contrary to the express command of the Mosaical law, seems to have been borrowed from the civil law; which, besides the terror of the example, gives also another reason for this practice, viz. that it is a comfortable sight to the relations and friends of the deceased. But now, in England, it is enacted by statute 25 Geo. II. c. 37. that the judges, before whom any person is found guilty of wilful murder, shall pronounce sentence immediately after conviction, unless he sees cause to postpone it; and shall in passing sentence direct him to be executed on the next day but one (unless the same shall be Sunday, and then on the Monday following), and that his body be delivered to the surgeons to be dissected and anatomized; and that the judge may direct his body to be afterwards hung in chains, but in nowise to be buried without dissection. And, during the short but awful interval between sentence and execution, the prisoner shall be kept alone, and sustained with only bread and water. But a power is allowed to the judge, upon good and sufficient cause, to respite the execution, and relax the other restraints of this act. See farther, PARRICIDE, and *PETIT Treason*.

MURDERERS, or *Murdering Pieces*, in a ship, are small pieces of ordnance, either of brass or iron, which have chambers put in at their breeches. They are used at the bulk-heads of the fore-castle, half-deck, or steerage, in order to clear the deck, on the ship's being boarded by an enemy.

MURENA. See MURÆNA, ICHTHYOLOGY *Index*.

MURENGERS, two officers of great antiquity in the city of Chester, annually chosen out of the aldermen, to see that the walls are kept in repair, and to receive a certain toll and custom for the maintenance thereof.

MUREX, a genus of animals belonging to the order of vermes testacea. See CONCHOLOGY *Index*.

MUREX, a caltrap or iron instrument, with sharp points projecting in every direction, used by the Romans as a defence against the enemy's horse. It was so called, probably, because the points bore some resemblance to the spines and tubercles with which the shell of the fish murex is surrounded.

MURGI, or MURGIS, in *Ancient Geography*, the last town of Bætica, next the Tarraconensis: the Urce of Ptolemy. Now *Muxara*, a port-town of Granada, on the Mediterranean. W. Long. 1° 50′. N. Lat. 37° 6′.

MURIA, the Latin name of common salt. See SODA, *Muriate of*, CHEMISTRY *Index*.

MURINA, or MURINES, a delicious sweet wine, medicated with spices, and the usual drink of the ladies of antiquity.

MURRAIN, or GARGLE, a contagious disease among cattle. See FARRIERY *Index*.

MURRAY, or MORAY, the name of a district in the north of Scotland, which, in a former division of the kingdom, was denominated a province. This district includes the counties of Banff, Elgin and Nairn. The county of Elgin, the middle division of this district, is still known by the name of Morayshire.

MURRHINE, MURRHINUS, Μοῤῥινος, in antiquity, an appellation given to a delicate sort of ware brought from the east, whereof cups and vases were made, which added not a little to the splendour of the Roman banquets.

Critics are divided concerning the matter of the pocula or vasa murrhina, murrina, or murrea. Some will have them to have been the same with our porcelain or china ware.

The generality held them to have been made of some precious kind of stone, which was found chiefly, as Pliny tells us, in Parthia, but more especially in Carmania. Arrian tells us, that there was a great quantity of them made at Diospolis in Egypt. This he calls another sort of murrhina work; and it is evident, from all accounts, that the murrhina of Diospolis was a sort of

Murrhine || Musæus.

of glass ware, made in imitation of the porcelain or murrha of India. There is some difference in the accounts given by Pliny and Martial of the murrhina vasa. The first author says, that they would not bear hot liquors, but that only cold ones were drank out of them. The latter, on the other hand, tells us, that they bore hot liquors very well. If we credit Pliny's account, their porcelain was much inferior to our's in this particular. Some conjecture them to have been of agate, others of onyx, others of coral. Baronius, doubtless, was farthest out of the way, when he took them to be made of myrrh, congealed and hardened. Some have supposed these vessels to be made of crystal, but this is contrary to the account of all the ancients. The Greeks had the words κρυσαλλος, for crystal, and σμυρνε for myrrh, very common among them; and therefore, if these vessels had been made of either of these substances, they would in some places have called them symrna or crystalline. On the contrary, the most correct among them call them murrhina or morrina. The cups made of crystal, which were also in use at those times were called crystallina, and these murrhina or murrhæa, by way of keeping up the distinction; and Martial tells us, that the stone they were made of was spotted or variegated, calling them pocula maculosæ murræ. And Statius mentions the crystalline and murrhine cups in the same sentence, but as different things, not the same. Arrian mentions also the λιθος μορρια; which his interpreters censure as an error of the copies, and would alter into myrrha, the name of the gum myrrh.

Pompey is recorded as the first who brought these murrhine vessels out of the east, which he exhibited in his triumph, and dedicated to Jupiter Capitolinus. But private persons were not long without them. So fond, in effect, did the Roman gentry grow of them, that a cup which held three sextaries was sold for 70 talents. T. Petronius, before his death, to spite Nero (or as Pliny expresses it, *ut mensam ejus exhæredaret*, to disinherit his table), broke a bason, *trulla murrhina*, valued at 300 talents, on which that emperor had set his heart.

MUS, a genus of quadrupeds belonging to the order of *Glires*. See MAMMALIA *Index*.

MUSA, the PLANTAIN-TREE; a genus of plants belonging to the polyandria class; and in the natural method ranking under the eighth order, *Scitamineæ*. See BOTANY *Index*.

MUSÆUS, an ancient Greek poet, was, according to Plato and Diodorus Siculus, an Athenian, the son of Orpheus, and chief of the Eleusinian mysteries instituted at Athens in honour of Ceres: or, according to others, he was only the disciple of Orpheus: but from the great resemblance which there was between his character and talents and those of his master, by giving a stronger outline to the figure he was called his *son*, as those were styled the *children of Apollo* who cultivated the arts of which he was the tutelar god.

Musæus is allowed to have been one of the first poets who versified the oracles. He is placed in the Arundelian marbles, epoch 15. 1426 B. C. at which time his hymns are there said to have been received in the celebration of the Eleusinian mysteries. Laertius tells us, that Musæus not only composed a theogony, but formed a sphere for the use of his companions; yet as this honour is generally given to Chiron, it is more natural to suppose, with Sir Isaac Newton, that he enlarged it with the addition of several constellations after the conquest of the golden fleece. The sphere itself shows that it was delineated after the Argonautic expedition, which is described in the asterisms, together with several other more ancient histories of the Greeks, and without any thing later; for the ship Argo was the first long vessel which they had built: hitherto they had used round ships of burthen, and kept within sight of the shore; but now, by the dictates of the oracle, and consent of the princes of Greece, the flower of that country sail rapidly through the deep, and guide their ship by the stars.

Musæus || Muschenbroeck.

Burney's History of Music.

Musæus is celebrated by Virgil in the character of hierophant, or priest of Ceres, at the head of the most illustrious mortals who have merited a place in Elysium. Here he is made the conductor of Æneas to the recess where he meets the shade of his father Anchises.

A hill near the citadel of Athens was called *Musæum*, according to Pausanias, from Musæus, who used to retire thither to meditate and compose his religious hymns; at which place he was afterwards buried. The works which went under his name, like those of Orpheus, were by many attributed to Onomacritus. Nothing remains of this poet now, nor were any of his writings extant in the time of Pausanias, except a hymn to Ceres, which he made for the Lycomides. And as these hymns were likewise set to music, and sung in the mysteries by Musæus himself in the character of priest, he thence perhaps acquired from future times the title of *musician*, as well as of *poet*; the performance of sacred music being probably at first confined to the priesthood in these celebrations, as it had been before in Egypt, whence they originated. However, he is not enumerated among ancient musicians by Plutarch; nor does it appear that he merited the title of *son* and *successor to Orpheus* for his musical abilities, so much as for his poetry, piety, and profound knowledge in religious mysteries.

MUSCA, the FLY; a genus of insects belonging to the order of diptera. See ENTOMOLOGY *Index*.

MUSCA, a name given to such persons among the Romans as officiously thrust themselves into the company of their superiors and those who despised them, by finding means of getting admittance to entertainments without invitation, and without a welcome: So that *muscæ* were the same as parasites, who were frequently by the Greeks termed Μυιαι. See PARASITE.

MUSCADINE, a rich wine, of the growth of Provence, Languedoc, Cividad, &c.—The word is supposed to be derived from *musk*; the wine being supposed to have a little of the smell of that perfume; others from *musca*, "a fly," because the flies are extremely fond of its grapes; as the Latins had their *vinum apianum*, so called *ab apibus*, from the bees which fed on it.

The process for making muscadine at Frontignac, is the following: The muscadine grapes are allowed half dried on the vine; and as soon as they are gathered, they are trod and pressed, and the liquor is tunned, without letting it stand to ferment in the fat; the lee which remains is supposed to produce the peculiar flavour of this wine.

MUSCHENBROECK, PETER DE, a very distinguished natural philosopher and mathematician, was born

born at Utrecht a little before 1700. He was first professor in his own university, and afterwards invited to the chair at Leyden, where he died full of reputation and honours in 1761. He was a member of several academies; particularly the Academy of Sciences at Paris. He was the author of several works in Latin, which are frequently referred to, and all of which discover great penetration and exactness of the subjects of which he treats. He was also consummate in the knowledge of law.

MUSCI, MOSSES, one of the orders of the class cryptogamia; which see, BOTANY *Index*.—The ancients took the moss of trees to be the effect of a disorder or discomposure of the texture of the bark; or at most a kind of little filaments arising from the bark: but the moderns find, by more accurate observation, that mosses are real distinct plants, whose seed, being extremely small, is enclosed in little capsules; which bursting of themselves, the seed is carried off by the winds; till, falling into the inequalities of the bark of trees, it is there stopped, takes root, and feeds at the expence of the tree, as mouldiness does on bread, &c.

MUSCLE, or MUSSEL. See MYTULUS, CONCHOLOGY *Index*.

MUSCOVY. See RUSSIA.

Muscovy Glass, or GLIMMER. See MICA, MINERALOGY *Index*.

MUSCULUS, a military machine, made use of by the Romans to cover and protect the soldiers while they approached and undermined the walls of besieged places, or filled the ditches. It seems to have resembled the testudo in form, but was smaller in size. See TESTUDO.

MUSEIA, were Grecian festivals in honour of the Muses, celebrated with games every fifth year, particularly by the Thespians. The Macedonians also observed a festival of the same name in honour of Jupiter and the Muses, which lasted for nine days, and was celebrated with stage plays, songs, and poetical compositions.

MUSES, certain fabulous deities among the Pagans, supposed to preside over the arts and sciences: for this reason it is usual for the poets, at the beginning of a poem, to invoke these goddesses to their aid.

The Muses were originally only singers and musicians in the service of Osiris, or the great Egyptian Bacchus, under the instruction and guidance of his son Orus; but in succeeding times they were called the *daughters of Jupiter and Mnemosyne* or *Memory*.

These are the only pagan divinities whose worship has been continued through all succeeding changes in the religion and sentiments of mankind. Professors of every liberal art in all the countries of Europe still revere them; particularly the poets, who seldom undertake the slightest work without invoking their aid.

Sir Isaac Newton tells us, that the singing women of Osiris were celebrated in Thrace by the name of the *Muses;* and that the daughters of Pierius, a Thracian, imitating them, were celebrated by the same name.

Diodorus Siculus informs us, that Alcman of Messene, a lyric poet who flourished in the 27th Olympiad, 670 years B. C. makes them the daughters of Uranus and Terra. It has been asserted by some ancient writers, that at first they were only three in number; but Homer, Hesiod, and other profound mythologists, admit of nine (A).

In his hymn to Apollo, Homer says,

> ——By turns the *nine* delight to sing.

And Hesiod, in his Theogony, names them all.—They are said severally to preside over some art or science, as music, poetry, dancing, astronomy. By some they are called *virgins*, because the virtues of education appear unalterable: they are called *muses* from a Greek word which signifies to explain mysteries, because they have taught things the most curious and important to know, and which are above the comprehension of vulgar minds. Each of their names is said to include some particular allegory; *Clio*, for instance, has been thus called, because those who are praised in verse acquire immortal fame; *Euterpe*, on account of the pleasure accruing to those who hear learned poetry; *Thalia* implies for ever flourishing; *Melpomene*, that her melody insinuates itself into the inmost recesses of the soul; *Terpsichore* marks the pleasure which those receive who are versed in the liberal arts; *Erato* seems to indicate, that the learned command the esteem and friendship of all mankind; *Polyhymnia*, that many poets are become immortal by the number of hymns which they have addressed to the gods; *Urania*, that those whom she instructs elevate their contemplations and celebrity to the heavens and the stars; and lastly, the exquisite voice of *Calliope* has acquired her that appellation, as the inventress and guardian of eloquence and rhetoric. *Burney's Hist. of Music.*

An epigram of Callimachus gives the attributes of the Muses in as many lines.

> *Calliope* the deeds of heroes sings;
> Great *Clio* sweeps to history the strings;
> *Euterpe* teaches mimes their silent show;
> *Melpomene* presides o'er scenes of wo;
> *Terpsichore* the flute's soft pow'r displays;
> And *Erato* gives hymns the gods to praise;
> *Polymnia's* skill inspires melodious strains:
> *Urania* wise, the starry course explains;
> And gay *Thalia's* glass points out where folly reigns.

This epigram does not, however, exactly correspond with the ideas of other poets, or of the ancient painters, in characterizing the attributes of the Muses. The ancients had numberless ingenious and fanciful ideas concerning the Muses, which we have not room to recite.—"It seems (says the abbé Barthelemi †) as if the first poets, enchanted with the beauties of nature, occasionally were led to invoke the nymphs of the woods, hills, and fountains; and that yielding to the prevailing taste for allegory, they gave them names relative to the influence

† Travels of Anacharsis, vol. iii. p. 261.

(A) It has been said, that when the citizens of Sicyon directed three skilful statuaries to make each of them statues of the three Muses, they were all so well executed, that they did not know which to choose, but erected all the nine, and that Hesiod and Homer only gave them names.

Museum. fluence they might be supposed to have over the productions of the mind. At first three Muses only were admitted, Melete, Mneme, and Aœde: that is to say, the meditation or reflection necessary to study; memory, which records illustrious deeds; and song, which accompanies their recital. In proportion as improvement was made in the art of versification, its characters and effects were personified, the number of the Muses increased, and the names they now received referred to the charms of poetry, its celestial origin, the beauty of its language, the pleasure and gaiety it inspires, the song and dance which add to it new charms, and the glory with which it is crowned. Afterwards were associated with them the Graces, whose employment it is to embellish poetry, and Love who is so frequently its object. These ideas took birth in a barbarous country, in Thrace, where Orpheus, Linus, and their disciples, suddenly appeared in the midst of ignorance. The Muses were honoured there on the Pierian mount; and extending their dominion, successively took their stations on Pindus, Parnassus, Helicon, and all those solitary places where the painters of nature, surrounded by the most pleasing images, experience the divine glow of inspiration."

Pythagoras, and afterwards Plato, make the Muses the soul of the planets in our system; from whence the imaginary music of the spheres.

MUSEUM, a name which originally signified a part of the palace of Alexandria, which took up at least one-fourth of the city. This quarter was called the *museum*, on account of its being set apart for the Muses and the study of the sciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the sciences of which they were the professors; and to each of these houses or colleges was allotted a handsome revenue. The foundation of this establishment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word *museum* is now applied to any place set apart as a repository for things that have an immediate relation to the arts.

The museum at Oxford, called the *Ashmolean museum*, is a noble pile of building, erected at the expence of the university, at the west end of the theatre, at which side it has a magnificent portal, sustained by pillars of the Corinthian order. The front, which is to the street, extends about 60 feet, where there is this inscription over the entrance in gilt characters, *Museum Ashmoleanum, schola naturalis historiæ, officina chymica*. It was begun in 1679, and finished in 1683, when a valuable collection of curiosities was presented to the university by Elias Ashmole, Esq. which were the same day reposited there: several accessions have been since made to the museum; among which are hieroglyphics, and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curiosities.

For an account of the British museum, see LONDON, N° 146.

Mushroom. MUSHROOM. See FUNGI, BOTANY *Index*.

To try the quality of mushrooms:—Take an onion, and strip the outer skin, and boil it with your mushrooms: if the onion become blue or black, there are certainly dangerous ones amongst them; if it remain white, they are good.

MUSIC;

Definition. THE art of combining sounds in a manner agreeable to the ear. This combination may be either simultaneous or successive: in the first case, it constitutes harmony; in the last, melody. But though the same sounds, or intervals of sound, which give pleasure when heard in succession, will not always produce the same effect in harmony; yet the principles which constitute the simpler and more perfect kinds of harmony, are almost, if not entirely, the same with those of melody. By *perfect harmony*, we do not here mean that plenitude, those complex modifications of harmonic sound, which are admired in practice; but that harmony which is called *perfect* by theoricians and artists; that harmony which results from the coalescence of simultaneous sounds produced by vibrations in the proportions of thirds, fifths, and octaves, or their duplicates.

The principles upon which these various combinations of sound are founded, and by which they are regulated, constitute a science, which is not only extensive but profound, when we would investigate the principles from whence these happy modifications of sound result, and by which they are determined; or when we would explore the sensations, whether mental or corporeal, with which they affect us. The ancient definitions of music are not proportioned in their extent to our present ideas of that art; but M. Rousseau betrays a temerity highly inconsistent with the philosophical character, when from thence he infers, that their ideas were vague and undetermined. Every soul susceptible of refinement and delicacy in taste or sentiment, must be conscious that there is a music in action as well as in sound; and that the ideas of beauty and decorum, of harmony and symmetry, are, if we may use the expression, equally constituent of visible as of audible music. Those illustrious minds, whose comprehensive prospects in every science where taste and propriety prevail took in nature at a single glance, would behold with contempt and ridicule those narrow and microscopic views of which alone their successors in philosophy have discovered themselves capacious. With these definitions, however, we are less concerned, as they bear no proportion to the ideas which are now entertained of music. Nor can we follow M. Rousseau, from whatever venerable sources his authority may be derived, in adopting his Egyptian etymology for the word *music*. The established derivation from *Musa* could only be questioned by a paradoxical genius. That music had been practised in Egypt before it was known as an art in Greece, is indeed a fact which cannot be questioned; but it does not thence follow that the Greeks had borrowed the name as well as the art

from

from Egypt. If the art of mufic be fo natural to man that vocal melody is practifed wherever articulate founds are ufed, there can be little reafon for deducing the idea of mufic from the whiftling of winds through the reeds that grew on the river Nile. And indeed, when we reflect with how eafy a tranfition we may pafs from the accents of fpeaking to diatonic founds; when we obferve how early children adapt the language of their amufements to meafure and melody, however rude; when we confider how early and univerfally thefe practices take place—there is no avoiding the conclufion, that the idea of mufic is connatural to man, and implied in the original principles of his conftitution. We have already faid, that the principles on which it is founded, and the rules by which it is conducted, conftitute a fcience. The fame maxims when applied to practice form an art: hence its firft and moft capital divifion is into *fpeculative* and *practical* mufic.

Speculative mufic is, if we may be permitted to ufe the expreffion, the knowledge of the nature and ufe of thofe materials which compofe it; or, in other words, of all the different relations between the high and low, between the harfh and the fweet, between the fwift and the flow, between the ftrong and the weak, of which founds are fufceptible: relations which, comprehending all the poffible combinations of mufic and founds, feem likewife to comprehend all the caufes of the impreffions which their fucceffion can make upon the ear and upon the foul.

Practical mufic is the art of applying and reducing to practice thofe principles which refult from the theory of agreeable founds, whether fimultaneous or fucceffive; or, in other words, to conduct and arrange founds according to the proportions refulting from confonance, from duration and fucceffion, in fuch a manner as to produce upon the ear the effect which the compofer intends. This is the art which we call *compofition* *. With refpect to the actual production of founds by voices or inftruments, which is called *execution*, this department is merely mechanical and operative: which, only prefuppofing the powers of founding the intervals true, of exactly proportioning their degrees of duration, of elevating or depreffing founds according to thofe gradations which are prefcribed by the tone, and to the value required by the time, demands no other knowledge but a familiar acquaintance with the characters ufed in mufic, and a habit of expreffing them with promptitude and facility.

* See *Compofition*.

Speculative mufic is likewife divided into two departments; viz. the knowledge of the proportions of founds or their intervals, and that of their relative durations; that is to fay, of meafure and of time.

The firft is what among the ancients feems to have been called *harmonical* mufic. It fhows in what the nature of air or melody confifts; and difcovers what is confonant or difcordant, agreeable or difagreeable, in the modulation. It difcovers, in a word, the effects which founds produce on the ear by their nature, by their force, and by their intervals; which is equally applicable to their confonance and their fucceffion.

The fecond has been called *rhythmical*, becaufe it treats of founds with regard to their time and quantity. It contains the explication of their continuance, of their proportions, of their meafures, whether long or fhort, quick or flow, of the different modes of time and the parts into which they are divided, that to thefe the fucceffion of founds may be conformed.

Practical mufic is likewife divided into two departments, which correfpond to the two preceding.

That which anfwers to *harmonical* mufic, and which the ancients called *melopée*, teaches the rules for combining and varying the intervals, whether confonant or diffonant, in an agreeable and harmonious manner.

The fecond, which anfwers to the *rhythmical* mufic, and which they called *rhythmopée*, contains the rules for applying the different modes of time, for underftanding the feet by which verfes were fcanned, and the diverfities of meafure; in a word, for the practice of the rhythmus.

Mufic is at prefent divided more fimply into *melody* and *harmony*; for fince the introduction of *harmony*, the proportion between the length and fhortnefs of founds, or even that between the diftance of returning cadences, are of lefs confequence amongft us. For it often happens in modern languages, that the verfes affume their meafures from the mufical air, and almoft entirely lofe the fmall fhare of proportion and quantity which in themfelves they poffefs.

By melody the fucceffions of found are regulated in fuch a manner as to produce pleafing airs. See MELODY.

Harmony confifts in uniting to each of the founds, in a regular fucceffion, two or more different founds, which fimultaneoufly ftriking the ear foothe it by their concurrence. See HARMONY.

Mufic, according to Rouffeau, may be, and perhaps likewife ought to be, divided into the *phyfical* and the *imitative*. The firft is limited to the mere mechanifm of founds, and reaches no farther than the external fenfes, without carrying its impreffions to the heart, and can produce nothing but corporeal fenfations more or lefs agreeable. Such is the mufic of fongs, of hymns, of all the airs which only confift in combinations of melodious founds, and in general all mufic which is merely harmonious.

It may, however, be queftioned, whether every found, even to the moft fimple, is not either by nature or by early and confirmed affociation, *imitative*. If we may truft our own feelings, there is no fuch thing in nature as mufic which gives mechanical pleafure alone. For if fo, it muft give fuch pleafure as we receive from taftes, from odours, or from other grateful titillations; but we abfolutely deny that there are any mufical fenfations or pleafures in the fmalleft degree analogous to thefe. Let any piece of mufic be refolved into its elementary parts and their proportions, it will then eafily appear from this analyfis, that fenfe is no more than the vehicle of fuch perceptions, and that mind alone can be fufceptible of them. It may indeed happen, from the number of the performers and the complication of the harmony, that meaning and fentiment may be loft in the multiplicity of founds; but this, though it may be harmony, lofes the name of *mufic*.

The fecond department of this divifion, by lively and accentuated inflections, and by founds which may be faid to fpeak, expreffes all the paffions, paints every poffible picture, reflects every object, fubjects the whole of nature to its fkilful imitations, and impreffes even on the heart and foul of man fentiments proper to affect them in the moft fenfible manner. This, continues

nues he, which is the genuine lyric and theatrical music, was what gave double charms and energy to ancient poetry; this is what, in our days, we exert ourſelves in applying to the drama, and what our fingers execute on the ſtage. It is in this muſic alone, and not in harmonics or the reſonance of nature, that we muſt expect to find accounts of thoſe prodigious effects which it formerly produced.

But, with M. Rouſſeau's permiſſion, all muſic which is not in ſome degree characteriſed by theſe pathetic and imitative powers, deſerves no better name than that of a *muſical jargon*, and can only be effectuated by ſuch a complication and intricacy of harmony, as may confound, but cannot entertain the audience. This character, therefore, ought to be added as eſſential to the definition of muſic; and it muſt be attributed to our neglect of this alone, whilſt our whole attention is beſtowed on harmony and execution, that the beſt performances of our artiſts and compoſers are heard with liſtleſs indifference and oſcitation, nor ever can conciliate any admirers, but ſuch as are induced, by pedantry and affectation, to pretend what they do not feel. Still may the curſe of indifference and inattention purſue and harrow up the ſouls of every compoſer or performer, who pretends to regale our ears with this muſical legerdemain, till the grin of ſcorn, or the hiſs of infamy, teach them to correct this depravity of taſte, and entertain us with the voice of nature!

Whilſt moral effects are ſought in the natural effects of ſound alone, the ſcrutiny will be vain, and diſputes will be maintained without being underſtood: but ſounds, as repreſentatives of objects, whether by nature or aſſociation, introduce new ſcenes to the fancy and new feelings to the heart; not from their mechanical powers, but from the connection eſtabliſhed by the Author of our frame between ſounds and the object which either by natural reſemblance or unavoidable aſſociation they are made to repreſent.

It would ſeem that muſic was one of thoſe arts which were firſt diſcovered: and that vocal was prior to inſtrumental muſic, if in the earlieſt ages there was any muſic which could be ſaid to be purely inſtrumental. For it is more than probable, that muſic was originally formed to be the vehicle of poetry; and of conſequence, though the voice might be ſupported and accompanied by inſtruments, yet muſic was never intended for inſtruments alone.

We are told by ancient authors, that all the laws, whether human or divine, exhortations to virtue, the knowledge of the characters and actions of gods and heroes, the lives, and atchievements of illuſtrious men, were written in verſe, and ſung publicly by a quire to the ſound of inſtruments; and it appears from the Scriptures, that ſuch from the earlieſt times was the cuſtom among the Iſraelites. Nor was it poſſible to find means more efficacious for impreſſing on the mind of man the principles of morals, and inſpiring the love of virtue. Perhaps, however, this was not the reſult of a premeditated plan; but inſpired by ſublime ſentiments and elevation of thought, which in accents that were ſuited and proportioned to their celeſtial nature endeavoured to find a language worthy of themſelves and expreſſive of their grandeur.

It merits attention, that the ancients were duly ſenſible of the value and importance of this divine art, not only as a ſymbol of that univerſal order and ſymmetry which prevails through the whole frame of material and intelligent nature, but as productive of the moſt momentous effects both in moral and political life. Plato and Ariſtotle, who diſagreed almoſt in every other maxim of politics, are unanimous in their approbation of muſic, as an efficacious inſtrument in the formation of the public character and in conducting the ſtate; and it was the general opinion, that whilſt the gymnaſtic exerciſes rendered the conſtitution robuſt and hardy, muſic humaniſed the character, and ſoftened thoſe habits of roughneſs and ferocity by which men might otherwiſe have degenerated into ſavages. The gradations by which voices were exerted and tuned, by which the invention of one inſtrument ſucceeded to another, or by which the principles of muſic were collected and methodiſed in ſuch a manner as to give it the form of an art and the dignity of a ſcience, are topics ſo fruitful of conjecture and ſo void of certainty, that we muſt leave them to employ minds more ſpeculative and inventions more prolific than ours, or transfer them to the *Hiſtory* of Muſic as a more proper place for ſuch diſquiſitions. For the amuſement of the curious, Rouſſeau in his *Muſical Dictionary*, Plates C and N, has tranſcribed ſome fragments of Grecian, Perſian, American, Chineſe, and Swiſs muſic, with which performers may entertain themſelves at leiſure. When they have tried the pieces, it is imagined they will be leſs ſanguinely fond than that author of aſcribing the power of muſic to its affinity with the national accents where it is compoſed. This may doubtleſs have its influence; but there are other cauſes more permanent and leſs arbitrary to which it owes its moſt powerful and univerſal charms.

The muſic now moſt generally celebrated and practiſed is that of the Italians, or their ſucceſsful imitators. The Engliſh, from the invaſion of the Saxons, to that more late though lucid era in which they imbibed the art and copied the manner of the Italians, had a muſic which neither pleaſed the ſoul nor charmed the ear. The primitive muſic of the French deſerves no higher panegyric. Of all the barbarous nations, the Scots and Iriſh ſeem to have poſſeſſed the moſt affecting original muſic. The firſt conſiſts of a melody characteriſed by tenderneſs: It melts the ſoul to a pleaſing penſive languor. The other is the native expreſſion of grief and melancholy. Taſſoni informs us, that in his time a prince from Scotland had imported into Italy a lamentable kind of muſic from his own country; and that he himſelf had compoſed pieces in the ſame ſpirit. From this expreſſive though laconic deſcription, we learn, that the character of our national muſic was even then eſtabliſhed; yet ſo groſs is our ignorance and credulity, that we aſcribe the beſt and moſt impaſſioned airs which are extant among us to David Rizzio; as if an Italian lutaniſt, who had lived ſo ſhort a time in Scotland, could at once, as it were by inſpiration, have imbibed a ſpirit and compoſed in a manner ſo different from his own. It is yet more ſurpriſing that Geminiani ſhould have entertained and publiſhed the ſame prejudice, upon the miſerable authority of popular tradition alone; for the fact is authenticated by no better credentials. The primitive muſic of the Scots may be divided into the *martial*, the *paſtoral*, and the *feſtive*. The *firſt* conſiſts either

either in marches, which were played before the chieftains, in imitation of the battles which they fought, or in lamentations for the cataſtrophes of war and the extinction of families. Theſe wild effuſions of natural melody preſerve ſeveral of the rules preſcribed for compoſition. The ſtrains, though rude and untutored, are frequently terrible or mournful in a very high degree. The port or march is ſometimes in common, ſometimes in treble time; regular in its meaſures, and exact in the diſtance between its returning cadences; moſt frequently, though not always, loud and briſk. The *pibroch*, or imitation of battles, is wild, and abrupt in its tranſitions from interval to interval and from key to key; various and deſultory in its movements; frequently irregular in the return of its cadences; and in ſhort, through the whole, ſeems inſpired with ſuch fury and enthuſiaſm, that the hearer is irreſiſtibly infected with all the rage of precipitate courage, notwithſtanding the rudeneſs of the accents by which it is kindled. To this the *paſtoral* forms a ſtriking contraſt. Its accents are plaintive, yet ſoothing; its harmony generally flat; its modulations natural and agreeable; its rhythmus ſimple and regular; its returning cadences at equal diſtance; its tranſitions from one concinnous interval to another, at leaſt for the moſt part; its movements ſlow, and may be either in common or treble time. It ſcarcely admits of any other harmony than that of a ſimple baſs. A greater number of parts would cover the air and deſtroy the melody. To this we ſhall add what has been ſaid upon the ſame ſubject by Dr Franklin. Writing to Lord K———, he proceeds thus:

"Give me leave, on this occaſion, to extend a little the ſenſe of your poſition, 'That melody and harmony are ſeparately agreeable, and in union delightful;' and to give it as my opinion, that the reaſon why the Scotch tunes have lived ſo long, and will probably live for ever (if they eſcape being ſtifled in modern affected ornament), is merely this, that they are really compoſitions of melody and harmony united, or rather that their melody is harmony. I mean, the ſimple tunes ſung by a ſingle voice. As this will appear paradoxical, I muſt explain my meaning. In common acceptation, indeed, only an agreeable *ſucceſſion* of ſounds is called *melody;* and only the *coexiſtence* of agreeable ſounds, *harmony*. But ſince the memory is capable of retaining for ſome moments a perfect idea of the pitch of a paſt ſound, ſo as to compare it with the pitch of a ſucceeding ſound, and judge truly of their agreement or diſagreement, there may and does ariſe from thence a ſenſe of a harmony between the preſent and paſt ſounds, equally pleaſing with that between two preſent ſounds. Now the conſtruction of the old Scotch tunes is this, that almoſt every ſucceeding emphatical note is a third, a fifth, an octave, or in ſhort ſome note that is in concord with the preceding note. Thirds are chiefly uſed, which are very pleaſing concords. I uſe the word *emphatical*, to diſtinguiſh thoſe notes which have a ſtreſs laid on them in ſinging the tune, from the lighter connecting notes that ſerve merely, like grammar-articles in common ſpeech, to tack the whole together.

"That we have a moſt perfect idea of a ſound juſt paſt, I might appeal to all acquainted with muſic, who know how eaſy it is to repeat a ſound in the ſame pitch with one juſt heard. In tuning an inſtrument, a good ear can as eaſily determine that two ſtrings are in uniſon by ſounding them ſeparately, as by ſounding them together; their diſagreement is alſo as eaſily, I believe I may ſay more eaſily and better diſtinguiſhed when ſounded ſeparately; for when ſounded together, though you know by the beating that one is higher than the other, you cannot tell which it is. I have aſcribed to memory the ability of comparing the pitch of a preſent tone with that of one paſt. But if there ſhould be, as poſſibly there may be, ſomething in the ear ſimilar to what we find in the eye, that ability would not be entirely owing to memory. Poſſibly the vibrations given to the auditory nerves by a particular ſound may actually continue for ſome time after the cauſe of theſe vibrations is paſt, and the agreement or diſagreement of a ſubſequent ſound become by compariſon with them more diſcernible. For the impreſſion made on the viſual nerves by a luminous object will continue for 20 or 30 ſeconds."

After ſome experiments to prove the permanency of viſible impreſſions, he continues thus:

"Farther, when we conſider by whom theſe ancient tunes were compoſed, and how they were firſt performed, we ſhall ſee that ſuch harmonical ſucceſſion of ſounds was natural and even neceſſary in their conſtruction. They were compoſed by the minſtrels of thoſe days, to be played on the harp accompanied by the voice. The harp was ſtrung with wire, which gives a ſound of long continuance; and had no contrivance like that of the modern harpſichord, by which the ſound of the preceding note can be ſtopt the moment a ſucceeding note begins. To avoid actual diſcord, it was therefore neceſſary that the ſucceeding emphatic note ſhould be a chord with the preceding, as their ſounds muſt exiſt at the ſame time. Hence aroſe that beauty in thoſe tunes that has ſo long pleaſed, and will pleaſe for ever, though men ſcarce know why. That they were originally compoſed for the harp, and of the moſt ſimple kind, I mean a harp without any half-notes but thoſe in the natural ſcale, and with no more than two octaves of ſtrings, from C to C, I conjecture from another circumſtance; which is, that not one of theſe tunes really ancient, has a ſingle artificial half-note in it; and that in tunes where it is moſt convenient for the voice to uſe the middle notes of the harp, and place the key in F, there the B, which if uſed ſhould be a B flat, is always omitted, by paſſing over it with a third. The connoiſſeurs in modern muſic will ſay I have no taſte: but I cannot help adding, that I believe our anceſtors, in having a good ſong, diſtinctly articulated, ſung to one of thoſe tunes, and accompanied by the harp, felt more real pleaſure than is communicated by the generality of modern operas, excluſive of that ariſing from the ſcenery and dancing. Moſt tunes of late compoſition, not having this natural harmony united with their melody, have recourſe to the artificial harmony of a baſs, and other accompanying parts. This ſupport, in my opinion, the old tunes do not need, and are rather confuſed than aided by it. Whoever has heard *James Oſwald* play them on his violincello, will be leſs inclined to diſpute this with me. I have more than once ſeen tears of pleaſure in the eyes of his auditors: and yet I think, even *his* playing thoſe tunes would

would pleafe more if he gave them lefs modern ornament."

As thefe obfervations are for the moft part true, and always ingenious, we need no other apology for quoting them at length. It is only proper to remark, that the tranfition in Scots mufic by confonant intervals, does not feem, as Dr Franklin imagines, to arife from the nature of the inftruments upon which they played. It is more than probable, that the ancient Britifh harp was not ftrung with wire, but with the fame materials as the Welfh harps at prefent. Thefe ftrings have not the fame permanency of tone as metal; fo that the found of a preceding emphatic note muft have expired before the fubfequent accented note could be introduced. Befides, they who are acquainted with the manœuvre of the Irifh harp, know well that there is a method of difcontinuing founds no lefs eafy and effectual than upon the harpfichord. When the performer finds it proper to interrupt a note, he has no more to do but return his finger gently upon the ftring immediately ftruck, which effectually ftops its vibration.

That fpecies of Scots mufic which we have diftinguifhed by the name of *feftive* feems now limited to reels and country-dances. Thefe may be either in common or treble time. They moft frequently confift of two ftrains: each of thefe contains eight or twelve bars. They are truly rhythmical; but the mirth which they excite feems rather to be infpired by the vivacity of the movement, than either by the force or variety of the melody. They poffefs a manœuvre and expreffion peculiar to themfelves, which it is impoffible to defcribe, and which can only be exhibited by good performers.

Having thus far purfued the general idea of mufic, we fhall, after the hiftory, give a more particular detail of the fcience.

HISTORY OF MUSIC.

No accurate accounts of the ftate of mufic in the earlier ages of the world.

MUSIC is capable of fo infinite a variety, fo greatly does the moft fimple differ from the moft complex, and fo multiplied are the degrees between thefe two extremes, that in no age could the incidents refpecting that fafcinating art have been few or uninterefting. But, that accounts of thefe incidents fhould have been handed down to us, fcanty and imperfect, is no matter of furprife, when we recollect that the hiftory of mufic is the hiftory only of founds, of which writing is a very inadequate medium; and that men would long employ themfelves in the pleafing exercife of cultivating mufic before they poffeffed either the ability or the inclination to record their exertions.

No accurate traces, therefore, of the actual ftate of mufic, in the earlier ages of the world, can be difcerned. Our ideas on the fubject have no foundation firmer than conjecture and analogy.

It is probable, that among all barbarous nations fome degree of fimilarity is difcernible in the ftyle of their mufic. Neither will much difference appear during the firft dawnings of civilization. But in the more advanced periods of fociety, when the powers of the human mind are permitted without obftacle to exert their native activity and tendency to invention, and are at the fame time affected by the infinite variety of circumftances and fituations which before had no exiftence, and which in one cafe accelerate, and in another retard; then that fimilarity, once fo diftinguifhable, gives place to the endlefs diverfity of which the fubject is capable.

Mufic not the invention of any one man.

The practice of mufic being univerfal in all ages and all nations, it would be abfurd to attribute the invention of the art to any one man. It muft have fuffered a regular progreffion, through infancy, childhood, and youth, before it could arrive at maturity. The firft attempts muft have been rude and artlefs. Perhaps the firft flute was a reed of the lake.

No nation has been able to produce proofs of antiquity fo indifputable as the Egyptians. It would be vain, therefore, to attempt tracing mufic higher than the hiftory of Egypt.

Egyptian mufic.

By comparing the accounts of Diodorus Siculus and of Plato, there is reafon to fuppofe, that in very ancient times the ftudy of mufic in Egypt was confined to the priefthood, who ufed it only on religious and folemn occafions; that, as well as fculpture, it was circumfcribed by law; that it was efteemed facred, and forbidden to be employed on light or common occafions; and that innovation in it was prohibited: But what the ftyle or relative excellence of this very ancient mufic was, there are no traces by which we can form an accurate judgement. After the reigns of the Pharaohs, the Egyptians fell by turns under the dominion of the Ethiopians, the Perfians, the Greeks, and the Romans. By fuch revolutions, the manners and amufements of the people, as well as their form of government, muft have been changed. In the age of the Ptolemies, the mufical games and contefts inftituted by thofe monarchs were of Greek origin, and the muficians who performed were chiefly Greek.

The moft ancient monuments of human art and induftry, at prefent extant at Rome, are the obelifks brought thither from Egypt, two of which are faid to have been erected by Sefoftris at Heliopolis, about 400 years before the fiege of Troy. Thefe were by the order of Auguftus brought to Rome after the conqueft of Egypt. One of them called *guglia rotta*, or the broken pillar, which during the facking of the city in 1527 was thrown down and broken, ftill lies in the Campus Martius. On it is feen the figure of a mufical inftrument of two ftrings, and with a neck. It refembles much the calafcione ftill ufed in the kingdom of Naples.

An Egyptian mufical inftrument.

This curious relick of antiquity is mentioned, becaufe it affords better evidence than, on the fubject of ancient mufic, is ufually to be met with, that the Egyptians, at fo very early a period of their hiftory, had advanced to a confiderable degree of excellence in the cultivation of the arts. By means of its neck, this inftrument was capable, with only two ftrings, of producing a great number of notes. Thefe two ftrings, if tuned fourths to each other, would furnifh that feries of founds called by the ancients *heptachord*, which

which conſiſts of a conjunct tetrachord as B, C, D, E; E, F, G, A; if tuned fifths, they would produce an octave, or two disjunct tetrachords. The calaſcione is tuned in this laſt manner. The annals of no nation other than Egypt, for many ages after the period of the obeliſk at Heliopolis, exhibit the veſtige of any contrivance to ſhorten ſtrings during performance by a neck or finger-board. Father Montfaucon obſerves, that after examining 500 ancient lyres, harps, and citharas, he could diſcover no ſuch thing.

Egypt indeed ſeems to have been the ſource of human intelligence, and the favourite reſidence of genius and invention. From that celebrated country did the Greeks derive their knowledge of the firſt elements of thoſe arts and ſciences in which they afterwards ſo eminently excelled. From Greece again did the Romans borrow their attainments in the ſame purſuits. And from the records of thoſe different nations have the moderns been enabled to accompliſh ſo wonderful an improvement in literature.

The Egyptian Hermes the inventor of the lyre.

The Hermes or Mercury of the Egyptians, ſirnamed *Triſmegiſtus*, or *thrice illuſtrious*, who was, according to Sir Iſaac Newton, the ſecretary of Oſiris, is celebrated as the inventor of muſic. It has already been obſerved, that no one perſon ought ſtrictly to be called the inventor of an art which ſeems to be natural to, and coeval with, the human ſpecies; but the Egyptian Mercury is without doubt entitled to the praiſe of having made ſtriking improvements in muſic, as well as of having advanced in various reſpects the civilization of the people, whoſe government was chiefly committed to his charge. The account given by Apollodorus of the manner in which he accidentally invented the lyre, is at once entertaining and probable. "The Nile (ſays Apollodorus), after having overflowed the whole country of Egypt, when it returned within its natural bounds, left on the ſhore a great number of dead animals of various kinds, and among the reſt a tortoiſe; the fleſh of which being dried and waſted by the ſun, nothing remained within the ſhell but nerves and cartilages, and theſe being braced and contracted by the drying heat became ſonorous. Mercury, walking along the banks of the Nile, happened to ſtrike his foot againſt this ſhell; and was ſo pleaſed with the ſound produced, that the idea of a lyre ſtarted into his imagination. He conſtructed the inſtrument in the form of a tortoiſe, and ſtrung it with the dried ſinews of dead animals."

How beautiful to conceive the energetic powers of the human mind in the early ages of the world, exploring the yet undiſcovered capabilities of nature, and directed to the inexhauſtible ſtore by the finger of God in the form of accident!

The ſingle flute of the Egyptians.

The monaulos, or ſingle flute, called by the Egyptians photinx, was probably one of the moſt ancient inſtruments uſed either by them or any other nation. From various remains of ancient ſculpture, it appears to have been ſhaped like a bull's horn, and was at firſt, it may be ſuppoſed, no other than the horn itſelf.—Before the invention of flutes, as no other inſtrument except thoſe of percuſſion were known, muſic muſt have been little more than metrical. When the art of refining and lengthening ſounds was firſt diſcovered, the power of muſic over mankind, from the agreeable ſurpriſe occaſioned by ſoft and extended notes, was probably irreſiſtible. At a time when all the reſt of the world was involved in ſavage ignorance, the Egyptians were poſſeſſed of muſical inſtruments capable of much variety and expreſſion.—Of this the aſtoniſhing remains of the city Thebes ſtill ſubſiſting afford ample evidence. In a letter from Mr Bruce, ingroſſed in Dr Burney's hiſtory of Muſic, there is given a particular deſcription of the Theban harp, an inſtrument of extenſive compaſs, and exquiſite elegance of form. It is accompanied with a drawing taken from the ruins of an ancient ſepulchre at Thebes, ſuppoſed by Mr Bruce to be that of the father of Seſoſtris.

The Theban harp of Egypt.

On the ſubject of this harp, Mr Bruce makes the following ſtriking obſervation. "It overturns all the accounts of the earlieſt ſtate of ancient muſic and inſtruments in Egypt, and is altogether, in its form, ornaments, and compaſs, an inconteſtable proof, ſtronger than a thouſand Greek quotations, that geometry, drawing, mechanics, and muſic, were at the greateſt perfection when this harp was made; and that what we think in Egypt was the invention of arts was only the beginning of the æra of their reſtoration."

Indeed, when the beauty and powers of this harp, along with the very great antiquity of the painting which repreſents it, are conſidered, ſuch an opinion as that which Mr Bruce hints at, does not ſeem to be devoid of probability.

It cannot be doubted that during the reigns of the Ptolemies, who were voluptuous princes, muſic muſt have been much cultivated and encouraged. The father of Cleopatra, who was the laſt of that race of kings, derived his title of auletes, or flute player, from his exceſſive attachment to the flute. Like Nero, he uſed to array himſelf in the dreſs of a tibicen, and exhibit his performance in the public muſical conteſts.

Some authors, particularly Am. Marcellinus and M. Pau, refuſe to the Egyptians, at any period of their hiſtory, any muſical genius, or any excellence in the art; but the arguments uſed to ſupport this opinion ſeem to be inconcluſive, and the evidences of the oppoſite deciſion appear to be inconteſtable.

Hebrew muſic

The ſacred Scriptures afford almoſt the only materials from which any knowledge of Hebrew muſic can be drawn. In the rapid ſketch, therefore, of ancient muſic which we mean to exhibit, a very few obſervations are all which can properly be given to that department of our ſubject.

Moſes, who led the Iſraelites out of Egypt, was educated by Pharaoh's daughter in all the literature and elegant arts cultivated in that country. It is probable, therefore, that the taſte and ſtyle of Egyptian muſic would be infuſed in ſome degree into that of the Hebrews. Muſic appears to have been interwoven through the whole tiſſue of religious ceremony in Paleſtine. The prieſthood ſeem to have been muſicians hereditarily and by office. The prophets appear to have accompanied their inſpired effuſions with muſic; and every prophet, like the preſent improviſatori of Italy, ſeems to have been accompanied by a muſical inſtrument.

Muſic, vocal and inſtrumental, conſtituted a great part of the funeral ceremonies of the Jews. The pomp and expence uſed on theſe occaſions advanced by degrees to an exceſſive extent. The number of flute-players in the proceſſions amounted ſometimes to ſeveral hundreds,

hundreds, and the attendance of the guests continued frequently for 30 days *.

* *Josephus*, lib. iii. c. 9.

The Hebrew language abounds with consonants, and has so few vowels, that in the original alphabet they had no characters. It must, therefore, have been harsh and unfavourable to music. Their instruments of music were chiefly those of percussion; so that, both on account of the language and the instruments, the music must have been coarse and noisy. The vast numbers of performers too, whom it was the taste of the Hebrews to collect together, could with such a language and such instruments produce nothing but clamour and jargon. According to Josephus, there were 200,000 musicians at the dedication of Solomon's temple. Such are the circumstances from which only an idea of Hebrew music can be formed; for the Jews, neither ancient nor modern, have ever had any characters peculiar to music; and the melodies used in their religious ceremonies have at all times been entirely traditional.

coarse and noisy.

Grecian music.

Cadmus, with the Phœnician colony which he led into Greece, imported at the same time various arts into that country. By the assistance of his Phœnician artificers, that chief discovered gold in Thrace and copper at Thebes. At Thebes that metal is still termed *cadmia*. Of these materials, and of iron, they formed to themselves armour and instruments of war. These they struck against each other during their dances at sacrifices, by which they first obtained the idea of music. Such is the account given of the origin of that species of music in Greece produced by instruments of percussion. The invention of wind instruments in Greece is attributed to Minerva; and to the Grecian Mercury is assigned, by the poets and historians of that country, the honour of many discoveries probably due to the Egyptian Hermes, particularly the invention of stringed instruments, The lyre of the Egyptian Mercury had only three strings; that of the Grecian seven: The last was perhaps no more than an improvement on the other. When the Greeks deified a prince or hero of their own country, they usually assigned him an Egyptian name, and with the name bestowed on their new divinity all the actions, attributes, and rites of the original.

The Grecian lyre, although said to have been invented by Mercury, was cultivated principally by Apollo, who first played upon it with method, and accompanied it with the voice. The celebrated contest between him and Marsyas is mentioned by various authors; in which, by conjoining the voice with his lyre (a combination never before attempted), his music was declared superior to the flute of Marsyas. The progress of the lyre, according to Diodorus Siculus, is the following. "The muses added to the Grecian lyre the string called *mese;* Linus that of lichanos; and Orpheus and Thamyras those strings which are named hypate and parhypate." It has been already mentioned, that the lyre invented by the Egyptian Mercury had but three strings. By putting these circumstances together, we may perhaps acquire some knowledge of the progress of music, or at least of the extension of its scale in the highest antiquity. *Mese*, in the Greek music, is the fourth sound of the second tetrachord of the great system, and first tetrachord invented by the ancients, answering to our A, on the fifth line in the base. If this sound then was added to the former three, it proves that the most ancient tetrachord was that from E in the base to A; and that the three original strings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks call *hypate meson, parhypate meson*, and *meson diatonos:* The addition, therefore, of *mese* to these, completed the first and most ancient tetrachord E, F, G, A. The string lichanos again being added to these, and answering to our D on the third line in the base, extended the compass downwards, and gave the ancient lyre a regular series of five sounds. The two strings hypate and parhypate, corresponding with our B and C in the base, completed the heptachord or seven sounds b, c, d, e, f, g, a; a compass which received no addition till after the days of Pindar.

Progress of the Grecian lyre.

It might perhaps be expected, that in a history of Greek music something ought to be said concerning the muses, Apollo, Bacchus, and the other gods and demi-gods, who in the mythology of that country appear to have promoted and improved the art. But such a discussion would be too diffusive, and involve too much foreign matter for the plan we have chosen to adopt. We cannot avoid, however, making a few observations on the poems of Homer, in so far as connected with our subject. It has been imagined, with much appearance of probability, that the occupation of the first poets and musicians of Greece resembled that of the Celtic and German bards and the scalds of Iceland and Scandinavia. They sung their poems in the streets of cities and in the palaces of princes. They were treated with high respect, and regarded as inspired persons. Such was the employment of Homer. His poems, so justly celebrated, exhibit the most authentic picture that can be found in the annals of antiquity, although perhaps somewhat highly coloured, of the times of which he wrote and in which he lived. Music is always named throughout the Iliad and Odyssey with rapture; but as in these poems no mention is made of instrumental music unaccompanied with poetry and singing, a considerable share no doubt of the poet's praises is to be attributed to the poetry. The instruments most frequently named are the lyre, the flute, and the syrinx. The trumpet appears not to have been known at the siege of Troy, although it had come to be in use in the days of Homer himself. From the time of Homer till that of Sappho, there is almost a total blank in literature. Only a few fragments remain of the works of those poets and musicians whose names are preserved as having flourished between those periods (A). During the century which elapsed between the days of Sappho and those of Anacreon, no literary productions are preserved entire.—From

Occupation of the first poets and musicians in Greece.

(A) Hesiod lived so near to Homer, that it has been disputed which of them is the most ancient. It is now, we believe, universally admitted, that the palm of antiquity is due to Homer; but we consider them as having both flourished in the same era.

From Anacreon to Pindar there is another chasm of near a century. Subsequent to this time, the works still extant of the three great tragic poets, Æschylus, Sophocles, and Euripides, together with those of Plato, Aristotle, Aristoxenus, Euclid, Theocritus, Callimachus, Polybius, and many others, produced all within a space less than 300 years, distinguish this illustrious and uncommon period as that in which the whole powers of genius seem to have been exerted to illuminate and instruct mankind in future ages. Then it was that eloquence, poetry, *music*, architecture, history, painting, sculpture, like the spontaneous blossoms of nature, flourished without the appearance of labour or of art.

The poets, as well epic as lyric and elegiac, were all likewise musicians; so strictly connected were music and poetry for many ages. It would afford amusement to collect the biographical anecdotes of these favourites of genius, and to assign to each the respective improvements made by him in music and poetry; but our limits do not admit of so extensive a disquisition; for which, therefore, reference must be made to the editors and commentators of these authors, and to the voluminous histories of music lately published.

The invention of musical characters.

The invention of notation and musical characters marked a distinguished æra in the progress of music. There are a diversity of accounts respecting the person to whom the honour of that invention is due; but the evidences seem to preponderate in favour of Terpander, a celebrated poet and musician, to whose genius music is much indebted. He flourished about the 27th Olympiad, or 671 years before Christ.

Before that valuable discovery, music being entirely traditional, must have depended much on the memory and taste of the performer.

Vociferous music of the Greeks.

There is an incident mentioned in the accounts handed down to us of the Olympic games, which may serve in some degree to mark the character of music at the time in which it happened. Lucian relates that a young flute-player named Harmonides, at his first public appearance in these games, began a solo with so violent a blast, on purpose to *surprise* and *elevate* the audience, that he *breathed his last breath into his flute*, and died on the spot. When to this anecdote, wonderful to us, and almost incredible, is added the circumstance, that the trumpet-players at these public exhibitions expressed an excess of joy when they found their exertions had neither rent their cheeks nor burst their blood-vessels, some idea may be formed of the noisy and vociferous style of music which then pleased; and from such facts only can any opinion be obtained of the actual state of ancient music.

In whatever *manner* the flute was played on, there is no doubt that it was long in Greece an instrument of high favour, and that the flute-players were held in much estimation. The flute used by Ismenias, a celebrated Theban musician, cost at Corinth three talents, or 581l. 5s. If, says Xenophon, a bad flute-player would pass for a good one, he must, like the *great flute-players*, expend large sums on *rich furniture*, and appear in public *with a great retinue of servants*.

Extravagance of the ancients with respect to music.

The ancients, it appears, were not less extravagant in gratifying the ministers of their pleasures than ourselves. Amœbæus, a harper, was paid an Attic talent, or 193l. 15s. per day for his performance (B).

It is proper to add, that the celebrated musicians of Greece who performed in public were of *both* sexes; and that the beautiful Lamia, who was taken captive by Demetrius, in the sea engagement in which he vanquished Ptolemy Soter, and who herself captivated her conqueror, was a public performer, as well as were many other elevated female spirits, who are recorded by ancient authors in terms of admiration, and of whom, did our limits here admit of biography, we would treat with pleasure. The philosophers of Greece, whose capacious minds grasped every other object of human intelligence, were not inattentive to the theory of music, or the philosophy of sound. This department of science became the source of various sects, and of much diversity of opinion.—The founders of the most distinguished sects were Pythagoras and Aristoxenus.

Roman music.

Like every other people, the Romans, from their first origin as a nation, were possessed of a species of music which might be distinguished as their own. It appears to have been rude and coarse, and probably was a variation of the music in use among the Etruscans and other tribes around them in Italy; but as soon as they began to open a communication with Greece, from that country, with their arts and philosophy, they borrowed also their music and musical instruments. No account, therefore, of Roman music is to be expected that would not be a repetition of what has been said on the subject of the music of Greece.

Vanity of Nero with respect to music.

The excessive vanity of Nero with respect to music, displayed in his public contentions for superiority with the most celebrated professors of the art in Greece and Rome, is known to every one conversant in the history of Rome. The solicitude with which that detestable tyrant attended to his voice is curious, and will throw some light on the practices of singers in ancient times. He was in use to lie on his back, with a thin plate of lead on his stomach. He took frequent emetics and cathartics, abstained from all kinds of fruits and such meats as were held to be prejudicial to singing. Apprehensive of injuring his voice, he at length desisted from haranguing the soldiery and the senate; and after his return from Greece established an officer (Phonascus) to regulate his tones in speaking.

Sacred music

Most nations have consented in introducing music into their religious ceremonies. That art was early admitted into the rites of the Egyptians and Hebrews; and that it constituted a considerable part of the Grecian and Roman religious service, appears from the writings of many ancient authors. The same pleasing art soon obtained an introduction into the Christian church, as the Acts of the Apostles discover in many passages. There remain no specimens of the music employed in the worship of the primitive Christians; but probably it was at first the same with that used in the Pagan rites of the Greeks and Romans. The practice

(B) Roscius gained 500 sestertia, or 4036l. 9s. 2d. sterling.

practice of chanting the pſalms was introduced into the weſtern churches by St Ambroſe, about 350 years after Chriſt. In the year 600, the method of chanting was improved by St Gregory the Great. The Ambroſian chant contained four modes. In the Gregorian the number was doubled. So early as the age of Conſtantine the Great, prior to either of the periods laſt mentioned, when the Chriſtian religion firſt obtained the countenance of power, inſtrumental muſic came to be introduced into the ſervice of the church. In England, according to Biſhop Stillingfleet, muſic was employed in the church ſervice, firſt by St Auguſtine, and afterwards much improved by St Dunſtan, who was himſelf an eminent muſician, and who is ſaid to have firſt furniſhed the Engliſh churches and convents with the organ. The organ, the moſt majeſtic of all inſtruments, ſeems to have been an improvement of the hydraulican or water organ of the Greeks.—The firſt organ ſeen in France was ſent from Conſtantinople in 757, as a preſent to King Pepin from the emperor Conſtantine Copronymus VI. In Italy, Germany, and England, that inſtrument became frequent during the 10th century.

Introduced into the Engliſh church.

During the dark ages no work of genius or taſte in any department of ſcience ſeems to have been produced in any part of Europe; and except in Italy, where the cultivation of muſic was rather more the object of attention, that art was neglected equally with all others. There has always been obſerved a correſpondence in every country between the progreſs of muſic and the cultivation of other arts and ſciences. In the middle ages, therefore, when the moſt fertile provinces of Europe were occupied by the Goths, Huns, Vandals, and other barbarous tribes, whoſe language was as harſh as their manners were ſavage, little perfection and no improvement of muſic is to be looked for. Literature, arts, and refinements, were encouraged more early at the courts of the Roman pontiffs than in any other country; and owing to that circumſtance it is, that the ſcale, the counterpoint, the beſt melodies, the dramas religious and ſecular, the chief graces and elegancies of modern muſic, have derived their origin from Italy. In modern times, Italy has been to the reſt of Europe what ancient Greece was to Rome. The Italians have aided the civilization of their conquerors, and enlightened the minds of thoſe whoſe ſuperior prowеſs had enſlaved them.

The great improvements in muſic had their origin in Italy.

Having mentioned counterpoint, it would be improper not to make one or two obſervations on an invention which is ſuppoſed to have been the ſource of great innovation in the practice of muſic. Counterpoint, or muſic in parts, ſeems to be an invention purely modern. The term harmony meant in the language of antiquity what is now underſtood by melody. Guido, a monk of Arezzo in Tuſcany, is, in the general opinion, ſuppoſed to have entertained the firſt idea of counterpoint about the year 1022: an art which, ſince his time, has experienced gradual and imperceptible improvements, far exceeding the powers or comprehenſion of any one individual. The term *counterpoint*, or *contra punctum*, denotes its own etymology and import. Muſical notation was at one time performed by ſmall points; and the preſent mode is only an improvement of that practice. Counterpoint, therefore, denotes the notation of harmony or muſic in parts, by points oppoſite to each other. The improvements of this important acquiſition to the art of muſic kept pace at firſt with thoſe of the organ; an inſtrument admirably adapted to harmony: And both the one and the other were till the 13th century employed chiefly in ſacred muſic. It was at this period that ſacred muſic began to be cultivated.

Counterpoint.

Before the invention of characters for time, muſic in parts muſt have conſiſted entirely of *ſimple counterpoint*, or note againſt note, as is ſtill practiſed in pſalmody. But the happy diſcovery of a time-table extended infinitely the powers of combined ſounds. The ancients had no other reſource to denote time and movement in muſic except two characters (— ⌣), equivalent to a long and a ſhort ſyllable. But time is of ſuch importance in muſic, that it can impart meaning and energy to the repetition of the ſame ſound. Without it variety of tones has no effect with reſpect to gravity and acuteneſs. The invention of the time-table is attributed by almoſt all the writers on muſic of the laſt and preſent century to John de Muris, who flouriſhed about the year 1330. But in a manuſcript of John de Muris himſelf, bequeathed to the Vatican library by the Queen of Sweden, that honour ſeems to be yielded to Magiſter Franco, who appears to have been alive as late at leaſt as 1083. John de Muris, however, who there is ſome cauſe to believe was an Engliſhman, though not the inventor of the *cantus menſurabilis*, did certainly by his numerous writings greatly improve it. His tract on the *Art of Counterpoint* is the moſt clear and uſeful eſſay on the ſubject of which thoſe times can boaſt.

The invention of the time-table.

In the 11th century, during the firſt cruſade, Europe began to emerge from the barbarous ſtupidity and ignorance which had long overwhelmed it. While its inhabitants were exerciſing in Aſia every ſpecies of rapine and pious cruelty, art, ingenuity, and reaſon, inſenſibly civilized and ſoftened their minds. Then it was that the poets and ſongſters, known by the name of *Troubadours*, who firſt appeared in Provence, inſtituted a new profeſſion; which obtained the patronage of the count of Poictou, and many other princes and barons, who had themſelves cultivated muſic and poetry with ſucceſs. At the courts of their munificent patrons the troubadours were treated with reſpect. The ladies, whoſe charms they celebrated, gave them the moſt generous and flattering reception. The ſucceſs of ſome inſpired others with hopes, and excited exertions in the exerciſe of their art; impelling them towards perfection with a rapidity which the united force alone of emulation and emolument could occaſion. Theſe founders of modern verſification, conſtructing their ſongs on plans of their own, claſſical authority, either through ignorance or deſign, was entirely diſregarded. It does not appear, however, during the cultivation and favour of Provençal literature, that any one troubadour ſo far outſtripped the reſt as to become a model of imitation. The progreſs of taſte muſt ever be impeded by the ignorance and caprice of thoſe who cultivate an art without ſcience or principles.

Troubadours.

During almoſt two centuries after the arrangement of of the scale attributed to Guido, and the invention of the time-table ascribed to Franco, no remains of secular music can be discovered, except those of the troubadours or Provençal poets. In the simple tunes of these bards no time indeed is marked, and but little variety of notation appears: It is not difficult, however, to discover in them the germs of the future melodies, as well as the poetry of France and Italy. Had the poetry and music of the troubadours been treated of in an agreeable manner by the writers who have chosen that subject, it would have been discovered to be worthy of attention; the poetry, as interesting to literature; the melody to which it was sung, as curious to the musical historian.

Almost every species of Italian poetry is derived from the Provençals. *Air*, the most captivating part of secular vocal music, seems to have had the same origin. The most ancient strains that have been spared by time, are such as were set to the songs of the troubadours. The Provençal language began to be in favour with poets about the end of the 10th century. In the 12th it became the general vehicle, not only of poetry, but of prose, to all who were ignorant of Latin. And these were not the laity only. At this period *violars*, or performers on the vielle or viol, *juglars* or flute-players, *musars* or players on other instruments, and *comics* or comedians, abounded all over Europe. This swarm of poet-musicians, who were formerly comprehended in France under the general title of *jongleurs*, travelled from province to province, singing their verses at the courts of princes. They were rewarded with clothes, horses, arms, and money. Jongleurs or musicians were employed often to sing the verses of troubadours, who themselves happened to be deficient in voice or ignorant or music. The term *troubadour*, therefore, implies poetry as well as music. The jongleurs, menetriers, strollers, or minstrels, were frequently musicians, without any pretensions to poetry. These last have been common at all times; but the troubadour or bard has distinguished a particular profession, either in ancient or modern times, only during the early dawnings of literature.

In the 13th century the songs were on various subjects; moral, merry, amorous: and at that time melody seems to have been little more than plain song or chanting. The notes were square, and written on four lines only like those of the Romish church in the cliff C, and without any marks for time. The movement and embellishments of the air depended on the abilities of the singer. Since that time, by the cultivation of the voice modern music has been much extended, for it was not till towards the end of St Lewis's reign that the fifth line began to be added to the stave. The singer always accompanied himself with an instrument in unison.

The harp the favourite instrument of the Troubadours.

As the lyre is the favourite instrument in Grecian poetry, so the harp held the same place in the estimation of the poets who flourished in the period of which we at present speak. A poet of the 14th century, Machau, wrote a poem on the subject of the harp alone; in which he assigns to each of its 25 strings an allegorical name; calling one *liberality*, another *wealth*, &c.

The viol or violin.

The instrument which frequently accompanied, and indeed disputed the pre-eminence with the harp, was the viol. Till the 16th century this instrument was furnished with frets; after that period it was reduced to four strings: and still under the denomination of *violin* holds the first place among treble instruments. The viol was played with a bow, and differed entirely from the vielle, the tones of which were produced by the friction of a wheel: The wheel performed the part of a bow.

British harpers were famous long before the conquest. The bounty of William of Normandy to his *joculator* or bard is recorded in the Doomsday book. The harp seems to have been the favourite instrument in Britain for many ages, under the British, Saxon, Danish, and Norman kings. The *fiddle*, however, is mentioned so early as 1200 in the legendary life of St Christopher. The ancient privileges of the minstrels at the fairs of Chester are well known in the history of England.

The extirpation of the bards of Wales by Edward I. is likewise too familiar an incident to be particularly mentioned here. His persecuting spirit, however, seems to have been limited to that principality; for we learn, that at the ceremony of knighting his son, a *multitude of minstrels* attended.

In 1315, during the reign of Edward II. such extensive privileges were claimed by the minstrels, and so many dissolute persons assumed that character, that it became necessary to restrain them by express laws.

St Cecilia.

The father of our genuine poetry, who in the 14th century enlarged our vocabulary, polished our numbers, and with acquisitions from France and Italy augmented our store of knowledge (Chaucer), entitles one of his poems The History of St Cecilia; and the celebrated patroness of music must no doubt be mentioned in a history of the art. Neither in Chaucer, however, nor in any of the histories or legendary accounts of this saint, does any thing appear to authorize the religious veneration paid to her by the votaries of music; nor is it easy to discover whence it has arisen.

Origin of the degree of Mus. D.

As an incident relative to the period of which we speak, it may be mentioned, that, according to Spelmann, the appellation of *Doctor* was not among the degrees granted to graduates in England sooner than the reign of King John, about 1207; although, in Wood's history of Oxford, that degree is said to have been conferred, even in music, in the reign of Henry II. It is known that the title was created on the continent in the 12th century; and as, during the middle ages, music was always ranked among the seven liberal arts, it is likely that the degree was extended to it.

After the invention of printing, an art which has tended to disseminate knowledge with wonderful rapidity among mankind, music, and particularly counterpoint, became an object of high importance. The names of the most eminent composers who flourished in England, from that time to the Reformation, were, Fairfax, William of Newark, Sheryngham, Turges, Banister, Tudor, Taverner, Tye, Johnson, Parsons; to whom may be added John Marbeck, who set the whole English cathedral service to music.

Scottish music.

Before this period Scottish music had advanced to a high degree of perfection. James I. was a great composer of airs to his own verses; and may be considered

dered as the father of that plaintive melody which in Scotch tunes is ſo pleaſing to a taſte not vitiated by modern affectation. Beſides the teſtimony of *Fordun* and *Major*, who may be ſuſpected of being under the influence of national prejudice, we have that of Aleſſandro Teſſani, to the muſical ſkill of that accompliſhed prince. "Among us moderns (ſays this foreigner) we may reckon *James king of Scotland*, who not only compoſed many ſacred pieces of vocal muſic, but alſo of himſelf *invented a new kind of muſic, plaintive and melancholy, different from all others;* in which he has *been imitated* by Carlo Geſueldo prince of Venoſa, who in our age has improved muſic with new and admirable inventions."

Under ſuch a genius in poetry and muſic as King James I. it cannot be doubted that the national muſic muſt have been greatly improved. We have ſeen that he compoſed ſeveral anthems, or vocal pieces of *ſacred muſic*, which ſhows that his knowledge of the ſcience muſt have been very conſiderable. It is likewiſe known, that organs were by him introduced into the cathedrals and abbeys of Scotland, and choir-ſervice brought to ſuch a degree of perfection, as to fall little ſhort of that eſtabliſhed in any country of Europe.—By an able and ingenious antiquary † the great era of muſic, as of poetry, in Scotland, is ſuppoſed to have been from the beginning of the reign of James I. down to the end of the reign of James V. During that period flouriſhed *Gavin Douglas* biſhop of Dunkeld, *Ballenden* archdeacon of Murray, *Dunbar*, *Henryſon*, *Scott*, *Montgomery*, *Sir David Lindſey*, and many others, whoſe fine poems have been preſerved in Banatyne's Collection, and of which ſeveral have been publiſhed by Allan Ramſay in his *Evergreen*.

† See *Tytler's Diſſertation on the Scotch Muſic*, vol. i. of the Tranſactions of the Society of Antiquaries in Scotland.

Before the Reformation, as there was but one religion, there was but one kind of ſacred muſic in Europe, plain chant, and the deſcant built upon it.—That muſic likewiſe was applied to one language only, the Latin. On that account, the compoſitions of Italy, France, Spain, Germany, Flanders, and England, kept pace in a great degree with each other in ſtyle and excellence. All the arts ſeem to have been the companions, if not the produce, of ſucceſsful commerce: they appeared firſt in Italy, then in the Hanſeatic towns, next in the Netherlands; and during the 16th century, when commerce became general, in every part of Europe.

In the 16th century muſic an indiſpenſable part of education.

In the 16th century muſic was an indiſpenſable part of polite education: All the princes of Europe were inſtructed in that art. There is a collection preſerved in manuſcript called *Queen Elizabeth's Virginal Book*. If her majeſty was able to execute any of the pieces in that book, ſhe muſt have been a great player; a month's practice would not be ſufficient for any matter now in Europe to enable him to play one of them to the end. *Tallis*, ſingularly profound in muſical compoſition, and *Bird* his admirable ſcholar, were two of the authors of this famous collection.

During the reign of Elizabeth, the genius and learning of the Britiſh muſicians were not inferior to any on the continent; an obſervation ſcarcely applicable at any other period of the hiſtory of this country. Sacred muſic was the principal object to ſtudy all over Europe.

Eminent muſicians in Italy during the 16th century.

The moſt eminent muſical theoriſts of Italy, who flouriſhed in the 16th century, were, Franchinus Gafierius, or Gafforio of Lode, Pietro Aaron of Florence, Lodovico Fogliano, Giov. Spatro, Giov. Maria da Terentio Lanfranco, Steffano Uanneo, Anton. Franciſco Done, Luigi Dentice, Nicolo Vicentino, and Gioteffo Zarlino, the moſt general, voluminous, and celebrated theoriſt of that period, Vincentio Galilei, a Florentine nobleman, and father of the great Galileo Galilei, Maria Artuſe of Bologna, Oraſeo Tegrini, Pietro Pontio, and Lodovico Zacconi.

The principal Roman authors were, Giovanni Anmuccia, Giovanni Pierluigi da Paleſtrina, juſtly celebrated, Ruggiero Giovanelli, Luca Marenzio, who brought to perfection madrigals, the moſt cheerful ſpecies of ſecular muſic.

Of the Venetians, Adrian Willaeri is allowed to be at the head.

At the head of the Neapolitans is deſervedly placed Rocco Rodio.

At Naples, too, the illuſtrious dilettante, Don Carlo Geſualdo prince of Venoſa, is highly celebrated. He ſeems, however, to have owed much of his fame to his high rank.

Lombardy might alſo furniſh an ample liſt of eminent muſicians during the 16th century, of whom, however, our limits will not admit of a particular enumeration:—The chief of them were, Conſtanzo Porta, Gaſtoldi, Biſſi, Cima, Vocchi, and Monteverde.

At Bologna, beſides Artuſi already mentioned, Andrea Rota of the ſame city appears to have been an admirable contrapunctiſt.

Franciſco Corteccia, a celebrated organiſt and compoſer, and Aleſſandro Striggio, a lutaniſt and voluminous compoſer, were the moſt eminent Florentines.

In Germany.

The inhabitants of the extenſive empire of Germany have long made muſic a part of general education.—They hold the place, next to Italy, among the moſt ſucceſsful cultivators of the art. During the 16th century, their moſt eminent compoſers of muſic and writers on the ſubject were, Geo. Reiſchius, Michael Roſwick, Andreas Ornithorparchus, Paul Hofhaimer, Luſpeinius, Henry Loris or Lorit, Faber, Fink, Hofman, and many others whom it would be tedious to mention; and for a particular account of whoſe treatiſes and compoſitions we muſt refer to more voluminous hiſtories of muſic.

In France.

In France, during, the 16th century, no art except the art of war made much progreſs in improvement.—Ronſard, Baif, Goudimel, Cland le Jeune, Caurroy, and Maudit, are the chief French muſicians of that period.

Spain.

In Spain, muſic was early received into the circle of ſciences in the univerſities. The muſical profeſſorſhip at Salamanca was founded and endowed by Alfonzo the Wiſe, king of Caſtile.

One of the moſt celebrated of the Spaniſh muſicians was Francis Salinas, who had been blind from his infancy. He was a native of Burgos.

D. Criſtofero Morales, and Tomaſo Lodovico da Vittorio, deſerve likewiſe to be mentioned; and to mention them is all we can attempt; the purpoſe of which is, to excite more minute inquiry by thoſe who may chooſe to inveſtigate the ſubject particularly.

The Netherlands.

The Netherlands, likewiſe, during the period of which we have been ſpeaking, produced eminent compoſers; of of whom we may mention Verletot, Gombert, Arkadelt, Berchem, Richefort or Ricciafort, Crequilon Le Cock or Le Coq, Canis, Jacob Clemens Non Papa, Pierre Manchicourt, Baſton, Kerl, Rore, Orlandi di Laſſo, and his ſons Ferdinand and Rodolph.

Muſical compoſers in England during the 17th century.

In the 17th century, the muſical writers and compoſers who acquired fame in England, were, Dr Nathanael Giles, Thomas Tomkins, and his ſon of the ſame name; Elway Bevin, Orlando Gibbons, Dr William Child, Adrian Batten, Martin Pierſon, William Lawes, Henry Lawes, Dr John Wilſon, John Hilton, John Playford, Captain Henry Cook, Pelham Humphrey, John Blow, William Turner, Dr Chriſtopher Gibbons, Benjamin Rogers, and Henry Purcell. Of theſe, Orlando Gibbons, Pelham Humphrey, and Henry Purcell, far excelled the reſt.

About the end of the reign of James I. a muſic-lecture or profeſſorſhip was founded in the univerſity of Oxford by Dr William Hychin.

In the reign of Charles I. a charter was granted to the muſicians of Weſtminſter, incorporating them, as the king's muſicians, into a body politic, with powers to proſecute and fine all who, except themſelves, ſhould "attempt to make any benefit or advantage of muſic in England or Wales;" powers which in the ſubſequent reign were put in execution.

About the end of the reign of Charles II. a paſſion ſeems to have been excited in England for the violin, and for pieces expreſsly compoſed for it, in the Italian manner (B). Prior to 1600, there was little other muſic except maſſes and madrigals, the two principal diviſions of ſacred and ſecular muſic; but from that time to the preſent, dramatic muſic becomes the chief object of attention. The muſic of the church and of the chamber continued indeed to be cultivated in Italy with diligence, and in a learned and elaborate ſtyle, till near the middle of the century; yet a revolution in favour of melody and expreſſion was preparing, even in ſacred muſic, by the ſucceſs of dramatic compoſition, conſiſting of recitation and melodies for a ſingle voice. Such melodies began now to be preferred to muſic of many parts; in which canons, fugues, and full harmony, had been the productions which chiefly employed the maſter's ſtudy and the hearer's attention.

Mean ſtate of the opera in the beginning of the 18th century.

So late as the beginning of the 18th century, according to Riccoboni, the performers in the operas of Germany, particularly at Hamburg, "were all tradeſmen or handicrafts. Your ſhoemaker (ſays he) was often the firſt performer on the ſtage; and you might have bought fruit and ſweetmeats of the ſame girls, whom the night before you had ſeen in the characters of Armida or Semiramis. Soon, however, the German opera aroſe to a more reſpectable ſituation; and even during the 17th century many eminent compoſers flouriſhed in that country.

State of muſic in France in the 17th century.

The liſt of great muſicians which France produced during the early part of the ſame century is not numerous. Muſic ſeems to have been but little cultivated in that country, till the operas of Lulli, under the powerful patronage of Louis XIV. excited public attention.

The favourite ſinging-maſter and compoſer of France, about the middle of the 17th century, was Michael Lambert. John Baptiſt Lulli, ſoon after this time, roſe from the rank of a menial ſervant to fame, opulence, and nobility, by his ſkill in muſical compoſitions. The celebrated ſinger La Rochois was taught ſinging and acting by Lulli.

Curious anecdotes of a French ſinger.

La Maupin the ſucceſſor of La Rochois, on account of her extraordinary character and romantic adventures, deſerves to be mentioned. She eloped from her huſband with a fencing-maſter, of whom ſhe learnt the ſmall ſword. She became an excellent fencer. At Marſeilles ſhe entertained a ſtrange attachment to a young lady, who was ſeized with a whimſical fondneſs in return, on account of which the latter was confined in a convent. La Maupin obtained admiſſion into the ſame convent as a novice. She ſet fire to the building, and in the confuſion carried off her favourite. At Paris when ſhe appeared on the ſtage in 1695, Dumeni a ſinger having affronted her, ſhe put on men's clothes, and inſiſted on his drawing his ſword and fighting her. When he refuſed, ſhe caned him, and took from him his watch and ſnuff-box as trophies of her victory. At a ball given by Monſieur brother of Louis XIV. ſhe again put on men's cloathes; and having behaved impertinently to a lady, three of the lady's friends, ſuppoſing La Maupin to be a man, called her out. She killed them all; and returning coolly to the ball, told the ſtory to Monſieur, who obtained her pardon. She became afterwards miſtreſs to the elector of Bavaria. This prince quitting her for the counteſs of Arcos, ſent her by the count, huſband of that lady, a purſe of 40,000 livres. She threw it at the count's head, telling him, it was a recompenſe worthy of ſuch meanneſs as he diſplayed. At laſt, ſeized with a fit of devotion, ſhe recalled her huſband, and ſpent the remainder of her life in piety. She died in 1707 at the age only of 34.

Chief compoſers for the church in England.

The Engliſh muſician whom we laſt mentioned was the celebrated Purcell. After his time the chief compoſers for the church were Clarke, Dr Holden, Dr Creyghton, Tucker, Aldrich, Golwin, Weldon, Dr Crofts, Dr Greene, Boyce, and Nares; to whom may be added John Stanley, who attained high proficiency in muſic, although from two years old totally deprived of ſight.

The annals of modern muſic have hitherto furniſhed no event ſo important to the progreſs of the art as the invention of recitative or dramatic melody; a ſtyle of muſic which reſembles the manner of the ancient rhapſodiſts.

Firſt muſical drama.

The *Orfeo* of Politian was the firſt attempt at muſical drama. It was afterwards perfected by Metaſtaſio. No muſical dramas ſimilar to thoſe afterwards known

(B) The moſt celebrated violin players of Italy, from the 16th century to the preſent time, have been Farina, M. Angelo Roſſi, Baſſani the violin-maſter of Corelli, the admirable Angelico Corelli himſelf, Torelli, Alberti, Albenoni, Teſſarini, Vivaldi, Geminiani one of the moſt diſtinguiſhed of Corelli's ſcholars, Tartini, Veracini, Barbella, Locatelli, Ferrari, Martini, Boccherini, and Giardini.

known by the names of *opera* and *oratorio*, had exiſtence in Italy before the beginning of the 17th century. It was above the 1600, or a little before that time, that eunuchs were firſt employed for ſinging in Italy.

First ſinging eunuchs.

There ſeem to have been no *ſinging* eunuchs in ancient times, unleſs the galli or archigalli, prieſts of Cybele, were ſuch. Caſtration has, however, at all times been practiſed in eaſtern countries, for the purpoſe of furniſhing to tyrannic jealouſy guards of female chaſtity; but never, ſo far as modern writers on the ſubject have diſcovered, merely to preſerve the voice, till about the end of the 16th century.

At Rome, the firſt public theatre opened for the exhibition of muſical dramas, in modern times, was *il Torre de Nona*, where in 1671 Giaſone was performed. In 1679, the opera of *Dou è Amore*, ſet by the famous organiſt Bernardo Paſquini, was repreſented at *Nilla Sala de Signori Capranica*; a theatre which ſtill ſubſiſts. In the year 1680, *L'Oneſta negl' Amore* was exhibited; the firſt dramatic compoſition of the elegant, profound, and original Aleſſandro Scarlatti.

The inhabitants of Venice have cultivated and encouraged the muſical drama with more zeal and diligence than the reſt of Italy, during the end of the laſt and beginning of the preſent century; yet the opera was not eſtabliſhed in Venice before the year 1637. In that year the firſt regular drama was performed. It was Andromeda.

Opera of Berenice.

In 1680 the opera of Berenice was exhibited at Padua with ſuch aſtoniſhing ſplendour as to merit notice. There were choruſes of 100 virgins, 100 ſoldiers, 100 horſemen in iron armour, 40 cornets of horſe, 6 trumpeters on horſeback, 6 drummers, 6 enſigns, 6 ſackbuts, 6 great flutes, 6 minſtrels playing on Turkiſh inſtruments, 6 others on octave flutes, 6 pages, 3 ſergeants, 6 cymbaliſts. There were 12 huntſmen, 12 grooms, 6 coachmen for the triumph, 6 others for the proceſſion, 2 lions led by two Turks, 2 elephants by two others, Berenice's triumphal car drawn by 4 horſes, 6 other cars with priſoners and ſpoils drawn by 12 horſes, 6 coaches. Among the ſcenes and repreſentations in the firſt act were, a vaſt plain with two triumphal arches, another plain with pavilions and tents, and a foreſt for the chaſe. In act third, the royal dreſſing room completely furniſhed, ſtables with 100 live horſes, portico adorned with tapeſtry, and a ſtupendous palace in perſpective. At the end of the firſt act were repreſentations of every kind of chaſe, wild boar, ſtag, deer, bears. At the end of the third act, an enormous globe, deſcending as from the ſky, divided itſelf into other globes ſuſpended in the air, and ornamented with emblematical figures of time, fame, honour, &c.

Early in the laſt century, machinery and decoration uſurped the importance due to poetry and muſic in ſuch exhibitions.

Few inſtances occur of muſical dramas at Naples till the beginning of the preſent century. Before the time of the elder Scarlatti, it ſeems as if Naples had been leſs fertile in great contrapuntiſts, and leſs diligent in the cultivation of dramatic muſic, than any other ſtate of Italy. Since that time all the reſt of Europe has been furniſhed with compoſers and performers from that city.

French and Engliſh opera.

The word *opera* ſeems to have been familiar to Engliſh poets from the beginning of the laſt century *Stilo recitativo*, a recent innovation even in Italy, is mentioned by Ben Johnſon ſo early as 1617. From this time it was uſed in maſques, occaſionally in plays, and in cantatas, before a regular drama wholly ſet to muſic was attempted. By the united abilities of Quinault and Lulli, the opera in France had ariſen to high favour. This circumſtance afforded encouragement to ſeveral attempts at dramatic muſic in England by Sir William D'Avenant and others, before the muſic, language, or performers of Italy were employed on our ſtage. Pieces, ſtyled *dramatic operas*, preceded the Italian opera on the ſtage of England. Theſe were written in Engliſh, and exhibited with a profuſe decoration of ſcenery and habits, and with the beſt ſingers and dancers that could be procured: Pſyche and Circe are entertainments of this kind: The Tempeſt and Macbeth were acted with the ſame accompaniments.

During the 17th century, whatever attempts were made in muſical drama, the language ſung was always Engliſh. About the end of that century, however, Italian ſinging began to be encouraged, and vocal as well as inſtrumental muſicians from that country began to appear in London.

The firſt muſical drama, performed wholly after the Italian manner in recitative for the dialogue or narrative parts, and meaſured melody for the airs, was Arſinoë Queen of Cyprus, tranſlated from an Italian opera of the ſame name, written by Stanzani of Bologna. The Engliſh verſion of this opera was ſet to muſic by Thomas Clayton, one of the royal band, in the reign of William and Mary. The ſingers were all Engliſh; Meſſrs Hughes, Leveredge, and Cook; Mrs Tofts, Mrs Croſs, and Mrs Lyndſey. The tranſlation of Arſinoë, and the muſic to which it is ſet, are execrable; yet ſuch is the charm of novelty, that this miſerable performance, deſerving neither the name of a drama by its poetry, nor of an opera by its muſic, ſuſtained 24 repreſentations, and the ſecond year 11.

Operas, notwithſtanding their deficiencies in poetry, muſic and performance (no foreign compoſer or eminent ſinger having yet arrived), became ſo formidable to our actors at the theatres, that it appears from the Daily Courant, 14th January 1707, a ſubſcription was opened "for the encouragement of the comedians acting in the Haymarket, and to enable them to keep the diverſion of plays under a ſeparate intereſt from operas."

Mr Addiſon's opera of Roſamond appeared about this time; but the muſic ſet by Clayton is ſo contemptible, that the merit of the poetry, however great, could not of itſelf long ſupport the piece. The choice of ſo mean a compoſer as Clayton, and Mr Addiſon's partiality to his abilities, betray a want of muſical taſte in that elegant author.

The firſt truly great ſinger who appeared on the ſtage of Britain was *Cavalier Nicolino Grimaldi*, commonly known by the name of *Nicolini*. He was a Neapolitan; and though a beautiful ſinger indeed, was ſtill more eminent as an actor. In the Tatler, N° 115. the elegance and propriety of his action are particularly deſcribed †. Recently before his appearance, *Valentini Urbani*, and a female ſinger called *The Baroneſs*,

† See alſo *Spectator*, vol. i. N° 13.

Baroness, arrived. Margarita de l'Epini, who afterwards married Dr Pepusch, had been in this country some time before.

The first opera performed *wholly in Italian*, and *by Italian singers*, was *Almahide*. As at present, so at that time, operas were generally performed twice a week.

Arrival of Handel in England.

The year 1710 is distinguished in the annals of music by the arrival in Britain of George Frederick Handel. Handel had been in the service of the elector of Hanover, and came first to England on a visit of curiosity. The fame of this great musician had penetrated into this country before he himself arrived in it; and Aaron Hill, then in the direction of the Haymarket theatre, instantly applied to him to compose an opera. It was Rinaldo; the admirable music of which he produced entirely in a fortnight. Soon after this period appeared, for the first time as an opera singer, the celebrated Mrs Anastasia Robinson. Mrs Robinson, who was the daugher of a portrait painter, made her first public exhibitions in the concerts at York-buildings; and acquired so much the public favour, that her father was encouraged to take a house in Golden Square, for the purpose of establishing weekly concerts and assemblies, in the manner of *Conversazioni*, which became the resort of the most polite audiences.

Soon after Mrs Robinson accepted an engagement at the Opera, where her salary is said to have been 1000l. and her other emoluments equal to that sum. She quitted the stage in consequence of her marriage with the gallant earl of Peterborough, the friend of Pope and Swift. The eminent virtues and accomplishments of this lady, who died at the age of 88, entitled her to be mentioned even in a compend too short for biography.

Progress of the opera under his management.

The conducting the opera having been found to be more expensive than profitable, it was entirely suspended from 1717 till 1720, when a fund of 50,000l. for supporting and carrying it on was subscribed by the first personages of the kingdom. The subscribers, of whom King George I. was one for 1000l. were formed into a society, and named *The Royal Academy of Music*. Handel was commissioned to engage the performers: For that purpose he went to Dresden, where Italian operas were at that time performed in the most splendid manner at the court of Augustus elector of Saxony, than king of Poland. Here Handel engaged Senesino-Berenstadt, Boschi, and the Duranstanti.

In the 1723, the celebrated Francesca Cuzzoni appeared as a first-rate singer: and two years afterwards arrived her distinguished rival Signora Faustina Bordoni.

In a cantabile air, though the notes Cuzzoni added were few, she never lost an opportunity of enriching the cantilena with the most beautiful embellishments. Her shake was perfect. She possessed a creative fancy; and she enjoyed the power of occasionally accelerating and retarding the measure in the most artificial and able manner, by what is in Italy called *tempo rubato*. Her high notes were unrivalled in clearness and sweetness. Her intonations were so just and so fixed, that it seemed as if she had not the power to sing out of tune.

Faustina Bordoni, wife of the celebrated Saxon composer Hasse, invented a new kind of singing, by running divisions, with a neatness and volocity which astonished all who heard her. By taking her breath imperceptibly, she had the art of sustaining a note apparently longer than any other singer. Her beats and trills were strong and rapid; her intonation perfect. Her professional perfections were enhanced by a beautiful face, fine symmetry of figure, and a countenance and gesture on the stage which indicated an entire intelligence and possession of the several parts allotted to her.

These two angelic performers excited so signally the attention of the public, that a party spirit between the abettors of the one and of the other was formed, as violent and as inveterate almost as any of those that had ever occurred relative to matters either theological or political; yet so distinct were their styles of singing, so different their talents, that the praise of the one was no reproach to the other.

In less than seven years, the whole 50,000l. subscribed by the Royal Academy, besides the produce of admission to non-subscribers, was expended, and the governor and directors of the society relinquished the idea of continuing their engagements; consequently, at the close of the season 1727, the whole band of singers dispersed. The next year we find Senesino, Faustina, Balde, Cuzzoni, Nicolini, Farinelli, and Bosche, at Venice.

Handel, however, at his own risk, after a suspension of about a twelvemonth, determined to recommence the Opera; and accordingly engaged a band of performers entirely new. These were Signior Bernacchi, Signora Merighi, Signora Strada, Signor Anibale Pio Fabri, his wife, Signora Bertoldi, and John Godfrid Reimschneider.

Invention of the oratorio, and its introduction in England.

The sacred musical drama, or oratorio, was invented early in the 14th century. Every nation in Europe seems first to have had recourse to religious subjects for dramatic exhibitions. The oratorios had been common in Italy during the last century. They had never been *publicly* introduced in England, till Handel, stimulated by the rivalship of other adventurers, exhibited in 1732 his oratorios of Esther, and of Acis and Galatea, the last of which he had composed twelve years before for the duke of Chandos's chapel at Cannons. The most formidable opposition which Handel met with in his conduct of the Italian opera was a new theatre for exhibiting these operas, opened by subscription in Lincoln's-inn Fields, under the conduct of Nicola Porpora, a respectable composer. A difference having occurred between Handel and Senesino; Senesino had for some time deserted the Haymarket, where Handel managed, and was now engaged at the rival theatre of Lincoln's-inn Fields. To supply the place of Senesino, Handel brought over *Giovanni Carestini*, a singer of the most extensive powers. His voice was at first a powerful and clear soprano: Afterwards it changed into the fullest, finest, deepest counter-tenor that has perhaps ever been heard. Carestini's person was tall, beautiful, and majestic. He rendered every thing he sung interesting by energy, taste, and judicious embellishment. In the execution of difficult divisions from the chest, his manner was articulate and admirable. It was the opinion of Hasse, as well as other eminent professors, that

that whoever had not heard Careſtini, was unacquainted with the moſt perfect ſtyle of ſinging. The opera under the direction of Porpora was removed to the Haymarket, which Handel had left. Handel occupied the theatre of Lincoln's-inn Fields; but his rivals now acquired a vaſt advantage of attraction, by the acceſſion of Carlo Broſchi detto Farinelli to their part, who at this time arrived. This renowned ſinger ſeems to have tranſcended the limits of all anterior vocal excellence. No vocal performer of the preſent century has been ſo unanimouſly allowed to poſſeſs an uncommon power, ſweetneſs, extent, and agility of voice, as Farinelli. Nicolini, Seneſino, and Careſtini, gratified the eye as much by the dignity, grace, and propriety of their action and deportment, as the ear, by the judicious uſe of a few notes within the limits of a ſmall compaſs of voice; but Farinelli, without the aſſiſtance of ſignificant geſtures or graceful attitudes, enchanted and aſtoniſhed his hearers, by the force, extent, and mellifluous tones of the mere organ, when he had nothing to execute, articulate, or expreſs. Though during the time of ſinging he was as motionleſs as a ſtatue, his voice was ſo active that no intervals were too cloſe, too wide, or too rapid, for his execution.

Handel having loſt a great part of his fortune by the opera, was under the neceſſity of trying the public gratitude in a benefit, which was not diſgraced by the event. The theatre, for the honour of the nation, was ſo crowded, that he is ſaid to have cleared 800l.

Opera in England given up.

After a fruitleſs attempt by Heidegger, the coadjutor of Handel in the conduct of the opera, and patentee of the King's Theatre in Haymarket, to procure a ſubſcription for continuing it, it was found neceſſary to give up the undertaking.

It was about this time that the ſtatue of Handel was erected in Vauxhall, at the expence of Mr Tyers, proprietor of thoſe gardens.

The next year (1739) Handel carried on oratorios at the Haymarket, as the opera there was ſuſpended. The earl of Middleſex now undertook the troubleſome office of *impreſario* of the Italian opera. He engaged the King's theatre, with a band of ſingers from the continent almoſt entirely new. Calluppi was his compoſer. Handel, almoſt ruined, retired at this time to Ireland, where he remained a conſiderable time. In 1744 he again attempted oratorios at the King's theatre, which was then, and till 1746, unoccupied by the opera, on account of the rebellion.

Revived.

The arrival of Giardini in London this year forms a memorable æra in the hiſtory of inſtrumental muſic of England. His powers on the violin were unequalled. The ſame year Dr Croza, then manager of the opera, eloped, leaving the performers, and innumerable trades people, his creditors. This incident put an end to operas of all kinds for ſome time.

This year a comic opera, called *Il Filoſofo di Campagna*, compoſed by Caluppi, was exhibited, which ſurpaſſed in muſical merit all the comic operas performed in England till the *Bicona Figliula*. Signora Paganini acquired ſuch fame by the airs allotted to her in that piece, that the crowds at her benefit were beyond example. Caps were loſt, gowns torn in pieces, and ladies in full dreſs, without ſervants or carriages, were obliged to walk home, amidſt the merriment of the ſpectators on the ſtreets.

1764 and 1765. Manzoli.

At this period the arrival of Giovanni Manzoli marked a ſplended era in the annals of muſical drama, by conferring on ſerious opera a degree of importance to which it had ſeldom yet ariſen ſince its eſtabliſhment in England. Manzoli's voice was the moſt powerful and voluminous ſoprano that had been heard ſince the time of Farinelli: His manner of ſinging was grand, and full of taſte and dignity.

Tenducci.

At this time Tenducci, who had been in England ſome time before, and was now returned much improved, performed in the ſtation of ſecond man to Manzoli.

1769. Guadagni.

Gaetano Guadagni made a great figure at this time. He had been in this country early in life (1748), as ſerious man in a burletta troop of ſingers. His voice was then a full and well-toned counter tenor; but he ſung wildly and careleſsly. The excellence of his voice, however, attracted the notice of Handel, who aſſigned him the parts in his oratorios, the Meſſiah and Samſon, which had been originally compoſed for Mrs Cibber. He quitted London for the firſt time about 1753. The higheſt expectations of his abilities were raiſed by fame before his ſecond arrival, at the time of which we treat. As an actor he ſeems to have had no equal on any ſtage in Europe. His figure was uncommonly elegant and noble; his countenance replete with beauty, intelligence, and dignity; his attitudes were full of grace and propriety. Thoſe who remember his voice when formerly in England were now diſappointed: It was comparatively thin and feeble: He had now changed it to a ſoprano, and extended its compaſs from ſix or ſeven notes to fourteen or fifteen. The muſic he ſung was the moſt ſimple imaginable; a few notes with frequent pauſes, and opportunities of being liberated from the compoſer and the band, were all he required. In theſe effuſions, ſeemingly extemporaneous, he diſplayed the native power of melody unaided by harmony or even by uniſonous accompaniment: The pleaſure he communicated proceeded principally from his artful manner of diminiſhing the tones of his voice, like the dying notes of the Æolian harp. Moſt other ſingers affect a ſwell, or *meſſa de voce*; but Guadagni, after beginning a note with force, attenuated it ſo delicately that it poſſeſſed all the effect of extreme diſtance. During the ſeaſon 1770 and 1771, Tenducci was the immediate ſucceſſor of Guadagni. This performer, who appeared in England firſt only as a ſinger of the ſecond or third claſs, was during his reſidence in Scotland and Ireland ſo much improved as to be well received as firſt man, not only on the ſtage of London, but in all the great theatres of Italy.

It was during this period that dancing ſeemed firſt to gain the aſcendant over muſic by the ſuperior talents of Mademoiſelle Heinel, whoſe grace and execution were ſo perfect as to eclipſe all other excellence.

1773. Miſs Davies.

In the firſt opera performed this ſeaſon (*Lucco Vero*) appeared Miſs Cecilia Davies, known in Italy by the name of L'Ingleſina. Miſs Davies had the honour of being the firſt Engliſh woman who had ever been thought worthy of ſinging on any ſtage in Italy. She even performed with eclat the principal female characters on many of the great theatres of that country.

Gabrielli only on the Continent was said to surpass her. Her voice, though not of great volume, was clear and perfectly in tune; her shake was open and distinct, without the sluggishness of the French cadence. The flexibility of her throat rendered her execution equal to the most rapid divisions.

Next season introduced Venanzio Ravygini, a beautiful and animated young man; a composer as well as a singer.—His voice was sweet, clear, flexible; in compass more than two octaves.

Caterina Gabrielli.

The season 1775 and 1776 was rendered memorable by the arrival of the celebrated *Caterina Gabrielli*, styled early in life *La Cuochetina*, being the daughter of a cardinal's cook at Rome. She had, however, in her countenance and deportment no indications of low birth. Her manner and appearance depicted dignity and grace. So great was her reputation before her arrival in England for singing and for caprice, that the public, expecting perhaps in both too much, were unwilling to allow her due praise for her performance, and were apt to ascribe every thing she did to pride and insolence. Her voice, though exquisite, was not very powerful. Her chief excellence having been the neatness and rapidity of her execution, the surprise of the public must have been much diminished on hearing her after Miss Davies, who sung many of the same songs in the same style, and with a neatness so nearly equal, that common hearers could distinguish no difference. The discriminating critic, however, might have discovered a superior sweetness in the natural tone of Gabrielli's voice, an elegance in the finishing of her musical periods or passages, an accent and precision in her divisions, superior not only to Miss Davies, but to every other singer of her time. In slow movements her pathetic powers, like those in general of performers most renowned for agility, were not exquisitely touching.

Agujari at the Pantheon.

About the time of which we have been treating, the proprietors of the Pantheon ventured to engage *Agujari* at the enormous salary of 100l. per night, for singing two songs only! *Lucrezia Agujari* was a truly wonderful performer. The lower part of her voice was full, round, and of excellent quality; its compass amazing. She had two octaves of fair natural voice, from A on the fifth line in the base to A on the sixth line in the treble, and beyond that *in alt* she had in early youth more than another octave. She has been heard to ascend to B b *in altissimo*. Her shake was open and perfect; her intonation true; her execution marked and rapid; the style of her singing, in the natural compass of her voice, grand and majestic.

Anna Pozzi.

In 1776 arrived Anna Pozzi, as successor to Gabrielli. She possessed a voice clear, sweet, and powerful; but her inexperience, both as an actress and as a singer, produced a contrast very unfavourable to her when compared with so celebrated a performer as Gabrielli. After that time, however, Pozzi, with more study and knowledge, became one of the best and most admired female singers in Italy.

Georgi.

After the departure of Agujari for the second and last time, the managers of the Pantheon engaged *Georgi* as her successor. Her voice was exquisitely fine, but totally uncultivated. She was thereafter employed as the first woman in the operas of the principal cities of Italy.

Roncaglia and Danze.

During the seasons 1777 and 1778, the principal singers at the opera in London were Francesco Roncaglia and Francesca Danze, afterwards Madame Le Brun.

Roncaglia possessed a sweet toned voice; but of the three great requisites of a complete stage singer, pathos, grace, and execution, which the Italians call *cantabile*, *graziosa*, and *bravura*, he could lay claim only to the second. His voice, a *voce de camera*, when confined to the *graziosa* in a room, left nothing to wish for.

Danze had a voice well in tune, a good shake, great execution, prodigious compass, with great knowledge of music; yet the pleasure her performance imparted was not equal to these accomplishments. But her object was not so much pathos and grace, as to surprise by the imitation of the tone and difficulties of instruments.

Pacchierotti.

This year *Gasparo Pachierotti* appeared in London, whither his high reputation had penetrated long before. The natural tone of his voice was interesting, sweet and, pathetic. His compass downwards was great, with an ascent up to B b, and sometimes to C *in alt*. He possessed an unbounded fancy, and the power not only of executing the most difficult and refined passages, but of inventing embellishment entirely new. *Ferdinando Bertoni*, a well known composer, came along with Pacchierotti to Britain.

Dancing gains the ascendant over music at the opera house.

About this time dancing became an important branch of the amusements of the opera house. Mademoiselle Heinel, M. Vestris le Jeune, Mademoiselle Baccelli, had, during some years, delighted the audience at the opera; but on the arrival of M. Vestris l'Aîné, pleasure was exchanged for ecstasy. In the year 1781, Pacchierotti had by this time been so frequently heard, that his singing was no impediment to conversation; but while the elder Vestris was on the stage, not a breathing was to be heard. Those lovers of music who talked the loudest while Pacchierotti sung, were in agonies of terror lest the graceful movements of Vestris, *le dieu de la danse*, should be disturbed by audible approbation. After that time, the most mute and respectful attention was paid to the manly grace of Le Picq, and the light fantastic toe of the younger Vestris; to the Rossis, the Theodores, the Coulons, the Hillingsburgs; while the slighted singers were disturbed, not by the violence of applause, but the clamour of inattention.

Commemoration of Handel in Westminster Abbey.

The year 1784 was rendered a memorable era in the annals of music by the splendid and magnificent manner in which the birth and genius of Handel were celebrated in Westminster Abbey and the Pantheon, by five performances of pieces selected from his own works, and executed by a band of more than 500 voices and instruments, in the presence and under the immediate auspices of their majesties and the first personages of the kingdom. The commemoration of Handel has been since established as an annual musical festival for charitable purposes; in which the number of performers and the perfection of the performances have continued to increase. In 1785 the band, vocal and instrumental, amounted to 616: in 1786 to 741; in 1787 to 806; and in subsequent years to still greater numbers.

Dr Burney published An Account of the Musical Performances in Commemoration of Handel, for the benefit

benefit of the Muſical Fund. The members and guardians of that fund are now incorporated under the title of *Royal Society of Muſicians*. See HANDEL.

This year Pacchierotti and his friend Bertoni left England. About the ſame time our country was deprived of the eminent composer Sacchini, and Giardini the greateſt performer on the violin now in Europe.

Excellence of Madame Mara.

As a compenſation for theſe loſſes, this memorable year is diſtinguiſhed by the arrival of Madame Mara, whoſe performance in the commemoration of Handel in Weſtminſter Abbey inſpired an audience of 3000 of the firſt people of the kingdom, not only with pleaſure but with ecſtacy and rapture.

Rubinelli.

In 1786 arrived *Giovanni Rubinelli*. His voice was a true and full contr'alto from C in the middle of the ſcale to the octave above. His ſtyle was grand; his execution neat and diſtinct; his taſte and embelliſhments new, ſelect, and maſterly.

A new dance by N. Noverre.

In 1788 a new dance, compoſed by the celebrated M. Noverre, called *Cupid and Pſyche*, was exhibited along with the opera *La Locandiera*, which produced an effect ſo uncommon as to deſerve notice. So great was the pleaſure it afforded to the ſpectators, that Noverre was unanimouſly brought on the ſtage and crowned with laurel by the principal performers. This, though common in France, was a new mark of approbation in England.

Marcheſi.

This year arrived Signior Luige Marcheſi, a ſinger whoſe talents have been the ſubject of praiſe and admiration on every great theatre of Europe. Marcheſi's ſtyle of ſinging was not only elegant and refined in an uncommon degree, but often grand and full of dignity, particularly in his recitative and occaſional low notes. His variety of embelliſhment and facility of running extempore diviſions were wonderful. Many of his graces were elegant and of his own invention.

Diſcriminated characters of Pacchierotti, Rubinelli, and Marcheſi.

The three greateſt Italian ſingers of theſe times were certainly Pacchierotti, Rubinelli, and Marcheſi. In diſcriminating the ſeveral excellencies of theſe great performers, a very reſpectable judge, Dr Burney, has particularly praiſed the ſweet and touching voice of Pacchierotti; his fine ſhake, his exquiſite taſte, his great fancy, and his divine expreſſion in pathetic ſongs: Of Rubinelli's voice, the fulneſs, ſteadineſs, and majeſty, the accuracy of his intonations, his judicious graces: Of Marcheſi's voice, the elegance and flexibility, his grandeur in recitative, and his boundleſs fancy and embelliſhments.—Having mentioned Dr Burney, we are in juſtice bound to acknowledge the aid we have derived from his hiſtory; a work which we greatly prefer to every other modern production on the ſubject.

Sovereign princes dilettanti.

During the latter part of the 18th century many eminent compoſers flouriſhed on the continent; ſuch as Jomelli, the family of the Bachs, Gluck, Haydn, and many others, whoſe different ſtyles and excellencies would well deſerve to be particularized, would our limits permit. With the ſame regard to brevity, we can do no more than juſt mention the late king of Pruſſia, the late elector of Bavaria, and Prince Lobkowitz, as eminent dilettanti of modern times.

Singers on theatres and in public gardens.

Beſides the opera ſingers whom we have mentioned, our theatres and public gardens have exhibited ſingers of conſiderable merit. In 1730 Miſs Raſter, afterwards the celebrated Mrs Clive, firſt appeared on the ſtage at Drury-lane as a ſinger. The ſame year introduced Miſs Cecilia Young, afterwards the wife of Dr Arne. Her ſtyle of ſinging was infinitely ſuperior to that of any other Engliſh woman of her time.

Favourite muſicians.

Our favourite muſicians at this time were, Dubourg, Clegg, Clarke, and Feſting, on the violin; Kytch on the hautboy; Jack Feſting on the German flute; Baſton on the common flute; Karba on the baſſoon; Valentine Snow on the trumpet: and on the organ, Roſeingrave, Green, Robinſon, Magnus, Jack James, and the blind Stanley, who ſeems to have been preferred. The favourite playhouſe ſinger was Salway; and at concerts Mountier of Chicheſter.

As compoſers for our national theatre, Pepuſch and Galliard ſeem to have been unrivalled till 1732; when two competitors appeared, who were long in poſſeſſion of the public favour: We allude to John Frederick Lampe and Thomas Auguſtus Arne.

In 1736 Mrs Cibber, who had captivated every hearer of ſenſibility by her native ſweetneſs of voice and powers of expreſſion as a ſinger, made her firſt attempt as a tragic actreſs. The ſame year Beard became a favourite ſinger at Covent-garden. At this time Miſs Young, afterwards Mrs Arne, and her two ſiſters Iſabella and Eſther, were the favourite Engliſh female ſingers.

Fund for decayed muſicians.

In 1738 was inſtituted the fund for the ſupport of decayed muſicians and their families.

It was in 1745 that Mr Tyers, proprietor of Vaux-hall gardens, firſt added vocal muſic to the other entertainments of that place. A ſhort time before Ranelagh had become a place of public amuſement.

Arrival of Giardini.

In 1749 arrived Giardini, whoſe great taſte, hand, and ſtyle in playing on the violin, procured him univerſal admiration. A few years after his arrival he formed a morning *academia* or concert at his houſe, compoſed chiefly of his ſcholars.

About this time San Martini and Charles Aviſon were eminent compoſers.

Style of Arne.

Of near 150 muſical pieces brought on our national theatres within 40 years, 38 of them at leaſt were ſet by Arne. The ſtyle of this compoſer, if analyzed, would perhaps appear to be neither Italian nor Engliſh; but an agreeable mixture of both and of Scotch.

The earl of Kelly.

The late earl of Kelly, who died ſome years ago, deſerves particular notice, as poſſeſſed of a very eminent degree of muſical ſcience, far ſuperior to other dilettanti, and perhaps not inferior to any profeſſor of his time. There was no part of theoretical or practical muſic in which he was not thoroughly verſed: He poſſeſſed a ſtrength of hand on the violin, and a genius for compoſition, with which few profeſſors are gifted.

Abel.

Charles Frederic Abel was an admirable muſician: His performance on the viol da gamba was in every particular complete and perfect. He had a hand which no difficulties could embarraſs; a taſte the moſt refined and delicate; a judgement ſo correct and certain as never to permit a ſingle note to eſcape him without meaning. His compoſitions were eaſy and elegantly ſimple. In writing and playing an *adagio* he was ſuperior to all praiſe; the moſt pleaſing yet learned modulation, the richeſt harmony, the moſt elegant and poliſhed melody, were all expreſſed with the moſt exquiſite feeling, taſte, and ſcience. His manner of playing an adagio soon became the model of imitation for all our young performers on bowed instruments. Bartholemon Cervetto, Cramer, and Crosdil, were in this respect to be ranked as of his school. All lovers of music must have lamented that Abel in youth had not attached himself to an instrument more worthy of his genius, taste, and learning, than the viol da gamba, that remnant of the old chest of viols which during the 17th century was a necessary appendage of a nobleman's or gentleman's family throughout Europe, previous to the admission of violins, tenors, and bases, in private houses or public concerts. Since the death of the late elector of Bavaria, (who was next to Abel the best performer on the viol da gamba in Europe): the instrument seems quite laid aside. It was used longer in Germany than elsewhere; but the place of gambist seems now as much suppressed in the chapels of German princes as that of lutanist. The celebrated performer on the violin, Lolle, came to England in 1785. Such was his caprice, that he was seldom heard; and so eccentric was his style and composition, that by many he was regarded as a madman. He was, however, during his lucid intervals a very great and expressive performer in the serious style.

Mrs Billington.

Mrs Billington, after distinguishing herself in childhood as a neat and expressive performer on the piano-forte, appeared all at once in 1786 as a sweet and captivating singer. In emulation of Mara and other great bravura singers, she at first too frequently attempted passages of difficulty; afterward, however, so greatly was she improved, that no song seemed too high or too rapid for her execution. Now, at the distance of 20 years, she retains her high reputation. The natural tone of her voice is so exquisitely sweet, her knowledge of music so considerable, her shake so true, her closes and embellishments so various, her expressions so grateful, that envy only or apathy could hear her without delight.

The present composers, and performers of the first class, are so well known to the lovers of the art, that it would be needless and improper to mention them particularly.

The catch-club and the concert of ancient music.

The Catch-club at the Thatched House, instituted in 1762 by the earl of Eglinton, the present duke of Queensberry, and others; and the concert of ancient music, suggested by the earl of Sandwich in 1776, have had a beneficial effect in improving the art.

Two female performers have lately appeared of distinguished eminence.

Madame Grassini.

Madame Grassini had exhibited her vocal powers in Paris with extraordinary applause, and arrived in London in 1805, where she excited uncommon admiration. She appeared in Zaira, where the display of her powers not only pleased, but she astonished, when it was considered that the compass of her voice did not exceed eight or ten notes.

Madame Catalani.

The year following Madame Catalani divided the public attention with Grassini.—This eminent performer is a native of Sinigaglia in Italy, where her father was a singer of the comic order.

She was educated in a convent. The virtuous impressions she there received, have continued ever since invariably to influence her conduct.

Her father soon discovered the excellence and the value of her vocal powers, which were first exhibited on the provincial theatres of Italy.—He soon carried her to Spain, where she attained very high celebrity. It was there her husband, M. de Valabregue, first paid his addresses to her; and it was not till after a perseverance of seven months that he at last obtained her consent, to unite her fortunes with his. Her hesitation proceeded from the reluctance of her father, at once to be deprived of his daughter, and of the very great emolument which she brought him. M. de Valabregue had been an officer in the French army under General Moreau.

From Spain Madame Catalani (for she has retained her father's name), proceeded to Portugal, where she accepted an engagement to come to London. She travelled through France, and at Paris appeared at an occasional concert, where her fame was so great, that the usual price of admission was trebled. She particularly attracted the attention of the singular man who now holds the imperial sceptre of the continent of Europe. He ordered her a pension (its value is about 30l. per annum); and it was with much difficulty, and only through the interference of the British ambassador (the earl of Lauderdale) then at Paris, that she was permitted to leave that capital, and proceed on her journey.

In the dramatic music of the opera, this singer is far superior to any performer ever heard in this country. Her merit in Semiramide, in particular, presents almost the idea of perfection. Her voice is equal to the most difficult execution, while her countenance is interesting, her gestures graceful, and her person elegant. It has been reported that she does not sing in tune; but it is an undeniable fact, vouched by the first musicians, that she possesses a most accurate ear. Every vocal performer occasionally emits a false sound in consequence of some temporary organic cause.

Catalani's easy and clear articulation are particularly striking. Her tones are full and liquid. Her cadenzas are appropriate and masterly. She has a practice of rapidly descending in half notes, which has excited admiration chiefly by its entire novelty. The clearness and rapidity displayed by her in chromatic passages excite astonishment; and she combines mellowness with distinctness, a high qualification which Mara first taught us to appreciate. In the course of summer 1807, Madame Catalani visited the provincial theatres of England, and appeared likewise in Dublin, Edinburgh, and Glasgow. Her total receipts for that year are said to have exceeded 15,000l.

We have been somewhat particular in our account of musical affairs in our own country during the 18th century, as what would be most interesting to general readers, and of which a well-informed gentleman would not wish to be ignorant. The professor and connoisseur will have recourse to disquisitions much more minute than those of which our limits can be supposed to admit.

ELEMENTS

ELEMENTS OF MUSIC,

THEORETICAL AND PRACTICAL (C).

PRELIMINARY DISCOURSE.

Mufic confidered in a double view.

MUSIC may be confidered, either as an art, which has for its object one of the greateft pleafures of which our fenfes (D) are fufceptible; or as a fcience, by which that art is reduced to principles. This is the double view in which we mean to treat of mufic in this work.

Progrefs of mufic like that of other arts and fciences.

It has been the cafe with mufic as with all the other arts invented by man: fome facts were at firft difcovered by accident; foon afterwards reflection and obfervation inveftigated others: and from thefe facts, properly difpofed and united, philofophers were not flow in forming a body of fcience, which afterwards increafed by degrees.

The firft theories of mufic were perhaps as ancient as the earlieft age which we know to have been diftinguifhed by philofophy, even as the age of Pythagoras; nor does hiftory leave us any room to doubt, that from the period when that philofopher taught, the ancients cultivated mufic, both as an art and as a fcience, with great affiduity. But there remains to us much uncertainty concerning the degree of perfection to which they brought it. Almoft every queftion which has been propofed with refpect to the mufic of the ancients has divided the learned; and probably may ftill continue to divide them, for want of monuments fufficient in their number, and inconteftable in their nature, from whence we might be enabled to exhibit teftimonies and difcoveries inftead of fuppofitions and conjectures. In the preceding hiftory we have ftated a few facts refpecting the nature of ancient mufic, and the inventors of the feveral mufical inftruments; but it were to be wifhed, that, in order to elucidate, as much as poffible, a point fo momentous in the hiftory of the fciences, fome perfon of learning, equally fkilled in the Greek language and in mufic, fhould exert himfelf to unite and difcufs in the fame work the moft probable opinions eftablifhed or propofed by the learned, upon a fubject fo difficult and curious. This philofophical hiftory of ancient mufic is a work which might highly embellifh the literature of our times.

The hiftory of mufic a defideratum in literature.

In the mean time, till an author can be found fufficiently inftructed in the arts and in hiftory to undertake fuch a labour with fuccefs, we fhall content ourfelves with confidering the prefent ftate of mufic, and limit our endeavours to the explication of thofe acceffions which have accrued to the theory of mufic in thefe latter times.

There are two departments in mufic, melody * and harmony †. Melody is the art of arranging feveral founds in fucceffion one to another in a manner agreeable to the ear; harmony is the art of pleafing that organ by the union of feveral founds which are heard at one and the fame time. Melody has been known and felt through all ages: perhaps the fame cannot be affirmed of harmony (E); we know not whether the ancients made any ufe of it or not, nor at what period it began to be practifed.

* See *Melody*.
† See *Harmony*.

Not but that the ancients certainly employed in their mufic

(C) To deliver the elementary principles of mufic, theoretical and practical, in a manner which may prove at once entertaining and inftructive, without protracting this article much beyond the limits prefcribed in our plan, appears to us no eafy tafk. We therefore hefitated for fome time whether to try our own ftrength, or to follow fome eminent author on the fame fubject. Of thefe the laft feemed preferable. Amongft thefe authors, none appeared to us to have written any thing fo fit for our purpofe as M. d'Alembert, whofe treatife on mufic is the moft methodical, perfpicuous, concife, and elegant differtation on that fubject with which we are acquainted. As it was unknown to moft Englifh readers before a former edition of this work, it ought to have all the merit of an original. We have given a tranflation of it; and in the notes, we have added, from the works of fucceeding authors, and from our own obfervation, fuch explanations as appeared neceffary, to adapt the work to the prefent day.

(D) In this paffage, and in the definitions of melody and harmony, our author feems to have adopted the vulgar error, that the pleafures of mufic terminate in corporeal fenfe. He would have pronounced it abfurd to affert the fame thing of painting. Yet if the former be no more than a mere pleafure of corporeal fenfe, the latter muft likewife be ranked in the fame predicament. We acknowledge that corporeal fenfe is the vehicle of found; but it is plain from our immediate feelings, that the refults of found arranged according to the principles of melody, or combined and difpofed according to the laws of harmony, are the objects of a reflex or internal fenfe.

For a more fatisfactory difcuffion of this matter, the reader may confult that elegant and judicious treatife on Mufical Expreffion by Mr Avifon. In the mean time it may be neceffary to add, that, in order to fhun the appearance of affectation, we fhall ufe the ordinary terms by which mufical fenfations, or the mediums by which they are conveyed, are generally denominated.

(E) Though no certainty can be obtained what the ancients underftood of harmony, nor in what manner and in what period they practifed it; yet it is not without probability, that, both in fpeculation and practice, they were in poffeffion of what we denominate *counterpoint*. Without fuppofing this, there are fome paffages in the Greek authors which can admit of no fatisfactory interpretation. See the *Origin and Progrefs of Language*, vol. ii.

Befides,

Preliminary Diſcourſe.

muſic thoſe chords which were moſt perfect and ſimple; ſuch as the octave, the fifth, and the third; but it ſeems doubtful whether they knew any of the other conſonances or not, or even whether in practice they could deduce the ſame advantages from the ſimple chords which were known to them, that have afterwards accrued from experience and combinations.

If that harmony which we now practiſe owes its origin to the experience and reflection of the moderns, there is the higheſt probability that the firſt eſſays of this art, as of all the others, were feeble, and the progreſs of its efforts almoſt imperceptible; and, that, in the courſe of time, improving by ſmall gradations, the ſucceſſive labours of ſeveral geniuſes have elevated it to that degree of perfection in which at preſent we find it.

The origin of arts often accidental, and their progreſs gradual.

The firſt inventor of harmony eſcapes our inveſtigation, from the ſame cauſes which leave us ignorant of thoſe who firſt invented each particular ſcience; becauſe the original inventors could only advance one ſtep, a ſucceeding diſcoverer afterwards made a more ſenſible improvement, and the firſt imperfect eſſays in every kind were loſt in the more extenſive and ſtriking views to which they led. Thus the arts which we now enjoy, are for the moſt part far from being due to any particular man, or to any nation excluſively: they are produced by the united and ſucceſſive endeavours of mankind; they are the reſults of ſuch continued and united reflections, as have been formed by all men at all periods and in all nations.

It might, however, be wiſhed, that after having aſcertained, with as much accuracy as poſſible, the ſtate of ancient muſic by the ſmall number of Greek authors which remain to us, the ſame application were immediately directed to inveſtigate the firſt inconteſtable traces of harmony which appear in the ſucceeding ages, and to purſue thoſe traces from period to period. The products of theſe reſearches would doubtleſs be very imperfect, becauſe the books and monuments of the middle ages are by far too few to enlighten that gloomy and barbarous era; yet theſe diſcoveries would ſtill be precious to a philoſopher, who delights to obſerve the human mind in the gradual evolution of its powers, and the progreſs of its attainments.

Delineations of the laws of harmony recent and imperfect.

The firſt compoſitions upon the laws of harmony which we know, are of no higher antiquity than two ages prior to our own; and they were followed by many others. But none of theſe eſſays was capable of ſatisfying the mind concerning the principles of harmony: they confined themſelves almoſt entirely to the ſingle occupation of collecting rules, without endeavouring to account for them; neither had their analogies one with another, nor their common ſource, been perceived; a blind and unenlightened experience was the only compaſs by which the artiſt could direct and regulate his courſe.

Its precepts not deduced from any principle till by M. Rameau.

M. Rameau was the firſt who began to transfuſe light and order through this chaos. In the different tones produced by the ſame ſonorous body, he found the moſt probable origin of harmony, and the cauſe of that pleaſure which we receive from it. His principle he unfolded, and ſhowed how the different phenomena of muſic were produced by it: he reduced all the conſonances to a ſmall number of ſimple and fundamental chords, of which the others are only combinations or various arrangements. He has, in ſhort, been able to diſcover, and render ſenſible to others, the mutual dependence between melody and harmony.

The author's motives for writing theſe elements.

Though theſe different topics may be contained in the writings of this celebrated artiſt, and in theſe writings may be underſtood by philoſophers who are likewiſe adepts in the art of muſic; ſtill, however, ſuch muſicians as were not philoſophers, and ſuch philoſophers as were not muſicians, have long deſired to ſee theſe objects brought more within the reach of their capacity. Such is the intention of the preſent treatiſe; in which we claim no other merit than that of having developed, elucidated, and perhaps in ſome reſpects improved, the ideas of another (F).

Improvements of this edition. Account of the work in general.

The firſt edition of this eſſay, publiſhed 1752, having been favourably received, we have endeavoured to render this more perfect. The detail which is meant to be given of my labour, will preſent the reader with a general idea of the principle of M. Rameau, of the conſequences deduced from it, of the manner in which I have diſpoſed this principle and its conſequences; in ſhort, of what is ſtill wanting, and might be advantageous to the theory of this delightful art; of what ſtill remains for the learned to contribute towards the perfection of this theory; of the rocks and quickſands which they ought to avoid in this reſearch, and which could ſerve no other purpoſe than to retard their progreſs.

Rameau's origin of harmony.

Every ſonorous body, beſides its principal ſound, likewiſe exhibits to the ear the 12th and 17th major of that ſound. This multiplicity of different yet concordant ſounds, known for a conſiderable time, conſtitutes the baſis of the whole theory of M. Rameau, and the foundation upon which he builds the whole ſuperſtructure of a muſical ſyſtem *. In theſe our *elements* may be ſeen, how from this experiment one may deduce, by an eaſy operation of reaſon, the chief points of melody and harmony; the perfect † chord, as well major as minor; the two ‡ tetrachords employed in ancient muſic; the formation of our diatonic || ſcale; the different values § which the ſame ſound may have in that ſcale, according to the turn which is given to the baſs ¶; the alterations * which we obſerve in that ſcale, and the reaſon why they are totally imperceptible to the ear; the rules peculiar to the mode † major; the difficulty in ‡ intonation of forming three tones || in ſucceſſion; the reaſon why two perfect chords are proſcribed

* See *Syſtem.*
† See *Chord.*
‡ See *Tetrachord.*
|| See *Diatonic.*
§ See *Value.*
¶ See *Baſs.*
* See *Alteration.*
† See *Mode.*
‡ See *Intonation.*
|| See *Tone.*

Beſides, we can diſcover ſome veſtiges of harmony, however rude and imperfect, in the hiſtory of the Gothic ages, and amongſt the moſt barbarous people. This they could not have derived from more cultivated countries, becauſe it appears to be incorporated with their national muſic. The moſt rational account, therefore, which can be given, ſeems to be, that it was conveyed in a mechanical or traditionary manner through the Roman provinces from a more remote period of antiquity.

(F) See M. Rameau's letter upon this ſubject, *Merc. de Mai*, 17 2.

fcribed in immediate fucceffion in the diatonic order; the origin of the minor mode, its fubordination to the mode major, and its variations; the ufe of difcord §; the caufes of fuch effects as are produced by different kinds of mufic, whether diatonic, chromatic *, or enharmonic †; the principles and laws of temperament ‡. In this difcourfe we can only point out thofe different objects, the fubfequent effay being defigned to explain them with the minutenefs and precifion which they require.

§ See *Difcord.*
* See *Chromatic.*
† See *Enharmonic.*
‡ See *Temperament.*

One end which we have propofed in this treatife, was not only to elucidate, but to fimplify the difcoveries of M. Rameau.—For inftance, befides the fundamental experiment mentioned above, that celebrated mufician, to facilitate the explication of certain phenomena, had recourfe to another experiment; that which fhows that a fonorous body ftruck and put in vibration, forces its 12th and 17th major in defcending to divide themfelves and produce a tremulous found. The chief ufe which M. Rameau made of this fecond experiment was to inveftigate the origin of the minor mode, and to account for fome other rules eftablifhed in harmony; but we have found means to deduce from the firft experiment alone the formation of the minor mode, and, befides, to difengage that formation from all queftions foreign to it.

In fome other points alfo, (as, the origin of the chord of the fub-dominant *, and the explication of the feventh in certain cafes) it is imagined that we have fimplified, and perhaps in fome meafure extended, the principles of the celebrated artift.

* See *Subdominant.*

We have likewife banifhed every confideration of geometrical, arithmetical, and harmonical proportions and progreffions, which have been fought in the mixture and protraction of tones produced by a fonorous body; perfuaded as we are, that M. Rameau was under no neceffity of paying the leaft regard to thefe proportions, which we believe to be not only ufelefs, but even, if we may venture to fay fo, fallacious when applied to the theory of mufic. In fhort, though the relations produced by the octave, the fifth, and the third, &c. were quite different from what they are; though in thefe chords we fhould neither remark any progreffion nor any law; though they fhould be incommenfurable one with another; the protracted tone of a fonorous body, and the multiplied founds which refult from it, are a fufficient foundation for the whole harmonic fyftem.

Theoretical muficians cautioned with regard to the admiffion of mathematical or metaphyfical principles in mufic.

But though this work is intended to explain the theory of mufic, and to reduce it to a fyftem more complete and more luminous than has hitherto been done, we ought to caution our readers againft mifapprehenfion either of the nature of our fubject or of the purpofe of our endeavours.

We muft not here look for that ftriking evidence which is peculiar to geometrical difcoveries alone, and which can be fo rarely obtained in thefe mixed difquifitions, where natural philofophy is likewife concerned. Into the theory of mufical phenomena there muft always enter a particular kind of metaphyfics, which thefe phenomena implicitly take for granted, and which brings along with it its natural obfcurity. In this fubject, therefore, it would be vain to expect what is called *demonftration*: it is much to have reduced the principal facts to a confiftent and connected fyftem; to have deduced them from one fimple experiment; and to have eftablifhed upon this foundation the moft common and effential rules of the mufical art. But if the intimate and unalterable conviction which can only be produced by the ftrongeft evidence is not here to be required, we muft alfo doubt whether a clearer elucidation of our fubject be poffible.

After this declaration, it will not excite furprife, that, amongft the facts deduced from our fundamental experiment, fome fhould immediately appear to depend upon that experiment, and others to refult from it in a way more remote and lefs direct. In difquifitions of natural philofophy, where we are fcarcely allowed to ufe any other arguments than thofe which arife from analogy or congruity, it is natural that the analogy fhould be fometimes more and fometimes lefs fenfible; and we will venture to pronounce that mind very unphilofophical, which cannot recognife and diftinguifh this gradation and the different circumftances on which it proceeds. It is not even furprifing, that, in a fubject where analogy alone can take place, this conductrefs fhould defert us all at once in our attempts to account for certain phenomena. This likewife happens in the fubject which we now treat; nor do we conceal the fact, however mortifying, that there are certain points (though their number be but fmall) which appear ftill in fome degree unaccountable from our principle. Such, for inftance, is the procedure of the diatonic fcale of the minor mode in defcending, the formation of the chord commonly termed the *fixth redundant* † or *fuperfluous*, and fome other facts of lefs importance, for which as yet we can fcarcely offer any fatisfactory account except from experience alone.

† See *Redundant.*

Rameau's primary experiment has not as yet accounted for all the phenomena of mufic. Perhaps fome other may be neceffary.

Thus, though the greateft number of the phenomena of mufic appear to be deducible in a fimple and eafy manner from the protracted tone of fonorous bodies, it ought not perhaps with too much temerity to be affirmed as yet, that this mixed and protracted tone is *demonftratively* the only original principle of harmony. But in the mean time it would not be lefs unjuft to reject this principle, becaufe certain phenomena appear to be deduced from it with lefs fuccefs than others. It is only neceffary to conclude from this, either that by future fcrutinies means may be found for reducing thefe phenomena to this principle; or that harmony has perhaps fome other unknown principle, more general than that which refults from the protracted and compounded tone of fonorous bodies, and of which this is only a branch; or, laftly, that we ought not perhaps to attempt the reduction of the whole fcience of mufic to one and the fame principle; which, however, is the natural effect of an impatience fo frequent even among philofophers themfelves, which induces them to take a part for the whole, and to judge of objects in their full extent by the greateft number of their appearances.

In thofe fciences which are called *phyfico-mathematical* (and amongft this number perhaps the fcience of founds may be placed), there are fome phenomena which depend only upon one fingle principle and one fingle experiment: there are others which neceffarily fuppofe a greater number both of experiments and principles, whofe combination is indifpenfable in forming an exact and complete fyftem; and mufic perhaps is in this laft cafe. It is for this reafon, that whilft we

Preliminary Discourse.

we bestow on M. Rameau all due praise, we should not at the same time neglect to stimulate the learned in their endeavours to carry them still to higher degrees of perfection, by adding, if it is possible, such improvements as may be wanting to consummate the science.

Whatever the result of their efforts may be, the reputation of this intelligent artist has nothing to fear: he will still have the advantage of being the first who rendered music a science worthy of philosophical attention; of having made the practice of it more simple and easy; and of having taught musicians to employ in this subject the light of reason and analogy.

Tartini's experiment.

We would the more willingly persuade those who are skilled in theory and eminent in practice to extend and improve the views of him who before them pursued and pointed out the career, because many amongst them have already made laudable attempts, and have even been in some measure successful in diffusing new light through the theory of this enchanting art. It was with this view that the celebrated Tartini has presented us in 1754 with a treatise of harmony, founded on a principle different from that of M. Rameau. This principle is the result of a most beautiful experiment (G). If at once two different sounds are produced from two instruments of the same kind, these two sounds generate * a third different from both the others. We have inserted in the *Encyclopédie*, under the article *Fundamental*, a detail of this experiment according to M. Martini; and we owe to the public an information, of which in composing this article we were ignorant: M. Romieu, a member of the Royal Society at Montpelier, had presented to that society in the year 1753, before the work of M. Tartini had appeared, a memorial printed the same year, and where may be found the same experiment displayed at full length. In relating this fact, which it was necessary for us to do, it is by no means our intention to detract in any degree from the reputation of M. Tartini; we are persuaded that he owes this discovery to his own researches alone: but we think ourselves obliged in honour to give public testimony in favour of him who was the first in exhibiting this discovery.

* See *Generate.*

Its discovery originally due to Romieu.

But whatever be the case, it is in this experiment that M. Tartini attempts to find the origin of harmony: his book, however, is written in a manner so obscure, that it is impossible for us to form any judgement of it; and we are told that others distinguished for their knowledge of the science are of the same opinion. It were to be wished that the author would engage some man of letters, equally practised in music and skilled in the art of writing, to unfold these ideas which

---

(G) Had the utility of the preliminary discourse in which we are now engaged been less important and obvious than it really is, we should not have given ourselves the trouble of translating, or our readers that of perusing it. But it must be evident to every one, that the cautions here given, and the advices offered, are no less applicable to students than to authors. The first question here decided is, Whether pure mathematics can be successfully applied to the theory of music? The author is justly of a contrary opinion. It may certainly be doubted with great justice, whether the solid contents of sonorous bodies, and their degrees of cohesion or elasticity, can be ascertained with sufficient accuracy to render them the subjects of musical speculation, and to determine their effects with such precision as may render the conclusions deduced from them geometrically true. It is admitted, that sound is a secondary quality of matter, and that secondary qualities have no obvious connexion which we can trace with the sensations produced by them. Experience, therefore, and not speculation, is the grand criterion of musical phenomena. For the effects of geometry in illustrating the theory of music (if any will still be so credulous as to pay them much attention), the English reader may consult Smith's Harmonics, Malcolm's Dissertation on Music, and Pleydel's Treatise on the same subject inserted in a former edition of this work. Our author next treats of the famous discovery made by Signor Tartini, of which the reader may accept the following compendious account.

If two sounds be produced at the same time properly tuned and with due force, from their conjunction a third sound is generated, so much more distinctly to be perceived by delicate ears as the relation between the generating sounds is more simple; yet from this rule we must except the unison and octave. From the fifth is produced a sound unison with its lowest generator; from the fourth, one which is an octave lower than the highest of its generators; from the third major, one which is an octave lower than its lowest; and from the sixth minor (whose highest note forms an octave with the lowest in the third formerly mentioned) will be produced a sound lower by a double octave than the highest of the lesser sixth; from the third minor, one which is double the distance of a greater third from its lowest; but from the sixth major (whose highest note makes an octave to the lowest in the third minor) will be produced a sound only lower by double the quantity of a greater third than the highest; from the second major, a sound lower by a double octave than the lowest; from a second minor, a sound lower by triple the quantity of a third major than the highest; from the interval of a diatonic or greater semitone, a sound lower by a triple octave than the highest; from that of a minor or chromatic semitone, a sound lower by the quantity of a fifth four times multiplied than the lowest, &c. &c. But that these musical phenomena may be tried by experiments proper to ascertain them, two hautboys tuned with scrupulous exactness must be procured, whilst the musicians are placed at the distance of some paces one from the other, and the hearers in the middle. The violin will likewise give the same chords, but they will be less distinctly perceived, and the experiment more fallacious, because the vibrations of other strings may be supposed to enter into it.

If our English reader should be curious to examine these experiments and the deductions made from them in the theory of music, he will find them clearly explained and illustrated in a treatise called *Principles and Power of Harmony*, printed at London in the year 1771.

Preliminary Difcourfe.

which he has not communicated with fufficient perfpicuity, and from whence the art might perhaps derive confiderable advantage if they were placed in a proper light. Of this we are fo much the more perfuaded, that even though this experiment fhould not be regarded by others in the fame view with M. Tartini as the foundation of the mufical art, it is neverthelefs extremely probable that one might ufe it with the greateft advantage to enlighten and facilitate the practice of harmony.

In exhorting philofophers and artifts to make new attempts for the advancement of the theory of mufic, we ought at the fame time to caution them againft miftaking the real end of their refearches. Experience is the only foundation upon which they can proceed; it is alone by the obfervation of facts, by bringing them together in one view, by fhowing their dependency upon one, if poffible, or at leaft upon a very fmall number of primary facts, that they can reach the end to which they fo ardently afpire, the important end of eftablifhing a theory of mufic, at once great, complete and luminous. The enlightened philofopher will not attempt the explanation of facts, becaufe he knows how little fuch explanations are to be relied on. To eftimate them according to their proper value, it is only neceffary to confider the attempts of natural philofophers who have difcovered the greateft fkill in their fcience, to explain, for inftance, the multiplicity of tones produced by fonorous bodies. Some having remarked (what is by no means difficult to conclude) that the univerfal vibration of a mufical ftring is a mixture of feveral partial vibrations, infer, that a fonorous body ought to produce a multiplicity of tones, as it really does. But why fhould this multiplied found only appear to contain three, and why thefe three preferable to others? Others pretend that there are particles in the air, which, by their different degrees of tenfion, being naturally fufceptible of different ofcillations, produce the multiplicity of found in queftion. But what do we know of all this? And though it fhould even be granted, that there is fuch a diverfity of tenfion in thefe aerial particles, how fhould this diverfity prevent them from being all of them confounded in their vibrations by the motions of a fonorous body? What then fhould be the refult, when the vibrations arrive at our ears, but a confufed and inappretiable * noife, where one could not diftinguifh any particular found?

Mechanical conclufions inadequate to the fituation of mufical phenomena.

* See *Inappretiable*.

Metaphyfical conclufions lefs adequate.

If philofophical muficians ought not to lofe their time in fearching for mechanical explications of the phenomena in mufic, explications which will always be found vague and unfatisfactory; much lefs is it their province to exhauft their powers in vain attempts to rife above their fphere into a region ftill more remote from the profpect of their faculties, and to lofe themfelves in a labyrinth of metaphyfical fpeculations upon the caufes of that pleafure which we feel from harmony. In vain would they accumulate hypothefis on hypothefis, to find a reafon why fome chords fhould pleafe us more than others. The futility of thefe fuppofititious accounts muft be obvious to every one who has the leaft penetration. Let us judge of the reft by the moft probable which has till now been invented for that purpofe. Some afcribe the different degrees of pleafure which we feel from chords, to the more or lefs frequent coincidence of vibrations; others to the relations which thefe vibrations have among themfelves as they are more or lefs fimple. But why fhould this coincidence of vibrations, that is to fay, their fimultaneous impulfe on the fame organs of fenfation, and the accident of beginning frequently at the fame time, prove fo great a fource of pleafure? Upon what is this gratuitous fuppofition founded? And though it fhould be granted, would it not follow, that the fame chord fhould fucceffively and rapidly affect us with contrary fenfations, fince the vibrations are alternately coincident and difcrepant? On the other hand, how fhould the ear be fo fenfible to the fimplicity of relations, whilft for the moft part thefe relations are entirely unknown to him whofe organs are notwithftanding fenfibly affected with the charms of agreeable mufic? We may conceive without difficulty how the eye judges of relations; but how does the ear form fimilar judgements? Befides, why fhould certain chords which are extremely pleafing in themfelves, fuch as the fifth, lofe almoft nothing of the pleafure which they give us, when they are altered, and of confequence when the fimplicity of their relations are deftroyed; whilft other chords, which are likewife extremely agreeable, fuch as the third, become harfh almoft by the fmalleft alteration; nay, whilft the moft perfect and the moft agreeable of all chords, the octave, cannot fuffer the moft inconfiderable change? Let us in fincerity confefs our ignorance concerning the genuine caufes of thefe effects (H). The metaphyfical

(H) We have as great an averfion as our author to the explication of mufical phenomena from mechanical principles; yet we fear the following obfervations, deduced from irrefiftible and univerfal experience, evidently fhow that the latter neceffarily depend on the former. It is, for inftance, univerfally allowed, that diffonances grate and concords pleafe a mufical ear: It is likewife no lefs unanimoufly agreed, that in proportion as a chord is perfect, the pleafure is increafed; now the perfection of a chord confifts in the regularity and frequency of coincident ofcillations between two fonorous bodies impelled to vibrate: thus the third is a chord lefs perfect than the fifth, and the fifth than the octave. Of all thefe confonances, therefore, the octave is moft pleafing to the ear; the fifth next, and the third laft. In abfolute difcords, the vibrations are never coincident, and of confequence a perpetual pulfation or jarring is recognifed between the protracted founds, which exceedingly hurts the ear; but in proportion as the vibrations coincide, thofe pulfations are fuperfeded, and a kindred formed betwixt the two continued founds, which delights even the corporeal fenfe: that relation, therefore, without recognizing the aptitudes which produce it, muft be the obvious caufe of the pleafure which chords give to the ear. What we mean by coincident vibrations is, that while one fonorous body performs a given number of vibrations, another performs a different number in the fame time; fo that the vibrations of the quickeft muft fometimes be fimultaneous with thofe of the floweft, as will plainly appear from the following

Preliminary Discourse.

taphyfical conjectures concerning the acouftic organs are probably in the fame predicament with thofe which are formed concerning the organs of vifion, if one may fpeak fo, in which philofophers have even till now made fuch inconfiderable progrefs, and in all likelihood will not be furpaffed by their fucceffors.

Since the theory of mufic, even to thofe who confine themfelves within its limits, implies queftions from which every wife mufician will abftain; with much greater reafon fhould they avoid idle excurfions beyond the boundaries of that theory, and endeavours to inveftigate between mufic and the other fciences chimerical relations which have no foundation in nature. The fingular opinions advanced upon this fubject by fome even of the moft celebrated muficians, deferve not to be refcued from oblivion, nor refuted; and ought only to be regarded as a new proof how far men of genius may err, when they engage in fubjects of which they are ignorant.

The rules which we have attempted to eftablifh concerning the track to be followed in the theory of the mufical art, may fuffice to fhow our readers the end which we have propofed, and which we have endeavoured to attain in this Work. We have here (we repeat it), nothing to do with the mechanical principles of protracted and harmonic tones produced by fonorous bodies; principles which have hitherto been and perhaps may yet be long explored in vain: we have lefs to do with the metaphyfical caufes of the fenfations impreffed on the mind by harmony; caufes which are ftill lefs difcovered, and which, according to all appearances, will remain latent in perpetual obfcurity. We are alone concerned to fhow how the principal laws of harmony may be deduced from one fingle experiment; for which, if we may fpeak fo, preceding artifts have been under a neceffity of groping in the dark.

With an intention to render this work as generally ufeful as poffible, we have endeavoured to adapt it to the capacity even of thofe who are abfolutely uninftructed in mufic. To accomplifh this defign, it appeared neceffary to purfue the following plan.

Plan of the treatife.

To begin with a fhort introduction, in which are defined the technical terms moft frequently ufed in this art; fuch as *chord*, *harmony*, *key*, *third*, *fifth*, *octave*, &c.

Afterwards to enter into the theory of harmony, which is explained according to M. Rameau, with all poffible perfpicuity. This is the fubject of the *Firft Part;* which, as well as the introduction, prefuppofes no other knowledge of mufic than that of the names of the notes, C, D, E, F, G, A, B, which all the world knows (1).

The theory of harmony requires fome arithmetical calculations, neceffary for comparing founds one with another. Thefe calculations are fhort, fimple, and may be comprehended by every one; they demand no operation but what is explained, and which every fchool-boy may perform. Yet, that even the trouble of this may be fpared to fuch as are not difpofed to take it, thefe calculations are not inferted in the text, but in the notes, which the reader may omit, if he can take for granted the propofitions contained in the text which will be found proved in the notes.

Thefe calculations we have not endeavoured to multiply; we could even have wifhed to fupprefs them, if it had been poffible: fo much did it appear to us to be apprehended that our readers might be mifled upon this fubject, and might either believe, or fufpect us of believing,

---

following deduction: Between the extremes of a third, the vibrations of the higheft are as 5 to 4 of the loweft; thofe of the fifth as 3 to 2; thofe of the octave as 2 to 1. Thus it is obvious, that in proportion to the frequent coincidence of periodical vibrations, the compound fenfation is more agreeable to the ear. Now, to inquire why that organ fhould be rather pleafed with thefe than with the pulfation and tremulous motion of encountering vibrations which can never coalefce, would be to afk why the touch is rather pleafed with polifhed than rough furfaces? or, why the eye is rather pleafed with the waving line of Hogarth than with fharp angles and abrupt or irregular prominences? No alteration of which any chord is fufceptible will hurt the ear unlefs it fhould violate or deftroy the regular and periodical coincidence of vibrations. When alterations can be made without this difagreeable effect, they form a pleafing diverfity; but ftill this fact corroborates our argument, that in proportion as any chord is perfect, it is impatient of the fmalleft alteration; for this reafon, even in temperament, the octave endures no alteration at all, and the fifth as little as poffible.

(1) In our former editions, the French fyllabic names of the notes *ut*, *re*, *mi*, *fa*, *fol*, *la*, *fi*, were retained, as being thought to convey the idea of the relative founds more diftinctly than the feven letters ufed in Britain. It is no doubt true, that by conftantly ufing the fyllables, and confidering each as reprefenting one certain found in the fcale, a finger will in time affociate the idea of each found with its proper fyllable, fo that he will habitually give *ut* the found of the firft or fundamental note, *re* that of a fecond, *mi* of a third, &c. but this requires a long time, and much application: and is, befides, ufelefs in *modulation* or changes of the key, and in all inftrumental mufic. Teachers of *fol-fa'ing* as it is called, or finging by the fyllables, in Britain, have long difcarded, (if they ever ufed) the fyllables *ut*, *re*, and *fi:* and the prevalent, and we think, the founder opinion is now, that a fcholar will, by attending to the founds themfelves rather than to their names, foon learn their diftinct characters and relations to the key, and to each other, and be able of courfe to affign to each its proper degree in the fcale which he employs for the time, by whatever name the note reprefenting that degree may be generally known. See *Holden's Effay towards a Rational Syftem of Mufic*, Part I. chap. i. § 32, 33.

We have therefore, in our prefent edition, preferred to the French fyllables the Britifh nomenclature by the letters C, D, E, F, G, A, B, as being more fimple, more familiar to Britifh muficians, and equally applicable to inftrumental as to vocal mufic.

Preliminary Diſcourſe.

believing, all this arithmetic neceſſary to form an artiſt. Calculations may indeed facilitate the underſtanding of certain points in the theory, as of the relations between the different notes in the gammut and of the temperament; but the calculations neceſſary for treating of theſe points are ſo ſimple, and of ſo little importance, that nothing can require a leſs oſtentatious diſplay. Let us not imitate thoſe muſicians, who, believing themſelves geometers, or thoſe geometers who, believing themſelves muſicians, fill their writings with figures upon figures; imagining, perhaps, that this apparatus is neceſſary to the art. The propenſity of adorning their works with a falſe air of ſcience, can only impoſe upon ignorance, and render their treatiſes more obſcure and leſs inſtructive.

Mathematical concluſions not transferable to ſenſible objects without caution.

This abuſe of geometry in muſic may be condemned with ſo much more reaſon, that in this ſubject the foundations of thoſe calculations are in ſome manner hypothetical, and can never ariſe to a degree of certainty above hypotheſis. The relation of the octave as 1 to 2, that of the fifth as 2 to 3, that of the third major as 4 to 5, &c. are not perhaps the genuine relations eſtabliſhed in nature; but only relations which approach them, and ſuch as experience can diſcover. For are the reſults of experience any thing more but mere approaches to truth?

But happily theſe approximated relations are ſufficient, though they ſhould not be exactly agreeable to truth, for giving a ſatisfactory account of thoſe phenomena which depend on the relations of ſound; as in the difference between the notes in the gammut, of the alterations neceſſary in the fifth and third, of the different manner in which inſtruments are tuned, and other facts of the ſame kind. If the relations of the octave, of the fifth, and of the third, are not exactly ſuch as we have ſuppoſed them, at leaſt no experiments can prove that they are not ſo; and ſince theſe relations are ſignified by a ſimple expreſſion, ſince they are beſides ſufficient for all the purpoſes of theory, it would be uſeleſs, and contrary to ſound philoſophy, to invent other relations in order to form the baſis of any ſyſtem of muſic leſs eaſy and ſimple than that which we have delineated in this treatiſe.

* See *Compoſition*.

The *ſecond part* contains the moſt eſſential rules of compoſition *, or in other words the practice of harmony. Theſe rules are founded on the principles laid down in the *firſt part*; yet thoſe who wiſh to underſtand no more than is neceſſary for practice, without exploring the reaſons why ſuch practical rules are neceſſary, may limit the objects of their ſtudy to the *introduction* and the *ſecond part*. They who have read the *firſt part*, will find at every rule contained in the *ſecond*, a reference to that paſſage in the *firſt* where the reaſons for eſtabliſhing that rule are given.

Some rules, on account of their intricacy, transferred to the notes.

That we may not preſent at once too great a number of objects and precepts, we have transferred to the notes in the ſecond part ſeveral rules and obſervations which are leſs frequently put in practice, which perhaps it may be proper to omit till the treatiſe is read a ſecond time, when the reader is well acquainted with the eſſential and fundamental rules explained in it.

This ſecond part preſuppoſes no more than the firſt, any habit of ſinging, nor even any knowledge of muſic; it only requires that one ſhould know, not even the intonation, but merely the poſition of the notes in the cleff F on the fourth line, and that of G upon the ſecond: and even this knowledge may be acquired from the work itſelf; for in the beginning of the ſecond part we explain the poſition of the cleffs and of the notes. Nothing is neceſſary but to render it a little familiar, and any difficulty in it will diſappear.

All the rules of compoſition not to be expected in an elementary eſſay.

It would be wrong to expect here all the rules of compoſition, and eſpecially thoſe which direct the compoſition of muſic in ſeveral parts, and which, being leſs ſevere and indiſpenſable, may be chiefly acquired by practice, by ſtudying the moſt approved models, by the aſſiſtance of a proper maſter, but above all by the cultivation of the ear and of the taſte. This treatiſe is properly nothing elſe, if the expreſſion may be allowed, but the rudiments of muſic, intended for explaining to beginners the fundamental principles, not the practical detail of compoſition. Thoſe who wiſh to enter more deeply into this detail, will either find it in M. Rameau's treatiſe of harmony, or in the code of muſic which he publiſhed more lately (K), or laſtly in the explication of the theory and practice of muſic by M Bethizi (L); this laſt book appears to us clear and methodical (M).

Nature the eſſential miſtreſs of muſical compoſition.

Is it neceſſary to add, that, in order to compoſe muſic in a proper taſte, it is by no means enough to have familiarized with much application the principles explained in this treatiſe? Here can only be learned the mechaniſm of the art; it is the province of nature alone to accompliſh the reſt. Without her aſſiſtance, it is no more poſſible to compoſe agreeable muſic by having read theſe elements, than to write verſes in a proper manner with the Dictionary of Richelet. In one word, it is the elements of muſic alone, and not the principles of genius, that the reader may expect to find in this treatiſe.

DEFINITIONS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

Melody, what.

1. *Melody* is a ſeries of ſounds which ſucceed one to another in a manner agreeable to the ear.

Chord and harmony, what.

2. A *Chord* is a combination of ſeveral ſounds heard together; and *Harmony* is properly a ſeries of chords of which the ſucceſſion pleaſes the ear. A ſingle chord is

---

(K) From my general recommendation of this code, I except the reflections on the principle of ſound which are at the end, and which I ſhould not adviſe any one to read.

(L) Printed at Paris by Lambert in the year 1754.

(M) In addition to the works mentioned in the text, we recommend to our readers, Holden's Eſſay, Glaſgow 1770, Edin. 1805; Kollmann's Eſſay on Muſical Harmony, 1796; his Eſſay on Muſical Compoſition, fol. 1799; Shield's Introduction, 1800; and Dr Callcott's Muſical Grammar, 1806.

Definitions.

is likewise sometimes called *harmony*, to signify the coalescence of the sounds which form the chord, and the sensation produced in the ear by that coalescence. We shall occasionally use the word *harmony* in this last sense, but in such a manner as never to leave our meaning ambiguous.

See *Interval.*

3. An *Interval*, in melody and harmony, is the distance, or difference in pitch, between one sound, and another higher or lower than it.

4. That we may learn to distinguish the intervals, and the manner of perceiving them, let us take the ordinary scale C, D, E, F, G, A, B, c, which every person whose ear or voice is not extremely false naturally modulates. The following observations will occur to us in singing this scale.

Account of the simple intervals.

The sound D is higher or sharper than the sound C, the sound E higher than the sound D, the sound F higher than the sound E, &c. and so through the whole octave; so that the interval, or the distance from the sound C to the sound D, is less than the interval or distance between the sound C and the sound E, the interval from C to F is less than that between C and F, &c. and in short that the interval from the first to the second C is the greatest of all.—To distinguish the first from the second C, we have marked the last with a small letter (N).

Definitions.

The distinction between strong and faint, or acute and grave.

5. In general, the interval between two sounds is proportionably greater, as one of these sounds is higher or lower with relation to the other: but it is necessary to observe, that two sounds may be equally high or low, though unequal in their force. The string of a violin touched with a bow produces always a sound equally high, whether strongly or faintly struck; the sound will only have a greater or lesser degree of strength. It is the same with vocal modulation; let any one form a sound by gradually swelling the voice, the sound may be perceived to increase in force, whilst it continues always equally low or equally high.

Between tonic and semitonic intervals.

6. We must likewise observe concerning the scale, that the intervals between C and D, between D and E, between F and G, between G and A, between A and B, are equal, or at least nearly equal; and that the intervals between E and F, and between B and C, are likewise equal among themselves, but consist almost only of half the former. This fact is known and recognised by every one: the reason for it shall be given in the sequel; in the mean time every one may ascertain its reality by the assistance of an experiment (O).

7. It

(N) We shall afterwards find that three different series of the seven letters are used, which we have distinguished by capitals, small Roman, and Italic characters. When the notes represented by small Roman characters occur in this treatise we shall, merely to distinguish them from the typography of the text, place them in inverted commas, thus 'c', 'd', &c.

(O) This experiment may be easily tried. Let any one sing the scale C, D, E, F, G, A, B, 'c', it will be immediately observed without difficulty, that the last four notes of the octave G, A, B, 'c', are quite similar to the first C, D, E, F; insomuch, that if, after having sung this scale, one would choose to repeat it, beginning with C in the same tone which was occupied by G in the former scale, the note D of the last scale would have the same sound with the note A in the first, the E with the B, and the F with the 'c'.

Whence it follows, that the interval between C and D, is the same as between G and A; between D and F, as between A and B, and E and F, as between B and 'c'.

From D to E, from F to G, there is the same interval as from C to D. To be convinced of this, we need only sing the scale once more; then sing it again, beginning with C, in this last scale, in the same tone which was given to D in the first; and it will be perceived, that the D in the second scale will have the same sound, at least as far as the ear can discover, with the E in the former scale; whence it follows, that the difference between D and E is, at least as far as the ear can perceive, equal to that between C and D. It will also be found, that the interval between F and G is, so far as our sense can determine, the same with that between C and D.

This experiment may perhaps be tried with some difficulty by those who are not inured to form the notes and change the key; but such may very easily perform it by the assistance of a harpsichord, by means of which the performer will be saved the trouble of retaining the sounds in one intonation whilst he performs another. In touching upon this harpsichord the keys G, A, B, 'f', and in performing with the voice at the same time C, D, E, F, in such a manner that the same sound may be given to C in the voice with that of the key G in the harpsichord, it will be found that D in the vocal intonation shall be the same with A upon the harpsichord, &c.

It will be found likewise by the same harpsichord, that if one should sing the scale beginning with C in the same tone with E on the instrument, the D, which ought to have followed C, will be higher by an extremely perceptible degree than the F which follows E: thus it may be concluded, that the interval between E and F is less than between C and D; and if one would rise from F to another sound which is at the same distance from F, as F from E, he would find, in the same manner, that the interval from E to this new sound is almost the same as that between C and D. The interval then from E to F is nearly half of that between C and D.

Since then, in the scale thus divided, C, D, E, F,
G, A, B, 'c',

the first division is perfectly like the last; and since the intervals between C and D, between D and E, and between F and G, are equal; it follows, that the intervals between G and A, and between A and B, are likewise equal to every one of the three intervals between C and D, between D and E, and between F and G; and that the intervals between E and F and between B and 'c' are also equal, but that they only constitute one half of the others.

Definitions.

7. It is for this reason that they have called the interval from E to F, and from B to C, a semitone; whereas those between C and D, D and E, F and G, G and A, A and B, are tones.

* Plate CCCXXIII. fig. 1.

The *tone* is likewise called a *second major* *, and the *semitone* a *second minor* †.

† See *Interval.*

8. To descend or rise diatonically, is to descend or rise from one sound to another by the interval of a tone or of a semitone, or in general by seconds, whether major or minor; as from D to C, or from C to D, from F to E, or from E to F.

II. *The Terms by which the different Intervals of the Scale are denominated.*

Third minor, what.

9. An interval composed of a tone and a semitone, as from E to G, from A to C, or from D to F, is called a *third minor*.

Third major, what.

An interval composed of two full tones, as from C to E, from F to A, or from G to B, is called a *third major*.

Fourth, what.

An interval composed of two tones and a semitone, as from C to F, or from G to C, is called a *fourth*.

Triton, what.

An interval consisting of three full tones, as from F to B, is called a *tritone* or *fourth redundant*.

Fifth, what.

An interval consisting of three tones and a semitone, as from C to G, from F to C, from D to A, or from E to B, &c. is called a *fifth*.

Sixth minor, what.

An interval composed of three tones and two semitones, as from E to C, is called a *sixth minor*.

Sixth major, what.

An interval composed of four tones and a semitone, as from C to A, is called a *sixth major*.

Seventh minor, what.

An interval consisting of four tones and two semitones, as from D to C, is called a *seventh minor*.

Seventh major, what.

An interval composed of five tones and a semitone, as from C to B, is called a *seventh major*.

Octave, what.

And in short, an interval consisting of five tones and two semitones, as from C to 'c' is called an *octave*.

Several of the intervals now mentioned, are distinguished by other names, as may be seen in the beginning of the second part; but those now given are the most common, and the only terms which our present purpose demands.

Unison, what.

10. Two sounds equally high, or equally low, however unequal in their force, are said to be in *unison* one with the other.

Definitions.

11. If two sounds form between them any interval, whatever it be, we say, that the highest when ascending is in that interval with relation to the lowest; and when descending, we pronounce the lowest in the same interval with relation to the highest. Thus in the third minor, E, G, where E is the lowest and G the highest sound, G is a third minor from E *ascending*, and E is third minor from G *in descending*.

12. In the same manner, if, speaking of two sonorous bodies, we should say, that the one is a fifth above the other *in ascending*; this infers that the sound given by the one is at the distance of a fifth *ascending* from the sound given by the other.

III. *Of Intervals greater than the Octave.*

13. If, after having sung the scale C, D, E, F, G, A, B, c, one would carry this scale still farther in ascent, it would be discovered without difficulty that a new scale would be formed, 'c, d, e, f', &c. entirely similar to the former, and of which the sounds will be an octave ascending, each to its correspondent note in the former scale; thus 'd', the second note of the second scale, will be an octave in ascent to the D of the first scale; in the same manner 'e' shall be the octave to E, &c. and so of the rest. Fig. 2.

Ninth, what.

14. As there are nine notes from the first C to the second 'd', the interval between these two sounds is called a *ninth*, and this ninth is composed of six full tones and two semitones. For the same reason the interval from C to 'f' is called an *eleventh*, and the interval between C and 'g' a *twelfth*, &c.

Eleventh and twelfth what.

It is plain that the *ninth* is the octave of the *second*, the *eleventh* of the *fourth*, and the *twelfth* of the *fifth*, &c.

* See *Interval* and *Double Octave.*

The octave above the octave of any sound is called a *double octave* *; the octave of the double octave is called a *triple octave*, and so of the rest.

The double octave is likewise called a *fifteenth*: and for the same reason the double octave of the third is called a *seventeenth*, the double octave of the fifth a *nineteenth*, &c. (P).

IV.

(P) Let us suppose two vocal strings formed of the same matter, of the same thickness, and equal in their tension, but unequal in their length; it will be found by experience,

1st, That if the shortest is equal to half the longest, the sound which it will produce must be an octave above the sound produced by the longest.

2dly, That if the shortest constitutes a third part of the longest, the sound which it produces must be a twelfth above the sound produced by the longest.

3dly, That if it constitutes the fifth part, its sound will be a seventeenth above.

Besides, it is a truth demonstrated and generally admitted, that in proportion as one musical string is less than another, the vibrations of the least will be more frequent (that is to say, its departures and returns through the same space) in the same time; for instance, in an hour, a minute, a second, &c. in such a manner that one string which constitutes a third part of another, forms three vibrations, whilst the largest has only accomplished one. In the same manner, a string which is one half less than another, performs two vibrations, whilst the other only completes one; and a string which is only the fifth part of another, will perform five vibrations in the same time which is occupied by the other in one.

From thence it follows, that the sound of a string is proportionally higher or lower, as the number of its vibrations is greater or smaller in a given time; for instance, in a second.

It is for that reason, that if we represent any sound whatever by 1, one may represent the octave above by 2, that is to say, by the number of vibrations formed by the string which produces the octave, whilst the longest string only vibrates once; in the same manner we may represent the twelfth above the sound 1 by 3, the seventeenth

Definitions.

IV. *What is meant by Sharps and Flats.*

Sharps and flats, what. See *Interval.*

15. It is plain that one may imagine the five tones which enter into the ſcale, as divided each into two ſemitones; thus one may advance from C to D, forming in his progreſs an intermediate ſound, which ſhall be higher by a ſemitone than C, and lower in the ſame degree than D. A ſound in the ſcale is called *ſharp*, when it is raiſed by a ſemitone; and it is marked with this character ※: thus C ※ ſignifies C *ſharp*, that is to ſay, C raiſed by a ſemitone above its pitch in the natural ſcale. A ſound in the ſcale depreſſed by a ſemitone is called *flat*, and is marked thus, ♭: thus A ♭ ſignifies A *flat*, or A depreſſed by a ſemitone.

V. *What is meant by Conſonances and Diſſonances.*

Conſonance, what. See *Chord.*

16. A chord compoſed of ſounds whoſe union or coaleſcence pleaſes the ear is called a *conſonance*; and the ſounds which form this chord are ſaid to be conſonant one with relation to the other. The reaſon of this denomination is, that a chord is found more perfect, as the ſounds which form it coaleſce more cloſely among themſelves.

Definitions.

17. The octave of a ſound is the moſt perfect of conſonances of which that ſound is ſuſceptible; then the fifth, afterwards the third, &c. This is a fact founded on experiment.

Diſſonance, what.

18. A number of ſounds ſimultaneouſly produced whoſe union is diſpleaſing to the ear is called a *diſſonance*, and the ſounds which form it are ſaid to be diſſonant one with relation to the other. The ſecond, the tritone, and the ſeventh of a ſound, are diſſonants with relation to it. Thus the ſounds C D, C B, or F B, &c. ſimultaneouſly heard, form a diſſonance. The reaſon which renders diſſonance diſagreeable, is, that the ſounds which compoſe it, ſeem by no means coaleſcent to the ear, and are heard each of them by itſelf as diſtinct ſounds, though produced at the ſame time.

See *Diſcord.*

Part I. THEORY of HARMONY.

Chap. I. *Preliminary and Fundamental Experiments.*

Experiment I.

19. WHEN a ſonorous body is ſtruck till it gives a ſound, the ear, beſides the principal ſound and its octave, perceives two other ſounds very high, of which one is the twelfth above the principal ſound, that is to ſay, the octave to the fifth of that ſound; and the other is the ſeventeenth major about the ſame ſound, that is to ſay, the double octave of its third major.

20. This experiment is peculiarly ſenſible upon the thick ſtrings of the violoncello, of which the ſound being extremely low, gives to an ear, though not very much practiſed, an opportunity of diſtinguiſhing with ſufficient eaſe and clearneſs the twelfth and ſeventeenth now in queſtion (Q).

21.

teenth major above 5, &c. But it is very neceſſary to remark, that by theſe numerical expreſſions, we do not pretend to compare ſounds as ſuch; for ſounds in themſelves are nothing but mere ſenſations, and it cannot be ſaid of any ſenſation that it is double or triple to another: thus the expreſſions 1, 2, 3, &c. employed to denominate a ſound, its octave above, its twelfth above, &c. ſignify only, that if a ſtring performs a certain number of vibrations, for inſtance, in a ſecond, the ſtring which is in the octave above ſhall double the number in the ſame time, the ſtring which is in the twelfth above ſhall triple it, &c.

Thus to compare ſounds among themſelves is nothing elſe than to compare among themſelves the numbers of vibrations which are formed in a given time by the ſtrings that produce theſe ſounds.

(Q) Since the octave above the ſound 1 is 2, the octave below that ſame ſound ſhall be $\frac{1}{2}$; that is to ſay, that the ſtring which produces this octave ſhall have performed half its vibration, whilſt the ſtring which produces the ſound 1 ſhall have completed one. To obtain therefore the octave above any ſound, the operator muſt multiply the quantity which expreſſes the ſound by 2; and to obtain the octave below, he muſt on the contrary divide the ſame quantity by 2.

It is for that reaſon that if any ſound whatever, for inſtance C, is denominated	1
Its octave above will be	2
Its double octave above	4
Its triple octave above	8
In the ſame manner its octave below will be	$\frac{1}{2}$
Its double octave below	$\frac{1}{4}$
Its triple octave below	$\frac{1}{8}$
And ſo of the reſt.	
Its twelfth above	3
Its twelfth below	$\frac{1}{3}$
Its 17th major above	5
Its 17th major below	$\frac{1}{5}$

The fifth then above the ſound 1 being the octave beneath the twelfth, ſhall be, as we have immediately obſerved,

Theory of Harmony.

* See *Generator*.

Generator, what.

§ See *Harmonic*.

21. The principal sound is called the *generator* *; and the two other sounds which it produces, and with which it is accompanied, are, inclusive of its octave, called its *harmonics* §.

EXPERIMENT II.

22. There is no person insensible of the resemblance which subsists between any sound and its octave, whether above or below. These two sounds, when heard together, almost entirely coalesce in the organ of sensation. We may besides be convinced (by two facts which are extremely simple) of the facility with which one of these sounds may be taken for the other.

Let it be supposed that any person has an inclination to sing a tune, and having at first begun this air upon a pitch too high or too low for his voice, so that he is obliged, lest he should strain himself too much, to sing the tune in question on a key higher or lower than the first; he will naturally, without being initiated in the art of music, take his new key in the octave below or the octave above the first; and in order to take this key in any other interval except the octave, he will find it necessary to exert a sensible degree of attention. This is a fact of which we may easily be persuaded by experience.

Another fact. Let any person sing a tune in our presence, and let it be sung in a tone too high or too low for our voice; if we wish to join in singing this air, we naturally take the octave below or above, and frequently, in taking this octave, we imagine it to be the unison (Q*).

Theory of Harmony.

served, $\frac{3}{2}$; which signifies that this string performs $\frac{3}{2}$ vibrations; that is to say, one vibration and a half during a single vibration of the string which gives the sound 1.

To obtain the fourth above the sound 1, we must take the twelfth below that sound, and the double octave above that twelfth. In effect, the twelfth below C, for instance, is F, of which the double octave *f* is the fourth above *c*. Since then the twelfth below 1 is $\frac{1}{3}$, it follows that the double octave above this twelfth, that is to say, the fourth from the sound 1 in ascending, will be $\frac{1}{3}$ multiplied by 4, or $\frac{4}{3}$.

In short, the third major being nothing else but the double octave beneath the seventeenth, it follows, that the third major above the sound 1 will be 5 divided by 4, or in other words $\frac{5}{4}$.

The third major of a sound, for instance the third major E, from the sound C, and its fifth G, form between them a third minor E, G; now E is $\frac{5}{4}$, and G $\frac{3}{2}$, by what has been immediately demonstrated: from whence it follows, that the third minor, or the interval between E and G, shall be expressed by the relation of the fraction $\frac{5}{4}$ to the fraction $\frac{3}{2}$.

To determine this relation, it is necessary to remark, that $\frac{5}{4}$ are the same thing with $\frac{10}{8}$, and that $\frac{3}{2}$ are the same thing with $\frac{12}{8}$: so that $\frac{5}{4}$ shall be to $\frac{3}{2}$ in the same relation as $\frac{10}{8}$ to $\frac{12}{8}$; that is to say, in the same relation as 10 to 12, or as 5 to 6. If, then, two sounds form between themselves a third minor, and that the first is represented by 5, the second shall be expressed by 6; or, what is the same thing, if the first is represented by 1, the second shall be expressed by $\frac{6}{5}$.

Thus the third minor, an harmonic sound which is even found in the protracted and coalescent tones of a sonorous body between the sound E and G, an harmonic of the principal sound, may be expressed by the fraction $\frac{6}{5}$.

N. B. One may see by this example, that in order to compare two sounds one with another which are expressed by fractions, it is necessary first to multiply the numerator of the fraction which expresses the first by the denominator of the fraction which expresses the second, which will give a primary number; as here the numerator 5 of the fraction $\frac{5}{4}$, multiplied by 2 of the fraction $\frac{3}{2}$, has given 10. Afterwards may be multiplied the numerator of the second fraction by the denominator of the first, which will give a secondary number, as here 12 is the product of 4 multiplied by 3; and the relation between these two numbers (which in the preceding example are 10 and 12), will express the relation between these sounds, or, what is the same thing, the interval which there is between the one and the other; in such a manner, that the farther the relation between these sounds departs from unity, the greater the interval will be.

Such is the manner in which we may compare two sounds one with another whose numerical value is known. We shall now show the manner how the numerical expression of a sound may be obtained, when the relation which it ought to have with another sound is known whose numerical expression is given.

Let us suppose, for example, that the third major of the fifth $\frac{3}{2}$ is sought. That third major ought to be, by what has been shown above, the $\frac{5}{4}$ of the fifth; for the third major of any sound whatever is the $\frac{5}{4}$ of that sound. We must then look for a fraction which expresses the $\frac{5}{4}$ of $\frac{3}{2}$; which is done by multiplying the numerators and denominators of both fractions one by the other, from whence results the new fraction $\frac{15}{8}$. It will likewise be found that the fifth of the fifth is $\frac{9}{4}$, because the fifth of the fifth is the $\frac{3}{2}$ of $\frac{3}{2}$.

Thus far we have only treated of fifths, fourths, thirds major and minor, in ascending; now it is extremely easy to find by the same rules the fifths, fourths, thirds major and minor in descending. For suppose C equal to 1, we have seen that its fifth, its fourth, its third, its major and minor in ascending, are $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{6}{5}$. To find its fifth, its fourth, its third, its major and minor in descending, nothing more is necessary than to reverse these fractions, which will give $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

(Q*) It is not then imagined that we change the value of a sound in multiplying or dividing it by 2, by 4, or by 8, &c. the number which expresses these sounds, since by these operations we do nothing but take the simple double, or triple octave, &c. of the sound in question, and that a sound coalesces with its octave.

Theory of Harmony.

CHAP. II. *The Origin of the Modes Major and Minor; of the most natural Modulation, and the most perfect Harmony.*

Fundamental and harmonics, what.

23. To render our ideas still more precise and permanent, we shall call the tone produced by the sonorous body C: it is evident, by the first experiment, that this sound is always attended by its 12th and 17th major; that is to say, with the octave of G, and the double octave of E.

24. This octave of G then, and this double octave of E, produce the most perfect chord which can be joined with C, since that chord is the work and choice of nature (R).

Harmony reduced to chords, fifths, and octaves.

25. For the same reason, the modulation formed by C with the octave of G, and the double octave of E, sung one after the other, would likewise be the most simple and natural of all modulations which do not descend or ascend directly in the diatonic order, if our voices had sufficient compass to form intervals so great without difficulty: but the ease and freedom with which we can substitute its octave to any sound, when it is more convenient for the voice, afford us the means of representing this modulation.

Mode major, what.

26. It is on this account that, after having sung the tone C, we naturally modulate the third E, and the fifth G, instead of the double octave of E, and the octave of G; from whence we form, by joining the octave of the sound G, this modulation, C, E, G, 'c', which in effect is the simplest and easiest of them all; aad which likewise has its origin even in the protracted and compounded tones produced by a sonorous body.

See *Mode*. See likewise *Interval*.

27. The modulation C, E, G, 'c', in which the chord C, E, is a third major, constitutes that kind of harmony or melody which we call the *mode major;* from whence it follows, that this mode results from the immediate operation of nature.

Mode minor, what.

28. In the modulation C, E, G, of which we have now been treating, the sounds E and G are so proportioned one to the other, that the principal sound C (art. 19.) causes both of them to resound; but the second tone E does not cause G to resound, which only forms the interval of a third minor.

29. Let us then imagine, that, instead of this sound E, one should substitute between the sounds C and G, another note which (as well as the sound C) has the power of causing G to resound, and which is, however, different from the sound C; the sound which we explore ought to be such, by art. 19. that it may have for its 17th major G, or one of the octaves of G; of consequence the sound which we seek ought to be a 17th major below G, or, what is the same thing, a third major below the same G. Now the sound E being a third minor beneath G, and the third major being (art. 9.) greater by a semitone than the third minor, it follows, that the sound of which we are in search shall be a semitone beneath the natural E, and of consequence E ♭.

30. This new arrangement, C, E ♭, G, in which the sounds C and E ♭ have both the power of causing G to resound, though C does not cause E ♭ to resound, is not indeed equally perfect with the first arrangement C, E, G; because in this the two sounds E and G are both the one and the other generated by the principal sound C; whereas, in the other, the sound E ♭, is not generated by the sound C; but this arrangement C, E ♭, G, is likewise dictated by nature (art. 19.), though less immediately than the former; and accordingly experience evinces that the ear accommodates itself almost as well to the latter as to the former.

Origin of mode minor. See *Mode*. See also *Interval*.

31. In this modulation or chord C, E ♭, G, C, it is evident that the third from C to E ♭ is minor; and such is the origin of that mode which we call *minor* (S).

Perfect chords, what.

32. The most perfect chords then are, 1. All chords related one to another, as C, E, G, 'c', consisting of any sound, of its third major, of its fifth, and of its octave. 2. All chords related one to another, as C E ♭, G, 'c', consisting of any sound, of its third minor,

(R) The chord formed with the twelfth and seventeenth major united with the principal sound, being exactly conformed to that which is produced by nature, is likewise for that reason the most agreeable of all; especially when the composer can proportion the voices and instruments together in a proper manner to give this chord its full effect. M. Rameau has executed this with the greatest success in the opera of *Pygmalion*, page 34. where Pygmalion sings with the chorus *L'amour triomphe*, &c.: in this passage of the chorus, the two parts of the vocal and instrumental basses give the principal sound and its octave; the first part above, or treble, and that of the counter-tenor, produce the seventeenth major, and its octave, in descending; and the second part, or tenor abo gives the twelfth.

See fig. 3.

(S) The origin which we have here given of the mode minor, is the most simple and natural that can possibly be given. M. Rameau deduces it, more artificially, from the following experiment.—If you put in vibration a musical string HI, and if there are at the same time contiguous to this two other strings KN, RW, of which the first shall be a twelfth, and the second a seventeenth major below the string HI, the strings KN, RW will vibrate without being struck as soon as the string HI shall give a sound, and divide themselves by a kind of undulation, the first into three, the last into five equal parts; in such a manner, that, in the vibration of the string KN, you may easily distinguish two points at rest LM, and in the tremulous motion of the string RW, four quiescent points S, T, U, V, all placed at equal distances from each other, and dividing the strings into three or five equal parts. In this experiment, says M. Rameau, if we represent by the note C the tone of the string HI, the two other strings will represent the sounds F and A ♭; and from thence M. Rameau deduces the modulation F, A ♭, C, and of consequence the mode minor. The origin which we have assigned to the minor mode, appears more direct and more simple, because it presupposes no other experiment than that of art. 19. and because also the fundamental sound C is still retained in both the modes, without being obliged, as M. Rameau found himself, to change it into F.

Theory of Harmony.

minor, of its fifth, and of its octave. In effect, theſe two kinds of chords are exhibited by nature; but the firſt more immediately than the ſecond. The firſt are called *perfect chords major*, the ſecond *perfect chords minor*.

Chap. III. *Of the Succeſſion by Fifths, and of the Laws which it obſerves.*

Fundamental baſs, what.

33. Since the ſound C cauſes the ſound G to be heard, and is itſelf heard in the ſound F, which ſounds G and F are its two twelfths, we may imagine a modulation compoſed of that ſound C and its two twelfths, or, which is the ſame thing (art. 22.), of its two fifths, F and G, the one below, the other above; which gives the modulation or ſeries of fifths F, C, G, which we call the *fundamental baſs* of C by fifths.

We ſhall find in the ſequel (Chap. XVIII.), that there may be ſome fundamental baſes by thirds, deduced from the two ſeventeenths, of which the one is an attendant of the principal ſound, and of which the other includes that ſound. But we muſt advance ſtep by ſtep, and ſatisfy ourſelves at preſent to conſider immediately the fundamental baſes by fifths.

34. Thus, from the ſound C, one may make a tranſition indifferently to the ſound G, or to the ſound F.

35. One may, for the ſame reaſon, continue this kind of fifths in aſcending, and in deſcending, from C, in this manner:

E♭, B♭, F, C, G, D, A, &c.

And from this ſeries of fifths one may paſs to any ſound which immediately precedes or follows it.

Exception to the rule.

36. But it is not allowed in the ſame manner to paſs from one ſound to another which is not immediately contiguous to it; for inſtance, from C to D, or from D to C: for this very ſimple reaſon, that the ſound D is not contained in the ſound C, nor the ſound C in that of D; and thus theſe ſounds have not any alliance the one with the other, which may authoriſe the tranſition from one to the other.

Two perfect chords in ſucceſſion proſcribed.

37. And as theſe ſounds C and D, by the firſt experiment, naturally bring along with them the perfect chords conſiſting of greater intervals C, E, G, 'c', and D, F♯, A, 'd'; hence may be deduced this rule, That two perfect chords, eſpecially if they are major (T), cannot ſucceed one another diatonically in a fundamental baſs; we mean, that in a fundamental baſs two ſounds cannot be diatonically placed in ſucceſſion, each of which, with its harmonics, forms a perfect chord, eſpecially if this perfect chord be major in both.

Chap. IV. *Of Modes in general.*

Mode in general, what.

38. A *mode*, in muſic, is, the order of ſounds preſcribed, as well in harmony as melody, by the ſeries of fifths. Thus the three ſounds F, C, G, and the harmonics of each of theſe three ſounds, that is to ſay, their thirds major and their fifths, compoſe all the major modes which are proper to C.

Modes, how repreſented by the ſeries of fifths.

39. The ſeries of fifths then, or the fundamental baſs F, C, G, of which C holds the middle ſpace, may be regarded as repreſenting the mode of C. One may likewiſe take the ſeries of fifths, or fundamental baſs, C, G, D, as repreſenting the mode of G; in the ſame manner B♭, F, C, will repreſent the mode of F.

Thus the mode of G, or rather the fundamental baſs of that mode, has two ſounds in common with the fundamental baſs of the mode of C. It is the ſame with the fundamental baſs of the mode F.

Principal mode, and adjuncts, what. See *Adjunct*.

40. The mode of C (F, C, G) is called the *principal mode* with reſpect to the modes of theſe two fifths, which are called its two *adjuncts*.

Modes reliſhed in proportion as their ſounds are common.

41. It is then, in ſome meaſure, indifferent to the ear whether a tranſition be made to the one or to the other of theſe adjuncts, ſince each of them has equally two ſounds in common with the principal mode. Yet the mode of G ſeems a little more eligible: for G is heard amongſt the harmonics of C, and of conſequence is implied and ſignified by C; whereas C does not cauſe F to be heard, though C is included in the ſame ſound F. It is hence that the ear, affected by the mode of C, is a little more prepoſſeſſed for the mode of G than for that of F. Nothing likewiſe is more frequent, nor more natural, than to paſs from the mode of C to that of G.

Dominant and ſub-dominant, what. See *Dominant*.

42. It is for this reaſon, as well as to diſtinguiſh the two fifths one from the other, that we call G the fifth above the generator the *dominant* ſound, and the fifth F, below the generator, the *ſubdominant*.

Tranſition to contiguous ſounds, how to be managed.

43. As in the ſeries of fifths, we may indifferently paſs from one ſound to that which is contiguous: ſo, having paſſed from the mode of C to that of G, one may from thence proceed to the mode of D. And on the other hand, having paſſed from the mode of C to that of F we may then paſs to the mode of B♭. But it is neceſſary, however, to obſerve, that the ear, which has been immediately affected with the principal mode, feels always a ſtrong propenſity to return to it. Thus the further the mode to which we make a tranſition is removed from the principal mode, the leſs time we ought to dwell upon it; or rather, to ſpeak in the terms of the art, the leſs ought the phraſe (U) of that mode to be protracted.

Chap. V. *Of the Formation of the Diatonic Scale as uſed by the Greeks.*

44. From this rule, that two ſounds which are contiguous may be placed in immediate ſucceſſion in the ſeries of fifths, F, C, G, it follows, that one may form

(T) We ſay *eſpecially if they are major*; for in the major chord D, F♯, A, 'd', beſides that the ſounds C and D have no common harmonical relation, and are even diſſonant between themſelves (art. 13.), it will likewiſe be found, that F♯ forms a diſſonance with C. The minor chord D, F, A, 'd', would be more tolerable, becauſe the natural F, which occurs in this chord carries along with it its fifth C, or rather the octave of that fifth: It has likewiſe been ſometimes the practice of compoſers, though rather by a licence indulged them than ſtrictly agreeable to their art, to place a minor in diatonic ſucceſſion to a major chord.

(U) As the mere Engliſh reader, unacquainted with the technical phraſeology of muſic, may be ſurpriſed at the

Theory of Harmony.

form this modulation, or this fundamental bafs, by fifths,

G, C, G, C, F, C, F.

See fig. 4.

Formation of the Greek diatonic fcale by the fundamental bafs.

45. Each of the founds which forms this modulation brings neceffarily along with itfelf its third major, its fifth, and its octave; infomuch that he who, for inftance, fings the note G, may be reckoned to fing at the fame time the notes G, B, 'd, g': in the fame manner the found C in the fundamental bafs brings along with it this modulation, C, E, G, C: and, in fhort, the found F brings along with it F, A, C, 'f'. This modulation then, or this fundamental bafs,

G, C, G, C, F, C, F,

gives the following diatonic feries,

B, 'c, d, e, f, g, a';

See fig. 4.

which is precifely the diatonic fcale of the Greeks. We are ignorant upon what principles they had formed this fcale; but it may be fenfibly perceived, that that feries arifes from the bafs G, C, G, C, F, C, F; and that of confequence this bafs is juftly called *fundamental*, as being the real primitive modulation, that which conducts the ear, and which it feels to be implied in the diatonic modulation, B, 'c, d, e, f, g, a' (x).

46. We fhall be ftill more convinced of this truth by the following remarks.

In the modulation B, 'c, d, e, f, g, a', the founds 'd' and 'f' form between themfelves a third minor, which is not fo perfectly true as that between 'e' and 'g' (Y). Neverthelefs, this alteration in the third minor between 'd' and 'f' gives the ear no pain, becaufe that 'd' and that 'f' which do not form between themfelves a true third minor, form, each in particular, confonances perfectly juft with the founds in the fundamental bafs which correfpond with them: for 'd' in the fcale is the true fifth of G, which anfwers to it in the fundamental bafs; and 'f' in the fcale is the true octave of F, which anfwers to it in the fame bafs.

Altered intervals, no objection.

47. If, therefore, thefe founds in the fcale form confonances perfectly true with the notes which correfpond to them in the fundamental bafs, the ear gives itfelf little trouble to inveftigate the alterations which there may be in the intervals which thefe founds in the fcale form between themfelves. This is a new proof that the fundamental bafs is the genuine guide of the ear, and the true origin of the diatonic fcale.

Reafons why this fcale includes only feven founds.

48. Moreover, this diatonic fcale includes only feven founds, and goes no higher than 'b', which would be the octave of the firft: a new fingularity, for which a reafon may be given by the principles above eftablifhed.

---

the ufe of the word *phrafe* when transferred from language to that art, we have though proper to infert the definition of Rouffeau.

A *phrafe*, according to him, is in melody a feries of modulations, or in harmony a fucceffion of chords, which form without interruption a fenfe more or lefs complete, and which terminate in a repofe by a cadence more or lefs perfect.

(x) Nothing is eafier than to find in this fcale the value or proportions of each found with relation to the found C, which we call 1; for the two founds G and F in the bafs are $\frac{3}{2}$ and $\frac{2}{3}$; from whence it follows,

1. That 'c' in the fcale is the octave of C in the bafs; that is to fay, 2.
2. That 'b' is the third major of G; that is to fay $\frac{5}{4}$ of $\frac{3}{2}$ (note Q), and of confequence $\frac{15}{8}$.
3. That 'd' is the fifth of G; that is to fay $\frac{3}{2}$ of $\frac{3}{2}$, and of confequence $\frac{9}{4}$.
4. That 'e' is the third major of the octave of C, and of confequence the double of $\frac{5}{4}$; that is to fay, $\frac{5}{2}$.
5. That 'f' is the double octave of F of the bafs, and confequently $\frac{8}{3}$.
6. That 'g' of the fcale is the octave of G of the bafs, and confequently 3.
7. That 'a' in the fcale is the third major of 'f' of the fcale; that is to fay, $\frac{5}{4}$ of $\frac{8}{3}$, or $\frac{10}{3}$.

Hence then will refult the following table, in which each found has its numerical value above or below it.

Diatonic	$\frac{15}{8}$	2	$\frac{9}{4}$	$\frac{5}{2}$	$\frac{8}{3}$	3	$\frac{10}{3}$
Scale.	B,	c,	d,	e,	f,	g,	a.
Fundamental	G,	C,	G,	C,	F,	C,	F.
Bafs.	$\frac{3}{2}$	1,	$\frac{3}{2}$	1	$\frac{2}{3}$	1	$\frac{2}{3}$

And if, for the conveniency of calculation, we choofe to call the found C of the fcale 1; in this cafe we have only to divide each of the numbers by 2, which reprefent the diatonic fcale, and we fhall have

$\frac{15}{16}$	1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$
B,	c,	d,	e,	f,	g,	a.

(Y) In order to compare 'd' with 'f', we need only compare $\frac{9}{8}$ with $\frac{4}{3}$; the relation between thefe fractions will be, (note C) that of 9 times 3 to 8 times 4; that is to fay, of 27 to 32: the third minor, then, from 'd' to 'f', is not true; becaufe the proportion of 27 to 32 is not the fame with that of 5 to 6, thefe two proportions being between themfelves as 27 times 6 is to 32 times 5, that is to fay, as 162 to 160, or as the halves of thefe two numbers, that is to fay, as 81 to 80.

M. Rameau, when he publifhed, in 1726, his *New theoretical and practical Syftem of Mufic*, had not as yet found the true reafon of the alteration in the confonance which is between 'd' and 'f', and of the little attention which the ear pays to it. For he pretends, in the work now quoted, that there are two thirds minor, one in the proportion of 5 to 6, the other in the proportion of 27 to 32. But the opinion which he has afterwards adopted, feems much preferable. In reality, the genuine third minor, is that which is produced by nature between 'e' and 'g', in the continued tone of thofe fonorous bodies of which 'e' and 'g' are the two harmonics: and that third minor, which is in the proportion of 5 to 6, is likewife that which takes place in the minor mode, and not that third minor which is falfe and different, being in the proportion of 27 to 32.

Theory of Harmony.

ed. In reality, in order that the found 'b' may fucceed immediately in the fcale to the found 'a', it is neceffary that the note 'g', which is the only one from whence 'b' as a harmonic may be deduced, fhould immediately fucceed to the found 'f', in the fundamental bafs, which is the only one from whence 'a' can be harmonically deduced. Now, the diatonic fucceffion from F to G cannot be admitted in the fundamental bafs, according to what we have remarked (art. 36.). The founds 'a' and 'b', then, cannot immediately fucceed one another in the fcale: we fhall fee in the fequel why this is not the cafe in the feries 'c, d, e, f, g, a, b', *c*, which begins upon C; whereas the fcale in queftion here begins upon B.

Completion of the Greek octave. See *Proflambanomene.*

49. The Greeks likewife, to form an entire octave, added below the firft B the note A, which they diftinguifhed and feparated from the reft of the fcale, which for that reafon they called *proflambanomene*, that is to fay, a ftring or note fubadded to the fcale, and put before B to form the entire octave.

The fcale compofed of two fimilar conjunctive tetrachords.

50. The diatonic fcale B, 'c, d, e, f, g, a', is compofed of two tetrachords, that is to fay, of two diatonic fcales, each confifting of four founds, B, 'c, d, e, and 'e, f', g, a'. Thefe two tetrachords are exactly fimilar; for from 'e' to 'f' there is the fame interval as from B to 'c,' from 'f' to 'g' the fame as from 'c' to 'd,' from 'g' to 'a' the fame as from 'd' to 'e' (Z): this is the reafon why the Greeks diftinguifhed thefe two tetrachords; yet they joined them by the note 'a' which is common to both, and which gave them the name of *conjunctive tetrachords*.

Intervals in both tetrachords equal.

51. Moreover, the intervals between any two founds, taken in each tetrachord in particular, are precifely true: thus, in the firft tetrachord, the intervals of C 'e', and B 'd', are thirds, the one major and the other minor, exactly true, as well as the fourth B 'e' (AA); it is the fame thing with the tetrachord 'e, f, g, a', fince this tetrachord is exactly like the former.

Intervals between the notes of different tetrachords diffimilar.

52. But the cafe is not the fame when we compare two founds taken each from a different tetrachord; for we have already feen, that the note 'd' in the firft tetrachord forms with the note 'f' in the fecond a third minor, which is not true. In like manner it will be found, that the fifth from 'd' to 'a' is not exactly true, which is evident; for the third major from 'f' to 'a' is true, and the third minor from 'd' to 'f' is not fo: now, in order to form a true fifth, a third major and a third minor, which are both exactly true, are neceffary.

Another reafon for diftinguifhing the fcale into two tetrachords.

53. From thence it follows, that every confonance is abfolutely perfect in each tetrachord taken by itfelf; but that there is fome alteration in paffing from one tetrachord to the other. This is a new reafon for diftinguifhing the fcale into thefe two tetrachords.

The fource of tones major and minor inveftigated.

54. It may be afcertained by calculation, that in the tetrachord B, 'c, d, e', the interval, or the tone from 'd' to 'e', is a little lefs than the interval or tone from 'c' to 'd' (BB). In the fame manner, in the fecond tetrachord 'e, f, g, a', which is, as we have proved, perfectly fimilar to the firft, the note from 'g' to 'a' is a little lefs than the note from 'f' to 'g'. It is for this reafon that they diftinguifh two kinds of tones; the greater tone *, as from 'c' to 'd', from 'f' to 'g', &c.; and the leffer †, from 'd' to 'e', from 'g' to 'a', &c.

Greater tone. * See *Interval*. Leffer tone. † See *Interval*.

Chap. VI. *The formation of the Diatonic Scale among the Moderns, or the ordinary Gammut.*

The modern fcale, how formed.

55. We have juft fhown in the preceding chapter, how the fcale of the Greeks is formed, B, 'c, d, e, g, a', by means of a fundamental bafs compofed of three founds only, F, C, G; but to form the fcale 'c, d, e, f, g, a, b,' *c*, which we ufe at prefent, we muft neceffarily add to the fundamental bafs the note D, and form, with thefe four founds F, C, G, D, the following fundamental bafs:

C, G, C, F, C, G, D, G, C; *See* fig. 5.

from whence we deduce the modulation or fcale See *Scale*.

'c, d, e, f, g, a, b,' *c*.

In effect (CC), 'c' in the fcale belongs to the harmony of C which correfponds with it in the bafs; 'd', which is the fecond note in the gammut, is included in the harmony of G, the fecond note of the bafs; 'e', the third note of the gammut, is a natural harmonic of C, which is the third found in the bafs, &c.

56. From

(Z) The proportion of B to 'c' is as $\frac{15}{16}$ to 1, that is to fay as 15 to 16; that between 'e' and 'f' is as $\frac{5}{4}$ to $\frac{4}{3}$, that is to fay (note Q), as 5 times 3 to 4 times 4, or as 15 to 16: thefe two proportions then are equal. In the fame manner, the proportion of 'c' to 'd' is as 1 to $\frac{9}{8}$, or as 8 to 9; that between 'f' and 'g' is as $\frac{4}{3}$ to $\frac{3}{2}$; that is to fay (note Q), as 8 to 9. The proportion of 'e' to 'c' is as $\frac{5}{4}$ to 1, or as 5 to 4; that between 'f' and 'a' is as $\frac{5}{3}$ to $\frac{4}{3}$, or as 5 to 4: the proportions here then are likewife equal.

(AA) The proportion of 'e' to 'c' is as $\frac{5}{4}$ to 1, or as 5 to 4, which is a true third major; that from 'd' to 'b' is as $\frac{9}{8}$ to $\frac{15}{16}$; that is to fay, as 9 times 16 to 15 times 8, or as 9 times 2 to 15, or as 6 to 5. In like manner we fhall find, that the proportion of 'c' to 'b' is as $\frac{5}{4}$ to $\frac{15}{16}$; that is to fay, as 5 times 16 to 15 times 4, or as 4 to 3, which is a true fourth.

(BB) The proportion of 'd' to 'c' is as $\frac{9}{8}$ to 1, or as 9 to 8; that of 'e' to 'd' is as $\frac{5}{4}$ to $\frac{9}{8}$, that is to fay, as 40 to 36, or as 10 to 9: now $\frac{10}{9}$ is lefs removed from unity than $\frac{9}{8}$; the interval then from 'd' to 'e' is a little lefs than that from 'c' to 'd'.

If any one would wifh to know the proportion which $\frac{10}{9}$ bear to $\frac{9}{8}$, he will find (note Q) that it is as 8 times 10 to 9 times 9, that is to fay, as 80 to 81. Thus the proportion of a leffer to a greater tone is as 80 to 81; this difference between the greater and leffer tone is what the Greeks called a *comma*.

We may remark, that this difference of a comma is found between the third minor when true and harmonical, and the fame chord when it fuffers alteration 'd', 'f', of which we have taken notice in the fcale (note Y); for we have feen, that this third minor thus altered is in the proportion of 80 to 81 with the true third minor.

(CC) The values or eftimates of the notes fhall be the fame in this as in the former fcale, excepting only the

tone

Theory of Harmony.

The Greek diatonic scale simpler than ours, and why.

56. Hence it follows, that the diatonic ſcale of the Greeks is, at leaſt in ſome reſpects, more ſimple than ours; ſince the ſcale of the Greeks (chap. v.) may be formed alone from the mode proper to C; whereas ours is originally and primitively formed, not only from the mode of C (F, C, G), but likewiſe from the mode of G, (C, G, D).

It will likewiſe appear, that this laſt ſcale conſiſts of two parts; of which the one, 'c, d, e, f, g,' is in the mode of C; and the other, 'g, a, b,' *c*, in that of G.

The note g twice repeated in the diatonic ſcale from its harmonic relations to the fundamental baſs.

57. For this reaſon the note 'g' is twice repeated in immediate ſucceſſion in this ſcale; once as the fifth of C, which correſponds with it in the fundamental baſs; and again, as the octave of G, which immediately follows G in the ſame baſs. Theſe two conſecutive 'g's are otherwiſe in perfect uniſon. For this reaſon we ſing only one of them when we modulate the ſcale 'c, d, e, f, g, a, b,' *c*; but this does not prevent us from employing a pauſe or repoſe, expreſſed or underſtood, after the ſound 'f'. There is no perſon who does not perceive this whilſt he himſelf ſings the ſcale.

The modern ſcale compoſed of two disjunctive tetrachords of different modes.

58. The ſcale of the moderns, then, may be conſidered as conſiſting of two tetrachords, disjunctive indeed, but perfectly ſimilar one to the other, 'c, d, e, f', and 'g, a, b, c', one in the mode of C, the other in that of G. We ſhall ſee in the ſequel, by what artifice one may cauſe the ſcale 'c, d, e, f, g, a, b, c', to be regarded as belonging to the mode of C alone. For this purpoſe it is neceſſary to make ſome changes in the fundamental baſs, which we have already aſſigned: but this ſhall be explained at large in chap. xiii.

The mode of G introduced in the fundamental baſs productive of conveniences.

59. The introduction of the mode proper to G in the fundamental baſs has this happy effect, that the notes 'f, g, a, b', may immediately ſucceed each other in aſcending the ſcale, which cannot take place (art. 48.) in the diatonic ſeries of the Greeks, becauſe that ſeries is formed from the mode of C alone. Whence it follows:

1. That we change the mode at every time when we modulate three whole tones in ſucceſſion.

2. That if theſe three tones are ſung in ſucceſſion in the ſcale 'c, d, e, f, g, a, b', *c*, this cannot be done but by the aſſiſtance of a pauſe expreſſed or underſtood after the note 'f'; inſomuch, that the three tones 'f g', 'g a', 'a b', are ſuppoſed to belong to two different tetrachords.

Change of mode the cauſe of the difficulty in ſinging three conſecutive tones aſcending.

60. It ought not then any longer to ſurpriſe us, that we feel ſome difficulty whilſt we aſcend the ſcale in ſinging three tones in ſucceſſion, becauſe this is impracticable without changing the mode; and if one pauſes in the ſame mode, the fourth ſound above the firſt note will never be higher than a ſemitone above that which immediately precedes it; as may be ſeen by 'c, d, e, f', and by 'g, a, b', *c*, where there is no more than a ſemitone between 'e' and 'f', and between 'b' and *c*.

Intervals, though altered in themſelves, form true conſonances with the fundamental baſs.

61. We may likewiſe obſerve in the ſcale 'c, d, e, f', that the third minor from 'd' to 'f', is not true, for the reaſons which have been already given (art. 49.). It is the ſame caſe with the third minor from 'a' to *c*, and with the third major from 'f' to 'a'; but each of theſe ſounds forms otherwiſe conſonances perfectly true, with their correſpondent ſounds in the fundamental baſs.

62. The thirds 'a' *c*, 'fa', which were true in the former ſcale, are falſe in this; becauſe in the former ſcale 'a' was the third of 'f', and here it is the fifth of D, which correſponds with it in the fundamental baſs.

Fewer altered conſonances in the Greek ſcale than in ours.

63. Thus it appears, that the ſcale of the Greeks contains fewer conſonances that are altered than ours (DD); and this likewiſe happens from the introduction of the mode of G into the fundamental baſs (EE).

We ſee likewiſe that the value of 'a' in the diatonic ſcale, a value which authors have been divided in aſcertaining, ſolely depends upon the fundamental baſs, and that

---

tone 'a'; for 'd' being repreſented by $\frac{9}{8}$, its fifth will be expreſſed by $\frac{27}{16}$; ſo that the ſcale will be numerically ſignified thus:

$$\begin{array}{cccccccc} 1 & \frac{9}{8} & \frac{5}{4} & \frac{4}{3} & \frac{3}{2} & \frac{27}{16} & \frac{15}{8} & 2 \\ c, & d, & e, & f, & g, & a, & b, & c, \end{array}$$

Where you may ſee, that the note 'a' of this ſcale is different from that in the ſcale of the Greeks; and that the 'a' in the modern ſeries ſtands in proportion to that of the Greeks as $\frac{27}{16}$ to $\frac{5}{3}$, that is to ſay, as 81 to 80; theſe two 'a's then likewiſe differ by a *comma*.

(DD) In the ſcale of the Greeks, the note 'a' being a third from 'f', there is an altered fifth between 'a' and 'd': but in ours, 'a' being a fifth to 'd', produces two altered thirds, 'f a' and 'a' *c*; and likewiſe a fifth altered, 'a' *e*, as we ſhall ſee in the following chapter. Thus there are in our ſcale two intervals more than in the ſcale of the Greeks which ſuffer alteration.

(EE) But here it may be with ſome colour objected: The ſcale of the Greeks, it may be ſaid, has a fundamental baſs more ſimple than ours; and beſides, in it there are fewer chords which will not be found exactly true: why then, notwithſtanding this, does ours appear more eaſy to be ſung than that of the Greeks? The Grecian ſcale begins with a ſemitone, whereas the intonation prompted by nature ſeems to impel us to riſe by a full tone at once. This objection may be thus anſwered. The ſcale of the Greeks is indeed better diſpoſed than ours for the ſimplicity of the baſs, but the arrangement of ours is more ſuitable to natural intonation. Our ſcale commences by the fundamental ſound c, and it is in reality from that ſound that we ought to begin; it is from this that all the others naturally ariſe, and upon this that they depend; nay, if we may ſpeak ſo, in this they are included: on the contrary, neither the ſcale of the Greeks, nor its fundamental baſs, commences with C; but it is from this C that we muſt depart, in order to regulate our intonation, whether in riſing or deſcending; now, in aſcending from 'c', the intonation, even of the Greek ſcale, gives the ſeries 'c, d, e, f, g, a': and ſo true is it that the fundamental ſound C is here the genuine guide of the ear, that if, before we modulate the ſound 'c', we

Theory of Harmony.

that it muſt be different according as the note 'a' has 'f' or 'd' for its baſs. See the note (cc).

Chap. VII. *Of Temperament.*

Temperament, why neceſſary.

64. The alterations which we have obſerved in the intervals between particular ſounds of the diatonic ſcale, naturally lead us to ſpeak of temperament. To give a clear idea of this, and to render the neceſſity of it palpable, let us ſuppoſe that we have before us an inſtrument with keys, a harpſichord, for inſtance, conſiſting of ſeveral octaves or ſcales, of which each includes its twelve ſemitones.

See fig. 6.

Let us chooſe in that harpſichord one of the ſtrings which will ſound the note C, and let us tune the ſtring G to a perfect fifth with C in aſcending; let us afterwards tune to a perfect fifth with this G the 'd' which is above it; we ſhall evidently perceive that this 'd' will be in the ſcale above that from which we ſet out: but it is alſo evident that this 'd' muſt have in the ſcale a D which correſponds with it, and which muſt be tuned a true octave below 'd'; and between 'd' and G there ſhould be the interval of a fifth; ſo that the D in the firſt ſcale will be a true fourth below the G of the ſame ſcale. We may afterwards tune the note A of the firſt ſcale to a juſt fifth with this laſt D; then the note 'e' in the higheſt ſcale to a true fifth with this new A, and of conſequence the E in the firſt ſcale to a true fourth beneath this ſame A: Having finiſhed this operation, it will be found that the laſt E, thus tuned, will by no means form a juſt third major from the ſound C (FF): that is to ſay, that it is impoſſible for E to conſtitute at the ſame time the third major of C and the true fifth of A; or, what is the ſame thing, the true fourth of A in deſcending.

65. If, after having ſucceſſively and alternately tuned the ſtrings C, G, 'd', A, E, in perfect fifths and fourths one from the other, we continue to tune ſucceſſively by true fifths and fourths the ſtrings E, B, F♯, C♯, G♯, 'd♯', E♯, B♯; we ſhall find, that, though B♯, being a ſemitone higher than the natural note, ſhould be equivalent to 'c' natural, it will by no means form a juſt octave to the firſt C in the ſcale, but be conſiderably higher (GG); yet this B♯ upon the harpſichord ought not

---

ſhould attempt to riſe to it by that note in the ſcale which is moſt immediately contiguous, we cannot reach it but by the note B, and by the ſemitone from B to 'c'. Now to make a tranſition from B to 'c', by this ſemitone, the ear muſt of neceſſity be prediſpoſed for that modulation, and conſequently preoccupied with the mode of C: if this were not the caſe, we ſhould naturally riſe from B to 'c♯', and by this operation paſs into another mode.

(FF) The A conſidered as the fifth of D is $\frac{27}{16}$, and the fourth beneath this A will conſtitute $\frac{3}{4}$ of $\frac{27}{16}$, that is to ſay, $\frac{81}{64}$; $\frac{81}{64}$ then ſhall be the value of E, conſidered as a true fourth from A in deſcending: now E, conſidered as the third major of the ſound C, is $\frac{5}{4}$, or $\frac{80}{64}$: theſe two E's then are between themſelves in the proportion of 81 to 80; thus it is impoſſible that E ſhould be at the ſame time a perfect third major from C, and a true fourth beneath A.

(GG) In effect, if you thus alternately tune the fifth above, and the fourth below, in the ſame octave, you may here ſee what will be the proceſs of your operation.

C, G, a fifth; D a fourth; A a fifth; E a fourth; B a fifth; F♯ a fourth; C♯ a fifth; G♯ a fourth; 'd♯' a fifth; A♯ a fourth; 'e♯' or 'f♮' a fifth; B♯ a fourth: now it will be found, by a very eaſy computation, that the firſt C being repreſented by 1, G ſhall be $\frac{3}{2}$, D $\frac{9}{8}$, A $\frac{27}{16}$, E $\frac{81}{64}$, &c. and ſo of the reſt, till you arrive at B♯, which will be found $\frac{531441}{262144}$. This fraction is evidently greater than the number 2, which expreſſes the perfect octave c to its correſpondent C; and the octave below B♯ would be one half of the ſame fraction, that is to ſay $\frac{531441}{524288}$, which is evidently greater than C repreſented by unity. This laſt fraction $\frac{531441}{524288}$ is compoſed of two numbers; the numerator of the fraction is nothing elſe but the number 3 multiplied 11 times in ſucceſſion by itſelf, and the denominator is the number 2 multiplied 18 times in ſucceſſion by itſelf. Now it is evident, that this fraction, which expreſſes the value of B♯, is not equal to the unity which expreſſes the value of the ſound C, though, upon the harpſichord, B♯ and C are identical. This fraction riſes above unity by $\frac{7153}{524288}$, that is to ſay, by about $\frac{1}{73}$; and this difference was called the *comma of Pythagoras*. It is palpable that this comma is much more conſiderable than that which we have already mentioned (note BB), and which is only $\frac{1}{80}$.

We have already proved that the ſeries of fifths produces a 'c' different from B♯, the ſeries of thirds major gives another ſtill more different. For, let us ſuppoſe this ſeries of thirds, C, E, G♯, B♯, we ſhall have E equal to $\frac{5}{4}$, G♯ to $\frac{25}{16}$, and B to $\frac{125}{64}$, whoſe octave below is $\frac{125}{128}$; from whence it appears, that this laſt B is leſs than unity (that is to ſay than C), by $\frac{3}{128}$, or by $\frac{1}{42}$, or near it: A new comma, much greater than the preceding, and which the Greeks have called *apotome major*.

It may be obſerved, that this B♯, deduced from the ſeries of thirds, is to the B♯ deduced from the ſeries of fifths, as $\frac{125}{128}$ is to $\frac{531441}{524288}$; that is to ſay, in multiplying by 524288, as 125 multiplied by 4096 is to 531441, or as 51200 to 531441, that is to ſay, nearly as 26 is to 27: from whence it may be ſeen, that theſe two B's♯ are very conſiderably different one from the other, and even ſufficiently different to make the ear ſenſible of it; becauſe the difference conſiſts almoſt of a minor ſemitone, whoſe value, as will afterwards be ſeen (art. 139.), is $\frac{25}{24}$.

Moreover, if, after having found the G♯ equal to $\frac{25}{16}$, we then tune by fifths and by fourths, G♯, 'd♯' A♯, C♯ B♯, as we have done with reſpect to the firſt ſeries of fifths, we find that the B♯ muſt be $\frac{2025}{2048}$; its difference, then, from unity, or, in other words, from C, is $\frac{23}{2048}$, that is to ſay, about $\frac{1}{89}$; a comma ſtill leſs than any of the preceding, and which the Greeks have called *apotome minor*:

In

Reasons and rules for temperament.

not to be different from the octave above C; for every B※ and every 'c' is the same sound, since the octave or the scale only consists of twelve semitones.

66. From thence it necessarily follows, 1. That it is impossible that all the octaves and all the fifths should be just at the same time, particularly in instruments which have keys, where no intervals less than a semitone are admitted. 2. That, of consequence, if the fifths are justly tuned, some alteration must be made in the octaves; now the sympathy or sound which subsists between any note and its octave, does not permit us to make such an alteration: this perfect coalescence of sound is the cause why the octave should serve as limits to the other intervals, and that all the notes which rise above or fall below the ordinary scale, are no more than replications, i. e. repetitions, of all that have gone before them. For this reason, if the octave were altered, there could be no longer any fixed point either in harmony or melody. It is then absolutely necessary to tune the 'c' or B※ in a just octave with the first; from whence it follows, that, in the progression of fifths, or, what is the same thing, in the alternate series of fifths and fourths, C, G, D, A, E, B, F※, C※, G※, 'd※', A※, 'e※', B※, it is necessary that all the fifths should be altered, or at least some of them. Now, since there is no reason why one should rather be altered than another, it follows, that we ought to alter them all equally. By these means, as the alteration is made to influence all the fifths, it will be in each of them almost imperceptible; and thus the fifth, which, after the octave, is the most perfect of all consonances, and which we are under the necessity of altering, must only be altered in the least degree possible.

67. It is true, that the thirds will be a little harsh: but as the interval of sounds which constitutes the third, produces a less perfect coalescence than that of the fifth, it is necessary, says M. Rameau, to sacrifice the justice of that chord to the perfection of the fifth; for the more perfect a chord is in its own nature, the more displeasing to the ear is any alteration which can be made in it. In the octave the least alteration is insupportable.

68. This change in the intervals of instruments which have, or even which have not, keys, is that which we call *temperament*. Its definition.

69. It results then from all that we have now said, that the theory of temperament may be reduced to this question.—The alternate succession of fifths and fourths having been given, (art. 66.), in which B※ or C is not the true octave of the first C; it is proposed to alter all the fifths equally, in such a manner that the two C's may be in a perfect octave the one to the other. Principle whence is theory may be deduced.

70. For a solution of this question, we must begin with tuning the two C's in a perfect octave the one to the other; in consequence of which, we will render all the semitones which compose the octave as equal as possible. By this means (HH) the alteration made in each Practical directions for temperament.

In a word, if, after having found E equal to $\frac{5}{4}$ in the progression of thirds, we then tune by fifths and fourths E, B, F※, C※, &c. we shall arrive at a new B※, which shall be $\frac{32805}{32768}$, and which will not differ from unity but by about $\frac{1}{885}$, which is the last and smallest of all the commas; but it must be observed, that, in this case, the thirds major from E to G※, from G※ to B※ or C, &c. are extremely false, and greatly altered.

(HH) All the semitones being equal in the temperament proposed by M. Rameau, it follows, that the twelve semitones C, C※, D, D※, E, E※, &c. shall form a continued geometrical progression; that is to say, a series in which C shall be to C※ in the same proportion as C※ to D, as D to D※, &c. and so of the rest.

These twelve semitones are formed by a series of thirteen sounds, of which C and its octave 'c' are the first and last. Thus to find by computation the value of each sound in the temperament, which is the present object of our speculations, our scrutiny is limited to the investigation of eleven other numbers between 1 and 2 which may form with the 1 and the 2 a continued geometrical progression.

However little any one is practised in calculation, he will easily find each of these numbers, or at least a number approaching to its value. These are the characters by which they may be expressed, which mathematicians will easily understand, and which others may neglect.

C	C※	D	D※	E	F	F※	G	G※
1	$\sqrt[12]{2}$	$\sqrt[12]{2^2}$	$\sqrt[12]{2^3}$	$\sqrt[12]{2^4}$	$\sqrt[12]{2^5}$	$\sqrt[12]{2^6}$	$\sqrt[12]{2^7}$	$\sqrt[12]{2^8}$
	A	A※	B	'c'				
	$\sqrt[12]{2^9}$	$\sqrt[12]{2^{10}}$	$\sqrt[12]{}^{11}$	$\sqrt[12]{}^{12}$				

It is obvious, that in this temperament all the fifths are equally altered. One may likewise prove, that the alteration of each in particular is very inconsiderable; for it will be found, for instance, that the fifth from C to G, which should be $\frac{3}{2}$, ought to be diminished by about $\frac{1}{12}$ of $\frac{1}{73}$; that is to say, by $\frac{1}{876}$, a quantity almost inconceivably small.

It is true, that the thirds major will be a little more altered; for the third major from C to E, for instance, shall be increased in its interval by about $\frac{1}{100}$: but it is better, according to M. Rameau, that the alteration should fall upon the third than upon the fifth, which after the octave is the most perfect chord, and from the perfection of which we ought never to degenerate but as little as possible.

Besides, it has appeared from the series of thirds major C, E, G※, B※, that this last B※ is very different from 'c' (note GG); from whence it follows, that if we would tune this B※ in unison with the octave of C, and alter at the same time each of the thirds major by a degree as small as possible, they must all be equally altered. This is what occurred in the temperament which we propose; and if in it the third be more altered than the fifth, it is a consequence of the difference which we find between the degrees of perfection in these intervals; a difference with which, if we may speak so, the temperament proposed conforms itself. Thus this diversity of alteration is rather advantageous than inconvenient.

Theory of Harmony.

each fifth will be very confiderable, but equal in all of them.

Rameau's method of tempera-ment pro-pofed.

71. In this, then, the theory of temperament confifts: but as it would be difficult in practice to tune a harpfichord or organ by thus rendering all the femitones equal, M. Rameau, in his *Generation Harmonique*, has furnifhed us with the following method, to alter all the fifths as equally as poffible.

72. Take any key of the harpfichord which you pleafe; but let it be towards the middle of the inftrument; for inftance, C: then tune the note G a fifth above it, at firft with as much accuracy as poffible; this you may imperceptibly diminifh: tune afterwards the fifth to this with equal accuracy, and diminifh it in the fame manner; and thus proceed from one fifth to another in afcent: and as the ear does not appreciate fo exactly founds that are extremely fharp, it is neceffary, when by fifths you have rifen to notes extremely high, that you fhould tune in the moft perfect manner the octave below the laft fifth which you had immediately formed; then you may continue always in the fame manner; till in this procefs you arrive at the laft fifth from E※ to B※, which fhould of themfelves be in tune; that is to fay, they ought to be in fuch a ftate, that B※, the higheft note of the two which compofe the fifth, may be identical with the found C, with which you began, or at leaft the octave of that found perfectly juft: it will be neceffary then to try if this C, or its octave, forms a juft fifth with the laft found E※ or F, which has been already tuned. If this be the cafe, we may be certain that the harpfichord is properly tuned. But if this laft fifth be not true, in this cafe it will be too fharp, and it is an indication that the other fifths have been too much diminifhed, or at leaft fome of them; or it will be too flat, and confequently difcover that they have not been fufficiently diminifhed. We muft then begin and proceed as formerly, till we find the laft fifth in tune of itfelf, and without our immediate interpofition (11).

By

(11) We have only to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: it may here be feen in what this laft temperament confifts as applied to the organ or harpfichord. They begin with C in the middle of the keys, and they flatten the four firft fifths G, D, A, E, till they form a true third major from E to C; afterwards, fetting out from this E, they tune the fifths B, F※, C※, G※, but flattening them ftill lefs than the former, fo that G※ may almoft form a true third major with E. When they have arrived at G※, they ftop; they refume the firft C, and tune to it the fifth F in defcending, then the fifth B♭, &c. and they heighten a little all the fifths till they have arrived at A♭, which ought to be the fame with the G※ already tuned.

If, in the temperament commonly practifed, fome thirds are found to be lefs altered than in that prefcribed by M. Rameau, in return, the fifths in the firft temperament are much more falfe, and many thirds are likewife fo; infomuch, that upon a harpfichord tuned according to the temperament in common ufe, there are five or fix modes which the ear cannot endure, and in which it is impoffible to execute any thing. On the contrary, in the temperament fuggefted by M. Rameau, all the modes are equally perfect; which is a new argument in its favour, fince the temperament is peculiarly neceffary in paffing from one mode to another, without fhocking the ear; for inftance, from the mode of C to that of G, from the mode of G to that of D, &c. It is true, that this uniformity of modulation will to the greateft number of muficians appear a defect: for they imagine, that, by tuning the femitones of the fcale unequal, they give each of the modes a peculiar character; fo that, according to them, the fcale of C,

C, D, E, F, G, A, B, C,

is not perfectly fimilar to the gammut or diatonic fcale of the mode of E,

E, F※, G※, A※, B, c※, d※, e,

which, in their judgement, renders the modes of C and E proper for different manners of expreffion. But after all that we have faid in this treatife on the formation of diatonic intervals, every one fhould be convinced, that, according to the intention of nature, the diatonic fcale ought to be perfectly the fame in all its modes: The contrary opinion, fays M. Rameau, is a mere prejudice of muficians. The character of an air arifes chiefly from the intermixture of the modes; from the greater or leffer degrees of vivacity in the movement; from the tones, more or lefs grave, or more or lefs acute, which are affigned to the generator of the mode; and from the chords more or lefs beautiful, as they are more or lefs deep, more or lefs flat, more or lefs fharp, which are found in it.

In fhort, the laft advantage of this temperament is, that it will be found conformed with, or at leaft very little different from that which is practifed upon inftruments without keys; as the bafs-viol, the violin, in which true fifths and fourths are preferred to thirds and fixths tuned with equal accuracy; a temperament which appears incompatible with that commonly ufed in tuning the harpfichord.

Yet M. Rameau, in his *New Syftem of Mufic*, printed in 1726, adopted the ordinary temperament. In that work, (as may be feen chap. xxiv.), he pretends that the alteration of the fifths is much more fupportable than that of the thirds major; and that this laft interval can hardly fuffer a greater alteration than the octave, which, as we know, cannot fuffer the flighteft alteration. He fays, that if three ftrings are tuned, one by an octave, the other by a fifth, and the next by a third major to a fourth ftring, and if a found be produced from the laft, the ftrings tuned by a fifth will vibrate, though a little lefs true than it ought to have been; but that the octave and the third major, if altered in the leaft degree, will not vibrate: and he adds, that the temperament which is now practifed, is founded upon that principle. M. Rameau goes ftill farther; and as, in the ordinary temperament,

Theory of Harmony.

By this method all the twelve ſounds which compoſe one of the ſcales ſhall be tuned: nothing is neceſſary but to tune with the greateſt poſſible exactneſs their octaves in the other ſcales, and the harpſichord ſhall be well tuned.

Alterations by either method hardly diſagreeable.

We have given this rule for temperament from M. Rameau; and it belongs only to diſintereſted artiſts to judge of it. However this queſtion be determined, and whatever kind of temperament may be received, the alteration which it produces in harmony will be but very ſmall, or not perceptible to the ear, whoſe attention is entirely engroſſed in attuning itſelf with the fundamental baſs, and which ſuffers, without uneaſineſs, theſe alterations, or rather takes no notice of them, becauſe it ſupplies from itſelf what may be wanting to the truth and perfection of the intervals.

Simple and daily experiments confirm what we now advance. Liſten to a voice which is accompanied, in ſinging, by different inſtruments; though the temperament of the voice, and the temperament of each of the inſtruments, are all different one from another, yet you will not be in the leaſt affected with the kind of cacophony which ought to reſult from theſe diverſities, becauſe the ear ſuppoſes theſe intervals true, of which it does not appreciate differences.

We may give another experiment. Let the three keys E, G, B be ſtruck upon an organ, and the minor perfect chord only will be heard; though E, by the conſtruction of that inſtrument, muſt cauſe G※ likewiſe to be heard; though G ſhould have the ſame effect upon D, and B upon F※; inſomuch that the ear is at once affected with all theſe ſounds, D, E, F※, G, G※, B: how many diſſonances perceived at the ſame time, and what a jarring multitude of diſcordant ſenſations, would reſult from thence to the ear, if the perfect chord with which it is preoccupied had not power entirely to abſtract its attention from ſuch ſounds as might offend!

Chap. VIII. *Of Repoſes or Cadences* (KK).

Theory of Harmony.

Cadences perfect and imperfect, what and why.

73. In a fundamental baſs whoſe procedure is by fifths, there always is, or always may be, a *repoſe*, or criſis, in which the mind acquieſces in its tranſition from one ſound to another: but a repoſe may be more or leſs diſtinctly ſignified, and of conſequence more or leſs perfect. If one ſhould riſe by fifths; if, for inſtance, we paſs from C to G; it is the generator which paſſes to one of theſe fifths, and this fifth was already pre-exiſtent in its generator: but the generator exiſts no longer in this fifth; and the ear, as this generator is the principle of all harmony and of all melody, feels a deſire to return to it. Thus the tranſition from a ſound to its fifth in aſcent, is termed an *imperfect repoſe*, or *imperfect cadence;* but the tranſition from any ſound to its fifth in deſcent, is denominated a *perfect cadence*, or an *abſolute repoſe:* it is the offspring which returns to its generator, and as it were recovers its exiſtence once more in that generator itſelf, with which when ſounding it reſounds (chap. i.)

See *Repoſe* or *Cadence.*

Perfect cadences more or leſs perfect, and why.

74. Amongſt abſolute repoſes, there are ſome, if we may be allowed the expreſſion, more abſolute, that is to ſay, more perfect, than others. Thus in the fundamental baſs

C, G, C, F, C, G, D, G, C.

which forms, as we have ſeen, the diatonic ſcale of the moderns, there is an abſolute repoſe from D to G, as from G to C; yet this laſt abſolute repoſe is more perfect than the preceding, becauſe the ear, prepoſſeſſed with the mode of C by the multiplied impreſſion of the ſound C which it has already heard thrice before, feels a deſire to return to the generator C; and it accordingly does ſo by the abſolute repoſe G C.

Cadence in melody different from what it is in harmony.

75. We may ſtill add, that what is commonly called *cadence* in melody, ought not to be confounded with what we name *cadence* in harmony. In

temperament, there is a neceſſity for altering the laſt thirds major, and to make them a little more ſharp, that they may naturally return to the octave of the principal ſound, he pretends that this alteration is tolerable, not only becauſe it is almoſt inſenſible, but becauſe it is found in modulations not much in uſe, unleſs the compoſer ſhould chooſe it on purpoſe to render the expreſſion ſtronger. "For it is proper to remark (ſays he), that we receive different impreſſions from the intervals in proportion to their different alterations: for inſtance, the third major, which naturally elevates us to joy, in proportion as we feel it, heightens our feelings even to a kind of fury, when it is tuned too ſharp; and the third minor, which naturally inſpires us with tenderneſs and ſerenity, depreſſes us to melancholy when it is too flat." All this is very different from what this celebrated muſician afterwards exhibited in his *Generation Harmonique*, and in the performances which followed it. From this we can only conclude, that the reaſons which, after him, we have urged for the new temperament, muſt without doubt have appeared to him very ſtrong, becauſe in his mind they had ſuperſeded thoſe which he had formerly adduced in favour of the ordinary temperament.

We do not pretend to give any deciſion for either the one or the other of theſe methods of temperament, each of which appears to us to have its particular advantages. We ſhall only remark, that the choice of the one or the other muſt be left abſolutely to the taſte and inclination of the reader; without, however, admitting this choice to have any influence upon the principles of the ſyſtem of muſic, which we have followed even till this period, and which muſt always ſubſiſt, whatever temperament we adopt.

(KK) That the reader may have a clear idea of the term before he enters upon the ſubject of this chapter, it may be neceſſary to caution him againſt a miſtake into which he may be too eaſily led by the ordinary ſignification of the word *repoſe.* In muſic, therefore, it is far from being ſynonymous with the word *reſt.* It is, on the contrary, the termination of a muſical *phraſe* which ends in a cadence more or leſs emphatic, as the ſentiment implied in the phraſe is more or leſs complete. Thus a repoſe in muſic anſwers the ſame purpoſe as punctuation in language. See REPOS, in Rouſſeau's Muſical Dictionary.

Theory of Harmony.

In the firſt caſe, this word only ſignifies an agreeable and rapid alteration between two contiguous ſounds, called likewiſe a *trill* or *ſhake;* in the ſecond, it ſignifies a repoſe or cloſe. It is however true, that this ſhake implies, or at leaſt frequently enough preſages, a repoſe, either preſent or impending, in the fundamental baſs (LL).

Cadences in the fundamental baſs neceſſary in the diatonic ſcale, and which the moſt perfect.

76. Since there is a repoſe in paſſing from one ſound to another in the fundamental baſs, there is alſo a repoſe in paſſing from one note to another in the diatonic ſcale, which is formed from it, and which this baſs repreſents: and as the abſolute repoſe G C is of all others the moſt perfect in the fundamental baſs, the repoſe from B to 'c', which anſwers to it in the ſcale, and which is likewiſe terminated by the generator, is for that reaſon the moſt perfect of all others in the diatonic ſcale aſcending.

Definition and uſe of a ſenſible note.

77. It is then a law dictated by nature itſelf that if you would aſcend diatonically to the generator of a mode, you can only do this by means of the third major from the fifth of that very generator. This third major, which with the generator forms a ſemitone, has for that reaſon been called the *ſenſible note* or *leading note*, as introducing the generator, and preparing us for the moſt perfect repoſe.

See *Senſible Note.*

We have already proved, that the fundamental baſs is the principle of melody. We ſhall beſides make it appear in the ſequel, that the effect of a repoſe in melody ariſes ſolely from the fundamental baſs.

Chap. IX. *Of the Minor Mode and its Diatonic Series.*

The diatonic ſeries of the minor mode aſcertained by different examples.

78. In the ſecond chapter, we have explained (art. 20. 30. 31. and 32.) by what means, and upon what principle, the minor chord C, E♭, G, 'c', may be formed, which is the characteriſtical chord of the minor mode. Now what we have there ſaid, taking C for the principal and fundamental ſound, we might likewiſe have ſaid of any other note in the ſcale, aſſumed in the ſame manner as the principal and fundamental ſound: but as in the minor chord, C, E♭, G, 'c', there occurs an E♭ which is not found in the ordinary diatonic ſcale, we ſhall immediately ſubſtitute, for greater eaſe and conveniency, another chord, which is likewiſe minor and exactly ſimilar to the former, of which all the notes are found in the ſcale.

79. The ſcale affords us three chords of this kind, viz. D, F, A, 'd'; A, 'c, e, a'; and E, G, B, 'e'. Among theſe three we ſhall chooſe A, 'c, e, a'; becauſe this chord, without including any ſharp or flat, has two ſounds in common with the major chord C, E G, 'c'; and beſides, one of theſe two ſounds is the very ſame 'c': ſo that this chord appears to have the moſt immediate, and at the ſame time the moſt ſimple, relation with the chord C, E, G, 'c'. Concerning this we need only add, that this preference of the chord A, 'c, e, a', to every other minor chord, is by no means in itſelf neceſſary for what we have to ſay in this chapter upon the diatonic ſcale of the minor mode. We might in the ſame manner have choſen any other minor chord; and it is only, as we have ſaid, for greater eaſe and conveniency that we fix upon this.

Theory of Harmony.

Tonic or key in harmony, what.

80. In every mode, whether major or minor, the *principal* ſound which implies the perfect chord, whether major or minor, is called the *tonic note* or *key;* thus C is the key in its proper mode, A in the mode of A, &c. Having laid down this principle,

See *Principal.* See *Tonic.*

The formation of the ſcale purſued. See fig. 4.

81. We have ſhown how the three ſounds, F, C, G, which conſtitute (art. 38.) the mode of C, of which the firſt, F, and the laſt, G, are the two fifths of C, one deſcending, the other riſing, produce the ſcale, B, 'c, d, e, f, g, a', of the major mode, by means of the fundamental baſs G, C, G, C, F, C, F; let us in the ſame manner take the three ſounds D, A, E, which conſtitute the mode of A, for the ſame reaſon that the ſounds F, C, G, conſtitute the mode of C; and of them let us form this fundamental baſs, perfectly like the preceding E, A, F, A, D, A, D; let us afterwards place below each of theſe ſounds one of their harmonics, as we have done (chap. v.), for the firſt ſcale of the major mode; with this difference, that we muſt ſuppoſe D and A as implying their thirds minor in the fundamental baſs to characterize the minor mode; and we ſhall have the diatonic ſcale of that mode,

See fig. 7.

G✻, A, B, 'c, d, e, f'.

82. The G✻, which correſponds with E in the fundamental baſs, forms a third major with that E, though the mode be minor; for the ſame reaſon that a third from the fifth of the fundamental ſound ought to be major (art. 77.) when that third riſes to the fundamental ſound A.

83. It is true, that, in cauſing E to imply its third minor G, one might alſo riſe to A by a diatonic progreſs. But that manner of riſing to A would be leſs perfect than the preceding; for this reaſon (art. 76.), that the abſolute repoſe or perfect cadence E, A, in the fundamental baſs, ought to be repreſented in the moſt perfect manner in the two notes of the diatonic ſcale which anſwer to it, eſpecially when one of theſe two notes is A, the key itſelf upon which the repoſe is made. From whence it follows, that the preceding note G ought rather to be ſharp than natural; becauſe G✻, being included in E (art. 19.), much more perfectly repreſents the note E in the baſs, than the natural G could do, which is not included in E.

See *Imply* or *Carry.*

Diverſities in the ſcales of the major and minor mode.

84. We may remark this firſt difference between the ſcale

G✻, A, B, 'c, d, e, f',

and the ſcale which correſponds with it in the major mode

B, 'c, d, e, f, g, a',

that from 'e' to 'f', which are the two laſt notes of the former ſcale, there is only a ſemitone; whereas from 'g' to 'a', which are the two laſt ſounds of the latter ſeries, there is the interval of a complete tone; but this is not the only diſcrimination which may be found between the ſcales of the two modes.

(LL) M. Rouſſeau, in his letter on French muſic, has called this alternate undulation of different ſounds a *trill*, from the Italian word *trillo*, which ſignifies the ſame thing; and ſome French muſicians already appear to have adopted this expreſſion.

Theory of Harmony.

Investigation of these differences and their reasons, See fig. 5.

85. To investigate these differences, and to discover the reason for which they happen, we shall begin by forming a new diatonic scale of the minor mode, similar to the second scale of the major mode,

'c, d, e, f, g, g, a, b', *c*.

That last series, as we have seen, was formed by means of the fundamental bass F, C, G, D, disposed in this manner,

C, G, C, F, C, G, D, G, C.

Let us take in the same manner the fundamental bass D, A, E, B, and arrange it in the following order,

A, E, A, D, A, E, B, E, A,

See fig. 8.

and it will produce the scale immediately subjoined,

A, B, 'c, d, e, e, f※, g※, a',

in which 'c' forms a third minor with A, which in the fundamental bass corresponds with it, which denominates the minor mode; and, on the contrary, 'g※' forms a third major with E in the fundamental bass, because 'g※' rises towards 'a' (art. 82. 83.)

86. We see besides an 'f※', which does not occur in the former,

G※, A, B, 'c, d, e, f',

where 'f' is natural. It is because, in the first scale, 'f' is a third minor from D in the bass; and in the second, 'f※' is the fifth from B in the bass (MM).

Difference between the two scales of the minor mode greater than those of the major.

87. Thus the two scales of the minor mode are still in this respect more different one from the other than the two scales of the major mode; for we do not remark this difference of a semitone between the two scales of the major mode. We have only observed (art. 63.) some difference in the value of A as it stands in each of these scales, but this amounts to much less than a semitone.

'f' and 'g' sharp in the minor mode, and why.

88. From thence it may be seen why 'f' and 'g' are sharp when ascending in the minor mode; besides the the 'f' is only natural in the first scale G※, A, B, 'c, d, e, f', because this 'f' cannot rise to 'g※', (art. 48.)

The case different in descending, and why.

89. It is not the same case in descending. For E, the fifth of the generator, ought not to imply the third major 'g※', but in the case when that E descends to the generator A to form a perfect repose (art. 77. and 83.); and in this case the third major 'g※' rises to the generator 'a': but the fundamental bass AE may, in descending, give the scale 'a, g', natural, provided 'g' does not rise again to 'a'.

Explication of the descending scale in the minor mode from a fundamental bass difficult.

90. It is much more difficult to explain how the 'f' which ought to follow this 'g' in descending, is natural and not sharp; for the fundamental bass

A, E, B, E, A, D, A, E, A,

produces in descending,

'a, g, f※, e, e, d, c', B, A.

And it is plain that the 'f' cannot be otherwise than sharp, since 'f※' is the fifth of the note B of the fundamental bass. Experience, however, evinces that the 'f' is natural in descending in the diatonic scale of the major mode of A, especially when the preceding 'g' is natural: and it must be acknowledged, that here the fundamental bass appears defective.

Rameau's solution, though the only one, yet unsatisfactory.

M. Rameau has attempted the following solution of this difficulty. In the diatonic scale of the minor mode in descending, ('a, g, f, e, d, c,' B, A,) 'g' may be regarded simply as a note of passage, merely added to give sweetness to the modulation, and as a diatonic gradation by which we may descend to 'f' natural. This is easily perceived, according to M. Rameau, by the fundamental bass,

A, D, A, D, A, E, A,

which produces

'a, f, e, d, c', B, A;

which may be regarded, as he says, as the real scale of the minor mode in descending; to which is added 'g' natural between 'a' and 'f', to preserve the diatonic order.

This appears the only possible answer to the difficulty above proposed: but we know not whether it will fully satisfy the reader; whether he will not see with regret, that the fundamental bass does not produce, to speak properly, the diatonic scale of the minor mode in descent, when at the same time this same bass so happily produces the diatonic scale of that identical mode in ascending, and the diatonic scale of the major mode whether in rising or descending (NN).

Chap. X. *Of Relative Modes.*

Modes relative, what. See *Mode*.

91. Two modes of such a nature that we can pass from the one to the other, are called *relative modes*. Thus the major mode of C is relative to the major mode of F and to that of G. It has also been seen how many intimate connexions there are between the major mode of C, and the minor mode of A. For, 1. The perfect chords, one major, C, E, G, 'c', the other minor, A, 'c, e, a', which characterize each of those two kinds of modulation * or harmony, have two sounds in common, 'c' and 'e'. 2. The scale of the minor mode of A in descent, absolutely contains the same sounds with the scale of the major mode of C.

* See *Modulation*.

Hence the transition is so natural and easy from the major mode of C to the minor mode of A, or from the the minor mode of A to the major mode of C, as experience proves.

92. In the minor mode of E, the minor perfect chord E, G, B, 'e', which characterizes it, has likewise two sounds, E, G, in common with the perfect chord major C, E, G, 'c', which characterizes the major mode of

(MM) Besides, without appealing to the proof of the fundamental bass, 'f※' obviously presents itself as the sixth note of this scale; because the seventh note being necessarily 'g※' (art. 77.) if the sixth were not 'f※', but 'f♮', there would be an interval of three semitones between the sixth and the seventh, consequently the scale would not be diatonic, (art. 8.)

(NN) When 'g' is said to be natural in descending the diatonic scale of the minor mode of A, it is only meant that this 'g' is not necessarily sharp in descending as it is in rising; for it may be sharp, as may be proved by numberless examples, of which all musical compositions are full. It is true, that when 'g' is found sharp in descending to the minor mode of A, we are not sure that the mode is minor till the 'f' or 'c' natural is found; both of which impress a peculiar character on the minor mode, viz. 'c' natural, in rising and in descending, and the 'f' natural in descending.

Theory of Harmony.

of C. But the minor mode of E is not ſo cloſely related nor allied to the major mode of C as the minor mode of A; becauſe the diatonic ſcale of the minor mode of E in deſcent, has not, like the ſeries of the minor mode of A, all theſe ſounds in common with the ſcale of C. In reality, this ſcale is 'e, d, c', B, A, G, F※, E, where there occurs an 'f' ſharp which is not in the ſcale of C. Though the minor mode of E is thus leſs relative to the major mode of C than that of A; yet the artiſt does not heſitate ſometimes to paſs immediately from the one to the other.

When we paſs from one mode to another by the interval of a third, whether in deſcending or riſing, as from C to A, or from A to C, from C to E, or from E to C, the major mode becomes minor, or the minor mode becomes major.

93. There is ſtill another minor mode, into which an immediate tranſition may be made in iſſuing from the major mode of C. It is the minor mode of C itſelf in which the perfect minor chord C, E♭, G, 'c', has two ſounds, C and G, in common with the perfect major chord C, E, G, 'c'. Nor is there any thing more common than a tranſition from the major mode of C to the minor mode, or from the minor to the major (OO).

Chap. XI. *Of Diſſonance.*

Caſes in which the mode is uncertain.

94. We have already obſerved, that the mode of C (F, C, G,) has two ſounds in common with the mode of G (C, G, D); and two ſounds in common with the mode of F (B♭, F, C); of conſequence, this procedure of the baſs C G may belong to the mode of C, or to the mode of G, as the procedure of the baſs F C, or C F, may belong to the mode of C or the mode of F. When one therefore paſſes from C to F or to G in a fundamental baſs, he is ſtill ignorant what mode he is in. It would be, however, advantageous to know it, and to be able by ſome means to diſtinguiſh the generator from its fifths.

How we may inveſtigate the generator and its fifths, and by that means determine the mode.

95. This advantage may be obtained by uniting at the ſame time the ſounds G and F in the ſame harmony, that is to ſay, by joining to the harmony G, B, 'd' of the fifth G, the other fifth F in this manner, G, B, 'd, f'; this 'f' which is added, forms a diſſonance with G (art. 18.) Hence the chord G, B, 'd, f', is called a *diſſonant* chord, or a chord of the ſeventh. It ſerves to diſtinguiſh the fifth G from the generator C, which always implies, without mixture or alteration, the perfect chord C, E, G, 'c', reſulting from nature itſelf (art. 32.) By this we may ſee, that when we paſs from C to G, one paſſes at the ſame time from C to F, becauſe 'f' is found to be comprehended in the chord of G; and the mode of C by theſe means plainly appears to be determined, becauſe there is none but that mode to which the ſounds F and G at once belong.

Manner of treating diſſonances continued.

96. Let us now ſee what may be added to the harmony F, A, C, of the fifth F *below* the generator, to diſtinguiſh this harmony from that of the generator. It ſeems probable at firſt, that we ſhould add to it the other fifth G, ſo that the generator C, in paſſing to F, may at the ſame time paſs to G, and that by this the mode ſhould be determined: but this introduction of G, in the chord F, A, C, would produce two ſeconds in ſucceſſion F G, G A, that is to ſay, two diſſonances whoſe union would prove extremely harſh to the ear; an inconvenience to be avoided. For if, to diſtinguiſh the mode, we ſhould alter the harmony of the fifth F in the fundamental baſs, it muſt only be altered in the leaſt degree poſſible.

Chord of the great ſixth.

97. For this reaſon, inſtead of G, we ſhall take its fifth 'd', the ſound that approaches it the neareſt; and we ſhall have, inſtead of the fifth F, the chord F, A, 'c, d', which is called a *chord of the great ſixth.*

One may here remark the analogy there is obſerved between the harmony of the fifth G and that of the fifth F.

The ſubject of diſſonances continued.

98. The fifth G, in riſing above the generator, gives a chord entirely conſiſting of thirds aſcending from G, C, B, 'd, f'; now the fifth F being below the generator C in deſcending, we ſhall find, as we go lower by thirds from 'c' towards E, the ſame ſounds 'c', A, F, D, which form the chord F, A, 'c, d', given to the fifth F.

99. It appears beſides, that the alteration of the harmony in the two fifths conſiſts only in the third minor D, F, which was reciprocally added to the harmony of theſe two fifths.

Chap. XII. *Of the Double Uſe or Employment of Diſſonance.*

Account of the double employment.

100. It is evident by the reſemblance of ſounds to their octaves, that the chord F, A, 'c, d', is in effect the ſame as the chord D, F, A, 'c', taken inverſely †, that the inverſe of the chord C, A, F, D, has been found (art. 98.) in deſcending by thirds, from the generator C (PP).

† See *Inverted.*

101. The

(OO) There are likewiſe other minor modes, into which we may paſs in our egreſs from the mode major of C; as that of F minor, in which the perfect minor chord F, A♭, 'c', includes the ſound 'c', and whoſe ſcale in aſcent F, G, A♭, B♭, 'c, d, e, f', only includes the two ſounds A♭, B♭, which do not occur in the ſcale of C. This tranſition, however, is not frequent.

The minor mode of D has only in its ſcale aſcending D, E, F, G, A, B, 'c※, d', one 'c' ſharp which is not found in the ſcale of C. For this reaſon a tranſition may likewiſe be made, without grating the ear, from the mode of C major to the mode of D minor; but this paſſage is leſs immediate than the former, becauſe the chords C, E, G, 'c', and D, F, A, 'd', not having a ſingle ſound in common, one cannot (art. 37.) paſs immediately from the one to the other.

(PP) M. Rameau, in ſeveral paſſages of his works (for inſtance, in p. 110, 111, 112, and 113, of the *Generation Harmonique*), appears to conſider the chord D, F, A, C, as the primary chord and generator of the chord E, A, 'c, d', which is that chord reverſed; in other paſſages (particularly in p. 116. of the ſame performance), he ſeems to conſider the firſt of theſe chords as nothing elſe but the reverſe of the ſecond. It would ſeem that this

Theory of Harmony.

Difference between dominant and tonic dominant.

101. The chord D, F, A, 'c', is a chord of the seventh like the chord G, B, 'd, f'; with this only difference, that the latter in the third G, B, is major: whereas in the former, the third D, F, is minor. If the F were sharp, the chord D, F✱, A, 'c', would be a genuine chord of the dominant, like the chord G, B, D, 'f'; and as the dominant G may descend to C in the fundamental bass, the dominant D implying or carrying with it the third major F✱ might in the same manner descend to G.

102. Now if the F✱ should be changed into F natural, D, the fundamental tone of this chord D, F, A, 'c', might still descend to G; for the change from F✱ to F natural will have no other effect, than to preserve the impression of the mode of C, instead of that of the mode of G, which the F✱ would have here introduced. The note D will, however, preserve its character as a dominant, on account of the mode of C, which forms a seventh. Thus in the chord of which we treat, (D, F, A, 'c'), D may be considered as an *imperfect dominant:* we call it *imperfect*, because it carries with it the third minor F, instead of the third major F✱. It is for this reason that in the sequel we shall call it simply the *dominant*, to distinguish it from the dominant G, which shall be named the *tonic dominant* †.

† See *Dominant.*

103. Thus the sounds F and G, which cannot succeed each other (art. 36.) in a diatonic bass, when they only carry with them the perfect chords F A C, G B d, may succeed one another, if 'd' be added to the harmony of the first, and 'f' to the harmony of the second; and if the first chord be inverted, that is to say, if the two chords take this form, D, F, A, C, G, B, d, a.

Seeming contradictions reconciled.

104. Besides, the chord F, A, 'c, d', being allowed to succeed the perfect chord C, E, G, 'c', it follows for the same reasons, that the chord C, E, G, C may be succeeded by D, F, A, 'c'; which is not contradictory to what we have above said (art. 37.), that the sounds C and D cannot succeed one another in the fundamental bass: for in the passage quoted, we had supposed that both C and D carried with them a perfect chord major; whereas, in the present case, D carries the third minor E, and likewise the sound 'c', by which the chord D F A 'c' is connected with that which precedes it C E G 'c'; and in which the sound 'c' is found. Besides, this chord, D F A 'c', is properly nothing else but the chord F A 'c d' inverted, and if we may speak so, disguised.

105. This manner of presenting the chord of the subdominant under two different forms, and of employing it under these two different forms, has been called by M. Rameau its *double office* or *employment* †. This is the source of one of the finest varieties in harmony; and we shall see in the following chapter the advantages which result from it.

Double employment, what, and why so called.

† See *Double Employment.*

We may add, that as this double employment is a kind of license, it ought not to be practised without some precaution. We have lately seen that the chords D F A 'c', considered as the inverse of F A 'c d', may succeed to C E G 'c', but this liberty is not reciprocal: and though the chord F A 'c d', may be followed by the chord C E G 'c', we have no right to conclude from thence that the chord D F A 'c', considered as the inverse of F A 'c d', may be followed by the chord C E G 'c'. For this the reason shall be given in chap. xvi.

Chap. XIII. *Concerning the Use of this Double Employment, and its Rules.*

By the double use of the above-mentioned chord, the impression of the mode may be preserved.

106. We have shown (chap. xvi.) how the diatonic scale, or ordinary gammut, may be formed from the fundamental bass F, C, G, D, by twice repeating the note G in that series; so that this gammut is primitively composed of two similar tetrachords, one in the mode of C, the other in that of G. Now it is possible, by means of this double employment, to preserve the impression of the mode of C through the whole extent of the scale, without twice repeating the note C, or even without supposing this repetition. For this effect we form the following fundamental bass,

C, G, C, F, C, D, G, C:

in which C is understood to carry with it the perfect chord C E G 'c'; G, the chord G B 'd f'; F the chord F A 'c d'; and D, the chord D F A 'c'. It is plain from what has been said in the preceding chapter, that in this case C may ascend to D in the fundamental bass, and D descend to G, and that the impression of the mode of C is preserved by the 'f' natural, which forms the third minor 'd f', instead of the third major which D ought naturally to imply.

107. This fundamental bass will give, as it is evident, the ordinary diatonic scale,

'c, d, e, f, g, a, b', *c*,

which of consequence will be in the mode of C alone; and if one should choose to have the second tetrachord in the mode of G, it will be necessary to substitute 'f✱' instead of 'f♮' in the harmony of D (QQ).

108. Thus the generator C may be followed according-

this great artist has neither expressed himself upon this subject with so much uniformity nor with so much precision as is required. We think that there is some foundation for considering the chord F, A, 'c, d', as primitive: 1. Because in this chord, the fundamental and principal note is the subdominant F, which ought in effect to be the fundamental and principal sound in the chord of the sub-dominant. 2. Because that without having recourse, with M. Rameau, to harmonical and arithmetical progressions, of which the consideration appears to us quite foreign to the question, we have found a probable and even a satisfactory reason for adding the note 'd' to the harmony of the fifth F (art. 96. and 97.) The origin thus assigned for the chord of the sub-dominant appears to us the most natural, though M. Rameau does not appear to have felt its full value; for scarcely has it been slightly insinuated by him.

(QQ) It is obvious that this fundamental bass C, G, C, F, C, D, G, C, which formed the ascending scale 'c, d, e, f, g, a, b', *c*, cannot by inverting it, and taking it inversely in this manner, C, G, D, C, F, C, G, C, form the diatonic scale *c*, 'b, a, g, f, e, d, c', in descent. In reality, from the chord G, B, 'd, f', we cannot pass to the chord D, F, A, 'c', nor from thence to C, E, G 'c'. For this reason, in order to have the fundamental bass ing to pleafure in afcending diatonically either by a tonic dominant (D F※ A C), or by a fimple dominant (D F A C).

109. In the minor mode of A, the tonic dominant E ought always to imply its third major E G※, when this dominant E defcends to the generator A (art. 83.); and the chord of this dominant fhall be E G※B 'd', entirely fimilar to G B 'd f'. With refpect to the fub-dominant D, it will immediately imply the third minor F, to denominate the minor mode; and we may add B above its chord D F A, in this manner D F A B, a chord fimilar to that of F A 'c d'; and as we have deduced from the chord F A 'c d' that of D F A 'c', we may in the fame manner deduce from the chord D F A B 'a' a new chord of the feventh B 'd f a', which will exhibit the *double employment of diffonances* in the minor mode.

110. One may employ this chord B 'd f a', to preferve the impreffion of the mode of A in the diatonic fcale of the minor mode, and to prevent the neceffity of twice repeating the found E; but in this cafe, the F muft be rendered fharp, and the chord changed to B 'd f※ a', the fifth of B being 'f '※, as we have feen above. This chord is then the inverfe of D F※ A B, the fubdominant implying the third major, which ought not to furprife us; for in the minor mode of A, the fecond tetrachord E F※ G※ A is exactly the fame as it would be in the major mode of A: Now, in the major mode of A the fubdominant D ought to imply the third major F※.

Diverfities in the minor mode more numerous than in the major.

111. Hence the minor mode is fufceptible of a much greater number of varieties than the major: the major mode is founded in nature alone; whereas the minor is in fome meafure the product of art. But, in return, the major mode has received from nature, to which it owes its immediate formation, a force and energy which the minor cannot boaft.

Chap. XIV. *Of the different Kinds of Chords of the Seventh.*

Inveftigation whether art, in confequence of fome fuccefsful advances, may not be carried farther.

112. The diffonance added to the chord of the dominant and of the fubdominant, though in fome meafure fuggefted by nature (chap. xi.), is neverthelefs a work of art; but as it produces great beauties in harmony by the variety which it introduces into it, let us difcover whether, in confequence of this firft advance, art may not ftill be carried farther.

Different chords of the feventh.

113. We have already three different kinds of chords of the feventh, viz.

1. The chord G B 'd f', compofed of a third major followed by two thirds minor.

2. The chord D F A 'c', or B 'd f※ a', a third major between two minors.

3. The chord B 'd f a', two thirds minor followed by a major.

114. There are ftill two other kinds of chords of the feventh which are employed in harmony; one is compofed of a third minor between two thirds major, C E G B, or F A 'c e'; the other is wholly compofed of thirds minor G※ B 'd f'. Thefe two chords, which at firft appear as if they ought not to enter into harmony if we rigoroufly keep to the preceding rules, are neverthelefs frequently practifed with fuccefs in the fundamental bafs. The reafon is this:

The chords laft defcribed admiffible, and why.

115. According to what has been faid above, if we would add a feventh to the chord C E G, to make a dominant of C, one can add nothing but B♭; and in this cafe C E G B♭ would be the chord of the tonic dominant in the mode of F, as G B 'd f' is the chord of the tonic dominant in the mode of C; but if we would preferve the impreffion of the mode of C in the harmony, we change this B♭ into B natural, and the chord C E G B♭ becomes C E G B. It is the fame cafe with the chord F A 'c e', which is nothing elfe but the chord F A 'c e♭'; in which one may fubftitute for 'e♭', 'e' natural, to preferve the impreffion of the mode of C, or of that of F.

Befides, in fuch chords as C E G B, F A 'c e', the founds B and 'e', though they form a diffonance with C in the firft cafe, and with F in the fecond, are neverthelefs fupportable to the ear, becaufe thefe founds B and 'e' (art. 19.) are already contained and underftood, the firft in the note E of the chord C E G B, as likewife in the note G of the fame chord; the fecond in the note A of the chord F A 'c e', as likewife in the note 'c' of the fame chord. All together then feem to allow the artift to introduce the note B and 'e' into thefe two chords (RR).

Chords of the feventh continued and explained.

116. With refpect to the chord of the feventh G※ B 'd f', wholly compofed of thirds minor, it may be regarded as formed from the union of the two chords of

---

bafs of the fcale, *c*, 'b, a, g, f, e, d, c', in defcent, we muft either determine to invert the fundamental bafs mentioned in art. 55. in this manner, C, G, D, G, C, F, C, G, C, in which the fecond G and the fecond C anfwer to the G alone in the fcale; or otherwife we muft form the fundamental bafs C, G, D, G, C, G, C, in which all the notes imply perfect chords major, except the fecond G, which implies the chord of the feventh G, B, 'd, f', and which anfwers to the two notes of the fcale G, F, both comprehended in the chord G, B, 'd, f'.

Whichever of thefe two baffes we fhall choofe, it is obvious that neither the one nor the other fhall be wholly in the mode of C, but in the mode of C and in that of G. Whence it follows, that the double employment which gives to the fcale a fundamental bafs all in the fame mode when afcending, cannot do the fame in defcending; and that the fundamental bafs of the fcale in defcending will be neceffarily in two different modes.

(RR) On the contrary, a chord fuch as C E♭ G B, in which E would be flat, could not be admitted in harmony, becaufe in this chord the B is not included and underftood in E♭. It is the fame cafe with feveral other chords, fuch as B D F A※, B D※ F A, &c. It is true, that in the laft of thefe chords, A is included in F, but it is not contained in D※; and this D※ likewife forms with F and with A a double diffonance, which, joined with the diffonance B F, would neceffarily render this chord not very pleafing to the ear; we fhall yet, however, fee in the fecond part, that this chord is fometimes ufed.

Theory of Harmony.

the dominant and of the sub-dominant in the minor mode. In effect, in the minor mode of A, for instance, these two chords are E G✕ B, 'd', and D E A B, whose union produces E G✕, B, 'd, f, a'. Now, if we should suffer this chord to remain thus, it would be disagreeable to the ear, by its multiplicity of dissonances, D E, E F, F G✕, A B, D G✕, (art. 18.); so that, to avoid this inconveniency, the generator A is immediately expunged, which, (art. 19.) is as it were understood in D, and the fifth or dominant E, whose place the sensible note G✕ is supposed to hold: thus there remains only the chord G✕ B 'd f', wholly composed of thirds minor, and in which the dominant E is considered as understood; in such a manner that the chord G✕B 'd f' represents the chord of the tonic dominant E G✕B 'd', to which we have joined the chord of the sub-dominant D F A B, but in which the dominant E is always reckoned the principal note (ss).

117. Since, then, from the chord E G✕B 'd', we may pass to the perfect A C 'e a', and *vice versa*, we may in like manner pass from the chord G✕B 'd f' to the chord A C 'e a', and from this last to the chord G✕B 'd f': this remark will be very useful to us in the sequel.

CHAP. XV. *Of the* Preparation *of Discords.*

Dissonance, what.

118. IN every chord of the seventh, the highest note, that is to say, the seventh above the fundamental, is called a *dissonance* or *discord;* thus 'f' is the dissonance of the chord G 'B d f'; 'c' in the chord D F, A 'c', &c.

Manner of preparing dissonances investigated.

119. When the chord G B 'd f' follows the chord C E G 'c', as often happens, it is obvious that we do not find the dissonance 'f' in the preceding chord C E G 'c'. Nor ought it indeed to be found in that chord; for this dissonance is nothing else but the sub-dominant added to the harmony of the dominant to determine the mode: now, the sub-dominant is not found in the harmony of the generator.

120. For the same reason, when the chord of the sub-dominant F A 'c d' follows the chord C E G 'c', the note 'd', which forms a dissonance with 'c', is not found in the preceding chord.

It is not so when the chord D F A 'c' follows the chord C E G 'c'; for 'c', which forms a dissonance in the second chord, stands as a consonance in the preceding.

Dissonance is only tolerable to the ear when found in preceding chords.

121. In general, dissonance being the production of art (chap. xi.), especially in such chords as are not of the tonic dominant nor sub-dominant, the only means to prevent its displeasing the ear by appearing too heterogeneous to the chord, is, that it may be, if we may speak so, announced to the ear by being found in the preceding chord, and by that means connect the two chords. Hence follows this rule:

Preparation of dissonances how performed.

122. In every chord of the seventh, which is not the chord of the tonic dominant, that is to say, (art. 102.) which is not composed of a third major followed by two thirds minor, the dissonance which this chord forms ought to stand as a consonance in the chord which precedes it.

This is what we call a *prepared dissonance.* See *Preparation.*

123. Hence, in order to prepare a dissonance, the fundamental bass must necessarily ascend by the interval of a second, as

C E G 'c', D F A 'c';

or descend by a third, as

C E G 'c', A C E G;

or descend by a fifth, as

C E G 'c', F A C E:

in every other case the dissonance cannot be prepared. This may be easily ascertained. If, for instance, the fundamental bass rises by a third, as C E G 'c', E G B 'd', the dissonance 'd' is not found in the chord C E G 'c'. The same might be said of C E G 'c', G B 'd f', and C E G 'c', B D 'f a', in which the fundamental bass rises by a fifth or descends by a second.

124. When a tonic, that is to say, a note which carries with it a perfect chord, is followed by a dominant in the interval of a fifth or third, this succession may be regarded as a process from that same tonic to another, which has been rendered a dominant by the addition of the dissonance.

Moreover, we have seen (art. 119. and 120.) that a dissonance does not require preparation in the chords of the tonic dominant and of the sub-dominant: whence it follows, that every tonic carrying with it a perfect chord, may be changed into a tonic dominant (if the perfect chord be major), or into a sub-dominant (whether the chord bass be major or minor) by adding the dissonance all at once.

CHAP. XVI. *Of the Rules for* resolving *Dissonances.*

Dissonances to be resolved, must be disguised and made to appear in the character of harmonics.

125. WE have seen (chap. v. and vi.) how the diatonic scale, so natural to the voice, is formed by the harmonies of fundamental sounds; from whence it follows, that the most natural succession of harmonical sounds is to be diatonic. To give a dissonance then, in some measure, as much the character of an harmonic sound as may be possible, it is necessary that this dissonance, in that part of the modulation where it is found, should descend or rise diatonically upon another note, which may be one of the consonances of the subsequent chord.

In the chord of the tonic dominant, the dissonance should rather rise than descend, and why.

126. Now in the chord of the tonic dominant it ought

(ss) We have seen (art. 109.) that the chord B 'd f a', in the minor mode of A, may be regarded as the inverse of the chord D F A B; it would likewise seem, that, in certain cases, this chord B d f a may be considered as composed of the two chords G B 'd f', F A 'c d' of the dominant and of the sub-dominant of the major mode of C; which chords may be joined together after having excluded from them, 1. The dominant G, represented by its third major B, which is presumed to retain its place. 2. The note C which is understood in F, which will form this chord B 'd f a'. The chord B 'd f a', considered in this point of view, may be understood as belonging to the major mode of C upon certain occasions.

Theory of Harmony.

ought rather to deſcend than to riſe; for this reaſon. Let us take, for inſtance, the chord G B 'd f' followed by the chord C E G 'c'; the part which formed the diſſonance 'f' ought to deſcend to 'e' rather than riſe to 'g', though both the ſounds E and G are found in the ſubſequent chord C E G 'c'; becauſe it is more natural and more conformed to the connexion which ought to be found in every part of the muſic, that G ſhould be found in the ſame part where G has already been ſounded, whilſt the other part was ſounding 'f', as may be here ſeen (Parts Firſt and Fourth).

Firſt part, - -	'f'	'e'
Second, - -	'd'	'c'
Third, - - -	B	
Fourth, - -	G	G
Fundamental baſs, -	G	C

Conſequences of the former rule.

127. So, in the chord of the ſimple dominant D F A 'c', followed by G B d 'f', the diſſonance 'c' ought rather to deſcend to B than riſe to 'd'.

Another conſequence.

128. And, for the ſame reaſon, in the chord of the ſub-dominant F A 'c d', the diſſonance 'd' ought to riſe to 'e' of the following chord C E G 'c', rather than deſcend to 'c'; whence may be deduced the following rules.

But is deduced from the former propoſitions.

129. 1°, In every chord of the dominant, whether tonic or ſimple, the note which conſtitutes the ſeventh, that is to ſay the diſſonance, ought diatonically to deſcend upon one of the notes which form a conſonance in the ſubſequent chord.

2°, In every chord of the ſub-dominant, the diſſonance ought to riſe diatonically upon the third of the ſubſequent chord.

Diſſonance reſolved, what. See *Reſolution.*

130. A diſſonance which deſcends or riſes diatonically according to theſe two rules, is called a *diſſonance reſolved.*

From theſe rules it is a neceſſary reſult, that the chord of the ſeventh D F A 'c', though it ſhould even be conſidered as the inverſe of F A 'c d', cannot be ſucceeded by the chord C E G 'c', ſince there is not in this laſt chord the note B, upon which the diſſonance 'c' of the chord D F A 'c' can deſcend.

One may beſides find another reaſon for this rule, in examining the nature of the double employment of diſſonances. In effect, in order to paſs from D F A 'c', to C E G 'c', it is neceſſary that D F A 'c' ſhould in this caſe be underſtood as the inverſe of F A 'c d'. Now the chord D F A 'c' can only be conceived as the inverſe of F A 'c d', when this chord D F A 'c' precedes or immediately follows the C E G 'c'; in every other caſe the chord D F A 'c' is a primitive chord, formed from the perfect minor chord D F A, to which the diſſonance 'c' was added, to take from D the character of a tonic. Thus the chord D F A 'c', could not be followed by the chord C E G 'c', but after having been preceded by the ſame chord. Now, in this caſe, the *double employment* would be entirely a futile expedient, without producing any agreeable effect: becauſe, inſtead of this ſucceſſion of chords, C E G 'c', D F A 'c', C E G 'c', it would be much more eaſy and natural to ſubſtitute this other, which furniſhes this natural ſucceſſion C E G 'c', F A 'c d', C E G 'c'. The proper uſe of the double employment is, that, by means of inverting the chord of the ſub-dominant, it may be able to paſs from that chord thus inverted to any other chord except that of the tonic, to which it naturally leads.

Chap. XVII. *Of the Broken or Interrupted Cadence.*

The teſt of perfection in cadences to be found in the fundamental baſs.

131. In a fundamental baſs which moves by fifths, there is always, as we have formerly obſerved (chap. viii.), a repoſe more or leſs perfect from one ſound to another; and of conſequence there muſt likewiſe be a repoſe more or leſs perfect from one ſound to another in the diatonic ſcale, which reſults from that baſs.— It may be demonſtrated by a very ſimple experiment, that the cauſe of a repoſe in melody is ſolely in the fundamental baſs expreſſed or underſtood. Let any perſon ſing theſe three notes 'c d g', performing on the 'd' a ſhake, which is commonly called a *cadence;* the modulation will appear to him to be finiſhed after the ſecond 'c', in ſuch a manner that the ear will neither expect nor wiſh any thing to follow. The caſe will be the ſame if we accompany this modulation with its natural fundamental baſs C G C: but if, inſtead of this baſs, we ſhould give it the following, C G A: in this caſe the modulation 'c d c' would not appear to be finiſhed, and the ear would ſtill expect and deſire ſomething more. This experiment may eaſily be made.

Broken cadences, what, and why. See *Cadence.*

132. This paſſage G A, when the dominant G diatonically aſcends upon the note A inſtead of deſcending by a fifth upon the generator C, as it ought naturally to do, is called a *broken cadence;* becauſe the perfect cadence G C, which the ear expected after the dominant G, is, if we may ſpeak ſo, broken and ſuſpended by the tranſition from G to A.

133. Hence it follows, that if the modulation 'c d c' appeared finiſhed when we ſuppoſed no baſs to it at all, it is becauſe its natural fundamental baſs C G C is implied; for the ear deſires ſomething to follow this modulation, as ſoon as it is reduced to the neceſſity of hearing another baſs.

Origin of broken cadence the double employment of diſſonances.

134. The broken cadence may be conſidered as having its origin in the *double employment of diſſonances;* ſince this cadence, like the double employment, only conſiſts in a diatonic procedure of the baſs aſcending (chap. xii.) In effect, nothing hinders us to deſcend from the chord G B 'd f' to the chord C E G A by converting the tonic C into a ſub-dominant, that is to ſay, by paſſing all at once from the mode of C to the mode of G: now to deſcend from G B 'd f' to C E G A is the ſame thing as to riſe from the chord G B 'd f' to the chord A 'c e g', in changing the chord of the ſub-dominant C E G A for the imperfect chord of the dominant, according to the laws of the double employment.

Manner of performing this cadence.

135. In this kind of cadence, the diſſonance of the firſt chord is reſolved by deſcending diatonically upon the fifth of the ſubſequent chord. For inſtance, in the broken cadence G B 'd f', A 'c e g', the diſſonance 'f' is reſolved by deſcending diatonically upon the fifth 'e'.

Interrupted cadence, what. See *Cadence.*

136. There is another kind of cadence, called an *interrupted cadence,* where the dominant deſcends by a third to another dominant, inſtead of deſcending by a fifth upon the tonic, as in this ſucceſſion of the baſs G B 'd f',

Theory of Harmony.

G B ‘d f’, E G B ‘d’; in the caſe of an interrupted cadence, the diſſonance of the former chord is reſolved by deſcending diatonically upon the octave of the fundamental note of the ſubſequent chord, as may be here ſeen, where ‘f’ is reſolved upon the octave of E.

Origin of this kind of cadence, likewiſe in the double employment.

137. This kind of interrupted cadence has likewiſe its origin in the double employment of diſſonances. For let us ſuppoſe theſe two chords in ſucceſſion, G B ‘d f’, G B ‘d e’, where G is ſucceſſively a tonic dominant and ſub-dominant; that is to ſay, in which we paſs from the mode of C to the mode of D; if we ſhould change the ſecond of theſe chords into the chord of the dominant, according to the laws of the double employment, we ſhall have the interrupted cadence G B ‘d f’, E G B ‘d’.

Chap. XVIII. *Of the Chromatic Species.*

Fundamental baſs may be formed by thirds major.

138. The ſeries or fundamental baſs by fifths produces the diatonic ſpecies in common uſe (chap. vi.); now the third major being one of the harmonics of a fundamental ſound as well as the fifth, it follows, that we may form fundamental baſſes by thirds major, as we have already formed fundamental baſſes by fifths.

A chromatic interval or minor ſemitone, how found. See fig. 10.

139. If then we ſhould form this baſs C, E, G♯, the two firſt ſounds carrying each along with it their thirds major and fifths, it is evident that C will give G, and that E will give G♯: now the ſemitone which is between this G and this G♯ is an interval much leſs than the ſemitone which is found in the diatonic ſcale between E and F, or between B and ‘c’. This may be aſcertained by calculation (TT): and for this reaſon the ſemitone from E to F is called *major*, and the other *minor* (UU).

140. If the fundamental baſs ſhould proceed by thirds minor in this manner, C, E♭, a ſucceſſion which is allowed when we have inveſtigated the origin of the minor mode (chap. ix.), we ſhall find this modulation G, G♭, which would likewiſe give a minor ſemitone (XX).

An intonation minor ſemitone difficult to be hit, and why.

141. The minor ſemitone is hit by young practitioners in intonation with more difficulty than the ſemitone major. For which this reaſon may be aſſigned: The ſemitone major which is found in the diatonic ſcale, as from E to F, reſults from a fundamental baſs by fifths C F, that is to ſay, by a ſucceſſion which is moſt natural, and for this reaſon the eaſieſt to the ear. On the contrary, the minor ſemitone ariſes from a ſucceſſion by thirds, which is ſtill leſs natural than the former. Hence, that ſcholars may truly hit the minor ſemitone, the following artifice is employed. Let us ſuppoſe, for inſtance, that they intend to riſe from G to G♯; they riſe at firſt from G to A, then deſcend from A to G♯ by the interval of a ſemitone major: for this G ſharp, which is a ſemitone major below A, proves a ſemitone minor above G. [See the notes (TT) and (UU).]

Minor ſemitone to be found in every procedure of the fundamental baſs by thirds.

142. Every procedure of the fundamental baſs by thirds, whether major or minor, riſing or deſcending, gives the minor ſemitone. This we have already ſeen from the ſucceſſion of thirds in aſcending. The ſeries of thirds minor in deſcending, C A, gives, C, C♯ (YY); and the ſeries of thirds major in deſcending, C, A♭, gives C, C♭, (ZZ).

The minor ſemitone, when prevalent, conſtitutes chromatic muſic.

143. The minor ſemitone conſtitutes the ſpecies, called *chromatic;* and with the ſpecies which moves by diatonic intervals, reſulting from the ſucceſſion of fifths (chap. v. and vi.), it comprehends the whole of melody.

Chap. XIX. *Of the Enharmonic Species.*

Dieſis or enharmonic interval, what, and how formed. * See *Fourth of a Tone.* Fig. 11.

144. The two extremes, or higheſt and loweſt notes, C G♯, of the fundamental baſs by thirds major CEG♯, give this modulation ‘c’B♯; and theſe two ſounds ‘c’ B♯, differ between themſelves by a ſmall interval which is called the *dïeſis*, or *enharmonic fourth* of a tone* (3A), which

(TT) In reality, C being ſuppoſed 1, as we have always ſuppoſed it, E is $\frac{4}{5}$, and ♯$\frac{25}{16}$: now G being $\frac{3}{2}$, G♯ then ſhall be to G as $\frac{25}{16}$ to $\frac{3}{2}$; that is to ſay, as 25 times 2 to 3 times 16: the proportion then of G♯ to G is as 25 to 24, an interval much leſs than that of 16 to 15, which conſtitutes the ſemitone from ‘c’ to B, or from F to E (note Z).

(UU) A minor joined to a major ſemitone will form a minor tone; that is to ſay, if one riſes, for inſtance, from E to F, by the interval of a ſemitone major, and afterwards from F to F♯ by the interval of a minor ſemitone, the interval from E to F♯ will be a minor tone. For let us ſuppoſe E to be 1, F will be $\frac{16}{15}$, and F♯ will be $\frac{25}{24}$ of $\frac{16}{15}$; that is to ſay, 25 times 16 divided by 24 times 15, or $\frac{10}{9}$; E then is to F♯ as 1 is to $\frac{10}{9}$, the interval which conſtitutes the minor tone (note BB).

With reſpect to the tone major, it cannot be exactly formed by two ſemitones; for, 1. Two major ſemitones in immediate ſucceſſion would produce more than a tone major. In effect, $\frac{16}{15}$ multiplied by $\frac{16}{15}$ gives $\frac{256}{225}$, which is greater than $\frac{3}{8}$, the interval which conſtitutes (note BB) the major tone. 2. A ſemitone minor and a ſemitone major would give leſs than a major tone, ſince they amount only to a true minor. 3. And, *à fortiori*, two minor ſemitones would ſtill give leſs.

(XX) In effect, E♭ being $\frac{6}{5}$, G♭ will be $\frac{6}{5}$ of $\frac{6}{5}$; that is to ſay, (note Q) $\frac{36}{25}$: now the proportion of $\frac{3}{2}$ to $\frac{36}{25}$ (note Q) is that of 3 times 25 to 2 times 36; that is to ſay, as 25 to 24.

(YY) A being $\frac{5}{6}$, C♯ is $\frac{5}{4}$ of $\frac{5}{6}$; that is to ſay $\frac{25}{24}$, and C is 1: the proportion then between C and C♯ is that of 1 to $\frac{25}{24}$, or of 24 to 25.

(ZZ) A♭ being the third major below C, will be $\frac{4}{5}$ (note Q): C♭, then, is $\frac{7}{5}$ of $\frac{4}{5}$; that is to ſay $\frac{24}{25}$. The proportion, then, between C and C♭, is as 25 to 24.

(3A) G♯ being $\frac{25}{16}$ and B♯ being $\frac{5}{4}$ of $\frac{25}{16}$, we ſhall have B♯ equal (note Q) to $\frac{125}{64}$, and its octave below ſhall be $\frac{125}{128}$; an interval leſs than unity by about $\frac{3}{128}$ or $\frac{1}{43}$. It is plain then from this fraction, that the B♯ in queſtion muſt be conſiderably lower than C.

Theory of Harmony.

which is the difference between a ſemitone major and a ſemitone minor (3 B). This quarter tone is inappretiable by the ear, and impracticable upon ſeveral of our inſtruments. Yet have means been found to put it in practice in the following manner, or rather to perform what will have the ſame effect upon the ear.

Manner of ſeemingly introducing this interval upon inſtruments of fixed ſcales.

145. We have explained (art. 116.) in what manner the chord G𝄪 B 'd f' may be introduced into the minor mode, entirely conſiſting of thirds minor perfectly true, or at leaſt ſuppoſed ſuch. This chord ſupplying the place of the chord of the dominant (art. 116.) from thence we may paſs to that of the tonic or generator A (art. 117.). But we muſt remark,

1. That this chord G𝄪 B 'd f', entirely conſiſting of thirds minor, may be inverted or modified according to the three following arrangements, B 'd f g𝄪', D F G𝄪B, F G𝄪B 'd'; and that in all theſe three different ſtates, it will ſtill remain compoſed of thirds minor; or at leaſt there will only be wanting the enharmonic fourth of a tone to render the third minor between F and G𝄪 entirely juſt; for a true third minor, as that from E to G in the diatonic ſcale, is compoſed of a ſemitone and a tone both major. Now from F to G there is a tone major, and from G to G𝄪 there is only a minor ſemitone. There is then wanting (art. 144.) the enharmonic fourth of a tone, to render the third F G𝄪 exactly true.

2. But as this diviſion of a tone cannot be found in the gradations of any ſcale practicable upon moſt of our inſtruments, nor be appretiated by the ear, the ear takes the different chords.

B	'd'	'f'	'g𝄪'
D	F	G𝄪	B
F	G𝄪	B	'd',

which are abſolutely the ſame, for chords compoſed every one of thirds minor exactly juſt.

Now the chord G𝄪B 'd f', belonging to the minor mode of A, where G𝄪 is the ſenſible note; the chord B 'd f g𝄪', or B 'd f a♭', will, for the ſame reaſon, belong to the minor mode of C, where B is the ſenſible note. In like manner, the chord D F G𝄪 B, or D F A♭ 'c♭', will belong to the minor mode of E♭, and the chord F G𝄪B 'd', or F A♭ 'c♭ e♭♭', to the minor mode of G♭.

After having paſſed then by the mode of A to the chord G𝄪 B 'd f' (art. 117.), one may by means of this laſt chord, and by merely ſatisfying ourſelves to invert it, afterwards paſs all at once to the modes of C minor, of E♭ minor, or of G♭ minor; that is to ſay, into the modes which have nothing, or almoſt nothing, in common with the minor mode of A, and which are entirely foreign to it (3 C).

The alteration, however, by which it is effectuated abrupt and ſenſible.

146. It muſt, however, be acknowledged, that a tranſition ſo abrupt, and ſo little expected, cannot deceive nor elude the ear; it is ſtruck with a ſenſation ſo unlooked-for, without being able to account for the paſſage to itſelf. And this account has its foundation in the enharmonic fourth of a tone; which is overlooked

This interval has been called *the fourth of a tone*, and this denomination is founded on reaſon. In effect, we may diſtinguiſh in muſic four kinds of quarter tones.

1. The fourth of a tone major: now, a tone major being $\frac{9}{8}$, and its difference from unity being $\frac{1}{8}$, the difference of this quarter tone from unity will be almoſt the fourth of $\frac{1}{8}$; that is to ſay, $\frac{1}{32}$.

2. The fourth of a tone minor; and as a tone minor, which is $\frac{10}{9}$, differs from unity by $\frac{1}{9}$, the fourth of a minor tone will differ from unity about $\frac{1}{36}$.

3. One half of a ſemitone major; and as this ſemitone differs from unity by $\frac{1}{15}$, one half of it will differ from unity about $\frac{1}{30}$.

4. Finally, one half of a ſemitone minor, which differs from unity by $\frac{1}{24}$: its half then will be $\frac{1}{48}$.

The interval, then, which forms the enharmonic fourth of a tone, as it does not differ from unity but by $\frac{1}{48}$, may juſtly be called the *fourth of a tone*, ſince it is leſs different from unity than the largeſt interval of a quarter tone, and more than the leaſt.

We ſhall add, that ſince the enharmonic fourth of a tone is the difference between a ſemitone major and a ſemitone minor; and ſince the tone minor is formed (note UU) of two ſemitones, one major and the other minor; it follows, that two ſemitones major in ſucceſſion form an interval larger than that of a tone by the enharmonic fourth of a tone; and that two minor ſemitones in ſucceſſion form an interval leſs than a tone by the ſame fourth of a tone.

(3 B) That is to ſay, that if you riſe from E to F, for inſtance, by the interval of a ſemitone major, and afterwards, returning to E, you ſhould riſe by the interval of a ſemitone minor to another ſound which is not in the ſcale, and which I ſhall mark thus, F+, the two ſounds F+ and F will form the enharmonic fourth of a tone: for E being 1, F will be $\frac{16}{15}$; and F+$\frac{25}{24}$: the proportion then between F+ and F is that of $\frac{25}{24}$ to $\frac{16}{15}$ (note Q); that is to ſay, as 25 times 15 to 16 times 24; or otherwiſe, as 25 times 5 to 16 times 8, or as 125 to 128. Now this proportion is the ſame which is found, in the beginning of the preceding note, to expreſs the enharmonic fourth of a tone.

(3 C) As this method for obtaining or ſupplying enharmonic gradations cannot be practiſed on every occaſion when the compoſer or practitioner would wiſh to find them, eſpecially upon inſtruments where the ſcale is fixed and invariable, except by a total alteration of their economy, and re-tuning the ſtrings, Dr Smith in his Harmonics has propoſed an expedient for redreſſing or qualifying this defect, by the addition of a greater number of keys or ſtrings, which may divide the tone or ſemitone into as many appretiable or ſenſible intervals as may be neceſſary. For this, as well as for the other advantageous improvements which he propoſes in the ſtructure of inſtruments, we cannot with too much warmth recommend the peruſal of his learned and ingenious book to ſuch of our readers as aſpire to the character of genuine adepts in the theory of muſic.

Theory of Harmony.

ed as nothing, becauſe it is inappretiable by the ear; but of which, though its value is not aſcertained, the whole harſhneſs is ſenſibly perceived. The inſtant of ſurpriſe, however, immediately vaniſhes; and that aſtoniſhment is turned into admiration, when one feels himſelf tranſported as it were all at once, and almoſt imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately paſſed by the ordinary ſeries of fundamental notes.

Chap. XX. *Of the Diatonic Enharmonic Species.*

147. If we form a fundamental baſs, which riſes alternately by fifths and thirds, as F, C, E, B, this baſs will give the following modulation, 'f, e, e, d※'; in which the ſemitones from 'f' to 'e', and from 'e' to 'd※', are equal and major (3 D).

See fig. 12.

This ſpecies of modulation or of harmony, in which all the ſemitones are major, is called the *enharmonic diatonic* ſpecies. The major ſemitones peculiar to this ſpecies give it the name of *diatonic*, becauſe major ſemitones belong to the diatonic ſpecies; and the tones which are greater than major by the exceſs of a fourth, reſulting from a ſucceſſion of major ſemitones, give it the name of *enharmonic* (note 3 A).

See *Enharmonic*.

Chap. XXI. *Of the Chromatic Enharmonic Species.*

Chromatic enharmonic intervals, how formed.

148. If we paſs alternately from a third minor in deſcending to a third major in riſing, as C, C, A, C※, C※, we ſhall form this modulation 'e♭, e, e, e e※', in which all the ſemitones are minor (3 E).

See fig. 13.

This ſpecies is called the *chromatic enharmonic* ſpecies: the minor ſemitones peculiar to this kind give it the name of *chromatic*, becauſe minor ſemitones belong to the chromatic ſpecies; and the ſemitones which are leſſer by the diminution of a fourth reſulting from a ſucceſſion of minor ſemitones, give it the name of *enharmonic* (note 3 F).

From this ſpecies, the effects of harmony and melody appear to be in the fundamental baſs.

149. Theſe new ſpecies confirm what we have all along ſaid, that the whole effects of harmony and melody reſide in the fundamental baſs.

Diatonic ſpecies moſt agreeable, and why.

150. The diatonic ſpecies is the moſt agreeable, becauſe the fundamental baſs which produces it is formed from a ſucceſſion of fifths alone, which is the moſt natural of all others.

The chromatic next.

151. The chromatic being formed from a ſucceſſion of thirds, is the moſt natural after the preceding.

Laſtly, the enharmonic.

152. Finally, the enharmonic is the leaſt agreeable of all, becauſe the fundamental baſs which gives it is not immediately indicated by nature. The fourth of a tone which conſtitutes this ſpecies, and which is itſelf inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination ſuggeſts the fundamental baſs from whence it reſults; a baſs whoſe procedure is not agreeable to nature, ſince it is formed of two ſounds which are not contiguous one to the other in the ſeries of thirds (art. 144.).

Chap. XXII. *Showing that Melody is the Offspring of Harmony.*

The effects of melody to be inveſtigated in harmony expreſſed or underſtood.

153. All that we have hitherto ſaid, as it ſeems to me, is more than ſufficient to convince us, that melody has its original principle in harmony; and that it is in harmony, expreſſed or underſtood, that we ought to look for the effects of melody.

154. If this ſhould ſtill appear doubtful, nothing more is neceſſary than to pay due attention to the firſt experiment (art. 19.), where it may be ſeen that the principal ſound is always the loweſt, and that the ſharper ſounds which it generates are with relation to it what the treble of an air is to its baſs.

155. Yet more, we have proved, in treating of the broken cadence (chap. xvii.), that the diverſification of baſſes produces effects totally different in a modulation which, in other reſpects, remains the ſame.

156. Can it be ſtill neceſſary to adduce more convincing proofs? We have but to examine the different baſſes which may be given to this very ſimple modulation GC. It will be found ſuſceptible of many, and each will give a different character to the modulation GC, though in itſelf it remains always the ſame. We may thus change the whole nature and effects of a modulation, without any other alteration than that of its fundamental baſs.

M. Rameau has ſhown, in his *New System of Muſic*, printed at Paris 1726, p. 44. that this modulation G, C, is ſuſceptible of 20 different fundamental baſſes. Now the ſame fundamental baſs, as may be ſeen in our ſecond part, will afford ſeveral continued or thorough baſſes. How many means, of conſequence, may be practiſed to vary the expreſſion of the ſame modulation?

Conſequences deducible from this principle.

157. From theſe different obſervations it may be concluded, 1. That an agreeable melody, naturally implies a baſs extremely ſweet and adapted for ſinging; and that reciprocally, as muſicians expreſs it, a baſs of this kind generally prognoſticates an agreeable melody (3 F).

2. That the character of a juſt harmony is only to form in ſome meaſure one ſyſtem with the modulation, ſo

---

(3 D) It is obvious, that if F in the baſs be ſuppoſed 1, 'f' of the ſcale will be 2, C of the baſs $\frac{3}{2}$ and 'e' of the ſcale $\frac{5}{4}$ of $\frac{3}{2}$, that is, $\frac{15}{8}$; the proportion of 'f' to 'e' is as 2 to $\frac{15}{8}$, or as 1 to $\frac{15}{16}$. Now E of the baſs being likewiſe $\frac{5}{4}$ of $\frac{3}{2}$, or $\frac{15}{8}$; B of the baſs is $\frac{3}{2}$ of $\frac{15}{8}$, and its third major D※ $\frac{5}{4}$ of $\frac{3}{2}$ of $\frac{15}{8}$, or $\frac{15}{8}$: of $\frac{15}{8}$; this third major, approximated as much as poſſible to 'e' in the ſcale by means of octaves, will be $\frac{15}{16}$ of $\frac{15}{8}$: 'e' then of the ſcale will be to 'd'※ which follows it, as $\frac{15}{8}$ is to $\frac{15}{16}$ of $\frac{15}{8}$, that is to ſay, as 1 to $\frac{15}{16}$. The ſemitones then from 'f' to 'e', and from 'e' to 'd'※, are both major.

(3 E) It is evident that 'e'♭ is $\frac{6}{5}$ (note Q), and that 'e' is $\frac{5}{4}$: theſe two 'e's, then, are between themſelves as $\frac{6}{5}$ to $\frac{5}{4}$, that is to ſay, as 6 times 4 to 5 times 5, or as 24 to 25, the interval which conſtitutes the minor ſemitone. Moreover, the A of the baſs is $\frac{5}{6}$, and C※ $\frac{5}{4}$ of $\frac{5}{6}$, or $\frac{25}{24}$: 'e'※ then is $\frac{5}{4}$ of $\frac{25}{24}$, the 'e' in the ſcale is likewiſe to the 'e'※ which follows it, as 24 to 25. All the ſemitones therefore in this ſcale are minor.

(3 F) Many compoſers begin with determining and writing the baſs; a method, however, which appears in general

Principles of Composition.

so that from the whole taken together, the ear may only receive, if we may speak so, one simple and indivisible impression.

3. That the character of the same modulation may be diversified, according to the character of the bass which is joined with it.

But notwithstanding the dependency of melody upon harmony, and the sensible influence which the latter may exert upon the former; we must not however conclude, with some celebrated musicians, that the effects of harmony are preferable to those of melody. Experience proves the contrary. [See, on this account, what is written on the license of music, printed in tom. iv. of D'Alembert's *Melanges de Literature*, p. 448.]

General Remark.

The diatonic scale or gammut being composed of twelve semitones, it is clear that each of these semitones taken by itself may be the generator of a mode; and that thus there must be twenty-four modes in all, twelve major and twelve minor. We have assumed the major mode of C, to represent all the major modes in general, and the minor mode of A to represent the modes minor, to avoid the difficulties arising from sharps and flats, of which we must have encountered either a greater or lesser number in the other modes. But the rules we have given for each mode are general, whatever note of the gammut be taken for the generator of a mode.

Part II. Principles and Rules of COMPOSITION.

Composition in harmony, what. See *Composition.*

158. COMPOSITION, called also *counterpoint*, is not only the art of composing an agreeable air, but also that of composing several airs in such a manner that when heard at the same time, they may unite in producing an effect agreeable and delightful to the ear; this is what we call *composing music in several parts.*

The highest of these parts is called the *treble*, the lowest is termed the *bass*; the other parts, when there are any, are termed *middle parts*; and each in particular is signified by a different name.

Chap. I. *Of the Different Names given to the same Interval.*

Particular intervals signified by different names, and why.

159. In the introduction (art. 9.), we have seen a detail of the most common names given to the different intervals. But particular intervals have obtained different names, according to circumstances; which it is proper to explain.

Second redundant, what.

160. An interval composed of a tone and a semitone, which is commonly called a *third minor*, is likewise sometimes called a *second redundant*; such is the interval from C to D✕ in ascending, or that of A to G♭ descending.

Why so called.

This interval is so termed, because one of the sounds which form it is always either sharp or flat, and that, if that sharp or flat be taken away, the interval will be that of a second (3 G).

False fifth, what.

161. An interval composed of two tones and two semitones, as that from B to 'f', is called a *false fifth.* This interval is the same with the *tritone* (art. 9.), since two tones and two semitones are equivalent to three tones. There are, however, reasons for distinguishing them, as will appear below.

Fifth redundant, what.

162. As the interval from C to D✕ in ascending has been called a second redundant, we likewise call the interval from C to G✕ in ascending, a *fifth redundant*, or from B to E♭ in descending, each of which intervals are composed of four tones (3 H).

Distinguished from the sixth minor.

This interval is, in the main, the same with that of the sixth minor (art. 6.): but in the fifth redundant there is always a sharp or a flat; insomuch, that if this sharp or flat were removed, the interval would become a true fifth.

Seventh diminished, what.

163. For the same reason, an interval composed of three tones and three semitones, as from G✕ to 'f' in ascending, is called a *seventh diminished*; because, if we remove the sharp from G, the interval from G to 'f' will become that of an ordinary seventh. The interval of a seventh diminished is in other respects the same with that of the sixth major (art. 9.) (3 I).

Seventh major and redundant coincident.

164. The major seventh is likewise sometimes called a *seventh redundant* (3 K).

Chap. II. *Comparison of the Different Intervals.*

Notes in different octaves or scales replications each of the other.

165. If we sing 'c' B in descending by a second, and afterwards C B in ascending by a seventh, these two B's shall be octaves one to the other; or, as we commonly express it, they will be *replications* one of the other.

166. On account then of the resemblance between every

general more proper to produce a learned and harmonious music, than a strain prompted by genius and animated by enthusiasm.

(3 G) For the same reason, this interval is frequently termed by English musicians an *extreme sharp-second.*

(3 H) This interval is usually termed by English theorists *a sharp fifth.*

(3 I) The material difference between the diminished seventh and the major sixth is, that the former always implies a division of the interval into three minor thirds, whereas a division into a fourth and third major, or into a second and major and minor third, is usually supposed in the latter.

(3 K) The chief use of these different denominations is therefore to distinguish chords: for instance, the chord of the redundant fifth and that of the diminished seventh are different from the chord of the sixth; the chord of the seventh redundant, from that of the seventh major. This will be explained in the following chapters.

Principles of Compoſition.

every ſound and its octave (art. 22.), it follows, that *to riſe by a ſeventh*, or *deſcend by a ſecond*, amount to the ſame thing.

Hence to deſcend to one replication, and riſe to another, has the ſame effect.

167. In like manner, it is evident that the ſixth deſcending is nothing but a replication of the third aſcending, nor the fourth deſcending but a replication of the fifth aſcending.

Detail of replications. Examples of this.

168. The following expreſſions either are or ought to be regarded as ſynonymous.

To riſe by a ſecond.—To deſcend by a ſeventh.
To deſcend by a ſecond.—To riſe by a ſeventh.
To riſe by a third.—To deſcend by a ſixth.
To deſcend by a third.—To riſe by a ſixth.
To riſe by a fourth.—To deſcend by a fifth.
To deſcend by a fourth.—To riſe by a fifth.

Principles of Compoſition.

169. Thus, therefore, we ſhall employ them indifferently the one for the other; ſo that when we ſay, for inſtance, *to riſe by a third*, it may be ſaid with equal propriety *to deſcend by a ſixth*, &c.

Chap. III. *Of the Cleffs; of the Value or Quantity; of the Rhythm; and of Syncopation.*

Cleffs, what, and how placed.

170. There are three cleffs * in muſic; the F cleff 𝄢; the C cleff 𝄡; and the G cleff 𝄞.

* See *Cleff.*

The F cleff is placed on the fourth line (3 L) or on the third; and the line on which this cleff is placed gives the name of F to all the notes on that line.

Plate CCCLV. Fig. 7.1. Fig. 7.2.

The C cleff is placed on the fourth, the third, the ſecond, or the firſt line: and in theſe different poſitions all

(3 L) Our author has treated this part of his ſubject with ſomewhat leſs perſpicuity than uſual. He has neither deſcribed the ſtaffs or ſyſtems of lines on which the cleffs are placed, nor explained their relation to each other. We have therefore attempted to ſupply the deficiency.

Muſical ſounds, like language, are repreſented by written characters, by which their graveneſs or acuteneſs, their duration, and the other qualities intended to be aſſigned to them, are accurately diſtinguiſhed.

The characters which denote the graveneſs or acuteneſs, or, as it is termed, the *pitch* of ſounds, are intended to repreſent the ordinary limits of the human voice, in the exerciſe of which, or the employment of inſtruments of nearly the ſame compaſs with it, all practical muſic conſiſts.

From the loweſt diſtinct note, without ſtraining, of the maſculine voice, to the higheſt note generally produced by the female voice, there is an interval of three octaves, or twenty-two diatonic notes.

Theſe notes are repreſented by characters deſcribed alternately on eleven parallel lines, and the ſpaces between them, forming what we ſhall here term the *general ſyſtem.*

The characters repreſenting the notes are differently formed according to their duration, but with this we have at preſent no concern. We ſhall employ the ſimpleſt, a ſmall circle or ellipſe.

The whole extent of the human voice, then, if deſcribed upon the *general ſyſtem*, would be repreſented as at Plate CCCLV. fig 1.

The maſculine voice, riſing from the loweſt note of the general ſyſtem, will, generally ſpeaking, reach the note on the central line; and an ordinary female voice will reach the ſame note, deſcending from the higheſt. Male voices more acute, and female voices graver than uſual, will conſequently execute this note with greater facility.

This central note then, being producible by every ſpecies of voice, has been aſſumed as a fundamental or key note, by which all the others are regulated (art. 4.). And to it is aſſigned the name of C, by which, in the theory of harmony, (as we have ſeen), the fundamental ſound of the diatonic ſcale is diſtinguiſhed.

The other notes take their denominations accordingly. The note below it is B, that above it 'd', &c.; and to diſtinguiſh this central C from its octaves, it is called the *middle* or *tenor* C.

As no human voice can execute the whole twenty-two notes, the general ſyſtem is divided into portions of five lines, each portion repreſenting the compaſs of an ordinary voice; and different portions are made uſe of, according to the graveneſs or acuteneſs of different voices.

The five lines in this ſtate form what is called a *ſtaff.* Each ſtaff is ſubdivided into *lines* and *ſpaces. On* the lines, and in the ſpaces, the heads of the notes are placed. The lines and ſpaces are counted upwards, from the loweſt to the higheſt; the loweſt line is termed the *firſt line;* the ſpace between it and the *ſecond line* is denominated the *firſt ſpace*, and ſo on. Both lines and ſpaces have the common name of *degrees;* the ſtaff thus contains nine degrees, viz. five lines and four ſpaces.

To aſcertain what part of the general ſyſtem is formed by a *ſtaff*, one of the *cleffs* mentioned in the text is placed at the beginning of the ſtaff, on one or other of the lines of it.

The C or tenor cleff always denotes the line on which it is placed to be that which carries the tenor C. The G or treble cleff diſtinguiſhes the line carrying 'g', the perfect fifth *above* the tenor C. And the F or baſs cleff aſcertains the line which repreſents F the perfect fifth *below* the tenor C.

The figures of the cleffs, (which are characters gradually corrupted from the Gothic C, G, and F), and their places in the general ſyſtem, appear on Plate CCCLV. Fig. 2.

By this diſpoſition of the cleffs, we ſee that the ſtaff, which includes the line bearing the treble cleff, is formed by the five higheſt lines of the general ſyſtem; and that the ſtaff which comprehends the baſs cleff conſiſts of the five loweſt.

The central line, which carries the tenor C, belongs neither to the treble nor the baſs ſtaves. But as that note frequently occurs in compoſition written on theſe ſtaves, a ſmall portion of the tenor line is occaſionally introduced below the treble cleff and above that of the baſs (fig. 3.)

As

Principles of Composition.

all the notes on the same line with the cleff take the name of C.

Fig. 7. 3.

The G cleff is placed on the second or first line; and all the notes on the line of the cleff take the name of G.

Names of the notes to be investigated from the position of the cleffs.

171. As the notes are placed on the lines, and in the spaces between the lines, the name of any note may be discovered from the position of the cleff. Thus, in the F cleff, the note on the lowest line is G; the note on the space between the two first lines A; the note on second line B, &c.

Marks and power of sharps, flats, and naturals.

172. A note before which there is a sharp (marked thus ※) must be raised by a semitone; and if there be a flat (marked ♭) before it, it must be depressed by a semitone.

The natural (marked thus ♮) restores to its natural value a note which had been raised or depressed by a semitone.

Fig. 8.

173. When a sharp or a flat is placed at the cleff, all the notes upon the line or space on which this sharp or flat is marked, are sharp or flat. For instance, if in the cleff of G a sharp be placed on the highest line, which is the place of '*f*', all the notes on that line will be '*f*※'—to restore them to their original value of '*f*' natural, a ♮ must be placed before them.

Fig. 9.

In the same manner, if a flat be marked at the cleff, all the notes on the same line or space with the flat will be flat; to restore them to their natural state, a ♮ must be placed before them (3 M).

Bars and Times, what,

174. Every piece of music is divided into different equal

As notes still more remote from the staff in use are sometimes introduced, small portions of the lines to which these lines belong are employed in the same manner. Thus, if in writing in the bass staff we want the note properly placed on the lowest line of the treble staff, we draw two short lines above the bass staff, one representing the tenor line, and the other the lowest line of the treble staff, and on this last short line we place the note in question, (fig. 4.)

On the other hand, if, in writing on the treble staff, we would employ a note properly belonging to the bass staff, we place it below the treble staff, and insert the requisite short lines, representing the corresponding lines of the general system (fig. 5.)

The occasional short lines thus employed are termed *leger lines*.

The same expedient is used to represent notes beyond the limits of the general system. Thus, we write the F which is one degree lower than the lowest G of the bass staff, on the space below that G; the E immediately lower, or on a leger line below the bass staff, and so on. Notes in this position are termed *double;* thus, the F just mentioned is double F, or FF; the E, double E, or EE, &c.

Again, the '*a*' above the highest '*g*' of the treble staff is placed on a leger line above that staff. The '*b*' is placed on the space above the leger line: The next note '*c*' is set on a second leger line, and so on. These high notes are, in compositions for some instruments, carried more than an octave above the general system. Those in the first octave are said to be *in alt;* those beyond it, to be *in altissimo*.

The tenor or C cleff is employed to form different intermediate staves between the treble and bass, according to the compass of the voice or instrument for which the staff is wanted.

Compositions for the gravest masculine voices and instruments are written on the bass cleff, and those for female voices and instruments highest in tone, on the treble staff *.

For masculine voices next in depth to the bass and for the higher octave of the violoncello and bassoon, a staff, called the *tenor staff*, is formed by adding to the tenor line the three highest lines of the bass staff and the lowest line of the treble (fig. 6. 1.)

For the highest masculine voices, which are called *counter tenor*, and for the tenor violin, a staff is formed by the tenor line, the two highest lines of the bass, and the two lowest of the treble staff (fig. 6. 2.).

For the gravest female voices, which are called *mezzo soprano*, the tenor line and four lowest lines of the treble form a staff (fig. 6. 3.).

The relation of all the staves to the general system, and to each other, will appear from fig. 6.

The bass cleff on the third line, the tenor cleff on the second, and the treble cleff on the first, rarely occur, except in old French music.

The tenor cleff, and the staves distinguished by it, are now less frequently used than the treble and bass cleffs. Those who cultivate music only as an amusement find it irksome to learn so many modes of notation. The tenor staves are accordingly banished from compositions for keyed instruments. Secular compositions for voices are likewise now written in the treble and bass staves only; although in this there is some inaccuracy, as the tenor parts now written in the treble staff, must often be sung an octave below that in which they appear. The chief use of the tenor cleff is in choral music and compositions for the bassoon and tenor violin; and its principal advantage, the facility of reading ancient music, which is almost exclusively written in this cleff, has seldom been deemed an insufficient recompense for the labour of acquiring it.

(3 M) The disposition of sharps or flats at the cleff, which is termed the *signature*, depends upon the mode, or tone assumed in the composition as a fundamental or key note, and will be afterwards explained.

The sharps or flats of the signature affect not only the notes placed on the same *degree* with themselves, as mentioned in the text, but also all the notes of the same letter, in every octave throughout the movement.

The sharps or flats of the signature determine the scale in which the movement is composed, and are therefore said to be *essential;* those which occur in the course of the piece on an occasional change of the scale, are termed *accidental*.

* Compositions for *French horns* are written in the treble staff, although the tone of the instrument be very grave; but this is because the horn is borrowed from and has the same natural intervals with the *Trumpet*, which is an acute instrument.

Principles of Composition.

See *Time.*

equal times, called *meaſures*; and each meaſure is likewiſe divided into different times.

There are properly two kinds of meaſures or modes of time; the meaſure of two times, or common time, marked by the figure 2 at the beginning of the time (fig. 10.); and the meaſure of three times, or triple time, marked by the figure 3 placed in the ſame manner (fig. 11.).

The different meaſures are diſtinguiſhed by perpendicular lines (3 N), called *bars*.

In a meaſures, we diſtinguiſh between the *ſtrong* and the *weak* time: the *ſtrong* time is that which is *beat*; the *weak*, that in which the hand or foot *is raiſed*. A meaſure conſiſting of four times ought to be conſidered as compounded of two meaſures, each conſiſting of two times: thus there are in this meaſure two *ſtrong* and two *weak* times. In general by the words *ſtrong* and *weak* even the parts of the ſame time are diſtinguiſhed; thus, the firſt note of each time is conſidered as *ſtrong* and the others as *weak*.

The value of notes in duration. Fig. 12.

175. The longeſt of all notes is a *ſemibreve*. A *minim* is half its value; that is to ſay, two minims are to be performed in the time occupied by one ſemibreve. A minim in the ſame manner is equivalent to two *crotchets*, the crotchet to two *quavers* (3 O).

Syncopation, what. See *Syncopation.*

176. A note which is divided into two parts by a *bar*, that is, which begins at the end of a meaſure, and terminates in the meaſure following, is called a *ſyncopated* note (3 P).

Value of a pointed note.

179. A note followed by a point or dot is increaſed half its value. Thus a *dotted* ſemibreve is equivalent to a ſemibreve and a minim, a dotted minim, to a minim and a crotchet, &c. (Fig. 17.) (3 Q).

CHAP.

(3 N) All the notes, therefore, contained between two bars conſtitute one meaſure; although in common language the word bar is improperly uſed for meaſure.

(3 O) The notes, in their figure, conſiſt of a *head* and a *ſtem*, except the ſemibreve, which has a *head* only.

The place of the note in the ſtaff is determined by the *head*, which muſt be placed *on* the line, or *in* the ſpace, aſſigned to the note. The *ſtem* may be turned either up or down.

The quaver is equivalent to two *ſemiquavers*, and the ſemiquaver to two *demi-ſemiquavers*. In modern muſic the demi-ſemiquaver is alſo ſubdivided.

The quaver and the notes of ſhorter duration may be grouped together, by two, three, or four, &c. and joined by as many black lines acroſs the ends of the ſtem as there are hooks in the ſingle note (fig. 12.) This arrangement is convenient in writing, and aſſiſts the eye in performance.

When quavers, or the ſhorter notes, are to be repeated in the ſame degree for a time equal to the duration of a longer note, the iterations are, by a ſort of muſical ſhort-hand, repreſented by writing the long note only, and placing over or under it, as many ſhort lines as the ſhort note has hooks (fig. 13.) And the repetition of a ſeries of ſhort notes is repreſented by merely writing for each repetition as many ſhort lines as there are hooks to the ſhort notes of which the ſeries is compoſed (fig. 14.)

(3 P) A note in the middle of a meaſure is alſo ſaid to be ſyncopated when it begins on a *ſtrong*, and ends on a *weak* part of the meaſure, (ſee fig. 15.) where D, C, and B are each of them ſyncopated.

A note which of itſelf occupies one, two, or more meaſures, is not ſaid to be ſyncopated, but *continued* or *protracted*. See fig. 16.

(3 Q) Notes have ſometimes in modern muſic a double dot after them, which makes them longer by three-fourths. Thus a minim twice dotted is equal to three crotchets and a half, or ſeven quavers. &c.

Our author, in this chapter, has omitted the explanation of *reſts*, and of the particular modifications of time.

Reſts are characters indicating the temporary ſuſpenſion of muſical ſounds. There are as many different reſts as there are notes. Thus the ſemibreve reſt indicates a pauſe of the duration of a ſemibreve; the minim reſt, of a minim, &c. (fig. 18.)

The ſemibreve reſt alſo denotes the ſilence of one entire meaſure, in triple as well as common time. The ſilence of ſeveral meaſures is marked as in fig. 18.; but where the ſilence exceeds three bars, the number is uſually marked over the reſts.

Common time is either of a ſemibreve, or of a minim to the meaſure.

Common time of a ſemibreve is indicated by the letter C at the cleff, fig. 1. of Plate CCCLVI. When it is meant to be ſomewhat quicker than uſual, a perpendicular line is drawn through the C, (fig. 2.)

Common time of a minim to the meaſure, which is called *half time*, is indicated by the fraction $\frac{2}{4}$, that is, two-fourths of a ſemibreve, or two crotchets equal to a minim, (fig. 3.)

In triple time the meaſure conſiſt of three minims, three crotchets or three quavers, ſix crotchets or ſix quavers, nine quavers or twelve quavers.

Triple time of three minims is marked at the cleff $\frac{3}{2}$, that is, three halves of a ſemibreve, (fig. 4.)

Triple time of three crotchets is indicated by the fraction $\frac{3}{4}$, (three-fourths of a ſemibreve) (fig. 5.) and that of three quavers by $\frac{3}{8}$ (three-eighths of a ſemibreve,) (fig. 6.)

In the laſt three examples the meaſure is divided into three *times*, of which the firſt is *ſtrong*, and the two others weak.

The meaſure of ſix crotchets is marked $\frac{6}{4}$, (fig. 7.); and that of ſix quavers, $\frac{6}{8}$, (fig. 8.) In both there are two times, of which the firſt is ſtrong, and the ſecond weak.

The meaſure of nine quavers is marked $\frac{9}{8}$, (fig. 9.); and is divided into one ſtrong and two weak times. That of twelve quavers is marked $\frac{12}{8}$, (fig. 10.); and is accented as if it were two meaſures of ſix quavers.

The meaſures of $\frac{9}{4}$ and $\frac{9}{16}$ rarely occur.

Three notes are often performed in the time of two of the ſame name, and are then termed *triplets*, (fig. 11.) where

Principles of Compoſition.

Chap. IV. *Definition of the principal Chords.*

Perfect chords, what.

178. (3 R) The chord compoſed of a third, a fifth, and an octave, as C, E, G, C, is called a *perfect chord* (art. 32.).

If the third be major, as in C, E, G, C, the perfect chord is denominated *major:* if the third be minor, as in A, C, E, A, the perfect chord is minor. The perfect chord major conſtitutes the *major mode;* and the perfect chord minor, the *minor mode* (art. 31.).

Chord of the ſeventh, what, and how to be practiſed.

179. A chord compoſed of a third, a fifth, and a ſeventh, as G, B, D, F, or D, F, A, C, &c. is called a *chord of the ſeventh.* Such a chord is wholly compoſed of thirds in aſcending.

All chords of the ſeventh are practiſed in harmony, ſave that which might carry the third minor and the ſeventh major, as C E♭ G B; and that which might carry a falſe fifth and a ſeventh major, B D F A✕, (chap. xiv. Part I.)

Thoſe of different kinds.

180. As thirds are either major or minor, and as they may be differently arranged, it is clear that there are different kinds of chords of the ſeventh; there is even one, B D F A, which is compoſed of a third, a falſe fifth, and a ſeventh.

Of the greater, ſixth, what.

181. A chord compoſed of a third, a fifth, and a ſixth, as F A C D, D F A B, is called a *chord of the greater ſixth.*

182. Every note which carries a perfect chord is called a *tonic;* and a perfect chord is marked by an 8, by a 3, or by a 5, which is written above the note; but frequently theſe numbers are ſuppreſſed. Thus in the example I. the two C's equally carry a perfect chord.

Plate CCCLVII.

Tonic, what, and its chords, how figured.

183. Every note which carries a chord of the ſeventh is called a *dominant* (art. 102.); and this chord is marked by a 7 written above the note. Thus in the example II. D carries the chord D F A C, and G the chord G B D F.

Dominant, what, and how figured.

It is neceſſary to remark, that among the chords of the ſeventh we do not reckon the chord of the ſeventh diminiſhed, which is only improperly called a *chord of the ſeventh;* and of which we ſhall ſay more below.

Sub-dominant what, and how figured.

184. Every note which carries the chord of the great ſixth, is called a *ſubdominant,* (art. 97. and 42.) and is marked with a 6. Thus in the example III. F carries the chord of F A C D. The ſixth ſhould always be major, (art. 97. and 109.).

Fundamental note, what. See *Fundamental.*

185. In every chord, whether perfect, or a chord of the ſeventh, or of the great ſixth, the note which carries this chord, and which is the flatteſt or loweſt, is called the *fundamental note.* Thus C in the example I. D and C in the example II. and F in the example III. are fundamental notes.

Diſſonance of a chord, what.

186. In every chord of the ſeventh, and of the great ſixth, the note which forms the ſeventh or ſixth above the fundamental, that is to ſay, the higheſt note of the chord, is called a *diſſonance.* Thus in the chords of the ſeventh G B D F, D F A C, F and C are the diſſonances, viz. F with relation to G in the firſt chord, and C with relation to D in the ſecond. In the chord of the great ſixth F A C D, D is the diſſonance (art. 120.); but that D is only, properly ſpeaking, a diſſonance with relation to C from which it is a *ſecond,* and not with reſpect to F from which it is a *ſixth major* (art. 17, and 18.)

Tonic and ſimple dominant, what.

187. When a chord of the ſeventh is compoſed of a third major followed by two thirds minor, the fundamental note of this chord is called the *tonic dominant.* In every other chord of the ſeventh the fundamental is called the *ſimple dominant* (art. 102.) Thus in the chord G B D F, the fundamental G is the *tonic dominant;* but in the other chords of the ſeventh, as C E G B, D F A C, &c. the fundamentals C and D are *ſimple dominants.*

Major chords, how rendered minor, and *vice verſa.*

188. In every chord, whether perfect, or of the ſeventh, or of the ſixth, if it is meant that the third above the fundamental note ſhould be major though it be naturally minor, a ſharp muſt be placed above the fundamental

---

where the groups of quavers in the ſecond meaſure are triplets, and each triplet occupies the time of two quavers only. Triplets alſo occur in triple time, fig. 12.

Certain other characters will be with propriety explained here.

The *Pauſe* ſignifies that the regular time is to be delayed, and the note marked with the pauſe protracted. See fig. 13. where the pauſe is on the laſt note of the ſecond meaſure.

The *Repeat,* a character reſembling an S, denotes, that the following part of the movement muſt be repeated. See fig. 14.

The *Direct* (fig. 15.) is placed at the end of the ſtaff, to ſhew upon what degree the firſt note of the following ſtaff is placed.

When the inner ſides of two bars are dotted, the meaſures between them are to be repeated (fig. 16.) The word *bis* is ſometimes placed over ſuch paſſages.

The double bar diſtinguiſhes the end of a movement or ſtrain, (fig. 17.) If the double bar be dotted on one or both ſides, the ſtrain is to be repeated, (fig. 18.) The double bar does not affect the time; ſo that when the ſtrain terminates before the end of a meaſure, as is often the caſe, the double bar only marks the concluſion of the ſtrain, but the time is kept exactly as if it were not inſerted. See fig. 19.

The graces of exertion and expreſſion, ſuch as the appogiature, the ſhake, the ſlur, the creſcendo, the diminuendo, &c. are not neceſſary to the conſideration of the theory of muſic or principles of compoſition, but belong to the performer only. See Shake, &c.

(3 R) In this part of our ſubject, we ſhall, in mentioning the harmonics of the chords, make uſe of the capital letters only, as the general names of the notes, without diſtinguiſhing octaves by minuſcular or Italic letters. The harmonics may be arranged in different octaves. Their different poſitions will be moſt eaſily ſeen and beſt underſtood from the examples in the plates.

Principles of Composition.

fundamental note. For example, if we would mark the perfect major chord D F♯ A D, as the third F above D is naturally minor, we place above D a sharp, as in Example IV. In the same manner, the chord of the seventh D F♯ A C, and the chord of the great sixth D F♯ A B, is marked with a ♯ above D, and above the ♯ a 7 or a 6 (see V. and VI.).

On the contrary, when the third is naturally major, and if we would render it minor, we place above the fundamental note a ♭. Thus the examples VII. VIII. IX. show the chords G B♭ D G G B♭ D F, G B♭ D E (3 s).

Chap. V. *Of the Fundamental Bass.*

Fundamental bass, how formed.

189. Let a modulation be invented at pleasure; and under this modulation let there be set a bass composed of different notes, of which some may carry a perfect chord, others that of the seventh, and others that of the great sixth, in such a manner that each note of the modulation which answers to each of the bass, may be one of those which enters into the chord of that note in the bass; this bass being composed according to the rules which shall be immediately given, will be the *fundamental bass* of the modulation proposed. See Part I. where *the nature and principles of the fundamental bass* are explained.

See *Fundamental bass.*

Thus (Exam. XVI.) it will be found that this modulation, C D E F G A B C, has or may admit for its fundamental bass, C $\overset{7}{G}$ C $\overset{6}{F}$ C $\overset{7}{D}$ $\overset{7}{G}$ C.

In reality, the first note C in the upper part is found in the chord of the first note C in the bass, which chord is G E G C; the second note D in the treble is found in the chord G B D G, which is the chord of the second note in the bass, &c. and the bass is composed only of notes which carry a perfect chord, or that of the seventh, or that of the great sixth. Moreover, it is formed according to the rules which we are now about to give.

Principles of Composition.

Chap. VI. *Rules for the Fundamental Bass.*

Rules for the formation of the bass.

190. All the notes of the fundamental bass being only capable of carrying a perfect chord, or the chord of the seventh, or that of the great sixth, are either tonics, or dominants, or sub-dominants; and the dominants may be either simple or tonic.

The fundamental bass ought always to begin with a tonic, as much as it is practicable. And now follow the rules for all the succeeding chords; rules which are evidently derived from the principles established in the *First Part* of this treatise. To be convinced of this, we shall find it only necessary to review the articles 34, 91, 122, 124, 126, 127.

Rule I.

191. In every chord of the tonic, or of the tonic dominant, it is necessary that at least one of the notes which form that chord should be found in the chord that precedes it.

Rule II.

192. In every chord of the simple dominant, it is necessary that the note which constitutes the seventh, or dissonance, should likewise be found in the preceding chord.

Rule III.

193. In every chord of the sub-dominant, at least one of its consonances must be found in the preceding chord. Thus, in the chord of the sub-dominant F A C D, it is necessary that F, A, or C, which are the consonances

---

(3 s) We may only add, that there is no occasion for marking these sharps or flats when they are originally placed at the cleff. For instance, if the sharp be upon F which indicates the key of G (see Exam. X.) it is sufficient to write D, without a sharp, to mark the perfect chord major of D, D F♯ A D. In the same manner, in the Example XI. where the flat is at the cleff upon B, which denotes the key of F, it is sufficient to write G, to mark the perfect chord minor of G B♭ D G.

But where there is a sharp or a flat at the cleff, if we would render the chord minor which is major, or *vice versa*, we must place above the fundamental note a ♮ or natural. Thus the Example XII. marks the minor chord D F A D, and Example XIII. the major chord G B D G.—Sometimes, in lieu of a natural, a flat is used to signify the minor chord, and a sharp to signify the major. Thus Example XIV. in the key of G, marks the minor chord D F A D, and Example XV. in F, the major chord G B D G.

When in a chord of the great sixth, the dissonance, that is to say, the sixth, ought to be sharp, and when the sharp is not found at the cleff, we write before or after the 6 a ♯; and if this sixth should be flat according to the cleff, we write a ♮.

In the same manner, if in a chord of the seventh of the tonic dominant, the dissonance, that is to say, the seventh, ought to be flat or natural, we write by the side of the seventh a ♭ or a ♮. Many musicians, when a seventh from the simple dominant ought to be altered by a sharp or a natural, have likewise written by the side of the seventh a ♯ or a ♮; but M. Rameau suppresses these characters. The reason shall be given below, when we speak of chords by supposition.

If there be one sharp at the cleff, and if we would mark the chord G B D F♮, or the chord A C E F♮, we ought to place before the seventh or the sixth a ♮ or a ♭.

In the same manner, if there be one flat at the cleff, and if we would mark the chord C E G B♮, we ought to place before the seventh a ♯ or a ♮; and so of the rest.

All these intricate combinations of figuring shew the superior convenience of the modern method of writing the notes themselves instead of the figures, which has the farther advantage of exhibiting the proper arrangement of the chord, see Example II.

Principles of Composition.

consonances of the chord, should be found in the chord preceding. The dissonance D may either be found in it or not.

RULE IV.

194. Every simple or tonic dominant ought to descend by a fifth. In the first case, that is to say, when the dominant is simple, the note which follows can only be a dominant; in the second it may be any one; or, in other words, it may either be a tonic, a tonic dominant, a simple dominant, or a sub-dominant. It is necessary, however, that the conditions prescribed in the second rule should be observed, if it be a simple dominant.

This last reflection is necessary, as will presently be seen. For, let us assume the succession of the two chords A C※E G, D F A C (see Exam. XVII.), this succession is by no means legitimate, though in it the first dominant descends by a fifth; because the C which forms the dissonance in the second chord, and which belongs to a simple dominant, is not in the preceding chord. But the succession will be admissible, if, without meddling with the second chord, we take away the sharp carried by the C in the first; or if, without meddling with the first chord, we render C and F sharp in the second (3 T); or, if we simply render the D of the second chord a tonic dominant, in causing it to carry F※ instead of F♮ (119. and 122.).

It is likewise by the same rule that we ought to reject the succession of the two following chords,

D F A C, G B D F※;

(see Exam. XVIII).

RULE V.

195. Every sub-dominant ought to rise by a fifth; and the note which follows it may, at pleasure, be either a tonic, a tonic dominant, or a sub-dominant.

REMARK.

Other rules substituted. Of the five fundamental rules which have now been given, instead of the three first, one may substitute the three following, which are consequences from them.

RULE I.

If a note of the fundamental bass be a tonic, and rise by a fifth or a third to another note, that second note may be either a *tonic* (34. & 91.), see Examples XIX. and XX. (3 U); a *tonic dominant* (124.), see XXI. and XXII.; or a *sub-dominant* (124.), see XXIII. and XXIV; or, to express the rule more simply, that second note may be any one, except a *simple dominant*.

RULE II.

If a note of the fundamental bass be a tonic, and descend by a fifth or a third upon another note, this second note may be either a tonic (34. & 91.) see Exam. XXV. and XXVI.; or a tonic dominant, or a simple dominant, yet in such a manner that the rule of art. 192. may be observed (124.), see XXVII. XXVIII. XXIX. and XXX.; or a sub-dominant (124.), see XXXI. and XXXII.

The succession of the bass C E♭ G C, F A C E, is excluded by art. 192.

RULE III.

If a note in the fundamental bass be a tonic, and rise by a second to another note, that note ought to be a tonic dominant, or a simple dominant (101. & 102.). See XXXIV. and XXXV. (3 X).

We must here advertise our readers, that the examples XXXVI. XXXVII. XXXVIII. XXXIX. belong to the fourth rule above, art. 194.; and the examples XL. XLI. XLII. to the fifth rule above, art. 195. See the articles 34, 35, 121, 123, 124.

REMARK I.

196. The transition from a tonic dominant to a tonic is called an *absolute repose*, or a *perfect cadence* (73.); and the transition from a sub-dominant to a tonic is called an *imperfect* or *irregular cadence* (73.); the tonic falls upon the accented part of the bar. See XLIII. XLIV. XLV. XLVI. Perfect and imperfect cadences, what, and how employed.

REMARK II.

197. We must avoid, as much as we can, syncopations in the fundamental bass; that the ear may accurately distinguish the primarily accented part of a measure, by means of a harmony different from that which it had before perceived in the last unaccented part of the preceding measure. Nevertheless, syncopation may be sometimes admitted in the fundamental bass, but it is by a license (3 Y). Syncopation only admissible in the fundamental bass by licence.

 CHAP.

(3 T) In this chord it is necessary that the C and F should be sharp at the same time; for the chord D F A C※, in which C would be sharp without the F, is excluded by art. 179.

(3 U) When the bass rises or descends from one tonic to another by the interval of a third, the mode is commonly changed; that is to say, from a major it becomes a minor. For instance, if we ascend from the tonic C to the tonic E, the major mode of C, C E G C, will be changed into the minor mode of E, E G B E. We must never ascend from one tonic to another, when there is no sound common to both their modes: for example, we cannot rise from the mode of C, C E G C, to the minor mode of E♭, E♭ G♭ B♭ E♭ (91.).

(3 X) Thus all the intervals, viz. the third, the fifth, and second, may be admitted in the fundamental bass, except that of a second in descending. The rules now given for the fundamental bass are not, however, without exception, as approved compositions in music will certainly discover; but these exceptions being in reality licences, and for the most part in opposition to the great principle of connection, which prescribes that there should be at least one note in common between a preceding and a subsequent chord, it does not seem necessary to enter into a minute detail of these licences in an elementary work, where the first and most essential rules of the art alone ought to be expected.

(3 Y) There are notes which may be found several times in the fundamental bass in succession with a different

CHAP. VII. *Of the Rules which ought to be obſerved in the Treble with relation to the Fundamental Baſs.*

Definition of treble.

198. THE treble is nothing elſe but a modulation above the fundamental baſs, and whoſe notes are found in the chords of that baſs which correſponds with it (189.) Thus in Ex. XVI. the ſcale C D E F G A B C, is a treble with reſpect to the fundamental baſs C G C F C D G C.

One note in the treble or baſs may anſwer to its correſpondent parts, and why.

199. We are about to give the rules for the treble; but firſt we think it neceſſary to make the two following remarks.

1. It is obvious, that many notes of the treble may anſwer to one and the ſame note in the fundamental baſs, when theſe notes belong to the chord of the ſame note in the fundamental baſs. For example, this modulation C E G E C, may have for its fundamental baſs the note C alone, becauſe the chord of that note comprehends the ſounds C, E, G, which are found in the treble.

2. In like manner, a ſingle note in the treble may, for the ſame reaſon, anſwer to ſeveral notes in the baſs. For inſtance, G alone may anſwer to theſe three notes in the baſs, C G C (3 Z).

RULE I. *For the* TREBLE.

200. If the note which forms the ſeventh in a chord of the *ſimple dominant*, is found in the treble, the note which precedes it muſt be the very ſame. This is what we call a *diſcord prepared* (122). For inſtance, let us ſuppoſe that the note of the fundamental baſs ſhall be D, bearing the chord of the ſimple dominant D F A C; and that this C, which (art. 18. and 118.) is the diſſonance, ſhould be found in the treble; it is neceſſary that the note which goes before it in the treble ſhould likewiſe be a C.

201. According to the rules which we have given for the fundamental baſs, C will always be found in the chord of that note in the fundamental baſs which precedes the ſimple dominant D. See XLVIII. XLIX. L. In the firſt example the diſſonance is C, in the ſecond G, and in the third E; and theſe notes are already in the preceding chord (4 A).

RULE II.

202. If a note of the fundamental baſs be a tonic dominant, or a ſimple dominant, and if the diſſonance be found in the treble, this diſſonance in the ſame treble ought to deſcend diatonically. But if the note of the baſs be a ſub-dominant, it ought to riſe diatonically. This diſſonance, which riſes or deſcends diatonically, is what we have called a *diſſonance ſaved* or *reſolved* (129, 130.) See LII. LIII. LIV.

203. According to the rules for the fundamental baſs which we have given, the note upon which the diſſonance

---

ferent harmony. For inſtance, the tonic C, after having carried the chord C E G C, may be followed by another C which carries the chord of the ſeventh, provided that this chord be the chord of the tonic dominant C E G B♭. In the ſame manner, the tonic C may be followed by the ſame tonic C, which may be rendered a *ſub-dominant*, by cauſing it to carry the chord C E G A.

A dominant, whether tonic or ſimple, ſometimes deſcends or riſes to another by the interval of a tritone or falſe fifth. For example, the dominant F carrying the chord F A C E, may be followed by another dominant B carrying the chord B D F A. This is a licence in which the muſician indulges himſelf, that he may not be obliged to depart from the ſcale in which he is; for inſtance, from the ſcale of C to which F and B belong. If one ſhould deſcend from F to B♭ by the interval of a juſt fifth, he would then depart from that ſcale, becauſe B♭ is no part of it.

(3 Z) There are often in the treble ſeveral notes which may, if we choose, carry no chord, and be regarded merely as notes of paſſage, ſerving only to connect between themſelves the notes that do carry chords, and to form a more agreeable modulation. Theſe notes of paſſage are commonly quavers. See Example XLVII. (Plate CCCLVIII). in which this modulation C D E F G, may be regarded as equivalent to this other, C E G, as D and F are no more than notes of paſſage. So that the baſs of this modulation may be ſimply C G.

When the notes are of equal duration, and arranged in a diatonic order, the notes which are accented ought each of them to carry chords. Thoſe which are unaccented, are mere notes of paſſage. Sometimes, however, the unaccented note may be made to carry harmony; but the duration of this note is then commonly increaſed by a point placed after it, which proportionably diminiſhes the continuance of the accented note, and makes it paſs more ſwiftly.

When the notes do not move diatonically, they ought generally all of them to enter into the chord which is placed in the lower part correſpondent with theſe notes.

(4 A) There is, however, one caſe in which the ſeventh of a ſimple dominant may be found in a modulation without being prepared. It is when, having already employed that dominant in the fundamental baſs, its ſeventh is afterwards heard in the modulation, while the dominant is ſtill retained. For inſtance, let us imagine this modulation,

	C	D C B C	D;
and this fundamental baſs,	C	$\overset{7}{D}$ $\overset{7}{G}$C	G;

(ſee example LI.); the $\overset{7}{D}$ of the fundamental baſs anſwers to the two notes D C of the treble. The diſſonance C has no need of preparation, becauſe the note $\overset{7}{D}$ of the fundamental baſs having already been employed for the D which precedes C, the diſſonance C is afterwards preſented, below which the chord D may be preſerved, or D F A C.

Principles of Composition.

ance ought to descend or rise will always be found in the subsequent chord (4 B).

Chap. VIII. *Of the Continued Bass, and its Rules.*

‡See *Continued Bass.*

Continued bass, what.

Chords inverted; how.

204. The *continued* ‡ bass, is a fundamental bass whose chords are *inverted.* We invert a chord when we change the order of the notes which compose it. For example, if, instead of the chord G B D F, we should say B D F G or D F G B, &c. the chord is inverted.

The ways in which a Perfect Chord may be Inverted.

205. The perfect chord C E G C may be inverted in two different ways.

1. E G C E, which we call a chord of the *sixth*, composed of a third, a sixth, and an octave; and in this case the bass note E is marked with a 6. (See LVI.)

2. G C E G, which we call a *chord of the sixth and fourth*, composed of a fourth, a sixth, and an octave; and it is marked with a $\frac{6}{4}$. (See LVII.)

The perfect minor chord is inverted in the same manner.

The ways in which the Chord of the Seventh may be Inverted.

206. In the chord of the tonic dominant, as GBDF, the third major B above the fundamental note G is called a *sensible note* (77.); and the inverted chord B D F G composed of a third, a false fifth and sixth, is called the *chord of the false fifth*, and is marked as in examples LVIII. and LIX.

The chord D F G B, composed of a third, a fourth, and a sixth, is called the *chord of the sensible sixth*, and marked as in Example LX. (4 C). In this chord, the third is minor, and the sixth major.

The chord F G B D, composed of a second, a tritone, and a sixth, is called the *chord of the tritone*, and is marked as in Example LXI. (4 D).

207. In the chord of the simple dominant D F A C, we find,

1. F A C D, a chord of the great sixth, which is composed of a third, a fifth, and a sixth, and which is figured with a $\frac{6}{5}$. See LXII. (4 E).

2. A C D F, a chord of the lesser sixth, which is figured with a 6. See LXIII. (4 F).

3. C D F A, a chord of the second, composed of a second, a fourth, and a sixth, and which is marked with a 2. See LXIV. (4 G).

The ways in which the Chord of the sub-dominant may be Inverted.

208. The chord of the sub-dominant, as F A C D, may be inverted in three different manners; but the method of inverting it which is most in practice is the chord of the lesser sixth A C D F (LXIII.), and the chord of the seventh D F A C. See LXV.

Rules for the Continued Bass.

209. The continued bass is a fundamental bass, whose chords are only inverted in order to render it more in the taste of singing, and suitable to the voice. See LXVI. in which the fundamental bass which in itself is monotonic and little suited for singing, C G C G C G C, produces, by inverting its chords, this continued bass highly proper to be sung, C B C D E F E, &c. (4 H.)

The continued bass then is properly a treble with respect to the fundamental bass. Its rules immediately follow, which are properly those already given for the treble.

Rule I.

210. Every note which carries the chord of the false fifth,

(4 B) When the treble syncopates in descending diatonically, it is common enough to make the second part of the syncope carry a discord, and the first a concord. See Example LV. where the first part of the syncopated note G, is in concord with the notes C E G C, which answers to it in the fundamental bass, and where the second part is a dissonance in the subsequent chord A C E G. In the same manner, the first part of the syncopated note F is in concord with the notes D F A C, which answer to it; and the second part is a dissonance in the subsequent chord G B D F, which answer to it, &c.

(4 C) This chord is called by English musicians, the chord of the *third* and *fourth*, and generally figured $\frac{4}{3}$.

(4 D) This chord is in England called the chord of the second and fourth, and is figured $\frac{4}{2}$.

(4 E) We are obliged to mark likewise, in the continued bass, the chord of the sub-dominant with a $\frac{6}{5}$ which in the fundamental bass is figured with a 6 alone; and this to distinguish it from the chords of the sixth and of the lesser sixth. (See examples LVI. and LXIII.) The chord of the great sixth in the fundamental bass carries always the sixth major, whereas in the continued bass it may carry the sixth minor. For instance, the chord of the seventh C E G B, gives the chord of the great sixth E G B C, thus improperly called, since the sixth from E to C is minor.

(4 F) M. Rameau has justly observed, that we ought rather to figure this lesser sixth with a $\frac{3}{4}$, to distinguish it from the sensible sixth which arises from the chord of the tonic dominant, and from the sixth which arises from the perfect chord. In the mean time he figures in his works with a 6 alone, the lesser sixths which do not arise from the tonic dominant; that is to say, he figures them as those which arise from the perfect chord; and we have followed him in that notation, though we thought with him, that it would be better to mark this chord by a particular figure.

(4 G) The chord of the seventh B D F A gives, when inverted, the chord F A B D, composed of a third, a tritone, and a sixth. The chord is commonly marked with a 6, as if the tritone were a just fourth. It is his business who performs the accompaniment, to know whether the fourth above F be a tritone or a fourth redundant. One may figure this chord thus, $\frac{4*}{3}$.

(4 H) The continued bass is proportionably adapted to singing, as the sounds which form it more scrupulously observe

Principles of Composition.

fifth, and which of consequence must be what we have called a *sensible note*, ought (77.) to rise diatonically upon the note which follows it. Thus in example LXIV. the note B, carrying the chord of the false fifth, rises diatonically upon C (4 I).

RULE II.

211. Every note carrying the chord of the tritone should descend diatonically upon the subsequent note. Thus in the same example LXVI. F, which carries the chord of the tritone figured with a 4+, descends diatonically upon E (art. 202.)

RULE III.

212. The chord of the second is commonly put in practice upon notes which are syncopated in descending, because these notes are dissonances which ought to be prepared and resolved (200. 302.) See the example LXVII. where the second C, which is syncopated, and which descends afterwards upon B, carries the chord of the second (4 K).

CHAP. IX. *Of some Licenses assumed in the Fundamental Bass.*

§ 1. *Of BROKEN and INTERRUPTED CADENCES.*

Broken cadence, how executed.

213. THE broken cadence is executed by means of a dominant which rises diatonically upon another, or upon a tonic by a license. See, in the example LXXIV. G A, (132, and 134).

Interrupted cadence, how formed.

214. The interrupted cadence is formed by a dominant,

---

observe the diatonic order, because this order is the most agreeable of all. We must therefore endeavour to preserve it as much as possible. It is for this reason that the continued bass in Example LXV. is much more in the taste of singing, and more agreeable, than the fundamental bass which answers to it.

(4 I) The continued bass being a kind of treble with relation to the fundamental bass, it ought to observe the same rules with respect to that bass as the treble. Thus a note, for instance D, carrying a chord of the seventh D F A C, to which the chord of the sub-dominant F A C D corresponds in the fundamental bass, ought to rise diatonically upon E, (art. 129. N° 1. and art. 202.)

(4 K) When there is a *repose* in the treble, the note of the continued bass ought to be the same with that of the fundamental bass, (see Example LXVIII.) In the closes which are found in the treble at D and C (measures second and fourth), the notes in the fundamental and continued bass are the same, viz. G for the first cadence, and C for the second. This rule ought above all to be observed in cadences which terminate a piece or a modulation.

It is necessary, as much as possible, to prevent coincidences of the same notes in the treble and continued bass, unless the motion of the continued bass should be contrary to that of the treble. For example, in the first note of the second measure in Example LXIX. D is found at the same time in the continued bass and in the treble; but the treble rises from C to D, and from D to E, whilst the bass descends from E to D, and from D to C.

Two octaves, or two fifths, in succession, must likewise be avoided. For instance, in the treble sounds G E, the bass must be prevented from sounding G E, C A, or D B; because in the first case there are two octaves in succession, E against E, and G against G; and because in the second case there are two fifths in succession, C against E, and A against G, or D against G, and B against E. This rule, as well as the preceding, is founded upon this principle, that the continued bass ought not to be a copy of the treble, but to form a different melody.

Every time that several notes of the continued bass answer to one note alone of the fundamental, the composer satisfies himself with figuring the first of them. Nay he does not even figure it if it be a tonic; and he draws above the others a line, continued from the note upon which the chord is formed. See Example LXX. (Plate CCCLIX). where the fundamental bass C gives the continued bass C E G E; the two E's ought in this bass to carry the chord 6, and G the chord $\substack{6\\4}$: but as these chords are comprehended in the perfect chord C E G C, which is the first of the continued bass, we place nothing above C, only we draw a line over C E G E.

In like manner, in the second measure of the same example, the notes F and D of the continued bass, arising from the note G alone of the fundamental bass which carries the chord G B D F, we think it sufficient to figure F only, and to draw a line above F and D because the same harmony is used with both.

It should be remarked, that this F ought naturally to descend to E; but this note is considered as subsisting so long as the chord subsists; and when the chord changes, we ought necessarily to find the E, as may be seen by that example.

In general, whilst the same chord subsists in passing through different notes, the chord is reckoned the same as if the first note of the chord had subsisted; in such a manner, that, if the first note of the chord is, for instance, the sensible note, we ought to find the tonic when the chord changes. See Example LXXI. where this continued bass, C B D B G C, is reckoned the same with this C, B C. (Example LXXII.)

If a single note of the continued bass answers to several notes of the fundamental bass, it is figured with the different chords which agree to it. For example, the note G in a continued bass may answer to this fundamental bass C G C, (see Example LXXIII.); in this case, we may regard the note G as divided into three parts, of which the first carries the chord $\substack{6\\4}$, the second the chord 7, and the third the chord $\substack{6\\4}$.

We shall repeat here, with respect to the rules of the continued bass, what we have formerly said concerning the rules of the fundamental bass in the note upon the third rule, art. 193. The rules of the continued bass have exceptions, which practice and the perusal of good authors will teach. There are likewise several other rules which might require a considerable detail, and which will be found in the *Treatise of Harmony*, by M. Rameau, and minant which deſcends by a third upon another (136.). See, in the example LXXV. G E (4 L).

Theſe cadences ought to be permitted but rarely and and with precaution.

2. *Of* SUPPOSITION.

Chord by ſuppoſition what.

215. When a dominant is preceded by a tonic in the fundamental baſs, we add ſometimes, in the continued baſs to the chord of that dominant, a new note which is a third or a fifth below; and the chord which reſults from it in this continued baſs is called *a chord by ſuppoſition.*

See Suppoſition.

For example, let us ſuppoſe, that in the fundamental baſs we have a dominant G carrying the chord of the ſeventh G B D F; let us add to this chord the note C, which is a fifth below this dominant, and we ſhall have the total chord C G B D F, or C D F G, which is called *a chord by ſuppoſition* (4 M).

Of the different kinds of Chords by Suppoſition.

216. Chords by ſuppoſition are of different kinds. For inſtance, the chord of the tonic dominant G B D F gives,

Theſe different chords what, and how figured.

1. By adding the fifth C, the chord C G B D F, called a *chord of the ſeventh redundant*, and compoſed of a fifth, ſeventh, ninth, and eleventh. It is figured with a ※7; ſee LXXVI. (4 N). This chord is not practiſed but upon the tonic. They ſometimes leave out the ſenſible note, for reaſons which we ſhall give in the note (4 O), upon the art. 219; it is then reduced to C F G D, and marked with $\frac{5}{4}$ or $\frac{5}{2}$.

2. By adding the third E, we ſhall have the chord E G B D F, called a *chord of the ninth*, and compoſed of a third, fifth, ſeventh, and ninth. And it is figured with a 9. This third may be added to every third of the dominant. See LXXVII.

3. If

---

and elſewhere. Theſe rules, which are proper for a complete diſſertation, did not appear indiſpenſably neceſſary in an *elementary eſſay on muſic*, ſuch as the preſent. The books which we have quoted at the end of our *preliminary diſcourſe* will more particularly inſtruct the reader concerning this practical detail.

(4 L) One may ſometimes, but very rarely, cauſe ſeveral tonics in ſucceſſion to follow one another in aſcending or deſcending diatonically, as C E G C, D F A D, B♭ D F B♭; but, beſides that this ſucceſſion is harſh, it is neceſſary, in order to render it practicable, that the fifth below the firſt tonic ſhould be found in the chord of the tonic following, as here F, a fifth below the firſt tonic C, is found in the chord D F A D, and in the chord B♭ D F B♭ (37. and note T).

(4 M) Though ſuppoſition be a kind of licenſe, yet it is in ſome meaſure founded on the experiment related in the note (S), where you may ſee that every principal or fundamental ſound cauſes its twelfth and ſeventeenth major in deſcending to vibrate, whilſt the twelfth and the ſeventeenth major aſcending reſound: which ſeems to authorize us in certain caſes to join with the fundamental harmony this twelfth and ſeventeenth in deſcending; or, which is the ſame thing, the fifth or the third beneath the fundamental ſound.

Even without having recourſe to this experiment, we may remark, that the note added beneath the fundamental ſound, cauſes that very fundamental ſound to be heard. For inſtance, C added beneath G, cauſes G to reſound. Thus G is found in ſome meaſure to be implied at C.

If the third added beneath the fundamental ſound be minor, for example, if to the chord G B D F, we add the third E, the ſuppoſition is then no longer founded on the experiment, which only gives the ſeventeenth major, or, what is the ſame thing, the third major beneath the fundamental ſound. In this caſe the addition of the third minor muſt be conſidered as an extenſion of the rule, which in reality has no foundation in the chords emitted by a ſonorous body, but is authorized by the ſanction of the ear and by practical experiment.

(4 N) Many muſicians figure this chord with a ※$\frac{7}{2}$; M. Rameau ſuppreſſes this 2, and merely marks it to be the ſeventh redundant by a 7※ or ※7. But it may be ſaid, how ſhall we diſtinguiſh this chord from the ſeventh major, which, as it would ſeem, ought to be marked with a 7※? M. Rameau anſwers, that there is no danger of miſtake, becauſe in the ſeventh major, as the ſeventh ought to be prepared, it is found in the preceding chord; and thus the ſharp ſubſiſting already in the preceding chord, it would be uſeleſs to repeat it.

7
※
Thus D G, according to M. Rameau, would indicate D F※ A C, G B D F※. If we would change F※ of

7
※7♮
the ſecond chord into F♮, it would then be neceſſary to write D G. In notes ſuch as C, whoſe natural ſeventh is major, the figure 7 preceded or followed by a ſharp will ſufficiently ſerve to diſtinguiſh the chord of the ſeventh redundant C G B D F, from the ſimple chord of the ſeventh C E G B, which is marked with a 7 alone. All this appears juſt and well founded.

(4 O) Suppoſition introduces into a chord diſſonances which were not in it before. For inſtance, if to the chord E G B D, we ſhould add the note of ſuppoſition C deſcending by a third, it is plain that, beſides the diſſonance between E and D which was in the original chord, we have two new diſſonances, C B, and C D; that is to ſay, the ſeventh and the ninth. Theſe diſſonances, like the others, ought to be prepared and reſolved. They are prepared by being ſyncopated, and reſolved by deſcending diatonically upon one of the conſonances of the ſubſequent chord. The ſenſible note alone can be reſolved in aſcending; but it is even neceſſary that this ſenſible note ſhould be in the chord of the tonic dominant. As to the diſſonances which are found in the primitive chord, they ſhould always follow the common rules. (See art. 202.)

Principles of Compoſition.

3. If to a chord of the ſimple dominant, as D F A C, we ſhould add the fifth G, we would have the chord G D F A C, called a *chord of the eleventh*, and which is figured with a $^{9}_{4}$ or $^{4}_{9}$. (See LXXVIII.)

OBSERVE.

Occaſions when retrenchments of chords are proper.

217. WHEN the dominant is not a tonic dominant, we often tak away ſome notes from the chord. For example, let us ſuppoſe that there is in the fundamental baſs this ſimple dominant E, carrying the chord E G B D: if there ſhould be added the third C beneath, we ſhall have this chord of the continued baſs C E G B D; but we ſuppreſs the ſeventh B, for reaſons which ſhall be explained in the note upon art. 210. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9. See LXXIX. (4 P).

218. In the chord of the ſimple dominant, as D F A C, when the fifth G is added, we frequently obliterate the ſounds F and A, that too great a number of diſſonances may be avoided, which reduces the chord to G C D. This laſt is compoſed only of the fourth and the fifth. It is called a *chord of the fourth*, and it is figured with a 4 (4 Q) (See LXXX.)

219. Sometimes we only remove the note A, and then the chord ought to be figured with $^{7}_{4}$ or $^{4}_{7}$ (4 R).

Chord of the fifth redundant what, and how figured.

220. Finally, in the minor mode, for example, in that of A, where the chord of the tonic dominant (109), is E G※B D; if we add to this chord the third C below, we ſhall have E G※B D, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh, and a ninth. It is figured as in LXXXI. (4 S)

§ 3. *Of the* CHORD *of the* DIMINISHED SEVENTH.

Chord of the flat ſeventh what, and how figured.

221. In the minor mode, for inſtance, in that of A, E a fifth from A is the tonic dominant (109), and carries the chord E G※B D, in which G is the ſenſible note. For this chord we ſometimes ſubſtitute G B※D F, (116), all compoſed of minor thirds; and which has for its fundamental ſound the ſenſible note G※. This chord is called a *chord of the flat* or *diminiſhed ſeventh*, and is figured with a $\not{7}$ in the fundamental baſs, (ſee LXXXIV.); but it is always conſidered as repreſenting the chord of the tonic dominant.

Chords produced in the continued baſs by this what, and how figured.

222. This chord by inverſion produces in the continued baſs the following chords:

1. The chord B D F G※, compoſed of a third, falſe fifth, and ſixth major. They call it the *chord of the ſixth ſenſible and falſe fifth;* and it is figured as in Exam. LXXXV. (Plate CCCLX).

2. The chord D F G※B, compoſed of a third, a tritone, and a ſixth. It is called the *chord of the tritone and third minor;* and marked as in LXXXVI.

3. The chord F G※B D, compoſed of a ſecond redundant, a tritone, and a ſixth. It is called the *chord of the ſecond redundant*, and figured as in LXXXVII. (4 T).

Alterations by ſuppoſition, chords which they produce, what, and how figured.

223. Beſides, ſince the chord G※ B D F repreſents the chord EG※BD, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon EG※BD; that is to ſay, that it will be neceſſary to add to the chord G※B D F, the notes C or A, which are the third or fifth below E, and which will produce,

1. By adding C, the chord C G※B D F, compoſed of a fifth redundant, a ſeventh, a ninth, and eleventh, which is the octave of the fourth. It is called a *chord of the fifth redundant and fourth*, and marked as in LXXXVIII.

2. By adding A, we ſhall have the chord A G※B D F, compoſed of a ſeventh redundant, a ninth, an eleventh, and a thirteenth minor, which is the octave of the ſixth minor. It is called the *chord of the ſeventh redundant and ſixth minor*, and marked as in LXXXIX. It is of all chords the moſt harſh, and the moſt rarely practiſed (4 U).

CHAP.

(4 P) Several muſicians call this laſt chord the *chord of the ninth;* and that which, with M. Rameau, we have ſimply called a *chord of the ninth*, they term a *chord of the ninth and ſeventh.* This laſt chord they mark with a $^{9}_{7}$; but the denomination and figure uſed by M. Rameau are more ſimple, and can lead to no error; becauſe the chord of the ninth always includes the ſeventh, except in the caſes of which we have already ſpoken

(4 Q) In England it is figured $^{5}_{4}$.

(4 R) We often remove ſome diſſonances from chords of ſuppoſition, either to ſoften the harſhneſs of the chord, or to remove diſcords which can neither be prepared nor reſolved. For inſtance, let us ſuppoſe, that in the continued baſs the note C is preceded by the ſenſible note B carrying the chord of the falſe fifth, and that we ſhould chooſe to form upon this note C the chord C E G B D, we muſt obliterate the ſeventh B, becauſe in retaining it we ſhould deſtroy the effect of the ſenſible note B, which ought to riſe to C.

In the ſame manner, if to the harmony of a tonic dominant G B D F, one ſhould add the note by ſuppoſition C, it is uſual to retrench from this chord the ſenſible note B; becauſe, as the D ought to deſcend diatonically to C, and the B to riſe to it, the effect of the one would deſtroy that of the other. This above all takes place in the *ſuſpenſion*, concerning which we ſhall preſently treat.

(4 S) *Suppoſition* produces what we call *ſuſpenſion;* and which is almoſt the ſame thing. Suſpenſion conſiſts in retaining as many as poſſible of the ſounds in a preceding chord, that they may be heard in the chord which ſucceeds. For inſtance, in Example LXXXII. the C bearing ※7 is a ſuppoſition; but in Example LXXXIII. it is a ſuſpenſion, becauſe it ſuſpends or retards the perfect chord C E G C which the ear expects after the tonic dominant G B D F.

(4 T) The chord of the diminiſhed ſeventh, and the three derived from it, are termed *chords of ſubſtitution.* They are in general harſh, and proper for imitating melancholy objects.

(4 U) As the chord of the diminiſhed ſeventh G※B D F, and the chord of the tonic dominant E G※B D, only differ

Principles of Composition.

Chap. X. *Of some licenses used in the Treble and Continued Bass.*

License 1st.

224. Sometimes in a treble, the dissonance which ought to have been resolved by descending diatonically upon the succeeding note, instead of descending, on the contrary rises diatonically: but in that case, the note upon which it ought to have descended must be found in some of the other parts. This license ought to be rarely practised.

In like manner, in a continued bass, the dissonance in a chord of the sub-dominant inverted, as A in the chord A C E G, inverted from C E G A, may sometimes descend diatonically instead of rising as it ought to do, art. 129. N° 2.; but in that case the note ought to be repeated in another part, that the dissonance may be there resolved in ascending.

License 2d.

225. Sometimes likewise, to render a continued bass more agreeable by causing it to proceed diatonically, we place between two sounds of that bass a note which belongs to the chord of neither. See Example xcii. in which the fundamental bass G C produces the continued bass G A B G C, where A is added on account of the diatonic modulation. This A has a line drawn above it, to show its resolution by passing under the chord G B D F.

In the same manner, (see xciii.) this fundamental bass C F may produce the continued bass C D E C F, where the note D, which is added, passes under the chord C E G C.

Chap. XI. *Containing the Method of finding the Fundamental Bass when the continued Bass is figured.*

How to find the fundamental bass when the continued is figured.

226. As the continued bass alone appears in practical compositions, it becomes necessary to know how to find the fundamental bass when the continued bass is figured. This problem may be easily solved by the following rules.

227. 1. Every note which has no figure in the continued bass, ought to be the same, and without a figure in the fundamental bass; it is either a tonic, or reckoned such (4 x).

2. Every note which in the continued bass carries a 6, ought in the fundamental bass to give its third below not figured *, or its fifth below marked with a 7. We shall distinguish these two cases below. See lvi. and the note (4 y).

* See Figured.

3. Every note carrying $\frac{6}{4}$ gives in the fundamental bass its fifth below not figured. See lvii.

4. Every note figured with a 7, or a ♯7, is the same in both basses, and with the same figure (4 y).

5. Every note figured with a 2 gives in the fundamental bass the diatonic note above figured with a 7. See lxiv. (4 z).

6. Every note marked with a 4 gives in the fundamental mental

---

differ one from the other by the notes E and F; one may form a diatonic modulation of these two notes, and then the fundamental bass does nothing but pass from the tonic dominant to the sensible note, and from that note to the tonic dominant, till it arrives at the tonic. (See xc.)

For the same reason, as the chord of the diminished seventh G✕B D F, and the chord B D F A, which carries the fifth B of the tonic dominant E, only differs by the sensible note G✕, and the tonic A; one may sometimes, while the treble modulates G✕A G✕A G✕A, ascend in the fundamental bass, from the bass note to the third above, provided one descend at last from thence to the tonic dominant, and from thence to the tonic; (see xci.) This and the preceding examples are licenses.

(4 x) We say a tonic, or *reckoned such*, because it may perhaps be a dominant from which the dissonance has been removed. But in that case one may know that it is a real dominant by the note which precedes it. For instance, if the note G, carrying a perfect chord, is preceded by D a simple dominant, carrying the chord D F A C, that note G is not a real tonic; because, in order to this, it would have been necessary that D should have been a tonic dominant, and should have carried the chord D F✕A C; and that a simple dominant, as D, carrying the chord D F A C, should only naturally descend to a dominant, (art. 194.)

(4 y) Sometimes a note which carries a 7 in the continued bass, gives in the fundamental bass its third above, figured with a 6. For example, this continued bass $\overset{7}{A}\ \overset{6}{B}$ C gives this fundamental bass $\overset{6}{C}\ \overset{7}{G}$ C; but in this case it is necessary that the note figured with a 6 should rise by a fifth, as we see here C rise to G.

(4 z) A note figured with a 2, gives likewise sometimes in the fundamental bass its fourth above, figured with a 6; but it is necessary in that case that the note figured with a 6, may even here rise to a fifth. (See note 4 y.)

These variations in the fundamental bass, as well in the chord concerning which we now treat, as in the chord figured with a 7, and in two others which shall afterwards be mentioned (art. 228 and 229), are caused by a deficiency in the signs proper for the chord of the sub-dominant, and for the different arrangements by which it is inverted.

M. l'Abbé Roussier, to redress this deficiency, had invented a new manner of figuring the continued bass. His method is most simple for those who know the fundamental bass. It consists in expressing each chord by only signifying the fundamental sound with that letter of the scale by which it is denominated, to which is joined a 7 or ♯7, or a 6, in order to mark all the discords. Thus the fundamental chord of the seventh D F A C is expressed by a $\overset{7}{D}$; and the same chord, when it is inverted from that of the sub-dominant F A C D, is characterized by $\overset{6}{F}$; the chord of the second C D F A, inverted from the dominant D F A C, is likewise represented by $\overset{7}{D}$; and the same chord C D F A, inverted from that of the sub-dominant F A C D, is signified by $\overset{6}{F}$; the case is the

Principles of Composition.

mental bafs the diatonic note above, figured with a 7. (See LXI.).

7. Every note figured with a $\not{8}$ gives its third below figured with a 7. (See LVIII.)

8. Every note marked with a $\not{6}$ gives the fifth below marked with a 7; (fee LX.) and it is plain by art. 187. that in the chord of the feventh, of which we treat in thefe three laft articles, the third ought to be major, and the feventh minor, this chord of the feventh being the chord of the tonic dominant. (See art. 102.).

9. Every note marked with a 9 gives its third above figured with a 7. (See LXXVII. and LXXIX.)

10. Every note marked with a $\frac{9}{4}$ gives the fifth above figured with a 7. (See LXXVIII).

11. Every note marked with a ※5, or with a +5, gives the third above figured with a $\overset{7}{※}$. (See LXXXI.)

12. Every note marked with a ※7 gives a fifth above figured with a 7, or with a $\overset{7}{※}$. (See LXXVI.) It is the fame cafe with the notes marked $\frac{7}{4}$, $\frac{5}{\frac{4}{2}}$, or $\frac{5}{2}$: which fhows a retrenchment, either in the complete chord of the eleventh, or in that of the feventh redundant.

13. Every note marked with a 4 gives a fifth above figured with a 7, or a $\overset{7}{※}$. (See LXXX.)

14. Every note marked with a ※6 gives the third minor below, figured with a $\not{7}$. (See LXXXV.)

15. Every note marked with a $\overset{4}{♭}$ gives the tritone above figured with a $\not{7}$. (See LXXXVI.)

16. Every note marked with a ※2 gives the fecond redundant above, figured with a $\not{7}$. (See LXXXVII.)

17. Every note marked with a ※$\frac{5}{4}$ gives the fifth redundant above, figured with a $\not{7}$. (See LXXXVIII.)

18. Every note marked with a $\frac{※7}{♭6}$ gives the feventh redundant above, figured with a $\not{7}$. (See LXXXIX.) (5 A).

REMARK.

A difficulty in finding the fundamental bafs.

228. We have omitted two cafes, which may caufe fome uncertainty.

The firft is that where the note of the continued bafs is figured with a 6. We now prefent the reafon of the difficulty.

Principles of Compofition.

Suppofe we fhould have the dominant $\overset{7}{D}$ in the fundamental bafs, the note which anfwers to it in the continued bafs may be A carrying the figure 6 (fee LXIV.); that is to fay, the chord A C D F: now if we fhould have the fubdominant $\overset{6}{F}$ in the fundamental bafs, this fubdominant might produce in the continued bafs the fame note A figured with a 6. When therefore we find in the continued bafs a note marked with a 6, it appears at firft uncertain whether we fhould place in the fundamental bafs the fifth below marked with a 7, or the third below marked with a 6.

Another.

229. The fecond cafe is that in which the continued bafs is figured with a $\frac{6}{5}$. For inftance, if there fhould be found $\overset{\frac{6}{5}}{F}$ in the continued bafs, we may be ignorant whether we ought to infert in the fundamental bafs F marked with a 6, or D figured with a 7.

Solution.

230. This difficulty may be removed by leaving for an inftant this uncertain note in fufpenfe, and in examining the fucceeding note of the fundamental bafs; for if that note be in the prefent cafe a fifth above F, that is to fay, if it be C, in this cafe, and in this alone, we may place $\overset{6}{F}$ in the fundamental bafs. It is a confequence of this rule, that in the fundamental bafs every fub-dominant ought to rife by a fifth (195).

CHAP. XII. *What is meant by being in a Mode or Tone.*

Method of determining the mode in which we are.

231. IN the firft part of this treatife (chap. vi.) we have explained, how by the means of the note C, and of its two-fifths G and F, one in afcending, which is called a *tonic dominant*, the other in defcending, which is called a *fub-dominant*, the fcale C D E F A B C may be found: the different founds which form this fcale compofe

---

the fame when the chords are differently inverted. By this means it would be impoffible to miftake either with refpect to the fundamental bafs of a chord, or with refpect to the note which forms its diffonance, or with refpect to the nature and fpecies of that difcord.

(5 A) We may only add, that here, and in the preceding articles of the text, we fuppofe, that the continued bafs is figured in the manner of M. Rameau. For it is proper to obferve, that there are not, perhaps, two muficians who characterize their chords with the fame figures; which produces a great inconveniency to the perfon who plays the accompaniments: but here we do not treat of accompaniments. We prefer the continued baffes of M. Rameau to all the others, as by them the fundamental bafs will be moft eafily difcovered.

M. Rameau only marks the leffer fixth by a 6 without a line, when this leffer fixth does not refult from the chord of the tonic dominant; in fuch a manner that the 6 renders it uncertain whether in the fundamental bafs we ought to choofe the third or the fifth below; but it will be eafy to fee whether the third or the fifth is fignified by that figure. This may be diftinguifhed, 1. In obferving which of the two notes is excluded by the rules of the fundamental bafs. 2. If the two notes may with equal propriety be placed in the fundamental bafs, the preference muft be determined by the tone or mode of the treble in that particular paffage. In the following chapter we fhall give rules for determining the mode (note 3 Z).

There is a chord of which we have not fpoken in this enumeration, and which is called the *chord of the fixth redundant*. This chord is compofed of a note, of its third major, of its redundant fourth or tritone, and its redundant fixth, as F A B D※. It is marked with a 6※. It appears difficult to find a fundamental bafs for this chord; nor is it indeed much in ufe amongft us. (See the note upon the art. 115.)

This chord is called in England the chord of the *extreme fharp fixth*. When accompanied by the third only, it is called the *Italian fixth*. When the fifth is fubftituted for the tritone, it has been called the *German fixth*.

Principles of Composition.

compose the *major mode* of C, because the third E above C is major. If therefore we would have a modulation in the major mode of C, no other sounds must enter into it than those which compose this scale; in such a manner that if, for instance, we should find F♯ in this modulation, this F♯ discovers to us that we are not in the mode of C, or at least that, if we have been in it, we are no longer so.

232. In the same manner, if we form this scale in ascending A B C♯ D E F♯ G♯ A, which is exactly similar to the scale C D E F G A B C of the major mode of C, this scale, in which the third from A to C♯ is major, shall be in the major mode of A; and if we incline to be in the minor mode of A, we have only to substitute for C sharp C natural; so that the major third A C♯ may become minor A C: we shall have then

A B C D E F♯ G♯ A,

which is (85.) the scale of the minor mode of A in ascending; and the scale of the minor mode of A in descending shall be (90.),

A G F E C D B A,

in which the G and F are no longer sharp. For it is a singularity peculiar to the minor mode, that its scale is not the same in rising as in descending (89.).

Hence it appears what sharps and flats should be placed at the cleff in the major mode of A, and why they are omitted in the minor mode in descending.

233. This is the reason why, when we wish to begin a piece in the major mode of A, we place three sharps at the cleff upon F, C, and G; and on the contrary, in the minor mode of A, we place none, because the minor mode of A, in descending, has neither sharps nor flats.

234. As the scale contains twelve sounds, each distant from the other by the interval of a semitone, it is obvious that each of these sounds can produce both a major and a minor mode, which constitute 24 modes upon the whole. Of these we shall immediately give a table, which may be very useful to discover the mode in which we are.

Modes 24 in the whole.

A TABLE of the Different Modes.

Major Modes.

Maj. Mode	
of C;	C, D, E, F, G, A, B, c.
of G;	G, A, B, c, d, e, f♯, g.
of D;	D, E, F♯, G, A, B, c♯, d.
of A;	A, B, c♯, d, e, f♯. g♯, a.
of E;	E, F♯, G♯, A B c♯, d♯, e.
of B:	B, c♯, d♯, e, f♯, g♯, a♯, b.
Of F♯.	F♯, G♯, A♯, B, c♯, d♯, e♯, f♯ (5 B).
Of C♯, or D♭;	D♭, E♭, F, G♭, A♭, B♭, c, d♭.
Of G♯, or A♭;	A♭, B♭, c, d♭, e♭, f, g, a♭.
Of D♯, or E♭;	E♭, F, G, A♭, B♭, c, d, e♭,
of A♯, or B♭;	B♭, C, D, E♭, F, G, A, B♭.
of E♯, or F♮;	F, G, A, B♭, c, d, e, f.
of B♯, or C♮;	C, D, E, F, G, A, B, c.

(See Ex. xciv.)

Minor Modes.

	Of A.
In descending.	A G F E D C B A.
In rising.	A B C D E F♯ G♯ A.
	Of E.
In descending.	e d c B A G F♯ E.
In rising.	E F♯ G A B c♯ d♯ e.
	Of B.
In descending.	B A G F♯ E D C♯ B
In rising.	B C♯ D E F♯ G♯ A♯ B.
	Of F♯.
In descending.	f♯ e d c♯ B A G♯ E♯.
In rising.	F♯ G♯ A B C♯ d♯ e♯ f♯.
	Of C♯.
In descending.	C♯ B A G♯ F♯ E D♯ C♯.
In rising.	C♯ D♯ E F♯ G♯ A♯ B♯ C♯.
	Of G♯ or A♭.
In descending.	g♯ f♯ e d♯ c♯ B A♯ G♯.
In rising.	A♭ B♭ C♭ d♭ e♭ f g a♭.
	Of D♯ or E♭.
In descending.	e♭ d♭ c♭ B♭ A♭ G♭ F E♭.
In rising.	E♭ F G♭ A♭ B♭ c d e♭.
	Of A♯ or B♭.
In descending.	B♭ A♭, G♭ F E♭ D♭ C B♭.
In rising.	D♭ C D♭ E♭ F G A B♭.

 Of

(5 B) The major mode of F♯, of C♯, and of G♯, are not much practised.

When a piece begins upon C♯, there ought to be seven sharps placed at the cleff: but it is more convenient only to place five flats, and to suppose the key D♭, which is almost the same thing with C♯. For this reason we substitute here the mode of D♭, for that of C♯.

It is still much more necessary to substitute the mode of A♭ for that of G♯; for the scale of the major mode of G♯ is,

G♯, A♯, B♯, C♯, d♯, e♯, g, g♯,

in which it appears that there are at the same time both a 'g♮' and a 'g♯': it would then be necessary, even at the same time, that upon G there should and should not be a sharp at the cleff; which is inconsistent. It is true that this inconvenience may be avoided by placing a sharp upon G at the cleff, and by marking the note G with a natural through the course of the music wherever it ought to be natural; but this would become troublesome, above all if there should be occasion to transpose. In the article 236. we shall give an account of transposition. We might likewise in this series, instead of G natural, which is the note immediately before the last, substitute F♯♯, that is to say, F twice sharp: which, however, is not absolutely the same sound with G natural, especially upon instruments whose scales are fixed, or whose intervals are invariable. But in that case two sharps must be placed at the cleff upon F, which would produce another inconvenience. But by substituting A♭ for G♯, the trouble is eluded.

The double sharp, however, is incidentally used, when in a composition in the key of F♯ there is an occasional modulation into the dominant of that key, and it is distinguished by the character × or ♯♯.

Principles of Composition.

Of E※ or F♮.

In descending. f F e♭ d♭ c B♭ A♭ GF.
In rising. F G A♭ B♭ c d e f.

Of C.

In descending. c B♭ A♭ G F E♭ D C.
In rising. C D E♭ F G A B c.

Of G.

In descending. g f e♭ d C B♭ A G.
In rising. G A B♭ c d e f※ g.

Of D.

In descending. d c B♭ A G F E D.
In rising. D E F G A B c※ d (5 c).

Modes crowded with sharps and flats little practised.

235. These then are all the modes, as well major as minor. Those which are crowded with sharps and flats are little practised, as being extremely difficult in execution.

Principles of Composition. Results.

236. Hence it follows,

1. That when there are neither sharps nor flats at the cleff, the piece begins in the major mode of C, or in the minor mode of A.

2. That when there is one sharp, it will always be placed upon F, and that the piece begins in the major mode of G, or the minor of E, in such a manner that it may be sung as if there were no sharp, by singing B instead of F※, and in singing the tune as if it had been in another cleff. For instance, let there be a sharp upon F in the cleff of G upon the first line; one may then sing the tune as if there were no sharp; and as if, instead of the cleff of G upon the first line, it were the cleff of C; for the F※, when changed into B, will require that the cleff of G should be changed to the cleff of C, as may be easily seen. This is what we call *transposition* (5 D).

See *Transposition*.

237. It is evident, that when F※ is changed into B,

(5 C) We have already seen, that in each mode, the principal note is called a *tonic;* that the fifth above that note is called a *tonic dominant*, or the *dominant of the mode*, or simply a *dominant;* that the fifth below the tonic, or, what is the same thing, the fourth above that tonic, is called a *sub-dominant;* and in short, that the note which forms a semitone below the tonic, and which is a third major from the dominant, is called a *sensible note.* The other notes have likewise in every mode particular names which it is advantageous to know. Thus a note which is a tone immediately above the tonic, as D in the mode of C, and B in that of A is termed a *super-tonic;* the following note, which is a third major or minor from the tonic, according as the chord is major or minor, such as E in the major mode of C, and C in the minor mode of A, is called a *mediant;* and the note which is a tone above the dominant, such as A, in the mode of C, and F※ in that of A, is called a *super-dominant.*

(5 D) Though our author's account of this delicate operation in music will be found extremely just and compendious; though it proceeds upon simple principles, and comprehends every possible contingency; yet as the manner of thinking upon which it depends may be less familiar to English readers, if not profoundly skilled in music, it has been thought proper to give a more familiar, though less comprehensive, explanation of the manner in which *transposition* may be executed.

It will easily occur to every reader, that if each of the intervals through the whole diatonic series were equal, in a mathematical sense, it would be absolutely indifferent upon what note any air were begun, if within the compass of the gammut; because the same equal intervals must always have the same effects. But since, besides the natural semitones, there is another distinction of diatonic intervals into *greater* and *lesser tones;* and since these vary their positions in the series of an octave, according as the note from whence you begin is placed, that note is consequently the best key for any tune whose natural series is most exactly correspondent with the intervals which that melody or harmony requires. But in instruments whose scales are fixed, notwithstanding the temperament and other expedients of the same kind, such a series is far from being easily found, and is indeed in common practice almost totally neglected. All that can frequently be done is, to take care that the ear may not be sensibly shocked. This, however, would be the case, if, in transposing any tune, the situation of the semitones, whether natural or artificial, were not exactly correspondent in the series to which your air must be transposed, with their positions in the scale from which you transpose it. Suppose, for instance, your air should begin upon C, requiring the natural diatonic series through the whole gammut, in which the distance between E and F, as also that between B and C, is only a semitone. Again, suppose it necessary for your voice, or the instrument on which you play, that the same air should be transposed to G, a fifth above its former key; then because in the first series the intervals between the third and the fourth, seventh and eighth notes, are no more than semitones, the same intervals must take the same place in the octave to which you transpose. Now, from G, the note with which you propose to begin, the three tones immediately succeeding are full; but the fourth C is only a semitone; it may therefore be kept in its place. But from F, the seventh note above, to G, the eighth, the interval is a full tone, which must consequently be redressed by raising the F a semitone higher. Thus the situations of the semitonic intervals in both octaves will be correspondent; and thus, by conforming the positions of the semitones in the octave to which you transpose, with those in the octave in which the original key of the tune is contained, you will perform your operation with as much success as the nature of fixed scales can admit.

The order to be observed in these alterations of the intervals, is deduced from the relation which the fifth ascending and descending bear to the fundamental (art. 34. 35.); and therefore the farther we depart from the natural fundamental C by a series of fifths ascending or descending, the alterations, and consequently the number of sharps or flats indicating them, will be the greater.

Thus if G, which is the perfect fifth ascending from , therefore the note most nearly allied to C (art. 39, 40.), be

Principles of Composition.

All the modes reducible to the major of C and the minor of A.

B, G must be changed into C, and E into A. Thus, by transposition, the air has the same melody as if it were in the major mode of C, or in the minor mode of A. The major mode then of G, and the minor of E, are by transposition reduced to those of C major, and of A minor. It is the same case with all the other modes (5 E).

CHAP. XIII. *To find the Fundamental Bass of a given Modulation.*

Method of finding a fundamental bass to a given air not difficult, and why.

238. As we have reduced to a very small number the rules of the fundamental bass, and those which in the treble ought to be observed with relation to this bass,

---

be taken for a fundamental, F, which is the seventh of the scale of G, must be made sharp, that it may be a whole tone from the sixth E, and only a semitone from the key note G, according to the laws of the diatonic scale (art. 77.). See Ex. XCIV. 1. 2.

Again, if D, the perfect fifth ascending from G, and the second in the series of progressive fifths ascending from C, be used as a fundamental, C, which is the seventh of the scale of D, must, to render it the sensible or leading note (art. 77.), be made sharp in addition to F; so that in the scale of D, there are two sharps, F and C. See Ex. XCIV. (3.).

If A, the perfect fifth above D, and the third in the series of fifths ascending from C, be the fundamental, the seventh G must, in addition to F and C, be made sharp, for the same reason (4.); and so on, in the scale of E, which is next in order, F, C, G, and D, must be sharp (5.): in that of B, the sharps must be F, C, G, D and A (6.).

The perfect fifth above B is F※, and in that scale F, C, G, D, A, and E, must be sharp (7.). And in the next scale C※ all the notes of the system are sharp (8.).

This, for the reasons mentioned in the note (5 B), is the last scale to which we can properly go by the progressions of fifths ascending.

Returning to the natural scale of C, if, instead of assuming G, the perfect fifth above, for a fundamental, we take F, the perfect fifth below; B, which is the fourth note above F, and forms a *tritone* or sharp fourth to it, must, to become a perfect fourth, according to the laws of the diatonic scale, (art. 60.) be made flat (12.).

Proceeding with the series of fifths descending, if B♭, which is the perfect fifth below F, be taken for a fundamental; E, which, in its natural state, is the tritone or sharp fourth to B♭, must, to become the diatonic fourth (art. 60.), also be rendered flat (11.).

If E♭, which is the perfect fifth below B♭, and the third in the series of fifths descending from C, be made the fundamental, A, the sharp fourth, must, to become the diatonic fourth, be made flat, and the flats marked at the cleff are B, E and A (10.).

To form the next scale in the series of fifths descending, which is that of A flat, D must be flattened; and B, E, A, and D, are marked flat at the cleff (9.).

The next scale, that of D flat, is formed by flattening G, and adding its flat to the others at the cleff (8.). This is the scale recommended to be used rather than that of C※. (See note 5 B).

We do not proceed farther with the series of fifths descending, since the next scale, that of G♭, would just or very nearly exhibit the sounds already represented by the scale of F※ (7.). This scale is, however, sometimes written in the key of G flat, and we even meet with the scale of its fifth below, C flat, and, with an occasional modulation from that key into its fifth below, F flat, where B being necessarily twice flattened, is distinguished by this character 𝄫, or ♭♭, called a double flat.

We have thus seen, 1st, That each of the notes of the diatonic scale of C, and each of the semitones into which the whole tones of that scale are divided, may be taken for the fundamental note of a diatonic scale, called the *scale of that note*. 2dly, That the notes of the natural scale are more or less altered, as the note assumed for a fundamental is more or less distant from C, in a progression of fifths ascending or descending. 3dly, That in the progression by fifths ascending, the notes are altered by sharps, and in the progression by fifths descending, the alterations are by flats. 4thly, That in the alteration by sharps, the last sharp is always on the seventh or *sensible* note of the scale; and where there are more than one, is always on the fifth above the sharp immediately preceding; and in the alteration by flats, the last flat is always on the fourth of the scale; and where there are more than one, is always on the fifth below the flat immediately preceding.

The signatures of sharps and flats at the cleffs, belonging to the twelve major scales, are also used for their relative minor scales. The occasional elevation and depression of the sixths and sevenths of the minor scales, are denoted by occasional sharps or flats placed before these notes.

(5 E) Many musicians, and amongst others the ancient musicians of France, as Lulli, Campra, &c. place one flat less in the minor mode: so that in the minor mode of D, they place neither sharp nor flat at the cleff; in the minor mode of G, one flat only; in the minor mode of C, two flats, &c.

This practice in itself is sufficiently indifferent, and scarcely merits the trouble of a dispute. Yet the method which we have here described, according to M. Rameau, has the advantage of reducing all the modes to two; and besides it is founded upon this simple and very general rule, That in the major mode, we must place as many sharps or flats at the cleff, as are contained in the diatonic scale of that mode in ascending; and in the minor mode, as many as are contained in that same scale in descending.

Principles of Composition.

bass, it should no longer be difficult to find the fundamental bass of a given modulation, nay, frequently to find several; for every fundamental bass will be legitimate, when it is formed according to the rules which we have given (chap. vi.); and that, besides this, the dissonances which the modulation may form with this bass, will both be prepared, if it is necessary that they should be so, and always resolved (5 F).

Difficulty of assigning general rules for ascertaining the mode of a melody whose fundamental bass is sought.

239. It is of the greatest utility in searching for the fundamental bass, to know what is the tone or mode of the melody to which that bass should correspond.—But it is difficult in this matter to assign general rules, and such as are absolutely without exception, in which nothing may be left that appears indifferent or discretionary; because sometimes we seem to have the free choice of referring a particular melody either to one mode or another. For example, this melody G C may belong to all the modes, as well major as minor, in which G and C are found together; and each of these two sounds may even be considered as belonging to a different mode.

Reasons why we may proceed without the knowledge of the mode, and how we may be preserved from deviating in composition.

240. We may sometimes, as it should seem, operate without the knowledge of the mode, for two reasons: 1. Because, since the same sounds belong to several different modes, the mode is sometimes considerably undetermined; above all, in the middle of a piece, and during the time of one or two bars. 2. Without giving ourselves much trouble about the mode, it is often sufficient to preserve us from deviating in composition, if we observe in the simplest manner the rules above prescribed (chap. vi.) for the procedure of the fundamental bass.

Knowledge of the mode in beginning a piece indispensable, and why.

241. In the mean time, it is above all things necessary to know in what mode we operate at the beginning of the piece, because it is indispensable that the fundamental bass should begin in the same mode, and that the treble and bass should likewise end in it; nay, that they should even terminate in its fundamental note, which in the mode of C is C, and A in that of A, &c. Besides, in those passages of the modulation where there is a cadence, it is generally necessary that the mode of the fundamental bass should be the same with that of the part to which it corresponds.

Investigation of the mode continued.

242. To know upon what mode or in what key a piece commences, our inquiry may be entirely reduced to distinguish the major mode of C from the minor of A. For we have already seen (art. 236. and 237.), that all the modes may be reduced to these two, at least in the beginning of the piece. We shall now therefore give a detail of the different means by which these two modes may be distinguished.

Means by which the modes may be determined.

1. From the principal and characteristical sounds of the mode, which are C E G in the one, and A C E in the other; so that if a piece should, for instance, begin thus, A C E A, it may be almost constantly concluded, that the tone or mode is in A minor, although the notes A C E belong to the mode of C.

2. From the sensible note, which is B in the one, and G♯ in the other; so that if G♯ appears in the first bars of a piece, we may be certain that we are in the mode of A.

3. From the adjuncts of the mode, that is to say, the modes of its two-fifths, which for C are F and G, and D and E for A. For example, if after having begun a melody by some of the notes which are common to the modes of C and of A (as E D E F E D C B C), we should afterwards find the mode of G, which we ascertain by the F♯, or that of F which we ascertain by the B♭ or C♮, we may conclude that we have begun in the mode of C; but if we find the mode of D, or that of E, which we ascertain by B♭, C♯, or D♯, &c. we conclude from thence that we have begun in the mode of A.

4. A mode is not usually changed, especially in the beginning of a piece, unless in order to pass into one or other of the modes most relative to it, which are the mode of its fifth above, and that of its third below, if the original mode be major, or of its third above if it be minor. Thus, for instance, the modes which are most intimately relative to the major mode of C, are the major mode of G, and that of A minor. From the mode of C we commonly pass either into the one or the other of these modes; so that we may sometimes judge of the principal mode in which we are, by the relative mode which follows it, or which goes before it, when these relative modes are decisively marked. Besides these two relative modes, there are likewise two others into which the principal mode may pass, but less frequently, viz. the mode of its fifth below, and that of its third above, as F and E for the mode of C (5 G).

5. The modes may still be likewise distinguished by the cadences of the melody. These cadences ought to occur at the end of every two, or at most of every four bars, as in the fundamental bass: now the note of the fundamental bass which is most suitable to these closes,

(5 F) We often say, *that we are upon a particular key* or *scale*, instead of saying *that we are in a particular mode*. The following expressions therefore are synonymous; *such a piece is in* C *major*, or *in the mode of* C *major*, or *in the key of* C *major*, or in the scale of C *major*.

(5 G) It is certain that the minor mode of E has an extremely natural connection with the mode of C, as has been proven (art. 92.) both by arguments and by examples. It has likewise appeared in the note upon the art. 93. that the minor mode of D may be joined to the major mode of C: and thus in a particular sense, this mode may be considered as relative to the mode of C, but it is still less so than the major modes of G and F, or than those of A and E minor; because we cannot immediately, and without licence, pass in a fundamental bass from the perfect minor chord of C to the perfect minor chord of D; and if you pass immediately from the major mode of C to the minor mode of D in a fundamental bass, it is by passing, for instance, from the tonic C, or from E G C, to the tonic dominant of D, carrying the chord A C♯ E G, in which there are two sounds, E G, which are found in the preceding chord, (Ex. xcv.) or otherwise from C E G C to G B♭ D E, a chord of the sub-dominant in the minor mode of D, which chord has likewise two sounds, G and E, in common with that which went immediately before it. See Ex. xcvi.

Principles of Compoſition.

cloſes *, is always eaſy to be found. For the ſounds which occur in the treble, M. Rameau may be conſulted, p. 54. of his *Nouveau Syſteme de Muſique theorique et pratique* (5 H).

* See *Cadence.*

Having aſcertained the mode, the fundamental baſs not difficult.

When the mode is aſcertained, by the different means which we have pointed out, the fundamental baſs will coſt little pains. For in each mode there are three fundamental ſounds.

1. The tonic of the mode, or its principal ſound, which carries always the perfect chord major or minor, according as the mode itſelf is major or minor.

Major mode of C, C E G 'c'.
Minor mode of A, A C E A.

2. The tonic dominant, which is a fifth above the tonic, and which, whether in the major or minor mode, always carries a chord of the ſeventh, compoſed of a third major followed by two thirds minor.

Tonic dominant.
Major mode of C, G B D 'f'.

Tonic dominant.
Minor mode of A, E G♯ B 'd'.

3. The ſub-dominant, which is a fifth below the tonic, and which carries a chord compoſed of a third, fifth, and ſixth major, the third being either greater or leſſer, according as the mode is major or minor.

Sub-dominant.
Major mode of C, F A C 'd'.
Minor mode of A, D F A B.

Theſe three ſounds, the tonic, the tonic dominant, and the ſub-dominant, contain in their chords all the notes which enter into the ſcale of the mode; ſo that when a melody is given, it may almoſt always be found which of theſe three ſounds ſhould be placed in the fundamental baſs, under any particular note of the upper part. Yet it ſometimes happens that not one of theſe notes can be uſed. For example, let it be ſuppoſed that we are in the mode of C, and that we find in the melody theſe two notes A B in ſucceſſion; if we confine ourſelves to place in the fundamental baſs one of the three ſounds C G F, we ſhall find nothing for the ſounds A and B but this fundamental baſs $\overset{6}{F}\,\overset{7}{G}$; now ſuch a ſucceſſion as $\overset{6}{F}$ to $\overset{7}{G}$ is prohibited by the fifth rule for the fundamental baſs according to which every ſub-dominant, as F, ſhould riſe by a fifth; ſo that $\overset{6}{F}$ can only be followed by C in the fundamental baſs, and not by $\overset{7}{G}$.

Principles of Compoſition.

To remedy this, the chord of the ſub-dominant F A C 'd' muſt be inverted into a fundamental chord of the ſeventh, in this manner, D F A 'c', which has been called the *double employment* (art. 105.) becauſe it is a ſecondary manner of employing the chord of the ſub-dominant. By theſe means we give to the modulation A B this fundamental baſs $\overset{7}{D}\,\overset{7}{G}$; which procedure is agreeable to rules. See Ex. XCVII.

Here then are four chords, C E G 'c', G B D 'f', F A C 'd', D F A 'c', which may be employed in the major mode of C. We ſhall find in like manner, for the minor mode of A, four chords.

A C 'e a', E G♯ B 'd',
D F A B, B D 'f a'.

And in this mode we ſometimes change the laſt of theſe chords into B D 'f♯ a', ſubſtituting the 'f♯' for 'f♮'. For inſtance, if we have this melody in the minor mode of A, E F♯ G♯ A, we would cauſe the firſt note E to carry the perfect chord A C E A; the ſecond note F♯ to carry the chord of the ſeventh B D F♯ A; the third note G♯, the chord of the tonic dominant E G♯ B D, and the laſt the perfect chord A C E A. See Ex. XCVIII.

On the contrary, if this melody is given always in the minor mode, A A G♯ A, the ſecond A being ſyncopated, it might have the ſame baſs as the modulation E F♯ G♯ A, with this difference alone, that F♮ might be ſubſtituted for F♯ in the chord B D F♯ A, the better to mark out the minor mode. See Exam. XCIX.

Beſides theſe chords which we have juſt mentioned, and which may be regarded as the principal chords of the mode, there are ſtill a great many others; for example, the ſeries of dominants,

$$C\ \overset{7}{A}\ \overset{7}{D}\ \overset{7}{G}\ \overset{7}{C}\ F\quad \overset{7}{B}\ \overset{7}{E}\ \overset{7}{A}\ \overset{7}{D}\ \overset{7}{G}\ C,$$

which are terminated equally in the tonic C, either entirely belong, or at leaſt may be reckoned as belonging (5 I) to the mode of C; becauſe none of theſe dominants are tonic dominants, except G, which is the tonic dominant of the mode of C; and beſides, becauſe the chord of each of theſe dominants forms no other

---

(5 H) All theſe different manners of diſtinguiſhing the modes ought, if we may ſpeak ſo, to give mutual light and aſſiſtance one to the other. But it often happens, that one of theſe ſigns alone is not ſufficient to determine the mode, and may even lead to error. For example, if a piece of muſic begins with theſe three notes, E C G, we muſt not with too much precipitation conclude from thence that we are in the major mode of C, although theſe three ſounds, E C G, be the principal and characteriſtical ſounds in the major mode of C: we may be in the minor mode of E, eſpecially if the note E ſhould be long.

(5 I) I have ſaid, *that they may be reckoned as belonging to this mode*, for two reaſons: 1. Becauſe, properly ſpeaking, there are only three chords which eſſentially and primitively belong to the mode of C, viz. C carrying the perfect chord, F carrying that of the ſub-dominant, and G that of the tonic dominant, to which we may join the chord of the ſeventh, D F A C (art. 105.): but we here regard *as extended* the ſeries of dominants in queſtion, as belonging to the mode of C, becauſe it preſerves in the ear the impreſſion of that mode. 2. In a ſeries of dominants, there are a great many of them which likewiſe belong to other modes; for inſtance, the ſimple dominant A belongs naturally to the mode of G, the ſimple dominant B to that of A, &c. Thus it is only improperly, and by way of extenſion, as I have already ſaid, that we regard here theſe dominants as belonging to the mode of C.

Principles of Compoſition.

other ſounds than ſuch as belong to the ſcale of C. See Ex. C.

But if we were to form this fundamental baſs,

7 7 7 7♭
C A D G C,

conſidering the laſt C as a tonic dominant in this manner, C E G B♭; the mode would then be changed at the ſecond C, and we ſhould enter into the mode of F, becauſe the chord C E G B♭ indicates the tonic dominant of the mode of F; beſides, it is evident that the mode is changed, becauſe B♭ does not belong to the ſcale of C. See Ex. CI.

In the ſame manner, were we to form this fundamental baſs

7 7 7 6
C A D G C,

conſidering the laſt C as a ſub-dominant in this manner, C E G A; this laſt C would indicate the mode of G, of which C is the *ſub-dominant*. See Ex. CII.

In like manner, ſtill, if in the firſt ſeries of dominants, we cauſed the firſt D to carry the third major, in this manner, D F♯ A 'c'; this D having become a tonic dominant, would ſignify to us the major mode of G, and the $\overset{7}{G}$ which ſhould follow it, carrying the chord B D 'f', would relapſe into the mode of C, from whence we had departed. See Ex. CIII.

Finally, in the ſame manner, if in this ſeries of dominants, we ſhould cauſe B to carry F♯ in this manner, B D F♯ A, this F would ſhow that we had departed from the mode C, to enter into that of G. See Ex. CIV.

Hence it is eaſy to form this rule for diſcovering the changes of mode in the fundamental baſs.

A rule for diſcovering the changes of mode.

1. When we find a tonic in the fundamental baſs, we are in the mode of that tonic; and the mode is major or minor, according as the perfect chord is major or minor.

2. When we find a ſub-dominant, we are in the mode of the fifth above that ſub-dominant; and the mode is major or minor, according as the third in the chord of the ſub-dominant is major or minor.

3. When we find a tonic dominant, we are in the mode of the fifth below that tonic dominant. As the tonic dominant carries always the third major, it cannot be aſcertained from this dominant alone, whether the mode be major or minor: but it is only neceſſary to examine the following note, which muſt be the tonic of the mode in which he is; by the third of this tonic it will be diſcovered whether the mode be major or minor.

243. Every change of the mode ſuppoſes a cadence; and when the mode changes in the fundamental baſs, it is almoſt always either after the tonic of the mode in which we have been, or after the tonic dominant of that mode, conſidered then as a tonic by favour of a cloſe which ought neceſſarily to be found in that place: Whence it happens that cadences in a melody for the moſt part preſage a change of mode which ought to follow them.

244. All theſe rules, joined with the table of modes which we have given (art. 234.), will ſerve to diſcover in what mode we are in the middle of a piece, eſpecially in the moſt eſſential paſſages, as cadences (5 K).

Chap. XIV. *Of the Chromatic and Enharmonic.*

Chromatic, what.

245. We call that melody *chromatic* which is compoſed of ſeveral notes in ſucceſſion, whether riſing or deſcending by ſemitones. See CV. and CVI.

To an air deſcending by chromatic intervals, fundamental baſs, what.

246. When an air is chromatic in deſcending, the moſt natural and ordinary fundamental baſs is a concatenated ſeries of tonic dominants; all of which follow one another in deſcending by a fifth, or which is the ſame thing, in riſing by a fourth. See Ex. CV. (5 L).

247.

(5 K) Two modes are ſo much more intimately relative, as they contain a greater number of ſounds common to both; for example, the minor mode of C and the major of G, or the major mode of C and the minor of A: on the contrary, two modes are leſs intimately relative as the number of ſounds which they contain as common to both is ſmaller; for inſtance, the major mode of C and the minor of B, &c.

When the compoſer, led away by the current of the modulation, that is to ſay, by the manner in which the fundamental baſs is conſtituted, into a mode remote from that in which the piece was begun, he ought to continue in it but for a ſhort time, becauſe the ear is always impatient to return to the former mode.

(5 L) We may likewiſe give to a chromatic melody in deſcending, a fundamental baſs, into which may enter chords of the ſeventh and of the diminiſhed ſeventh, which may ſucceed one another by the intervals of a falſe fifth and a fifth redundant: thus in the Example CVII, where the continued baſs deſcends chromatically, it may eaſily be ſeen that the fundamental baſs carries ſucceſſively the chords of the ſeventh and of the ſeventh diminiſhed, and that in this baſs there is a falſe fifth from D to G♯, and a fifth redundant from G♯ to C.

The reaſon of this licence is, at it appears to us, becauſe the chord of the diminiſhed ſeventh may be conſidered as repreſenting (art. 221.) the chord of the tonic dominant; in ſuch a manner that this fundamental baſs

7 ♮ 7 7 7 ♯7
A D G♯ C F♯ B E A

(ſee Example CVIII.) may be conſidered as repreſenting (art. 116.) that which is written below,

7 ♯7 7 7 7 ♯7
A D E C F♯ B E A.

Now this laſt fundamental baſs is formed according to the common rules, unleſs that there is a broken cadence from D to $\overset{\sharp 7}{E}$, and an interrupted cadence from E to C, which are licenſes (art. 213 and 214.)

Fig. 1.

Tone Tone Semi T. Tone Tone Tone Semi T.

C D EF G A Bc

Fig. 9.

Scale

c d e f g a b c

C G C F C D G C

Fig. 2. C D EF G A Bc d ef g a bc d ef g a b

Scale First — Scale Second — Scale Third

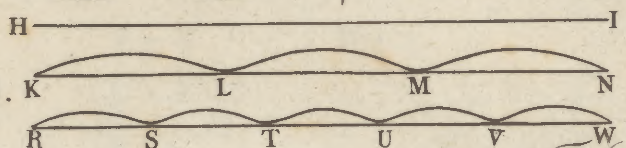


Fig. 3.

The Diatonic Scale of the Greeks

Fig. 4.

B c d e f g a

G C G C F C F

The Fundamental Bass

The Chromatic Species

Fig. 10.

Scale

g g♯ &c

C E G♯

The Fund: Bass

Fig. 5.

c d e f g g a b c

C G C F C G D G C

The Fundamental Bass

Fig. 11.

c e b♯

C E G♯

Fig. 6. C, C♯, D, D♯, E, E♯, F, F♯, G, G♯, A, A♯, B, B♯, c, c♯, d, d♯, e, e♯,

Scale First — Scale Second

The first Scale of the Minor Mode

Fig. 7.

G A B c d e f

Third Minor — Third Minor — Third Minor

E A E A D A D

The Fundamental Bass

Fig. 12.

Scale

f e e d♯

F C E B

The Fund. Bass

The Second Scale of the Minor Mode

Fig. 8.

A B c d e e f♯ g♯ a

A E A D A E B E A

The Fundamental Bass

Fig. 13.

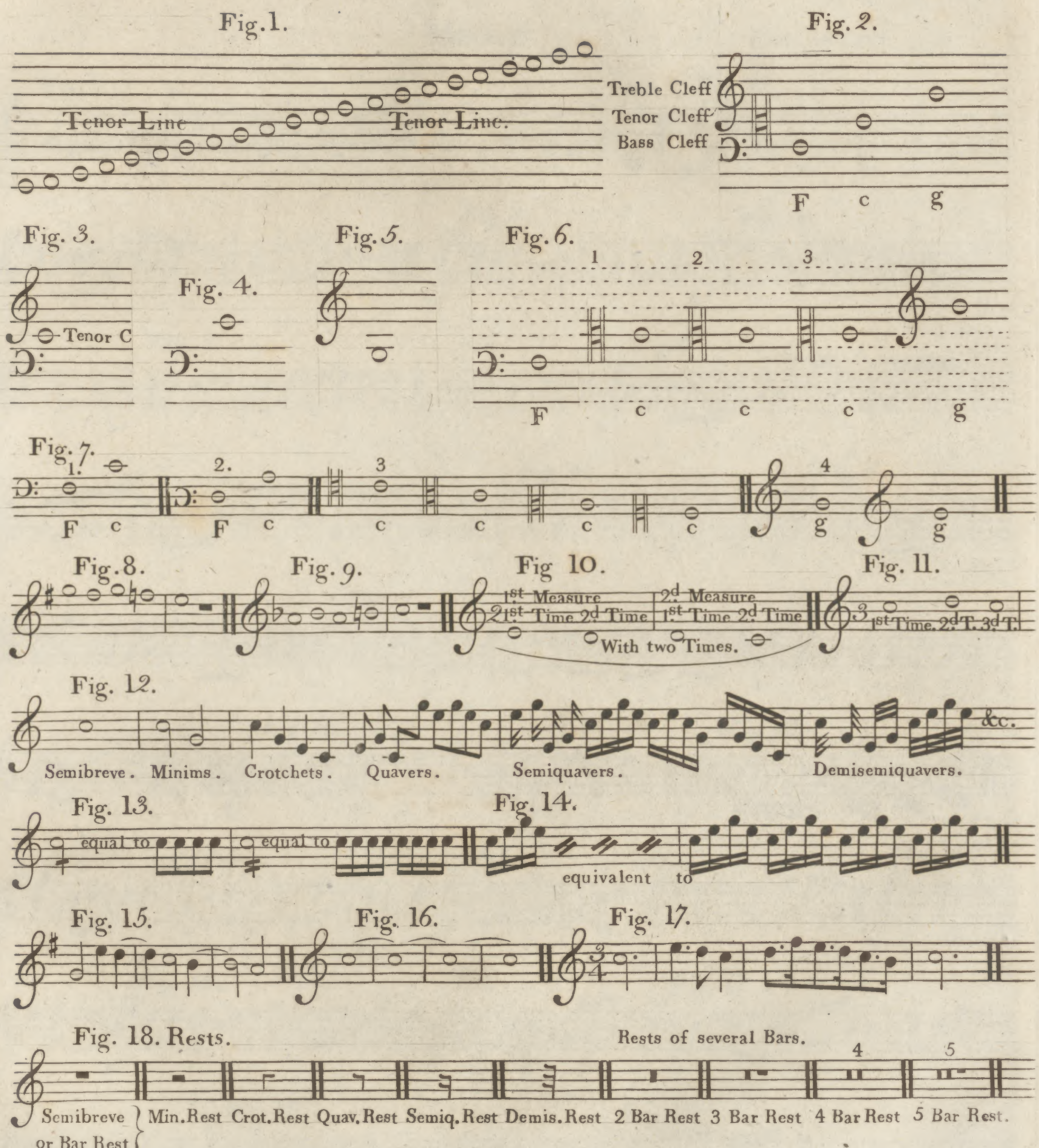
Scale

e♭ e e e e♯

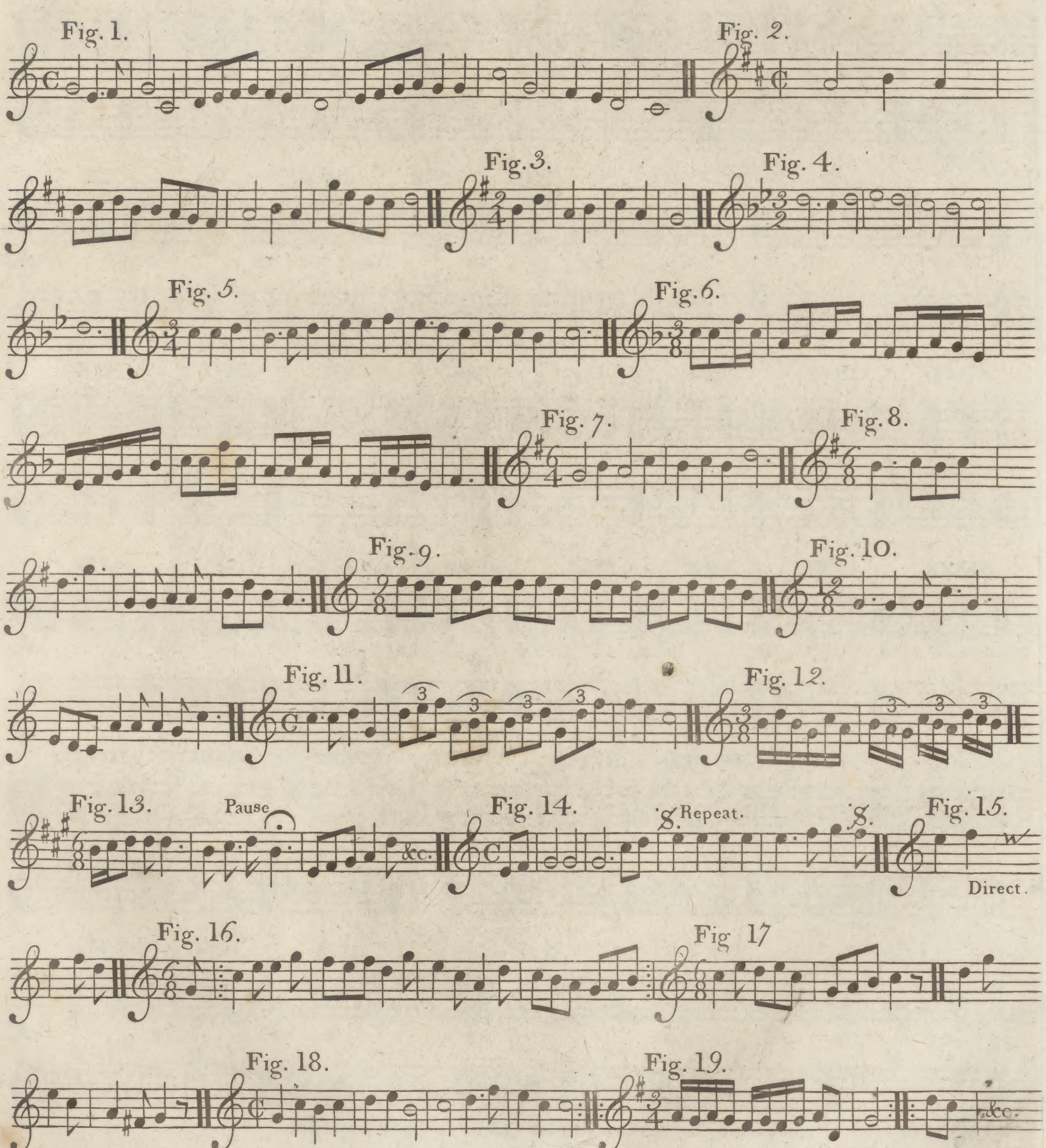
C C A C♯ C♯

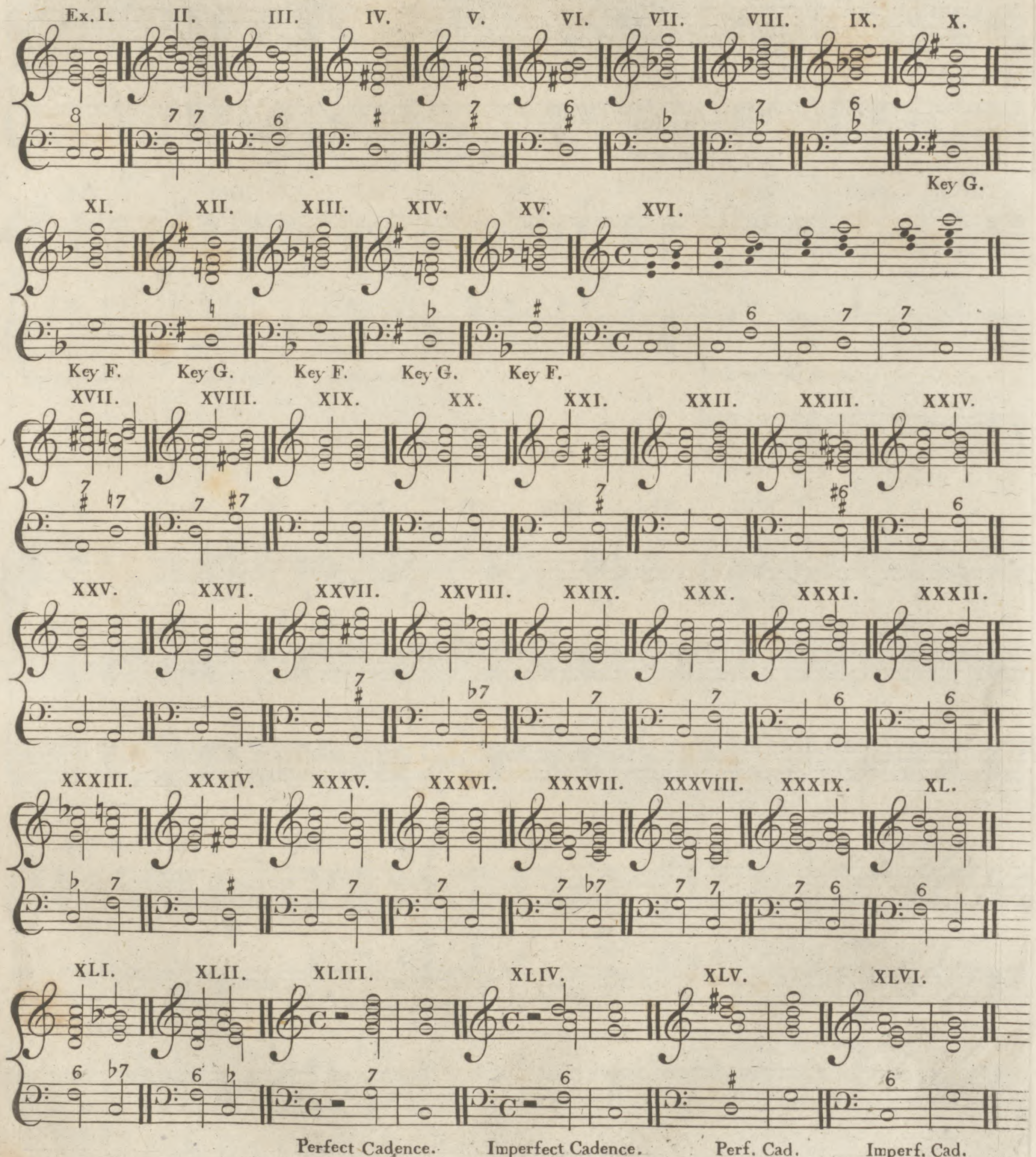
The Fund. Bass.

Music. Plate CCCLV.



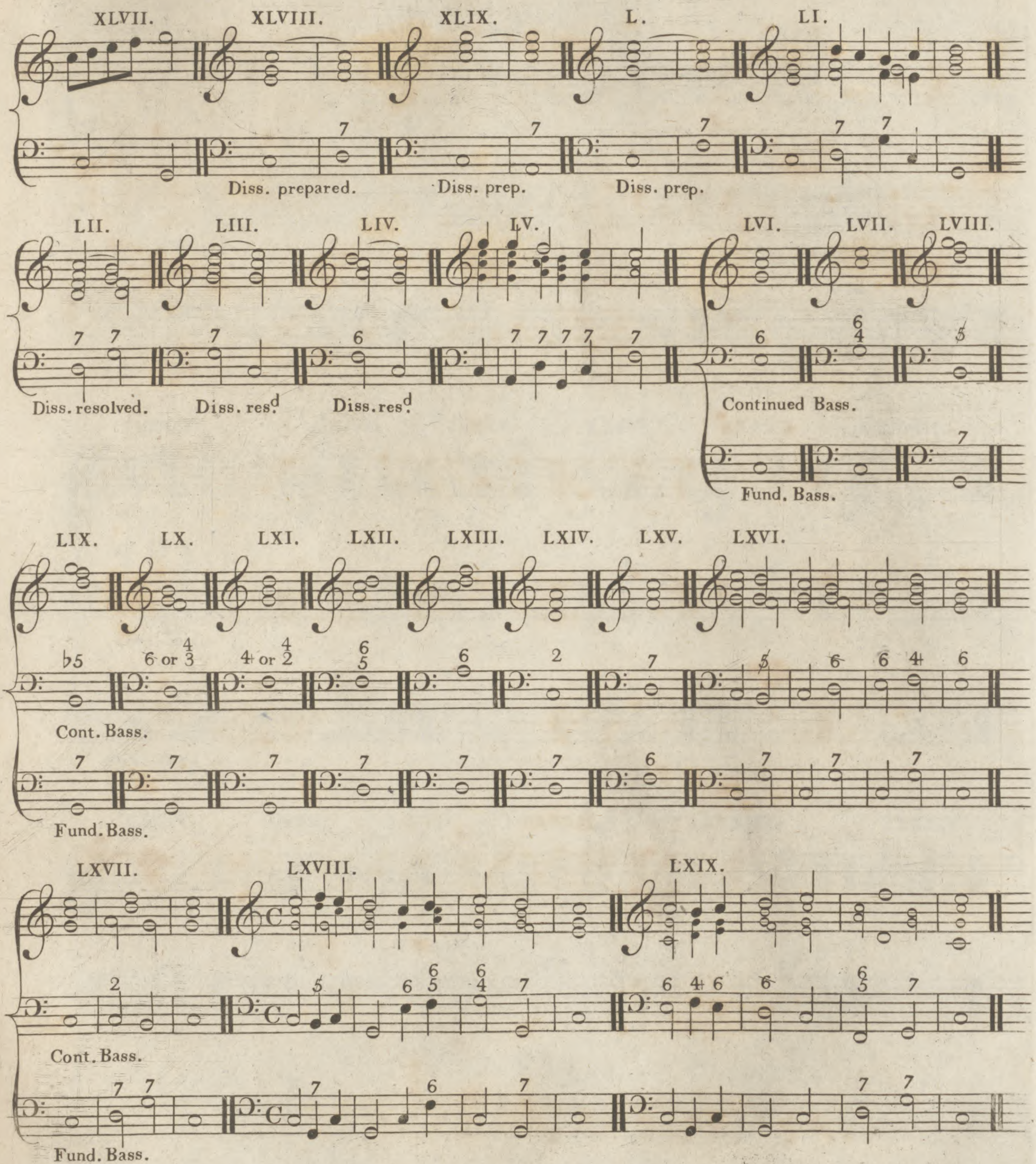
MUSIC. Plate CCCLVI.

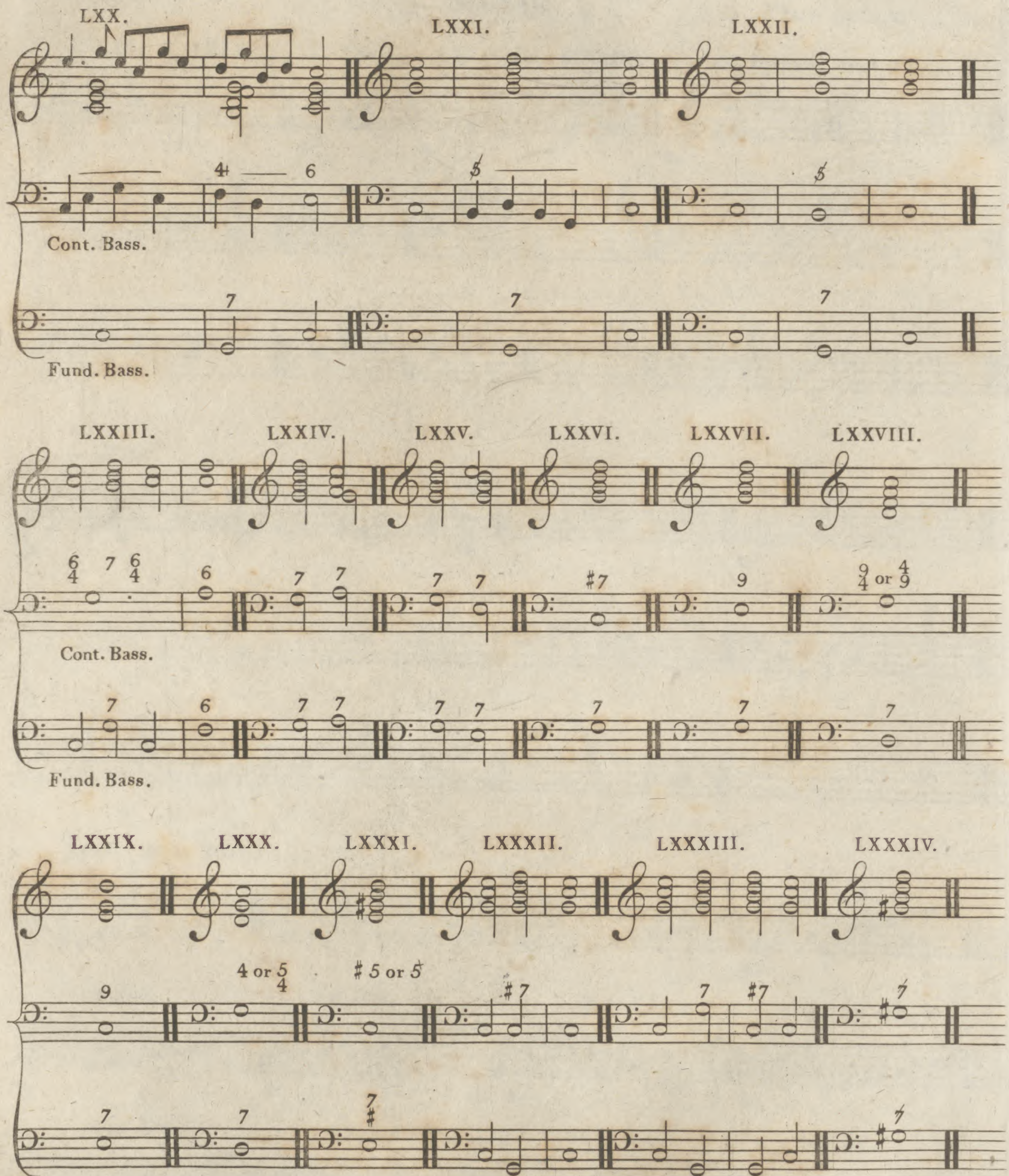



Ex. I. II. III. IV. V. VI. VII. VIII. IX. X.
Key G.
XI. XII. XIII. XIV. XV. XVI.
Key F. Key G. Key F. Key G. Key F.
XVII. XVIII. XIX. XX. XXI. XXII. XXIII. XXIV.
XXV. XXVI. XXVII. XXVIII. XXIX. XXX. XXXI. XXXII.
XXXIII. XXXIV. XXXV. XXXVI. XXXVII. XXXVIII. XXXIX. XL.
XLI. XLII. XLIII. XLIV. XLV. XLVI.
Perfect Cadence.
Imperfect Cadence.
Perf. Cad.
Imperf. Cad.

Music.

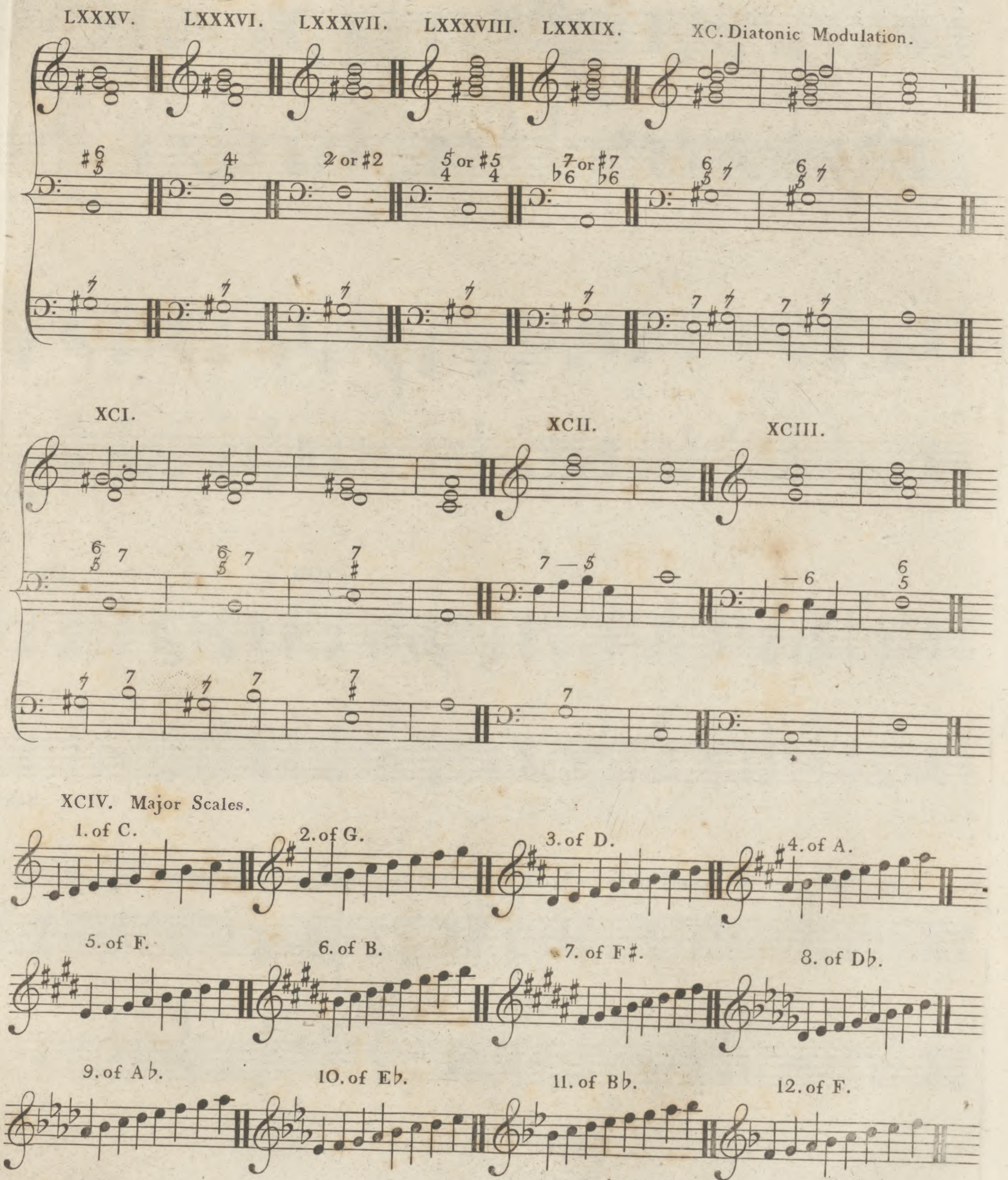
Plate CCCLVIII.

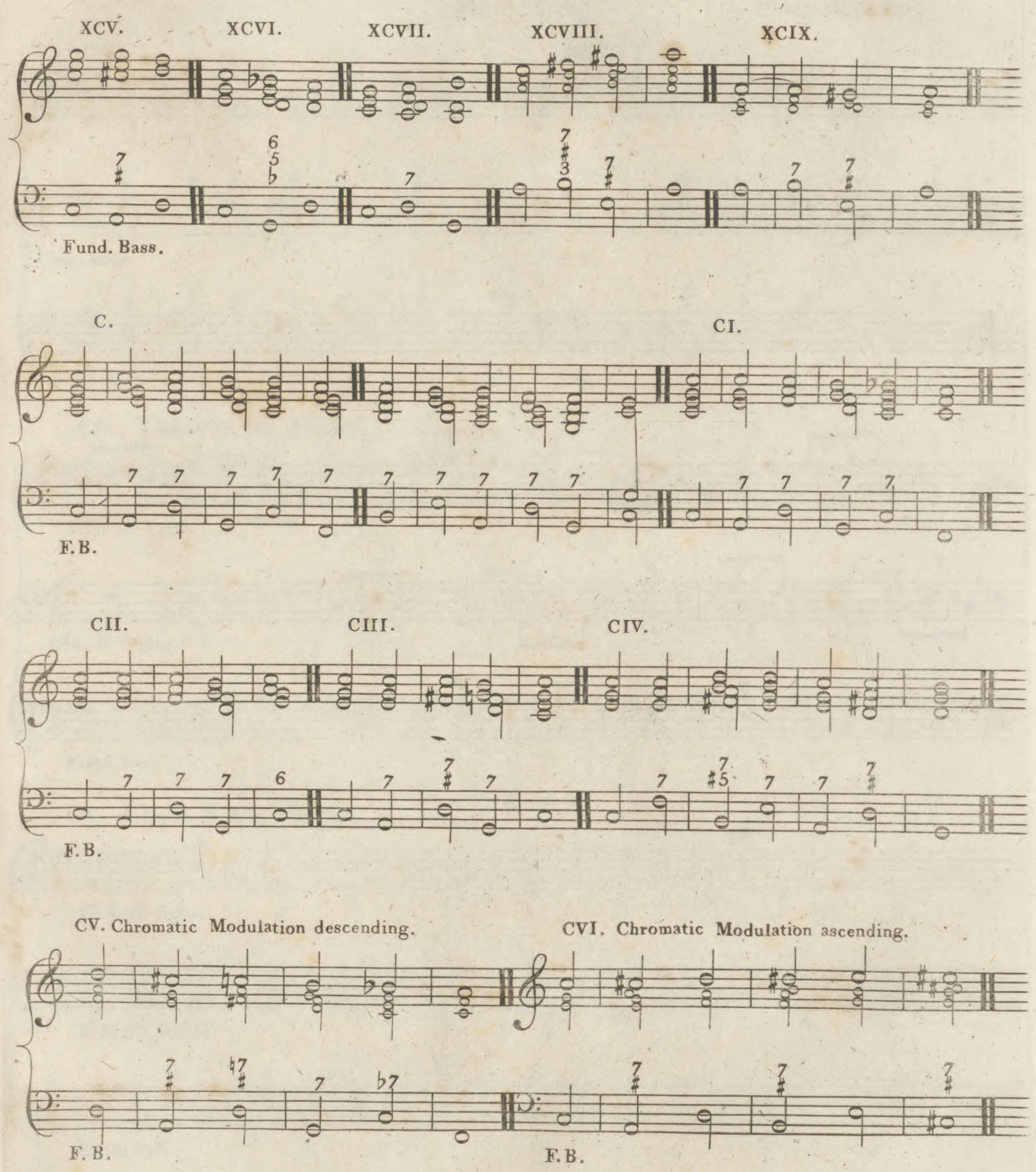



LXX.
LXXI.
LXXII.
Cont. Bass.
Fund. Bass.
LXXIII.
LXXIV.
LXXV.
LXXVI.
LXXVII.
LXXVIII.
Cont. Bass.
Fund. Bass.
LXXIX.
LXXX.
LXXXI.
LXXXII.
LXXXIII.
LXXXIV.

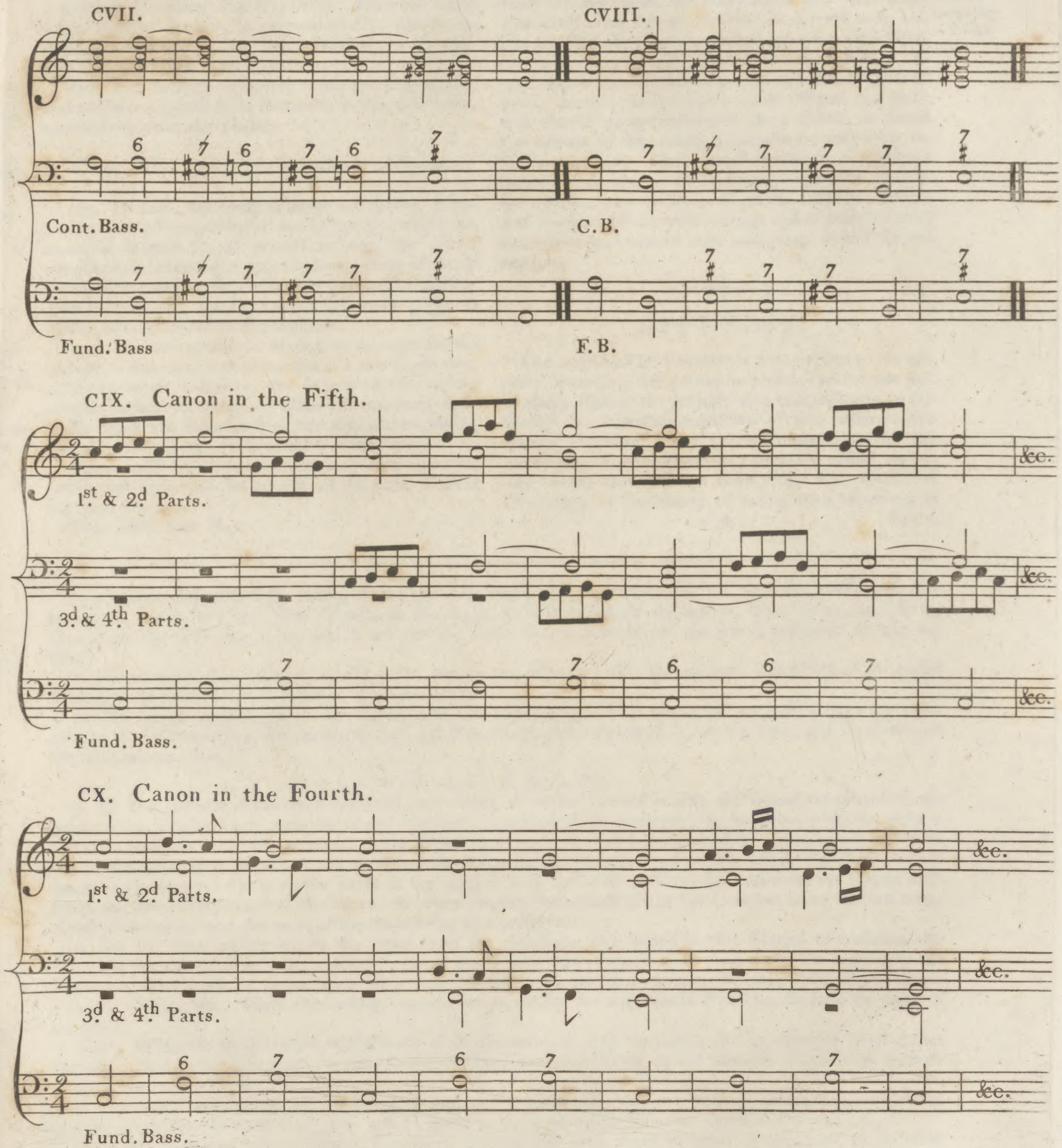
Music.

Plate CCCLX.




XCV.
XCVI.
XCVII.
XCVIII.
XCIX.
Fund. Bass.
C.
CI.
F.B.
CII.
CIII.
CIV.
F.B.
CV. Chromatic Modulation descending.
CVI. Chromatic Modulation ascending.
F.B.
F.B.

MUSIC. Plate CCCLXII.



Principles of Composition.

Ascending, what.

247. When the air is chromatic in ascending, one may form a fundamental bass by a series of tonics and of tonic dominants, which succeed one another alternately by the interval of a third in descending, and of a fourth in ascending, (see Ex. CVI.) There are many other ways of forming a chromatic air, whether in rising or descending; but these details in an elementary essay are by no means necessary.

Enharmonic little practised.

248. The enharmonic is very rarely put in practice; and we have explained its formation in the first book, to which we refer our readers.

See *Design*.

Chap. XV. *Of Design, Imitation, and Fugue.*

Design, what.

249. In music, the name of *design*, or *subject*, is generally given to a particular air or melody, which the composer intends should prevail through the piece; whether it is intended to express the meaning of words to which it may be set, or merely inspired by the impulse of taste and fancy. In this last case, design is distinguished into *imitation* and *fugue*.

See *Imitation*.

Imitation, what.

250. *Imitation* consists in causing to be repeated the melody of one or of several measures in one single part, or in the whole harmony, and in any of the various modes that may be chosen. When all the parts absolutely repeat the same air * or melody, and beginning one after the other, this is called a *canon* (5 M).

* See *Air*, *Canon*, *Fugue*.

Fugue consists in alternately repeating that air in the treble, and in the bass, or even in all the parts, if there are more than two.

251. Imitation and fugue are sometimes conducted by rules merely deducible from taste, which may be seen in the 332d and following pages of M. Rameau's *Treatise on Harmony*; where will likewise be found a detail of the rules for composition in several parts. The chief rules for composition in several parts are, that the discords should be found, as much as possible, prepared and resolved in the same part; that a discord should not be heard at the same time in several parts, because its harshness would disgust the ear; and that in no particular part there should be found two octaves or two fifths in succession (5 N) with respect to the bass. Musicians, however, do not hesitate sometimes to violate this precept, when taste or occasion require. In music, as in all the other fine arts, it is the business of the artist to assign and to observe rules; and province of men of taste and genius to find the exceptions.

Principal rules for composing in several parts.

APPENDIX.

The treatise of D'Alembert is well entitled to the merit of accuracy; but perhaps a person who has not particularly studied the subject, may find difficulty in following the scientific deductions of that author.—We subjoin, therefore, a few general observations on the philosophy of musical sound, commonly called *harmonics*, which may perhaps convey the full portion of knowledge of the theory of music, with which one in

 search

(5 M) Compositions in strict canon, where one part begins with a certain subject, and the other parts are bound to repeat the very same subject, or the reply, as it is called, in the unison, fifth, fourth, or octave, depend on the following rules, which are nothing more than a summary of the system explained by our author.

1. The chords to be employed are the tonic, and its two adjuncts; the subdominant, susceptible of an added sixth, and the dominant, susceptible of an added seventh.

2. The subject must begin in the harmony of the tonic, and as the fundamental progression from the dominant to the subdominant is not permitted (art. 33. 36.), the subdominant must follow the tonic, and the dominant the subdominant, thus,

$$C,\ \overset{6}{F},\ \overset{7}{G},\ C,\ \overset{6}{F}\ \overset{7}{G},\ C,\ \&c.$$

3. As the diatonic scale consists of two tetrachords, of which the first is also the second tetrachord of the mode of the sub-dominant, and the second the first tetrachord of the dominant; so, in canon, when the reply is meant to be in the mode of the dominant, the subject must be in the first tetrachord of the tonic, by which means the corresponding first tetrachord of the dominant being the second tetrachord of the tonic, the whole piece is truely in that mode. On the other hand, if the reply is to be in the mode of the sub-dominant, the subject must be in the second tetrachord of the tonic, the corresponding tetrachord of the sub-dominant being the first tetrachord of the tonic, and the mode of the tonic being thus preserved.

4. For the same reason, where the reply is in the dominant, the subject is only allowed to modulate into the mode of the sub-dominant, and the reply of course into that of the tonic. And where the reply is in the dominant, the subject is to modulate only into the mode of the sub-dominant, the reply following of course into that of the tonic. Were the contrary modulation permitted, the reply would depart too far from the mode of the tonic.

Lastly, When the reply is to be in the mode of the dominant it must commence in the measure bearing that harmony; and in the same way, the reply in the sub-dominant must begin in the measure which bears the harmony of the sub-dominant.

If these rules be observed, and due attention paid to the preparation and resolution of dissonances, composition in strict canon, in any number of parts, will be found to be by no means difficult. See Ex. CIX. and CX.

(5 N) Yet there may be two fifths in succession, provided the parts move in contrary directions, or, in other words, if the progress of one part be ascending, and the other descending; but in this case they are not properly two fifths, they are a fifth and a twelfth: for example, if one of the parts in descending should sound F D, and the other 'c a' in rising, C is the fifth of F, and 'a' the twelfth of D.

General Obfervations on Harmonies.

fearch only of general information, and not a profeffed ftudent of this particular fcience, would choofe to reft fatisfied.

The theory of mufical found, which only in the beginning of the prefent century was ultimately eftablifhed by mathematical demonftration, is no other than that which diftinguifhed the ancient mufical fect who followed the opinions of Pythagoras on that fubject.

No part of natural philofophy has been more fruitful of hypothefis than that of which mufical found is the object. The mufical fpeculators of Greece arranged themfelves into a great number of fects, the chief of whom were the Pythagoreans and the Ariftoxenians.

Pythagoras fuppofed the air to be the *vehicle* of found; and the agitation of that element, occafioned by a fimilar agitation in the parts of the founding body, to be the *caufe* of it. The vibrations of a ftring or other fonorous body, being communicated to the air, affected the auditory nerves with the fenfation of found; and this found, he argued, was acute or grave in proportion as the vibrations were quick or flow.—He difcovered by experiment, that of two ftrings equal in every thing but length, the fhorter made the quicker vibrations, and emitted the acuter found:—in other words, that the number of vibrations made in the fame time, by two ftrings of different lengths, was inverfely as thofe lengths; that is, the greater the length the fmaller the number of vibrations in any given time. Thus found, confidered in the vibrations that caufe it, and the dimenfions of the vibrating body, came to be reduced to quantity, and as fuch was the fubject of calculation, and expreffible by numbers.—For inftance, the two founds that form an octave could be expreffed by the numbers 1 and 2, which would reprefent either the number of vibrations in a given time, or the length of the ftrings; and would mean, that the acuter found vibrates twice, while the graver vibrates once; or that the ftring producing the lower found is twice the length of that which gives the higher. If the vibrations were confidered, the higher found was as 2, the lower as 1; the reverfe, if the length was alluded to. In the fame manner, in the fame fenfe, the 5th would be expreffed by the ratio of 2 to 3, and the 4th by that of 3 to 4.

Ariftoxenes, in oppofition to the calculations of Pythagoras, held the ear to be the fole ftandard of mufical proportions. That fenfe he accounted fufficiently accurate for mufical, though not for mathematical, purpofes; and it was in his opinion abfurd to aim at an artificial accuracy in gratifying the ear beyond its own power of diftinction. He, therefore, rejected the velocities, vibrations, and proportions of Pythagoras, as foreign to the fubject, in fo far as they fubftituted *abftract caufes* in the room of *experience*, and made mufic the object of *intellect* rather than of *fenfe*.

Of late, however, as has been already mentioned, the opinions of Pythagoras have been confirmed by abfolute demonftration; and the following propofitions, in relation to mufical found, have paffed from conjecture to certainty.

Sound is generated by the vibrations of elaftic bodies, which communicate the like vibrations to the air, and thefe again the like to our organs of hearing. This is evident, becaufe founding bodies communicate tremors to other bodies at a diftance from them. The vibrating motion, for inftance, of a mufical ftring, excites motion in others, whofe tenfion and quantity of matter difpofe their vibrations to keep time with the undulations of air propagated from it (the ftring firft fet in motion.)

If the vibrations be ifochronous, and the found mufical, continuing at the fame pitch, it is faid to be acuter, fharper, or higher, than any other found whofe vibrations are flower; and graver, flatter, or lower, than any other whofe vibrations are quicker.—For while a mufical ftring vibrates, its vibrations become quicker by increafing its tenfion or diminifhing its length; its found at the fame time will be more acute: and, on the contrary, by diminifhing its tenfion or increafing its length, the vibrations will become flower and the found graver. The like alteration of the pitch of the found will follow, by applying, by means of a weight, an equal degree of tenfion to a thicker or heavier and to a fmaller or lighter ftring, both of the fame length, as in the fmaller ftring the mafs of matter to be moved by the fame force is lefs.

If feveral ftrings, however, different in length, denfity, and tenfion, vibrate altogether in equal times, their founds will have all one and the fame pitch, however they may differ in loudnefs or other qualities.—They are called *unifons*. The vibrations of unifons are ifochronous.

The vibrations of a mufical ftring, whether wider or or narrower, are nearly ifochronous. Otherwife, while the vibrations decreafe in breadth till they ceafe, the pitch of the found could not continue the fame (which we perceive by experience it does), unlefs where the firft vibrations are made very violently; in which cafe, the found is a little acuter at the beginning than afterwards.

Laftly, The word *vibration* is underftood to mean the time which paffes between the departure of the vibrating body from any affigned place and its return to the fame.

Mufic, Mufimon.

Glafs-Mufic. See HARMONICA.

MUSIMON, in *Natural Hiftory*, the name of an animal efteemed a fpecies of fheep, defcribed by the ancients as common in Corfica, Sardinia, Barbary, and the north-eaft parts of Afia. It has been doubted whether the animal defcribed under this name is now any where to be found in the world; and whether it was not, probably, a fpurious breed between two animals of different fpecies, perhaps the fheep and goat, which, like the mule, not being able to propagate its fpecies, the production of them may have been difcontinued.

Buffon fuppofes it to be the fheep in a wild ftate; and it is defcribed as fuch by Mr Pennant. Thefe animals live in the mountaints, and run with great fwiftnefs among the rocks. Thofe of Kamtfchatka are fo ftrong, that 10 men can fcarce hold one; and the horns are fo large as fometimes to weigh 30 pounds, and so capacious that young foxes often shelter themselves in the hollow of such as by accident fall off in the deserts.

MUSIVUM AURUM. See CHEMISTRY, N° 1806.

MUSK, a very strong scented substance, found in a bag under the belly of a species of moschus. See MOSCHUS, MAMMALIA *Index*. And for an account of the nature and properties of musk, see MATERIA MEDICA *Index*.

Musk Animal. See MOSCHUS,
Musk Ox. See BOS,
Musk Rat. See CASTOR,
} MAMMALIA *Index*.

MUSKET, or MUSQUET, properly a fire-arm borne on the shoulder, and used in war; to be fired by the application of a lighted mach.

The length of the barrel is fixed to three feet eight inches from the muzzle to the touch-pan, and its bore is to be such as may receive a bullet of 14 in a pound, and its diameter differs not above one 50th part from that of the bullet.

Muskets were anciently borne in the field by the infantry, and were used in England so lately as the beginning of the civil wars. At present they are little used, except in the defence of places; fusees or fire-locks having taken their place and name.

MUSKETOON, a kind of short thick musket, whose bore is the 38th part of its length; it carries five ounces of iron, or seven and a half of lead, with an equal quantity of powder. This is the shortest kind of blunderbusses.

MUSLIN, a fine sort of cotton cloth, which bears a downy knot on its surface. There are several sorts of muslins brought from the East Indies, and more particularly from Bengal; such as doreas, betelles, mulmuls, tanjecbs, &c. Muslin is now manufactured in Britain, and brought to very great perfection.

MUSQUETOE. See CULEX, ENTOMOLOGY *Index*.

MUSSULMAN, or MUSYLMAN, a title by which the Mahometans distinguish themselves; signifying, in the Turkish language, "true believer, or orthodox." See MAHOMETANISM.

In Arabic, the word is written *Moslem*, *Mosleman*, or *Mosolman*. The appellation was first given to the Saracens, as is observed by Leunclavius.—There are two kinds of Mussulmans, very averse to each other; the one called *Sonnites*, and the other *Shiites*.—The Sonnites follow the interpretation of the Alcoran given by Omar; the Shiites are the followers of Ali. The subjects of the king of Persia are Shiites; and those of the grand signior, Sonnites. See SONNA, and ALCORAN.

According to some authors the word Mussulman signifies *saved*, that is, predestinated; and hence the Mahometans give themselves the appellation, as believing they are all predestinated to salvation.—Martinius is more particular as to the origin of the name; which he derives from the Arabic מסלם *musalem*, "saved, snatched out of danger:" the Mahometans, he observes, establishing their religion by fire and sword, massacred all those who would not embrace it, and granted life to all that did, calling them *Mussulmans*, q. d. *erepti è periculo;* whence the word, in course of time, became the distinguishing title of all those of that sect, who have affixed to it the signification of *true believers*.

MUST, MUSTUM, sweet wine newly pressed from the grape; or the new liquor pressed from the fruit before it is fermented. See WINE.

MUSTARD. See SINAPI, BOTANY *Index*.

Mustard Seed. For an account of its medical qualities, see MATERIA MEDICA *Index*.

MUSTELA, the OTTER and WEASEL; a genus of quadrupeds of the order of feræ. See MAMMALIA *Index*.

MUSTER, in a military sense, a review of troops under arms, to see if they be complete and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutements, &c.

Muster-Master-general, or *Commissary-general of the Musters;* one who takes account of every regiment, their number, horses, arms, &c. reviews them, sees the horses be well mounted, and all the men well armed and accoutred, &c.

Muster-Rolls, lists of soldiers in each company, troop, or regiment, by which they are paid, and the strength of the army is known.

MUTABILITY is opposed to immutability. See IMMUTABILITY.

MUTATION, the act of changing, or sometimes the change itself.

MUTATION, in the ancient music, is applied to the changes or alterations that happen in the order of the sounds which compose the melody.

MUTATIONES, among the Romans, post stages, or places where the public couriers were supplied with fresh horses.—The *mutationes* were wholly designed for the use of these couriers, or messengers of state; in which respect they differ from *mansiones*.

MUTCHKIN, a liquid measure used in Scotland; it contains four gills, and is the fourth part of a Scotch pint.

MUTE, is a general sense, signifies a person that cannot speak, or has not the use of speech.

MUTE, in *Law*, a person that stands dumb or speechless when he ought to answer, or to plead. See ARRAIGNMENT.

MUTE, in *Grammar*, a letter which yields no sound without the addition of a vowel. The simple consonants are distinguished into mutes and liquids, or semi-vowels. See the articles CONSONANT, LIQUID, &c.

The mutes in the Greek alphabet are nine, three of which, viz. π, κ, τ, are termed *tenues;* three β, γ, δ, termed *mediæ;* and three φ, χ, θ, termed *aspiratæ*. See the article ASPIRATE, &c.

The mutes of the Latin alphabet are also nine, viz. B, C, D, G, I, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body.

This word is also extended to statues and buildings, where any part is wanting, or the projecture of any member, as a cornice or an impost, is broken off. It is sometimes also used in a more immediate manner for castration: (See CASTRATION and EUNUCH.) The practice of this sort of mutilation is of various kinds: the Hottentots are said to cut away one testicle from their children, upon supposition that they are thereby made lighter and more active for running. In other countries, poor people completely mutilate their boys, to to prevent the misery and want which would attend their offspring. Those who have nothing in view but the improvement of a vain talent, or the formation of a voice which disfigures nature, as was the case formerly in Italy, are contented with cutting away the testicles. But in some countries of Asia, especially among the Turks, and in a part of Africa, those whom jealousy inspires with distrust would not think their wives safe in the custody of such eunuchs: They employ no slaves in their seraglios who have not been deprived of all the external parts of generation.

Amputation is not the only means of accomplishing this end. Formerly, the growth of the testicles was prevented, and their organization destroyed by simple rubbing, while the child was put into a warm bath made of a decoction of plants. Some pretend that by this species of castration the life is in no danger. Amputation of the testicles is not attended with much danger; but complete amputation of the external parts of generation is often fatal. This operation can only be performed on children from seven to ten years of age. Eunuchs of this kind, owing to the danger attending the operation, cost in Turkey five or six times more than others. *Chardin* relates, that this operation is so painful and dangerous after 15 years of age, that hardly a fourth part of those by whom it is undergone escape with life. *Pietro della Valle*, on the contrary, informs us, that in Persia those who suffer this cruel and dangerous operation as a punishment for rapes and other crimes of this kind, are easily cured though far advanced in life; and that nothing but ashes is applied to the wound.

There are eunuchs at Constantinople, throughout all Turkey, and in Persia, of a gray complexion: they come for the most part from the kingdom of Golconda, the peninsula on this side the Ganges, the kingdoms of Assan, Aracan, Pegu, and Malabar. Those from the gulf of Bengal are of an olive colour. There are some white eunuchs who come from Georgia and Circassia, but their number is small. The black eunuchs come from Africa, and especially from Ethiopia. These, in proportion to their horrible appearance, are the more esteemed and cost dearer. It appears that a very considerable trade is carried on in this species of men; for Tavernier informs us, that when he was in the kingdom of Golconda, in the year 1657, 22,000 eunuchs were made in it. In that country they are sold at the fairs.

The object of improving the voice by means of this species of mutilation, it is said, often fails; for of 2000 victims to the luxury and extravagant caprices of the art, hardly three are found who unite good talents with good organs. The other languishing and inactive wretches are, in some measure, outcasts from both sexes, and paralytic members in the community. But let us pay the tribute which is due to that virtuous pontiff Pope Clement VIII. who, listening to the voice of modesty and humanity, proscribed and abolished this detestable and infamous practice. Mutilation, he declared was the most abominable and disgraceful of crimes.

MUTILLA, a genus of insects belonging to the order of hymenoptera. See ENTOMOLOGY *Index*.

MUTINA, in *Ancient Geography*, a noble city of the Cispadana, made a Roman colony in the same year with Parma, situated between the rivers Gabellus and Scultenna, on the Via Æmilia. Here D. Brutus, being besieged by Antony, was relieved by the consuls Hirtius and Pansa. The Greeks called it *Mutine*; except Polybius, in whom it is *Motine*; and in Ptolemy *Mutina*, after the Roman manner.—Now *Modena*, a city of Lombardy, and capital of a cognominal duchy. E. Long. 11. 20. N. Lat. 44. 45.

MUTINY, in a military sense, to rise against authority.—" Any officer or soldier who shall presume to use traiterous or disrespectful words against the sacred person of his majesty, or any of the royal family, is guilty of mutiny.

" Any officer or soldier who shall behave himself with contempt or disrespect towards the general or other commander in chief of our forces, or shall speak words tending to their hurt or dishonour, is guilty of mutiny.

" Any officer or soldier who shall begin, excite, cause, or join in, any mutiny or sedition, in the troop, company, or regiment, to which he belongs, or in any other troop or company in our service, or in any party, post, detachment, or guard, on any pretence whatsoever, is guilty of mutiny.

" Any officer or soldier who, being present at any mutiny or sedition, does not use his utmost endeavours to suppress the same, or coming to the knowledge of any mutiny, or intended mutiny, does not without delay give information to his commanding officer, is guilty of mutiny.

" Any officer or soldier, who shall strike his superior officer, or draw, or offer to draw, or shall lift up any weapon, or offer any violence against him, being in the execution on his office, on any pretence whatsoever, or shall disobey any lawful command of his superior officer, is guilty of mutiny."

Mutiny Act. See *Military State*.

MUTIUS, CAIUS, surnamed *Codrus*, and afterwards *Scævola*, was one of the illustrious Roman family of the Mutii, and rendered his name famous in the war between Porsenna king of Tuscany and the Romans. That prince resolving to restore the family of Tarquin the Proud, went to besiege Rome 507 B. C. Mutius resolved to sacrifice himself for the safety of his country; and boldly entering the enemy's camp, killed Porsenna's secretary, whom he took for Porsenna himself. Being seized and brought before Porsenna, he told him boldly, that 300 young men like himself had sworn to murder him; *but since this hand has missed thee*, continued he, *it must be punished*; then putting his right hand on the burning coals, he let it burn with such constancy as astonished the beholders. The king, amazed at the intrepidity of this young Roman, ordered that he should have his freedom and return to Rome, and soon after concluded a peace with the Romans. From this action Mutius obtained the surname of *Scævola*, " or left-handed," which was enjoyed by his family.

Mutius Scævola, *Q*. surnamed the *Augur*, was an excellent civilian, and instructed Cicero in the laws. He was made prætor in Asia; was afterwards consul, and performed very important services for the republic.

He ought not to be confounded with *Quintus Mutius Scævola*, another excellent civilian, who was prætor

tor in Afia, tribune of the people, and at length conful, 95 B. C. He governed Afia with fuch prudence and equity, that his example was propofed to the governors who were fent into the provinces. Cicero fays, "that he was the moft eloquent orator of all the civilians, and the moft able civilian of all the orators." He was affaffinated in the temple of Vefta, during the wars of Marius and Sylla, 82 B. C.

MUTTON, the common name of the flefh of a fheep after the animal has been killed. Mutton has been commonly preferred to all the flefhes of quadrupeds. And indeed, befides its being more perfect, it has the advantage over them of being more generally fuited to different climates: whereas beef, *e. g.* requires a very nice intermediate ftate, which it feems to enjoy chiefly in England; for although Scotland fupplies what are reckoned the beft cattle, it is in the rich Englifh paftures that they are brought to perfection. Now the fheep can be brought almoft to the fame perfection in this bleak northern region as in the fouthern countries.

MUTUAL, a relative term, denoting fomething that is reciprocal between two or more perfons.

This we fay, *mutual affiftance*, *mutual averfion*, &c. There are mutual or reciprocal duties, offices, &c. between fuperiors and inferiors; as the king and his fubjects, the mafter and his fervants, &c.

Vaugelas makes a diftinction between *mutual* and *reciprocal*: *mutual*, according to him, is underftood of what is between two only; and *reciprocal*, of what is between more than two: but this diftinction is little regarded in common ufe.

MUTULE, in *Architecture*, a kind of fquare modillion fet under the cornice of the Doric order.

MUTUNUS, or MUTINUS, in *Fabulous Hiftory*, a deity among the Romans, fimilar to the Priapus of the Greeks.

MUZZLE *of a* GUN *or* MORTAR, the extremity at which the powder and ball is put in; and hence the muzzle ring is the metalline circle or moulding that furrounds the mouth of the piece.

MYA, the GAPER; a genus of fhell fifh. See CONCHOLOGY *Index*.

MYAGRUM, GOLD OF PLEASURE, a genus of plants, belonging to the tetradynamia clafs; and in the natural method ranking under the 39th order, *Siliquofæ*. See BOTANY *Index*.

MYCALE, a city and mountain of Caria; alfo a promontory of Afia oppofite Samos, celebrated for a battle which was fought there between the Greeks and Perfians about the year of Rome 275. The Perfians were about 100,000 men, who had juft returned from the unfuccefsful expedition of Xerxes in Greece.—They had drawn their fhips to the fhore, and fortified themfelves ftrongly, as if determined to fupport a fiege. They fuffered the Greeks to difembark from their fleet without the leaft moleftation, and were foon obliged to give way before the cool and refolute intrepidity of an inferior number of men. The Greeks obtained a complete victory, flaughtered fome thoufands of the enemy, burned their camp, and failed back to Samos with an immenfe booty, in which were 70 chefts of money.

MYCENÆ, in *Ancient Geography*, a town of Argolis, in Peloponnefus. The kingdom of the Argives was divided into two portions by Acrifius and his brother Prœtus. Argos and Mycenæ were their capitals. —Thefe, as belonging to the fame family, and diftant only about 50 ftadia or fix miles and a quarter from each other, had one tutelary deity, Juno, and were jointly proprietors of her temple, the Heræum, which was near Mycenæ. It was here that Agamemnon reigned. He enlarged his dominions by his valour and good fortune, and poffeffed, befides Mycenæ, the region about Corinth and Sicyon, and that called afterwards Achæa. On his return from Troy, he was flain with his companions at a banquet. Mycenæ then declined; and under the Heraclidæ was made fubject to Argos. (See ARGOS and ARGEIA.) The Mycenæans fending 80 men, partook with the Lacedæmonians in the glory acquired at Thermopylæ. The jealoufy of the Argives produced the deftruction of their city, which was abandoned after a fiege, and laid wafte in the firft year of the 78th Olympiad, or 466 years before Chrift. Some part of the wall remainined in the fecond century, with a gate, on which were lions, a fountain, the fubterraneous edifices where Atreus and his fons had depofited their treafures, and, among other fepulchral monuments, one of Agamemnon, and one of his fellow foldiers and fufferers.

MYCONE, an ifland of the Archipelago, fituated in E. Long. 25. 51. N. Lat. 37. 28. It is about 36 miles in circuit, and has a town of the fame name, containing about 3000 inhabitants. The people of this ifland are faid to be the beft failors in the Archipelago, and have about 150 veffels of different fizes. The ifland yields a fufficient quantity of barley for the inhabitants, and produces abundance of figs, and fome olives; but there is a fcarcity of water, efpecially in fummer, there being but one well in the ifland.—There are a great number of churches and chapels, with fome monafteries.

MYCONUS, in *Ancient Geography*, one of the iflands called Cyclades, near Delos, under which the laft of the Centaurs flain by Hercules are feigned to lie buried. Hence the proverb, *Omnia fub unam Myconum congerere*, applied to an injudicious or unnatural farrago. Myconii, the people, noted for baldnefs. Hence Myconius, a bald perfon. According to Strabo, the inhabitants became bald at the age of 20 or 25; and Pliny fays that the children were always born without hair. The ifland was poor, and the inhabitants very avaricious; whence Archilochus reproached a certain Pericles, that he came to a feaft like a Myconian; that is without previous invitation. Now called *Mycone*, which fee.

MYCTERIA, the JABIRU, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

MYGDONIA, in *Ancient Geography*, a diftrict of Macedonia, to the north of the Sinus Thermaicus, and eaft of the river Axius, which feparates it from Bottæis, and weft of the river Strymon, (Pliny). Alfo a diftrict of Mefopotamia, which took its name from that of Macedonia, running along the Euphrates, from Zeugma down to Thapfacus, extending a great way eaft, becaufe Nifibis was reckoned to it.

MYGINDA, a genus of plants belonging to the tetrandria clafs; and in the natural method ranking with thofe of which the order is doubtful. See BOTANY *Index*.

MYIAGRUS DEUS, in the heathen mythology, a name given ſometimes to Jupiter, and ſometimes to Hercules, on occaſion of their being ſacrificed to for the driving away the vaſt numbers of flies which infeſted the ſacrifices on certain public occaſions. The word is uſually ſpelt *Myagrus;* but this muſt be an error, as this word does not expreſs the *fly-deſtroyer*, but the *mouſe-deſtroyer;* and we have it ſufficiently teſtified by the ancients, that flies were the only creatures againſt whom this deity was invoked. Pliny calls this deity alſo *Myiodes;* and tells us, that the flies which uſed to peſter the Olympic rites went away in whole clouds on the ſacrificing a bull to this god. We find in Athenæus alſo, that this ſacrificing to the god of flies at the Olympic games was a conſtant cuſtom. Some diſtinguiſh theſe two deities, and tell us that the latter or Myiodes, uſed to viſit the nations in vengeance, with a vaſt multitude of flies: and that, on paying him the due honours of a ſacrifice, they all went away again; and this ſeems to agree with what Pliny tells us in ſome places.

At the time of the Olympic games, Jupiter was worſhipped under the name of *Apomyos* or *Myiagrus Deus*, to ſupplicate the deſtruction of thoſe troubleſome creatures. This happened only once in many years, when the ſacrifices were performed there; but the Elians worſhipped him continually under this name, to deprecate the vengeance of heaven, which uſually ſent, as they expreſſed it, an army of flies and other inſects, toward the latter end of the ſummer, that infeſted the whole country with ſickneſs and peſtilence.

MYIODES DEUS, in the heathen mythology, a name ſometimes given to Hercules, but more frequently to Jupiter, to whom a bull was ſacrificed, in order to make him propitious in driving away the flies that infeſted the Olympic games.

MYLÆ, in *Ancient Geography*, a Greek city ſituated on an iſthmus of a cognominal peninſula, on the north-eaſt ſide of the iſland. *Mylaei*, or *Mylenſes*, the people. A town built by thoſe of Zancle (Strabo). Mylæus, the epithet, as Mylæus Campus, mentioned by Polybius. Now called *Milazzo*, a port town of Sicily, in the Val di Demona. E. Long. 15. 5. Lat. 38. 36.

MYLASA, or MYLASSA, in *Ancient Geography*, a noble city of Caria in Aſia Minor, ſituated about three leagues from the *Sinus Ceramicus*. It was the capital of Hecatomnus king of Caria, and father of Mauſolus. Pliny ſpeaks of Menander king of Caria, and ſays that the Rhodians preſerved with the greateſt care his portrait painted by Apelles: but it was not in honour of this Menander that a Corinthian pillar was erected at Mylaſa, which ſtill exiſts, and on which is to be ſeen the following inſcription: "The people erected this pillar in honour of Menander, the ſon of Uliades, and grandſon of Euthydemus, the benefactor of his country, and whoſe anceſtors rendered it great ſervices alſo." Euthydemus, the grandfather of this Menander, lived in the time of Julius Cæſar and Auguſtus. Caria was taken by Mithridates, and afterwards by Labienus, whoſe father had been one of Cæſar's generals. Hybrias, whoſe eloquence and valour deſervedly entitled him to a diſtinguiſhed rank among his countrymen, in vain encouraged them to make a moſt obſtinate defence while it was beſieged by the latter. He himſelf was obliged to yield to neceſſity, and to take refuge at Rhodes: but ſcarcely had the conqueror quitted the city, when Hybrias returned, and reſtored liberty to his country.—Not content with rendering it this ſervice, he alſo deſtroyed the power of a dangerous citizen, whoſe riches and talents rendered him a neceſſary evil. Euthydemus, often baniſhed, and as often recalled, always too powerful in a ſtate the independence of which he threatened, ſaw his ambition checked by the zeal and activity of Hybrias. The Romans left to Mylaſa that liberty of which it rendered itſelf ſo worthy, by the great efforts it made to preſerve it. Pliny calls it *Mylaſa libera*. Strabo informs us, that it was one of the moſt magnificent cities of antiquity, and one of thoſe, the temples, porticoes, and other public monuments of which were highly admired. A quarry of white marble in the neighbourhood furniſhed it with abundance of materials for erecting theſe edifices.—The Mylaſians had two temples dedicated to Jupiter, one ſituated in the city, which was named *Oſogo*, and another built on a mountain, at the diſtance of 60 leagues. The latter was dedicated to *Jupiter Stratius*, Jupiter the Warrior. His ſtatue, which was very ancient, inſpired great veneration; people came from all quarters to implore his protection; and for the greater accommodation of his votaries a paved way was conſtructed, which reached from Mylaſa to this venerable fabric. This city is now called *Melaſſo*, and, according to Dr Chandler, is ſtill a large place.—The houſes are numerous, but chiefly of plaſter, and mean, with trees interſperſed. The air is accounted bad; and ſcorpions abound as anciently, entering often at the doors and windows, and lurking in the rooms. The plain is ſurrounded by lofty mountains, and cultivated. Round the town are ranges of broken columns, the remnants of porticoes, now with rubbiſh bounding the vineyards. A large portion of the plain is covered with ſcattered fragments, and with piers of ordinary aqueducts; beſides inſcriptions, moſtly ruined and illegible. Some altars dedicated to Hecatomnus have been diſcovered. Of all the ancient temples which formerly ornamented this city, one only eſcaped the power of time, the blind zeal of the early Chriſtians, and the barbarous ſuperſtition of the Mahometans. This monument was dedicated to Auguſtus and the divinity of Rome. When Pococke viſited Melaſſo, it was perfect and entire; but at preſent no traces of it remain, except a few fragments, which have been employed to conſtruct a Turkiſh moſque.

MYLOGLOSSUM, in *Anatomy*. See ANATOMY, *Table of the Muſcles*.

MYLOHYOIDÆUS. *Ibid.*

MYOLOGY, (formed of μυς, μυος, "a muſcle," and λογος, "diſcourſe"), in anatomy, a deſcription of the muſcles; or the knowledge of what relates to the muſcles of the human body. *Ibid.*

MYOMANCY, a kind of divination, or method of foretelling future events by means of mice.

Some authors hold myomancy to be one of the moſt ancient kinds of divination; and think it is on this account that Iſaiah, lxvi. 17. reckons mice among the abominable things of the Idolaters. But, beſide that, it is not certain that the Hebrew word עכבר uſed by the

the prophet fignifies *a moufe*, it is evident it is not the divination by that animal, be it what it will, that is fpoken of, but the eating it.

MYOPIA, Short-sightedness; a fpecies of vifion wherein objects are feen only at fmall diftances. See Medicine, N° 361.

MYOSOTIS, Scorpion-grass; a genus of plants belonging to the pentandria clafs, and in the natural method ranking under the 41ft order, *Afperifoliæ*. See Botany *Index*.

MYOSURUS, a genus of plants belonging to the pentandria clafs, and in the natural method ranking under the 26th order, *Multifiliquæ*. See Botany *Index*.

MYOXUS, the Dormouse, a genus of quadrupeds belonging to the order of glires. See Mammalia *Index*.

MYRIAD, a term fometimes ufed to denote ten thoufand.

MYRICA, Gale, or Sweet-willow, a genus of plants belonging to the diœcia clafs, and in the natural method ranking under the 5th order, *Amentaceæ*. See Botany *Index*.

MYRIOPHYLLUM, a genus of plants belonging to the monœcia clafs, and in the natural method ranking under the 15th order, *Inundatæ*. See Botany *Index*.

MYRISTICA, the Nutmeg-tree, in *Botany*, a genus of plants belonging to the clafs diœcia, and order fyngenefia, and of the natural order, *Lauri*. The defcription of this genus having been omitted in its proper place under Botany, we fhall here introduce a fhort account of it.—The male calyx is monophyllous, ftrong, and parted into three *laciniæ* of an oval fhape, and ending in a point: it has no corolla. In the middle of the receptacle rifes a column of the height of the calyx; to the upper part of which the antheræ are attached. They vary in number from three to twelve or thirteen.—The female calyx and corolla as in the male, on a diftinct tree. The germen of an oval fhape; the ftyle fhort, with a bifid ftigma, the lacinii of which are oval and fpreading.—The fruit is of that fort called *drupa*. It is flefhy, roundifh, fometimes unilocular, fometimes bivalved, and burfts when ripe at the fide. The feed is enveloped with a flefhy and fatty membranous fubftance which divides into filaments (this, in one of the fpecies, is the mace of the fhops). The feed or nutmeg is round or oval fhaped, unilocular, and contains a fmall kernel, variegated on the furface by the fibres running in the form of a fcrew.

Species.—There are five fpecies of this genus according to fome authors; but feveral of thefe being only varieties, may be reduced to three, viz.

1. Myriftica fatua, or wild nutmeg: this grows in Tobago, and rifes to the height of an apple-tree; has oblong, lanceolated, downy leaves, and hairy fruit:—the nutmeg of which is aromatic, but when given inwardly is narcotic, and occafions drunkennefs, delirium, and madnefs, for a time.

2. The myriftica febifera, (*Virola Sebifera* Aublet, page 904. tab. 345.) a tree frequent in Guiana, rifing to 40 or even to 60 feet high; on wounding the trunk of which, a thick, acrid, red juice runs out. Aublet fays nothing of the nutmegs being aromatic; he only obferves, that a yellow fat is obtained from them, which ferves many economical and medical purpofes, and that the natives make candles of it.

3. The myriftica mofchata, or nutmeg, rifes to the height of 30 feet, producing numerous branches; the bark of the trunk is of a reddifh brown, but that of the young branches is of a bright green colour: the leaves are nearly elliptical, pointed, undulated, obliquely nerved, on the upper fide of a bright green, on the under whitifh, and ftand alternately upon footftalks: the flowers are fmall, and hang upon flender peduncles, proceeding from the axillæ of the leaves: they are both male and female upon feparate trees.

M. Schwartz, who has carefully examined this as well as the two firft fpecies, preferved in fpirits, places them among the monadelphia.

The nutmeg has been fuppofed to be the *comacum* of Theophraftus, but there feems little foundation for this opinion; nor can it with more probability be thought to be the *chryfobalanos* of Galen. Our firft knowledge of it was evidently derived from the Arabians; by Avicenna it was called *jiaufiban*, or *jaufiband*, which fignifies nut of Banda. Rumphius both figured and defcribed this tree; but the figure given by him is fo imperfect, and the defcription fo confufed, that Linnæus, who gave it the generic name *myriftica*, was unable to affign its proper characters. M. Lamarck informs us, that he received feveral branches of the myriftica, both in flower and fruit, from the ifle of France, where a nutmeg-tree, which was introduced by Monfieur Poivre in 1770, is now very large, and continually producing flowers and fruit. From thefe branches, which were fent from Monf. Cere, director of the king's garden in that ifland, Lamarck has been enabled to defcribe and figure this and other fpecies of the myriftica. See Plate CXXIV. Botany.

Fig. *a*. A fprig with fructification. The drupa of the natural fize, and burfting open. Fig. *b*. the full-grown fruit cut lengthways. Fig. *c*. Another fection of the fame. Fig. *d*. The nutmeg enveloped with its covering, the mace. Fig. *e*. The fatty membrane or mace fpread out. Fig. *f*. The nutmeg of its natural fize. Fig. *g*. The fame with its external tegument removed at one end. Fig. *h*. The fame with its outer tegument entirely removed. Fig. *i*. A tranfverfe fection of the nutmeg.

The feeds or kernels called *nutmegs* are well known, as they have been long ufed both for culinary and medical purpofes. Diftilled with water, they yield a large quantity of effential oil, refembling in flavour the fpice itfelf; after the diftillation an infipid febaceous matter is found fwimming on the water; the decoction infpiffated, gives an extract of an unctuous, very lightly bitterifh tafte, and with little or no aftringency. Rectified fpirit extracts the whole virtue of nutmegs by infufion, and elevates very little of it in diftillation; hence the fpirituous extract poffeffes the flavour of the fpice in an eminent degree.

Nutmegs, when heated, yield to the prefs a confiderable quantity of limpid yellow oil, which on cooling concretes into a febaceous confiftence. In the fhops we meet with three forts of unctuous fubftances, called *oil of mace*, though really expreffed from the nutmeg. The beft is brought from the Eaft Indies in ftone jars; this is of a thick confiftence, of the colour of mace, Myristica. mace, and has an agreeable fragrant ſmell; the ſecond ſort, which is paler coloured, and much inferior in quality, comes from Holland in ſolid maſſes, generally flat, and of a ſquare figure: the third, which is the worſt of all, and uſually called *common oil of mace*, is an artificial compoſition of ſevum, palm oil, and the like, flavoured with a little genuine oil of nutmeg.

Method of gathering and preparing Nutmeg.—When the fruit is ripe the natives aſcend the trees, and gather it by pulling the branches to them with long hooks. Some are employed in opening them immediately, and in taking off the green ſhell or firſt rind, which is laid together in a heap in the woods, where in time in putrefies. As ſoon as the putrefaction has taken place, there ſpring up a kind of muſhrooms called *boleti moſchatyni*, of a blackiſh colour, and much valued by the natives, who conſider them as delicate eating. When the nuts are ſtripped of their firſt rind, they are carried home, and the mace is carefully taken off with a ſmall knife. The mace, which is of a beautiful red, but afterwards aſſumes a darkiſh or reddiſh colour, is laid to dry in the ſun for the ſpace of a day, and is then removed to a place leſs expoſed to his rays, where it remains for eight days, that it may ſoften a little. They afterwards moiſten it with ſea water, to prevent it from drying too much, or from loſing its oil. They are careful, however, not to employ too much water, leſt it ſhould become putrid, and be devoured by the worms. It is laſt of all put into ſmall bags, and ſqueezed very cloſe.

The nuts which are ſtill covered with their ligneous ſhell, are for three days expoſed to the ſun, and afterwards dried before a fire till they emit a ſound when they are ſhaken; they then beat them with ſmall ſticks in order to remove their ſhell, which flies off in pieces. Theſe nuts are diſtributed into three parcels; the firſt of which contains the largeſt and moſt beautiful, which are deſtined to be brought to Europe; the ſecond contains ſuch as are reſerved for the uſe of the inhabitants; and the third contains the ſmalleſt, which are irregular or unripe. Theſe are burnt; and part of the reſt is employed for procuring oil by preſſure. A pound of them commonly gives three ounces of oil, which has the conſiſtence of tallow, and has entirely the taſte of nutmeg. Both the nut and mace, when diſtilled, afford an eſſential, tranſparent, and volatile oil, of an excellent flavour.

The nutmegs which have been thus ſelected would ſoon corrupt if they were not watered, or rather pickled, with lime-water made from calcined ſhell fiſh, which they dilute with ſalt water till it attain the conſiſtence of fluid pap. Into this mixture they plunge the nutmegs, contained in ſmall baſkets, two or three times, till they are completely covered over with the liquor. They are afterwards laid in a heap, where they heat, and loſe their ſuperfluous moiſture by evaporation. When they have ſweated ſufficiently, they are then properly prepared, and fit for a ſea voyage.

In the iſland of Banda, the fruit of the nutmeg tree is preſerved entire in the following manner: When it is almoſt ripe, but previous to its opening, it is boiled in water and pierced with a needle. They next lay it in water to ſoak for ten days, till it has loſt its four and ſharp taſte. They then boil it gently in a ſyrup of ſugar, to which, if they wiſh it to be hard, a little lime is added. This operation is repeated for eight days, and each time the ſyrup is renewed. The fruit when thus preſerved is put for the laſt time into a pretty thick ſyrup, and is kept in earthen pots cloſely ſhut. Myristica.

Theſe nuts are likewiſe pickled with brine or with vinegar; and when they intend to eat them, they firſt ſteep them in freſh water, and afterwards boil them in ſyrup of ſugar, &c.

Uſes.—Nutmegs preſerved entire are preſented as deſſerts, and the inhabitants of India ſometimes eat them when they drink tea. Some of them uſe nothing but the pulp; others likewiſe chew the mace; but they generally throw away the kernel, which is really the nutmeg. Many who perform ſea voyages to the north chew this fruit every morning.

The medicinal qualities of nutmeg are ſuppoſed to be aromatic, anodyne, ſtomachic, and reſtringent; and with a view to the laſt mentioned effects, it has been much uſed in diarrhœas and dyſenteries.

Remarks on the Trade of Nutmegs.—Nutmeg trees grow in ſeveral iſlands in the eaſtern ocean. The wood pigeon of the Moluccas is unintentionally a great planter of theſe trees, and diſſeminates them in places where a nation, powerful by its commerce, thinks it for its intereſt that they ſhould be rooted out and deſtroyed. The Dutch, whoſe unwearied patience can ſurmount the greateſt obſtacles, formerly appropriated to themſelves the crop of nutmeg, as well as that of cloves and cinnamon, growing in the iſlands of Ternate, Ceylon, &c. either by right of conqueſt or by paying ſubſidies to the iſlanders, who find theſe much more profitable than the former produce of their trees. It is nevertheleſs true, that they have prevailed upon or compelled the inhabitants of the Moluccas to cut down and root out all the clove trees, which they have preſerved only in the iſlands of Amboyna and Ternate, which are in a great meaſure ſubject to them. We know for certain, that the Dutch pay 18,000 rixdollars yearly to the king of Ternate, by way of tribute or gift, in order to recompenſe him for the loſs of his clove trees in the other Molucca iſlands; and that they are moreover bound by treaty to take at 3½d. a pound, all the cloves brought by the natives of Amboyna to their magazines.

The Dutch had formerly immenſe and very rich magazines of theſe precious aromatics, both in India and Europe. It is ſaid, that they had actually by them the produce of 16 years, and never ſupplied their neighbours with the laſt, but always with the oldeſt crop: in 1760 they ſold what was laid up in 1744; and when they had too great a quantity of cloves, nutmeg, &c. in their magazines, they threw them into the ſea, or deſtroyed them by burning. On the 10th of June 1760, M. Bomare ſaw at Amſterdam, near the Admiralty, a fire, the fuel of which was valued at 8,000,000 of livres; and as much was to be burned on the day following. The feet of the ſpectators were bathed in the eſſential oil of theſe ſubſtances; but no perſon was allowed to gather any of it, much leſs to take any of the ſpices which were in the fire. Some years before, upon a ſimilar occaſion, and at the ſame place, a poor man

man who had taken up ſome nutmegs which had rolled out of the fire, was, as M. Bomare was informed, ſeized and condemned to immediate execution.

But after all, although the ſpice trade is leſs excluſively limited to the Dutch of late years, it does not appear that the price of Eaſt Indian ſpiceries is in any degree reduced to the conſumer.

MYRMECOPHAGA, or ANT-BEAR, a genus of quadrupeds, belonging to the order of bruta. See MAMMALIA *Index*.

MYRMELEON, or ANT-LION, a genus of inſects of the neuroptera order. See ENTOMOLOGY *Index*.

MYRMIDONS, MYRMIDONES, in antiquity; a people on the ſouthern borders of Theſſaly, who accompanied Achilles to the Trojan war. They received their name from Myrmidon, a ſon of Jupiter and Eurymeduſa, who married one of the daughters of Æolus, ſon of Helen. His ſon Actor married Ægina the daughter of Æſopus. He gave his name to his ſubjects, who dwelt near the river Peneus in Theſſaly. According to ſome, the Myrmidons received their name from their having ariſen from ants or piſmires, upon a prayer put up for that purpoſe by King Æacus to Jupiter, after his kingdom had been diſpeopled by a ſevere peſtilence. According to Strabo, they received it from their induſtry, becauſe they imitated the diligence of the ants, and like them were indefatigable, and were continually employed in cultivating the earth.

MYRMILLONES were gladiators of a certain kind at Rome, who fought againſt the Retiarii. Their arms were a ſword, head-piece, and ſhield. On the top of the head-piece they wore a fiſh emboſſed, called Μορμυρος, whence their name is by ſome ſuppoſed to be derived. The Retiarii, in their engagements, made uſe of a net, in which they endeavoured to entangle their adverſaries; and ſung during the fight, "*Non te peto, piſcem peto; quid me fugis, Galle?*" "I aim not at thee, but I aim at thy fiſh; why doſt thou ſhun me, O Gaul?" The Myrmillones were called Galli, becauſe they wore Gallic armour. They were alſo named *Secutores*. This kind of gladiators was ſuppreſſed by Caligula. See GLADIATORS, RETIARII, &c.

MYROBALANS, a kind of medicinal fruit brought from the Indies, of which there are five kinds. 1. The citrine, of a yellowiſh red colour, hard, oblong, and the ſize of an olive. 2. The black or Indian myrobalan, of the bigneſs of an acorn, wrinkled, and without a ſtone. 3. Chebulic myrobalans, which are of the ſize of a date, pointed at the end, and of a yellowiſh brown. 4. Emblic, which are round, rough, the ſize of gall, and of a dark brown. 5. Balleric, which are hard, round, of the ſize of an ordinary prune, leſs angular than the reſt, and yellow. They are all ſlightly purgative and aſtringent. The word comes from the Greek μυρον, "ointment," and βαλανος, "acorn," as being in the form of acorns, and uſed in medicine.

MYRON, an excellent Grecian ſtatuary, flouriſhed 442 B. C. The cow he repreſented in braſs was an admirable piece of workmanſhip, and was the occaſion of many fine epigrams in Greek.

MYROXYLON, a genus of plants belonging to the decandria claſs. See BOTANY *Index*.

MYRRH, a gummy-reſinous concrete juice, which is brought from the Eaſt Indies or from Abyſſinia. See MATERIA MEDICA *Index*.

It is affirmed by ſome, that the myrrh we have at preſent is not equal in quality to that of the ancients, and has not that exquiſite ſmell which all authors aſcribe to the latter. They aromatized their moſt delicious wines with it; and it was preſented as a very valuable perfume to our Lord while he lay in the manger.

It was this gum alſo which was mingled with the wine given him to drink at his paſſion, to deaden his pains, and produce a ſtupor. (See Mark xv. 32.). The gall mentioned on the ſame occaſion by St Matthew is probably the ſame with myrrh; for any thing bitter was uſually diſtinguiſhed by the name of gall. The Hebrews were accuſtomed to give thoſe that were executed ſome ſtupefying draught. The difficulty which ariſes from the ſeeming difference betwixt the two evangeliſts, by ſome is ſolved by ſaying, that St Matthew, writing in Syriac, made uſe of the word *marra*, which ſignifies "myrrh, bitterneſs, or gall;" but the Greek tranſlator has taken it for gall, and St Mark for myrrh. Others think that our Saviour's drink was mingled with myrrh as a ſtupefying drug; but ſuppoſe that the ſoldiers out of wanton cruelty and inhumanity, infuſed gall; which was the reaſon, ſay they, why, when he had taſted, he refuſed to drink.

MYRRHINE, or MURRINE. See MURRINE.

MYRSINE, a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 18th order, *Bicornes*. See BOTANY *Index*.

MYRTIFORM, in *Anatomy*, an appellation given to ſeveral parts, from their reſembling myrtle berries.

MYRTLE. See MYRTUS, BOTANY *Index*.

MYRTOUM MARE, a part of the Ægean ſea, lying between Eubœa, Peloponneſus, and Attica. It receives this name from Myrto a woman, or from Myrtos a ſmall iſland in the neighbourhood, or from Myrtilus the ſon of Mercury who was drowned there, &c.

MYRTUS, in *Ancient Geography*, a ſmall iſland near Caryſtus in Eubœa, which gave name to the Mare Myrtoum. Others, according to Pauſanias, derive the appellation from *Myrto*, the name of a woman. Strabo extends this ſea between Crete, Argia, and Attica. Pauſanias beginning it at Eubœa, joins it at Helena, a deſert iſland, with the Ægean ſea. Ptolemy carries it to the coaſt of Caria. Pliny ſays, that the Cyclades and Sporades are bounded on the weſt by the Myrtoan coaſt of Attica.

MYRTUS, the *Myrtle*, a genus of plants belonging to the icoſandria claſs; and in the natural method ranking under the 19th order, *Heſperideæ*. See BOTANY *Index*.

MYSIA, a country of Aſia Minor, generally divided into Major and Minor. Myſia Minor was bounded on the north and weſt by the Propontis and Bithynia, and Phrygia on the ſouthern and eaſtern borders. Myſia Major had Æolia on the ſouth, the Ægean ſea on the weſt, and Phrygia on the north and eaſt. Its chief cities were Cyzicum, Lampſacus, &c. The inhabitants were once very warlike; but they greatly degenerated, and the words *Myſorum ultimus* were emphatically uſed to ſignify a perſon of no merit. The ancients generally hired them to attend their funerals as mourners, Myson. mourners, because they were naturally melancholy and inclined to shed tears. They were once governed by monarchs. They are supposed to be descended from the Mysians of Europe, a nation who inhabited that part of Thrace which was situated between Mount Hæmus and the Danube.

MYSON, a native of Sparta, one of the seven wise men of Greece. When Anacharsis consulted the oracle of Apollo, to know which was the wisest man in Greece, he received for answer, he who is now ploughing his fields. This was Myson.

Mysore. MYSORE, or MYSOREAN DOMINIONS, a kingdom of Asia, in the East Indies, including the territories usurped or subdued by Hyder Ali, and transmitted to his son Tippoo Saib, but now subject to the British government. For an account of the conquest of which, see INDIA.

M Y S T E R I E S.

1 The gradual introduction of mysteries into religion.

RELIGION, in its original form, was simple and intelligible. It was intended for the instruction and edification of all ranks of men; and of consequence its doctrines were on a level with vulgar capacities. The Jewish dispensation was openly practised: nothing was performed in secret; every article was plain, open, and accessible. The divine Author of the Christian economy commanded his disciples to preach his doctrine in the most public manner: "What ye have heard in secret (says he) preach openly; and what I have taught you in private teach ye publicly, and proclaim it on the house tops." Such are the charms of truth, and such the character of that religion which came down from heaven, that they, as it were, "delight, and lift up their voice in the streets, and cry in the chief places of concourse."

But such is the depravity of the nature of man, that the noblest institutions degenerate in his hands. Religion itself, originally pure, simple, and amiable, under his management has often been transformed into pollution, perplexity, and deformity. The ministers of religion, whose province it was to guard the sacred deposite, and to secure it from foreign and spurious intermixtures, have generally been the first innovators, and the first and most industrious agents in corrupting its integrity and tarnishing its beauty. Avarice and ambition prompted that class of men to deviate from the original plainness and simplicity of religious institutions, and to introduce articles, rites, and usages, which might furnish them with opportunities of gratifying these unhallowed and insatiable passions. Hence distinctions unknown to pure and undefiled religion were fabricated; and that heavenly institution, heretofore one, simple, indivisible, was divided into two partitions: the one popular and public; the other dark, secret, and mysterious. The latter of these we intend as the subject of this article.

2 Etymology and import of the term.

The English word *mystery* is derived from the Greek μυστηριον; and in its modern acceptation imports something above human intelligence, something awfully obscure and enigmatical; any thing artfully made difficult; the secret of any business or profession. The word is often used by the founder of the Christian religion, and more frequently by his apostles, especially St Paul. In these cases, it generally signifies those doctrines of Christianity which the Jews, prior to the advent of the Messiah, either did not or could not understand. The Trinity in Unity, and the Unity in Trinity; the incarnation of the Son of God; the union of two natures in one and the same person, &c. we generally call *mysteries*, because they are infinitely above human comprehension. All these significations are out of the question at present. Our intention in this article is to lay before our readers the fullest and fairest account we have been able to collect, of those αποῤῥητα, or *secret rites*, of the Pagan superstition, which were carefully concealed from the knowledge of the vulgar, and which are universally known under the denomination of *mysteries*.

3 Object of this article.

The word μυστηριον is evidently deduced from μυστης; but the origin of this last term is not altogether so obvious. The etymologies of it exhibited by the learned are various; some of them absurd and inconsistent, others foolish and futile. Instead of fatiguing our readers with a detail of these, which would be equally unentertaining and uninteresting, we shall only produce one, which to us appears to come nearest the truth. The mysteries under consideration at present were certainly imported into Greece from the east. In those regions, then, we ought of course to look for the etymology of the word. *Mistor*, or *mistur*, in Hebrew, signifies "any place or thing hidden or concealed." As this word implies a kind of definition of the nature of the thing intended, and as it is one of the excellencies of original languages to apply vocables with this propriety, we find ourselves strongly inclined to assign the word *mistur* as the root of the term μυστης, *myster*.

4 Motives to the introduction of the mysteries.

We have already observed, that the avarice and ambition of the Pagan priesthood probably gave birth to the institution of the mysteries. To this observation we may now add, that the ministers of that superstition might possibly imagine, that some articles of their ritual were too profound to be comprehended by the vulgar; others, too sacred to be communicated to a description of men, whom the institutions of civil society had placed in a situation not only subordinate but even contemptible. It was imagined, that things sacred and venerable would have contracted a taint and pollution by an intercourse with sordid and untutored souls. These appear to us the most probable motives for making that odious and pernicious distinction between the popular religion and that contained in the sacred and mysterious ritual.

The learned Bishop Warburton is positive, that the mysteries of the Pagan religion were the invention of legislators * and other great personages, whom fortune or their own merit had placed at the head of those civil societies which were formed in the earliest ages in different parts of the world. It is with reluctance, and indeed

* *Divin. Leg.*

5 The hypothesis of Warburton ill founded.

indeed with diffidence, that we presume to differ in our sentiments from such respectable authority. Whatever hypothesis this prelate had once adopted, so extensive was his reading, and so exuberant his intellectual resources, that he found little difficulty in defending it by an appearance of plausibility, if not of rational argumentation. The large quotations he has adduced from Plato and Cicero, do indeed prove that the sages and legislators of antiquity sometimes availed themselves of the influence derived from the doctrines of the mysteries, and from the authority they acquired by the opinion of their having been initiated in them; but that those men were the inventors and fabricators of them is a position for which his quotations do not furnish the most slender presumption. At the same time, we think it not altogether certain, that the doctrine of a divine Providence, and a future state of rewards and punishments, were revealed in the mysteries with all the clearness and cogency which is pretended by his Lordship.

But granting that the fabric was raised by the hands of sages and legislators, we imagine it would be rather difficult to discover what emolument that description of men could propose to derive from the enterprise.—The institution was evidently, and indeed confessedly, devised to conceal from the million those very doctrines and maxims, which had they known and embraced them, would have contributed most effectually to dispose them to submit to those wise regulations which their governors and legislators wished most ardently to establish. Experience has taught, that nothing has a more commanding influence on the minds of the vulgar, than those very dogmas, which, according to the Bishop, were communicated to the initiated. A conviction of the unity of the Deity, of his wisdom, power, goodness, omnipresence, &c. the steady belief of the immortality of the human soul, and of a future state of rewards and punishments, have in all ages, and in all countries, proved the firmest supports of legal authority. The very same doctrines, in the dawn of Christianity, contributed, of all other methods, the most effectually to tame and civilize the savage (A) inhabitants of the northern regions of Europe. Supposing those principles to have been inculcated by the mysteries, the most prudent plan legislators could have adopted. would have been to publish them to all mankind. They ought to have sent forth apostles to preach them to the savages whom they had undertaken to civilize. According to the learned prelate, they pursued the opposite course, and deprived themselves of those very arms by which they might have encountered and overthrown all the armies of savagism.

6 Mysteries of Eleusis said to be revealed publicly in Crete.

Of all the legislators of antiquity, the Cretan alone was prudent enough to see and adopt this rational plan. Diodorus the Sicilian informs us *, that the mysteries of Eleusis, Samothracia, &c. which were elsewhere buried in profound darkness, were among the Cretans taught publicly, and communicated to all the world. Minos, however, was a successful legislator; and his intercourse with Jupiter Idæus extended his influence and established his authority. He was not under the necessity of calling in the mysteries to his assistance: on the contrary, it is highly probable that the universal knowledge of the doctrines of the mysteries among his countrymen contributed in a considerable degree to facilitate his labour, and ensure his success.

* Lib. v.

The divine Author of the Christian economy, viewed in the light of a human legislator, saw the propriety of this procedure. Nothing was concealed in his institutions; nothing was veiled with mystery, or buried in darkness. The success was answerable to the wisdom of the plan. The million flocked to the evangelical standard: the gospel was preached to the poor, to the illiterate and the vulgar; and the meanest of mankind eagerly embraced its maxims. Wherever it prevailed, it produced civilization, morality, sobriety, loyalty, and every other private and social virtue.—Upon the supposition that the mysteries had contained and inculcated the principles and practices which the prelate supposes they did, the civilizers of mankind, legislators, magistrates, and princes, ought to have combined to make them public for the sake of their own tranquillity, and the more effectual support of their authority and influence.

6 Mysteries the offspring of Egyptian priestcraft; but

Upon the whole, we are inclined to believe that the mysteries were the offspring of Egyptian priestcraft. They were instituted with a view to aggrandize that order of men, to extend their influence, and enlarge their revenues. To accomplish those selfish projects, they applied every engine towards besotting the multitude with superstition and enthusiasm. They taught them to believe, that themselves were the distinguished favourites of heaven; and that celestial doctrines had been revealed to them, too holy to be communicated to the profane rabble, and too sublime to be comprehended by vulgar capacities. It is, we confess, exceedingly probable, that after the mysteries were instituted, and had acquired an exalted reputation in the world, legislators, magistrates, judges, and potentates, joined in the imposture, with the same views and from the same principles. Princes and legislators, who found their advantage in overawing and humbling the multitude, readily adopted a plan which they found so artfully fabricated to answer these very purposes. They had interest enough with the sacerdotal (B) mystagogues, to induce them to allow them to participate in those venerable rites which had already established the authority of that description of men in whose hands they were deposited. The views of both parties were exactly congenial. The respect, the admiration, and dependance on the million, were the ultimate objects of their ambition respectively.—Priests and princes were actuated by the very same spirit. The combination was advantageous, and of consequence harmonious. For these reasons we have taken the liberty of differing from his Lordship of Gloucester with respect to

8 adopted by legislators, &c.

(A) The Germans, Russians, and Scandinavians, who were never thoroughly civilized till the gospel was preached among them.

(B) The mystagogues were the ministers who acted the chief part in celebrating the mysteries.

to the persons who first instituted the secret mysteries of the Pagan religion.

9 Hypothesis of Mosheim

Another writer, of considerable reputation in the republic of letters, is of opinion, that the mysteries were entirely commemorative; that they were instituted with a view to preserve the remembrance of heroes and great men, who had been deified in consideration of their martial exploits, useful inventions, public virtues, and especially in consequence of the benefits by them conferred on their contemporaries.—According to him, the (C) mysteries of Mithras were established for this very purpose. It would be no difficult matter to prove that the Persian deity of that name was the sun, and that his name and insignia jointly ascertain the truth of this assertion. The same writer extends this observation to the mysteries of the Egyptians, Phœnicians, Greeks, Hetruscans; and in a word, to all the institutions of that species throughout the world.

10 singular and indefensible.

In opposition to this singular opinion, it may be argued, we think with some show of reason, that the method of preserving the memory of great and illustrious men generally adopted, was the establishing festivals, celebrating games, offering sacrifices, singing hymns, dances, &c. We can recollect no secret mysteries instituted for that purpose at least in their original intention. If any usage of the commemorative kind was admitted, it was superinduced at some period posterior to the primary institution. At the same time, upon the supposition that the orgia of Bacchus were the same with those of the Egyptian Osiris, and that the mysteries of Ceres exhibited at Eleusis were copied from those of the Egyptian Isis, and allowing that the former was the sun, and the latter the moon; it will be difficult to find out the human persons whose exploits, adventures, inventions, &c. were intended to be immortalized by those institutions. Upon the whole, the mysteries were performed in secret; they were intended to be communicated only to a few; of course, had they been instituted with a view to immortalize the memory of heroes and great men, the authors would have acted the most foolish and inconsistent part imaginable.—Instead of transmitting the fame of their heroes with eclat to posterity, they would by this procedure have consigned it to eternal oblivion.

11 Our first position supported by the character of the priests of Egypt.

We must then recur to our first position. The mysteries were the offspring of bigotry and priestcraft; they originated in Egypt, the native land of idolatry. In that country the priesthood ruled predominant. The kings were engrafted into their body before they could ascend the throne. They were possessed of a third part * of all the land of Egypt. The sacerdotal function was confined to one tribe, and was transmitted unalienably from father to son. All the orientals, but more especially the Egyptians, delighted in mysterious and allegorical doctrines. Every maxim of morality, every tenet of theology, every dogma of philosophy, was wrapt up in a veil of allegory and mysticism. This propensity, no doubt, conspired with avarice and ambition to dispose them to a dark and mysterious system of religion. Besides, the Egyptians were a gloomy † race of men; they delighted in darkness and solitude. Their sacred rites were generally celebrated with melancholy airs, weeping, and lamentation. This gloomy and unsocial bias of mind must have stimulated them to a congenial mode of worship. In Egypt then we are to search for the origin of the mysteries. Both the nature of the institution and the genius of the people confirm this position; and historians, both ancient and modern, are agreed in admitting the certainty of the fact.

* *Diodor. Sicul.* lib. i.

† *Plutarch.*

12 The Osiris and Isis of Egypt the Bacchus and Ceres of Greece.

The Osiris of Egypt, every body knows, was the original Bacchus; as the Isis of the same country was the Ceres of the Greeks. The rites of Osiris were performed with loud shrieks and lamentations when he was put into the coffin; and with the most extravagant mirth, when he was in a manner raised from the dead, or supposed to be found again. Their hymns were upon the whole always composed in melancholy affecting strains; and consisted of lamentations for the loss of Osiris, the mystic flight of Bacchus, the wanderings of Isis, and the sufferings ‡ of the gods. The Canaanites, who were a kindred tribe of the Mizraim or Egyptians, imitated them in their sacred rites. At Byblus, Berytus, Sidon, and afterwards at Tyre, they used particularly mournful dirges for the death of Adonis or Tammuz §, who was the same with the Egyptian Osiris, i. e. the sun.

‡ *Plut. Is. et Osir.*

§ *Ezek.* chap. viii. *and Nonni Dionys.*

13 Death of Osiris and wanderings of Isis.

The Egyptians, then, naturally inclined to gloom and secrecy, instituted a mode of worship congenial with their natural disposition of mind. The recess of the sun towards the southern hemisphere, was the death * of Osiris; the wanderings of Isis in search of her husband and brother, allegorically imported the longing of the earth † for the return of the fructifying influences of the solar heat.

* *Macrob. Saturn.*

† *Plut. Is. et Osir.*

When that luminary returned towards the summer solstice, and grain, trees, fruits, herbs, and flowers adorned the face of nature, another festival was celebrated of a very different complexion from that of the former. In this season all Egypt was dissolved in the most extravagant mirth and jollity. During the celebration of those festivals, the priests formed allegorical representations of the sun and the earth (D). They personified the one and the other, and allegorized their motions, aspects, relations, sympathies, accesses, recesses, &c. into real adventures, peregrinations, sufferings, contests, battles, victories, defeats, and so forth. These, in process of time, were held up to the vulgar as real occurrences; and these in a few ages became the most essential articles of the popular creed. From this source were derived the conquests of Dionysus or Bacchus, so beautifully exhibited by Nonnus in his Dionysiacs;

(C) Principio hoc ego quidem controversia vacare, arbitror, mysteria quæ vocantur, ritus fuisse idcirco institutos ne memoria periret veterum beneficiorum, inventorum, fatorum rerum gestarum quibus primi populorum conditores, aut alii præclari homines, decus nomen, et famam, inter suos sibi comparaverant. Neque hæc cuiquam sententia mirabilis videri poterit. *Cud. Syst. Intellect. ed. Moshemii*, p. 329.

(D) Isis, among the Egyptians, sometimes signified the moon, and sometimes the earth.

Dionysiacs; the wanderings of Io, wonderfully adorned by Æschylus; and the labours of Hercules, afterwards usurped by the Greeks.

14 The Egyptians deified departed heroes.

Whether the Egyptians deified mortal men in the earliest ages has been much controverted. Jablonski † has taken much pains to prove the negative. Diodorus ‡ assures us, that they paid their monarchs a kind of divine adoration, even in their lifetime. Plutarch tells us plainly §, that some were of opinion that Isis, Osiris, Horus, Anubis, Typhon, were once mortal persons, who were exalted into demons after their death. The Sicilian, in his history of Isis and Osiris, Pan, Hermes, &c. plainly represents them as human personages; and informs us, that the Egyptians imagined, that after their decease they transmigrated into particular stars. From these authorities, we are inclined to believe that the Egyptians, as well as the other Pagans, did actually deify persons who had distinguished themselves in in their days of nature by prowess, wisdom, useful arts, and inventions. This was a constant practice among the Greeks, who probably learned it from the people in question.

† *Panth. Egypt.*
‡ Lib. i.
§ *Is. et Osir.*

15 Secrets respecting the objects of worship revealed in the mysteries.

The exploits of these heroes had been disguised by allegorical traditions and hieroglyphical representations. They had been magnified beyond all dimensions, in order to astonish and intimidate the vulgar. They had been interlarded with the most extravagant fables, in order to gratify their propensity towards the marvellous. All these secrets were developed in the mysteries. The catechumens (E) were informed of every particular relating to the birth, the life, the exploits, the adventures, the misfortunes, and decease of those heroic personages, and when, and by what means, they had attained to the high rank of divinities. At the same time we think it highly probable, that those demi-gods were represented in their state of exaltation and heavenly splendour. The magicians of Egypt were abundantly qualified for exhibiting *angels in machines*. The souls of virtuous men, who had not been eminent enough to merit the honour of deification, were shown in all the perfection of Elysian felicity; and perhaps the souls of tyrants, and of the children of (F) Typhon, were shown in Tartarus, suffering all the extremes of infernal punishment. From these exhibitions the mystagogues might naturally enough take occasion to read their pupils suitable lectures on the happy tendency of a virtuous conduct, and the dishonour and misery consequent upon a contrary course. They might set before them immortal renown, deification, and Elysium, on the one hand, and eternal infamy and misery on the other. This will probably be deemed the chief advantage accruing from this institution.

16 Chief advantage of the mysteries.

Besides the communications above mentioned, the catechumens were taught many secrets of physiology, or the nature of the phenomena of the world. This Pharnutus * every where affirms, especially in his last book towards the end. Plutarch too informs us, that many of the Greek philosophers were of opinion, that most of the Egyptian fables were allegorical details of physical operations. Eusebius acquaints us †, that the physiology, not only of the Greeks, but likewise of the barbarians, was nothing else but a kind of science of nature, a concealed and dark theology, involved in fable and fiction, whose hidden mysteries were so veiled over with enigmas and allegories, that the ignorant million were as little capable of comprehending what was said as what was suppressed in silence. This, says he, is apparent from the poems of Orpheus and the fables of the Phrygians and Egyptians. Dionysius of Halicarnassus likewise observes ‡, that the fables of the Greeks detail the operations of nature by allegories. Proclus § makes the same observation concerning the people in question. The Egyptians, says he, taught the latent operations of nature by fables.

* *De Nat. Deorum.*
† *Prop. Evangel.*
‡ *Antiq. Rom.*
§ *In Tim.*

17 Physiological secrets expounded in the mysteries of Egypt.

These physiological secrets were no doubt expounded to the initiated; and that the Egyptian priests were deeply skilled in physiological science, can scarce be questioned, if we believe that Jannes and Jambres rivalled Moses with their enchantments. The preceding detail comprehends all that was revealed to the Epoptæ in the original Egyptian mysteries. What articles might have been introduced afterwards we cannot pretend to determine.

Be that as it may, one thing is certain, namely, that the vulgar were excluded from all those choice secrets, which were carefully reserved for the nobility and sacerdotal tribes. To them it was given to know the mysteries of the kingdom of darkness; but to those who were without, all was mystery and parable. While the laity fed on husks, the clergy and the quality feasted on royal dainties. The priests who had devised these allegories understood their original import, and bequeathed it as an inestimable legacy to their children. Here then we have the primary object of the mysteries, namely, to develope to the initiated the original and rational import of those allegorical and mystical doctrines which were tendered to the uninitiated, wrapt up in impenetrable allegory and obscurity. To the former, these were communicated and explained: The latter were obliged to stand at an awful distance, and retire as the *Procul, O procul este profani*, thundered in their ears.

These allegorical traditions originated in Egypt, (See Mythology.) It was the general bias of the oriental genius. The Egyptians, however, according to the most authentic accounts (G), were the greatest proficients in that science. The original subject of these institutions were, we imagine, the articles we have specified above: but in process of time, according to the natural course of things, numerous improvements were made, and many new rites, ceremonies, usages, and even doctrines, were superinduced, which were utterly unknown to the original hierophants (H). Simplicity is, for

(E) Catechumens were pupils who were learning the elements of any science.

(F) Typhon was the evil genius, or devil, of the Egyptians.

(G) As early as the age of Joseph, the Egyptians were skilled in the interpretations of dreams, divinations, &c. and in the age of Moses they were become wise men, magicians, &c.

(H) Hierophant imports a priest employed in explaining the doctrines, rites, &c. communicated to the initiated.

for the moſt part, one of the diſtinguiſhing characters of a new inſtitution; but ſucceeding architects generally imagine that ſomething is ſtill wanting to complete the beauty, the regularity, the uniformity, the magnificence, and perhaps the conveniency of the ſtructure. Hence, at length, it comes to be ſo overloaded with adventitious drapery, that its primary elegance and ſymmetry are altogether defaced. This was the caſe with the earlieſt Egyptian myſteries. Their ſubject was at firſt ſimple and eaſy to be comprehended; in time it became complex, intricate, and unintelligible.

18 Temples where the myſteries were celebrated.

In order to celebrate thoſe myſteries with the greater ſecrecy, their temples were ſo conſtructed as to favour the artifice of the prieſts. The fanes, in which they uſed to execute their ſacred functions, and to perform the rites and ceremonies of their religion, were ſubterraneous apartments, conſtructed with ſuch wonderful ſkill and dexterity, that every thing that appeared in them breathed an air of ſolemn ſecrecy. Their walls were covered with hieroglyphic paintings and ſculpture, and the altar was ſituated in the centre of the apartment. Modern ‡ travellers have of late years diſcovered ſome veſtiges of them, and bear witneſs to the above deſcription of thoſe dark abodes (I). In thoſe ſubterraneous manſions, which the prieſts of that ingenious nation had planned with the moſt conſummate ſkill, the kings, princes, and great men of the ſtate, encountered the dangers and hardſhips contrived to prove their prudence, fortitude, patience, abſtinence, &c. Theſe were appointed to try their merit; and by theſe the hierophants were enabled to decide whether or not they were duly qualified for receiving that benefit. Upon theſe occaſions, we may believe, abundance of thoſe magical tricks were exhibited, for which the magicians of Egypt were ſo much celebrated among the ancients. The ſtrange and aſtoniſhing ſights, the alternate ſucceſſions of light and darkneſs, the hideous ſpectres expoſed to view, the frightful howlings reechoed by theſe infernal domes, the ſcenes of Tartarus and Elyſium, exhibited alternately and in quick ſucceſſion, muſt have made a deep and laſting impreſſion on the mind of the affrighted votary (K). Theſe ſcenes we ſhall deſcribe more fully in the ſequel.

‡ *Norden, Shaw, Pococke*, &c.

19 The Grecian infernal regions copied from the Egyptian myſteries.

From the ſcenes exhibited in celebrating the Egyptian myſteries, eſpecially thoſe of Iſis and Oſiris, the Greeks ſeem to have copied their ideas of the infernal regions, and the ſubterraneous manſions of departed ſouls. Many colonies of Egyptians ſettled in Greece. From theſe the ἀοιδοὶ (L), or moſt early bards of Greece, learned them imperfectly. Of courſe, we find Homer's account of the infernal regions, and of the ſtate of departed ſouls, lame and incoherent. Succeeding bards obtained more full and more diſtinct information. Euripides and Ariſtophanes ſeem to have paved the way for the prince of Roman poets. Plato † and ſome of the other philoſophers have ſhown by their deſcriptions or alluſions, that the whole apparatus of Tartarus and Elyſium had become a hackneyed topic ſome centuries before Virgil was born. This incomparable poet borrowed his ideas from Homer, Ariſtophanes, Euripides, Plato, &c. Theſe, under his plaſtic hand, in the ſixth Æneid, grew into a ſyſtem beautiful, regular, uniform, and conſiſtent. The materials he has employed were created to his hand; he had only to collect, poliſh, arrange, and connect them.—The ſentiments collected from the Platonic philoſophy, and the inimitable epiſode copied from the annals of Rome, by the maſterly ſkill which he has diſplayed in the application of them, form the chief excellencies of the piece. For the reſt, he could well diſpenſe with going to Eleuſis (M): every old woman in Athens and Rome could repeat them.

† *Phædo.*

20 Myſteries brought from Egypt into Perſia and Greece.

Egypt was then the native land of myſteries as well as of idolatry. Every god and goddeſs reſpectively had their myſteries; but as thoſe of Iſis and Oſiris were the moſt celebrated, they of courſe became principal objects of purſuit as well as of imitation to the neighbouring nations. Theſe, as is generally believed, were carried into Perſia by Zoroaſtres, or Zerduſht, by whom they were conſecrated to Mithras. On theſe we ſhall make ſome obſervations in the ſequel.—Orpheus imported them into Thrace; Cadmus brought them into Bœotia, where they were ſacred to Bacchus. Inachus eſtabliſhed them at Argos in honour of Juno, the ſame with Iſis (N); Cyniras in Cyprus, where they were dedicated to Venus. In Phrygia they were ſacred to Cybele, the mother of the gods.

Our learned readers, who will probably reflect that the Egyptians were in ancient times inhoſpitable to ſtrangers, will perhaps be ſurpriſed that this faſtidious and jealous people were ſo ready to communicate the arcana of their religion to foreigners.—But they will pleaſe recollect, that a great part of Greece was planted with colonies from Egypt, Phœnicia, Paleſtine, &c. This we could eaſily prove, did the bounds preſcribed us admit ſuch a digreſſion. Orpheus, if not an Egyptian, was at leaſt of oriental extraction. Inachus, Cadmus, and Melampus, are univerſally allowed to have been Egyptians. Erechtheus, in whoſe reign the Eleuſinian myſteries were eſtabliſhed, was an Egyptian by birth, or at leaſt ſprung from Egyptian anceſtors. The Egyptians, then, in thoſe early ages, did not view the Greeks in the light of aliens, but as a people nearly related either to themſelves or the Phœnicians, who were their brethren. Upon this connexion we imagine it was, that in later times moſt of the ſages of Greece,

---

(I) See an excellent deſcription of theſe ſubterraneous abodes, and of the proceſs of probation carried on there, in a French romance, entitled *The Life of Sethos*.

(K) Perſons who had deſcended into Trophonius's vault were ſaid to have been ſo terrified with ſhocking ſights, that they never laughed during the remainder of their lives.

(L) Theſe were ſtrolling poets like our minſtrels, who frequented the houſes of the great men of Greece, and entertained the company upon public occaſions with ſinging and tales of other times.

(M) Biſhop Warburton has, with much ingenuity, and a vaſt profuſion of reading, endeavoured to prove that Virgil borrowed the whole ſcenery of the ſixth Æneid from the ſources mentioned in the text.

(N) Iſis was the moon, and the original Juno was the ſame planet.

Greece, eſpecially of Athens, found ſo hoſpitable a reception among that people. They probably viewed them in the light of propagandi; apoſtles able and willing to diſſeminate their idolatrous rites. This obſervation, which might be ſupported by numberleſs authorities, did the nature of the preſent inquiry permit, will, we think, go a great way towards obviating the objection.

21 Myſteries of Mithras, Bacchus, and Ceres, the moſt auguſt.

Although, as has been obſerved, every particular deity had his own peculiar myſterious ſacred rites, yet of all others thoſe of Mithras, Bacchus (O), and Ceres, were deemed the moſt auguſt, and were moſt univerſally and moſt religiouſly celebrated. To theſe, therefore, we ſhall in a good meaſure confine ourſelves upon this occaſion. If our readers ſhall become intimately acquainted with theſe, they may readily diſpenſe with the knowledge of the reſt, which are, indeed, no more than ſtreams and emanations from theſe ſources. We ſhall then, in the firſt place, preſent to our readers a brief ſketch of the myſteries of Mithras.

MITHRAS, or, according to the Perſian, *Mihr*, was one of the great gods of the Aſiatics. His worſhip was for many ages confined to Perſia. Afterwards, however, it was propagated ſo far and wide, that ſome have imagined they had diſcovered veſtiges of it even in Gaul. *Mihr*, according to Dr Hyde †, ſignifies love, and likewiſe the *ſun*. If we might preſume to differ from ſo reſpectable an authority, we ſhould conjecture that it is a cognate of the Hebrew word *muthir*, "excellentia, præſtantia." That there was an analogy between the Hebrew and old Perſian, is generally admitted by the learned. Be that as it may, Mithras was the ſun (P) among the Perſians; and in honour of that luminary this inſtitution was eſtabliſhed. Mithras, according to Plutarch (Q), was the middle god between Oramaz and Ariman, the two ſupreme divinities of Perſia. But the fact is, the ſolar planet was the viſible emblem of Oramaz, the good genius of the Perſian tribes, and the ſame with the Oſiris of the Egyptians. From theſe people, ſome have imagined that Zoroaſtres (R), or Zerduſht, borrowed his myſteries of Mithras. To this opinion we cannot give our aſſent, becauſe the probationary trials to be undergone by the candidates among the former were much more ſavage and ſanguinary than among the latter.—Both, however, were inſtituted in honour of the ſame deity; and probably the ſcenes exhibited, and the information communicated in both, were analogous; a circumſtance which perhaps gave birth to the opinion above mentioned.

† *Relig. vet. Perſarum.*

22 Account of the myſteries of Mithras.

The grand feſtival of Mithras was celebrated ſix days, in the middle of the month Mihr (S). Upon theſe days, it was lawful for the kings of Perſia to get drunk and dance. On this feſtival, we imagine, the candidates for initiation, having duly proved their vocation, were ſolemnly admitted to the participation of the myſteries.

Zoroaſtres (T) worſhipped Mithras, or the Sun, in a certain natural cave, which he formed into a temple, and filled up in a manner exactly mathematical. There Mithras was repreſented as preſiding over the lower world with all the pomp of royal magnificence. In it too were ſeen the ſymbols of Mithras and of the world, philoſophically and mathematically exhibited, to be contemplated and worſhipped. This deity was ſometimes repreſented as mounted on a bull, which he is breaking, and which he kills with a ſword. On ſome bas reliefs ſtill exiſting, he appears as a young man with his tiara turned upward, after the manner of the Perſian kings. He is clothed with a ſhort tunic and breeches, after the Perſian faſhion. Sometimes he wears a ſmall cloak. By his ſides are ſeen other human figures, with tiaras of the ſame faſhion on their heads, but without cloaks. One of theſe figures commonly holds in his one hand a torch lifted up; in the other, one turned downward. Sometimes over the cave are ſeen the chariots of the ſun and moon, and divers conſtellations, ſuch as cancer, ſcorpio, &c.

23 Probationary exerciſes previous to initiation.

In one of thoſe caves the ceremonies of initiation were performed; but before the candidate could be admitted, he was forced to undergo a courſe of probationary exerciſes, ſo numerous and ſo rigorous, that very few had courage and fortitude enough to go through them. He was obliged to live a life of virtue and abſtinence for the ſpace of ſeven years previous to the period of his initiation. Some months before it, he was obliged to ſubmit to a long and auſtere faſt, which continued fifty days. He was to retire ſeveral days to a deep and dark dungeon, where he was ſucceſſively expoſed to all the extremes of heat and cold. Meantime he frequently underwent the baſtinado, which the prieſts applied without mercy. Some ſay this fuſtigation continued two whole days, and was repeated no leſs than 15 times. In the courſe of theſe probationary exerciſes, the candidate was generally reduced to a ſkeleton: and we are told, that there have been ſeveral inſtances of perſons who have periſhed in the attempt.

Upon the eve of the initiation, the aſpirant was obliged to † brace on his armour, in order to encounter

† *Jul. Firmicus.*

(O) Bacchus was the Oſiris of the Egyptians, and Ceres was the Iſis of the ſame people.

(P) Moſheim, in his notes on Cudworth's Intellectual Syſtem, page 330. has taken much pains to prove that Mithras was a deified mortal; but we cannot agree with that learned man in this point.

(Q) Iſis and Oſiris, page 369. l. 20. from the bottom. This philoſopher makes Zoroaſter, according to ſome, 5000 years prior to the Trojan war. This date is certainly extravagant. We cannot, however, agree, with ſome moderns, who make him contemporary with Darius Hyſtaſpes, the immediate ſucceſſor of Cambyſes, becauſe it contradicts all antiquity.

(R) M. Silohwette, Diſſer. v. page 17. aſſerts that Zoroaſtres was initiated among the Egyptians.

(S) The month Mehr began September 30. and ended October 30.

(T) See Dr Hyde de Rel. vet. Perſ. pages 16, 17. Mr Bryant's Anal. vol i. page 232. Porphyr. de Antro Nymph. page 254. This philoſopher often mentions the cave of Mithras, and always attributes the inſtitution of his rites to Zoroaſter.

ter giants and ſavage monſters. In thoſe ſpacious ſubterraneous manſions a mock hunting was exhibited. The prieſts and all the ſubordinate officers of the temple, transformed into lions, tygers, leopards, boars, wolves, and other ſavage creatures, aſſailed him with loud howlings, roaring, and yelling, and every inſtance of ferine fury. In thoſe mock combats, the hero was often in danger of being really worried, and always came off with bruiſes and wounds. Lampridius informs us, that when the emperor Commodus was initiated, he actually carried the joke too far, and butchered one of the prieſts who attacked him in the figure of a wild beaſt. The Perſians worſhipped Mithras or the Sun by a perpetual fire: hence the votary was obliged to undergo a fiery trial; that is, to paſs ſeven times through the ſacred fire, and each time to plunge himſelf into cold water. Some have made theſe probationary penances amount to 80: others have thought that they were in all only 8. As we find no good authority for either of theſe numbers, we think ourſelves at liberty to hazard the following conjecture: The number *ſeven* was deemed ſacred over all the eaſt. The Mithriac penances we imagine were either ſeven, or if they exceeded it, were regulated by ſeven repetitions of that number. The candidate having undergone all theſe torturing trials with becoming patience and fortitude, was declared a proper ſubject for initiation. But before his admiſſion he was obliged to bind himſelf by the moſt ſolemn oath, with horrible imprecations annexed, never to divulge any ſingle article of all that ſhould be communicated to him in the courſe of his initiation.

24 Oath of ſecrecy.

25 Revelations in the myſteries of Mithras.

What *αποῤῥητα* or *ineffable ſecrets* were imparted to the initiated, it is impoſſible at this diſtance of time to diſcover with any tolerable degree of certainty. We may, however, reſt aſſured, that the moſt authentic tradition concerning the origin of the univerſe; the nature, attributes, perfections, and operations, of Oromaſd; the baleful influences of Ariman; and the benign effects of the government of Mithras, were unfolded and inculcated. The ſecret phenomena of nature, as far as they had been diſcovered by the Magi, were likewiſe exhibited; and the application of their effects, to aſtoniſh and delude the vulgar, were taught both in theory and practice. The exerciſe of public and private virtues was warmly recommended; and vice repreſented in the moſt odious and frightful colours. Both theſe injunctions were, we may ſuppoſe, enforced by a diſplay of the pleaſures of Elyſium and the pains of Tartarus, as has been obſerved above in deſcribing the myſteries of the Egyptians.

Thoſe initiations are mentioned by Lampridius in the life of Commodus, and likewiſe by Juſtin † and Tertullian ‡, who both flouriſhed in the ſecond century. The laſt of theſe two ſpeaks of a kind of baptiſm, which waſhed from the ſouls of the initiated all the ſtains which they had contracted during the courſe of their lives prior to their initiation. He at the ſame time mentions a particular mark which was imprinted upon them (U), of an offering of bread, and an emblem of the reſurrection; which particulars, however, he does not deſcribe in detail. In that offering, which was accompanied with a certain form of prayer, a veſſel of water was offered up with the bread. The ſame father elſewhere informs us, that there was preſented to the initiated a crown ſuſpended on the point of a ſword; but that they were taught to ſay, *Mithras is my crown*. By this anſwer was intimated, that they looked upon the ſervice of that deity as their chief honour and ornament.

† *Dial. cum Tryphone.*
‡ *De præſcript. adver. Hæret.*

After that the Teletæ (X) were finiſhed, the pupil was brought out of the cave or temple, and with great ſolemnity proclaimed a lion of Mithras (Y); a title which imported ſtrength and intrepid courage in the ſervice of the deity. They were now conſecrated to the god, and were ſuppoſed to be under his immediate protection; an idea which of courſe animated them to the moſt daring and dangerous enterpriſes.

The worſhip of Mithras was introduced into the Roman empire towards the end of the republic, where it made very rapid progreſs. When Chriſtianity began to make a figure in the empire, the champions for paganiſm thought of propoſing to men the worſhip of this *power of benevolence*, in order to counterbalance or annihilate that worſhip which the Chriſtians paid to Jeſus Chriſt the true *Sun* of righteouſneſs. But this mode was ſoon aboliſhed, together with the other rites of paganiſm. The Perſian grandees often affected names compounded with Mithras; hence Mithridates, Mithrobarzanes, &c. Hence, too, the precious ſtone called *Mithridat* †, which by the reflection of the ſun ſparkled with a variety of colours. There is likewiſe a certain pearl of many different colours, which they call *Mithras*. It is found among the mountains near the Red ſea; and when expoſed to the ſun, it ſparkles with a variety of dyes. We find likewiſe a king of Egypt of that name, who reigned at Heliopolis; who being commanded in a dream to erect an obeliſk to the ſolar deity, reared a moſt prodigious one in the neighbourhood of that city.

† *Solinus*, cap. 10.

26 Mithras ſaid to have ſprung from a rock.

The votaries of Mithras pretended that he was ſprung from a rock, and that therefore the place where the myſterious ceremonies were communicated to the initiated was always a cave. Many different reaſons have been aſſigned for the origin of this rock-born deity, moſt of which appear to us unſatisfactory. If our readers will be obliging enough to accept of a ſimple and obvious conjecture, they may take the following: A

(U) In alluſion to this practice of imprinting a ſacred mark, probably on the forehead of the initiated, we find the injunction to the angel, Ezek. chap. ix. ver. 4. and the Revelation *paſſim*.

(X) The myſteries were called *Teletæ*, which imports, "the rites which confer perfection."

(Y) *Tertull. adv. Marc.* p. 55. The prieſts of Mithras were called the *lions of Mithras*, and his prieſteſſes *lioneſſes*; ſome ſay *hyænas*. The other inferior miniſters were called *eagles*, *hawks*, *ravens*, &c. and on their feſtivals they wore maſks correſponding to their titles, after the Egyptian manner, where the prieſts appeared at the ceremonies with maſks reſembling the heads of lions, apes, dogs, &c. a circumſtance which furniſhes a preſumption that the myſteries of Mithras were of Egyptian original.

A rock is the ſymbol of ſtrength and ſtability (z); the dominion of Mithras, in the opinion of his votaries, was firm as a rock, and ſtable as the everlaſting hills. If our readers ſhould not admit the probability of this conjecture, we would beg leave to remit them to the learned Mr Bryant's *Analyſis of Mythology*, where they will find this point diſcuſſed with deep reſearch and wonderful ingenuity. Whatever may have been the origin of this opinion with relation to the birth of Mithras, it is certain that ſome reverence to rocks and caves was kept up a long time even after the eſtabliſhment of Chriſtianity. Hence the prohibition given to ſome of the proſelytes to that religion, that they ſhould no more preſume to offer up their prayers *ad petras*, at the rocks (A).

We ſhall conclude our account of the myſteries of Mithras, with a paſſage from M. Anquetil, to whom we are ſo much indebted for what knowledge we have of the Perſian theology, and in which the functions of that deity are briefly and comprehenſively delineated. " The peculiar functions of Mithras are to fight continually againſt Ahriman and the impure army of evil genii, whoſe conſtant employment is to ſcatter terror and deſolation over the univerſe; to protect the frame of nature from the demons and their productions. For this purpoſe he is furniſhed with a thouſand ears and a thouſand eyes, and traverſes the ſpace between heaven and earth: his hands armed with a club or mace. Mithras gives to the earth light and ſun: he traces a courſe for the waters: he gives to men corn, paſtures, and children; to the world virtuous kings and warriors; maintains harmony upon earth, watches over the law," &c. As the hiſtory of Mithras, and the nature of his myſteries, are not generally known, we imagined it would be agreeable to many of our readers to have the moſt important articles relating to that ſubject laid before them as it were in detail.

27
Myſteries of Bacchus.

We now proceed to the orgia or myſteries of Bacchus, which we ſhall introduce with a brief hiſtory of that deity. The original Dionyſus or Bacchus was the Oſiris of the Egyptians, which laſt was the Sun (B). Whether there was an Egyptian monarch of that name, as Diodorus Siculus affirms §, has no manner of connexion with the preſent diſquiſition. The Greek name of that deity is plainly oriental, being compounded of *di*, " bright," and *naſta* or *naſa*, in the Æolic dialect *nuſa*, " a prince." This name was imported from the eaſt by Orpheus, Cadmus, or by whoever elſe communicated the worſhip of Oſiris to the Greeks. That the Dionyſus of the Greeks was the ſame with the Oſiris of the Egyptians, is univerſally allowed. Herodotus tells us expreſsly *, that *Oſiris* is *Dionyſus* in the Greek language: Martianus Capellus, quoted above, expreſſes the very ſame idea †. The original Oſiris was then the ſun; but the Dionyſus or Bacchus of the Greeks was the ſame with the Oſiris of the Egyptians; therefore the Bacchus or Dionyſus of the Greeks was likewiſe the ſame luminary.

§ Lib. i.

78
Bacchus the ſame with Oſiris.

* Lib. ii. cap. 144.
† *Theol. Egyp.* lib. ii. cap. 1.

The name *Oſiris* has much embarraſſed critics and etymologiſts. The learned Jablonſki ‡, inſtead of delineating the character, attributes, operations, adventures, exploits, and peculiar department aſſigned this deity by his votaries, has ſpent much of his pains on trying to inveſtigate the etymology of his name. If it be granted, which is highly probable, that the Hebrew and Egyptian tongues are cognate dialects, we ſhould imagine that it is actually the *Choſher* or *Oſhir* of the former language, which imports, " to make rich, to become rich." Indeed the words *Oſiris* and *Iſis* were not the vulgar names of the ſun and moon among the Egyptians, but only epithets importing their qualities. The name of the ſun among that people was *Phri* or *Phry*, and that of moon *Ioh*, whence the Greek *Io*. The term *Oſiris* was applied both to the ſun and to the river Nile; both which by their influence contributed reſpectively to enrich and fertilize the land of Egypt.

‡ *Panth. Egyp.*

It was a general cuſtom among the orientals to denominate their princes and great men from their gods, demigods, heroes, &c. When the former were advanced to divine honours, they were in proceſs of time confounded with their archetypes. The original divinities were forgotten, and theſe upſtart deities uſurped their place and prerogatives. In the earlieſt periods of the Egyptian monarchy, there appeared two illuſtrious perſonages, Oſiris and Iſis. Theſe were the children of Cronus; and being brother and ſiſter, they were joined in matrimony, according to the cuſtom of the Egyptians. As the brother and huſband had aſſumed the name of the *Sun*, ſo the ſiſter and conſort took that of *Iſis*, that is, " the woman §," a name which the Egyptians applied both to the moon and to the earth, in conſequence of the ſimilarity of their nature, their mutual ſympathy, and congenial fecundity.

§ *Horapollo, Cap.* 3.

29
Exploits of Oſiris.

Oſiris having left his conſort Iſis regent of the kingdom, with Hermes as her prime miniſter, and Hercules as general of her armies, quitted Egypt with a numerous body of troops, attended by companies of fauns (C), ſatyrs, ſinging women, muſicians, &c. and traverſed all Aſia to the eaſtern ocean. He then returned homeward through the Upper Aſia, Thrace, Pontus, Aſia Minor, Syria, and Paleſtine. Wherever he marched he conferred numberleſs benefits on the ſavage inhabitants. He taught the art of cultivating the ground, preſerving the fruits of the earth, and diſtinguiſhing the wholeſome and nutritive from the unwholeſome and poiſonous. He inſtructed them in the culture of the vine; and where vines could not be produced, he communicated to them the method of producing a fermented liquor from barley, very little inferior to wine itſelf. He built many cities in different parts

(Z) Our Saviour probably alludes to this emblem, when he talks of *building his church on a rock;* and adds, *that the gates of hell ſhould not prevail againſt it.*

(A) The Caledonian druids ſeem to have regarded certain ſtones with a ſuperſtitious veneration, in which the Catholics imitated them. There are in ſeveral places of Scotland large ſtones, which the vulgar call *lecre* ſtones, i. e. we imagine, *lecture*.

(B) See Macrob. lib. i. cap. 21. p. 247. bottom. Diogenes Laert. in proœmio, par. 10. Martian. Capel. lib. ii. Jablonſki, vol. i. lib. ii. 415. par. 3. Plut. Iſis et Oſir. *paſſim*.

(C) Men and women dreſſed in the habits of thoſe rural deities.

parts of the globe, planted numerous colonies (D), and wherever he directed his courſe inſtituted juſt and wholeſome laws, and eſtabliſhed the rites and ceremonies of religion, and left prieſts and catechiſts of his train to teach and inculcate the obſervance of them. In ſhort, he left everywhere laſting monuments of his progreſs, and at the ſame time of his generoſity and beneficence. Where he found the people docile and ſubmiſſive, he treated them with kindneſs and humanity: if any ſhowed themſelves obſtinate, he compelled them to ſubmit to his inſtitutions by force of arms.

At the end of three years, he returned to Egypt, where his brother Typhon, a wicked unnatural monſter, had been forming a conſpiracy againſt his life.

30 His death.

This traiterous deſign he ſoon after accompliſhed in the following manner: He invited Oſiris, with ſome other perſons whom he had gained over, to an entertainment. When the repaſt was finiſhed, he produced a beautiful coffer, highly finiſhed, and adorned with ſtuds of gold; promiſing to beſtow it on the perſon whom it ſhould fit beſt. Oſiris was tempted to make the experiment. The conſpirators nailed down the cover upon him, and threw the coffer into the river. This coffer, which was now become the coffin of Oſiris, was, they tell us, wafted by the winds and waves to the neighbourhood of Byblus, a city of Phœnicia, where it was caſt on ſhore, and left by the waves at the foot of a tamarind tree.

31 Wanderings of Iſis in ſearch of his body.

Iſis in the mean time, diſconſolate and forlorn, attended by Anubis, was ranſacking every quarter in ſearch of her beloved Oſiris. At length being informed by her faithful attendant and guardian, that his body was lodged ſomewhere in the neighbourhood of Byblus, ſhe repaired to that city. There, they ſay, ſhe was introduced to the queen, and after (E) a variety of adventures ſhe recovered the corpſe of her huſband, which, of courſe, ſhe carried back with her to Egypt: but the miſchievous Typhon, ever on the watch, found her on the banks of the Nile; and having robbed her of her charge, cut the body into 14 parts, and ſcattered them up and down. Now, once more, according to the fable, Iſis ſet out in queſt of thoſe parts, all of which, only one excepted, ſhe found, and interred in the place where ſhe found them; and hence the many tombs of Oſiris in that country. Theſe tombs were denominated *tapoſins* by the natives. Many other fabulous adventures were aſcribed to thoſe two perſonages, which it is not our province to enumerate at preſent. If our readers ſhould wiſh to be more minutely informed on this ſubject, they may have recourſe to the authors mentioned in the laſt quoted author, or to the learned Mr Bryant's Analyſis of Ancient Mythology, and M. Cour de Gebelin, where they will find matter enough to gratify their curioſity.

32 The myſteries of Iſis and Oſiris inſtituted in commemoration of thoſe adventures.

To commemorate thoſe adventures, the myſteries of Iſis and Oſiris were inſtituted; and from them both thoſe of Bacchus and Ceres, among the Greeks, were derived. Of the Egyptian ſolemnity, we have an exact epitome in one of the fathers of the church to the following purpoſe: "Here follows (ſays he) an epitome of the myſteries of Iſis and Oſiris. They deplore annually, with deep lamentations and ſhaved heads, the cataſtrophe of Oſiris over a buried ſtatue of that monarch. They beat their breaſts, mangle their arms, tear open the ſcars of their former wounds; that by annual lamentations the cataſtrophe of his miſerable and fatal death may be revived in their minds. When they have practiſed theſe things a certain number of days, then they pretend that they have found the remains of his mangled body; and having found them, their ſorrows are lulled aſleep, and they break out into immoderate joy." What maxims of morality, ſecrets of phyſiology, or phenomena of aſtronomy, were couched under this allegorical proceſs, is not our buſineſs to inveſtigate in this place. We ſhall only obſerve, that, in all probability, Oſiris and Iſis were ſovereigns of Egypt at a very early period; that they had conferred many ſignal benefits on their ſubjects, who, influenced by a ſenſe of gratitude, paid them divine honours after their deceaſe; that in proceſs of time they were confounded with the ſun and the moon; and that their adventures were at length magnified beyond all credibility, interlarded with fables and allegories, and employed in the myſteries as channels to convey a variety of inſtructions to the initiated.

33 Transferred to Byblus and Tyre, where Oſiris was called *Adonis* and *Bacchus*.

Be that as it may, it is certain that the very ſame mode of worſhip, was eſtabliſhed at Byblus, and in after ages transferred to Tyre. The Mizraim and Chanaanim were nearly connected by blood, and their religious ceremonies were derived from the very ſame ſource. By what medium the worſhip of Oſiris at Abydus and Tyre was connected, we ſhall leave to others to explain; we ſhall only obſerve, that among the Phœnicians this deity obtained the names *Adonis* and *Bacchus*. The former is rather an (F) epithet than a name: the latter is evidently an alluſion to the weeping and lamentation (G) with which the rites were performed. We find another name of that divinity mentioned in Scripture (H); but that term is plainly of Egyptian original: we ſhall now proceed to the myſteries of Oſiris as they were celebrated among the Greeks and Thracians, under the name of the *Orgia of Dionyſus* or *Bacchus* †.

Orpheus, the celebrated Thracian philoſopher, had travelled into Egypt in queſt of knowledge; and from that

† *Diod. Sicul. Voſſius de Idol.*

(D) Many have thought this expedition fabulous; but the numberleſs monuments of Egyptian architecture, ſculpture, and ſtatuary, lately diſcovered in the eaſt, confirm it.

(E) For the conqueſts and adventures of Oſiris and Iſis, we muſt ſend our learned readers to Diod. Sic. Bibl. l. i. and Plut. Iſis et Oſiris, p. 256. et ſeq. which we have been obliged to abridge, in conſequence of the narrow limits preſcribed us.

(F) Adonis is evidently the Hebrew *Adoni*, "my lord," and imports the ſovereignty of the deity.

(G) Bacchus is derived from the Phœnician word *bahah*, "to weep." This was the name embraced by the Romans.

(H) Ezek. chap. viii. ver. 14. *Tammuz* is the name of one of the months of the Egyptian year.

that country, according to the moſt authentic accounts, he imported the Bacchanalian rites and inſtitutions. Some have affirmed that this ſame Orpheus being intimately acquainted with the family of Cadmus, communicated theſe rites to them, and endeavoured to transfer them to the grandſon of that hero, which grandſon became afterwards the Grecian Bacchus. It is, however, we think much more probable, that thoſe rites were imported from Egypt or Phœnicia, by (I) Cadmus himſelf, who was a native of the former country, and is thought to have ſpent ſome time in the latter, before he emigrated in queſt of a ſettlement in Bœotia. It is ſaid that Semele, the daughter of Cadmus, and the mother of the Grecian Bacchus, was ſtruck with lightning at the very inſtant of his birth. The child was, in all probability, denominated *Bacchus* (K), from the ſorrow and lamentation this melancholy accident had occaſioned in the family. Cadmus, in order to conceal the diſhonour of his daughter, might, we imagine, convey away his infant grandſon to ſome of his relations in Phœnicia or Egypt. There he was educated and inſtructed in all the myſteries of Iſis and Oſiris, and at the ſame time initiated in all the magical or juggling tricks of the Egyptian prieſts and hierophants. Thus accompliſhed, when he arrived at manhood, he returned to Thebes with the traditional retinue of the original deity of the ſame name; and claimed divine honours accordingly. This claim, however, was not admitted without much oppoſition; Pentheus, another grandſon of Cadmus, was torn to pieces by the frantic Bacchanalians upon Mount Citheron, becauſe he attempted to interrupt them in celebrating the orgia. Some have thought that Cadmus loſt his kingdom for the ſame reaſon; but this we think is by no means probable: we ſhould rather imagine that the old prince was privy to the whole proceſs, and that it was originally planned by him, with a view to attract the veneration of his new ſubjects, by making them believe that there was a divinity in his family.

34 and thence imported by Cadmus into Bœotia.

35 The actions of Oſiris attributed to the Grecian Bacchus.

Be that as it may, the vain-glorious Greeks attributed all the actions of the Egyptian hero to their new Bacchus; and according to their laudable practice, engaged him in numberleſs adventures in which his prototype had no ſhare. Moſt of thoſe are futile and unentertaining (L). The Greeks commonly adopted ſome oriental perſonage as the hero of their mythological rhapſodies. Him they naturalized and adopted into ſome Grecian family, and ſo he became their own. To him they aſcribed all the adventures and exploits of the oriental archetype from whom he was copied. Conſequently in the orgia (M), every thing was collected that had been imported from the eaſt relating to Oſiris; and to that farrago was joined all that the Grecian rhapſodiſts had thought fit to invent, in order to amuſe the credulous multitude. This, however, was not the whole of the misfortune: The adventures of Oſiris were deſcribed by the Egyptian hierophants, veiled with allegorical and hieroglyphical myſteries. Theſe the perſons who imported them into Greece did not thoroughly comprehend, or if they did, they were not inclined to communicate them ſound and unſophiſticated. Beſides, many oriental terms were retained, the import of which was in proceſs of time loſt or diſtorted. Hence the religious ceremonies of the Greeks became a medley of inconſiſtencies. The myſteries of Bacchus, in particular, were deeply tinctured with this meretricious colouring; the adventures of the Theban pretender were grafted upon thoſe of the Egyptian archetype, and out of this combination was formed a tiſſue of adventures diſgraceful to human nature, abſurd, and inconſiſtent. Indeed the younger or Theban Bacchus ſeems to have been a monſter of debauchery; whereas the Egyptian is repreſented as a perſon of an oppoſite character. Of courſe the myſteries of the former were attended with the moſt ſhocking abominations.

These myſteries, as has been obſerved above, were firſt celebrated at Thebes the capital of Bœotia, under the auſpices of the family of Cadmus. From this country they gradually found their way into Greece, and all the neighbouring parts of Europe. They were celebrated once every three years (N), becauſe at the end of three years Oſiris returned from his Indian expedition. As the Greeks had impudently transferred the actions of the Egyptian hero to their upſtart divinity, the ſame period of time was obſerved for the celebration of thoſe rites in Greece that had been ordained for the ſame purpoſe in Egypt. 36

36 Myſteries of Bacchus ſpread into Greece, &c.

When the day appointed for the celebration of the orgia (O) approached, the prieſts iſſued a proclamation, enjoining all the initiated to equip themſelves according to the ritual, and attend the proceſſion on the 37

37 Proceſs of their celebration.

(I) Cadmus and Melampus, who were both Egyptians, introduced the Bacchanalia into Greece. The Egyptian or oriental name of Bacchus was *Dinuſi*, that is, "the prince of light." Cadmus had learned the name *Bacchus* from the Phœnicians.

(K) We have omitted the immenſe farrago of fable relating to the connexion between Jupiter and Semele as of little importance to our readers.

(L) Nonnus, an Egyptian of Pentapolis, has collected all the fabulous adventures of Bacchus, and exhibited them in a beautiful but irregular poem: To this we muſt refer our learned readers. Of the Dionyſiacs we have a moſt judicious ſketch, *Geblin. Calend.* p. 553. et ſeq.

(M) The orgia belonged to all the Mydones, but to thoſe of Bacchus in a peculiar manner.

(N) Hence theſe orgia were called *Triteria*.

(O) According to Clem. Alexand. Cohort. page 12. Pott. the word *orgia* is derived from *orge*, which ſignifies "anger," and originated from the reſentment of Ceres againſt Jupiter, in conſequence of a moſt outrageous inſult he had offered her with ſucceſs. We ſhould rather imagine it derived from the Hebrew word *argoz*, ſignifying a "cheſt or coffer," alluding to the caſket which contained the ſacred ſymbols of the god.—The Egyptians or Phœnicians might write and pronounce, argoz, *orgoz*, or in ſome manner nearly reſembling *orgia*.

the day appointed. The votaries were to drefs themfelves in coats of deer-fkins, to loofe the fillets of their hair, to cover their legs with the fame ftuff with their coats, and to arm themfelves with thyrfi, which were a kind of fpears wholly of wood entwined with leaves and twigs of the vine or ivy. It is faid that the Bacchanalians, efpecially the Thracians, ufed often to quarrel and commit murder in their drunken revels; and that in order to prevent thofe unlucky accidents, a law was enacted, that the votaries, inftead of real fpears, fhould arm themfelves with thofe fham weapons which were comparatively inoffenfive. The ftatue of the deity, which was always covered with vine or ivy leaves, was now taken down from its pedeftal, and elevated on the fhoulders of the priefts. The cavalcade then proceeded nearly in the following manner:

Firft of all, hymns were chanted in honour of Bacchus, who was called the *Power of dances, fmiles, and jefts;* while at the fame time he was deemed equally qualified for the exploits of war and heroifm. Horace, in fome of his dithyrambic odes, has concifely pointed out the fubjects of thofe Bacchanalian fongs. In the collection of hymns fabuloufly attributed to Orpheus, we find feveral addreffed to this deity (P), each under a different title, derived from the different appellations of the god. All thefe names are of oriental original, and might eafily be explained, did the bounds prefcribed us admit of etymological difquifitions.

The hymn being finifhed, the firft divifion of the votaries proceeded, carrying a pitcher of wine, with a bunch of the vine. Then followed the he-goat; an animal odious to Bacchus, becaufe he ravages the vines. The chanting the hymns, the facrificing the he-goat, and the revels, games, and diverfions, with which the celebration of thofe rites was attended, gave birth to the dramatic poetry of the Greeks; as the perfons habited in the drefs of Fauns, Sylvans, and Satyrs (Q), furnifhed the name of another fpecies of poetry of a coarfer and more forbidding afpect.

38 The myfterious coffer, with its contents.

Then appeared the myfterious coffer or bafket, containing the fecret fymbols of the deity. Thefe were the phallus (R), fome grains of fefama, heads of poppies, pomegranates, dry ftems, cakes baked of the meal of different kinds of corn, falt, carded wool, rolls of honey, and cheefe; a child, a ferpent (S), and a van (T). Such was the furniture of the facred coffer carried in the folemn Bacchanalian proceffion. The inventory given by fome of the fathers ‡ of the church is fomewhat different. They mention the dye, the ball, the top, the wheel, the apples, the looking-glafs, and the fleece. The articles firft mentioned feem to have been of Egyptian original; the laft were certainly fuperinduced by the Greeks, in allufion to his being murdered and torn in pieces when he was a child by the machinations of Juno, who prevailed with the Titans to commit the horrid deed. Thefe laft feem to have been memorials of his boyifh playthings; for, fays Maternus, "the Cretans §, in celebrating the rites of the child Bacchus, acted every thing that the dying boy either faid, or did, or fuffered. They likewife (fays he) tore a live bull in pieces with their teeth, in order to commemorate the difmembering of the boy." For our part, we think, that if fuch a beaftly rite was practifed, it was done in commemoration of the favage manner of life which had prevailed among men prior to the more humane diet invented and introduced by Ifis and Ofiris. Be that as it may, we learn from Porphyry *, that in the ifland of Chios they ufed to facrifice a man to Bacchus, and that they ufed to mangle and tear him limb from limb. This was no doubt practifed in commemoration of the cataftrophe mentioned above.

‡ *Clem. Alexand.*

§ *De Errore Prof. Gent.*

39 Human facrifices.

* *De Abftinentia.*

The orgia of this Pagan god were originally fimple enough; but this unfophifticated mode was of no long continuance, for riches foon introduced luxury, which quickly infected even the ceremonies of religion. On the day fet apart for this folemnity, men and women crowned with ivy, their hair difhevelled, and their bodies almoft naked, ran about the ftreets, roaring aloud *Evohe* (U) Bacche. In this rout were to be feen people intoxicated at once with wine and enthufiafm, dreffed like Satyrs, Fauns, and Sileni, in fuch fcandalous poftures and attitudes, with fo little regard to modefty and even common decency, that we are perfuaded our readers will readily enough forgive our omitting to defcribe them. Next followed a company mounted upon affes, attended by Fauns, Bacchanals, Thyades, Mimallonides, Naiads, Tityri, &c. who made the adjacent places echo to their frantic fhrieks and howlings. After this tumultuous herd were carried the ftatues of Victory

40 Total contempt of decency.

(P) Thefe ftand between the 41 and 52; one to Lenæus, or the preffer; one to Libnites, or the winnower; one to Beffareus, or the vintager; one to Sabazius the god of reft; to Myfes, or the Mediator, &c.

(Q) Dacier, Cafaubon, and other French critics, have puzzled and perplexed themfelves to little purpofe about the origin of this word, without confidering that it was coeval to dramatic poetry.

(R) The phallus was highly refpected by the Egyptians, and was ufed as the emblem of the fecundity of the human race.

(S) That reptile was in high veneration among the Egyptians. See Eufeb. Præp. Evang. lib. i. pag. 26. Steph. where we have a minute detail of the fymbolical properties of that creature, according to Taautos the great legiflator of that people.

(T) Servius in Georg. I. Virg. ver. 166. Myftica *vannus* Iacchi. The van, fays he, is an emblem of that purifying influence of the myfteries, by which the initiated were cleanfed from all their former pollutions, and qualified for commencing a holy courfe of life.

(U) Clem. Alexand. Cohort. pag. 11. Pott. derives this word from *Cheveh*, the mother of mankind, who, firft opened the gate to that and every other error; but we are rather inclined to believe that it comes from the oriental word *Hevé*, which fignifies a "ferpent;" which among the Egyptians was facred to the fun, and was likewife the emblem of life and immortality. It then imported a prayer to Bacchus for life, vigour, health, and every other bleffing.

Victory and altars in form of vine-sets, crowned with ivy, smoking with incense and other aromatics. Then appeared several chariots loaded with thyrsi, arms, garlands, casks, pitchers, and other vases, tripods, and vans. The chariots were followed by young virgins of quality, who carried the baskets and little boxes, which in general contained the mysterious articles above enumerated. These, from their office, were called *cistophoræ*. The phallophori (x) followed them, with a chorus of itophallophori habited like Fauns, counterfeiting drunk persons, singing in honour of Bacchus songs and catches suited to the occasion. The procession was closed by a troop of Bacchanalians crowned with ivy, interwoven with branches of yew and with serpents §. Upon some occasions, at those scandalous festivals, naked women whipped themselves, and tore their skin in a most barbarous manner. The procession terminated on Mount Citheron, when it set out from Thebes; and in other places, in some distant unfrequented desert, where the votaries practised every species of debauchery with secrecy and impunity. Orpheus saw the degeneracy of those ceremonies; and in endeavouring to reform them he probably lost his life. Pentheus suffered in the like attempt, being torn in pieces by the Bacchanalians on Mount Citheron, among whom were his own mother and his aunts. The Greeks, who were an airy jovial people, seem to have paid little regard to the plaintive part of the orgia; or rather, we believe, they acted with howling and frantic exclamations, often enhanced by a combination of drunkenness, ecstacy, and enthusiastic fury.

§ *Ovid. Met.*

What secrets, religious, moral, political, or physical, were communicated to the votaries, it is impossible to determine with any degree of certainty.—

41 Doctrines inculcated in the orgia.

One thing we may admit, namely, that the doctrines discovered and inculcated in the orgia, were originally the very same which the apostles of the sect had imbibed in Egypt and Phœnicia; and of which we have given a brief account near the beginning of this article. It is, however, probable, that the spurious or Theban Bacchus had superadded a great deal of his own invention, which, we may believe, was not altogether so sound and salubrious as the original doctrine. However that may be, the initiated were made to believe that they were to derive wonderful advantages from the participation of those rites, both in this life and that which is to come. Of this, however, we shall talk more at length by and bye, in our account of the Eleusinian mysteries.

To detail the etymology of the names of this Pagan deity, the fables relating to his birth, his education, his transformations, his wars, peregrinations, adventures, the various and multiform rites with which he was worshipped, would swell this article to a most immoderate size. If any of our readers should wish to be more minutely and more accurately acquainted with this subject, we must beg leave to remit them to Diod. Sic. Apollod. Bibl. Euripid. Bacchæ, Aristophanis Ranæ, Nonn. Dionys.; and among the moderns, to Ban. Mythol. Voss. de Orig. Idol. Monf. Fourmont, Reflexions sur l'origine des anciens peuples, Mr Bryant's Analys. and especially to Monf. Cour de Gebelin, Calendries ou Almanach. That prince of etymologists, in his account of the festival of Bacchus, has given a most acute and ingenious explication of the names and epithets of that deity. For our part, we have endeavoured to collect and exhibit such as we judged most important, most entertaining, and most instructive, to the less enlightened classes of our readers.

42 Eleusinian mysteries instituted in honour of Ceres.

We now proceed to the Eleusinian mysteries, which, among the ancient Greeks and Romans, were treated with a superior degree of awe and veneration. These were instituted in honour of Ceres, the goddess of corn; who, according to the most authentic accounts, was the Isis of the Egyptians. The mysteries of Osiris and Isis have been hinted at in the preceding part of this article. They were originally instituted in honour of the sun and moon, and afterwards consecrated to an Egyptian prince and princess; who, in consequence of their merits, had been deified by that people. We know of no more exact and brilliant description of the ceremonies of that goddess, in the most polished ages of the Egyptian superstition, than what we meet with in the witty and florid Apuleius †, to which we must take the liberty to refer our more curious readers. Our business at present shall be to try to investigate by what means, and upon what occasion, those mysteries were introduced into Attica, and established at Eleusis. A passage from Diodorus Siculus §, which we shall here translate, will, we think, throw no inconsiderable light on that abstruse part of the subject.

† Lib. ix.

§ Lib. i.

"In like manner with him (Cecrops), says that judicious historian, they tell us, that Erectheus, a prince of Egyptian extraction, once reigned at Athens. Of this fact they produce the following evidence: A scorching drought, during the reign of this prince, prevailed over almost all the habitable world, except Egypt; which, in consequence of the humidity of its soil, was not affected by that calamity. The fruits of the earth were burnt up; and at the same time multitudes of people perished by famine. Erectheus, upon this occasion, as he was connected with Egypt, imported a vast quantity of grain from that country to Athens. The people, who had been relieved by his munificence, unanimously elected him king. Being invested with the government, he taught his subjects the mysteries of Ceres at Eleusis, and the mode of celebrating the sacred ceremonies, having transferred from Egypt the ritual for that purpose. In those times the goddess is said to have made her appearance at Athens three several times; because, according to tradition, the fruits of the earth which bear her name were then imported into Attica. On this account the seeds and fruits of the earth were said to be the invention of that deity. Now the Athenians themselves acknowledge, that, in the reign of Erectheus, the fruits of the earth having perished for want of rain, the arrival of Ceres in their country did actually happen, and that along with her the blessing of corn

43 On what occasion introduced into Attica.

(x) The phallus was the symbol of the fructifying power of Nature. The itophallus was the type of that power in act.

corn was reſtored to the earth. They tell us at the ſame time, that the teletæ and the myſteries of that goddeſs were then received and inſtituted at Eleuſis."

Here then we have the whole myſtery of the arrival of Ceres in Attica, and the inſtitution of her myſteries at Eleuſis, unveiled. The whole is evidently an oriental allegory. The fruits of the earth had been deſtroyed by a long courſe of drought: Egypt, by its peculiar ſituation, had been preſerved from that dreadful calamity. Erectheus, in conſequence of his relation to the Egyptians, imported from their country a quantity of grain, not only ſufficient for the conſumption of his own ſubjects, but alſo a great overplus to export to other parts of Greece, Sicily, Italy, Spain, &c. Triptolemus, another Egyptian, was appointed by Erectheus to export this ſuperfluous ſtore. That hero, according to Pherecydes, was the ſon of Oceanus and Tellus, that is, of the ſea and the earth; becauſe his parents were not known, and becauſe he came to Eleuſis by ſea. The ſhip in which he ſailed, when he diſtributed his corn to the weſtern parts of the world, was decorated with the figure of a winged dragon: therefore, in the allegorical ſtyle of his country, he was ſaid to be wafted through the air in a chariot drawn by dragons. Thoſe creatures, every body knows, were held ſacred by the Egyptians.

Wherever Triptolemus diſpoſed of his corn, thither were extended the wanderings of Ceres. In order to elucidate this point, we muſt obſerve, that along with the grain imported from Egypt, Erectheus, or Triptolemus, or both, tranſported into Attica a cargo of prieſts and prieſteſſes from the temples of Buſiris, a city which lay in the * centre of the Delta, where the goddeſs Iſis had a number of chapels erected for her worſhip. The preſidents of theſe ceremonies, like all other bigots, gladly laid hold on this opportunity of propagating their religious rites, and diſſeminating the worſhip of the deities of their country. That the Egyptian prieſts were zealous in propagating the dogmas of their ſuperſtition, is abundantly evident from the extenſive ſpreading of their rites and ceremonies over almoſt all Aſia and a conſiderable part of Europe. The Greek and Roman idolatry is known to have originated from them; and numberleſs monuments of their impious worſhip are ſtill extant in Perſia ‡, India, Japan, Tartary, &c. Our inference then is, that the worſhip of Iſis was introduced into every country where Triptolemus ſold or diſpoſed of his commodities.—Hence the wanderings of Ceres in ſearch of her daughter Proſerpine who is generally called *Core*. The famine occaſioned by the drought deſtroying the fruits of the ground, imports the loſs of Proſerpine. The reſtoration of the corn in various parts of the earth, by freſh ſupplies from Egypt from time to time, imports the wanderings of Ceres in queſt of Proſerpine. The whole proceſs is an oriental allegory. The diſappearing of the fruits of the earth, of which Proſerpine, or Perſephone †, or Pereſephone (Y), is the emblem, is the allegorical rape of that goddeſs. She was ſeized and carried off by Pluto, ſovereign of the infernal regions. The ſeed committed to the earth in that dry ſeaſon appeared no more, and was, conſequently, ſaid to dwell under ground with Pluto. It was then that Ceres, that is, corn imported from Egypt, ſet out in queſt of her daughter. Again, When the earth recovered her priſtine fertility, the Core, or maid, was found by her mother Ceres, that is, the earth; for Iſis, among the Egyptians, frequently ſignified the earth. The wanderings of Iſis in ſearch of Oſiris furniſhed the model for the peregrinations of Ceres.

* *Herod.* lib. i.

‡ *Aſiatic Reſearches*, vol. i. and ii.

† *Plutarch, Iſis et Oſir.*

44 Different names of Ceres.

Ceres, the Roman name of the goddeſs of corn, was unknown to the modern Greeks. They always denominated her *Damater* (Z), which is rather an epithet than a proper name. The Greeks, who always affected to paſs for originals, we think, ſuppreſſed the Egyptian name on purpoſe, to conceal the country of that deity. As a proof of the probability of this conjecture, it may be obſerved, that they metamorphoſed the wanderings of Iſis in ſearch of Oſiris into the peregrinations of Ceres in queſt of Proſerpine. The Romans who were leſs ambitious of the character of originality, retained one of her oriental names (AA.) Ceres, ſays Diodorus, appeared thrice in Attica during the reign of Erectheus; which ſeems to import, that fleets loaded with corn had thrice arrived in that country from Egypt during that period.

45 Contentions at Athens reſpecting Minerva and Neptune, the immediate cauſe of fixing the myſteries at Eleuſis.

Cecrops, the firſt king of Attica, had eſtabliſhed the worſhip of the Saitic Athena or Minerva in that region, and conſecrated his capital to that deity. Erectheus, in his turn, introduced the worſhip of Iſis, or Damater, who in all appearance was the tutelar deity of Buſiris his native city. The ſubjects of Cecrops were a colony of Saites, and readily embraced the worſhip of Minerva; but the aborigines of that diſtrict being accuſtomed to a maritime, perhaps to a piratical, courſe of life, were more inclined to conſecrate their city to Neptune the god of the ſea, and to conſtitute him their guardian and protector. Cecrops by a ſtratagem ſecured the preference to Minerva his favourite divinity. Erectheus, in order to give equal importance to his patroneſs,

(Y) This word ſeems to be formed of two Hebrew terms, *pheri* "fruit," and *tzaphon*, or *tzephon*, "abſcondit, recondidit."

(Z) Damater is compounded of the Chaldaic particle *da* "the," and *mater* "mother." As Iſis often ſignified the earth, the Greeks naturally adopted that title; becauſe, according to them, that element is the mother of all living. In the very ſame manner they diſcarded the word *Juno*, an original title of the moon, and ſubſtituted *Hera*, which intimates "miſtreſs or lady."

(AA) According to ſome of the Latin etymologiſts, *Ceres*, or rather *Geres*, is derived from *gero* "to bear, to carry," becauſe the earth bears all things; or becauſe that element is the general fruit-bearer. But as this term came to Italy immediately from the eaſt, and not by the medium of Greece, we would rather incline to adopt an oriental etymology. The Hebrew word *cheres* ſignifies *arare* "to plow;" a name naturally applicable to the goddeſs of huſbandry.

patroneſs, had the addreſs to inſtitute the Eleuſinian myſteries; and to accompliſh his deſign laid hold on the opportunity above mentioned.

This appears to us the moſt probable account of the origin and inſtitution of the Eleuſinian myſteries; for which the Sicilian hiſtorian has indeed furniſhed the clue. We ſhall now proceed to detail ſome other circumſtances which attended the original inſtitution of theſe far-famed ceremonies.

† *Apollod. Bibl.* lib. iii. cap. 13.

46 Circumſtances attending the firſt appearance of Ceres in Attica.

The archprieſteſs who perſonated the newly imported deity was entertained by one Celeus †, who was either viceroy of that petty diſtrict of which Eleuſis was the capital, or ſome conſiderable perſonage in that city or its neighbourhood. Upon her immediate arrival, according to the fabulous relations of the Greeks, a farce was acted not altogether ſuitable to the character of a goddeſs whoſe myſteries were one day to be deemed ſo ſacred and auſtere. Theſe coarſe receptions, and other indecencies attending the firſt appearance of the goddeſs, that is, the Egyptian dame who aſſumed her character, were copied from the like unhallowed modes of behaviour practiſed on occaſion of the ſolemn proceſſions of her native country. Theſe ſcommata, or coarſe jokes, had an allegorical ſignification in Egypt; and among the moſt ancient Greeks the very ſame ſpirit was univerſally diffuſed by the oriental coloniſts who from time to time arrived and ſettled among them. In proceſs of time they abandoned the figurative and allegorical ſtyle, in conſequence of their acquaintance with philoſophy and abſtract reaſoning. In the ceremonies of religion, however, the ſame allegorical and typical repreſentations which had been imported from the eaſt were retained; but the Grecian hierophants in a ſhort time loſt every idea of their latent import, and religious, moral, or phyſical interpretation. Accordingly, this ſhameful rencounter between Ceres and Banbo (BB), or Jambe, was retained in the myſteries, though we think it was copied from Egypt, as was ſaid above, where even that obſcene action was probably an allegorical repreſentation of ſomething very different from what appeared to the Greeks.

At the ſame time that Ceres arrived in Attica, Bacchus likewiſe made his appearance in that country. He was entertained by one Icarus; whom, as a reward for his hoſpitality, he inſtructed in the art of cultivating the vine, and the method of manufacturing wine. Thus it appears that both agriculture and the art of managing the vintage were introduced into Athens much about the ſame time. Ceres was no other than a prieſteſs of Iſis; Bacchus was no doubt a prieſt of Oſiris. The arrival of thoſe two perſonages from Egypt, with a number of inferior prieſts in their train, produced a memorable revolution in Athens, both with reſpect to life, manners, and religion. The ſacred rites of Iſis, afterwards ſo famous under the name of the Eleuſinian myſteries, date their inſtitution from this period.

47 Ceres and Bacchus, who they were.

When this company of propagandi arrived at Eleuſis, they were entertained by ſome of the moſt reſpectable perſons who then inhabited that diſtrict. Their names, according to Clem. Alexand. were Banbo, Dyſaulis, Triptolemus, Eumolpus, and Eubulus. From Eumolpus were deſcended a race of prieſts called Eumolpidæ, who figured at Athens many ages after. Triptolemus was an ox herd, Eumolpus a ſhepherd, and Eubulus a ſwine herd. Theſe were the firſt apoſtles of the Eleuſinian myſteries. They were inſtructed by the Egyptian miſſionaries; and they, in their turn inſtructed their ſucceſſors. Erechtheus, or, as ſome ſay, Pandion, countenanced the ſeminary, and built a ſmall temple for its accommodation in Eleuſis, a city of Attica, a few miles weſt from Athens, and originally one of the twelve diſtricts into which that territory was divided. Here then we have arrived at the ſcene of thoſe renowned myſteries, which for the ſpace of near 2000 years were the pride of Athens and the wonder of the world.

The myſteries were divided into the greater and leſſer. The latter were celebrated at Agræ, a ſmall town on the river Ilyſſus: the former were celebrated in the month which the Athenians called Boedromion (CC); the latter in the month Antheſterion (DD). The leſſer myſteries, according to the fabulous legends of the Greeks, were inſtituted in favour of the celebrated Hercules. That hero being commanded by Euryſtheus to bring up Cerberus from the infernal regions, was deſirous of being initiated in the Eleuſinian myſteries before he engaged in that perilous undertaking. He addreſſed himſelf to Eumolpus the hierophant for that purpoſe. There was a law among the Eleuſinians prohibiting the initiation of foreigners. The prieſt not daring to refuſe the benefit to Hercules, who was both a friend and benefactor to the Athenians, adviſed the hero to get himſelf adopted by a native of the place, and ſo to elude the force of the law. He was accordingly adopted by one Pyolius, and ſo was initiated in the leſſer myſteries, which were inſtituted for the firſt time upon that occaſion. This account has all the air of a fable. The leſſer myſteries were inſtituted by way of preparation for the greater.

48 Eleuſinian myſteries divided into greater and leſſer.

The perſon who was to be initiated in the leſſer myſteries, as well as in the greater, was obliged to practiſe the virtue of chaſtity a conſiderable time before his admiſſion. Beſides, he was to bind himſelf by the moſt ſolemn vows not to divulge any part of the myſteries. At the ſame time, he was, according to the original inſtitution, to be a perſon of unblemiſhed moral character. Theſe were preliminaries indiſpenſably neceſſary in order to his admiſſion. A bull was ſacrificed to Jupiter, and the hide of that animal, called by a peculiar name (Διος Κωδιον) was carefully preſerved and carried to Eleuſis, where it was ſpread under the feet of the initiated. The candidate was then purified by bathing in the river Ilyſſus, by aſperſions with ſalt water or ſalt, with laurel, barley, and paſſing through

49 Auſterities and rites previous to initiation

(BB) Apollod. Bib. ubi ſupra. Clem. Alexand. Cohort. page 17. where the ſtory is told with very little reſerve.

(CC) The third month of the Athenian year, anſwering to our September.

(DD) The eighth month, anſwering to our February; but Meurſius makes it November.

through the fire: all which rites were attended with incantations and other usages equally insignificant and ridiculous. Last of all, a young sow was sacrificed to Ceres; and this animal, according to the ritual, behoved to be with pigs; and before it was killed it was to be washed in Cantharus, one of the three harbours which formed the Piræus.

50 into the lesser mysteries; of which

All these ceremonies duly performed, the candidate was carried into the hall appointed for the purpose of initiation. There he was taught the first elements of those arcana which were afterwards to be more fully and more clearly revealed in the more august mysteries of Eleusis. The pupils at Agræ were called *Mystæ*, which may intimate probationers; whereas those of Eleusis were denominated *Epoptæ*, importing that they saw as they were seen.

51 there were several stages, with long intervals between them.

The lesser mysteries were divided into several stages, and candidates were admitted to them according to their quality and capacity respectively. Those who were initiated in the lowest were obliged to wait five years before they were admitted to the greater. Those who had partaken of the second kind underwent a noviciate of three years; those who had been admitted to the third, one of two years; and those who had gone through the fourth were admitted to the greater at the end of one year; which was the shortest period of probation a candidate for that honour could legally undergo. Such was the process generally observed in administering the lesser mysteries.

52 None but natives of Athens originally admitted to the greater mysteries.

With respect to the greater mysteries, it is probable that originally none but the natives of Attica were admitted to partake of them. In process of time, however, the pale was extended so far and wide as to comprehend all who spoke the Greek language. All foreigners were debarred from those sacred rites. They tell us, however, that Hercules, Bacchus, Castor and Pollux, Æsculapius, and Hippocrates, were initiated in an extraordinary manner, from a regard to their high character and heroic exploits. All barbarians, too, were excluded; yet Anacharsis the Scythian was indulged that privilege, in consequence of his reputation for science and philosophy. All persons guilty of manslaughter, though even accidentally or involuntarily, all magicians, enchanters; in a word, all impious and profane persons, were expressly prohibited the benefit of this Pagan sacrament. At last, however, the gate became wider, and crowds of people, of all nations, kindreds, and languages, provided their character was fair and irreproachable, rushed in by it. In process of time the Athenians initiated even their infants; but this, we imagine, must have been a kind of lustration or purification, from which it was supposed that they derived a kind of moral ablution from vice, and were thought to be under the peculiar protection of the goddess.

53 Celebration lasted nine days; but

The celebration of the mysteries began on the 15th day of the month Boedromion; and, according to most ancient authors, lasted nine days. Meursius has enumerated the transactions of each day, which are much too numerous to fall within the compass of this article; we must therefore refer our curious reader to the author just mentioned. Some days before the commencement of the festival, the præcones, or public criers, invited all the initiated, and all the pretenders to that honour, to attend the festival, with clean hands and a pure heart, and the knowledge of the Greek language.

On the evening of the 15th day of the month called *Boedromion* the initiations commenced. Our readers will observe, that all the most sacred and solemn rites of the Pagan superstition were performed during the night: they were indeed generally works of darkness. 54 was performed only during the night.

On this day there was a solemn cavalcade of Athenian matrons from Athens to Eleusis, in carriages drawn by oxen. In this procession the ladies used to rally one another in pretty loose terms, in imitation, we suppose, of the Isiac procession described by Herodotus, which has been mentioned above. The most remarkable object in this procession was the Mundus Cereris, contained in a small coffer or basket. 55 The Mundus Cereris. This was carried by a select company of Athenian matrons, who, from their office, were styled *Camphoræ*. In this coffer were lodged the comb of Ceres, her mirror, a serpentine figure, some wheat and barley, the pudenda of the two sexes, and perhaps some other articles which we have not been able to discover. The procession ended at the temple, where this sacred charge was deposited with the greatest solemnity.

We have no description of the temple of Eleusis upon record. Pausanias intended to have described it; but says he was diverted from his design by a dream †. Strabo informs us that the mystic sanctuary was as large as a theatre, and that it was built by Ictinus ‡. In the porch, or outer part of this temple, the candidates were crowned with garlands of flowers, which they called *himera*, or "the desirable." They were at the same time dressed in new garments, which they continued to wear till they were quite worn out. 56 Dress of the candidates. They then washed their hands in a laver filled with holy water; a ceremony which intimated the purity of their hearts and hands. Before the doors were locked, one of the officers of the temple proclaimed with a loud voice a stern mandate, enjoining all the uninitiated to keep at a distance from the temple, and denouncing the most terrible menaces if any should dare to disturb or pry into the holy mysteries. 57 Care to keep the uninitiated at a distance. Nor were these menaces without effect: for if any person was found to have crowded into the sanctuary even through ignorance, he was put to death without mercy. Every precaution having been taken to secure secrecy, the initiatory ceremonies now began. But before we describe these, we must lay before our readers a brief account of the ministers and retainers of these secrets of paganism.

58 The hierophant.

The chief minister of these far-famed mysteries was the hierophant. He was styled *King*, and enjoyed that dignity during life, and was always by birth an Athenian. He presided in the solemnity, as is evident from his title. This personage, as we learn from Eusebius, represented the Demiurgus, or Creator of the world. "Now in the mysteries of Eleusis (says that father) the hierophant is dressed out in the figure of the demiurgus." What this demiurgus was, we learn from the same writer. As this whole institution was copied from the Egyptians, we may rest assured that the figure of the Eleusinian Demiurgus was borrowed from the same quarter. "As for the symbols of the Egyptians (says he, quoting from Porphyry §), they are of the following complexion. The Demiurgus, whom the Egyptians call *Cneph*, is figured as

† Lib. ix.

‡ See *Eleusis*.

§ *Prop. Evan.*

as a man of an azure colour, ſhaded with black, holding in his right hand a ſceptre and in his left a girdle, and having on his head a royal wing or feather wreathed round." Such, we imagine, was the equipment of the Eleuſinian hierophant. This perſon was likewiſe ſtyled *Prophet*. He was to be of the family of the Eumolpidæ; was obliged to make a vow of perpetual chaſtity; and even his voice, hair, and attitude, were adjuſted to the ritual.

59 The daduchus.

The next miniſter was the daduchus, or torch-bearer; who, according to the father above quoted, was attired like the ſun. This miniſter reſembled the ſun, becauſe that luminary was deemed the viſible type of the ſupreme Demiurgus, and his vicegerent in governing and arranging the affairs of this lower world.

60 The prieſts.

The third was the perſon who officiated at the altar. He was habited like the moon. His office was to implore the favour of the gods for all the initiated. We ſhould rather imagine, that the perſon at the altar, as he reſembled the moon, was intended to repreſent the goddeſs herſelf: for the Egyptian Iſis, who was the archetype of Ceres, was ſometimes the moon and ſometimes the earth.

61 The herald.

The ſacred herald was another principal actor in this ſolemn exhibition. His province was to recite every thing that, according to the ritual, was to be communicated to the novices; and he probably repreſented Thyoth or Thoth, that is Hermes or Mercury, the interpreter of the gods.

62 The curators, &c.

Beſides theſe, there were five epimeletæ or curators, of whom the king was one, who jointly directed the whole ceremonial. Laſtly, There were ten prieſts to offer the ſacrifices. There were no doubt many officers of inferior note employed upon theſe occaſions; but theſe were only inſignificant appendages, whoſe departments have not been tranſmitted to poſterity.

After this detail of the miniſters of this ſolemn ſervice, we return to the *myſtæ*, or candidates for initiation. Some of the fathers of the church † mention a hymn compoſed by the celebrated Orpheus, which was ſung by the myſtagogue or king upon that occaſion. This hymn appears to us one of thoſe ſpurious compoſitions which abounded in the firſt ages of Chriſtianity, and which the pious apologiſts often adopted without ſufficient examination. That ſome ſacred hymn was chanted upon that occaſion, we think highly probable; but that the one in queſtion was either compoſed by Orpheus, or uſed at the opening of theſe ceremonies, to us appears ſomewhat problematical.

† *Juſtin. Euſeb. Clem. Alex.*

Before the ceremony opened, a book was produced, which contained every thing relating to the teletæ. This was read over in the ears of the myſtæ; who were ordered to write out a copy of it for themſelves. This book was kept at Eleuſis in a ſacred repoſitory,

63 The petroma.

formed by two ſtones exactly fitted to each other, and of a very large ſize. This repoſitory was called *petroma*. At the annual celebration of the greater myſteries, theſe ſtones were taken aſunder, and the book taken out; which, after being read to the myſtæ, was replaced in the ſame caſement.

64 Commencement of the initiations.

The initiations began with a repreſentation of the wanderings of Ceres, and her bitter and loud lamentations for the loſs of her beloved daughter. Upon this occaſion, no doubt, a figure of that deity was diſplayed to the myſtæ, while loud lamentations echoed from every corner of the ſanctuary. One of the company having kindled a firebrand at the altar, and ſprung to a certain place in the temple, waving the torch with the utmoſt fury, a ſecond ſnatched it from him, roaring and waving it in the ſame frantic manner; then a third, fourth, &c. in the moſt rapid ſucceſſion, This was done to imitate Ceres, who was ſaid to have perluſtrated the globe of the earth with a flaming pine in her hand, which ſhe had lighted at Mount Etna.

When the pageant of the goddeſs was ſuppoſed to arrive at Eleuſis, a ſolemn pauſe enſued, aud a few trifling queſtions were put to the myſtæ: What theſe queſtions were, is evident from the anſwers. "I have faſted; I have drunk the liquor; I have taken the contents out of the coffer; and having performed the ceremony, have put them into the hamper: I have taken them out of the hamper, and put them again in the coffer." The meaning of theſe anſwers, we conjecture, was this: "I have faſted, as Ceres faſted while in ſearch of her daughter; I have drunk off the wort as ſhe drank when given her by Banbo; I have performed what Ceres taught her firſt diſciples to perform, when ſhe committed to them the ſacred hamper and coffer." After theſe interrogatories, and the ſuitable reſponſes, the *mundus Cereris* was diſplayed before the eyes of the myſtæ, and the *myſtagogue* or hierophant, or perhaps the ſacred herald by his command, read a lecture on the allegorical import of thoſe ſacred ſymbols. This was heard with the moſt profound attention; and a ſolemn ſilence prevailed throughout the fane. Such was the firſt act of this religious farce, which perhaps conſiſted originally of nothing more, 65 Queſtions put to the myſtæ.

66 Traditions reſpecting the origin of the univerſe, &c.

After the expoſition of the *mundus Cereris*, and the import of her wanderings, many traditions were communicated to the myſtæ concerning the origin of the univerſe and the nature of things. The doctrines delivered in the greater myſteries, ſays Clem. Alex. "relate to the nature of the univerſe. Here all inſtruction ends. Things are ſeen as they are; and nature, and the things of nature, are given to be comprehended." To the ſame purpoſe Cicero: "Which points being explained and reduced to the ſtandard of reaſon, the nature of things, rather than that of the gods, is diſcovered." The Father of the univerſe, or the ſupreme demiurgus, was repreſented as forming the chaotic maſs into the four elements, and producing animals, vegetables, and all kinds of organized beings, out of thoſe materials. They ſay that they were informed of the ſecrets of the anomalies of the moon, and the eclipſes of the ſun and moon; and, according to Virgil,

Unde hominum genus, et pecudes, unde imber et ignes.

What ſyſtem of coſmogony thoſe hierophants adopted, is evident from the paſſage above quoted from Euſebius; and, from the account immediately preceding, it was that of the moſt ancient Egyptians, and of the orientals in general. This coſmogony is beautifully and energetically exhibited in Plato's Timæus, and in the genuine ſpirit of poetry by Ovid in the beginning of his Metamorphoſes.

67 Exploits of the gods, and

The next ſcene exhibited upon the ſtage, on this ſolemn occaſion, conſiſted of the exploits and adventures of the gods, demigods, and heroes, who had from time to to time, been advanced to divine honours. These were displayed as passing before the mystæ in pageants fabricated for that important purpose. This was the original mode among the Egyptians, and was no doubt followed by their Eleusinian pupils. These adventures were probably demonstrated to have been allegorical, symbolical, hieroglyphical, &c. at least they were exhibited in such a favourable point of view as to dispel those absurdities and inconsistencies with which they were sophisticated by the poets and the vulgar.

68 their origin.

With respect to the origin of those factitious deities, it was discovered that they had been originally men who had been exalted to the rank of divinity, in consequence of their heroic exploits, their useful inventions, their beneficent actions, &c. This is so clear from the two passages quoted from Cicero, by Bishop Warburton †, that the fact cannot be contradicted. But that prelate has not informed us so precisely, whether the mystagogues represented them as nothing more than dead men, in their present state, or as beings who were actually existing in a deified state, and executing the functions assigned them in the rubric of Paganism. Another query naturally occurs; that is, to what purpose did the mystagogues apply this communication? That the hierophants did actually represent those deified mortals in the latter predicament, is obvious from another passage quoted from Cicero by the same prelate, which we shall transcribe as translated by him: "What think you of those who assert that valiant, or famous, or powerful men, have obtained divine honours after death; and that these are the very gods now become the objects of our worship, our prayers, and adoration? Euhemerus tells us, when these gods died, and where they lie buried. I forbear to speak of the sacred and august rites of Eleusis. I pass by Samothrace and the mysteries of Lemnos, whose hidden rites are celebrated in darkness, and amidst the thick shades of groves and forests." If, then, those deified mortals were become the objects of worship and prayers, there can be no doubt of the belief of their deified existence. The allusion to the Eleusinian and other Pagan mysteries towards the close of the quotation, places the question beyond the reach of controversy. But though, according to this account, "there were gods many and lords many;" yet it is evident from the passage quoted from Eusebius in the preceding part of this article, that the unity of the Supreme Being was maintained, exhibited, and inculcated. This was the original doctrine of the hierophants of Egypt: It was maintained by Thales and all the retainers of the Ionian school. It was the doctrine of Pythagoras, who probably gleaned it up in the country just mentioned, in connexion with many other dogmas which he had the assurance to claim as his own.

† *Div. Leg.*

69 Unity of the supreme Being maintained in the mysteries.

But however the unity, and perhaps some of the most obvious attributes, of the Supreme Author of nature, might be illustrated and inculcated, the tribute of homage and veneration due to the subordinate divinities was by no means neglected. The initiated were taught to look to the *dii majorum gentium* with a superior degree of awe and veneration, as beings endowed with an ineffable measure of power, wisdom, purity, goodness, &c. These were, if we may use the expression, the prime favourites of the Monarch of the universe, who were admitted into his immediate presence, and who received his behests from his own mouth, and communicated them to his subordinate officers, prefects, lieutenants, &c. These they were exhorted to adore; to them they were to offer sacrifices, prayers, and every other act of devotion, both on account of the excellency of their nature and the high rank they bore at the court of heaven. They were instructed to look up to hero gods and demigods, as being exalted to the high rank of governors of different parts of nature, as the immediate guardians and protectors of the human race; in short, as gods near at hand, as prompters to a virtuous course, and assistants in it; as ready upon all occasions to confer blessings upon the virtuous and deserving. Such were the doctrines taught in the teletæ with respect to the nature of the Pagan divinities, and the worship and devotion enjoined to be offered them by the mysteries.

70 Offices of the other gods.

71 Excellent plan for accomplishing the ends proposed in the mysteries.

As the two principal ends proposed by these initiations were the exercise of heroic virtues in men, and the practice of sincere and uniform piety by the candidates for immortal happiness, the hierophants had adopted a plan of operations excellently accommodated to both these purposes. The virtuous conduct and heroic exploits of the great men and demigods of early antiquity, were magnified by the most pompous eulogiums, enforced with suitable exhortations to animate the votaries to imitate so noble and alluring an example. But this was not all: the heroes and demigods themselves were displayed in pageants, or vehicles of celestial light. Their honours, offices, habitations, attendants, and other appendages, in the capacity of demons, were exhibited with all the pomp and splendour that the sacerdotal college were able to devise. The sudden glare of mimic light, the melting music stealing upon the ear, the artificial thunders reverberated from the roof and walls of the temple, the appearance of fire and ethereal radiance, the vehicles of flame, the effigies of heroes and demons adorned with crowns of laurel emitting rays from every sprig, the fragrant odours and aromatic gales which breathed from every quarter, all dexterously counterfeited by sacerdotal mechanism, must have filled the imagination of the astonished votaries with pictures at once tremendous and transporting: Add to this, that every thing was transacted in the dead of night amidst a dismal gloom; whence the most bright effulgence instantaneously burst upon the sight. By this arrangement the aspirants to initiation were wonderfully animated to the practice of virtue while they lived, and inspired with the hope of a blessed immortality when they died. At the same time, their awe and veneration for the gods of their country were wonderfully enhanced by reflecting on the appearances above described. Accordingly Strabo very judiciously observes, "that the mystical secrecy of the sacred rites preserves the majesty of the Deity, imitating its nature, which escapes our apprehension. For these reasons, in celebrating the teletæ, the demons were introduced in their deified or glorified state.

But as all the candidates for initiation might not aspire to the rank of heroes and demigods, a more easy and a more attainable mode of conduct, in order to arrive at the palace of happiness, behoved to be opened. Private virtues were inculcated, and these

72 Private virtues inculcated in the mysteries, by the doctrine of a future ſtate.

too were to meet a condign reward. But alas! this preſent life is too often a chequered ſcene, where virtue is depreſſed and trodden under foot, and vice lifts up its head and rides triumphant. It is a dictate of common ſenſe, that virtue ſhould ſooner or later emerge, and vice ſink into contempt and miſery. Here then the conductors of the myſteries, properly and naturally, adopted the doctrine of a future ſtate of rewards and puniſhments. The dogma of the immortality of the human ſoul was elucidated, and carefully and pathetically inculcated. This doctrine was likewiſe imported from Egypt; for Herodotus * informs us, "that the Egyptians were the firſt people who maintained the immortality of the human ſoul." The Egyptian immortality, however, according to him, was only the metempſychoſis or tranſmigration of ſouls. This was not the ſyſtem of the ancient Egyptians, nor indeed of the teletæ. In theſe, a metempſychoſis was admitted; but that was carried forward to a very diſtant period, to wit, to the grand Egyptian period of 36,000 years.

* *Lib.* ii.

73 Emblems of Elyſium and Tartarus.

As the myſtagogues well knew that the human mind is more powerfully affected by objects preſented to the eyes than by the moſt engaging inſtructions conveyed by the ear, they made the emblems of Elyſium and Tartarus paſs in review before the eyes of their novices. There the Elyſian ſcenes, ſo nobly deſcribed by the Roman poet, appeared in mimic ſplendour; and, on the other hand, the gloom of Tartarus, Charon's boat, the dog of hell, the Furies with treſſes of ſnakes, the tribunal of Minos and Rhadamanthus, &c. were diſplayed in all their terrific ſtate. Tantalus, Ixion, Siſyphus, the daughters of Danaus, &c. were repreſented in pageants before their eyes. Theſe exhibitions were accompanied with moſt horrible cries and howlings, thunders, lightning, and other objects of terror which we ſhall mention in their proper place.

No contrivance could be better accommodated to animate the pupils to the practice of virtue on the one hand, or to deter them from indulging vicious paſſions on the other. It reſembled opening heaven and hell to a hardened ſinner. The practices inculcated in celebrating the myſteries are too numerous to be detailed in this imperfect ſketch. The worſhip of the gods was ſtrictly enjoined, as has been ſhown above. The three laws generally aſcribed to Triptolemus were inculcated, 1. To honour their parents; 2. To honour the gods with the firſt fruits of the earth; 3. Not to treat brute animals with cruelty. Theſe laws were imported from Egypt, and were communicated to the Eleuſinians by the original miſſionaries. Cicero makes the civilization of mankind one of the moſt beneficial effects of the Eleuſinian inſtitutions: "Nullum mihi, cum multo eximia divinaque videntur Athenæ tuæ peperiſſe; tum nihil melius illis myſteriis, quibus ex agreſti immanique vita, exculti ad humanitatem, et mitigati ſumus; initiaque, ut appellantur, ita revera principia vitæ cognovimus; neque ſolum cum lectitia vivendi rationem accepimus, ſed etiam cum ſpe meliore moriendi." Hence it is evident that the precepts of humanity and morality were warmly recommended in theſe inſtitutions. The virtue of humanity was extended, one may ſay, even to the brute creation, as appears from the laſt of Triptolemus's laws above quoted. Some articles were enjoined in the teletæ which may appear to us of leſs importance, which, however, in the ſymbolical ſtyle of the Egyptians, were abundantly ſignificant. The initiated were "commanded to abſtain from the fleſh of certain birds and fiſhes; from beans, from pomegranates and apples, which were deemed equally polluting. It was taught, that to touch the plant of aſparagus was as dangerous as the moſt deadly poiſon. Now, ſays Porphyry, whoever is verſed in the hiſtory of the *viſions*, knows for what reaſon they were commanded to abſtain from the fleſh of birds."

74 The three laws of Triptolemus.

75 The initiated bound themſelves by oaths to obſerve the precepts of the myſteries.

The initiated then bound themſelves by dreadful oaths to obſerve moſt conſcientiouſly and to practiſe every precept tendered to them in the courſe of the teletæ; and at the ſame time never to divulge one article of all that had been heard or ſeen by them upon that occaſion. In this they were ſo exceedingly jealous, that Æſchylus the tragedian was in danger of capital puniſhment, for having only alluded to one of the Eleuſinian arcana in a tragedy of his; and one of the articles of indictment againſt Diagoras the Melian was, his having ſpoken diſreſpectfully of the myſteries, and diſſuaded people from partaking of them. It muſt then be allowed, that the inſtitution of the myſteries was of infinite advantage to the Pagan world. They were indeed a kind of ſacraments, by which the initiated bound themſelves by a ſolemn vow to practiſe piety towards the gods, juſtice and humanity towards their fellow men, and gentleneſs and tenderneſs towards the inoffenſive part of the brute creation. The Pagans themſelves were ſo thoroughly convinced of this fact, that in their diſputes with the apologiſts for Chriſtianity, they often appealed to the teletæ, and contraſted their maxims with the moſt ſublime doctrines of that heavenly inſtitution.

In order to impreſs theſe maxims the more deeply upon the minds of the novices, and to fix their attention more ſtedfaſtly upon the lectures which were delivered them by the myſtagogue or the ſacred herald, a mechanical operation was played off at proper intervals during the courſe of the celebration. "Towards the end of the celebration (ſays Stobæus), the whole ſcene is terrible; all is trembling, ſhuddering, ſweat, and aſtoniſhment. Many horrible ſpectres are ſeen, and ſtrange cries and howlings uttered. Light ſucceeds darkneſs; and again the blackeſt darkneſs the moſt glaring light. Now appear open plains, flowery meads, and waving groves; where are ſeen dances and choruſes; and various holy phantaſies enchant the ſight. Melodious notes are heard from far, with all the ſublime ſymphony of the ſacred hymns. The pupil now is completely perfect, is initiated, becomes free, releaſed, and walks about with a crown on his head, and is admitted to bear a part in the ſacred rites." Ariſtides de Myſt. Eleuſ. calls Eleuſis "a kind of temple of the whole earth, and of all that man beholds done in the moſt dreadful and the moſt exhilerating manner. In what other place have the records of fable ſung of things more marvellous? or in what region upon earth have the objects preſented to the eye borne a more exact reſemblance to the ſounds which ſtrike the ear? What object of ſight have the numberleſs generations of men and women beheld comparable to theſe exhibited in the ineffable myſteries?" To the ſame purpoſe, Pletho, in the oracles of Zoroaſtres, informs us, "that

76 Horrible ſpectres and pleaſing ſcenes alternately exhibited.

" that frightful and ſhocking apparitions, in a variety of forms, uſed to be diſplayed to the myſtæ in the courſe of their initiation." And a little after, he adds, " that thunder and lightning and fire, and every thing terrible which might be held ſymbolical of the divine preſence, were introduced." Claudian, in his poem *De Rapta Proſerpina*, gives an elegant, though brief, deſcription of this phenomenon, which throws ſome light on the paſſages above quoted.

> *Jam mihi cernuntur trepidis delubra moveri*
> *Sedibus et clarum dis pergere culmina lucem,*
> *Adventum teſtata Dea, jam magnus ab imis*
> *Auditur fremitus terris, templumque remugit*
> *Cecropidum.*

The ſight of thoſe appearances was called the *Antopſia*, or " the real preſence :" hence thoſe rites were ſometimes called *Epoptica*. The *Epoptæ* were actually initiated, and were admitted into the *Sanctum Sanctorum*, and bore a part in the ceremonial : whereas the *myſtæ*, who had only been initiated in the leſſer myſteries at Agræ, were obliged to take their ſtation in the porch of the temple.

77 A kind of baptiſmal ablution in the myſteries.

The candidates for initiation bathed themſelves in holy water, and put on new clothes, all of linen, which they continued to wear till they were quite torn, and then they were conſecrated to Ceres and Proſerpine. From the ceremony of bathing they were denominated *Hydrani ;* and this again was a kind of baptiſmal ablution. Whether the phraſes of *waſhing away ſin, putting on the Lord Jeſus Chriſt, putting off the old man with his deeds, putting on a robe of righteouſneſs, being buried in baptiſm*, the words *mystery, perfect, perfection*, which occur ſo frequently in the New Teſtament, eſpecially in the writings of the apoſtle St Paul, are borrowed from the Pagan myſteries, or from uſages current among the Jews, we leave to our more learned readers to determine.

78 The initiated declared perfect men.

The Epoptæ having ſuſtained all thoſe fiery trials, heard and ſeen every thing requiſite, taken upon them the vows and engagements above narrated, and, in a word, having ſhown themſelves good ſoldiers of Ceres and Proſerpine, were now declared *perfect men*. They might, like Cebes's *virtuous man*, travel wherever they choſe ; thoſe wild beaſts (the human paſſions) which tyrannize over the reſt of mankind, and often deſtroy them, had no longer dominion over them. They were now not only *perfect* but *regenerated* men. They were now crowned with laurel, as was ſaid above, and diſmiſſed with two barbarous words Κογξ, ὀμπαξ, *Konx ompax*, of which perhaps the hierophants themſelves did not comprehend the import. They had been introduced by the firſt Egyptian miſſionaries, and retained in the ſacra after their ſignification was loſt. This was a common practice among the Greeks. In the adminiſtration of their religious ceremonies, they retained many names of perſons, places, things, cuſtoms, &c. which had been introduced by the Phœnicians and Egyptians, from whom they borrowed their ſyſtem of idolatry. Theſe terms conſtituted the language of the gods, ſo often mentioned by the prince of poets. To us the words in queſtion appear to be Syriac, and to ſignify, *Be vigilant, be innocent.*

Numerous and important were the advantages ſuppoſed to redound to the initiated, from their being admitted to partake of the myſteries, both in this life and that which is to come. Firſt, They were highly honoured, and even revered, by their contemporaries. Indeed, they were looked up to as a kind of ſacred perſons : they were, in reality, conſecrated to Ceres and Proſerpine. Secondly, They were obliged by their oath to practice every virtue, religious, moral, political, public, and private. Thirdly, They imagined, that ſound advice and happy meaſures of conduct were ſuggeſted to the initiated by the Eleuſinian goddeſſes. Accordingly, ſays Pericles the celebrated Athenian ſtateſman, " I am convinced, that the deities of Eleuſis inſpired me with this ſentiment, and that this ſtratagem was ſuggeſted by the principle of the myſtic rites." There is a beautiful paſſage in Ariſtophanes's * comedy of the Ranæ to the very ſame purpoſe, of which we ſhall ſubjoin the following periphraſis. It is ſung by the chorus of the initiated.

* Act. i.

> Let us to flow'ry meads repair,
> With deathleſs roſes blooming,
> Whoſe balmy ſweets impregn the air,
> Both hills and dales perfuming.
> Since fate benign our choir has join'd,
> We'll trip in myſtic meaſure ;
> In ſweeteſt harmony combin'd
> We'll quaff full draughts of pleaſure.
> For us alone the pow'r of day
> A milder light diſpenſes ;
> And ſheds benign a mellow'd ray
> To cheer our raviſh'd ſenſes :
> For we beheld the myſtic ſhow,
> And brav'd Eleuſis' dangers.
> We do and know the deeds we owe
> To neighbours, friends, and ſtrangers.

Euripides, in his Bacchæ (E), introduces the chorus extolling the happineſs of thoſe who had been acquainted with God, by participating in the holy myſteries, and whoſe minds had been enlightened by the myſtical rites. They boaſt, " that they had led a holy and unblemiſhed life, from the time that they had been initiated in the ſacred rites of Jupiter Idæus, and from the time that they had relinquiſhed celebrating the nocturnal rites of Bacchus, and the banquets of raw fleſh torn off living animals." To this ſanctity of life they had no doubt engaged themſelves, when they were initiated in the myſteries of that god. The Eleuſinian Epoptæ derived the ſame advantages from their ſacramental engagements. Fourthly, The initiated were imagined to be the peculiar wards of the Eleuſinian goddeſſes. Theſe deities were ſuppoſed to watch over them, and often to avert impending danger, and to reſcue them when beſet with troubles.— Our readers will not imagine that the initiated reaped much benefit from the protection of his Eleuſinian tutelary deities ; but it was ſufficient that they believed

(E) Act I. near the beginning, and in many other places.

ed the fact, and actually depended upon their interposition. Fifthly, The happy influences of the teletæ, were supposed to administer consolation to the Epoptæ in the hour of dissolution; for, says Isocrates, "Ceres bestowed upon the Athenians two gifts of the greatest importance; the fruits of the earth, which were the cause of our no longer leading a savage course of life; and the teletæ, for they who partake of these entertain more pleasant hopes both at the end of life, and eternity afterwards." Another author * tells us, "that the initiated were not only often rescued from many hardships in their lifetime, but at death entertained hopes that they should be raised to a more happy condition." Sixthly, After death, in the Elysian fields, they were to enjoy superior degrees of felicity, and were to bask in eternal sunshine, to quaff nectar, and feast upon ambrosia, &c.

* *Aristides, de Myst. Eleus.*

79 Interestedness of the priests.

The priests were not altogether disinterested in this salutary process. They made their disciples believe, that the souls of the uninitiated, when they arrived in the infernal regions, should roll in mire and dirt, and with very great difficulty arrive at their destined mansion. Hence Plato introduces Socrates † observing, "that the sages who introduced the teletæ had positively affirmed, that whatever soul should arrive in the infernal mansions *unhousell'd* and *unanneal'd*, should lie there immersed in mire and filth." And as to a future state (says Aristides), "the initiated shall not roll in mire and grope in darkness; a fate which awaits the unholy and uninitiated." It is not hard to conceive with what a commanding influence such doctrines as these must have operated on the generality of mankind.

† *Phædo.*

80 Remarks of Diogenes and Antisthenes.

When the Athenians advised Diogenes to get himself initiated, and enforced their arguments with the above considerations, "It will be pretty enough (replied the philosopher) to see Agesilaus and Epaminondas wallowing in the mire, while the most contemptible rascals who have been initiated are strutting in the islands of bliss."

When Antisthenes was to be initiated in the Orphic mysteries, and the priest was boasting of the many astonishing benefits which the initiated should enjoy in a future state ‡, "Why, forsooth, (says Antisthenes), 'tis wonder your reverence don't e'en hang yourself in order to come at them the sooner."

‡ *Diog. Laert.*

81 All the world crowd to Eleusis.

When such benefits were expected to be derived from the mysteries, no wonder if all the world crowded to the Eleusinian standard. After the Macedonian conquests, the hierophants abated much of their original strictness. By the age of Cicero, Eleusis was a temple whither all nations resorted to partake of the benefits of that institution. We find that almost all the great men of Rome were initiated. The hierophants, however, would not admit Nero on account of the profligacy of his character. Few others were refused that honour; even the children of the Athenians were admitted. But this, we think, was rather a lustration or consecration, than an initiation. Perhaps it paved the way for the more august ceremony, as the Christian baptism does among us for the other sacrament.

82 Degeneracy of the mysteries.

That this institution gradually degenerated, can hardly be questioned; but how much, and in what points, we have not been able to investigate. The fathers of the church, from whom that charge is chiefly to be collected, are not always to be trusted, especially when they set themselves to arraign the institutions of Paganism. There were indeed several ancient authors, such as Melanthius, Menander, Sotades, &c. who wrote purposely on the subject in question; but their works are long since irrecoverably lost. For this reason, modern writers, who have professedly handled it, have not always been successful in their researches. The two who have laboured most indefatigably, and perhaps most successfully, in this field, are Meursius and Warburton. The former, in his *Liber Singularis*, has collected every thing that can be gleaned from antiquity relating to the ceremonial of these institutions, without, however, pointing out their original, or elucidating the end and import of their establishment. The latter has drawn them into the vortex of a system which has in many instances led him to ascribe to them a higher degree of merit than we think they deserve. These instances we would willingly have noticed in our progress, had the limits prescribed us admitted such a discussion.

If we may believe Diodorus the Sicilian, these mysteries, which were celebrated with such wonderful secrecy at Eleusis, were communicated to all mankind among the Cretans. This, however, we think, is rather problematical. We imagine that excellent historian has confounded the mysteries of Cybele with those of the Eleusinian Ceres. These two deities were undoubtedly one and the same, that is, the moon or the earth. Hence it is probable, that there was a striking resemblance between the sacred mysteries of the Cretans and Eleusinians.

This institution continued in high reputation to the age of St Jerome, as appears from the following passage: "Hierophantæ quoque Atheniensium legant usque hodie cicutæ sorbitione castrari." The emperor Valentinianus intended to have suppressed them; but Zozimus *, informs us, that he was diverted from his design by the proconsul of Greece. At length Theodosius the elder, by an imperial edict, prohibited the celebration of these as well as of all the other sacra of Paganism. These mysteries, instituted in the reign of Erectheus, maintained their ground to the period just mentioned, that is, near 2000 years; during which space, the celebration of them never had been interrupted but once. When Alexander the Great massacred the Thebans and razed their city, the Athenians were so much affected with this melancholy event, that they neglected the celebration of that festival.

* *Adverf. Jovin.*

83 Abolished by the emperor Theodosius.

84 Other mysteries among the Pagans of less celebrity.

There were almost numberless other mysterious institutions among the ancient Pagans, of which these sketched above were the most celebrated. The Samothracian mysteries, instituted in honour of the Cabiri, were likewise of considerable celebrity, and were supposed to confer much the same blessings with the Eleusinian, but were not of equal celebrity. The Cabiri were Phœnician and likewise Egyptian * deities. The learned Bochart has explained their origin, number, names, and some part of their worship. The Orphic mysteries were likewise famous among the Thracians. Orpheus learned them in Egypt, and they were nearly the same with the sacra Bacchanalia of the Greeks. There were likewise the mysteries of

* *Sanchoniathon* and *Herodotus.*

of Jupiter Idæus in great requeſt among the Cretans, thoſe of the Magna Mater or Cybele, celebrated in Phrygia. To enumerate and detail all theſe would require a complete volume. We hope our readers will be fully ſatisfied with the ſpecimen exhibited above. We are convinced many things have been omitted which might have been inſerted, but we have collected the moſt curious and the moſt important.—Every one of the poſitions might have been authenticated by quotations from authors of the moſt undoubted credibility, but that proceſs would have ſwelled the article beyond all proportion.

MYSTICAL, ſomething myſterious or allegorical. Some of the commentators on the ſacred writings, beſides a literal find alſo a myſtical meaning. The ſenſe of Scripture, ſay they, is either that immediately ſignified by the words and expreſſions in the common uſe of language; or it is mediate, ſublime, typical, and myſtical. The literal ſenſe they again divide into proper literal, which is contained in the words taken ſimply and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical ſenſe. The myſtical ſenſe of Scripture they divide into three kinds: the firſt correſponding to faith, and called *allegorical;* the ſecond to hope, called *anagogical;* and the third to charity, called the *tropological ſenſe*. And ſometimes they take the ſame word in Scripture in all the four ſenſes: thus the word *Jeruſalem* literally ſignifies the capital of Judea: allegorically, the church militant; tropologically, a believer: and anagogically, heaven. So, that paſſage in Geneſis, *let there be light, and there was light*, literally ſignifies corporeal light; by an allegory, the Meſſiah; in the tropological ſenſe, grace; and anagogically, beatitude, or the light of glory.

MYSTICS, *myſtici*, a kind of religious ſect, diſtinguiſhed by their profeſſing pure, ſublime, and perfect devotion, with an entire diſintereſted love of God, free from all ſelfiſh conſiderations.

The myſtics, to excuſe their fanatic ecſtaſies and amorous extravagancies, allege that paſſage of St Paul, *The Spirit prays in us by ſighs and groans that are unutterable.* Now, if the Spirit, ſay they, pray in us, we muſt reſign ourſelves to its motions, and be ſwayed and guided by its impulſe, by remaining in a ſtate of mere inaction.

Paſſive contemplation is that ſtate of perfection to which the myſtics all aſpire.

The authors of this myſtic ſcience, which ſprung up towards the cloſe of the third century, are not known; but the principles from which it was formed are manifeſt. Its firſt promoters proceeded from the known doctrine of the Platonic ſchool, which was alſo adopted by Origen and his diſciples, that the divine nature was diffuſed through all human ſouls, or that the faculty of reaſon, from which proceed the health and vigour of the mind, was an emanation from God into the human ſoul, and comprehended in it the principles and elements of all truth, human and divine. They denied that men could by labour or ſtudy excite this celeſtial flame in their breaſts; and therefore they diſapproved highly of the attempts of thoſe, who by definitions, abſtract theorems, and profound ſpeculations, endeavoured to form diſtinct notions of truth, and to diſcover its hidden nature. On the contrary, they maintained that ſilence, tranquillity, repoſe, and ſolitude, accompanied with ſuch acts as might tend to extenuate and exhauſt the body, were the means by which the hidden and internal word was excited to produce its latent virtues, and to inſtruct men in the knowledge of divine things. For thus they reaſoned; thoſe who behold with a noble contempt all human affairs, who turn away their eyes from terreſtrial vanities, and ſhut all the avenues of the outward ſenſes againſt the contagious influences of a material world, muſt neceſſarily return to God, when the ſpirit is thus diſengaged from the impediments that prevented that happy union. And in this bleſſed frame they not only enjoy inexpreſſible raptures from their communion with the Supreme Being, but alſo are inveſted with the ineſtimable privilege of contemplating truth undiſguiſed and uncorrupted in its native purity, while others behold it in a vitiated and deluſive form.

The number of the myſtics increaſed in the fourth century, under the influence of the Grecian fanatic, who gave himſelf out for Dionyſius the Areopagite, diſciple of St Paul, and probably lived about this period; and by pretending to higher degrees of perfection than other Chriſtians, and practiſing greater auſterity, their cauſe gained ground, eſpecially in the eaſtern provinces, in the fifth century. A copy of the pretended works of Dionyſius was ſent by Balbus to Lewis the Meek, in the year 824, which kindled the holy flame of myſticiſm in the weſtern provinces, and filled the Latins with the moſt enthuſiaſtic admiration of this new religion.

In the twelfth century, theſe myſtics took the lead in their method of expounding Scripture; and by ſearching for myſteries and hidden meaning in the plaineſt expreſſions, forced the word of God into a conformity with their viſionary doctrines, their enthuſiaſtic feelings, and the ſyſtem of diſcipline which they had drawn from the excurſions of their irregular fancies. In the thirteenth century, they were the moſt formidable antagoniſts of the ſchoolmen; and towards the cloſe of the fourteenth, many of them reſided and propagated their tenets almoſt in every part of Europe. They had, in the fifteenth century, many perſons of diſtinguiſhed merit in their number: and in the ſixteenth century, previous to the Reformation, if any ſparks of real piety ſubſiſted under the deſpotic empire of ſuperſtition, they were only to be found among the myſtics.

The principles of this ſect were adopted by thoſe called *Quietiſts* in the ſeventeenth century, and, under different modifications, by the Quakers and Methodiſts.

MYSTRUM, a liquid meaſure among the ancients, containing the fourth part of the cyathus, and weighing two drachms and a half of oil, or two drachms two ſcruples of water or wine. It nearly anſwers to our ſpoonful.

MYTELENE. See METYLENE.

MYTHOLOGY

MYTHOLOGY

Definition. IS a term compounded of two Greek words, and in its original import it ſignifies any kind of fabulous doctrine: In its more appropriated ſenſe, it means thoſe fabulous details concerning the objects of worſhip which were invented and propagated by men who lived in the early ages of the world, and by them tranſmitted to ſucceeding generations, either by written records or by oral tradition.

As the theology and mythology of the ancients are almoſt inſeparably connected, it will be impoſſible for us to develope the latter, without often introducing ſome obſervations relating to the former. We muſt therefore entreat the indulgence of our readers, if upon many occaſions we would hazard a few ſtrictures on the names, characters, adventures, and functions of ſuch Pagan divinities as may have furniſhed materials for thoſe fabulous narrations which the nature of the ſubject may lead us to diſcuſs.

2 Origin of fable. With reſpect to *fable*, it may be obſerved in general, that it is a creature of the human imagination, and derives its birth from that love of the *marvellous* which is in a manner congenial to the ſoul of man.—The appearances of nature which every day occur, objects, actions, and events, which ſucceed each other, by a kind of routine, are too familiar, too obvious, and unintereſting, either to gratify curioſity or to excite admiration. On the other hand, when the moſt common phenomena in nature or life are new modelled by the plaſtic power of a warm imagination; when they are diverſified, compounded, embelliſhed, or even arranged and moulded into forms which ſeldom or perhaps never occur in the ordinary courſe of things;—novelty generates admiration, a paſſion always attended with delightful ſenſations. Here then we imagine we have diſcovered the very ſource of *fiction* and *fable*.—They originated from that powerful propenſity in our nature towards the *new* and *ſurpriſing*, animated by the delight with which the contemplation of them is generally attended.

Many circumſtances contributed to extend and eſtabliſh the empire of fable. The legiſlator laid hold on this bias of human nature, and of courſe employed *fable* and *fiction* as the moſt effectual means to civilize a rude, unpoliſhed world. The philoſopher, the theologiſt, the poet, the muſician, each in his turn, made uſe of this vehicle to convey his maxims and inſtructions to the ſavage tribes. They knew that *truth*, ſimple and unadorned, is not poſſeſſed of charms powerful enough to captivate the heart of man in his preſent corrupt and degenerate ſtate. This conſideration, which did indeed reſult from the character of their audience, naturally led them to employ fiction and allegory. From this was derived the allegorical ſtate of the ancients, and eſpecially of the primary ſages of the eaſt.

3 Boldneſs of the oriental mythology. Though almoſt every nation on the face of the globe, however remote from the centre of population, however ſavage and averſe from cultivation, has fabricated and adopted its own ſyſtem of mythology; the Orientals, however, have diſtinguiſhed themſelves in a peculiar manner, by the boldneſs, the inconſiſtency, and the extravagance of their mythology. The genial warmth of thoſe happy climes, the fertility of the ſoil, which afforded every neceſſary, every conveniency, and often every luxury of life, without depreſſing their ſpirits by laborious exertions; the face of nature perpetually blooming around them, the ſkies ſmiling with uninterrupted ſerenity; all contributed to inſpire the Orientals with a glow of fancy and a vigour of imagination rarely to be met with in leſs happy regions. Hence every object was ſwelled beyond its natural dimenſions. Nothing was great or little in moderation, but every ſentiment was heightened with incredible hyperbole. The magnificent, the ſublime, the vaſt, the enormous, the marvellous, firſt ſprung up, and were brought to maturity, in thoſe native regions of fable and fairy land. As nature, in the ordinary courſe of her operations, exhibited neither objects nor effects adequate to the extent of their romantic imaginations, they naturally deviated into the fields of fiction and fable. Of conſequence, the cuſtom of detailing fabulous adventures originated in the eaſt, and was from thence tranſplanted into the weſtern countries.

As the allegorical taſte of the eaſtern nations had ſprung from their propenſity to fable, and as that propenſity had in its turn originated from the love of the marvellous; ſo did allegory in proceſs of time contribute its influence towards multiplying fables and fiction almoſt *in infinitum*. The latent import of the allegorical doctrines being in a few ages loſt and obliterated, what was originally a moral or theological tenet, aſſumed the air and habit of a perſonal adventure.

4 Propenſity to perſonification a ſource of eaſtern mythology. The propenſity towards perſonification, almoſt univerſal among the orientals, was another fruitful ſource of fable and allegory. That the people of the eaſt were ſtrongly inclined to perſonify inanimate objects and abſtract ideas, we imagine will be readily granted, when it is conſidered, that in the formation of language they have generally annexed the affection of ſex to thoſe objects. Hence the diſtinction of grammatical genders, which is known to have originated in the eaſtern parts of the world. The practice of perſonifying virtues, vices, religious and moral affections, was neceſſary to ſupport that allegorical ſtyle which univerſally prevailed in thoſe countries. This mode of writing was in high reputation even in Europe ſome centuries ago; and to it we are indebted for ſome of the moſt noble poetical compoſitions now extant in our own language. Thoſe productions, however, are but faint imitations of the original mode of writing ſtill current among the eaſtern nations. The Europeans derived this ſpecies of compoſition from the Mooriſh inhabitants of Spain, who imported it from Arabia, their original country.

5 The effects of hieroglyphic writing on mythology. The general uſe of hieroglyphics in the eaſt, muſt have contributed largely towards extending the empire of mythology. As the import of the figures employed in this method of delineating the ſigns of ideas was in a great meaſure arbitrary, miſtakes muſt

have

have been frequently committed in aſcertaining the notions which they were at the firſt intended to repreſent. When the developement of theſe arbitrary ſigns happened to be attended with uncommon difficulty, the expounders were obliged to have recourſe to conjecture. Thoſe conjectural expoſitions were for the moſt part tinctured with that bias towards the marvellous which univerſally prevailed among the primitive men. This we find is the caſe even at this day, when moderns attempt to develope the purport of emblematical figures, preſerved on ancient medals, entaglions, &c.

The wiſe men of the eaſt delighted in obſcure enigmatical ſentences. They ſeem to have diſdained every ſentiment obvious to vulgar apprehenſion. The words of the wiſe, and their dark ſayings, often occur in the moſt ancient records both ſacred and profane. The ſages of antiquity uſed to vie with each order for the prize of ſuperior wiſdom, by propounding riddles, and dark and myſterious queſtions, as ſubjects of inveſtigation. The conteſt between Solomon and Hiram, and that between Amaſis king of Egypt and Polycrates tyrant of Samos, are univerſally known.— As the import of thoſe enigmatical propoſitions was often abſolutely loſt, in ages when the art of writing was little known, and ſtill leſs practiſed, nothing remained but fancy and conjecture, which always verged towards the regions of fable. This then, we think, was another ſource of mythology.

6 Mythology reduced to a kind of ſyſtem in Egypt.

The Pagan prieſts, eſpecially in Egypt, were probably the firſt who reduced mythology to a kind of ſyſtem. The ſacerdotal tribe, among that people, were the grand depoſitories of learning as well as of religion. That order of men monopolized all the arts and ſciences. They ſeem to have formed a conſpiracy among themſelves, to preclude the laity from all the avenues of intellectual improvement. This plan was adopted with a view to keep the laity in ſubjection, and to enhance their own importance. To accompliſh this end, they contrived to perform all the miniſtrations of their religion in an unknown tongue, and to cover them with a thick veil of fable and allegory. The language of Ethiopia became their ſacred dialect, and hieroglyphics their ſacred character.— Egypt, of courſe, became a kind of fairy land, where all was jugglery, magic, and enchantment. The initiated alone were admitted to the knowledge of the occult myſtical exhibitions, which, in their hands, conſtituted the eſſence of their religion. From theſe the vulgar and profane were prohibited by the moſt rigorous penalties (ſee MYSTERIES). The Egyptians, and indeed all the ancients without exception, deemed the myſteries of religion too ſacred and ſolemn to be communicated to the herd of mankind, naked and unreſerved; a mode by which they imagined thoſe ſacred and ſublime oracles would have been defiled and degraded. "Procul, ô procul eſte profani—Odi profanum vulgus et arceo." Egypt was the land of graven images; allegory and mythology were the veil which concealed religion from the eyes of the vulgar; fable was the groundwork of that impenetrable covering.

7 In the earlieſt ages of the world mythology had no exiſtence.

In the earlieſt and moſt unpoliſhed ſtage of ſociety we cannot ſuppoſe fable to have exiſted among men. Fables are always *tales of other times*, but at this period other times did not reach far enough backward to afford thoſe fruits of the imagination ſufficient time to arrive at maturity. Fable requires a conſiderable ſpace of time to acquire credibility, and to riſe into reputation. Accordingly, we find that both the Chineſe and Egyptians, the two moſt ancient nations whoſe annals have reached our times, were altogether unacquainted with fabulous details in the moſt early and leaſt improved periods of their reſpective monarchies. It has been ſhown almoſt to a demonſtration, by a variety of learned men, that both the one and the other people, during ſome centuries after the general deluge, retained and practiſed the primitive Noachic religion, in which fable and fancy could find no place; all was genuine unſophiſticated truth.

8 Fabulous coſmogony, the firſt mythological details.

As ſoon as the authentic tradition concerning the origin of the univerſe was either in a good meaſure loſt, or at leaſt adulterated by the inventions of men, fable and fiction began to prevail. The Egyptian *Thoth* or Thyoth, or Mercury Triſmegiſtus, and Moſchus the Phœnician, undertook to account for the formation and arrangement of the univerſe, upon principles purely mechanical. Here fable began to uſurp the place of genuine hiſtorical truth. Accordingly, we find that all the hiſtorians of antiquity, who have undertaken to give a general detail of the affairs of the world, have uſhered in their narration with a fabulous coſmogony. Here imagination ranged unconfined over the boundleſs extent of the primary chaos. To be convinced of the truth of this aſſertion, we need only look into Sanchoniathon's Coſmogony, Euſeb. Præp. Evang. l. 1. ſub init. and Diodorus Sic. l. 1. From this we ſuppoſe it will follow, that the firſt race of fables owed their birth to the erroneous opinions of the formation of the univerſe.

Having now endeavoured to point out the origin of mythology, or fabulous traditions, we ſhall proceed to lay before our readers a brief detail of the mythology of the moſt reſpectable nations of antiquity, following the natural order of their ſituation.

9 Chineſe mythology.

The Chineſe, if any credit be due to their own annals, or to the miſſionaries of the church of Rome, who pretend to have copied from them, were *the firſt of the nations*. Their fabulous records reach upwards many myriads of years before the Moſaic era of the creation. The events during that period of time, if any had been recorded, muſt have been fabulous as the period itſelf. Theſe, however, are buried in eternal oblivion. The miſſionaries, who are the only ſources of our information with relation to the earlieſt periods of the Chineſe hiſtory, repreſent thoſe people as having retained the religion of Noah many centuries after the foundation of their empire. Upon this ſuppoſition, their coſmogony muſt have been ſound and genuine, without the leaſt tincture of thoſe fabulous ingredients which have both diſguiſed and diſgraced the coſmogonies of moſt other nations.

10 Birth and inventions of Fohi.

According to the moſt authentic accounts, *Fohe* or *Fohi* laid the foundation of that empire about 4000 years ago. This emperor, according to the Chineſe, was conceived in a miraculous manner. His mother, ſay they, one day as ſhe was walking in a deſert place, was ſurrounded by a rainbow; and, being impregnated by this meteor, was in due time delivered of that celebrated legiſlator. This perſonage, like the Athenian Cecrops, was half a man and half a ſerpent. His

His intellectual powers were truly hyperbolical. In one day he discovered 50 different species of poisonous herbs. He taught his countrymen the whole art of agriculture in the space of a very few years. He instructed them how to sow five different sorts of grain. He invented boats, and nets for fishing, the art of fabricating porcelain, the management of silk worms, the manufacturing of silk, &c. In a word, that wonderful personage was inspired by Heaven with knowledge, which qualified him for composing that incomparable body of laws which are even at this day the wonder of the world. Our readers will admit, that this whole detail is fabulous and chimerical. The most learned part of them will readily observe, that the Chinese, in ascribing the invention of all the useful arts to their Fohi, are perfectly agreed with almost all the other nations of antiquity. The Indians ascribe every invention to *Budha*, or *Vishnou*, or *Foe*; the Persians to *Zerdusht* or *Zoroaster*; the Chaldeans to their man of the sea, whom they call *Oannes*; the Egyptians to *Thoth* or *Thyoth*; the Phœnicians to *Melicerta*; the Greeks to the family of the *Titans*: and the Scandinavians to *Odin*, &c.

11 Miraculous birth of Confucius.

About 551 years before the Christian era, appeared the famous Chinese philosopher *Con-fu-tse* or Confucius. Concerning the birth of this prince of philosophers, the Chinese have propagated the following legendary tale. His mother, walking in a solitary place, was impregnated by the vivifying influence of the heavens. The babe, thus produced, spake and reasoned as soon as it was born. Confucius, however, wrought no miracles, performed no romantic exploits, but lived an austere ascetic life, taught and inculcated the doctrines of pure morality, and died, remarkable only for superior wisdom, religious, moral, and political.

12 Lao-kiun and his doctrines.

About the year of Christ 601, flourished the sectary *Lao-kiun*. His mother carried him 30 years in her womb, and was at last delivered of him under a plum-tree. This philosopher was the Epicurus of the Chinese. His disciples, who were denominated *Fao-sse*, i. e. heavenly doctors, were the first who corrupted the religion of the Chinese. They were addicted to magic, and introduced the worship of good and bad demons. Their doctrine was embraced by a long succession of emperors. One of these princes, called *You-ti*, had been deprived by death of a favourite mistress, whom he loved with the most extravagant passion. The emperor, by the magical skill of one of these doctors, obtained an interview with his deceased mistress, a circumstance which rivetted the whole order in the affection and esteem of the deluded prince. Here our readers will observe the exact counterpart of the fable of Eurydice, so famous in the mythology of the Greeks and Romans. That such a system of religious principles must have abounded with mythological adventures is highly probable; but as the missionaries, to whom we are chiefly indebted for our information relation to the religion of the Chinese, have not taken the pains to record them, we find it impossible to gratify the curiosity of our readers on that head.

13 Introduction of the worship of Fo, and of the doctrine of the metempsychosis into China.

The worship of the idol Fo, or Foe, was transplanted from India into China about the 56th year of the Christian era, upon the following occasion. One of the doctors of the Fao-sse had promised a prince of the family of Tchou, and brother of the emperor Ming-ti, to make him enter into communion with the spirits. At this solicitation an ambassador was despatched into India, in order to inquire where the true religion was to be found. There had been a tradition, say the missionaries, ever since the age of Confucius, that the true religion was to be found in the west.—The ambassador stopt short in India; and finding that the god Foe was in high reputation in that country, he collected several images of that deity painted on chintz, and with it 42 chapters of the canonical books of the Hindoos, which, together with the images, he laid on a white elephant, and transported into his native country. At the same time he imported from the same quarter the doctrine of the transmigration of souls, which is firmly believed in China to this day. The doctrine and worship of Foe, thus introduced, made a most rapid progress all over China, Japan, Siam, &c. The priests of Foe are called among the Siamese, *Talopoins*; by the Tartars, *Lamas*; by the Chinese, *Ha-chang*; and by the people of Japan, *Bonzes*. By this last appellation they are generally known in Europe.

14 The worshippers of Fo great mythologists.

An infinitude of fables was invented and propagated by the disciples of Foe, concerning the life and adventures of their master. If the earlier ages of the Chinese history are barren of mythological incidents, the later periods, after the introduction of the worship of Foe, furnish an inexhaustible store of miracles, monsters, fables, intrigues, exploits, and adventures, of the most villanous complexion. Indeed, most of them are so absurd, so ridiculous, and at the same time so impious and profane, that we are convinced our readers will easily dispense with a detail from which they could reap neither entertainment nor instruction. Such as may find themselves disposed to rake into this abominable puddle, we must refer to the reverend fathers Du Halde, Couplet, Amiot, Kircher, and other members of the propaganda, in whose writings they will find wherewithal to satisfy, and even to surfeit, their appetite.

15 Hindoo mythology.

The Hindoos, like the other nations of the east, for a long time retained the worship of the true God. At length, however, idolatry broke in, and, like an impetuous torrent, overwhelmed the country. First of all, the genuine history of the origin of the universe was either utterly lost, or disguised under a variety of fictions and allegories. We are told that *Brimha*, the supreme divinity of the Hindoos, after three several efforts, at last succeeded in creating four persons, whom he appointed to rule over all the inferior creatures.—Afterwards Brimha joined his efficient power with Bishon and Rulder; and by their united exertions they produced ten men, whose general appellation is *Munies*, that is, the inspired. The same being, according to another mythology, produced four other persons, as imaginary as the former; one from his breast, one from his back, one from his lip, and one from his heart. These children were denominated *Bangs*; the import of which word we cannot pretend to determine. According to another tradition, Brimha produced the Bramins from his mouth, to pray, to read, to instruct; the Chiltern from his arms, to draw the bow, to fight, to govern; the Bice from his belly or thighs, to nourish, to provide the necessaries of life by agriculture and commerce; the Soder from his feet, for subjection,

ſubjection, to ſerve, to labour, to travel. The reader will ſee at once, in theſe allegorical perſons, the four caſts or ſepts into which the Hindoo nations have, time immemorial, been divided. Theſe are ſome of their moſt celebrated mythological traditions with relation to the origin of the univerſe.

16 Hindoo traditions relating to the deluge, &c.

The Hindoos have likewiſe ſome mythological opinions which ſeem to relate to the general deluge. They tell us, that deſiring the preſervation of herds and of brahmans, of genii and of virtuous men, of *vedas* of law, and of precious things, the Lord of the univerſe aſſumes many bodily ſhapes; but though he pervades, like the air, a variety of beings, yet he is himſelf unvaried, ſince he has no quality in him ſubject to change. At the cloſe of the laſt *calpa*, there was a general deſtruction, occaſioned by the ſleep of Brahme, whence his creatures in different worlds were drowned in a vaſt ocean. Brahme being inclined to ſlumber after a lapſe of ſo many ages, the ſtrong demon *Hyagri-va*, came near him, and ſtole the *vedas* which had flowed from his lips. When *Heri*, the preſerver of the univerſe, diſcovered this deed of the prince of *Dainavas*, he took the ſhape of a minute fiſh called *Sap-hari*. After various transformations, and an enormous increaſe of ſize in each of them, the Lord of the univerſe loving the righteous man (A), who had ſtill adhered to him under all theſe various ſhapes, and intending to preſerve him from the ſea of deſtruction cauſed by the depravity of the age, thus told him how he was to act: "In ſeven days from the preſent time, O thou tamer of enemies! the three worlds will be plunged in an ocean of death; but in the midſt of the deſtroying waves a large veſſel ſent by me for thy uſe ſhall ſtand before thee." The remaining part of the mythology ſo nearly reſembles the Moſaic hiſtory of Noah and the general deluge, that the former may be a ſtrong confirmation of the truth of the latter. To dry up the waters of the deluge, the power of the Deity deſcends in the form of a *boar*, the ſymbol of ſtrength, to draw up and ſupport on his tuſks the whole earth, which had been ſunk beneath the ocean. Again, The ſame power is repreſented as a tortoiſe ſuſtaining the globe, which had been convulſed by the violent aſſaults of demons, while the gods charmed the ſea with the mountain *Mandar*, and forced it to diſgorge the ſacred things and animals, together with the water of life which it had ſwallowed. All theſe ſtories, we think, relate to the ſame event, ſhadowed by a moral, a metaphyſical, and an aſtronomical allegory; and all three ſeem connected with the hieroglyphical ſculptures of the old Egyptians.

The Hindoos divide the duration of the world into four *yugs* or *jugs*, or *jogues*, each conſiſting of a prodigious number of years. In each of thoſe periods, the age and ſtature of the human race have been gradually diminiſhed; and in each of them mankind has gradually declined in virtue and piety, as well as in age and ſtature. The preſent period they call the *Collæ*, i. e. the corrupt jogue, which they ſay is to laſt 400,000 years, of which near 5000 years are already paſt. In the laſt part of the preceding jogue, which they call the *dwa paar*, the age of man was contracted into 1000 years, as in the preſent it is confined to 100. From this proportional diminution of the length of the human life, our readers will probably infer, that the two laſt jogues bear a pretty near reſemblance to the Moſaic hiſtory of the age of the antediluvian and poſtdiluvian patriarchs; and that the two firſt are imaginary periods prior to the creation of the world, like thoſe of the Chineſe, Chaldeans, and Egyptians.

17 The world ſubject to various diſſolutions and reſuſcitations.

According to the mythology of the Hindoos, the ſyſtem of the world is ſubject to various diſſolutions and reſuſcitations. At the concluſion of the Collæ jogue, ſay they, a grand revolution will take place, when the ſolar ſyſtem will be conſumed by fire, and all the elements reduced to their original conſtituent atoms. Upon the back of theſe revolutions, Brimha, the ſupreme deity of the Hindoos, is ſometimes repreſented as a new born infant, with his toe in his mouth, floating on a camala or water flower, ſometimes only on a leaf of that plant, on the ſurface of the vaſt abyſs. At other times he is figured as coming forth of a winding ſhell: and again as blowing up the mundane foam with a pipe at his mouth. Some of theſe emblematical figures and attitudes, our learned readers will probably obſerve, nearly reſemble thoſe of the ancient Egyptians.

But the vulgar religion of the ancient Hindoos was of a very different complexion, and opens a large field of mythological adventures. We have obſerved above, that the Fo or Foe of the Chineſe was imported from India; and now we ſhall give a brief detail of the mythological origin of that divinity. We have no certain account of the birth-place of this imaginary deity.—His followers relate, that he was born in one of the kingdoms of India near the line, and that his father was one of that country. His mother brought him into the world by the left ſide, and expired ſoon after her delivery. At the time of her conception, ſhe dreamed that ſhe had ſwallowed a white elephant; a circumſtance which is ſuppoſed to have given birth to the veneration which the kings of India have always ſhown for a white animal of that ſpecies. As ſoon as he was born, he had ſtrength enough to ſtand erect without aſſiſtance. He walked abroad at ſeven, and, pointing with one hand to the heavens, and with the other to the earth, he cried out, "In the heavens, and on the earth, there is no one but me who deſerves to be honoured." At the age of 30, he felt himſelf all on a ſudden filled with the divinity; and now he was metamorphoſed into Fo or Pagod, according to the expreſſion of the Hindoos. He had no ſooner declared himſelf a divinity, than he thought of propagating his doctrine, and proving his divine miſſion by miracles. The number of his diſciples was immenſe; and they ſoon ſpread his dogmas over all India, and even to the higher extremities of Aſia.

18 Birth, &c. of the god Fo.

19 Doctrines of Fo derived from Egypt.

One of the principal doctrines which Fo and his diſciples propagated, was the metempſychoſis or tranſmigration of ſouls. This doctrine, ſome imagine, has given

(A) He was Sovereign of the world. His name was *Mana*, or Statgavrata; his patronymic name was *Vaiſvata*, or Child of the Sun.

given riſe to the multitude of idols reverenced in every country where the worſhip of Fo is eſtabliſhed. Quadrupeds, birds, reptiles, and the vileſt animals, had temples erected for them; becauſe, ſay they, the ſoul of the god, in his numerous tranſmigrations, may have at one time or other inhabited their bodies.

Both the doctrine of tranſmigration and of the worſhip of animals ſeems, however, to have been imported from Egypt into India. If the intercourſe between theſe two countries was begun at ſo early a period as ſome very late writers have endeavoured to prove, ſuch a ſuppoſition is by no means improbable. The doctrine of the tranſmigration of ſouls was early eſtabliſhed among the Egyptians. It was, indeed, the only idea they formed of the ſoul's immortality. The worſhip of animals among them ſeems to have been ſtill more ancient. If ſuch an intercourſe did actually exiſt, we may naturally ſuppoſe that colonies of Egyptian prieſts found their way into India, as they did afterwards into Aſia Minor, Italy, and Greece. That colonies of Egyptians did actually penetrate into that country, and ſettle there, many centuries before the Nativity, is a fact that cannot be called in queſtion, for reaſons which the bounds preſcribed us in this article will not allow us to enumerate. We ſhall only obſerve, that from the hieroglyphical repreſentations of the Egyptian deities ſeem to have originated thoſe monſtrous idols which from time immemorial have been worſhipped in India, China, Japan, Siam, and even in the remoteſt parts of Aſiatic Tartary.

20 The incarnations of Viſhnou.

Foe is often called *Budha*, or *Budda*, and ſometimes *Viſhnou*; perhaps, indeed, he may be diſtinguiſhed by many other names, according to the variety of dialects of the different nations among which his worſhip was eſtabliſhed. An infinitude of fables was propagated by his diſciples concerning him after his death. They pretended that their maſter was ſtill alive; that he had been already born 8000 times, and that he had ſucceſſively appeared under the figure of an ape, a lion, a dragon, an elephant, a boar, &c. Theſe were called the incarnations of Viſhnou. At length he was confounded with the ſupreme God; and all the titles, attributes, operations, perfections, and enſigns of the Moſt High were aſcribed to him. Sometimes he is called Amida, and repreſented with the head of a dog, and worſhipped as the guardian of mankind. He ſometimes appears as a princely perſonage, iſſuing from the mouth of a fiſh. At other times, he wears a lunette on his head, in which are ſeen cities, mountains, towers, trees, in ſhort, all that the world contains. Theſe transformations are evidently the children of allegorical or hieroglyphical emblems, and form an exact counterpart to the ſymbolical worſhip of the Egyptians.

The enormous maſs of mythological traditions which have in a manner deluged the vaſt continent of India, would fill many volumes: We have ſelected the preceding articles as a ſpecimen only, by which our readers may be qualified to judge of the reſt. If they find themſelves diſpoſed to indulge their curioſity at greater length, we muſt remit them to Thevenot's and Hamilton's Travels, to Monſ. Anquetil in his Zond Aveſta, Halhed's Introduction to his Tranſlation of the Code of Gentoo Laws, Col. Dow's Hiſtory of Hindoſtan, Groſe's Voyage to the Eaſt Indies, Aſiatic Reſearches, vol. i. and ii.

21 Perſian mythology.

The mythology of the Perſians is, if poſſible, ſtill more extravagant than that of the Hindoos. It ſuppoſes the world to have been repeatedly deſtroyed, and repeopled by creatures of different formation, who were ſucceſſively annihilated or baniſhed for their diſobedience to the ſupreme Being. The monſtrous griffin *Sinergh* tells the hero *Caherman* that ſhe had already lived to ſee the earth ſeven times filled with creatures and ſeven times a perfect void: that before the creation of Adam, this globe was inhabited by a race of beings called *Peri* and *Dives*, whoſe characters formed a perfect contraſt. The Peri are deſcribed as beautiful and benevolent; the Dives as deformed, malevolent, and miſchievous, differing from infernal demons only in this, that they are not as yet confined to the pit of hell. They are for ever ranging over the world, to ſcatter diſcord and miſery among the ſons of men. The Peri nearly reſemble the fairies of Europe; and perhaps the Dives gave birth to the giants and magicians of the middle ages. The Peri and Dives wage inceſſant wars; and when the Dives make any of the Peri priſoners, they ſhut them up in iron cages, and hang them on the higheſt trees, to expoſe them to public view, and to the fury of every chilling blaſt.

22 *Peri* and *Dives*.

When the Peri are in danger of being overpowered by their foes, they ſolicit the aſſiſtance of ſome mortal hero; which produces a ſeries of mythological adventures, highly ornamental to the ſtrains of the Perſian bards, and which, at the ſame time, furniſhes an inexhauſtible fund of the moſt diverſified machinery.

One of the moſt celebrated adventurers in the mythology of Perſia is *Tahmuras*, one of their moſt ancient monarchs. This prince performs a variety of exploits, while he endeavours to recover the fairy Merjan. He attacks the Dive Demruſh in his own cave; where, having vanquiſhed the giant or demon, he finds vaſt piles of hoarded wealth: theſe he carries off with the fair captive. The battles, labours, and adventures of Roſtan, another Perſian worthy, who lived many ages after the former, are celebrated by the Perſian bards with the ſame extravagance of hyperbole with which the labours of Hercules have been ſung by the poets of Greece and Rome.

23 Perſia the birth place of chivalry and romance.

The adventures of the Perſian heroes breathe all the wildneſs of achievement recorded of the knights of Gothic romance. The doctrine of enchantments, transformations, &c. exhibited in both, is a characteriſtic ſymptom of one common original. Perſia is the genuine claſſic ground of eaſtern mythology, and the ſource of the ideas of chivalry and romance; from which they were propagated to the regions of Scandinavia, and indeed to the remoteſt corners of Europe towards the weſt.

Perhaps our readers may be of our opinion, when we offer it as a conjecture, that the tales of the war of the Peri and Dives originated from a vague tradition concerning good and bad angels: nor is it, in our opinion, improbable, that the fable of the wars between the gods and giants, ſo famous in the mythology of Greece and Italy, was imported into the former of theſe countries from the ſame quarter. For a more particular account of the Perſian mythology, our readers may conſult Dr

Hyde

Hyde Relig. vet. Perſ. Medor. &c. D'Herbelot's Bibl. Orient. and Mr Richardſon's introduction to his Perſian and Arabic Dictionary.

24 Chaldean mythology.

The mythology of the Chaldeans, like that of the other nations of the eaſt, commences at a period myriads of years prior to the era of the Moſaic creation. Their coſmogony, exhibited by Beroſus, who was a prieſt of Belus, and deeply verſed in the antiquities of his country, is a piece of mythology of the moſt extravagant nature. It has been copied by Euſebius (Chron. lib. i. p. 5.); it is likewiſe to be found in Syncellus, copied from Alexander Polyhiſtor. According to this hiſtorian, there were at Babylon written records preſerved with the greateſt care, comprehending a period of fifteen myriads of years. Thoſe writings likewiſe contained a hiſtory of the heavens and the ſea, of the earth, and of the origin of mankind. "In the beginning (ſays Beroſus, copying from Oannes, of whom we ſhall give a brief account below) there was nothing but darkneſs and an abyſs of water, wherein reſided moſt hideous beings produced from a twofold principle. Men appeared with two wings; ſome with two and ſome with four faces. They had one body, but two heads; the one of a man, the other of a woman. Other human figures were to be ſeen, furniſhed with the legs and horns of goats. Some had the feet of horſes behind, but before were faſhioned like men, reſembling hippocentaurs." The remaining part of this mythology is much of the ſame complexion; indeed ſo extravagant, that we imagine our readers will readily enough diſpenſe with our tranſlating the ſequel. "Of all theſe (ſays the author) were preſerved delineations in the temple of Belus at Babylon. The perſon who was ſuppoſed to preſide over them was called *Omorea.* This word, in the Chaldean language, is *Thalath*, which the Greeks call Θαλαττα, but it more properly imports the moon. Matters being in this ſituation, *their* god (ſays Euſebius), *the* god (ſays Syncellus) came and cut the woman aſunder; and out of one half of her he formed the earth, and out of the other he made the heavens; and, at the ſame time, he deſtroyed the monſters of the abyſs." This whole mythology is an allegorical hiſtory copied from hieroglyphical repreſentations, the real purport of which could not be decyphered by the author. Such, in general, were the conſequences of the hieroglyphical ſtyle of writing.

25 Oannes the legiſlator of the Chaldeans.

Oannes, the great civilizer and legiſlator of the Chaldeans, according to Apollodorus, who copied from Beroſus, was an amphibious animal of a heterogeneous appearance. He was endowed with reaſon and a very uncommon acuteneſs of parts. His whole body reſembled a fiſh. Under the head of a fiſh he had alſo another head, and feet below ſimilar to thoſe of a man, which were ſubjoined to the tail of the fiſh. His voice and language were articulate and perfectly intelligible, and there was a figure of him ſtill extant in the days of Beroſus. He made his appearance in the Erythrean or Red ſea, where it borders upon Babylonia. This monſtrous being converſed with men by day; but at night he plunged into the ſea, and remained concealed in the water till next morning. He taught the Babylonians the uſe of letters, and the knowledge of all the arts and ſciences. He inſtructed them in the method of building houſes, conſtructing temples, and all other edifices. He taught them to compile laws and religious ceremonies, and explained to them the principles of mathematics, geometry, and aſtronomy. In a word he communicated to them every thing neceſſary, uſeful, and ornamental: and ſo univerſal were his inſtructions, that not one ſingle article had ever been added to them ſince the time they were firſt communicated. Helladius is of opinion that this ſtrange perſonage, whoever he was, came to be repreſented under the figure of a fiſh, not becauſe he was actually believed to be ſuch, but becauſe he was clothed with the ſkin of a ſeal. By this account our readers will ſee that the Babylonian Oannes is the exact counterpart of the Fohi of the Chineſe, and the Thyoth or the Mercury Triſmegiſtus of the Egyptians. It is likewiſe apparent, that the idea of the monſter compounded of the man and the fiſh has originated from ſome hieroglyphic of that form grafted upon the appearance of man. Some modern mythologiſts have been of opinion, that Oannes was actually Noah the great preacher of righteouſneſs; who, as ſome think, ſettled in Shinar or Chaldea after the deluge, and who, in conſequence of his connexion with that event, might be properly repreſented under the emblem of *the Man of the Sea.*

26 The nativity of the goddeſs of beauty and love.

The nativity of Venus, the goddeſs of beauty and love, is another piece of mythology famous among the Babylonians and Aſſyrians. An egg, ſay they, of a prodigious ſize, dropt from heaven into the river Euphrates. Some doves ſettled upon this egg, after that the fiſhes had rolled it to the bank. In a ſhort time this egg produced Venus, who was afterwards called *Dea Syria*, the Syrian goddeſs. In conſequence of this tradition (ſays Hyginus), pigeons and fiſhes became ſacred to this goddeſs among the Syrians, who always abſtained from eating the one or the other. Of this imaginary being we have a very exact and entertaining hiſtory in the treatiſe *De Dea Syria*, generally aſcribed to Lucian.

In this mythological tradition our readers will probably diſcover an alluſion to the celebrated *Mundane egg;* and at the ſame time the ſtory of the fiſhes will lead them to anticipate the connexion between the ſea and the moon. This ſame deity was the Atargatis of Aſcalon, deſcribed by Diodorus the Sicilian; the one half of her body a woman and the other a fiſh. This was no doubt a hieroglyphic figure of the moon, importing the influence of that planet upon the ſea and the ſex. The oriental name of this deity evidently points to the moon; for it is compounded of two Hebrew words (B), which import "the queen of the hoſt of heaven."

27 The fable of Semiramis.

The fable of Semiramis is nearly connected with the preceding one. Diodorus Siculus has preſerved the mythological hiſtory of this deity, which he and all the writers of antiquity have confounded with the Babylonian princeſs of the ſame name. That hiſtorian informs us, that the word *Semiramis*, in the Syrian dialect, ſignifies "a wild pigeon;" but we apprehend that this term was a name or epithet of the moon

(B) *Adar* or *Hadar*, "*magnificus;*" and *Gad*, "*exercitus turmi.*"

moon, as it is compounded of two words (c) of an import naturally applicable to the lunar planet. It was a general practice among the Orientals to denominate their ſacred animals from that deity to which they were conſecrated. Hence the moon being called *Semiramis*, and the pigeon being ſacred to her divinity, the latter was called by the name of the former.

As the bounds preſcribed this article render it impoſſible for us to do juſtice to this intereſting piece of mythology, we muſt beg leave to refer our readers for farther information to Diod. Sic. lib. ii. Hyginus Poet. Aſtron. Fab. 197. Pharnutus de Nat. Deor. Ovid. Metam. lib. iv. Athen. in Apol. Izetzes, Chil. ix. cap. 275. Seld. de Diis Syr. Syrit. ii. p. 183.

28 Little known of Arabian mythology.

We ſhould now proceed to the mythology of the Arabians, the far greateſt part of which is however, buried in the abyſs of ages; though, when, we reflect on the genius and character of that people, we muſt be convinced that they too, as well as the other nations of the eaſt, abounded in fabulous relations and romantic compoſitions. The natives of that country have always been enthuſiaſtically addicted to poetry, of which fable is the eſſence. Wherever the Muſes have erected their throne, fables and miracles have always appeared in their train. In the Koran we meet with frequent alluſions to well-known traditionary fables. Theſe had been tranſmitted from generation to generation by the bards and rhapſodiſts for the entertainment of the vulgar. In Arabia, from the earlieſt ages, it has always been one of the favourite entertainments of the common people, to aſſemble in the ſerene evenings around their tents, or on the platforms with which their houſes are generally covered, or in large halls erected for the purpoſe, in order to amuſe themſelves with traditional narrations of the moſt diſtinguiſhed actions of their moſt remote anceſtors. Oriental imagery always embelliſhed their romantic details. The glow of fancy, the love of the the marvellous, the propenſity towards the hyperbolical and the vaſt, which conſtitute the eſſence of oriental deſcription, muſt ever have drawn the relation aſide into the devious regions of fiction and fairy land. The religion of Mahomet beat down the original fabric of idolatry and mythology together. The Arabian fables current in modern times are borrowed or imitated from Perſian compoſitions; Perſia being ſtill the grand nurſery of romance in the eaſt.

29 Egyptian mythology.

In Egypt we find idolatry, theology, and mythology, almoſt inſeparably blended together. The inhabitants of this region, too, as well as of others in the vicinity of the centre of population, adhered for ſeveral centuries to the worſhip of the true God. At laſt, however, conſcious of their own ignorance, impurity, imperfection, and total unfitneſs to approach an infinitely perfect Being, diſtant, as they imagined, and inviſible, they began to caſt about for ſome beings more exalted, and more perfect than themſelves, by whoſe mediation they might prefer their prayers to the ſupreme Majeſty of heaven. The luminaries of heaven, which they imagined were animated bodies, naturally preſented themſelves. Theſe were ſplendid and glorious beings. They were thought to partake of the divine nature: they were revered as the ſatraps, prefects, and repreſentatives of the ſupreme Lord of the univerſe. They were viſible, they were beneficent; they dwelt nearer to the gods, they were near at hand and always acceſſible. Theſe were, of courſe, employed as mediators and interceſſors between the ſupreme Divinity and his humble ſubjects of this lower world. Thus employed, they might claim a ſubordinate ſhare of worſhip, which was accordingly aſſigned them. In proceſs of time, however, that worſhip, which was originally addreſſed to the ſupreme Creator by the mediation of the heavenly bodies, was in a great meaſure forgotten, and the adoration of mankind ultimately terminated on theſe illuſtrious creatures. To this circumſtance, we think, we may aſcribe the origin of that ſpecies of idolatry called *Zabiiſm*, or the worſhip of the hoſt of heaven, which overſpread the world early and almoſt univerſally. In Egypt this mode of worſhip was adopted in all its moſt abſurd and moſt enthuſiaſtic forms; and at the ſame time the moſt heterogeneous mythology appeared in its train. The mythology of the ancient Egyptians was ſo various and multiform, ſo complicated and ſo myſterious, that it would require many volumes even to give a ſuperficial account of its origin and progreſs, not only in its mother country, but even in many other parts of the eaſtern and weſtern world. Beſides, the idolatry and mythology of that wonderful country are ſo cloſely connected and ſo inſeparably blended together, that it is impoſſible to deſcribe the latter without at the ſame time developing the former. We hope, therefore, our readers will not be diſappointed, if, in a work of this nature, we touch only upon ſome of the leading or moſt intereſting articles of this complicated ſubject.

30 Origin of Zabiiſm.

31 Reign of gods and demigods, &c. in Egypt.

The Egyptians confounded the revolutions of the heavenly bodies with the reigns of their moſt early monarchs. Hence the incredible number of years included in the reign of their eight ſuperior gods, who, according to them, filled the Egyptian throne ſucceſſively in the moſt early periods of time. To theſe, according to their ſyſtem, ſucceeded twelve demigods, who likewiſe reigned an amazing number of years. Theſe imaginary reigns were no other than the periodical revolutions of the heavenly bodies preſerved in their almanacks, which might be carried back, and actually were carried back, at pleaſure. Hence the fabulous antiquity of that kingdom. The imaginary exploits and adventures of theſe gods and demigods furniſhed an inexhauſtible fund of mythological romances. To the demigods ſucceeded the kings of the cynic cycle, perſonages equally chimerical with the former. The import of this epithet has greatly perplexed critics and etymologiſts. We apprehend it is an oriental word importing *royal* dignity, elevation of rank. This appellation intimated, that the monarchs of that cycle, admitting that they actually exiſted, were more powerful and more highly revered than their ſucceſſors. After the princes of the cynic cycle comes another race, denominated *Nekyes*, a title likewiſe implying royal, ſplendid, glorious. Theſe cycles

(c) *Shem* or *Sem*, " a ſign," and *ramah*, " high."

32 Birth, exploits, and transformation of the gods.

cycles figure high in the mythological annals of the Egyptians, and have furnished materials for a variety of learned and ingenious disquisitions. The wars and adventures of Osiris, Orus, Typhon, and other allegorical personages who figure in the Egyptian rubric; the wanderings of Isis, the sister and wife of Osiris; the transformation of the gods into divers kinds of animals; their birth, education, peregrinations, and exploits;—compose a body of mythological fictions so various, so complicated, so ridiculous, and often so apparently absurd, that all attempts to develope and explain them have hitherto proved unsuccessful. All, or the greatest part, of those extravagant fables, are the offspring of hieroglyphical or allegorical emblems devised by the priests and sages of that nation, with a view to conceal the mysteries of their religion from that class of men whom they stigmatized with the name of the uninitiated rabble.

33 Worship of brute animals, &c.

The worship of brute animals and of certain vegetables, universal among the Egyptians, was another exuberant source of mythological adventures. The Egyptian priests, many of whom were likewise profound philosophers, observed, or pretended to observe, a kind of analogy between the qualities of certain animals and vegetables, and those of some of their subordinate divinities. Such animals and vegetables they adopted, and consecrated to the deities to whom they were supposed to bear this analogical resemblance; and in process of time they considered them as the visible emblems of those divinities to which they were consecrated. By these the vulgar addressed their archetypes: in the same manner, as in other countries, pictures and statues were employed for the very same purpose. The mob, in process of time, forgetting the emblematical character of those brutes and vegetables, addressed their devotion immediately to them; and of course these became the ultimate objects of vulgar adoration.

After that these objects, animate or inanimate, were consecrated as the visible symbols of the deities, it soon became fashionable to make use of their figures to represent those deities to which they were consecrated. This practice was the natural consequence of the hieroglyphical style which universally prevailed among the ancient Egyptians. Hence Jupiter Ammon was represented under the figure of a ram, Apis under that of a cow, Osiris of a bull, Pan of a goat, Thoth or Mercury of an ibis, Bubastis or Diana of a cat, &c. It was likewise a common practice among those deluded people to dignify these objects, by giving them the names of those deities which they represented. By this mode of dignifying these sacred emblems, the veneration of the rabble was considerably enhanced, and the ardour of their devotion inflamed in proportion. From these two sources, we think, are derived the fabulous transformations of the gods, so generally celebrated in the Egyptian mythology, and from it imported into Greece and Italy. In consequence of this practice, their mythological system was rendered at once enormous and unintelligible.

34 Mercury Trismegistus the author of the Egyptian mythology.

Their Thoth, or Mercury Trismegistus, was, in our opinion, the inventor of this unhappy system. This personage, according to the Egyptians, was the original author of letters, geometry, astronomy, music, architecture; in a word, of all the elegant and useful arts, and of all the branches of science and philosophy. He it was who first discovered the analogy between the divine affections, influences, appearances, operations, and the corresponding properties, qualities, and instincts of certain animals, and the propriety of dedicating particular kinds of vegetables to the service of particular deities.

The priests, whose province it was to expound the mysteries of that allegorical hieroglyphical religion, (see MYSTERIES), gradually lost all knowledge of the primary import of the symbolical characters. To supply this defect, and at the same time to veil their own ignorance, the sacerdotal instructors had recourse to fable and fiction. They heaped fable upon fable, till their religion became an accumulated chaos of mythological absurdities.

Two of the most learned and most acute of the ancient philosophers have attempted a rational explication of the latent import of the Egyptian mythology; but both have failed in the attempt; nor have the moderns, who have laboured in the same department, performed their part with much better success. Instead, therefore, of prosecuting this inexplicable subject, which would swell this article beyond all proportion, we must beg leave to refer those who are desirous of further information to the following authors, where they will find enough to gratify their curiosity, if not to inform their judgement: Herodotus, lib. ii. Diodorus Siculus, lib. i. Plut. Isis et Osiris; Jamblichus de Myst. Egypt. Horapollo Hieroglyp. Egypt. Macrob. Sat. cap. 23. among the ancients; and among the moderns, Kircher's Oedip. Voss. de Orig. et Prog. Idol. Mr Bryant's Analysis of Anc. Mythol. Mons. Gebelin Monde Prim.; and above all, to the learned Jablonski's Panth. Egyptiorum.

The elements of Phœnician mythology have been preserved by Eusebius, Præp. Evang. sub. init. In the large extract which that learned father hath copied from Philo Biblius's translation of Sanchoniathon's History of Phœnicia, we are furnished with several articles of mythology. Some of these throw considerable light on several passages of the sacred history; and all of them are strictly connected with the mythology of the Greeks and Romans. There we have preserved a brief but entertaining detail of the fabulous adventures of Uranus, Cronus, Dagon, Thyoth or Mercury, probably the same with the Egyptian hero of that name. Here we find Muth or Pluto, Æphcestus or Vulcan, Æsculapius, Nereus, Poseedon or Neptune, &c. Astarte, or Venus Urania, makes a conspicuous figure in the catalogue of Phœnician worthies; Pallas or Minerva is planted on the territory of Attica; in a word, all the branches of the family of the Titans, who in after ages figured in the rubric of the Greeks, are brought upon the stage, and their exploits and adventures briefly detailed. 35 Phœnician mythology.

By comparing this fragment with the mythology of the Atlantidæ and that of the Cretans preserved by Diodorus the Sicilian, lib. v. we think there is good reason to conclude, that the family of the Titans, the several branches of which seem to have been both the authors and objects of a great part of the Grecian idolatry, originally emigrated from Phœnicia. This conjecture will receive additional strength, when it is considered, that almost all their names recorded in the fabulous records of Greece, may be easily traced up to a Phœnician 36 Grecian mythology derived from Egypt and Phœnicia:

Phœnician original. We agree with Herodotus, that a conſiderable part of the idolatry of Greece may have been borrowed from the Egyptians; at the ſame time, we imagine it highly probable, that the idolatry of the Egyptians and Phœnicians was, in its original conſtitution, nearly the ſame. Both ſyſtems were Sabiiſm, or the worſhip of the hoſt of heaven. The Pelaſgi, according to Herodotus, learned the names of the gods from the Egyptians; but in this conjecture he is certainly warped by his partiality for that people. Had thoſe names been imported from Egypt, they would no doubt have bewrayed their Egyptian original; whereas, every etymologiſt will be convinced that every one is of Phœnician extraction.

The adventures of Jupiter, Juno, Mercury, Apollo, Diana, Mars, Minerva or Pallas, Venus, Bacchus, Ceres, Proſerpine, Pluto, Neptune, and the other deſcendants and coadjutors of the ambitious family of the Titans, furniſh by far the greateſt part of the mythology of Greece. They left Phœnicia, we think, about the age of Moſes; they ſettled in Crete, a large and fertile iſland; from this region they made their way into Greece, which, according to the moſt authentic accounts, was at that time inhabited by a race of ſavages. The arts and inventions which they communicated to the natives; the myſteries of religion which they inculcated; the laws, cuſtoms, polity, and good order, which they eſtabliſhed; in ſhort, the bleſſings of humanity and civilization, which they everywhere diſſeminated, in proceſs of time inſpired the unpoliſhed inhabitants with a kind of divine admiration. Thoſe ambitious mortals improved this admiration into divine homage and adoration. The greater part of that worſhip, which had been formerly addreſſed to the luminaries of heaven, was now transferred to thoſe illuſtrious perſonages. They claimed and obtained divine honours from the deluded rabble of enthuſiaſtic Greeks. Hence ſprung an inexhauſtible fund of the moſt inconſiſtent and irreconcilable fictions.

37 Hence the inconſiſtent fictions of the Greek poets.

The foibles and frailties of the deified mortals were tranſmitted to poſterity, incorporated as it were with the pompous attributes of ſupreme divinity. Hence the heterogeneous mixture of the mighty and the mean which checquers the characters of the heroes of the Iliad and Odyſſey. The Greeks adopted the oriental fables; the import of which they did not underſtand. Theſe they accommodated to heroes and illuſtrious perſonages, who had figured in their own country in the earlieſt periods. The labours of Hercules originated in Egypt, and evidently relate to the annual progreſs of the ſun in the zodiac, though the vain-glorious Greeks accommodated them to a hero of their own, the reputed ſon of Jupiter and Alcmena. The expedition of Oſiris they borrowed from the Egyptians, and transferred to their Bacchus, the ſon of Jupiter and Semele the daughter of Cadmus. The transformation and wanderings of Io are evidently tranſcribed from the Egyptian romance of the travels of Iſis in queſt of the body of Oſiris, or of the Phœnician Aſtarte, drawn from Sanchoniathon. *Io* or *Ioh* is in reality the Egyptian name of the moon, and Aſtarte was the name of the ſame planet among the Phœnicians. Both theſe fables are allegorical repreſentations of the anomalies of the lunar planet, or perhaps of the progreſs of the worſhip of that planet in different parts of the world. The fable of the conflagration occaſioned by Phaeton is clearly of oriental extraction, and alludes to an exceſſive drought which in the early periods of time ſcorched Ethiopia and the adjacent countries. The fabulous adventures of Perſeus are ſaid to have happened in the ſame regions, and are allegorical repreſentations of the influence of the ſolar luminary; for the original Perſeus was the ſun. The rape of Proſerpine and the wanderings of Ceres: the Eleuſinian myſteries; the orgia or ſacred rites of Bacchus; the rites and worſhip of the Cabiri—were imported from Egypt and Phœnicia; but ſtrangely garbled and disfigured by the hierophants of Greece. The gigantomachia, or war between the gods and the giants, and all the fabulous events and varieties of that war, form an exact counterpart to the battles of the Peri and Dives, celebrated in the romantic annals of Perſia.

A conſiderable part of the mythology of the Greeks ſprung from their ignorance of the oriental languages. They diſdained to apply themſelves to the ſtudy of languages ſpoken by people whom, in the pride of their heart, they ſtigmatized with the epithet of *barbarians*. This averſion to every foreign dialect was highly detrimental to their progreſs in the ſciences. The ſame neglect or averſion has, we imagine, proved an irreparable injury to the republic of letters in all ſucceeding ages. The aoids or ſtrolling bards laid hold on thoſe oriental legends, which they ſophiſticated with their own additions and improvements, in order to accommodate them to the popular taſte. Theſe wonderful tales figured in their rhapſodical compoſitions, and were greedily ſwallowed down by the credulous vulgar. Thoſe fictions, as they rolled down, were conſtantly augmented with freſh materials, till in proceſs of time their original import was either forgotten or buried in impenetrable darkneſs. A multitude of theſe Heſiod has collected in his Theogonia, or Generation of the Gods, which unhappily became the religious creed of the illiterate part of the Greeks. Indeed, fable was ſo cloſely interwoven with the religion of that airy volatile people, that it ſeems to have contaminated not only their religious and moral, but even their political tenets. 38 The Greeks ignorant of oriental languages.

The far-famed oracle of Dodona was copied from that of Ammon at Thebes in Egypt: The oracle of Apollo at Delphos was an emanation from the ſame ſource: The celebrated Apollo Pythius of the Greeks was no other than *Ob* or *Aub* of the Egyptians, who denominated the baſiliſk or royal ſnake *Ov Cai*, becauſe it was held ſacred to the ſun. *Ob* or *Aub* is ſtill retained in the Coptic dialect, and is one of the many names or epithets of that luminary. In ſhort, the ground-work of the Grecian mythology is to be traced in the eaſt. Only a ſmall part of it was fabricated in the country; and what was imported pure and genuine was miſerably ſophiſticated by the hands through which it paſſed, in order to give it a Grecian air, and to accommodate its ſtyle to the Grecian taſte. To enlarge upon this topic would be altogether ſuperfluous, as our learned readers muſt be well acquainted with it already, and the unlearned may without much trouble or expence furniſh themſelves with books upon that ſubject. 39 Oracle of Dodona.

The Roman mythology was borrowed from the Greeks, 40 Roman mythology borrowed from Greece.

Greeks. That people had addicted themſelves for many centuries to the arts of war and civil polity. Science and philoſophy were either neglected or unknown. At laſt they conquered Greece, the native land of ſcience, and then "Græcia capta ferum victorem cepit arte et intulit agreſti Latio." This being the caſe, their mythology was, upon the whole, a tranſcript from that of Greece. They had indeed gleaned a few fables from the Pelaſgi and Hetruſcans, which, however, are of ſo little conſequence, that they are ſcarce worth the trouble of tranſcribing.

The mythology of the Celtic nations is in a good meaſure loſt. There may poſſibly ſtill remain ſome veſtiges of the Druidical ſuperſtition in the remoteſt parts of the Highlands and iſlands of Scotland; and perhaps in the uncivilized places of Ireland. Theſe we preſume, would afford our readers but little entertainment, and ſtill leſs inſtruction. Inſtead therefore of giving a detail of thoſe unintereſting articles, we ſhall beg leave to refer our readers to Oſſian's Poems, and Col. Valency's Collections of Iriſh Antiquities, for ſatisfaction on that ſubject.

41 Mythology of the northern nations. The mythology of the northern nations, i. e. of the Norwegians, Danes, Swedes, Icelanders, &c. are uncommonly curious and entertaining. The Edda and Voluſpa contain a complete collection of fables which have not the ſmalleſt affinity with thoſe of the Greeks and Romans. They are wholly of an oriental complexion, and ſeem almoſt congenial with the tales of the Perſians above deſcribed. The Edda was compiled in Iceland in the 13th century. It is a kind of ſyſtem of the Scandinavian mythology: and has been reckoned, and we believe juſtly, a commentary on the Voluſpa, which was the Bible of the northern nations.

42 Odin or Woden. Odin or Othin, or Woden or Waden, was the ſupreme divinity of thoſe people. His exploits and adventures furniſh the far greateſt part of their mythological creed. That hero is ſuppoſed to have emigrated from the eaſt; but from what country or at what period is not certainly known. His achievements are magnified beyond all credibility. He is repreſented as the god of battles, and as ſlaughtering thouſands at a blow. His palace is called *Valhal:* it is ſituated in the city of Midgard, where, according to the fable, the ſouls of heroes who had bravely fallen in battle enjoy ſupreme felicity. They ſpend the day in mimic hunting matches, or imaginary combats. At night they aſſemble in the palace of Valhalla, where they feaſt on the moſt delicious viands, dreſſed and ſerved up by the *Valkyriæ*, virgins adorned with celeſtial charms, and fluſhed with the bloom of everlaſting youth. They ſolace themſelves with drinking mead out of the ſkulls of enemies whom they killed in their days of nature. Mead, it ſeems, was the nectar of the Scandinavian heroes.

43 The hell and devil of the Scandinavians. Sleepner, the horſe of Odin, is celebrated along with his maſter. Hela, the hell of the Scandinavians, affords a variety of fables equally ſhocking and heterogeneous. Loke, the evil genius or devil of the northern people, nearly reſembles the Typhon of the Egyptians. Signa or Sinna is the conſort of Loke; from this name the Engliſh word *ſin* is derived. The giants Weymur, Ferbanter, Belupher, and Hellunda, perform a variety of exploits, and are exhibited in the moſt frightful attitudes. One would be tempted to imagine, that they perform the exact counterpart of the giants of the Greek and Roman mythologiſts. Inſtead of glancing at theſe ridiculous and unintereſting fables, which is all that the limits preſcribed us would permit, we ſhall take the liberty to lay before our readers a brief account of the contents of the Voluſpa, which is indeed the text of the Scandinavian mythology.

The world *Voluſpa* imports, "the prophecy of Vola or Fola." This was perhaps a general name for the prophetic ladies of the north, as Sibyl was appropriated to women endowed with the like faculty in the ſouth. Certain it is, that the ancients generally connected madneſs with the prophetic faculty. Of this we have two celebrated examples: the one in Lycophron's Alexandra, and the other in the Sibyl of the Roman poet. The word *vola* ſignifies "mad or fooliſh;" whence the Engliſh words *fool*, *fooliſh*, *folly*. *Spa*, the latter part of the compoſition, ſignifies "to prophecy," and is ſtill current among the common people in Scotland, in the word *Spae*, which has nearly the ſame ſignification. 44 The Voluſpa.

The Voluſpa conſiſts of between 200 and 300 lines. The propheteſs having impoſed ſilence on all intelligent beings, declares that ſhe is about to reveal the works of the Father of nature, the actions and operations of the gods, which no mortal ever knew before herſelf. She then begins with a deſcription of the chaos; and then proceeds to the formation of the world, the creation of the different ſpecies of its inhabitants, giants, men, and dwarfs. She then explains the employments of the fairies or deſtinies, whom the northern people call *nornies;* the functions of the deities, their moſt memorable adventures, their diſputes with Loke, and the vengeance that enſued. She at laſt concludes with a long and indeed animated deſcription of the final ſtate of the univerſe, and its diſſolution by a general conflagration.

In this cataſtrophe, Odin and all the rabble of the Pagan divinities, are to be confounded in the general ruin, no more to appear on the ſtage of the univerſe. Out of the ruins of the former world, according to the Voluſpa, a new one ſhall ſpring up, arrayed in all the bloom of celeſtial beauty.

Such is the doctrine exhibited in the fabulous Voluſpa. So congenial are ſome of the details therein delivered, eſpecially thoſe relating to the final diſſolution of the preſent ſyſtem, and the ſucceſſion of a new heaven and a new earth, that we find ourſelves ſtrongly inclined to ſuſpect, that the original fabricator of the work was a ſemipagan writer, much of the ſame complexion with the authors of the Sibylline oracles, and of ſome other apocryphal pieces which appeared in the world during the firſt ages of Chriſtianity.

In America, the only mythological countries muſt be Mexico and Peru. The other parts of that large continent were originally inhabited by ſavages, moſt of them as remote from religion as from civilization. The two vaſt empires of Mexico and Peru had exiſted about 400 years only before the Spaniſh invaſion. In neither of them was the uſe of letters underſtood; and of courſe the ancient opinions of the natives relating to the origin of the univerſe, the changes which ſucceeded, and every other monument of antiquity, were obliterated and loſt. Clavigero has indeed enumerated a vaſt canaille of ſanguinary gods worſhipped by the Mexicans; 45 Mythology of Mexico and Peru.

Mexicans; but produces nothing either entertaining or interesting with respect to their mythology. The information to be derived from any other quarter is little to be depended upon. It passes through the hands of bigotted missionaries or other ecclesiastics, who were so deeply tinctured with fanaticism, that they viewed every action, every sentiment, every custom, every religious opinion and ceremony of those half-civilized people, through a false medium. They often imagined they discovered resemblances and analogies between the rites of those savages and the dogmas of Christianity, which nowhere existed but in their own heated imagination.

The only remarkable piece of mythology in the annals of the Peruvians, is the pretended extraction of Manco Capec the first Inca of Peru, and of Mama Ocolla his consort. These two illustrious personages appeared first on the banks of the lake Titiaca. They were persons of a majestic stature, and clothed in decent garments. They declared themselves to be the children of the Sun, sent by their beneficent parent, who beheld with pity the miseries of the human race, to instruct and to reclaim them. Thus we find these two legislators availed themselves of a pretence which had often been employed in more civilized regions to the very same purposes. The idolatry of Peru was gentle and beneficent, that of Mexico gloomy and sanguinary. Hence we may see, that every mode of superstition, where a divine revelation is not concerned, borrows its complexion from the characters of its professors.

In the course of this article, our readers will observe, that we have not much enlarged upon the mythology of the Greeks and Romans; that subject we imagine to be so universally known by the learned, and so little valued by the vulgar, that a minute discussion of it would be altogether superfluous. Besides, we hope it will be remembered, that the narrowness of the limits prescribed us would scarce admit of a more copious detail. We would flatter ourselves, that in the course of our disquisition, we have thrown out a few reflections and observations, which may perhaps prove more acceptable to both descriptions of readers.

MYTILUS, the Mussel, a genus of animals, belonging to the order of vermes testacea. See Conchology *Index*.

MYTTOTON, a coarse kind of food, used by the labouring people among the Greeks, and sometimes among the Romans. It was made of garlic, onions, eggs, cheese, oil, and vinegar, and reckoned very wholesome.

MYUS, in *Ancient Geography*, one of the twelve towns of Ionia; seated on the Meander, at the distance of 30 stadia from the sea. In Strabo's time it was incorporated with the Milesians, on account of the paucity of inhabitants, from its being formerly overwhelmed with water: for which reason the Ionians consigned its suffrage and religious ceremonies to the people of Miletus. Artaxerxes allotted this town to Themistocles, in order to furnish his table with meat: Magnesia was to support him in bread, and Lampsacus in wine. The town now lies in ruins.

MYXINE, the hag; a genus of animals belonging to the order of vermes intestina. See Helminthology *Index*.

N.

N, A liquid consonant, and the 13th letter of the Greek, Latin, English, &c. alphabets.

The *n* is a nasal consonant: its sound is that of a *d*, passed through the nose; so that when the nose is stopped by a cold, or the like, it is usual to pronounce *d* for *n*. M. Abbé de Dangeau observes, that in the French, the *n* is frequently a mere nasal vowel, without any thing of the consonant in it. He calls it the Sclavonic vowel. The Hebrews call their *n nun*, which signifies child, as being supposed the offspring of *m*; partly on account of the resemblance of sound, and partly on that of the figure. Thus from the *m*, by omitting the last column, is formed *n*; and thus from the capital N, by omitting the first column, is formed the Greek minuscle ν. Hence for *biennies*, &c. the Latins frequently use *bimus*, &c. and the same people convert the Greek ν, at the end of a word, into an *m*, as φαρμακον, *pharmacum*, &c. See M.

N before *p*, *b*, and *m*, the Latins change into *m*, and frequently into *l* and *r*; as in *in-ludo*, *illudo*; *in-rigo*, *irrigo*, &c.: in which they agree with the Hebrews, who, in lieu of *nun*, frequently double the following consonants: and the Greeks do the same; as when for *Manlius*, they write Μαλλιος, &c. The Greeks also, before κ, γ, χ, ν, changed the ν into γ: in which they were followed by the ancient Romans: who, for *Angulus*, wrote *Aggulus*; for *anceps*, *agceps*, &c.

The Latins retrench the *n* from Greek nouns ending

ing in ων; as Λεων, *Leo*; Δρακων, *Draco*; on the contrary, the Greeks add it to the Latin ones ending in *o*; as Κατων, Νερων, *Cato*, *Nero*.

N, among the ancients, was a numeral letter, signifying 900; according to the verse in Baronius,

N, quoque nongentos numero designat habendos.

And when a line was struck over it, N̄, nine thousand. Among the ancient lawyers, *N. L.* stood for *non liquet*, i. e. the cause is not clear enough to pass sentence upon. N, or N°, in commerce, &c. is used as an abbreviation of *numero*, number.

NAARDA, Nearda, *Neerda*, or *Nehardea*, in *Ancient Geography*, a town situated on the confines of Mesopotamia and Babylonia; populous, and with a rich and extensive territory, not easily to be attacked by an enemy, being surrounded on all sides by the Euphrates and strong walls (Josephus). In the lower age the Jews had a celebrated school there.

NAAS, a borough town of Ireland, in the county of Kildare and province of Leinster. It is the shire town of that county, and alternately with Athy the assizes town. It is distant above 15 miles south-west from Dublin, in N. Lat. 53. 10. W. Long. 6. 50. It gives title of viscount to the family of Burke. This place was anciently the residence of the kings of Leinster: the name signifies "the place of elders," for here the states of that province assembled during the 6th, 7th, and 8th centuries, after the Naasteighan of Carmen had been anathematized by the Christian clergy. On the arrival of the English it was fortified; many castles were erected, the ruins of which are partly visible; and parliaments were held there. At the foot of the mount or rath are the ruins of a house founded in 1484, for eremites of the order of St Augustin. In the 12th century the baron of Naas founded a priory dedicated to St John the Baptist, for Augustinian regular canons. In the centre of this town the family of Eustace erected a monastery for Dominican friars, dedicated to St Eustachius; and it appears that their possessions in Naas were granted them in the year 1355. This place was a strong hold during the civil wars.

NABATENE, or Regio Nabatæorum, according to Jerome, comprised all the country lying between the Euphrates and the Red sea, and thus contained Arabia Deserta, with a part of the Petræa: so called from Nabaioth, the first born of Ismael. According to Diodorus, it was situated between Syria and Egypt. The people Nabatæi (1 Maccabees, Diodorus Siculus): inhabiting a desert and barren country: they lived by plundering their neighbours according to Diodorus. Nabathæus the epithet.

NABIS, tyrant of Sparta, reigned about 204 B. C.; and is reported to have exceeded all other tyrants so far, that, upon comparison, he left the epithets of *gracious* and *merciful* to Dionysius and Phalaris. He is said to have contrived an instrument of torture in the form of a statue of a beautiful woman, whose rich dress concealed a number of iron spikes in her bosom and arms. When any one therefore opposed his demands, he would say, "If I have not talents enough to prevail with you, perhaps my woman Apega may persuade you." The statue then appeared; which Nabis taking by the hand, led up to the person, who, being embraced by it, was thus tortured into compliance. To render his tyranny less unpopular, Nabis made an alliance with Flaminius the Roman general, and pursued with the most inveterate enmity the war which he had undertaken against the Achæans. He besieged Gythium, and defeated Philopœmen in a naval battle. His triumph was short, the general of the Achæans soon repaired his losses, and Nabis was defeated in an engagement, and killed as he attempted to save his life by flight, about 194 years before the Christian era.

NABLOUS, a province of Syria, anciently celebrated under the name of the *kingdom of Samaria*. Its capital, likewise called *Nablous*, is situated near to Sichem on the ruins of the Niepolis of the Greeks, and is the residence of a sheik, who is subordinate to the pacha of Damascus, from whom he farms the tribute of the province.

NABLUM, in Hebrew, *Nebel*, was an instrument of music among the Jews. It had strings like the harp, and was played upon by both hands. Its form was that of a Greek Λ. In the Septuagint and Vulgate, it is called *noblum*, *psalterion*, *lyra*; and sometimes *cithara*.

NABO, or Nebo, in mythology, a deity of the Babylonians, who possessed the next rank to Bel. It is mentioned by Isaiah, chap. xlviii. Vossius apprehends that Nabo was the moon, and Bel the sun: but Grotius supposes that Nabo was some celebrated prophet of the country; which opinion is confirmed by the etymology of the name, signifying, according to Jerome, "one that presides over prophecy."

NABOB, properly Navab, the plural of *Naib*, a deputy. As used in Bengal, it is the same as Nazim. It is a title also given to the wives and daughters of princes, as well as to the princes themselves.

NABONASSAR, first king of the Chaldeans or Babylonians; memorable for the Jewish era which bears his name, which is generally fixed in 3257, beginning on Wednesday, February 26th, in the 3967th of the Julian period, 747 years before Christ. The Babylonians revolting from the Medes, who had overthrown the Assyrian monarchy, did, under Nabonassar, found a dominion, which was much increased under Nebuchadnezzar. It is probable, that this Nabonassar is that Baladan in the second of Kings, xx. 12. father of Merodach, who sent ambassadors to Hezekiah. See 2 Chron. xxxii.

NABOPOLASSAR, king of Babylon: he joined with Astyages the Mede, to destroy the empire of Assyria; which having accomplished, they founded the two empires of the Medes under Astyages, and the Chaldeans under Nabopolassar, 627 B. C.

NABUCHADNEZZAR, or Nabuchodonosor II. king of Assyria, son of Nabopolassar, and styled the *Great*, was associated by his father in the empire, 607 B. C. and the following year he took Jehoiakim king of Judah prisoner, and proposed to carry him and his subjects in captivity into Babylon; but upon his submission, and promising to hold his kingdom under Nabuchodonosor, he was permitted to remain at Jerusalem. In 603 B. C. Jehoiakim attempted to shake off the Assyrian yoke, but without success; and this revolt brought on the general captivity. Nabuchadnezzar having subdued the Ethiopians, Arabians, Idumæans, Philistines, Syrians, Persians, Medes, Assyrians,

ſyrians, and almoſt all Aſia; being puffed up with pride, cauſed a golden ſtatue to be ſet up, and commanded all to worſhip it; which Daniel's companions refuſing to do, they were caſt into the fiery furnace. But as he was admiring his own magnificence, by divine ſentence he was driven from men, and in the Scripture ſtyle is ſaid to have eaten graſs as oxen: i. e. he was ſeized with the diſeaſe called by the Greeks *lycanthropy*, which is a kind of madneſs that cauſes perſons to run into the fields and ſtreets in the night, and ſometimes to ſuppoſe themſelves to have the heads of oxen, or to be made of glaſs. At the end of ſeven years his reaſon returned to him, and he was reſtored to his throne and glory. He died 562 B. C. in the 43d year of his reign; in the 5th of which happened that eclipſe of the ſun mentioned by Ptolemy, which is the ſureſt foundation of the chronology of his reign.

NADIR, in *Aſtronomy*, that point of the heavens which is diametrically oppoſite to the zenith or point directly over our heads.

NÆNIA, the goddeſs of funerals at Rome. Her temple was without the gates of the city. The ſongs which were ſung at funerals were alſo called *nænia*. They were generally filled with the praiſes of the deceaſed; but ſometimes they were ſo unmeaning and improper, that the word became proverbial to ſignify nonſenſe.

NAERDEN, a ſtrong town of Holland, ſeated at the head of the canals of the province. The foundations of it were laid by William of Bavaria, in 1350. It was taken by the Spaniards in 1572, and by the French in 1672; but it was retaken by the prince of Orange the next year. It ſtands at the ſouth end of the Zuyder Zee, in E. Long. 5. 3. N. Lat. 51. 22.

NÆVIUS, Cneius, a famous poet of Campania, was bred a ſoldier; but quitted the profeſſion of arms, in order to apply himſelf to poetry, which he proſecuted with great diligence. He compoſed a hiſtory in verſe, and a great number of comedies: But it is ſaid, that his firſt performance of this laſt kind ſo diſpleaſed Metellus on account of the ſatirical ſtrokes it contained, that he procured his being baniſhed from the city: on which he retired to Utica in Africa, where he at length died, 202 B. C. We have only ſome fragments left of his works.

There was another Nævius, a famous augur in the reign of Tarquin, who, to convince the king and the Romans of his preternatural power, cut a flint with a razor, and turned the ridicule of the populace to admiration. Tarquin rewarded his merit by erecting him a ſtatue in the comitium, which was ſtill in being in the age of Auguſtus. The razor and flint were buried near it under an altar, and it was uſual among the Romans to make witneſſes in civil cauſes ſwear near it. This miraculous event of cutting a flint with a razor, though believed by ſome writers, is treated as fabulous and improbable by Cicero, who himſelf had been augur.

NÆVUS, a mole on the ſkin, generally called a *mother's mark*; alſo the tumour known by the name of a *wen*.

All preternatural tumours on the ſkin, in the form of a wart or tubercle, are called *excreſcences*; by the Greeks they are called *acrothymia*; and when they are born with a perſon, they are called *nævi materni*, or *marks from the mother*. See Tumours, Surgery *Index*.

NAGERA, or Nagara, a town of Spain, in Old Caſtile, and the territory of Rioja, with the title of a duchy and fortreſs; famous for a battle fought in its neighbourhood in 1369. It is ſituated in a fertile country, on a brook called *Naſerilla*. W. Long. 2. 20. N. Lat. 42. 45.

NAGRACUT, a town of India, the capital of a kingdom of the ſame name in the dominions of the Great Mogul, with a rich temple to which the Indians go in pilgrimage. It is ſeated on the river Ravi. E. Long. 78. 10. N. Lat. 33. 12.

NAHUM, or the *Prophecy of Nahum*, a canonical book of the Old Teſtament.

Nahum, the ſeventh of the 12 leſſer prophets, was a native of Elkoſhai, a little village of Galilee. The ſubject of his prophecy is the deſtruction of Nineveh, which he deſcribes in the moſt lively and pathetic manner; his ſtyle is bold and figurative, and cannot be exceeded by the moſt perfect maſters of oratory. This prophecy was verified at the ſiege of that city by Aſtyages, in the year of the world 3378, 622 years before Chriſt.

NAIADES, in fabulous hiſtory, certain inferior deities who preſided over rivers, ſprings, wells, and fountains. The Naiades generally inhabited the country, and reſorted to the woods or meadows near the ſtream over which they preſided. They are repreſented as young and beautiful virgins, often leaning upon an urn, from which flows a ſtream of water. Ægle was the faireſt of the Naiades, according to Virgil. Their name ſeems to be derived from ναειν, "to flow." They were held in great veneration among the ancients; and often ſacrifices of goats and lambs were offered to them, with libations of wine, honey, and oil. Sometimes they received only offerings of milk, fruit, and flowers.

NAIANT, in *Heraldry*, a term uſed in blazoning fiſhes, when borne in a horizontal poſture, as if ſwimming.

NAIAS, a genus of plants belonging to the diœcia claſs; and in the natural method ranking with thoſe of which the order is doubtful. See Botany *Index*.

NAID, the interior of the great deſert of Arabia, inhabited by a few ſcattered tribes of feeble and wretched Arabs. See Arabia.

NAIL, unguis, in *Anatomy*, which ſee.

Nails, in building, &c. ſmall ſpikes of iron, braſs, &c. which being driven into wood, ſerve to bind ſeveral pieces together, or to faſten ſomething upon them.

Nails were made uſe of by the ancient Hebrews for cancelling bonds: and the ceremony was performed by ſtriking them through the writing. This ſeems to be alluded to in Scripture, where God is ſaid by our crucified Saviour to have "blotted out the hand-writing of ordinances that was againſt us, and to have taken it out of the way, nailing it to his croſs," Col. ii. 14. For the cauſe and ceremony of driving the annual nail, or *clavus annalis*, among the Romans, ſee *Annalis Clavus*.

Nail, is alſo a meaſure of length, containing the 16th part of a yard.

Nailing of Cannon || Nairn.

NAILING *of Cannon*. When circumſtances make it neceſſary to abandon cannon, or when the enemy's artillery are ſeized, and it is not however poſſible to take them away, it is proper to nail them up, in order to render them uſeleſs; which is done by driving a large nail or iron ſpike into the vent of a piece of artillery, to render it unſerviceable. There are various contrivances to force the nail out, as alſo ſundry machines invented for that purpoſe, but they have never been found of general uſe; ſo that the beſt method is to drill a new vent.

One Gaſper Vimercalus was the firſt who invented the nailing of cannon. He was a native of Bremen, and made uſe of his invention firſt in nailing up the artillery of Sigiſmund Malateſta.

NAIN, LEWIS SEBASTIAN DE, a French critic and hiſtorian, was the ſon of a maſter of the requeſts, and was born at Paris in 1637. At ten years old he went to ſchool at Port Royal, and became one of the beſt writers of that inſtitution. Sacy, his intimate friend and counſellor, prevailed with him in 1676 to receive the prieſthood; which, it ſeems, his great humility would not before ſuffer him to aſpire to. This virtue he ſeems to have poſſeſſed in the extreme; ſo that Boſſuet, ſeeing one of his letters to Father Dami, with whom he had ſome little diſpute, beſought him merrily "not to be always upon his knees before his adverſary, but raiſe himſelf up now and then." He was ſolicited to puſh himſelf forward in the church, and Buzanval, biſhop of Beauvois, wiſhed to have him for his ſucceſſor; but Nain, regardleſs of dignities, wiſhed for nothing but retirement, ſo that he might indulge in the mortifications of a religious life and the indefatigable cultivation of letters. He died in 1698, aged 61. His principal works are, 1. Memoirs on the eccleſiaſtical hiſtory of the ſix firſt ages of the church, 16 vols. 4to. 2. The hiſtory of the emperors, 6 vols. 4to. Theſe works are deduced from original ſources, and compoſed with the utmoſt fidelity and accuracy.

NAIN, or NAIM, ſituated at the bottom of Mount Hermon on the north ſide, was anciently a city of the tribe of Iſſachar, in the province of Galilee. It was near the gates of this city that our Saviour reſtored to life the only ſon of a widow, and where he inſpired Mary Magdalen to come and mourn for her ſins at his feet. Theſe circumſtances alone make this place worthy of notice; for at preſent Nain is only a hamlet inhabited by Chriſtians, Mahometans, and Hebrews, where there is not a ſingle monument to attract the curioſity of the traveller.

NAIRES, NAHERS, or NAYERS, in modern hiſtory, a name which is given by the Malabarians to the military of their country, who form a very numerous claſs or tribe, out of which the ſovereigns of Malabar chooſe their body guard.

NAIRN, a county of Scotland, comprehending the weſtern part of the province of Murray. It is bounded on the north by the Murray frith, on the weſt and ſouth by Inverneſs, and on the eaſt by Elgin. The length is about 18 miles, and the breadth about 14. The air is temperate and ſalubrious, and the winters are remarkably mild. The face of the country is rough and mountainous; yet there are ſome fruitful valleys, which produce good crops of oats and barley; but in general the country is much better adapted for paſturage. Here are alſo large woods of fir, and other trees, that afford ſhelter to the game, of which there is great plenty. The moſt remarkable ſtraths or valleys in this county, are Strathnairn, on the river of that name, in the ſouth-weſt part of the ſhire; and on the ſouth-eaſt ſide, Stratherin, on both ſides of Findhorn river. Nairn is well watered with ſtreams, rivulets, and lakes abounding with fiſh. In the ſouthern part there is a ſmall lake, called *Moy*. The greater part of the ſhire is peopled by the Fraſers, a warlike Highland clan, whoſe chief, the lord Lovat, loſt his life on the ſcaffold for having been concerned in the rebellion of 1745. Here are a great number of villages; but no towns of note except Nairn, ſuppoſed to be the *Tuæſis* of Ptolemy, ſituated at the mouth of the river which bears the ſame name; a royal borough, which gave the title of *lord* to an ancient family, forfeited in the rebellion of 1715. The harbour, which opened in the Murray frith, is now choked up with ſand; and the commerce of the town is too inconſiderable to deſerve notice. About four miles from Nairn ſtands the caſtle of Calder, on the river of that name, belonging to a branch of the family of Campbell; and ſix miles to the north-weſt of Nairn, ſtands Fort George, built by order of the government, at a place called *Arderſier*, a ſmall iſthmus upon the Murray frith.

Nairn || Naiſſus.

The following is the population of the pariſhes of this county, according the Statiſtical Hiſtory of Scotland.

Pariſhes.	Population in 1755.	Population in 1790—1798.
Ardclach	1163	1186
Auldearn	1951	1406
Calder	882	1062
Nairn	1698	2400
	5694	6054
		5694
	Increaſe	360

Population in 1801, *including part of ſome other Pariſhes.*

Ardclach	- -	1256
Auldearn	- - -	1401
Calder	- - -	1179
Croy (Nairn diviſion)	- -	562
Moy do.	- -	34
Nairn	town	2215
Urquhart (do.)	- -	1610
		8257

NAISSANT, in *Heraldry*, is applied to any animal iſſuing out of the midſt of ſome ordinary, and ſhowing only his head, ſhoulders, fore feet, and legs, with the tip of his tail; the reſt of his body being hid in the ſhield, or ſome charge upon it: in which it differs from *iſſuant*, which denotes a living creature ariſing out of the bottom of any ordinary or charge.

NAISSUS, in *Ancient Geography*, a town of Dardania, a diſtrict of Mœſia Superior, ſaid to be the birthplace of Conſtantine the Great, which ſeems probable from his often reſiding at that place. *Naiſitani*, the

the people (Coin). Now called *Nissa*, a city of Servia. E. Long. 23. N. Lat. 43.

NAKED SEEDS, in *Botany*, those that are not enclosed in any pod or case.

NAKIB, in the oriental dignities, the name of an officer who is a deputy to the cadiliskier, or, as he may be called, the lord high chancellor of Egypt, appointed by the grand signior. His office is to carry the standard of Mahomet.

NAKOUS, an Egyptian musical instrument, made like two plates of brass, and of all sizes, from two inches to a foot in diameter; they hold them by strings fastened to their middles, and strike them together so as to beat time. They are used in the Coptic churches and in the Mahometan processions.

NAMA, a genus of plants belonging to the pentandria class, and order digynia; and, in the natural method, ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

NAME, denotes a word whereby men have agreed to express some idea; or which serves to denote or signify a thing or subject spoken of. See WORD.

This the grammarians usually call a *noun*, *nomen*, though their noun is not of quite so much extent as our name. See NOUN.

Seneca, lib. ii. *de Beneficiis*, observes, that there are a great number of things which have no name; and which, therefore, we are forced to call by other borrowed names. *Ingens est* (says he) *rerum copia sine nomine, quas cum propriis appellationibus signare non possumus, alienis accommodatis utimur*: which may show why, in the course of this dictionary, we frequently give divers senses to the same word.

Names are distinguished into *proper* and *appellative*.

Proper NAMES, are those which represent some individual thing or person, so as to distinguish it from all other things of the same species; as, *Socrates*, which represents a certain philosopher.

Appellative or *General* NAMES, are those which signify common ideas; or which are common to several individuals of the same species; as, *horse*, *animal*, *man*, *oak*, &c.

Proper names are either called *Christian*, as being given at baptism; or surnames: The first imposed for distinction of persons, answering to the Roman *prænomen*; the second, for the distinction of families, answering to the *nomen* of the Romans, and the *patronymicum* of the Greeks.

Originally every person had but one name; as among the Jews, *Adam*, &c. among the Egyptians, *Busiris*; among the Chaldees, *Ninus*; the Medes, *Astyages*; the Greeks, *Diomedes*; the Romans, *Romulus*; the Gauls, *Divitiacus*; the Germans, *Ariovistus*; the Britons, *Cassibelan*; the English, *Hengist*, &c. And thus of other nations, except the savages of Mount Atlas, whom Pliny and Marcellinus represent as *anonymi*, "nameless."

The Jews gave the name at the circumcision, viz. eight days after the birth: the Romans, to females the same day, to males the ninth; at which time they held a feast, called *nominalia*.

Since Christianity has obtained, most nations have followed the Jews, baptizing and giving the name on the eighth day after the birth; except our English ancestors, who, till of late, baptized and gave the name on the birth day.

The first imposition of names was founded on different views, among different people; the most common was to mark the good wishes of the parents, or to entitle the children to the good fortune a happy name seemed to promise. Hence, *Victor*, *Castor*, *Faustus*, *Statorius*, *Probus*, &c.

Accordingly, we find such names, by Cicero called *bona nomina*, and by Tacitus *fausta nomina*, were first enrolled and ranged in the Roman musters; first called to serve at the sacrifices, in the foundation of colonies, &c.—And, on the contrary, Livy calls Atrius Umber, *abominandi omnis nomen*: and Plautus, on occasion of a person named *Lyco*, i. e. "greedy wolf," says;

> *Vosmet nunc facite conjecturam cæterum*
> *Quid id sit hominis, cui* Lyco *nomen siet.*

Hence, Plato recommends it to men to be careful in giving happy names; and the Pythagoreans taught expressly, that the minds, actions, and successes of men, were according to their names, genius, and fate. Thus Panormitan, *ex bono nomine oritur bona præsumptio*; and the common proverb, *Bonum nomen bonum omen*; and hence the foundation of the onomomantia. See ONOMOMANTIA.

It is an observation deserving attention, says the abbé Barthelemi, that the greater part of names found in Homer are marks of distinction. They were given in honour of the qualities most esteemed in the heroic ages. From the word *polemos*, which signifies war, have been formed *Tlepolemus* and *Archepolemus*, the names of two heroes mentioned in the Iliad. The former name signifies *able to support*, and the latter, *able to direct*, *the labours of war*. By adding to the word *mache*, or *battle*, certain prepositions and different parts of speech, which modify the sense in a manner always honourable, are composed the names *Amphimachus*, *Antimachus*, *Promachus*, *Telemachus*. Proceeding in the same way, with the word *honorea*, "strength or intrepidity," they formed the names *Agapenor*, "he who esteems valour;" *Agenor*, "he who directs it." From *thoes*, "swift," are derived, *Alcathoes*, *Panthoes*, *Perithoes*, &c. From *nous*, "mind or intelligence," come *Astynoes*, *Arsinoes*, *Autenoes*, &c. From *medes*, "counsel," *Agamedes*, *Eumedes*, *Lycomedes*, *Thrasymedes*; and from *clios*, "glory," *Amphicles*, *Agacles*, *Iphicles*, *Patroclus*, *Cleobulus*, with many others.

Hence Camden takes it for granted, that the names, in all nations and languages, are significative, and not simple sounds for mere distinction's sake. This holds not only among the Jews, Greeks, Latins, &c. but even the Turks; among whom, Abdala signifies *God's servant*, Soliman, *peaceable*; Mahomet, *glorified*, &c. And the savages of Hispaniola, and throughout America, who, in their languages, name their children, *Glistering Light*, *Sun*, *Bright*, *Fine Gold*, &c.; and they of Congo, by the names of precious stones, flowers, &c.

To suppose names given without any meaning, however by the alteration of languages their signification may be lost, that learned author thinks is to reproach our ancestors; and that contrary to the sense of

Names.

of all ancient writers. Porphyry notes, that the barbarous *names*, as he calls them, were very emphatical, and very concife: and accordingly it was efteemed a duty to be φηρωνυμοι, or *fui nominis homines:* as Severus, Probus, and Aurelius, are called *fui nominis imperatores.*

It was the ufual way of giving names, to wifh the children might difcharge their names. Thus when Gunthram king of France named Clotharius at the font, he faid, *Crefcat puer, et hujus fit nominis executor.*

The ancient Britons, Camden fays, generally took their names from colours, becaufe they painted themfelves; which names are now loft, or remain hid among the Welfh. When they were fubdued by the Romans, they took Roman names, fome of which ftill remain corrupted; though the greateft part became extinct upon the admiffion of the Englifh Saxons, who introduced the German names, as *Cridda*, *Penda*, *Ofwald*, *Edward*, &c.—The Danes, too, brought with them their names; as *Suayne*, *Harold*, *Knute*, &c. The Normans, at the Conqueft, brought in other German names, as originally ufing the German tongue; fuch as *Robert*, *William*, *Richard*, *Henry*, *Hugh*, &c. after the fame manner as the Greek names *Afpafius*, *Boethius*, *Symmachus*, &c. were introduced into Italy upon the divifion of the empire. After the Conqueft, our nation, which had ever been averfe to foreign names, as deeming them unlucky, began to take Hebrew names: as *Matthew*, *David*, *Sampfon*, &c. The various names anciently or at prefent obtaining among us, from what language or people foever borrowed, are explained by Camden in his Remains. As to the period when names began to be multiplied, and furnames introduced, &c. fee SURNAME.

Of late years it has obtained among us to give furnames for Chriftian names; which fome diflike, on account of the confufion it may introduce. Camden relates it as an opinion, that the practice firft began in the reign of Edward VI. by fuch as would be godfathers, when they were more than half fathers. Upon which fome were perfuaded to change their names at confirmation; which, it feems, is ufual in other countries.—Thus, two fons of Henry II. of France, chriftened *Alexander* and *Hercules*, changed them at confirmation into *Henry* and *Francis*. In monafteries, the religious affume new names at their admittance, to fhow they are about to lead a new life, and have renounced the world, their family, and even their name: v. g. fifter Mary *of the Incarnation*, brother Henry *of the Holy Sacrament*, &c. The popes alfo changed their names at their exaltation to the pontificate; a cuftom firft introduced by Pope Sergius, whofe name till then, as Platina informs us, was *Swine's-fnout*. But Onuphrius refers it to John XII. or XIII. and at the fame time adds a different reafon for it from that of Platina, viz. that it was done in imitation of St Peter and St Paul, who were firft called *Simon* and *Saul*.

Among the ancients, thofe deified by the Heathen confecrations had new names given them; as Romulus was called *Quirinus;* Melicertes, *Portunus* or *Portumnus*, &c.

New names were alfo given in adoptions, and fometimes by teftament: thus L. Æmilius, adopted by Scipio, took the name of *Scipio Africanus;* and thus Auguftus, who was at firft called *C. Octavius Thurinus*, being adopted by the teftament of Julius Cæfar into his name and family, took the name of *Caius Julius Cæfar Octavianus.*

Names || Namur.

Names were alfo changed at enfranchifements into new cities. Thus Lucumo, at his firft being made free of Rome, took the name *Lucius Tarquinius Prifcus*, &c.; and flaves when made free, ufually affumed their mafters names. Thofe called to the equeftrian order, if they had bafe names, were always new named, *nomine ingenuorum veterumque Romanorum.* And among the primitive Chriftians, it was the practice to change the names of the catechumens: Thus the renegado Lucianus, till his baptifm, was called *Lucius.*

Toward the middle of the 15th century, it was the fancy of the wits and learned men of the age, particularly in Italy, to change their baptifmal names for claffical ones. As Sannazarius, for inftance, who altered his own plain name *Jacopo* to *Actius Syncerus*. Numbers did the fame, and among the reft Platina the hiftorian at Rome, who, not without a folemn ceremonial, took the name of *Callimachus* inftead of *Philip*. Pope Paul II. who reigned about that time, unluckily chanced to be fufpicious, illiterate, and heavy of comprehenfion. He had no idea that perfons could wifh to alter their names unlefs they had fome bad defign, and actually fcrupled not to employ imprifonment and other violent methods to difcover the fancied myftery. Platina was moft cruelly tortured on this frivolous account: he had nothing to confefs: fo the pope, after endeavouring in vain to convict him of herefy, fedition, &c. releafed him after a long imprifonment.

NAMPTWICH, or NANTWICH, a town of Chefhire in England, fituated on the river Weever, 14 miles S. E. from Chefter, and 162 miles from London. It lies in the Vale Royal, and is one of the largeft and beft built towns in the county, the ftreets being very regular, and adorned with many gentlemen's houfes. The inhabitants trade in corn, cattle, cheefe, fine white falt, and fhoes. It is governed by a conftable, &c. who are guardians of the falt fprings. It is divided into two equal parts by the Weever, which is navigable to Winsford bridge. The Chefter canal, terminates in a large bafon near this place. In this town were feveral religious foundations, now no more. The church is a handfome pile of building in the form of a crofs, with an octangular tower in the middle.

NAMUR, a province of the Netherlands, lying between the rivers Sambre and Maefe; bounded on the north by Brabant, on the eaft and fouth by the bifhopric of Liege, and on the weft by Hainault. It is pretty fertile; has feveral forefts, marble quarries, and mines of iron, lead, and pit coal; and is about 30 miles long and 20 broad. Namur is the capital town.

NAMUR, a large, rich, and very ftrong town of the Netherlands, capital of the county of Namur, with a ftrong caftle, feveral forts, and a bifhop's fee. The moft confiderable forts are, Fort William, Fort Maefe, Fort Coquelet, and Fort Efpinor. The caftle is built in the middle of the town, on a craggy rock. It was befieged by King William in 1695, who took it in the fight of an army of 100,000 French, though there were 16,000 men in the garrifon. It was ceded to the houfe of Auftria in 1713, but taken by the French in 1746; and

and restored by the treaty of Aix-la-Chapelle. It was again taken by the French in 1792, who evacuated it the following year, and retook it in 1794. It is situated between two mountains, at the confluence of the rivers Maese and Sambre, in E. Long. 4. 57. N. Lat. 50. 25.

NAN-TCHANG-FOU, the capital of Kiang-si, a province of China. This city has no trade but that of porcelain, which is made in the neighbourhood of Jaotcheou. It is the residence of a viceroy, and comprehends in its district eight cities; seven of which are of the third class, and only one of the second. So much of the country is cultivated, that the pastures left are scarcely sufficient for the flocks.

NANCI, a town of France, in the department of Meurthe, situated on the river Meuse, in the centre of the province. It is divided into the Old and New Towns. The first, though irregularly built, is very populous, and contains the ducal palace: the streets of the New Town are as straight as a line, adorned with handsome buildings, and a very fine square. The primatial church is a magnificent structure, and in that of the Cordeliers are the tombs of the ancient dukes. The two towns are separated by a canal; and the new town was very well fortified, but the king of France demolished the fortifications. It has been taken and retaken several times; particularly by the French, to whom it was ceded in 1736, to enjoy it after the death of Stanislaus. E. Long. 6. 17. N. Lat. 48. 41.

NANCOWRY, or SOWRY, one of the Nicobar islands, lying at the entrance of the bay of Bengal. See NICOBAR.

NANI, JOHN BAPTIST, was born in 1616. His father was procurator of St Mark, and ambassador from Venice to Rome. He was educated with attention, and made considerable improvement. Urban VIII. a just valuer of merit, soon perceived that of young Nani. He was admitted into the college of senators in 1641, and was shortly after nominated ambassador in France, where he signalized himself by his compliant manners. He procured considerable succours for the war of Candia against the Turks; and became, after his return to Venice, superintendant of the war office and of finances. He was afterwards ambassador to the empire; where he rendered those services to this country which, as a zealous and intelligent citizen, he was well qualified to discharge. He was again sent into France in 1660 to solicit fresh succours for Candia; and on his return was appointed procurator of St Mark. He died November 5. 1768, at the age of 63, much regretted by his countrymen. The senate had appointed him to write the History of the Republic; which he executed to the satisfaction of the Venetians, although the work was less admired by foreigners, who were not proper judges of the accuracy with which he stated the facts, of the purity of his diction, nor of the simplicity of his style; although it must be acknowledged that his narrative is much interrupted by too frequent parentheses. In writing his history of Venice he has given an universal history of his times, especially with respect to the affairs of the French in Italy. This history, which is continued from 1613 to 1671, was printed at Venice in 2 vols 4to, in the years 1662 and 1679.

NAN-KING, a city of China, and capital of the province of Kiang-nan, is said to have been formerly one of the most beautiful and flourishing cities in the world. When the Chinese speak of its extent, they say, if two horsemen should go out by the same gate, and ride round it on full speed, taking different directions, they would not meet before night. This account is evidently exaggerated; but it is certain, that Nanking surpasses in extent all the other cities of China. We are assured that its walls are five leagues and a half in circumference.

This city is situated at the distance of a league from the river Yang-tse-kiang: it is of an irregular figure; the mountains which are within its circumference having prevented its being built on a regular plan. It was formerly the imperial city; for this reason it was called *Nan-King*, which signifies, "the Southern Court;" but since the six grand tribunals have been transferred from hence to Peking, it is called *Kiang-ning* in all the public acts.

Nan-king has lost much of its ancient splendour: it had formerly a magnificent palace, no vestige of which is now to be seen; an observatory at present neglected, temples, tombs of the emperors, and other superb monuments, of which nothing remains but the remembrance. A third of the city is deserted, but the rest is well inhabited. Some quarters of it are extremely populous and full of business; particularly the manufacture of a species of cotton cloth, of which great quantities are imported into Europe under the name of *Nankin*. The streets are not so broad as those of Peking; they are, however, very beautiful, well paved, and bordered with rich shops.

In this city resides one of those great mandarins called *Tsong-tou*, who takes cognizance of all important affairs, not only of both the governments of the province, but also of those of the province of Kiang-si. The Tartars have a numerous garrison here, commanded by a general of their own nation; and they occupy a quarter of the city, separated from the rest by a plain wall.

The palaces of the mandarins, whether Chinese or Tartars, are in this city neither larger nor better built than those in the capital cities of other provinces. Here are no public edifices corresponding to the reputation of so celebrated a city, excepting its gates, which are very beautiful, and some temples, among which is the famous porcelain tower. It is 200 feet high, and divided into nine stories by plain boards within, and without by cornices and small projections covered with green varnished tiles. There is an ascent of 40 steps to the first story; between each of the others there are 21.

The breadth and depth of the river Yang-tse-kiang formerly rendered the port of Nan-king very commodious; but at present large barks, or rather Chinese junks, never enter it; whether it be that it is shut up by sand banks, or that the entrance of it has been forbid, in order that navigators may insensibly lose all knowledge of it.

In the months of April and May a great number of excellent fish are caught in this river near the city, which are sent to court; they are covered with ice, and transported in that manner by barks kept entirely on purpose. Although this city is more than 200 leagues from Peking, these boats make such expedition, that they arrive there in eight or nine days. This city, though

though the capital of the province, has under its particular jurisdiction only eight cities of the third class. The number of its inhabitants is said to be 1,000,000, without comprehending the garrison of 40,000 men. E. Long. 119. 25. N. Lat. 32. 46.

NANSIO, an island of the Archipelago, a little to the north of the island of Santorino, 16 miles in circumference; but has no harbour. The mountains are nothing but bare rocks, and there are not springs sufficient to water the fields. There is a vast number of partridges, whose eggs they destroy every year to preserve the corn, and yet vast numbers of them are always produced. The ruins of the temple of Apollo are yet to be seen, and consist chiefly of marble columns. E. Long. 26. 20. N. Lat. 36. 15.

NANTES, an ancient, rich, and very considerable town of France, in the department of Lower Loire, with a bishop's see, an university, and a mint. It is one of the most considerable places in the kingdom; contains the richest merchants; and was formerly the residence of the dukes of Bretagne, where they built a very strong castle on the side of the river, and which is strongly fortified. There are several parishes, and a great many religious houses; and the cathedral contains the tombs of the ancient dukes. There are several fine bridges over the river Loire, which is navigable. The suburbs are so large, on account of the number of people that come from all parts to settle here, that they exceed the city. The Spaniards trade here in wine, fine wool, iron, silk, oil, oranges, and lemons; and they carry back cloth, stuffs, corn, and hard ware. The Dutch send salt fish, and all sorts of spices; and in return have wine and brandy. The Swedes bring copper; and the English, lead, tin, &c. It was in this place that Henry IV. promulgated the famous edict in 1598, called the *Edict of Nantes*, and which was revoked in 1685. Nantes was anciently, like almost every considerable city in Europe, very strongly fortified. Peter de Dreux, one of the dukes of Bretagne, surrounded it with walls, which have only been demolished within these few years. The bridge is an object of curiosity. It is near a mile and a half in length, being continued across all the little islands in the Loire, from north to south. The territory of Nantes lies on both sides the Loire, and feeds a great number of cattle. Large vessels can come no higher than Port Launai, which is 12 miles from Nantes. W. Long. 1. 45. N. Lat. 47. 13.

NANTWICH. See NAMPTWICH.

NAPÆA, a genus of plants belonging to the polyadelphia class; and in the natural method ranking under the 37th order, *Columniferæ*. See BOTANY *Index*.

NAPHTHA, an inflammable substance of the bituminous kind. See CHEMISTRY and MINERALOGY.

NAPHTHALI, or NEPHTHALI (Josh. xix.), one of the tribes of Israel; having Zabulon on the south, Asher on the west, the Jordan on the east, and on the north Antilibanus.

NAPIER, JOHN, baron of Merchiston in Scotland, inventor of the logarithms, was the eldest son of Sir Archibald Napier of Merchiston, and born in the year 1550. Having given early discoveries of great natural parts, his father was careful to have them cultivated by a liberal education. After going through the ordinary courses of philosophy at the university of St Andrew's, he made the tour of France, Italy, and Germany. Upon his return to his native country, his literature and other fine accomplishments soon rendered him conspicuous, and might have raised him to the highest offices in the state: but declining all civil employments, and the bustle of the court, he retired from the world to pursue literary researches, in which he made an uncommon progress, so as to have favoured mankind with sundry useful discoveries. He applied himself chiefly to the study of mathematics; but at the same time did not neglect that of the Holy Scriptures. In both these he hath discovered the most extensive knowledge and profound penetration. His essay upon the book of the Apocalypse, indicates the most acute investigation, and an uncommon strength of judgement; though time hath discovered, that his calculations concerning particular events hath proceeded upon fallacious data. This work has been printed abroad in several languages; particularly in French at Rochelle in the year 1593, 8vo, announced in the title as revised by himself. Nothing, says Lord Buchan, could be more agreeable to the Rochellers or to the Huguenots of France at this time, than the author's annunciation of the pope as antichrist, which in this book he has endeavoured to set forth with much zeal and erudition.—But what has principally rendered his name famous, was his great and fortunate discovery of logarithms in trigonometry, by which the ease and expedition in calculation have so wonderfully assisted the science of astronomy and the arts of practical geometry and navigation. That he had begun about the year 1593 the train of inquiry which led him to that great achievement in arithmetic, appears from a letter to Crugerus from Kepler in the year 1624; wherein, mentioning the *Canon Mirificus*, he writes thus; "Nihil autem supra Neperianam rationem esse puto: etsi Scotus quidem literis ad Tychonem, anno 1564, scriptis jam spem fecit Canonis illius mirifici;" which allusion agrees with the idle story mentioned by Wood in his *Athenæ Oxon.* and explains it in a way perfectly consonant to the rights of Napier as the inventor.

When Napier had communicated to Mr Henry Briggs, mathematical professor in Gresham college, his wonderful canon for the logarithms, that learned professor set himself to apply the rules in his *Imitatio Nepeirea*; and in a letter to Archbishop Usher in the year 1615, he writes thus: "Napier, baron of Merchiston, hath set my head and hands at work with his new and admirable logarithms. I hope to see him this summer, if it please God; for I never saw a book which pleased me better, and made me more wonder." The following passage from the life of Lilly the astrologer is quoted by Lord Buchan, as giving a picturesque view of the meeting betwixt Briggs and the inventor of the logarithms at Merchiston near Edinburgh. "I will acquaint you (says Lilly) with one memorable story related unto me by John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was servant to King James I. and Charles I. When Merchiston first published his logarithms, Mr Briggs, then reader of the astronomy lectures at Gresham college in London, was so much surprised with admiration of them, that he could have no quietness in himself until he had seen that noble person whose

Napier.

whofe only invention they were: he acquaints John Marr therewith, who went into Scotland before Mr Briggs, purpofely to be there when thefe two fo learned perfons fhould meet. Mr Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, Merchifton was fearful he would not come. It happened one day as John Marr and the baron Napier were fpeaking of Mr Briggs; 'Ah, John (faid Merchifton), Mr Briggs will not come.' At the very inftant one knocks at the gate; John Marr hafted down, and it proved to be Mr Briggs to his great contentment. He brings Mr Briggs up to the baron's chamber, where almoft one quarter of an hour was fpent, each beholding the other with admiration before one word was fpoken. At laft Mr Briggs began; 'Sir, I have undertaken this long journey purpofely to fee your perfon, and to know by what engine of wit or ingenuity you came firft to think of this moft excellent help into aftronomy, viz. the logarithms; but, Sir, being by you found out, I wonder nobody elfe found it out before, when now being known it appears fo eafy.' He was nobly entertained by Baron Napier; and every fummer after that, during the laird's being alive, this venerable man, Mr Briggs, went purpofely to Scotland to vifit him."

Earl of Buchan's Account of the Writings and Inventions of Napier of Merchifton.

There is a paffage in the life of Tycho Brahe by Gaffendi, which may miflead an attentive reader to fuppofe that Napier's method had been explored by Herwart at Hoenburg: It is in Gaffendi's Obfervations on a Letter from Tycho to Herwart of the laft day of Auguft 1599. "Dixit Hervartus nihil morari fe folvendi cujufquam trianguli difficultatem; folere fe enim multiplicationum, ac divifionum vice additiones folum, fubtractiones 93 ufurpare (quod ut fieri poffet, docuit poftmodum fuo logarithmorum Canone Neperus)." But Herwart here alludes to this work afterwards publifhed in the year 1610, which folves triangles by proftaphærefis; a mode totally different from that of the logarithms.

Kepler dedicated his *Ephemerides*, to Napier, which were publifhed in the year 1617; and it appears from many paffages in his letter about this time, that he held Napier to be the greateft man of his age in the particular department to which he applied his abilities. "And indeed (fays our noble biographer), if we confider that Napier's difcovery was not like thofe of Kepler or of Newton, connected with any analogies or coincidences which might have led him to it, but the fruit of unaffifted reafon and fcience, we fhall be vindicating in placing him in one of the higheft niches in the temple of Fame. Kepler had made many unfuccefsful attempts to difcover his canon for the periodic motions of the planets, and hit upon it at laft, as he himfelf candidly owns, on the 15th of May 1618; and Newton applied the palpable tendency of heavy bodies to the earth to the fyftem of the univerfe in general; but Napier fought out his admirable rules by a flow fcientific progrefs, arifing from the gradual evolution of truth."

The laft literary exertion of this eminent perfon was the publication of his *Rabdology and Promptuary* in the year 1617, which he dedicated to the Chancellor Seton; and foon after died at Merchifton on the 3d of April O. S. of the fame year, in the 68th year of his age and 23d of his happy invention.—The particular titles of his works publifhed are: 1. A plain difcovery of the Revelation of St John. 2. *Mirifici ipfius canonis conftructio et logarithmorum, ad naturales ipforum numeros habitudines.* 3. *Appendix de alia atque præftantiore logarithmorum fpecie conftituenda, in qua fcilicet unitas logarithmus eft.* 4. *Rhabdologiæ, feu numerationis per virgulas, libri duo.* 5. *Propofitiones quædam eminentiffimæ, ad triangula fphærica mira facultate refolvenda.* To which may be added, 6. His Letter to Anthony Bacon (the original of which is in the archbifhop's library at Lambeth), entitled, "Secret inventions, profitable and neceffary in thefe days for the defence of this ifland, and withftanding ftrangers enemies to God's truth and religion;" which the earl of Buchan has caufed to be printed in the Appendix to his Account of Napier's Writings. This letter is dated June 2. 1596, about which time it appears the author had fet himfelf to explore his logarithmic canon.

This eminent perfon was twice married. By his firft wife, who was a daughter of Sir James Stirling of Keir, he had only one fon named Archibald, who fucceeded to the eftate. By his fecond wife, a daughter of Sir James Chifholm of Cromlix, he had a numerous iffue.—*Archibald Napier*, the only fon of the firft marriage, was a perfon of fine parts and learning. Having more a turn to public bufinefs than his father had, he was raifed to be a privy counfellor by James VI. under whofe reign he alfo held the offices of treafurer-depute, juftice-clerk, and fenator of the college of juftice. By Charles I. he was raifed to the peerage by the title of *Lord Napier*.

Napier's Rods, or *Bones*, an inftrument invented by Baron Napier, whereby the multiplication and divifion of large numbers is much facilitated.

As to the Conftruction of Napier's Rods: Suppofe the common table of multiplication to be made upon a plate of metal, ivory, or pafteboard, and then conceive the feveral columns (ftanding downwards from the digits on the head) to be cut afunder; and thefe are what we call *Napier's rods of multiplication*. But then there muft be a good number of each; for as many times as any figure is in the multiplicand, fo many rods of that fpecies (*i. e.* with that figure on the top of it) muft we have; though fix rods of each fpecies will be fufficient for any example in common affairs: there muft be alfo as many rods of o's.

But before we explain the way of ufing thefe rods, there is another thing to be known, viz. that the figures on every rod are written in an order different from that in the table. Thus the little fquare fpace or divifion in which the feveral products of every column are written, is divided into two parts by a line acrofs from the upper angle on the right to the lower on the left; and if the product is a digit, it is fet in the lower divifion; if it has two places, the firft is fet in the lower, and the fecond in the upper divifion; but the fpaces on the top are not divided; alfo there is a rod of digits, not divided, which is called the *index rod*, and of this we need but one fingle rod. See the figure of all the different rods, and the index, feparate from one another, in Plate CCCLXIX. fig. 1.

Multiplication by Napier's Rods. Firft lay down the index rod; then on the right of it fet a rod, whofe

Napier.

top is the figure in the highest place of the multiplicand; next to this again, set the rod whose top is the next figure of the multiplicand; and so on in order to the first figure. Then is your multiplicand tabulated for all the nine digits; for in the same line of squares standing against every figure of the index rod, you have the product of that figure; and therefore you have no more to do but to transfer the products and sum them. But in taking out these products from the rods, the order in which the figures stand obliges you to a very easy and small addition; thus, begin to take out the figure in the lower part, or units place, of the square of the first rod on the right; add the figure in the upper part of this rod to that in the lower part of the next, and so on; which may be done as fast as you can look on them. To make this practice as clear as possible, take the following example.

Example: To multiply 4768 by 385. Having set the rods together for the number 4768 (fig. 2.) against 5 in the index, I find this number, by adding according to the rule, - - 23840

Against 8, this number - -	38144
Against 3, this number - -	14304
Total product - - -	1835680

To make the use of the rods yet more regular and easy, they are kept in a flat square box, whose breadth is that of ten rods, and the length that of one rod, as thick as to hold six (or as many as you please) the capacity of the box being divided into ten cells, for the different species of rods. When the rods are put up in the box (each species in its own cell distinguished by the first figure of the rod set before it on the face of the box near the top), as much of every rod stands without the box as shows the first figure of that rod: also upon one of the flat sides without and near the edge, upon the left hand, the index rod is fixed; and along the foot there is a small ledge; so that the rods when applied are laid upon this side, and supported by the ledge, which makes the practice very easy; but in case the multiplicand should have more than nine places, that upper face of the box may be made broader. Some make the rods with four different faces, and figures on each for different purposes.

Division by Napier's Rods. First tabulate your divisor; then you have it multiplied by all the digits, out of which you may choose such convenient divisors as will be next less to the figures in the dividend, and write the index answering in the quotient, and so continually till the work is done. Thus 2179788, divided by 6123, gives in the quotient 356.

Having tabulated the divisor 6123, you see that 6123, cannot be had in 2179; therefore take five places, and on the rods find a number that is equal or next less to 21797, which is 18369; that is, 3 times the divisor; wherefore set 3 in the quotient, and subtract 18369 from the figures above, and there will remain 3428; to which add 8, the next figure of the dividend, and seek again on the rods for it, or the next less, which you will find to be five times; therefore set 5 in the quotient, and subtract 30615 from 34288, and there will remain 3673; to which add 8, the last figure in the dividend, and finding it to be just six times the divisor, set six in the quotient.

Naples.

```
6123)2179788(356
     18369..
     -----
      34288
      30615
      -----
       36738
       36738
       -----
           0
```

NAPLES, a kingdom of Italy, comprehending the ancient countries of Samnium, Campania, Apulia, and Magna Græcia. It is bounded on all sides by the Mediterranean and Adriatic, except on the north-east, where it terminates on the Ecclesiastical state. Its greatest length from south-east to north-west is about 280 English miles; and its breadth from north-east to south-west, from 96 to 120.

The ancient history of this country falls under the articles ROME and ITALY; the present state of it, as well as of the rest of Italy, is owing to the conquests of Charlemagne. When that monarch put an end to the kingdom of the Lombards, he obliged the dukes of Friuli, Spoletto, and Benevento, to acknowledge him as king of Italy; but allowed them to exercise the same power and authority which they had enjoyed before his conquest. Of these three dukedoms 1
Benevento was by far the most powerful and extensive, Extent of the duchy of Benevento.
as it comprehended almost all the present kingdom of Naples; that part of Farther Calabria beyond the rivers Savuto and Peto, a few maritime cities in Hither Calabria, with the city of Acripoli, and the promontory in its neighbourhood called *Capo di Licosa*: and lastly, the dukedoms of Gaeta, Naples, and Amalfi, which were very inconsiderable, and extended along the shore only about 100 miles, and were interrupted by the Gastaldate or county of Capua.

This flourishing and extensive dukedom was at this 2
Arechis duke of Benevento revolts from Charlemagne.
time governed by Arechis, who had married one of the daughters of the last king of the Lombards, and had submitted, and taken the oath of allegiance to the emperor Charles. However, a few years after, he renounced his allegiance to the Franks, declared himself an independent sovereign, and was acknowledged as such by all the inhabitants of his duchy. To strengthen himself against Pepin king of Italy, who resided at Ravenna, he enlarged and fortified the city of Benevento, and likewise built Salerno on the sea coast, surrounding it with a very strong and high wall. He engaged in several wars with the Greeks, whom he sometimes obliged to give him hostages; but having invaded the territories of the pope, whom Pepin could not assist, Charlemagne was prevailed on to return to Italy. Arechis, unable to oppose such a formidable enemy, sent his eldest son, Romuald, to Rome, with an offer of submission: but, at the instigation of the pope, Charles refused the offer, and detained his son prisoner; after which he ravaged the country, and made himself master of Capua. Other deputies, however, proved more successful; and, in the year 787, a peace was concluded on these conditions: That Arechis and the Beneventans should renew their allegiance to the Franks; that he should pay a yearly tribute to Pepin; deliver up all his treasure; and give

Naples. give his son Grimoald and his daughter Adelgisa, with twelve others, as hostages for his fidelity: however, after many entreaties, Adelgisa was restored to her father.

3 Submits.

4 Revolts a second time.

Charles had no sooner left Italy, than Arechis forgot all his engagements, and began to negotiate with Irene, empress of Constantinople, and her son Constantine, for expelling the Franks out of Italy. For himself, he desired the honour of patriciate, and the dukedom of Naples with all its dependencies; and, in return, promised to acknowledge the Greek emperor as his sovereign, and to live after the manner of the Greeks. He required, however, to be supported by a Greek army; and that his brother-in-law Adalgisus, son to Desiderius the last king of the Lombards, should be sent over into Italy, to raise a party among his countrymen. These conditions were readily accepted, on condition that Prince Romuald should be sent as an hostage; ambassadors were sent to Naples with the ensigns of the Patrician order, namely the mantle of cloth of gold, the sword, the comb, and the sandals: but before the ceremony could be performed, Prince Romuald died, and soon after him his father; whose death was supposed to have been hastened by that of his son.

After the death of Arechis, the Beneventans sent a most submissive embassy to Charlemagne, entreating him to send them Grimoald, the late king's son, and only lawful heir to his crown; threatening at the same time to revolt if their prince was denied them. Charles readily granted their request, and allowed Grimoald to depart, after he had agreed to the following conditions, viz. That he should oblige the Lombards to shave their beards; that, in writings, and on money, the name of the king should be put before that of the prince; and that he should cause the walls of Salerno, Acerenza, and Consia, to be entirely demolished.—

5 Grimoald continues for some time faithful to the Franks.

The new king was received by his subjects with the utmost joy; and for some time continued faithful to his engagements, excepting only the last article, which he either neglected or eluded. So far, however, was he from assisting the Greeks, that he gave notice of their machinations to Pepin king of Italy; raised an army to oppose his uncle Adalgisus; and being joined by Hildebrand duke of Spoletto, and Vinigise the general of Pepin, he attacked the Greeks in Calabria soon after they had landed, entirely defeated and took his uncle prisoner, and, as is said, put him to a cruel death. Yet in a short time Grimoald contracted an alliance with the Greek emperor by marrying his neice Wanzia; and in the fifth year of his reign a war broke out between him and Pepin, which continued for twelve years; at the end of which time a truce was concluded. Grimoald survived this pacification only three years, and was succeeded by his treasurer Grimoald II. who submitted to Charlemagne after the death of Pepin; and from this time the Beneventans were looked upon as tributaries of the western emperors. As yet, however, the city of Naples did not own allegiance to the dukes of Benevento, but was held by the eastern emperors; and frequent wars took place between the Beneventans and Neapolitans. This happened to be the case when Grimoald II. ascended the throne. He concluded a peace with them; which however, was of no long continuance; for Theodore, governor of Naples, having granted protections to Dauferius a noble Beneventan, who had been concerned in a conspiracy against his prince, Grimoald marched against the city of Naples, and invested it by sea and land. Theodore still refused to deliver up the traitor, and a general engagement both by land and sea was the consequence; in which the Neapolitans were defeated with so great slaughter, that the sea was stained with their blood for more than seven days. Theodore then consented to deliver up Dauferius, with 8000 crowns for the expences of the war; and Grimoald not only pardoned Dauferius, but received him into favour: The traitor, however, reflecting on the heinousness of his crime, was seized with remorse; and went a pilgrimage to the holy land, carrying a large stone in his mouth, by way of penance, which he never took out but at his meals. 6

In the year 821, Grimoald was murdered by Radelchis count of Consia, and Sico Gastald of Acerenza, the latter of whom succeeded to the dukedom of Benevento. Radelchis being soon after seized with remorse, became a monk; while Sico associated his son Sicardo with him in the government; and both, being of an ambitious and restless disposition, sought a pretence for attacking the Neapolitans. This was soon found, and the city was invested by sea and land. The walls were furiously battered; and part of them being beat down, Sico prepared for a general assault. Stephen, at that time duke of Naples, pretended to submit; but, that he might prevent the city from being pillaged, entreated Sico to put off his entry till the morning, and in the mean time sent out his mother and his two children as hostages. Sico consented to his request; but next morning found the breach built up, and the Neapolitans prepared for their defence. Exasperated at their perfidy, he renewed his attacks with vigour, but without any success; the besieged defending themselves with the utmost obstinacy. At last, perceiving that they should not be able to hold out much longer, they consented to a peace on the following conditions, viz. That the Neapolitans should pay an annual tribute to the princes of Benevento, and consent to the transporting of the body of St Januarius from his church without the walls of Naples to Benevento. These conditions being ratified, Sico returned with great honour to Benevento; but soon after renewed the war, under pretence that the Neapolitans had neglected to pay the stipulated sum; and hostilities continued till his death, which happened in 833.

Is murdered, and succeeded by Sico.

7 Naples besieged by Sico;

8 and by his successor Sicardo.

Sico was succeeded in the government of Benevento by his son Sicardo, who had married the daughter of Dauferius; and being influenced by the evil counsels of Roffrid's his wife's brother, oppressed his subjects to such a degree that they conspired against his life. He besieged Naples with a powerful army, and took possession of Acerra and Atella, both of which he fortified. But Bonus, the Neapolitan duke, defended himself so vigorously, that the Beneventans were obliged to retire, and even to abandon Acerra and Atella, the fortifications of which were immediately demolished. At last Sicardo agreed to a peace for five years, on the intercession of Lothaire, emperor and king of Italy; but his chief motive was thought to have been the fear of the Saracens, whom the duke of Naples had called over from Africa to his assistance: for no sooner were

 they

Naples.

they ſent back than Sicardo attempted to delay the concluſion of the treaty; but the emperor interpoſing his authority, a peace was concluded in the year 836, after the war had continued, with very little intermiſſion, for 16 years.

9 The Saracens called in by the duke of Naples.

Soon after the concluſion of this peace, the Saracens landed at Brindiſi; and having made themſelves maſters of the place, ravaged all the neighbouring country. Sicardo marched againſt them with a numerous army; but the Saracens having dug a great number of ditches which they ſlightly covered over, found means to draw the Beneventans in among them, whereby they were repulſed with great loſs. However, Sicardo, having reinforced his army, marched again to attack them; but the Saracens, deſpairing of ſucceſs, pillaged and burnt Brindiſi, and then retired with their booty, and a great many captives, to Sicily. Sicardo, then, without any apparent provocation, attacked the city of Amalfi, levelled its walls with the ground, carried off all its wealth, and the body of its tutelar ſaint Triphomen. A great many of the inhabitants were tranſported to Salerno; and by promoting alliances between the inhabitants of both places, he endeavoured to unite Amalfi to his own principality as firmly as poſſible.

During all theſe tranſactions, Sicardo had tyrannized over his ſubjects in ſuch a manner, that at laſt he became intolerable. Among other acts of injuſtice, he impriſoned his own brother Siconolphus; compelled him to turn prieſt; and afterwards ſent him bound to Tarento, where he cauſed him to be ſhut up in an old tower that had been built for a ciſtern. By ſuch acts of tyranny his nobles were provoked to conſpire againſt him; and in the year 839 he was murdered in his tent.

10 cardo murdered by Radelchis, which brings on a civil war.

On the death of Sicardo, Radelchis, his ſecretary or treaſurer, was unanimouſly elected prince of Benevento; but Siconolphus, the laſt king's brother, having regained his liberty, formed a great party againſt the new prince. Radelchis did not fail to oppoſe him with a formidable army; and a moſt ruinous civil war enſued. Both parties by turns called in the Saracens; and theſe treacherous allies acted ſometimes againſt one, and ſometimes againſt the other; or turned their arms againſt both, as ſeemed moſt ſuitable to their own intereſt. Thus the war continued with the utmoſt animoſity for 12 years, during which time the principality was almoſt entirely ruined; till at laſt the emperor Lewis interpoſed, and obliged the competitors to agree to a partition of the principality.

11 The principality divided.

By this treaty, Radelchis promiſed to acknowledge Siconolphus and his ſucceſſors as lawful princes of the principality of Salerno, which was declared to contain Tarento, Latiano, Caſſano, Coſſenzo, Laino, Lucadia, Conſia, Montella, Rota, Salerno, Sarno, Ciraterium, Furculo, Capua, Feano, Sora, and the half of the Gaſtaldate of Acerenza, where it joins Latiano and Conſia. The boundary betwixt Benevento and Capua was fixed at St Angelo ad Cerros; Alli Peregrini was made the boundary betwixt Benevento and Salerno, and Staffilo betwixt Benevento and Conſia. The monaſteries of Monte Caſſino and St Vincent were declared to be immediately under the protection of the emperor: both princes ſtipulated that no hoſtilities ſhould be committed by either againſt the ſubjects of each other; and promiſed to join their forces in order to drive out the Saracens. Soon after this pacification, however, both Radelchis and Siconolphus died; the former appointing his ſon Radelgarius, or Radelcar, to ſucceed him; and the latter leaving an infant ſon, Sico, to the care of his godfather, Peter.

12 Unſucceſsful war with the Saracens.

The war with the Saracens proved very unſucceſsful: neither the united efforts of the princes, nor the aſſiſtance of the emperor Lewis himſelf, being able to expel the infidels; and in 854, Adelgiſe the ſecond ſon of Radelchis, who had now ſucceeded, on the death of his brother Radelcar, to the principality of Benevento, was obliged to pay them an annual ſubſidy. Two years after, Lando, count of Capua, revolted from the prince of Salerno, and could not be reduced. In the mean time, Sico, the lawful prince of Salerno, had been poiſoned by Count Lando, and the principality uſurped by Ademarius, the ſon of Peter above mentioned; but in 861, Ademarius himſelf was ſeized and impriſoned by Gauferius, the ſon of Dauferius formerly mentioned. This was occaſioned by his cruelty and rapaciouſneſs, which entirely alienated the hearts of his ſubjects from him, and encouraged Gauferius to become the head of the conſpirators. The Saracens in the mean time committed terrible ravages throughout the Beneventan territories; which at laſt obliged Adelgiſe to enter into an alliance with Gauferius, and both together ſent a moſt humble embaſſy to the emperor Lewis, requeſting him to take them under his protection. About the ſame time an embaſſy arrived from Conſtantinople, propoſing a junction of the forces of the eaſtern and weſtern empires againſt the infidels; upon which Lewis gave orders for aſſembling a formidable army. But in the mean time Adelgiſe fell off from his alliance, and made peace with the Saracens; nay, according to ſome, he encouraged them in their incurſions, and it was at his deſire that they invaded the duchy of Capua, and afterwards that of Naples, which they ravaged in a moſt barbarous manner. The Neapolitans, in conjunction with the duke of Spoletto and the count of Marſi, endeavoured to oppoſe them; but being defeated, the Saracens continued their ravages with redoubled fury, and retired to Bari, which was their capital city, with an immenſe booty.

In 866, Lewis arrived at Sora with his army: and having marched to Capua, was there joined by Landulph, the biſhop and count, with a body of Capuans: but Landulph ſoon after perſuading his countrymen to deſert, Lewis marched againſt that city, which he took after a ſiege of three months, and almoſt totally deſtroyed. In the end of the year he was joined by Gauferius with his quota of troops, having ordered the eyes of Ardemarius to be put out in his abſence. Lewis confirmed him in the principality, and marched with his army to Benevento, where Adelgiſe received him with great reſpect. Having reduced ſome inconſiderable places belonging to the Saracens, Lewis ſoon after inveſted Bari; but as the Saracens received continual ſupplies from their countrymen ſettled in Sicily, and beſides were protected by the Neapolitans, he could not reduce the place till the year 871, though he had received conſiderable aſſiſtance from his brother Lotharius, and the Greek emperor had ſent him a fleet of

Naples.

200 sail. The expulsion of the Saracens was completed the same year by the taking of Tarento; after which the emperor returned with great glory to Benevento, resolving next to carry his arms into Sicily, and expel the infidels from thence also. But his future schemes of conquest were frustrated by a quarrel between him and Adelgise. The latter, pretending to have been insulted by the empress, and oppressed by the French, seized the emperor himself, and kept him prisoner for 40 days. His imprisonment would probably have been of much longer continuance, had not a body of Saracens arrived from Africa, who, being joined by such of their countrymen as had concealed themselves in Italy, laid siege to Salerno with an army of 30,000 men, ravaging the neighbouring country at the same time with the utmost barbarity. By this new invasion Adelgise was so much alarmed, that he set the emperor at liberty, but first obliged him to swear that he would not revenge the insult that had been offered him, and that he would never return to Benevento. Lewis having then joined his forces to those of the prince of Salerno, soon obliged the Saracens to raise the siege of Salerno; but though they were prevented from taking that city, they entirely destroyed the inhabitants of Calabria, leaving it, according to the expression of one of the historians of that time, "as desolate as it was at the flood."

13 They are at last expelled,

14 but soon return.

In the year 873, Lewis being absolved from his oath by the pope, went to Benevento, and was reconciled to Adelgise; but soon after this reconciliation he died, and the Saracens continued their ravages to such a degree that the inhabitants of Bari were constrained to deliver up their city to the Greeks. At the same time the Salernitans, Neapolitans, Cajetans, and Amalfitans, having made peace with the Saracens, were compelled to agree to their proposal of invading the territories of the Roman pontiff. His holiness exerted himself to the utmost, both with spiritual and temporal weapons, in order to defend his right; but was at last reduced to the necessity of becoming a tributary to the infidels, and promising to pay them a large sum annually.

15 The pope becomes their tributary.

In the mean time, all Italy was thrown into the greatest confusion by the death of Charles the Bald, who died of poison at Pavia, as he was coming to the pope's assistance. Sergius duke of Naples continued a firm friend to the infidels; nor could he be detached from their interests even by the thunder of a papal excommunication: but unluckily happening to fall into the hands of his brother Athanasius bishop of Naples, the zeal of that prelate prompted him to put out his eyes, and send him a close prisoner to Rome; for which the highest encomiums were bestowed on him by the holy father.

In 876, Adelgise was murdered by two of his nephews; one of whom, by name *Gaideris*, seized the principality. About the same time Landulph bishop of Capua dying, a civil war ensued among his children, though their father's dominions had been divided among them according to his will. The princes of Salerno and Benevento, the duke of Spoletto, and Gregory the Greek governor of Bari and Otranto, took different sides in the quarrel, as they thought most proper; and to complete the confusion, the new bishop was expelled, and his brother, though a laymen, chosen to that office, and even consecrated by the pope, who wrote to Gauferius, forbidding him to attack Capua under pain of excommunication. But though Gauferius was, in general, obedient to the pope's commands, he proved refractory in this particular, and laid siege to Capua for two years successively.

Naples.

Thus the Capuan territories were reduced to the most miserable situation; being obliged to maintain at the same time the armies of the prince of Benevento and the duke of Spoletto. The Saracens, in the mean time, took the opportunity of strengthening themselves in Italy; and Athanasius, notwithstanding the great commendations he had received from the pope for putting out his brother's eyes, consented to enter into an alliance with them, in conjunction with whom he ravaged the territories of the pope, as well as those of Benevento and Spoletto, plundering all the churches, monasteries, towns, and villages, through which they passed. At the same time the prince of Salerno was obliged to grant them a settlement in the neighbourhood of his capital; the duke of Geeta invited them to his assistance, being oppressed by the count of Capua; and even the pope himself was obliged to make peace with them, and to grant them a settlement on the north side of the Carigliano, where they fortified themselves, and continued for more than 40 years.

To put a stop to the confusion which reigned in Italy, the pope now thought proper to restore the bishop of Capua, who had been expelled, but allowed his brother to reside in the city, and govern one half of the diocese; but notwithstanding this partition, the civil dissensions continued with the utmost violence, the nearest relations murdering or banishing each other, according as the fortune of the one or the other prevailed. Athanasius, notwithstanding all the pope's remonstrances, continued his alliance with the Saracens; in conjunction with whom he ravaged the territory of Benevento, and fomented the divisions in Capua, in hopes of being able to make a conquest of it. At last his holiness thought proper to issue a sentence of excommunication against him: but this attached him to the Saracens more than ever: insomuch that he sent to Suchaim, king of the Saracens in Sicily, desiring him to come over and command a great body of his countrymen who had settled at the foot of Mount Vesuvius. Suchaim accepted the invitation, and immediately turned his arms against Athanasius; allowing his troops to live at discretion in the territory of Naples, where they ravished the women, and plundered the inhabitants. These calamities were, by the superstitious Neapolitans, imagined to be a consequence of the sentence of excommunication; and therefore they used their utmost endeavours to persuade the prelate to conclude a league with some Christian prince, and renounce all connexion with the infidels. In this they at last proved successful, and Athanasius concluded an alliance with Guaimarius prince of Salerno; in consequence of which the Saracens were obliged to quit the Neapolitan territories, and retire to Agropoli. Athanasius then directed his force against Capua, of which he made himself master in the year 882. The Saracens, however, still continued their incursions, and ravaged several provinces in such a manner, that they became entirely desolate.

These confusions continued for a long time; during which

Naples.

16 The Saracens almost entirely cut off.

which the Greeks found an opportunity of making themselves masters of Benevento, and well nigh became masters also of Salerno; but in this they failed through the treachery of the bishop, and in the year 896 they were totally expelled by the bishop, four years after they had become masters of it. In 915 the Saracens received such an overthrow at Carigliano, that scarce one of them remained. However, a new body soon arrived from Africa, and infested the sea coasts for some time longer. A war also ensued between Landulph and the Greeks; which concluded disadvantageously for the former, who was obliged to submit to the emperor of Constantinople in 943.

In 961, Otho the Great, king of Germany, invaded Italy with a powerful army against Berengarius III. and, marching to Rome, received the imperial crown from the hands of the Pope. In 964, he erected Capua into a principality, received homage from the other princes of Lombardy, and formed a design of recovering Puglia and Calabria from the Greeks. But in this last scheme he failed; and after various hostilities a treaty was concluded, and the young princess Theophania married to Otho's son, afterwards emperor.

All this time the Saracens continued their incursions; and the Greeks had gained ground so much, that they were now in possession of two thirds of the present kingdom of Naples; but in the year 1002 or 1003, the Normans first began to be remarkable in Italy. They had, about a century before, embraced Christianity, and become very zealous in all the superstitions which were then practised. They were particularly zealous in visiting sacred places, especially Rome, and the holy sepulchre at Jerusalem; and being naturally of a very martial disposition, they forced through great bodies of Greeks and Saracens who opposed their passage. About this time 40, or, as others write, 100, of these Normans, returning from Jerusalem by sea, landed at Salerno in the habit of pilgrims, where they were honourably received by Guaimarius. During their residence at Salerno, a great body of Saracens landed, and invested the city. Guaimarius, not being in a condition to oppose the invaders by force, was preparing to pay them a large sum of money, which they demanded, when the Normans proposed to attack them; and, having got arms and horses from the prince, they engaged the infidels with such fury and bravery, that they entirely defeated them, and obliged them to fly to their ships. By this complete victory Guaimarius was filled with such admiration of the valour of these strangers, that he entreated them to remain in his country; offering them lands, and the most honourable employments: but not being able to prevail with them to stay in Italy, or even accept of his presents; at their departure he sent some ambassadors with them to Normandy, in vessels loaded with exquisite fruits, rich furniture for horses, &c. in order to allure the valiant Normans to leave their own country. This kind invitation encouraged a Norman chief, named *Osmond Drengot*, to settle in Italy about the year 1015; having killed another lord in a duel, which obliged him to leave his own country, in order to avoid the resentment of his sovereign, Robert duke of Normandy. In the mean time, the city of Bari had revolted from the Greeks, and chosen one Mello for their leader, whose wife and children happened soon after to fall into the hands of their enemies, and were sent prisoners to Constantinople.

17 The Normans first known in Italy.

18 They return and defeat the Greeks.

No sooner, therefore, did Mello hear of the arrival of these adventurers, than he engaged them to assist him; and having drawn together a considerable army, defeated the Greeks with great slaughter, and obliged them to abandon their camp. In this engagement the Normans distinguished themselves by their bravery; and the news of their success soon brought from Normandy an innumerable multitude of their countrymen, with their wives and children. By this reinforcement, Mello gained two other victories, took a great many towns, and obliged the Greeks to abandon a large territory; but, in 1019, they were utterly defeated, and every thing recovered by the Greeks. The Greek general, Bajanus, continued to go on with such surprising success, that he almost entirely re-established the affairs of his countrymen in Italy, and made a distinct province of the western part of Puglia, which he called *Capatanata*, and which to this day retains the name of *Capitanata*. His great progress at last alarmed the emperors of Germany; and, in 1027, Pandulphus prince of Capua made himself master of Naples; but was obliged, three years afterwards, to leave it, by the Normans, who built the city of Aversa, which was now erected into a county. In consequence of this piece of good fortune, great numbers of Norman adventurers migrated into Italy; among whom were William, Drogo, and Umbert, three of the sons of Tancred duke of Hautville; from whose posterity those princes were descended, who first conquered the island of Sicily from the Saracens, and formed the present kingdom of Naples.

19 but are at last defeated by them.

In 1040, the Greek emperor Michael Paleologus, in order to secure the affection of his fickle subjects, undertook the conquest of Italy from the Saracens, and for that purpose sent a general named *Michael Maniacus* into Sicily. This commander, hearing of the great reputation of the Normans, sent to Guaimarius, prince of Salerno, entreating him to grant him some of those warriors. His request was most willingly hearkened to by the prince of Salerno, who, to encourage the Normans to engage in the expedition, promised them some additional rewards besides the emperor's pay. William, Drogo, and Umbert, accordingly marched from Salerno with 300 of their countrymen; and passing over into Sicily, distinguished themselves most remarkably in the conquest of that island. Maniacus acknowledged, that the recovery of Messina was chiefly owing to their valour; and William with his Normans gained a complete victory over the Saracens before Syracuse, where he killed the governor of the city in single combat. Maniacus made himself master of Syracuse, and almost entirely reduced the whole island; but being accused of treason, was next year carried prisoner to Constantinople. His successor Doceanus, being a man of no abilities, quickly lost the whole island except Messina, and treated his Norman auxiliaries with the utmost contempt. He would not allow them any share of the booty; and even caused one Ardoin, a noble Lombard, and associate and interpreter of the Normans, to be whipped round the camp, because he refused to part with the horse of a Saracen whom he had slain in single combat. The consequences of this tyrannical behaviour were very fatal to the Greeks.

20 The Normans pass over into Sicily.

Naples.

Greeks. Ardoin ſoon after obtained leave to return to Italy under a pretence of a vow, and all the Normans embarked at night along with him; but inſtead of going to Rome, Ardoin went immediately to Averſa, where he perſuaded Count Rainulphus, ſovereign of that province, to join with him in the deſign he had formed of attacking the Greek provinces in Italy, which he ſhowed him, would be an eaſy conqueſt, as the inhabitants ſubmitted with great reluctance to the Greeks, and the provinces were at that time almoſt entirely defenceleſs. Rainulphus approved of the ſcheme, and raiſed 300 ſoldiers, whom he ſent under 12 officers to join the other Normans under the ſons of Tancred; and made an agreement with Ardoin, that the conqueſts ſhould be equally divided among the chief leaders. Their firſt enterpriſe was the reduction of Melphis, one of the ſtrongeſt cities in Puglia, which preſently ſurrendered; and they increaſed its fortifications ſo much, that it thenceforth became impregnable. Soon after this they made themſelves maſters of Venoſa, Aſcoli, and Lavello, with very little oppoſition. Doceanus, alarmed with the rapidity of their conqueſts, immediately left Sicily, and marched with his army into Puglia, where he attacked the invaders near the river Oliviento; but after a fierce engagement, he was obliged to retire with conſiderable loſs. The Greeks were ſoon after defeated a ſecond time at Cannæ; and in a third engagement, which happened near the river Ofanto, the army of Doceanus was entirely routed, and he himſelf obliged to fly to Bari. On this bad ſucceſs Doceanus was ordered to return to his command in Sicily, and another general was ſent with an army into Puglia. This new commander, however, had no better ſucceſs than his predeceſſor; for his army was entirely defeated in an engagement with the Normans, and he himſelf taken priſoner. Atenulphus, brother to one of the princes of Benevento on whom the Normans had conferred the chief command, ſet at liberty the captive general without conſulting them, on receiving from him a conſiderable ſum of money. With this the Normans were ſo much diſpleaſed that they deprived Atenulphus of his command, and beſtowed it on Argyrus ſon to the late Mello, who had eſcaped from Conſtantinople, and now aſſumed the title of *duke and prince of Italy*. Before this time alſo Maniacus, whom we have formerly mentioned, had returned to Italy; and to ſtrike the greater terror into the revolted cities, had executed a number of people of all ages and ſexes with great inhumanity. Soon after this Maniacus openly rebelled againſt the Greek emperor Conſtantinus, and prevailed upon his own army to proclaim him emperor, beginning hoſtilities immediately againſt the Greek cities. Argyrus at the ſame time took Giovenazzo and beſieged Trani, and ſoon after beſieged Maniacus himſelf in Tarento; but he, being afraid of falling into the hands of the Normans, fled to Otranto, and from thence to Bulgaria, where, being entirely defeated by one of the emperor's generals, he was taken priſoner, and had his head ſtruck off.

21 Their conqueſt.

The Normans having now conquered the greateſt part of Puglia, proceeded to make a diviſion of their conqueſt, in which, after each commander had got his proper ſhare, the city of Melſis was left common to all, and appropriated as a place for aſſembling to conſult about the moſt important affairs of the nation. Argyrus alone was neglected in this diviſion; but he, having gained the favour of the emperor by expelling the rebel Maniacus from Italy, was by him created duke of Bari, on purpoſe to check the power of the Normans, with the title of *prince and duke of Puglia*. The Normans, however, were too powerful to be much awed by Argyrus, and behaved with great inſolence to the neighbouring princes; but as they could not be expelled by force, and were confirmed in their conqueſts by Henry II. emperor of Germany in 1047, the Greek emperor attempted to get rid of them, by ſending Argyrus with large ſums of money to bribe them to enter into his ſervice againſt the Perſians. But they, perceiving the ſnare, replied that they were reſolved not to leave Italy unleſs they were expelled by force: upon which Argyrus made uſe of the ſame money in bribing the Puglians to aſſaſſinate theſe invaders. This brought on a maſſacre, in which greater numbers of Normans periſhed than had fallen in all the late wars. Argyrus attempted to take advantage of the confuſion produced by this maſſacre, but was defeated; after which he had recourſe to Pope Leo, beſeeching him to deliver Italy from theſe cruel tyrants: but this ſcheme proved ſtill more unſucceſsful than the others had been; for the pope himſelf was defeated and taken priſoner; and, in conſequence of the reſpect ſhowed him by the Normans, granted them, as a fief of the holy ſee, all the conqueſts they had made or ſhould make in Calabria and Sicily.

22 Great numbers of them maſſacred.

23 They are confirmed by the ope in all their conqueſts.

Soon after this, the Norman power became extremely formidable; the famous Robert Guiſcard aſcended the throne in 1056. He made great progreſs in the conqueſt of Calabria, and reduced moſt of the cities which held out for the Greeks in theſe parts. About the ſame time the counts of Capua were expelled from their territory; and the abbot Deſiderius mentions his having ſeen the children of Landulphus V. the laſt count, going about as vagabonds, and begging for their ſupport. The pope alarmed by theſe conqueſts, excommunicated the Normans in wholeſale, pretending that they had ſeized ſome of the territories belonging to the church; but, by the pretended ſubmiſſion of Robert, he not only was perſuaded to take off the ſentence of excommunication, but to inveſt him with the provinces of Apulia, Calabria, and Sicily. After this, he continued the war againſt the Greeks with great ſucceſs. In 1071, in conjunction with his brother Roger, he conquered the iſland of Sicily, and gave the inveſtiture of the whole iſland to him with the title of *count*, reſerving to himſelf only the half of Palermo, Meſſino, and the valley of Demona. The like ſucceſs attended his arms againſt Salerno in 1074; but after this, having unadviſedly taken ſome places from the pope, he again fell under the ſentence of excommunication; yet he was reconciled to him in 1080, and received a ſecond time the inveſtiture of all his dominions. The next year he undertook an expedition againſt the Greeks; and though the emperor was aſſiſted by a Venetian fleet, Robert made himſelf maſter of the iſland of Corfu, reduced Durazzo, and great part of Romania; inſomuch that by the ſucceſs of his arms, and his near approach to Conſtantinople, he ſtruck an univerſal terror among the Greeks. But while Robert was thus extending his conqueſts, he was alarmed

24 Sicily conquered by Robert Guiſcard.

alarmed

Naples. alarmed by the news of a formidable rebellion in Italy, and that the emperor Henry had taken the city of Rome, and closely shut up the pope in the castle of St Angelo. Robert, therefore, leaving the command of the army to his son Boemund, returned to Italy, where he immediately dispersed the rebels, and released the pope, while his son gained a considerable victory over the Greeks. After this Robert made great preparations for another expedition into Greece, in order to second his son Boemund. Alexius Comnenus, who was about this time declared emperor by the Greek army, being assisted by the Venetian fleet, endeavoured to oppose his passage; but was entirely defeated, with the loss of a great many galleys. But a final stop was now put to his enterprises by his death, which happened in the island of Corfu in 1085.

Though the power of the Normans was thus thoroughly established in Italy and Sicily, and though the prince of Benevento was in 1130 invested by the pope with the title of king of Sicily; yet by reason of the civil dissensions which took place among themselves, and the general confusion which reigned in Italy in those ages, they were obliged, notwithstanding all their valour, to submit to the emperor in 1195. By him the Sicilians were treated with so great cruelty, that the empress Constantia was induced to conspire against him in 1197, took him prisoner, and released him only on condition of his sending off his army immediately for the Holy Land. This was complied with; but the emperor did not long revive the reconciliation, being poisoned, as was supposed, by order of the empress.

25
And by the emperor of Germany.

In 1254 the pope claimed the kingdom as a fief devolved on the church in consequence of a sentence of deposition pronounced against King Frederick at the council of Lyons; and, in 1263, the kingdom was, in consequence of this right, conferred on Charles count of Anjou. After much contention and bloodshed, the French thus became masters of Sicily and Naples. Their government was insupportably tyrannical; and at the same time the haughtiness of their king so provoked the pope, that he resolved to humble him.—Charles had resolved on an expedition against Constantinople; and for this purpose had fitted out a fleet of 100 galleys, 30 large ships, 200 transports, besides many other smaller vessels, on board of which he intended to embark 10,000 horse, and a numerous army of foot. This formidable armament greatly alarmed the emperor Michael Paleologus; for which reason he entered into a negotiation with John di Procida, a noble Salernitan, lord of the isle of Procida in the bay of Naples, who had formed a scheme for a general revolt in the island of Sicily. John, though a nobleman, was also a physician, and had been counsellor to two former princes, and even to King Charles himself; but being stripped of his estate by the king under pretence of treason, and his wife being debauched by the French, he retired to Constantia queen of Arragon, where he was created a baron of the kingdom of Valencia, by her husband King Peter, and lord of Luxen, Benizzano, and Palma. As he was greatly exasperated against the French, he employed many spies both in Puglia and Sicily; and being informed that the Sicilians were totally disaffected to the French, he came to the island in disguise, and concerted a plan with the most powerful of the malecontents for a revolution in favour of Constantia, though she derived her right only as being the daughter of a former usurper named *Manfred*. Procida then set out for Constantinople, where in some private conferences with the emperor, he persuaded him, that the most probable means of defeating Charles's scheme was by assisting the Spaniards and Sicilian malecontents. Paleologus accordingly granted him a large sum of money, and on his departure sent one of his secretaries along with him, who, landing in Sicily, had a conference with the chief conspirators. John, having received letters from them, disguised himself in the habit of a Franciscan, and went to Suriano in the neighbourhood of Rome. As he well knew the enmity which subsisted between the pope and King Charles, he disclosed his design to his holiness; who readily entered into his measures, wrote to Peter to hasten his armament, promising him the investiture of the island as soon as he had taken possession of it; and, by refusing the assistance he had promised to Charles, obliged him for the present to delay his expedition. In the beginning of the year 1280, Procida returned to Arragon, and by showing the letters from the pope and Sicilian barons, prevailed on Peter to embark in his design, by assuring him of the assistance of Paleologus. This king of Arragon accordingly prepared a formidable fleet under pretence of invading Africa, and is even said to have received 20,000 ducats from Charles, in order to assist him in his preparations.

26
The French become masters of Sicily and Naples.

But while John went on thus successfully with his scheme, all his measures were in danger of being broke by the death of Pope Nicholas. The new pope, Martin IV. was entirely in the interest of Charles, on whom, in 1281, he conferred the senatorial dignity of Rome. Procida, however, still resolved to prosecute his scheme; and, leaving Italy, had another conference with the conspirators in Sicily; after which, he again went to Constantinople, and obtained from Paleologus 30,000 ounces of gold, with which he immediately returned to Arragon. The death of Nicholas had damped the ardour of Peter; but, being urged with great earnestness by John, he again renewed his preparations; which alarmed the pope and the king of France. In consequence of this they sent a message to him, desiring to know against what Saracens he designed to employ his armament. In this particular Peter refused to satisfy them; upon which they earnestly counselled Charles to guard against an invasion: but he neglected their advice, being wholly intent on his eastern expedition, and encouraged by a revolt which had happened in Greece; and to facilitate his expedition, he prevailed on the pope to excommunicate the Greeks, on pretence that they had broken some of the articles of union concluded at the council of Lyons a few years before. Peter in the mean time continued his preparations with great diligence, intending to put to sea the following summer. Procida had returned to Palermo, to wait for a favourable opportunity of putting his design in execution, which was soon afforded him by the French. On Easter Monday, March 30. 1282, the chief conspirators had assembled at Palermo; and, after dinner, both the Palermitans and French went in a grand procession to the church of Monreale, about three miles without the city. While they were sporting

27
They are massacred.

ſporting in the fields, a bride happened to paſs by with her train, who being obſerved by one Drochettus, a Frenchman, he ran to her, and began to uſe her in a rude manner, under pretence of ſearching for concealed arms. A young Sicilian, exaſperated at this affront, ſtabbed him with his own ſword; and a tumult enſuing, 200 French were immediately murdered. The enraged populace then ran to the city, crying out, "Let the French die, Let the French die;" and, without diſtinction of age or ſex, ſlaughtered all of that nation they could find, even ſuch as had fled to the churches. The conſpirators then left Palermo, and excited the inhabitants to murder the French all over the iſland, excepting in Meſſina, which city at firſt refuſed to be concerned in the revolt. But, being invited by the Palermitans to throw off the French yoke, a few weeks after, the citizens in a tumultuous manner deſtroyed ſome of the French; and pulling down the arms of King Charles, and erecting thoſe of the city, choſe one Baldwin for their governor, who ſaved the remaining French from the fury of the populace, and allowed them to tranſport themſelves, with their wives and children to Italy. Eight thouſand perſons are ſaid to have been murdered on this occaſion.

Immediately after this maſſacre, the Sicilians offered their allegiance to the king of Arragon; who accepted of the invitation, and landed with his forces at Trapani. From thence he went to Palermo, where he was crowned king of Sicily with great ſolemnity, and Charles left the iſland with precipitation. The day after he landed his army in Italy, the Arragonian fleet arrived, took 29 of his galleys, and the next day burnt 80 tranſports in preſence of his army. Soon after this Charles ſent an embaſſy to Peter, accuſing him of perfidy, in invading his dominions in time of peace; and, according to ſome, challenged him at the ſame time to decide the matter by ſingle combat. Others ſay that the challenge was given by Peter. Certain it is, however, that a challenge was given, and to appearance accepted: but Peter determined to employ much more effectual means in ſupport of his pretenſions than truſting to a duel; and therefore puſhed on his operations moſt vigorouſly, while his adverſary trifled away his time: and thus he at laſt became maſter of the conteſted kingdom; which, however, he did not long enjoy, dying about the end of the year 1285.

By his will, Peter left the kingdom of Arragon to his eldeſt ſon Alphonſus, and Sicily to Don James his other ſon, who was alſo to ſucceed to the kingdom of Arragon in caſe Alphonſus ſhould die without male iſſue. Accordingly, Don James was ſolemnly crowned at Palermo the 2d of February 1286. In 1295 however, he deſerted them, and tamely reſigned up his right to Charles, ſon to him above mentioned, in a manner perhaps unparalleled. On his reſignation the Sicilians conferred the crown upon his brother Don Frederic: after which the war continued with great violence till the year 1303, when a peace was concluded, and the kingdoms of Naples and Sicily formally disjoined; Frederic being allowed to keep the latter, under the name of *Trinacria*; and Charles being confirmed in the poſſeſſion of the former, which he quietly enjoyed till his death in 1309.

28
The kingdoms of Naples and Sicily diſjoined.

Naples continued to be governed by its own kings till the beginning of the 16th century, when the kings of France and Spain contended for the ſovereignty of this country. Frederic, at that time king of Naples, reſigned the ſovereignty to Louis XII. on being created duke of Anjou, and receiving an annual penſion of 30,000 ducats. But, in 1504, the French were entirely defeated by the Spainards, and obliged to evacuate the kingdom; and the following year Louis renounced all pretenſions to the crown, which from that time hath remained almoſt conſtantly in the hands of the Spaniards.

29
The Spaniards become maſters of Naples.

The government of the Spaniards proved no leſs oppreſſive to the Neapolitans than that of others had been. The kings of Spain ſet no bounds to their exactions, and of conſequence the people were loaded with all manner of taxes; even the moſt indiſpenſable neceſſaries of life not being exempted. In 1647, a new tax was laid on fruit; which the people looked upon as the moſt grievous oppreſſion, the chief part of their ſubſiſtence, during the ſummer months, being fruit, which in the kingdom of Naples is very plentiful and delicious. The edict for collecting the new duty was no ſooner publiſhed, than the people began to murmur in a tumultuous manner; and when the viceroy came abroad, they ſurrounded his coach, bawling out to have their grievances redreſſed. They were encouraged in their ſedition, by the news that the citizens of Palermo had actually revolted on account of the impoſition of new duties. The viceroy, therefore, apprehenſive of greater diſorders, began to think of taking off the tax; but thoſe who farmed the tax having bribed ſome of his favourites, he was by their means perſuaded not to aboliſh it. The indignation of the people, who had ſuſpected his intention, was now greatly increaſed, eſpecially as they were privately excited by ſeveral malecontents. The farmers of the revenue, and all thoſe concerned in raiſing the taxes, had incurred the hatred and deteſtation of the people, particularly of Tommaſo Aniello, commonly called *Maſſaniello of Amalfi*, a fiſherman, whoſe wife, having been diſcovered in ſmuggling a ſmall quantity of meal, was impriſoned, and condemned to pay a fine of 100 ducats.

30
A general revolt.

31
Account of Maſſaniello.

Maſſaniello, a few years before, had come to Naples from Amalfi, where his father had been a fiſherman. At this time he was about 24 years of age, and the father of four children. He was of a middle ſtature, and an agreeable aſpect; was diſtinguiſhed for his boldneſs, activity, and integrity: and had a great influence with his companions, by whom he was beloved and eſteemed. As he was obliged even to ſell his furniture to pay the heavy fine, he had conceived an implacable hatred againſt the farmers of the taxes, and was alſo moved with compaſſion for the miſerable ſtate of the city and kingdom. He therefore formed a deſign, with ſome of his companions, to raiſe a tumult in the market place on the feſtival-day of the Carmelites, uſually celebrated about the middle of July, when between 500 and 600 youths entertain the people by a mock fight; one half of them, in the character of Turks, defending a wooden caſtle, which is attacked and ſtormed by the other half in the character of Chriſtians. Maſſaniello being appointed captain of one of theſe parties, and one Pione, who was privy to his deſign, commanding the other, for ſeveral weeks before

Naples.

before the feſtival they were very diligent in reviewing and training their followers, who were armed with ſticks and reeds; but a ſmall and unforeſeen accident tempted them to begin their enterpriſe without waiting for the feſtival.

On the 7th of July a diſpute happening in the market-place betwixt the tax-gatherers and ſome gardeners of Pozzuolo who had brought ſome figs into the city, whether the buyer or ſeller ſhould pay the duty; after the tumult had continued ſeveral hours, Maſſaniello, who was preſent with his company, excited the mob to pillage the office built in the market for receiving the duty, and to drive away the officers with ſtones. The elect of the people, who, by deciding againſt the gardeners, had increaſed the tumult, ran to the palace, and informed the viceroy, who moſt imprudently neglected all means of putting a ſtop to the commotion. Maſſaniello, in the mean time, being joined by great numbers of people, ordered his young troop to ſet fire to all the offices for the taxes through the city; which command being executed with deſpatch, he then conducted them directly to the palace, where the viceroy, inſtead of ordering his Spaniſh and German guards to diſperſe them, encouraged their inſolence by timidly granting their demands. As they ruſhed into the palace in a furious manner, he eſcaped by a private door, and endeavoured to ſave himſelf in *Caſtel del Ovo;* but being overtaken by the rioters in the ſtreets, he was trampled upon by them, and pulled by the hair and whiſkers. However, by throwing ſome handfuls of gold among them, he again eſcaped, and took ſanctuary in a convent of Minims, where, being joined by the archbiſhop of Naples, Cardinal Filomarini, and ſeveral nobles, by their advice he ſigned a billet, by which he aboliſhed all taxes upon proviſions. As a means to quell the tumult, he likewiſe deſired the cardinal to offer Maſſaniello a penſion of 2400 crowns, who generouſly rejected the bribe; and declared, that if the viceroy would keep his word, he would find them obedient ſubjects.

It was now expected that the tumult would ceaſe; but Maſſaniello, upon his return to the market-place, being joined by ſeveral malecontents, among whom were Genuino and one Peronne, who had formerly been a captain of the Sbirri, he was adviſed by them to order the houſes of thoſe concerned in raiſing the tax to be burned; which were accordingly in a few days reduced to aſhes, with all their rich furniture. Maſſaniello being now abſolute maſter of the whole city, and being joined by great numbers of people of deſperate fortunes, he required the viceroy, who had retired to the *Caſtel Nuovo*, to aboliſh all the taxes, and to deliver up the writ of exemption granted by Charles V. This new demand greatly embarraſſed the viceroy; but to appeaſe the people, he drew up a falſe deed in letters of gold, and ſent it to them by their favourite the duke of Matalone, who had before been in confinement. The fraud, however, being diſcovered, the duke was pulled from his horſe and maltreated by the mob, and at length committed as a priſoner to Peronne. This accident, to the great joy of the viceroy, enraged the people againſt the nobility, ſeveral of whom they killed, burnt the houſes of others, and threatened to extirpate them all. Maſſaniello, in the mean time, tattered and half naked, commanded his followers, who were now well armed, and reckoned about 100,000 men, with a moſt abſolute ſway. He ate and ſlept little, gave his orders with great preciſion and judgement, appeared full of moderation, without ambition and intereſted views. But the duke of Matalone having procured his liberty by bribing Peronne, the viceroy imitated his example, and ſecretly corrupted Genuino to betray his chief. A conſpiracy was accordingly formed againſt Maſſaniello by Matalone and Peronne; the duke, who was equally exaſperated againſt the viceroy, propoſing, that after his death his brother D. Joſeph ſhould head the rebels.

Maſſaniello in the mean time, by means of the cardinal archbiſhop was negotiating a general peace and accommodation; but while both parties were aſſembling in the convent of the Carmelites, the banditti hired by Matalone made an unſucceſsful attempt upon Maſſaniello's life. His followers immediately killed 150 of them. Peronne and D. Joſeph being diſcovered to be concerned in the conſpiracy, were likewiſe put to death, and the duke with great difficulty eſcaped. Maſſaniello by this conſpiracy was rendered more ſuſpicious and ſevere. He began to abuſe his power by putting ſeveral perſons to death upon ſlight pretences; and, to force the viceroy to an accommodation, he cut off all communication with the caſtles, which were unprovided with proviſion and ammunition.—The viceroy likewiſe being afraid leſt the French ſhould take advantage of the commotion, earneſtly deſired to agree to a treaty; which was accordingly concluded on the fifth day of the inſurrection, by the mediation of the archbiſhop. By the treaty it was ſtipulated, that all duties impoſed ſince the time of Charles V. ſhould be aboliſhed; that the writ of exemption granted by that emperor ſhould be delivered to the people; that for the future no new taxes ſhould be impoſed; that the vote of the elect of the people ſhould be equal to the votes of the nobility; that an act of oblivion ſhould be granted for all that was paſt; and that the people ſhould continue in arms under Maſſaniello till the ratification of the treaty by the king.

32 A treaty concluded between Maſſaniello and the viceroy.

By this treaty, no leſs than 10,000 perſons who fattened upon the blood of the public were ruined.—The people when it was ſolemnly publiſhed, manifeſted an extreme joy, believing they had now recovered all their ancient rights and privileges. Maſſaniello, at the deſire of the viceroy, went to the palace to viſit him, accompanied by the archbiſhop, who was obliged to threaten him with excommunication, before he would conſent to lay aſide his rags and aſſume a magnificent dreſs. He was received by the duke with the greateſt demonſtrations of reſpect and friendſhip, while the ducheſs entertained his wife, and preſented her with a robe of cloth of ſilver, and ſome jewels.—The viceroy, to preſerve ſome ſhadow of authority, appointed him captain-general; and at his departure made him a preſent of a golden chain of great value, which with great difficulty he was prevailed upon to accept; but yielded at length to the entreaties of the cardinal. Next day, in conſequence of the commiſſion granted him by the viceroy, he began to exerciſe all the functions of ſovereign authority; and having cauſed a ſcaffold to be erected in one of the ſtreets, and ſeveral

33 Maſſaniello appointed captain general.

Naples. veral gibbets, he judged all crimes, whether civil or military, in the laſt reſort; and ordered the guilty to be immediately put to death, which was the puniſhment he aſſigned to all offences. Though he neglected all forms of law, and even frequently judged by phyſiognomy, yet he is ſaid not to have overlooked any criminal, or puniſhed any innocent perſon.

His grandeur and proſperity were of very ſhort continuance; for his mind becoming diſtracted and delirious for two or three days, he committed a great many mad and extravagant actions; and on the 18th of July he was aſſaſſinated with the conſent of the viceroy.

34 Is aſſaſſinated.

The tumult did not end with the death of Maſſaniello: on the contrary, the people now expelled the Spaniards from moſt of the cities throughout the kingdom; and this general inſurrection being the ſubject of diſcourſe at Rome, the duke of Guiſe, who happened then to be at the pope's court, took the opportunity, at the inſtigation of his holineſs, to offer his ſervice to the Neapolitans againſt the Spaniards. The duke was prompted by his ambition to engage in this enterpriſe, eſpecially as he himſelf had ſome diſtant pretenſions to the crown. The Spaniards in the mean time made a vigorous attack on the city; but were repulſed by the people, who now formally renounced their allegiance to them. In a ſhort time, however, their city being ſurpriſed by the new viceroy, the count d'Oniate, and the duke of Guiſe himſelf taken priſoner, the people returned to their allegiance; and thus all the attempts of the French on Naples were fruſtrated. From that time the Spaniards continued in peaceable poſſeſſion of the kingdom till the year 1707, when it was taken from them by Prince Eugene. It was formally ceded to the emperor by the treaty of Raſtadt in 1713; but was recovered by the Spaniards in 1734, and the king of Spain's eldeſt ſon is now king of Naples and Sicily. For a particular account of theſe revolutions, ſee the articles SPAIN and SICILY.

35 The people return to their allegiance.

36 Climate, produce, &c. of Naples.

The climate of Naples is extremely hot, eſpecially in July, Auguſt, and September. In winter there is ſeldom any ice or ſnow, except on the mountains.—On account of its fertility, it is juſtly termed an earthly paradiſe; for it abounds with all ſorts of grain, the fineſt fruit and garden productions of every kind, with rice, flax, oil, and wine, in the greateſt plenty and perfection. It affords alſo ſaffron, manna, alum, vitriol, ſulphur, rock cryſtal, marble, and ſeveral ſorts of minerals, together with fine wool, and ſilk. The horſes of this country are famous, and the flocks and herds very numerous. Beſides theſe products, of which a conſiderable part is exported, there are manufactures of ſnuff, ſoap, and glaſs ware. Waiſtcoats, caps, ſtockings, and gloves, are alſo made of the hair or filaments of a ſhell fiſh, which are warmer than thoſe of wool, and of a beautiful gloſſy green. In this kingdom likewiſe is found that called the *Phrygian ſtone*, or *pietra fungifera*, which, being laid in a damp ſhady place, will yield muſhrooms, ſometimes of a very large ſize, eſpecially if the ſtone is ſprinkled with hot water. See AGARICUS.

As to the mountains of this country, the principal are the Apennines, which traverſe it from ſouth to north; and Mount Veſuvius, which, as is well known, is a noted volcano, five Italian miles from Naples. The ſide of this mountain next the ſea yields wine, particularly the two famed wines called *Vino Greco* and *Lachrymæ Chriſti*. One of the greateſt inconveniencies to which this kingdom is expoſed is earthquakes, which the eruptions of Mount Veſuvius contribute, in ſome meaſure, to prevent. Another inconveniency, which, however, is common to it with other hot countries, is the great number of reptiles and inſects, of which ſome are very poiſonous.

With reſpect to religion, it is on a very bad footing here. The number of convents and monaſteries is aſtoniſhing. It is ſaid, the clergy and convents poſſeſs two thirds of the whole kingdom: nay, ſome maintain, that were the kingdom divided into five parts, four would be found in the hands of the church. Notwithſtanding this power and influence of the clergy, they have not been able hitherto to get the inquiſition eſtabliſhed here. In the year 1731, meaſures were taken for leſſening the number of convents; and lately the order of Jeſuits hath been ſuppreſſed. The papal bulls cannot be made public without the king's permiſſion; nor are Proteſtants compelled to kneel in the churches, or at meeting the hoſt; and in Lent they can very eaſily procure fleſh meat. In the year 1740, the Jews were allowed to ſettle in the kingdom during the term of 50 years, and ſeveral privileges were granted them during that period; at the expiration of which, the grant was ſuppoſed to be renewed, unleſs they were expreſsly ordered to quit the country. 37 Religion.

The revenue of the kingdom is generally computed at 3,000,000 of crowns: but, as Mr Addiſon obſerves, there is no country in Europe which pays greater taxes, and where, at the ſame time, the public is leſs the better for them, moſt of them going to the enriching of the private perſons to whom they are mortgaged. 38 Revenue, &c.

The military force of this kingdom is ſaid to conſiſt of about 30,000 men, of which the Swiſs regiments are the beſt. As to the marine, it conſiſts only of a few galleys. The only order here is that of St Januarius, which was inſtituted by Don Carlos in the year 1738.

The king of Naples, or of the two Sicilies, is an hereditary monarch. The high colleges are, the council of ſtate, the privy council, the treaſury, the Sicily council, the council of war, &c. This kingdom is a papal fief; and the king, in acknowledgement of the pope's feudal right, ſends him every year a white palfry, and a purſe of 6000 ducats. The title of the king's eldeſt ſon is *prince of Calabria*. The number both of the high and low nobility in the kingdom of Naples is very great. "I am aſſured (ſays Dr Moore *) that the king of Naples counts among his ſubjects 100 perſons with the title of prince, and a ſtill greater with that of duke. Six or ſeven of theſe have eſtates which produce from 10 to 12 or 13,000l. a-year; a conſiderable number have fortunes of about half that value; and the annual revenue of many is not above 1000l. or 2000l. The inferior orders of the nobility are much poorer. Many counts and marquiſſes have not above 300l. or 400l. a-year of paternal eſtate; many have ſtill leſs; and not a few enjoy the title without any eſtate whatever. Theſe nobles, however, are exceſſively fond of ſplendour and ſhow, which appears in the brilliancy of their equipages, the number of their attendants, the richneſs of their dreſs, and the grandeur

* *View of Society, &c. in Italy.*

Naples. grandeur of their titles. The finest carriages are painted, gilt, varnished, and lined, in a richer and more beautiful manner than has yet become fashionable either in England or in France. They are often drawn by six and sometimes by eight horses. Before the carriage, it is the mode to have two running footmen, and behind three or four servants in the richest liveries. The ladies and gentlemen within the coaches glitter in all the brilliancy of lace, embroidery, and jewels.—This finery is not confined to the persons within and without the coaches; it is extended to the horses, whose heads, manes, and tails, are ornamented with the rarest plumage, and set off with ribbons and artificial flowers."

We shall mention a circumstance from which an idea may be formed of the grandeur of a Neapolitan palace, and the number of domestics which some of the nobility retain. "I dined (continues our author) at the prince Iacci's, where we passed through 12 or 13 large rooms before we arrived at the dining room. There were 36 persons at table served by the prince's domestics, and each guest had a footman behind his chair, while other domestics belonging to the prince remained in the adjacent rooms and in the hall. No estate in England could support such a number of servants, paid and fed as English servants are; but in Naples the wages are very moderate indeed, and the greater number of men servants, belonging to the first families, give their attendance through the day only, and find beds and provisions for themselves. It must be remembered also, that few of the nobles give any entertainments; and those who do not are said to live very sparingly; so that the whole of their revenue, whatever it may be, is expended on articles of show."

In the kingdom of Naples, the hereditary jurisdiction of the nobles over their vassals subsists in the full rigour of the feudal government. The peasants therefore are poor; and it depends entirely on the personal character of the master, whether their poverty be not the least of their grievances. As this power is too often abused, the importance of the nobility depends in a great measure on the favour of the king, who, under pretence of any offence, can confine them to their estates, or imprison them at pleasure. Unless this prince were so very impolitic as to disgust all the nobility at once, and so unite the whole body against him, he has little to fear from their resentment. Even in case of such an union, as the nobles have lost the affection of their vassals, what could they do in opposition to a standing army of 30,000 men, entirely devoted to the crown? The government of Naples, therefore, is in fact a despotic monarchy, though something like the form of a feudal constitution in its ancient purity is still kept up by the biennial summons of the general assembly. This convention, which consists of the nobility and commons, is called together every two years, to deliberate on the customary free gift to the crown.

The inhabitants of this country have at all times borne but an indifferent character among other nations. "From the few hints dropped by the classic authors, we collect that the ancient Neapolitans were a race of epicures, of a soft indolent turn, averse from martial exercises, passionately fond of theatrical amusements and music, expert in all the refined arts that administer to the caprices of luxury, extravagant in their expressions and gestures, and dupes to various sorts of superstition. If we make allowance for a quantity of northern blood which has joined the original Grecian stream, and imparted a roughness not yet worn off by the mildness of the climate, we shall find the modern Neapolitans very like the ancient.—Provisions being here plentiful and cheap, the lower class of people work but little. Their delight is to bask in the sun, and do nothing. Persons of a middle rank frequent places of public resort; and very few of any rank attend to their proper business with the zeal and activity we are wont to meet with in the professional men of colder countries. Gluttony is a predominant vice, while instances of ebriety are comparatively rare. In the female sex, the passion for finery is almost superior to every other; and, though chastity is not the characteristic virtue of the country, Mr Swinburne doubts * whether a Neapolitan woman would not nine times out of ten prefer a present to a lover. That furious jealousy for which the nation was once so remarkable, is now greatly abated. The breach of the conjugal vow sometimes occasions quarrels and assassinations among people of an inferior station; and in the metropolis, assassinations are often perpetrated from much less cogent motives. Of these vices, many are doubtless owing to that slavery and oppression under which they groan, and to a radical defect in the administration of justice, though the kingdom is divided into 12 provinces or jurisdictions.

* *Travels in the Two Sicilies.*

Such was the former state of Naples. But being seized by the emperor of France, he affirmed, "the Neapolitan dynasty has ceased to reign: its existence is incompatible with the repose of Europe, and the honour of our crown." By virtue of a decree which passed in the month of March 1806, the emperor Napoleon conferred the kingdom of Naples on his highness Prince Joseph, and his legitimate heirs male, reserving to that prince the rights assured to him by the constitutions of the empire, in providing always that the crown of France and that of Naples shall never be united upon the same head. No political changes of any importance have since taken place in that country.

Naples, anciently *Parthenope*, afterwards *Neapolis*, the capital of the kingdom of that name in Italy, lies in the province called *Terra di Lavora*, which is the richest and best inhabited of the whole kingdom, and comprehends a part of the ancient Campania Felix or the Happy. This city is fabled to owe its foundation to a Syren, and to have received its ancient name from its supernatural foundress. Whatever be its origin, it is the first for neatness, and the second for extent, of all the cities in Italy. It was formerly a place of strength; but its walls at present being of no real defence, its safety depends of course upon the force of its armies. It is most advantageously situated, having a delicious country on one side, and a noble bay of the Mediterranean on the other, with an excellent harbour. The circumference, including the suburbs, is said not to be less than 18 Italian miles, and the number of the inhabitants therein little less than 400,000. The houses are of stone, flat roofed, and generally lofty and uniform; but many of them have balconies, with lattice windows. The streets are well paved; but they are not lighted at night, and in the day time are disfigured, in many places, by stalls, on which provisions are exposed to sale. Here are a great number of fine churches,

Naples.

churches, convents, fountains, and palaces of the nobility, many of whom constantly reside here. It is usual to walk on the tops of the houses in the evenings, to breathe the sweet cool air, after a hot sultry day. The climate here is so mild and warm, even in the winter, that plenty of green pease, artichokes, asparagus, and other vegetables, may be had so early as the beginning of the new year, and even all the winter. This city swarms with monks and nuns of all sorts, to such a degree, that there are no less than 19 convents of the Dominicans alone, 18 of the Franciscans, 8 of the Augustines, and an equal proportion of the rest. The magnificence of many of the churches exceeds imagination. In a cloister of the Carthusian monastery is a crucifix, said to be done by Michael Angelo, of inimitable workmanship.

To repel hostile attempts by sea, which, from its situation, maritime powers might be tempted to make, Naples has, to the west, the Castel del Ovo, a confused pile of ancient buildings, and some modern batteries. The rock upon which this fortress stands was originally called *Megara*, then *Lucullanum;* and was considered as a place of strength so early as the year 475. Along the line of the shore towards the east are some batteries on the points of land, the bastions of the arsenal, and above it the lofty wall of the Castel Nuovo. This last fortress has been the usual refuge of the sovereigns and viceroys in all civil wars and tumults; for which reason they have long fixed their residence near its walls. A blockhouse and batteries defend the mouth of the harbour, and at the eastern extremity of the town is the Torrione de Carmine, better known by the figure it made in Massaniello's rebellion than by its extent or military strength. The castle of Saint Elmo commands Naples in every direction, and is in reality calculated rather to annoy and awe the citizens than to defend them from foreign invaders. The city is indeed far from being secure against a bombardment; for the sea is so deep, that a large vessel may come up to the very mole in defiance of the blockhouse and batteries, &c. Pictures, statues, and antiquities, are not so common in Naples as might be expected in so great and ancient a city, many of the most valuable pieces having been sent to Spain by the viceroys. The bay is one of the finest in the world, being almost of a round figure, about 30 miles in diameter, and three parts of it sheltered with a noble circuit of woods and mountains. The city stands in the bosom of this bay, in as pleasant a situation, perhaps, as is in the world. Mr Keysler says, they reckon about 18,000 *donne libere*, or courtezans, in the city; and Dr Moore computes the number of *lazzaroni* or blackguards at above 30,000. The greater part of these wretches have no dwelling houses, but sleep every night under porticos, piazzas, or any kind of shelter they can find. Those of them who have wives and children, live in the suburbs of Naples near Peusilippo, in huts, or in caverns or chambers dug out of that mountain. They are generally represented as a lazy, licentious, and turbulent set of people, as indeed by far the greater part of the rabble are, who prefer begging or robbing, or running errands, to any fixed and permanent employment. Yet there are in Naples some flourishing manufactures, particularly of silk stockings, soap, snuff-boxes of tortoise shells and the lava of Mount Vesuvius, tables, and ornamental furniture of marble. The city is supplied with a vast quantity of water, by means of a very costly aqueduct, from the foot of Mount Vesuvius. Mr Addison says, it is incredible how great a multitude of retainers to the law there are in Naples, who find continual employment from the fiery temper of the inhabitants. There are five piazzas or squares in the city, appropriated to the nobility, viz. those called *Capuana*, *Nido*, *Montagna*, *Porto*, and *Porta Nova*. Of all the palaces, that of the king is not only the most magnificent, but also in the best style of architecture. The cathedral, though Gothic, is a very grand splendid edifice. It is here that the head and blood of St Januarius, the tutelary saint of Naples, are kept, the latter in two glass or crystal vials. The pretended liquefaction of the dried blood, as soon as brought near the head of the saint, is a thing well known; Mr Addison says, it is one of the most bungling tricks he ever saw. The harbour is spacious, and kept in good repair. It is fortified with a mole, which runs about a quarter of a mile into the sea, and at the extremity has a high lanthorn to direct ships safely into the harbour. Luxury here is restrained by severe sumptuary laws, and the women are more closely confined than in any other city of Italy. Here is an university and two academies of wits, the one called *Gli Ardenti*, and the other *Gli Otiosi*. The nunnery for ladies of quality is said to be the largest in the whole world, containing no less than 350 nuns, besides servants. The Mount of Piety, or the office for advancing money to the poor, on pledges, at a low interest, or without any, has an income of upwards of 50,000 ducats. The arsenal is said to contain arms for 50,000 men. The walls of the city consist of hard black quarry stones, called *piperno*. Instead of ice vast quantities of snow are used for cooling their liquors, not so much as water being drank without it; so that, it is said, a scarcity of it would as soon occasion a mutiny as a dearth of corn or provisions. Certain persons, who farm the monopoly of it from the government, supply the city all the year round from a mountain about 18 miles off, at so much the pound. In the beginning of 1799, it was taken by a body of French troops under General Championet. The streets of this city were lighted for the first time on the 16th December, 1806. Naples stands 110 miles south-east from Rome, 164 north-east from Palermo in Sicily, 217 south-east from Florence, and 300 from Venice. E. Long. 14. 20. N. Lat. 40. 55.

Naples || Narbonne.

NARBO, in *Ancient Geography*, a town of the Volscæ Tectosages, called also *Narbo Martius*, from the Legio Martia, the colony led thither 59 years before the consulate of Cæsar, (Velleius); increased with a colony of the Decumani or tenth legion by Cæsar. An ancient trading town on the Atax, which discharges itself into the sea through the Lacus Rubresus, or Rubrensis. Capital of Gallia Narbonensis; surnamed *Colonia Julia Paterna*, from Julius Cæsar, the father of Augustus by adoption. Naw called *Narbonne*, a city of Languedoc.

NARBONNE, is a city of France, in the department of Aude, with an archbishop's see, and is particularly famous for its honey. It is seated on a canal cut from the river Aude, which being but three miles from the sea, vessels come up it laden with merchandise, which

renders

renders it a place of some trade. But though it pretends to the most remote antiquity under the Celtic kings, in ages anterior even to the Roman conquests, which under these latter masters gave its name to all *Gallia Narbonensis*, and was a colony of the first consideration, it is now dwindled to a wretched solitary town, containing scarce 8000 inhabitants, of whom three fourths are priests and women. The streets and buildings are mean and ruinous; it has indeed a communication with the Mediterranean, from which Narbonne is only about three leagues distant, by means of a small river which intersects the place; but their commerce is very limited, and chiefly consists in grain which they export to Cette and Marseilles. No marks of Roman magnificence remain, except several inscriptions in different parts of the city. It is divided into the city and the town, which are joined together by a bridge, with houses on each side, in which the richest merchants live. There are several churches and convents; the metropolitan church has a handsome steeple. E. Long. 3. 6. N. Lat. 43. 11.

NARCISSUS, in fabulous history, the son of the river Cephissus and Liriope the daughter of Oceanus, was a youth of great beauty. Tiresias foretold that he should live till he saw himself. He despised all the nymphs of the country; and made Echo languish till she became a mere sound, by refusing to return her passion: but one day coming weary and fatigued from the chase, he stopped on the bank of a fountain to quench his thirst: when, seeing his own form in the water, he became so in love with the shadowy image, that he languished till he died. On which the gods, being moved at his death, changed him into the flower which bears his name.

NARCISSUS, a genus of plants belonging to the hexandria class; and in the natural method ranking under the 9th order, *Spathaceæ*. See BOTANY *Index*.

NARCOTICS, in *Medicine*, soporiferous drugs, which bring on a stupefaction. Among narcotics the most eminent are those usually prepared for medicinal uses from the poppy, especially opium; as also all those prepared from mandragoras, hyoscyamus, stramonium and datura. See MATERIA MEDICA *Index*.

NARDO, a pretty populous town in the kingdom of Naples, and in the Terra d'Otranto, with the title of a duchy and a bishop's see. E. Long. 18. 27. N. Lat. 43. 28.

In this little city are 8000 inhabitants. The steeple of its cathedral is built in a very uncommon but showy style of Gothic architecture. Luco Giordano and Solimeni have adorned the church with some agreeable paintings. This place was a part of the Balzo estate. The Aquavivas were the next possessors: they are thought to have come from the Marca di Ancona. In 1401, in consideration of their relationship to Pope Boniface IX. Laudislaus erected their manor of Atri into a dukedom, an honour till then seldom granted to any but princes of the blood royal. Claudius Aquaviva, a famous general of the Jesuits, who died in 1615, was of this family.

NARDUS, a genus of plants belonging to the triandria class; and in the natural method ranking under the 4th order, *Gramina*. See BOTANY *Index*.

This plant was highly valued by the ancients, both as an article of luxury and medicine. The *unguentum nardinum*, was used at baths and feasts as a favourite perfume. Its value is evident from that passage of Scripture, where our Saviour's head was anointed with a box of it, with which Judas found fault. From a passage in Horace it appears that this ointment was so valuable among the Romans, that as much as could be contained in a small box of precious stone was considered as a sort of equivalent for a large vessel of wine, and a proper quota for a guest to contribute at an entertainment, according to the ancient custom:

———Nardo vina merebere,
Nardi parvus onyx eliciet cadum.

NAREA, the most southerly province of the empire of Abyssinia; a kingdom still governed by its own princes, who have the title of *Beneros*. Its territory was formerly more extensive than at present, the Galla having almost quite surrounded it, especially on the south-east and north. The country to the west is the most unknown part of Africa; the kingdom itself stands like a fortified place in the middle of a plain, being a high and mountainous country. A great many rivers, rising in the fourth and fifth degrees of north latitude, spread themselves over the level part of the country, and fill it with marshes all the way from south by east to north or north-west.—These marshes are bounded by mountains, of which those nearest the marshes are overgrown with coffee trees, the largest, if not the only ones, which grow in this country. The kingdom of Narea Proper is interspersed with small, unwholesome, but very fertile valleys. The mountainous country of Caffa adjoins immediately to Narea, and is said to be governed by a separate prince; but the Galla having settled themselves in all the flat ground to the very edge of the marshes, have in a great measure cut off the communication with Abyssinia for a long time past. The Nareans who inhabit the mountainous country have the lightest complexion of any people in Abyssinia; but those who inhabit the borders of the marshes are perfectly black, and have the features and woolly heads of negroes; but the mountaineers of Narea, and much more those of Caffa, are fair complexioned, more so than even the Neapolitans or Sicilians. It is said that snow has been seen to lie on some of the mountains of Caffa; but Mr Bruce imagines this to be a mistake, and thinks that it must have been hail.

Narea abounds with cattle, grain, and all kinds of provisions, both in the high and low country. The medium of commerce is gold, which they sell by weight; but the principal articles of trade are coarse cotton cloths, antimony, beads, and incense, which are carried from this country to the kingdom of Angola, and the parts of the African continent towards the Atlantic. The people are exceedingly brave; and though they have been driven out of the low country by multitudes of Galla, they now bid them defiance, and drive them from their frontiers whenever they come too near. The Narean prisoners taken in these skirmishes are sold to the Mahometan merchants at Gondar; and at Constantinople, Cairo, or in India, the women are more esteemed than those of any other part of the world. Both sexes have a cheerful kind disposition, and attach themselves inviolably to their masters, if properly treated. The people of Narea and Caffa speak a language peculiar to themselves.

NARRATION,

Narration.

NARRATION, in oratory, poetry, and hiſtory, a recital or rehearſal of a fact as it happened, or as it is ſuppoſed to have happened. See ORATORY, N° 26. 123.

Concerning NARRATION *and Deſcription* we have the following rules and obſervations in the Elements of Criticiſm.

1. The firſt rule is, That in hiſtory the reflections ought to be chaſte and ſolid; for while the mind is intent upon truth, it is little diſpoſed to the operation of the imagination. Strada's Belgic hiſtory is full of poetical images, which being diſcordant with the ſubject, are unpleaſant; and they have a ſtill worſe effect by giving an air of fiction to a genuine hiſtory. Such flowers ought to be ſcattered with a ſparing hand, even in epic poetry; and at no rate are they proper till the reader be warmed, and by an enlivened imagination be prepared to reliſh them: in that ſtate of mind, they are agreeable; but while we are ſedate and attentive to an hiſtorical chain of facts, we reject with diſdain every fiction.

2. Vida, following Horace, recommends a modeſt commencement of an epic poem; giving for a reaſon that the writer ought to huſband his fire. Beſides bold thoughts and figures are never reliſhed till the mind be heated and thoroughly engaged, which is not the reader's caſe at the commencement. Homer introduces not a ſingle ſimile in the firſt book of the Iliad, nor in the firſt book of the Odyſſey. On the other hand, Shakeſpeare begins one of his plays with a ſentiment too bold for the moſt heated imagination:

Bedford. Hung be the heav'ns with black, yield day to night!
Comets, importing change of times and ſtates,
Brandiſh your cryſtal treſſes in the ſky,
And with them ſcourge the bad revolting ſtars,
That have conſented unto Henry's death!
Henry the Fifth, too famous to live long!
England ne'er loſt a king of ſo much worth.
Firſt part Henry VI.

The paſſage with which Strada begins his hiſtory, is too poetical for a ſubject of that kind; and at any rate too high for the beginning of a grave performance.

3. A third rule or obſervation is, That where the ſubject is intended for entertainment ſolely, not for inſtruction, a thing ought to be deſcribed as it appears, not as it is in reality. In running, for example, the impulſe upon the ground is proportioned in ſome degree to the celerity of motion; though in appearance it is otherwiſe, for a perſon in ſwift motion ſeems to ſkim the ground, and ſcarcely to touch it. Virgil, with great taſte, deſcribes quick running according to appearance; and raiſes an image far more lively than by adhering ſcrupulouſly to truth:

Hos ſuper advenit Volſca de gente Camilla,
Agmen agens equitum, et florentes ære catervas,
Bellatrix: non illa colo calathiſve Minervæ
Fœmineas aſſueta manus; ſed prælia virgo
Dura pati curſuque pedum prævertere ventos.
Illa vel intactæ ſegetis per ſumma volaret
Gramina, nec teneras curſu læſiſſet ariſtas:
Vel mare per medium, fluctu ſuſpenſa tumenti,
Ferret iter, celeres nec tingeret æquore plantas.
Æneid, vii. 803.

4. In narration as well as in deſcription, objects ought to be painted ſo accurately as to form in the mind of the reader diſtinct and lively images. Every uſeleſs circumſtance ought indeed to be ſuppreſſed, becauſe every ſuch circumſtance loads the narration; but if a circumſtance be neceſſary, however ſlight, it cannot be deſcribed too minutely. The force of language conſiſts in raiſing complete images, which have the effect to tranſport the reader as by magic into the very place of the important action, and to convert him as it were into a ſpectator, beholding every thing that paſſes. The narrative in an epic poem ought to rival a picture in the livelineſs and accuracy of its repreſentations: no circumſtance muſt be omitted that tends to make a complete image; becauſe an imperfect image, as well as any other imperfect conception, is cold and unintereſting. We ſhall illuſtrate this rule by ſeveral examples, giving the firſt place to a beautiful paſſage from Virgil:

Qualis *populeâ* mœrens Philomela ſub umbrâ
Amiſſos queritur fœtus, quos durus *arator*
Obſervans nido *implumes* detraxit.
Georg. lib. iv. 511.

The poplar, ploughman, and unfledged young, though not eſſential in the deſcription, tend to make a complete image, and upon that account are an embelliſhment.

Again:

Hic viridem Æneas *frondenti ex ilice* metam
Conſtituit, ſignum nautis. *Æneid.* v. 129.

Horace addreſſing to Fortune:

Te pauper ambit ſollicita prece
Ruris colonus: te dominam æquoris,
Quicumque Bithynâ laceſſit
Carpathium pelagus carinâ.
Carm. lib. i. ode 35.

—— Illum ex mœnibus hoſticis
Matrona bellantis tyranni
Proſpiciens, et adulta virgo,
Suſpiret: Eheu, ne rudis agminum
Sponſus laceſſat regius aſperum
Tactu leonem, quem cruenta
Per medias rapit ira cædes.
Carm. lib. iii. ode 2.

Shakeſpeare ſays, "You may as well go about to turn the ſun to ice by fanning in his face with a *peacock's* feather." The peacock's feather, not to mention the beauty of the object, completes the image: an accurate image cannot be formed of that fanciful operation, without conceiving a particular feather; and one is at a loſs when this is neglected in the deſcription. Again, "The rogues ſlighted me into the river with as little remorſe, as they would have drown'd a bitch's blind puppies, fifteen i' th' litter."

Old Lady. You would not be a queen?
Anne. No, not for all the riches under heaven.
Old Lady. 'Tis ſtrange: a threepence bow'd would hire me, old as I am, to queen it.
Henry VIII. act. ii. ſc. 5.

In the following paſſage, the action, with all its materi-
al-

al circumſtances, is repreſented ſo much to the life, that it would ſcarce appear more diſtinct to a real ſpectator; and it is the manner of deſcription that contributes greatly to the ſublimity of the paſſage—

He ſpake; and, to confirm his words, out flew
Millions of flaming ſwords, drawn from the thighs
Of mighty cherubim; the ſudden blaze
Far round illumin'd hell: highly they rag'd
Againſt the Higheſt, and fierce with graſped arms,
Claſh'd on their ſounding ſhields the din of war,
Hurling defiance toward the vault of heav'n.
Milton, book i.

The following paſſage from Shakeſpeare falls not much ſhort of that now mentioned in particularity of deſcription:

O you hard hearts! you cruel men of Rome!
Knew you not Pompey? Many a time and oft
Have you climb'd up to walls and battlements,
To towers and windows, yea, to chimney tops,
Your infants in your arms; and there have ſat
The live-long day with patient expectation
To ſee great Pompey paſs the ſtreets of Rome;
And when you ſaw his chariot but appear,
Have you not made an univerſal ſhout,
That Tyber trembled underneath his banks,
To hear the replication of your ſounds,
Made in his concave ſhore?
Julius Cæſar, act i. ſc. 1.

The following paſſage is ſcarcely inferior to either of thoſe mentioned:

"Far before the reſt, the ſon of Oſſian comes: bright in the ſmiles of youth, fair as the firſt beams of the ſun. His long hair waves on his back: his dark brow is half beneath his helmet. The ſword hangs looſe on the hero's ſide; and his ſpear glitters as he moves. I fled from his terrible eye, king of high Temora." *Fingal.*

The Henriade of Voltaire errs greatly againſt the foregoing rule: every incident is touched in a ſummary way, without ever deſcending to circumſtances. This manner is good in a general hiſtory, the purpoſe of which is to record important tranſactions: but in a fable it is cold and unintereſting; becauſe it is impracticable to form diſtinct images of perſons or things repreſented in a manner ſo ſuperficial.

It is obſerved above, that every uſeleſs circumſtance ought to be ſuppreſſed. The crowding ſuch circumſtances is, on the one hand, not leſs to be avoided, than the conciſeneſs for which Voltaire is blamed, on the other. In the Æneid, Barce, the nurſe of Sichæus, whom we never hear of before nor after, is introduced for a purpoſe not more important than to call Anna to her ſiſter Dido: and that it might not be thought unjuſt in Dido, even in this trivial circumſtance, to prefer her huſband's nurſe before her own, the poet takes care to inform his reader, that Dido's nurſe was dead. To this may be oppoſed a beautiful paſſage in the ſame book, where, after Dido's laſt ſpeech, the poet, without detaining his readers by deſcribing the manner of her death, haſtens to the lamentation of her attendants:

Dixerat: atque illam media inter talia ferro
Collapſam aſpiciunt comites, enſemque cruore
Spumantem, ſparſaſque manus. It clamor ad alta
Atria; concuſſam bacchatur fama per urbem;
Lamentis gemituque, et fœmineo ululatu
Tecta fremunt, reſonat magnis plangoribus æther.
Lib. iv. 663.

As an appendix to the foregoing rule, may be added the following obſervation, That to make a ſudden and ſtrong impreſſion, ſome ſingle circumſtance, happily ſelected, has more power than the moſt laboured deſcription. Macbeth, mentioning to his lady ſome voices he heard while he was murdering the King, ſays,

There's one did laugh in's ſleep, and one cry'd Murder!
They wak'd each other; and I ſtood and heard them:
But they did ſay their prayers, and addreſs them
Again to ſleep.
Lady. There are two lodg'd together.
Macbeth. One cry'd, God bleſs us! and, Amen! the other;
As they had ſeen me with theſe hangman's hands,
Liſtening their fear. I could not ſay, Amen,
When they did ſay, God bleſs us.
Lady. Conſider it not ſo deeply.
Macbeth. But wherefore could not I pronounce Amen!
I had moſt need of bleſſing, and Amen
Stuck in my throat.
Lady. Theſe deeds muſt not be thought
After theſe ways; ſo, it will make us mad.
Macbeth. Methought, I heard a voice cry, Sleep no more!
Macbeth doth murder ſleep, &c. Act ii. ſc. 2.

Deſcribing Prince Henry:

I ſaw young Harry, with his beaver on,
His cuiſſes on his thighs, gallantly arm'd,
Riſe from the ground like feather'd Mercury;
And vaulted with ſuch eaſe into his ſeat,
As if an angel dropt down from the clouds,
To turn and wind a fiery Pegaſus,
And witch the world with noble horſemanſhip.
Firſt part Henry IV. act iii. ſc. 3.

King Henry. Lord Cardinal, if thou think'ſt on Heaven's bliſs,
Hold up thy hand, make ſignal of thy hope.
He dies, and makes no ſign!
Second part Henry VI. act iii. ſc. 3.

The ſame author, ſpeaking ludicrouſly of an army debilitated with diſeaſes, ſays,

"Half of them dare not ſhake the ſnow from off their caſſocks, leſt they ſhake themſelves to pieces."

"I have ſeen the walls of Balclutha, but they were deſolate. The flames had reſounded in the halls: and the voice of the people is heard no more. The ſtream of Clutha was removed from its place by the fall of the walls. The thiſtle ſhook there its lonely head: the moſs whiſtled to the wind. The fox looked out from the windows: and the rank graſs of the wall waved round

Narration.

round his head. Desolate is the dwelling of Morna: silence is in the house of her fathers." *Fingal.*

To draw a character is the master stroke of description. In this Tacitus excels: his portraits are natural and lively, not a feature wanting or misplaced. Shakespeare, however, exceeds Tacitus in liveliness; some characteristical circumstance being generally invented or laid hold of, which paints more to the life than many words. The following instances will explain our meaning, and at the same time prove our observation to be just.

Why should a man, whose blood is warm within,
Sit like his grandsire cut in alabaster?
Sleep when he wakes, and creep into the jaundice,
By being peevish? I tell thee what, Anthonio,
(I love thee, and it is my love that speaks),
There are a sort of men, whose visages
Do cream and mantle like a standing pond;
And do a wilful stillness entertain,
With purpose to be dress'd in an opinion
Of wisdom, gravity, profound conceit;
As who should say, I am Sir Oracle,
And when I ope my lips, let no dog bark!
O my Anthonio! I do know of those,
That therefore only are reputed wise,
For saying nothing.

Merchant of Venice, act i. sc. 1.

Again:

"Gratiano speaks an infinite deal of nothing, more than any man in all Venice: his reasons are two grains of wheat hid in two bushels of chaff; you shall seek all day ere you find them; and when you have them, they are not worth the search." *Ibid.*

In the following passage a character is completed by a single stroke:

Shallow. O the mad days that I have spent; and to see how many of mine old acquaintance are dead.
Silence. We shall all follow, cousin.
Shallow. Certain, 'tis certain, very sure, very sure; Death (as the Psalmist saith) is certain to all: all shall die. How good a yoke of bullocks at Stamford fair?
Slender. Truly cousin, I was not there.
Shallow. Death is certain. Is old *Double* of your town living yet?
Silence. Dead, Sir.
Shallow. Dead! see, see: he drew a good bow: and dead. He shot a fine shot. How a score of ewes now?
Silence. Thereafter as they be. A score of good ewes may be worth ten pounds.
Shallow. And is old *Double* dead?

Second part Henry IV. act iii. sc. 2.

Describing a jealous husband:

"Neither press, coffer, chest, trunk, well, vault, but he hath an abstract for the remembrance of such places, and goes to them by his note. There is no hiding you in the house." *Merry Wives of Windsor*, act. iv. sc. 3.

Congreve has an inimitable stroke of this kind in his comedy of *Love for Love:*

Ben Legend. Well, father, and how do all at home? how does brother Dick, and brother Val.

Sir Sampson. Dick, body o' me, Dick has been dead these two years. I writ you word when you were at Leghorn.
Ben. Mess, that's true; marry I had forgot. Dick's dead, as you say. Act iii. sc. 6.

Falstaff speaking of Ancient Pistol:

"He's no swaggerer, hostess; a tame cheater i'faith: you may stroak him as gently as a puppy greyhound; he will not swagger with a Barbary hen, if her feathers turn back in any show of resistance."

Second part Henry IV. act ii. sc. 4.

Ossian, among his other excellencies, is eminently successful in drawing characters; and he never fails to delight his reader with the beautiful attitudes of his heroes. Take the following instances:

"O Oscar! bend the strong in arm; but spare the feeble hand. Be thou a stream of many tides against the foes of thy people; but like the gale that moves the grass to those who ask thine aid.—So Trenmor lived; such Trathal was; and such has Fingal been. My arm was the support of the injured; and the weak rested behind the lightning of my steel."

"We heard the voice of joy on the coast, and we thought that the mighty Cathmor came. Cathmor the friend of strangers! the brother of red-haired Cairbar! But their souls were not the same; for the light of heaven was on the bosom of Cathmor. His towers rose on the banks of Atha: seven paths led to his halls: seven chiefs stood on these paths, and called the stranger to the feast. But Cathmor dwelt in the wood to avoid the voice of praise."

"Dermid and Oscar were one: they reaped the battle together. Their friendship was strong as their steel; and death walked between them to the field. They rush on the foe like two rocks falling from the brow of Ardven. Their swords are stained with the blood of the valiant: warriors faint at their name. Who is equal to Oscar but Dermid? who to Dermid but Oscar?"

"Son of Comhal, replied the chief, the strength of Morni's arm has failed: I attempted to draw the sword of my youth, but it remains in its place: I throw the spear, but it falls short of the mark: and I feel the weight of my shield. We decay like the grass of the mountain, and our strength returns no more. I have a son, O Fingal! his soul has delighted in the actions of Morni's youth; but his sword has not been fitted against the foe, neither has his fame begun. I come with him to battle, to direct his arm. His renown will be a sun to my soul, in the dark hour of my departure. O that the name of *Morni* were forgot among the people! that the heroes would only say, *Behold the father of Gaul.*"

Some writers, through heat of imagination, fall into contradiction; some are guilty of downright absurdities; and some even rave like madmen. Against such capital errors one cannot be more effectually warned than by collecting instances; and the first shall be of a contradiction, the most venial of all. Virgil speaking of Neptune,

 Interea

Interea magno miſceri murmure pontum,
Emiſſamque hyemem ſenſit Neptunus, et imis
Stagna refuſa vadis; *graviter commotus*, et alto
Proſpiciens, ſummâ *placidum* caput extulit undâ.
Æneid, i. 128.

Again:

When firſt young Maro, in his boundleſs mind,
A work t'outlaſt *immortal* Rome degn'd.
Eſſay on Criticiſm, 30.

The following examples are of abſurdities.

"Alii pulſis è tormento catenis diſcerpti ſectique, dimidiato corpore pugnabant ſibi ſuperſtites, ac peremptæ partis ultores." STRADA, *Dec*. ii. 2.

Il pover huomo, che non ſen' era accorto,
Andava combattendo, ed era morto. *Berni.*

He fled, but flying, left his life behind.
Iliad, xi. 443.

Full through his neck the weighty falchion ſped:
Along the pavement roll'd the mutt'ring head.
Odyſſey, xxii. 365.

The laſt article is of raving like one mad. Cleopatra ſpeaking to the aſpic,

———————Welcome, thou kind deceiver,
Thou beſt of thieves; who, with an eaſy key,
Doſt open life, and unperceiv'd by us
Ev'n ſteal us from ourſelves; diſcharging ſo
Death's dreadful office, better than himſelf;
Touching our limbs ſo gently into ſlumber,
That Death ſtands by, deceiv'd by his own image,
And thinks himſelf but ſleep.
DRYDEN, *All for Love*, act v.

Having diſcuſſed what obſervations occurred upon the thoughts or things expreſſed, we proceed to what more peculiarly concerns the language or verbal dreſs. As words are intimately connected with the ideas they repreſent, the emotions raiſed by the ſound and by the ſenſe ought to be concordant. An elevated ſubject requires an elevated ſtyle; what is familiar, ought to be familiarly expreſſed: a ſubject that is ſerious and important, ought to be clothed in plain nervous language: a deſcription, on the other hand, addreſſed to the imagination, is ſuſceptible of the higheſt ornaments that ſounding words, and figurative expreſſion can beſtow upon it.

We ſhall give a few examples of the foregoing rules. A poet of any genius is not apt to dreſs a high ſubject in low words; and yet blemiſhes of that kind are found even in claſſical works. Horace, obſerving that men are ſatisfied with themſelves, but ſeldom with their condition, introduces Jupiter indulging to each his own choice:

Jam faciam quod vultis; eris tu, qui modo miles,
Mercator; tu, conſultus modo, ruſticus: hinc vos,
Vos hinc, mutatis diſcedite partibus. eia,
Quid? ſtatis? nolint. atqui licet eſſe beatis.
Quid cauſæ eſt, merito quin illis *Jupiter ambas*
Iratus buccas inflet, neque ſe fore poſthac
Tam facilem dicat, votis ut præbeat aurem?
Sat. i. 16.

Jupiter in wrath puffing up both cheeks, is a low and even ludicrous expreſſion, far from ſuitable to the gravity and importance of the ſubject: every one muſt feel the diſcordance. The following couplet, ſinking far below the ſubject, is no leſs ludicrous:

Not one looks backward, onward ſtill he goes,
Yet ne'er looks forward farther than his noſe.
Eſſay on Man, ep. iv. 223.

On the other hand, to raiſe the expreſſion above the tone of the ſubject, is a fault than which none is more common. Take the following inſtances:

Orcan le plus fidéle à ſervir ſes deſſeins,
Ne ſous le ciel brûlant des plus noirs Africains.
Bajazet, act iii. ſc. 8.

Les ómbres par trois fois ont obſcurci les cieux
Depuis que le ſommeil n'eſt entré dans vos yeux;
Et le jour a trois fois chaſſé la nuit obſcure
Depuis que votre corps languit ſans nourriture.
Phædra, act i. ſc. 3.

Aſſueris. Ce mortel, qui montra tant de zéle pour moi, Vit-il encore?
Aſaph. ——Il voit l'aſtre qui vous éclaire.
Eſther, act ii. ſc. 3.

Oui, c'eſt Agamemnon, c'eſt ton roi qui t'eveille;
Viens, reconnois la voix qui frappe ton oreille.
Iphigenie.

No jocund health that Denmark drinks to-day,
But the great cannon to the clouds ſhall tell;
And the king's rowſe the heav'n ſhall bruit again,
Reſpeaking earthly thunder.
Hamlet, act i. ſc. 2.

———————In the inner room
I ſpy a winking lamp, that weakly ſtrikes
The ambient air, ſcarce kindling into light.
SOUTHERNE, *Fate of Capua*, act iii.

In the Funeral Orations of the biſhop of Meaux, the following paſſages are raiſed far above the tone of the ſuctject;

"L'Ocean etonné de ſe voir traverſé tant de fois, en des appareils ſi divers, et pour des cauſes ſi differentes, &c." Pag. 6.

"Grande reine, je ſatisfais à vos plus tendres deſirs, quand je célébre ce monarque; et ſon cœur qui n'a jamais vêcu que pour lui, s'eveille, tout poudre qu'il eſt, et devient ſenſible, même ſous ce drap mortuaire, au nom d'un epoux ſi cher" Pag. 32.

The following paſſage, intended, one would imagine, as a receipt to boil water, is altogether burleſque by the laboured elevation of the diction:

A maſſy cauldron of ſtupendous frame
They brought, and plac'd it o'er the riſing flame:
Then heap the lighted wood; the flame divides
Beneath the vaſe, and climbs around the ſides:
In its wide womb they pour the ruſhing ſtream:
The boiling water bubbles to the brim.
Iliad, xviii. 405.

In a paſſage at the beginning of the 4th book of Telemachus, one feels a ſudden bound upward without preparation, which accords not with the ſubject:

"Calypſo,

Narration.

"Calypſo, qui avoit été juſqu' à ce moment immobile et tranſporteé de plaiſir en écoutant les aventures de Télémaque, l'interrompit pour lui faire prendre quelque repôs. Il eſt tems, lui dit-elle, que vous alliez goûter la douceur du ſommeil aprés tant de travaux. Vous n'avez rien à craindre ici; tout vous eſt favorable. Abandonnez vous donc à la joie. Goutez la paix, et tous les autres dons des dieux dont vous allez être comblé. Demain, *quand l'Aurore avec ſes doigts de rôſes entr'ouvrira les portes dorées de l'Orient, et que les chevaux du ſoleil, ſortant de l'onde amére, répandront les flames du jour, pour chaſſer devant eux toutes les etoiles du ciel*, nous reprendrons, mon cher Télémaque, l'hiſtoire de vos malheurs."

This obviouſly is copied from a ſimilar paſſage in the Æneid, which ought not to have been copied, becauſe he lies open to the ſame cenſure; but the force of authority is great:

At regina gravi jamdudum ſaucia cura,
Vulnus alit venis, et cæco carpitur igni.
Multa viri virtus animo, multuſque recurſat
Gentis honos: hærent infixi pectore vultus,
Verbaque: nec placidam membris dat cura quietem.
Poſtera Phœbea luſtrabat lampade terras,
Humentemque Aurora polo dimoverat umbram;
Cum ſic unanimem alloquitur maleſana ſororem.
Lib. iv. 1.

The language of Homer is ſuited to his ſubject, not leſs accurately than the actions and ſentiments of his heroes are to their characters. Virgil, in that particular, falls ſhort of perfection: his language is ſtately throughout; and though he deſcends at times to the ſimpleſt branches of cookery, roaſting and boiling for example, yet he never relaxes a moment from the high tone.—In adjuſting his language to his ſubject, no writer equals Swift. We can recollect but one exception, which at the ſame time is far from being groſs: The Journal of a modern Lady is compoſed in a ſtyle blending ſprightlineſs with familiarity, perfectly ſuited to the ſubject: in one paſſage, however, the poet, deviating from that ſtyle, takes a tone above his ſubject. The paſſage we have in view begins l. 116. But *let me now a while ſurvey, &c.* and ends at l. 135.

It is proper to be obſerved upon this head, that writers of inferior rank are continually upon the ſtretch to enliven and enforce their ſubject by exaggeration and ſuperlatives. This unluckily has an effect contrary to what is intended; the reader, diſguſted with language that ſwells above the ſubject, is led by contraſt to think more meanly of the ſubject than it may poſſibly deſerve. A man of prudence, beſide, will be no leſs careful to huſband his ſtrength in writing than in walking; a writer, too liberal of ſuperlatives, exhauſts his whole ſtock upon ordinary incidents, and reſerves no ſhare to expreſs, with greater energy, matters of importance.

Many writers of that kind abound ſo in epithets, as if poetry conſiſted entirely in high ſounding words. Take the following inſtance:

When black brow'd night her duſky mantle ſpread,
  And wrapt in ſolemn gloom the ſable ſky;
When ſoothing ſleep her opiate dews had ſhed,
  And ſeal'd in ſilken ſlumbers every eye:
My waking thought admits no balmy reſt,
  Nor the ſweet bliſs of ſoft oblivion ſhare:
But watchful woe diſtracts my aching breaſt,
  My heart the ſubject of corroding care:
From haunts of men with wandering ſteps and ſlow
  I ſolitary ſteal, and ſoothe my penſive woe.

Here every ſubſtantive is faithfully attended by ſome tumid epithet.

We proceed to a ſecond remark, not leſs important than the former. No perſon of reflection but muſt be ſenſible, that an incident makes a ſtronger impreſſion on an eye witneſs, than when heard at ſecond hand. Writers of genius, ſenſible that the eye is the beſt avenue to the heart, repreſent every thing as paſſing in our ſight; and, from readers or hearers, transform us as it were into ſpectators: a ſkilful writer conceals himſelf, and preſents his perſonages: in a word, every thing becomes dramatic as much as poſſible. Plutarch, *de gloria Athenienſium*, obſerves, that Thucydides makes his reader a ſpectator, and inſpires him with the ſame paſſions as if he were an eye witneſs.

In the fine arts, it is a rule to put the capital objects in the ſtrongeſt point of view; and even to preſent them oftener than once, where it can be done. In hiſtory painting, the principal figure is placed in the front, and in the beſt light: an equeſtrian ſtatue is placed in a centre of ſtreets, that it may be ſeen from many places at once. In no compoſition is there greater opportunity for this rule than in writing:

———Sequitur pulcherrimus Aſtur,
Aſtur equo fidens et verſicoloribus armis.
Æneid, x. 180.

———Full many a lady
I've ey'd with beſt regard, and many a time
Th' harmony of their tongues hath into bondage
Brought my too diligent ear: for ſeveral virtues
Have I lik'd ſeveral women: never any
With ſo full ſoul, but ſome defect in her
Did quarrel with the nobleſt grace ſhe ow'd,
And put it to the foil. But you, O you,
So perfect, and ſo peerleſs, are created
Of every creature's beſt. *Tempeſt*, act iii. ſc. i.

Orlando.———Whate'er you are
That, in the deſert inacceſſible,
Under the ſhade of melancholy boughs,
Loſe and neglect the creeping hours of time;
If ever you have look'd on better days;
If ever been where bells have knoll'd to church;
If ever ſat at any good man's feaſt:
If ever from your eyelids wip'd a tear,
And known what 'tis to pity, and be pity'd;
Let gentleneſs my ſtrong enforcement be,
In the which hope I bluſh, and hide my ſword.
Duke ſen. True is it that we have ſeen better days;
And have with holy bell been knoll'd to church;
And ſat at good men's feaſts; and wip'd our eyes
Of drops that ſacred pity had engender'd:
And therefore ſit you down in gentleneſs,
And take upon command what help we have,
That to your wanting may be miniſt'red.
As you like it.

With thee converſing I forget all time;
All ſeaſons and their change, all pleaſe alike.

Sweet

Sweet is the breath of morn, her riſing ſweet,
With charm of earlieſt birds; pleaſant the ſun
When firſt on this delightful land he ſpreads
His orient beams on herbs, tree, fruit, and flow'r
Gliſt'ring with dew; fragrant the fertile earth
After ſoft ſhow'rs; and ſweet the coming on
Of grateful ev'ning mild, the ſilent night
With this her ſolemn bird, and this fair moon,
And theſe the gems of heav'n, her ſtarry train:
But neither breath of morn, when ſhe aſcends
With charm of earlieſt birds, nor riſing ſun
On this delightful land, nor herb, fruit, flow'r,
Gliſt'ring with dew, nor fragrance after ſhow'rs,
Nor grateful ev'ning mild, nor ſilent night,
With this her ſolemn bird, nor walk by moon,
Or glittering ſtar light, without thee is ſweet.
Paradiſe Loſt, book iv. l. 634.

"What mean ye, that ye uſe this proverb, The fathers have eaten ſour grapes, and the children's teeth are ſet on edge? As I live, ſaith the Lord God, ye ſhall not have occaſion to uſe this proverb in Iſrael. If a man keep my judgements to deal truly, he is juſt, he ſhall ſurely live. But if he be a robber, a ſhedder of blood: if he have eaten upon the mountains, and defiled his neighbour's wife: if he have oppreſſed the poor and needy, have ſpoiled by violence, have not reſtored the pledge, have lift up his eyes to idols, have given forth upon uſury, and have taken increaſe: ſhall he live? he ſhall not live: he ſhall ſurely die; and his blood ſhall be upon him. Now, lo, if he beget a ſon, that ſeeth all his father's ſins, and conſidereth, and doeth not ſuch like; that hath not eaten upon the mountains, hath not lift up his eyes to idols, nor defiled his neighbour's wife, hath not oppreſſed any, nor withheld the pledge, neither hath ſpoiled by violence, but hath given his bread to the hungry, and covered the naked with a garment: that hath not received uſury nor increaſe, that hath executed my judgements, and walked in my ſtatutes: he ſhall not die for the iniquity of his father; he ſhall ſurely live. The ſoul that ſinneth, it ſhall die; the ſon ſhall not bear the iniquity of the father, neither ſhall the father bear the iniquity of the ſon; the righteouſneſs of the righteous ſhall be upon him, and the wickedneſs of the wicked ſhall be upon him. Have I any pleaſure that the wicked ſhould die, ſaith the Lord God; and not that he ſhould return from his ways, and live?" *Ezekiel* xvii.

A conciſe comprehenſive ſtyle is a great ornament in narration; and a ſuperfluity of unneceſſary words, not leſs than of circumſtances, a great nuiſance. A judicious ſelection of the ſtriking circumſtances, clothed in a nervous ſtyle, is delightful. In this ſtyle, Tacitus excels all writers, ancient and modern. Inſtances are numberleſs: take the following ſpecimen:

"Crebra hinc prælia, et ſæpius in modum latrocinii: per ſaltus, per paludes; ut cuique fors aut virtus: temere, proviſo, ob iram, ob prædam, juſſu, et aliquando ignaris ducibus." *Annal.* lib. xii. § 39.

After Tacitus, Oſſian in that reſpect juſtly merits the place of diſtinction. One cannot go wrong for examples in any part of the book.

If a conciſe or nervous ſtyle be a beauty, tautology muſt be a blemiſh; and yet writers, fettered by verſe, are not ſufficiently careful to avoid this ſlovenly practice: they may be pitied, but they cannot be juſtified. Take for a ſpecimen the following inſtances, from the beſt poet, for verſification at leaſt, that England has to boaſt of:

Narration.

High on his helm celeſtial lightnings play,
His beamy ſhield emits a living ray;
Th' unweary'd blaze inceſſant ſtreams ſupplies,
Like the red ſtar that fires the autumnal ſkies.
Iliad. 5.

Strength and omnipotence inveſt thy throne.
Ibid. 576.

So ſilent fountains, from a rock's tall head,
In ſable ſtreams ſoft trickling waters ſhed.
Ibid. ix. 19.

His clanging armour rung. *Ibid.* xii. 94.

Fear on their cheek, and horror in their eye.
Ibid. xv. 4.

The blaze of armour flaſh'd againſt the day.
Ibid. xvii. 736.

As when the piercing blaſts of Boreas blow.
Ibid. xix. 380.

And like the moon, the broad refulgent ſhield
Blaz'd with long rays, and gleam'd athwart the field.
Ibid. xix. 402.

No—could our ſwiftneſs o'er the winds prevail,
Or beat the pinions of the weſtern gale,
All were in vain—— *Ibid.* xix. 604.

The humid ſweat from every pore deſcends.
Ibid. xxiii. 829.

We cloſe this article with a curious inquiry. An object, however ugly to the ſight, is far from being ſo when repreſented by colours or by words. What is the cauſe of this difference? With reſpect to painting, the cauſe is obvious: a good picture, whatever the ſubject be, is agreeable by the pleaſure we take in imitation; and this pleaſure overbalancing the diſagreeableneſs of the ſubject, makes the picture upon the whole agreeable. With reſpect to the deſcription of an ugly object, the cauſe follows. To connect individuals in the ſocial ſtate, no particular contributes more than language, by the power it poſſeſſes of an expeditious communication of thought, and a lively repreſentation of tranſactions. But nature hath not been ſatiſfied to recommend language by its utility merely: independent of utility, it is made ſuſceptible of many beauties, which are directly felt, without any intervening reflection. And this unfolds the myſtery; for the pleaſure of language is ſo great, as in a lively deſcription to overbalance the diſagreeableneſs of the image raiſed by it. This, however, is no encouragement to chooſe a diſagreeable ſubject; for the pleaſure is incomparably greater where the ſubject and the deſcription are both of them agreeable.

The following deſcription is upon the whole agreeable, though the ſubject deſcribed is in itſelf diſmal:

Nine times the ſpace that meaſures day and night
To mortal men, he with his horrid crew

Lay

Narration.

Lay vanquiſhed, rolling in the fiery gulf,
Confounded though immortal! but his doom
Reſerv'd him to more wrath; for now the thought
Both of loſt happineſs and laſting pain
Torments him: round he throws his baleful eyes
That witneſs'd huge affliction and diſmay,
Mix'd with obdurate pride and ſtedfaſt hate.
At once as far as angels ken he views
The diſmal ſituation waſte and wild:
A dungeon horrible, on all ſides round
As one great furnace flamed; yet from thoſe flames
No light, but rather darkneſs viſible
Serv'd only to diſcover ſights of wo,
Regions of ſorrow, doleful ſhades, where peace
And reſt can never dwell, hope never comes
That comes to all; but torture without end
Still urges, and a fiery deluge, fed
With ever-burning ſulphur unconſum'd!
Such place eternal juſtice had prepar'd
For thoſe rebellious. *Paradiſe Loſt*, book i. 50.

An unmanly depreſſion of ſpirits in time of danger is not an agreeable ſight; and yet a fine deſcription or repreſentation of it will be reliſhed:

K. Richard. What muſt the king do now? muſt he ſubmit?
The king ſhall do it: muſt he be depos'd?
The king ſhall be contented: muſt he loſe
The name of king? o' God's name let it go:
I'll give my jewels for a ſet of beads;
My gorgeous palace, for a hermitage;
My gay apparel, for an almſman's gown;
My figur'd goblets, for a diſh of wood;
My ſceptre, for a palmer's walking-ſtaff;
My ſubjects, for a pair of carved ſaints;
And my large kingdom, for a little grave;
A little, little, grave,——an obſcure grave.
Or I'll be bury'd in the king's highway;
Some way of common tread, where ſubjects feet
May hourly trample on their ſovereign's head;
For on my heart they tread now, whilſt I live;
And, bury'd once, why not upon my head?
Richard II. act iii. ſc. 6.

Objects that ſtrike terror in a ſpectator, have in poetry and painting a fine effect. The picture, by raiſing a ſlight emotion of terror, agitates the mind; and in that condition every beauty makes a deep impreſſion. May not contraſt heighten the pleaſure, by oppoſing our preſent ſecurity to the danger of encountering the object repreſented?

————————The other ſhape,
If ſhape it might be call'd that ſhape had none
Diſtinguiſhable in member, joint, or limb;
Or ſubſtance might be call'd that ſhadow ſeem'd,
For each ſeem'd either; black it ſtood as night,
Fierce as ten furies, terrible as hell,
And ſhook a dreadful dart. *Par. Loſt*, book ii. 666.

————————Now ſtorming fury roſe,
And clamour ſuch as heard in heaven till now
Was never: arms on armour claſhing bray'd
Horrible diſcord, and the madding wheels
Of brazen chariots rage; dire was the noiſe
Of conflict; overhead the diſmal hiſs
Of fiery darts in flaming volleys flew,
And flying vaulted either hoſt with fire.
So under fiery cope together ruſh'd
Both battles main, with ruinous aſſault
And unextinguiſhable rage: all heaven
Reſounded, and had earth been then, all earth
Had to her centre ſhook. *Ibid.* book vi. 207.

Narration || Narſes.

Ghoſt.————But that I am forbid
To tell the ſecrets of my priſon-houſe,
I could a tale unfold, whoſe lighteſt word
Would harrow up thy ſoul, freeze thy young blood,
Make thy two eyes, like ſtars ſtart from their ſpheres,
Thy knotty and combined locks to part,
And each particular hair to ſtand on end,
Like quills upon the fretful porcupine:
But this eternal blazon muſt not be
To ears of fleſh and blood. *Hamlet*, act i. ſc. 8.

Gratiano. Poor Deſdemona! I'm glad thy father's dead:
Thy match was mortal to him; and pure grief
Shore his old thread in twain. Did he live now,
This ſight would make him do a deſp'rate turn:
Yea, curſe his better angel from his ſide,
And fall to reprobation. *Othello*, act v. ſc. 8.

Objects of horror muſt be excepted from the foregoing theory; for no deſcription, however lively, is ſufficient to overbalance the diſguſt raiſed even by the idea of ſuch objects. Every thing horrible ought therefore to be avoided in a deſcription.

NARSES, the eunuch who rivalled Beliſarius in heroiſm under the reign of the emperor Juſtinian, emerged from obſcurity A. D. 538. From the domeſtic ſervice of the palace, and the adminiſtration of the private revenue, he was ſuddenly exalted to the head of an army. He is ranked among the few eunuchs who have reſcued that unhappy name from the contempt and hatred of mankind. A feeble diminutive body concealed the ſoul of a ſtateſman and a warrior. His youth had been employed in the management of the loom and diſtaff, in the cares of the houſehold, and the ſervice of female luxury; but, while his hands were buſy, he ſecretly exerciſed the faculties of a vigorous and diſcerning mind. A ſtranger to the ſchools and the camp, he ſtudied in the palace to diſſemble, to flatter, and to perſuade; and as ſoon as he approached the perſon of the emperor, Juſtinian liſtened with ſurpriſe and pleaſure to the manly counſels of his chamberlain and private treaſurer. The talents of Narſes were tried and improved in frequent embaſſies; he led an army into Italy, acquired a practical knowledge of the war and the country, and preſumed to ſtrive with the genius of Beliſarius. Twelve years after his return, the eunuch was choſen to achieve the conqueſt which had been left imperfect by the firſt of the Roman generals. Inſtead of being dazzled by vanity or emulation, he ſeriouſly declared, that unleſs he were armed with an adequate force, he would never conſent to riſk his own glory and that of his ſovereign. Juſtinian granted to the favourite what he might have denied to the hero: the Gothic war was rekindled from its aſhes, and the preparations were not unworthy of the ancient majeſty of the empire.

Narſes defeated the Goths, the Franks, and the Alamanni;

Alamanni; the Italian cities opened their gates to the conqueror; he entered the capital in triumph; and having eſtabliſhed the ſeat of his government at Ravenna, continued 15 years to govern Italy under the title of *Exarch.*

His virtues, we are told, were ſtained with avarice; and in this provincial reign he accumulated a treaſure of gold and ſilver which ſurpaſſed the modeſty of a private fortune. His government was oppreſſive or unpopular; and the general diſcontent was expreſſed with freedom by the deputies of Rome. Before the throne of Juſtinian they boldly declared, that their Gothic ſervitude had been more tolerable than the deſpotiſm of a Greek eunuch; and that unleſs their tyrant were inſtantly removed, they would conſult their own happineſs in the choice of a maſter. Thus was his diſgrace the effect of the people's diſaffection; and his death, though in the extreme period of old age, was unſeaſonable and premature, ſince his genius alone could have repaired the laſt and fatal error of his life. He died about the year 567, and, as ſome ſay, at the advanced age of 95; but this does not appear very probable. See Gibbon's Rom. Hiſt. vol. iv. 4to edit. p. 194, 298, &c.

NARVA, a ſtrong town of the Ruſſian empire, in Livonia, with a caſtle and a harbour. It was taken by the Muſcovites from the Danes in 1558, by the Swedes in 1581, and they defeated the Muſcovites near it in 1700; but it was retaken by the Ruſſians in 1704 by ſtorm, and the inhabitants ſent to Aſtracan. It is ſeated on the river Narva, 95 miles ſouth-weſt of Wiburg, and 172 north-eaſt of Riga. E. Long. 29. 0. N. Lat. 59. 8.

NARWAL, a genus of whales. See MONODON, CETOLOGY *Index.*

NASSAU-SIEGEN, a ſmall principality of Germany in the Weſterwalde, is in general a mountainous woody country, with ſome arable and paſture ground, and a good breed of cattle. Its manufactures are chiefly thoſe of iron and ſteel, having an iron mine in the neighbourhood of Siegen. Count John the Younger, in 1626, embraced the Roman Catholic religion, and endeavoured to introduce it into the country; but the principality, upon the extinction of the line of Naſſau-Siegen in 1743, falling to the line of Naſſau-Dietz, and therein to the prince of Orange, hereditary ſtadtholder of the United Provinces, the Proteſtants were delivered from their apprehenſions of Popiſh tyranny and bigotry. The prince, on account of theſe territories, has a ſeat and voice at the diets of the empire and circle in the college of princes. His aſſeſſment in the matricula for Naſſau-Siegen is 773 florins monthly; and towards the maintenance of the chamber judicatory, 50 rixdollars, ſix kruitzers and a half, each term. The revenue of this principality is eſtimated at 100,000 rixdollars.

NASSAU-Dillenbourg, a principality of Germany, ſituated near the former. It has not much arable land, but plenty of wood, good quarries of ſtone, ſome ſilver and vitriol, copper and lead, with ſtore of iron, for the working and ſmelting of which there are many forges and founderies in the country; and by theſe, and the ſale of their iron, the inhabitants chiefly ſubſiſt. Calviniſm is the religion of the principality, which contains five towns and two boroughs, and belongs entirely to William V. prince of Orange, and hereditary ſtadtholder of the United Provinces, whoſe father ſucceeded to a part of it in 1739 on the death of Prince Chriſtian, and to the reſt in 1743 on the death of Prince William Hyacynth of Siegen. The prince, on account of this principality alſo and Dietz, has a ſeat and voice in the college of princes, at the diets of the empire and circle. His aſſeſſment in the matricula, for Naſſau-Dillenbourg, is 102 florins monthly; and to the chamber judicatory, 59 rixdollars ſix and a half kruitzers, each term. His revenue from this principality is computed at above 130,000 florins.

NASSAU-Hadamar, a county of Germany, which, till the year 1711, had princes of its own; but now belongs wholly to William V. prince of Orange.

NASSAU, prince of Orange. See MAURICE.

NATES, in *Anatomy*, a term expreſſing thoſe two fleſhy exterior parts of the body, vulgarly called the *buttocks*. See ANATOMY.

NATES Cerebri, are two circular protuberances of the brain, ſituated on the back ſide of the medulla oblongata, near the cerebellum.

NATION, a collective term, uſed for a conſiderable number of people inhabiting a certain extent of land, confined within fixed limits, and under the ſame government.

NATIONAL DEBT: the money owing by government.

Our limits permit us to give but a very general ſketch of this ſubject: However, as it is of conſiderable importance to every inhabitant of theſe kingdoms, we ſhall endeavour to give as clear and comprehenſive a view of it as the bounds neceſſarily preſcribed us will admit. In order to this, it may not be improper to refer back to the times that have gone before us, that we may the better diſcover the nature of public revenues, the manner of their expenditure, and the cauſes of public debt.

In that rude ſtate of ſociety which precedes the extenſion of commerce and the improvements of manufactures, when thoſe expenſive luxuries which commerce and manufactures can alone introduce, are altogether unknown; the perſon who poſſeſſes a large revenue can ſpend or enjoy that revenue in no other way than by maintaining nearly as many people as it can maintain. Among our feudal anceſtors, the long time during which eſtates uſed to continue in the ſame family, ſufficiently demonſtrates the general diſpoſition of people to live within their income. Though the ruſtic hoſpitality conſtantly exerciſed by the great landholders may not to us in the preſent times ſeem conſiſtent with that order which we are apt to conſider as inſeparably connected with good economy, yet we muſt certainly allow them to have been at leaſt ſo far frugal as not commonly to have ſpent their whole income. Some part of this money, perhaps, they ſpent in purchaſing the few objects of vanity and luxury with which the circumſtances of the times could furniſh them: but ſome part of it they ſeem commonly to have hoarded. They could not well indeed do any thing elſe but hoard whatever money they ſaved. To trade was diſgraceful to a gentleman; and to lend money at intereſt, which at that time was conſidered as uſury and prohibited by law, would have been ſtill more ſo.

Smith's Wealth of Nations.

The

National debt.

The ſame diſpoſition to ſave and to hoard prevailed in the ſovereign as well as in the ſubjects. Among nations to whom commerce and manufactures are little known, the ſovereign is in a ſituation which naturally diſpoſes him to the parſimony requiſite for accumulation. In that ſituation the expence even of a ſovereign cannot be directed by that vanity which delights in the gaudy finery of a court. The ignorance of the times affords but few of the trinkets in which that finery conſiſts. Standing armies are not then neceſſary; ſo that the expence even of a ſovereign, like that of any other great lord, can be employed in ſcarce any thing but bounty to his tenants and hoſpitality to his retainers. But bounty and hoſpitality very ſeldom lead to extravagance: though vanity almoſt always does. All the ancient ſovereigns of Europe accordingly had treaſures. Every Tartar chief in the preſent times is ſaid to have one.

In a commercial country abounding with every ſort of expenſive luxury, the ſovereign, in the ſame manner as almoſt all the great proprietors in his dominions, naturally ſpends a great part of his revenue in purchaſing thoſe luxuries. His own and the neighbouring countries ſupply him abundantly with all the coſtly trinkets which compoſe the ſplendid but inſignificant pageantry of a court. His ordinary expence becomes equal to his ordinary revenue, and it is well if it does not frequently exceed it. The amaſſing of treaſure can no longer be expected: and when extraordinary exigencies require extraordinary expences, he muſt neceſſarily call upon his ſubjects for an extraordinary aid. The late king of Pruſſia and his father are the only great princes of Europe who, ſince the death of Henry IV. of France in 1610, are ſuppoſed to have amaſſed any conſiderable treaſure. The parſimony which leads to accumulation has become almoſt as rare in republican as in monarchical governments. The Italian republics, the United Provinces of the Netherlands, are all in debt. The canton of Berne is the ſingle republic in Europe which has amaſſed any conſiderable treaſure. The other Swiſs republics have not. The taſte for ſome ſort of pageantry, for ſplendid buildings at leaſt and other public ornaments, frequently prevails as much in the apparently ſober ſenate houſe of a little republic as in the diſſipated court of the greateſt king.

The want of parſimony in time of peace impoſes the neceſſity of contracting debt in time of war. When war comes, there is no money in the treaſury but what is neceſſary for carrying on the ordinary expence of the peace eſtabliſhment. In war an eſtabliſhment of three or four times that expence becomes neceſſary for the defence of the ſtate, and conſequently a revenue three or four times greater than the peace revenue. Suppoſing that the ſovereign ſhould have what he ſcarce ever has, the immediate means of augmenting his revenue in proportion to the augmentation of his expence; yet ſtill the produce of the taxes, from which this increaſe of revenue muſt be drawn, will not begin to come into the treaſury till perhaps ten or twelve months after they are impoſed. But the moment in which war begins, or rather the moment in which it appears likely to begin, the army muſt be augmented, the fleets muſt be fitted out, the garriſoned towns muſt be put into a poſture of defence: that army, that fleet, thoſe garriſoned towns, muſt be furniſhed with arms, ammunition, and proviſions. An immediate and great expence muſt be incurred in that moment of immediate danger, which will not wait for the gradual and ſlow returns of the new taxes. In this exigency government can have no other reſources but in borrowing.

The ſame commercial ſtate of ſociety which, by the operation of moral cauſes brings government in this manner into the neceſſity of borrowing, produces in the ſubjects both an ability and an inclination to lend. If it commonly brings along with it the neceſſity of borrowing, it likewiſe brings along with it the facility of doing ſo.

A country abounding with merchants and manufacturers, neceſſarily abounds with a ſet of people through whoſe hands not only their own capitals, but the capitals of all thoſe who either lend them money or truſt them with goods, paſs as frequently or more frequently than the revenue of a private man, who without trade or buſineſs lives upon his income, paſſes through his hands. The revenue of ſuch a man can regularly paſs through his hands only once in a year. But the whole amount of the capital and credit of a merchant who deals in a trade of which the returns are very quick may ſometimes paſs through his hands two, three, or four times in a year. A country abounding with merchants and manufacturers, therefore, neceſſarily abounds with a ſet of people who have it at all times in their power to advance, if they chooſe to do ſo, a very large ſum of money to government. Hence the ability in the ſubjects of a commercial ſtate to lend.

The progreſs of the enormous debts which at preſent oppreſs, and will in the long-run probably ruin, all the great nations of Europe, has been pretty uniform. In England, after the Revolution, when new connexions with Europe introduced a new ſyſtem of foreign politics, the expences of the nation, not only in ſettling the new eſtabliſhment, but in maintaining long wars, as principals, on the continent, for the ſecurity of the Dutch barrier, reducing the French monarchy, ſettling the Spaniſh ſucceſſion, ſupporting the houſe of Auſtria, maintaining the liberties of the Germanic body, and other purpoſes, increaſed to an unuſual degree: inſomuch that it was not thought adviſeable to raiſe all the expences of any one year by taxes to be levied within that year, leſt the unaccuſtomed weight of them ſhould create murmurs among the people. It was therefore the policy of the times to anticipate the revenues of their poſterity, by borrowing immenſe ſums for the current ſervice of the ſtate, and to lay no more taxes upon the ſubject than would ſuffice to pay the annual intereſt of the ſums ſo borrowed; by this means converting the principal debt into a new ſpecies of property, transferable from one man to another at any time and in any quantity. This ſyſtem indeed ſeems to have had its original in the ſtate of Florence, A. D. 1344; which government then owed about 60,000l. ſterling; and being unable to pay it, formed the principal into an aggregate ſum, called metaphorically a *mount* or *bank*, the ſhares whereof were transferable like our ſtocks, with intereſt at 5 per cent. the prices varying according to the exigencies of the ſtate.

Blackſt. Comment.

National debt

ſtate. This laid the foundation of what is called the *national debt;* for a few long annuities created in the reign of Charles II. will hardly deſerve that name.

Nations, like private men, have generally begun to borrow upon what may be called *perſonal credit*, without aſſigning or mortgaging any particular fund for the payment of the debt; and when this reſource has failed them, they have gone on to borrow upon aſſignments or mortgages of particular funds.

What is called the *unfunded debt of Great Britain*, is contracted in the former of thoſe two ways. It conſiſts partly in a debt which bears, or is ſuppoſed to bear, no intereſt, and which reſembles the debts that a private man contracts upon account; and partly in a debt which bears intereſt, and which reſembles what a private man contracts upon his bill or promiſſory note. The debts which are due either for extraordinary ſervices, or for ſervices either not provided for or not paid at the time when they are performed; part of the extraordinaries of the army, navy, and ordnance, the arrears of ſubſidies to foreign princes, thoſe of ſeamen's wages, &c. uſually conſtitute a debt of the firſt kind. Navy and exchequer bills, which are iſſued ſometimes in payment of a part of ſuch debts, and ſometimes for other purpoſes, conſtitute a debt of the ſecond kind; exchequer bills bearing intereſt from the day on which they are iſſued, and navy bills ſix months after they are iſſued. The bank of England, either by voluntarily diſcounting thoſe bills at their current value, or by agreeing with government for certain conſiderations to circulate exchequer bills, that is, to receive them at par, paying the intereſt which happens to be due upon them, keeps up their value, and facilitates their circulation, and thereby frequently enables government to contract a very large debt of this kind. During the great recoinage in King William's time, when the bank of England thought proper to put a ſtop to its uſual tranſactions, exchequer bills and tallies are ſaid to have ſold from 25 to 60 per cent. diſcount; owing partly, no doubt, to the ſuppoſed inſtability of the new government eſtabliſhed by the Revolution, but partly too to the want of the ſupport of the bank of England.

When this reſource is exhauſted, and it becomes neceſſary, in order to raiſe money, to aſſign or mortgage ſome particular branch of the public revenue for the payment of the debt, government has upon different occaſions done this in two different ways. Sometimes it has made this aſſignment or mortgage for a ſhort period of time only, a year or a few years, for example; and ſometimes for perpetuity. In the one caſe, the fund was ſuppoſed ſufficient to pay within the limited time both principal and intereſt of the money borrowed: In the other, it was ſuppoſed ſufficient to pay the intereſt only, or a perpetual annuity equivalent to the intereſt; government being at liberty to redeem at any time this annuity upon paying back the principal ſum borrowed. When money was raiſed in the one way, it was ſaid to be raiſed *by anticipation;* when in the other, *by perpetual funding*, or, more ſhortly, *by funding*.

In the reign of King William, when the debt began to be amaſſed, and during a great part of that of Queen Anne, before we had become ſo familiar as we are now with the practice of perpetual funding, the greater part of the new taxes were impoſed but for a ſhort period of time (for four, five, ſix, or ſeven years only), and a great part of the grants of every year conſiſted in loans upon anticipation of the produce of thoſe taxes. The produce being frequently inſufficient for paying within the limited term the principal and intereſt of the money borrowed, deficiencies aroſe to make good which it became neceſſary to prolong the term.

On the 31ſt of December 1697, the funded and unfunded debts amounted to 21,515,742l. 13s. 8½d.; at the ſame time, in 1714, they were 53,681,076l. 5s. 6$\frac{1}{12}$d. In 1755, before the breaking out of the war, they amounted to 72,289,673l.; and on the 5th of January 1763, at the concluſion of the peace, they had accumulated to 122,603,336l. 8s. 2¼d. of funded debt, and of unfunded 13,027,589l. 2s. 2d. more. In 1775, they were very nearly 130 millions; and the laſt American war added upwards of 120 millions more to that enormous ſum: to pay the intereſt of which, and the charges of management, amounting annually to nearly eight millions and a half, the extraordinary revenues elſewhere enumerated * (excepting only the land-tax and annual malt-tax) are in the firſt place mortgaged and made perpetual by parliament. Perpetual we ſay; but ſtill redeemable by the ſame authority that impoſed them: which, if it at any time can pay off the capital, will aboliſh thoſe taxes which are raiſed to diſcharge the intereſt.

* See *Revenue.*

By this means, then, the quantity of property in the kingdom is greatly increaſed in idea compared with former times; yet, if we coolly conſider it, not at all increaſed in reality. We may boaſt of large fortunes, and quantities of money in the funds. But where does this money exiſt? It exiſts only in name, in paper, in public faith, in parliamentary ſecurity: and that is undoubtedly ſufficient for the creditors of the public to rely on. But then what is the pledge which the public faith has pawned for the ſecurity of theſe debts? The land, the trade, and the perſonal induſtry of the ſubject; from which the money muſt ariſe that ſupplies the ſeveral taxes. In theſe, therefore, and theſe only, the property of the public creditors does really and intrinſically exiſt; and of courſe the land, the trade, and the perſonal induſtry of individuals, are diminiſhed in their true value juſt ſo much as they are pledged to anſwer. If A's income amounts to 100l. per annum; and he is ſo far indebted to B, that he pays him 50l. per annum for his intereſt; one half of the value of A's property is transferred to B the creditor. The creditor's property exiſts in the demand which he has upon the debtor, and nowhere elſe; and the debtor is only a truſtee to his creditor for one half of the value of his income. In ſhort, the property of a creditor of the public conſiſts in a certain portion of the national taxes; by how much therefore he is the richer, by ſo much the nation, which pays theſe taxes, is the poorer.

The only advantage that can reſult to a nation from public debts, is the increaſe of circulation, by multiplying the caſh of the kingdom, and creating a new ſpecies of currency, aſſignable at any time and in any quantity; always therefore ready to be employed in any beneficial undertaking, by means of this its tranſferable quality; and yet producing ſome profit even when

when it lies idle and unemployed. A certain proportion of debt ſeems to be highly uſeful to a trading people; but what that proportion is, it is not for us to determine. This much is indiſputably certain, that the preſent magnitude of our national encumbrances very far exceeds all calculations of commercial benefit, and is productive of the greateſt inconveniences. For, firſt, The enormous taxes that are raiſed upon the neceſſaries of life for the payment of the intereſt of this debt, are a hurt both to trade and manufactures, by raiſing the price as well of the artificer's ſubſiſtence as of the raw material, and of courſe, in a much greater proportion, the price of the commodity itſelf. Nay, the very increaſe of paper circulation itſelf, when extended beyond what is requiſite for commerce or foreign exchange, has a natural tendency to increaſe the price of proviſions as well as of all other merchandiſe. For as its effect is to multiply the caſh of the kingdom, and this to ſuch an extent that much muſt remain unemployed, that caſh (which is the univerſal meaſure of the reſpective values of all other commodities) muſt neceſſarily ſink in its own value, and every thing grow comparatively dearer. Secondly, If part of this debt be owing to foreigners, either they draw out of the kingdom annually a conſiderable quantity of ſpecie for the intereſt; or elſe it is made an argument to grant them unreaſonable privileges in order to reduce them to reſide here. Thirdly, If the whole be owing to ſubjects only, it is then charging the active and induſtrious ſubject, who pays his ſhare of the taxes to maintain the indolent and idle creditor who receives them. Laſtly, and principally, It weakens the internal ſtrength of a ſtate, by anticipating thoſe reſources which ſhould be reſerved to defend it in caſe of neceſſity. The intereſt we now pay for our debts would undoubtedly be ſufficient to maintain the moſt vigorous war that any national motives could poſſibly require. If indeed our anceſtors in King William's time had annually paid, ſo long as their exigencies laſted, a far leſs ſum than we now annually raiſe upon their accounts, they would not in time of war have borne ſo great burdens as they have bequeathed to and ſettled upon their poſterity in time of peace; and might have been eaſed the inſtant the exigence was over.

On the whole, then, the national debt is undoubtedly a ſubject of vaſt importance, and as ſuch it has been always conſidered; for much has been ſaid and written upon it, and many ſchemes have been propoſed at various times and by various perſons for gradually removing it, it being conſidered by the moſt judicious as a moſt pernicious encumbrance to a commercial country. Some, we are aware, think it of vaſt utility; but this opinion is too excentric, and in our eſtimation too feebly ſupported, to be convincing. The public debt is indiſputably a great grievance; and every lover of his country muſt ſurely wiſh to ſee it removed: the period, however, when this bleſſing ſhall take place, if indeed it ever arrive, muſt at leaſt be very diſtant.

We refer ſuch as wiſh for farther information on this intereſting topic to thoſe who have treated of it at full length, as Smith in his Wealth of Nations, and Sir John Sinclair in his Hiſtory of the Revenue. The writings of Dr Price likewiſe deſerve conſiderable attention, eſpecially as one of his plans for the reduction of the debt has in fact been adopted, and in conſequence eſtabliſhed, by the legiſlature: His three plans may be found in a pamphlet by William Morgan, entitled, A Review of Dr Price's Writings on the Subject of the Finances of this Kingdom.

NATIVITY, or NATAL DAY, the day of a perſon's birth. The word *nativity* is chiefly uſed in ſpeaking of the ſaints; as, the nativity of St John the Baptiſt, &c. But when we ſay *the* Nativity, it is underſtood of that of Jeſus Chriſt, or the feaſt of Chriſtmas.

NATIVITY, *nativitas*, in ancient law books, ſignifies bondage or ſervitude.

NATIVITY, in *Aſtrology*, the theme or figure of the heavens, and particularly of the twelve houſes, at the moment when a perſon was born; called alſo the *horoſcope*.

Caſting the nativity, or by calculation ſeeking to know how long the queen ſhould live, &c. was made felony, an. 23 Eliz. c. 2.

NATIVO HABENDO, in *Law*, a writ directed to the ſheriff, for a lord who claimed inheritance in any villain, when a villain was run away from him, for the apprehending and reſtoring him to the lord.

NATIX, in *Natural Hiſtory*, a name given by ſome old writers to the *nerita*.

NATOLIA, the modern name of the Leſſer Aſia, being the moſt weſterly part of Turkey in Aſia, and conſiſting of a large peninſula, which extends from the river Euphrates as far as the Archipelago, the ſea of Marmora, the ſtraits of Gallipoli and of Conſtantinople, which ſeparate it from Europe on the weſt. It is bounded on the north by the Black ſea, and on the ſouth by the Mediterranean.

NATRIX, in *Zoology*, the name of the common or water-ſnake, called alſo *torquata*, from the ring about its neck. See OPHIOLOGY *Index*.

NATRUM, or NATRON, the nitre of the ancients, one of the fixed alkalies. See SODA, CHEMISTRY *Index*.

It is found in great abundance in many parts of Aſia, where the natives ſweep it up from the ſurface of the ground, and call it *ſoap earth*. The earlieſt account we have of it is in the Scriptures, where we find that the ſalt called *nitre* in thoſe times would ferment with vinegar, and poſſeſſed a deterſive quality, ſo that it was uſed in baths and in waſhing. Solomon compares the ſinging of ſongs with a heavy heart, to the contrariety of vinegar and nitre; and Jeremiah ſays, that if the ſinner waſh himſelf with nitre, his ſin is not cleanſed off. Theſe are properties that perfectly agree with this ſalt, but not at all with our ſaltpetre, which is the nitre of the moderns.

NATTER-JACK, a ſpecies of RANA, which ſee, ERPETOLOGY *Index*.

NATURAL, in general, ſomething that relates to nature. See NATURE.

NATURAL *Children*, are thoſe born out of lawful wedlock. See BASTARD.

NATURAL *Functions*, are thoſe actions whereby the aliments are changed and aſſimilated ſo as to become a part of the body.

NATURAL, in *Heraldry*, is uſed where animals, fruits, flowers, &c. are blazoned with the colours they naturally have, though different from the common colours of of heraldry: and this is to prevent their armories being accufed of falfity, when blazoned with the names of colours unknown in heraldry.

Natural Note, in *Mufic*, is ufed in oppofition to flat and fharp notes, which are called *artificial notes*. See Note, Scale, &c.

Natural is alfo ufed for fomething coming immediately out of the hands of nature: in which fenfe it ftands oppofed to *factitious* or artificial, which fignifies fomething wrought by art. See Artificial.

Bifhop Wilkins obferves, that there appears a world of difference between natural and artificial things, when viewed with microfcopes. The firft ever appear adorned with all imaginable elegance and beauty; the latter, though the moft curious in their kind, infinitely rude and unhewn: the fineft needle appears a rough bar of iron; and the moft accurate engraving or emboffment, as if done with a mattock or a trowel.

Natural Beauty, or the beauty of natural objects, is that quality or thofe qualities in the works of nature, or more properly of God, which are calculated to excite pleafing fenfations in the minds of all fuch perfons of true tafte as attentively obferve them. It will not, we truft, be deemed improper or impertinent, therefore, to introduce a few obfervations on this fubject, previous to our treating of natural hiftory.—To many, it is hoped, it will appear to be a very proper introduction to that important article. "That fenfibility to beauty, which, when cultivated and improved, we term tafte, is univerfally diffufed through the human fpecies †; and it is moft uniform with refpect to thofe objects, which being out of our power, are not liable to variation from accident, caprice, or fafhion. The verdant lawn, the fhady grove, the variegated landfcape, the boundlefs ocean, and the ftarry firmament, are contemplated with pleafure by every attentive beholder. But the emotions of different fpectators, though fimilar in kind, differ widely in degree; and to relifh with full delight the enchanting fcenes of nature, the mind muft be uncorrupted by avarice, fenfuality, or ambition; quick in her fenfibilities; elevated in her fentiments; and devout in her affections. He who poffeffes fuch exalted powers of perception and enjoyment, may almoft fay, with the poet,

† Dr Percival's *Moral and Literary Differtations.*

I care not, Fortune! what you me deny;
You cannot rob me of free Nature's grace;
You cannot fhut the windows of the fky,
Through which Aurora fhows her bright'ning face;
You cannot bar my conftant feet to trace
The woods and lawns, by living ftream, at eve:
Let health my nerves and finer fibres brace,
And I their toys to the great children leave:
Of fancy, reafon, virtue, nought can me bereave.

"Perhaps fuch ardent enthufiafm may not be compatible with the neceffary toils and active offices which Providence has affigned to the generality of men. But there are none to whom fome portion of it may not prove advantageous: and if it were cherifhed by each individual, in that degree which is confiftent with the indifpenfable duties of his ftation, the felicity of human life would be confiderably augmented. From this fource, the refined and vivid pleafures of the imagination are almoft entirely derived: and the elegant arts owe their choiceft beauties to a tafte for the contemplation of nature. Painting and fculpture are exprefs imitations of vifible objects; and where would be the charms of poetry, if divefted of the imagery and embellifhments which fhe borrows from rural fcenes? Painters, ftatuaries, and poets, therefore, are always ambitious to acknowledge themfelves the pupil of nature; and as their fkill increafes, they grow more and more delighted with every view of the animal and vegetable world. But the pleafure refulting from admiration is tranfient; and to cultivate tafte, without regard to its influence on the paffions and affections, 'is to rear a tree for its bloffoms, which is capable of yielding the richeft and moft valuable fruit.' Phyfical and moral beauty bear fo intimate a relation to each other, that they may be confidered as different gradations in the fcale of excellence; and the knowledge and relifh of the former fhould be deemed only a ftep to the nobler and more permanent enjoyments of the latter.

"Whoever has vifited the Leafowes, in Warwickfhire, muft have felt the force and propriety of an infcription which meets the eye at the entrance into thofe delightful grounds.

Would you then tafte the tranquil fcene?
Be fure your bofoms be ferene:
Devoid of hate, devoid of ftrife,
Devoid of all that poifons life:
And much it 'vails you, in their place,
To graft the love of human race.

"Now fuch fcenes contribute powerfully to infpire that ferenity which is neceffary to enjoy and to heighten their beauties. By a fecret contagion, the foul catches the harmony which fhe contemplates; and the frame within affimilates itfelf to that which is without. For,

Who can forbear to fmile with Nature? Can
The ftormy paffions in the bofom roll,
While every gale is peace, and every grove
Is melody?

"In this ftate of fweet compofure, we become fufceptible of virtuous impreffions, from almoft every furrounding object. The patient ox is viewed with generous complacency; the guilelefs fheep with pity; and the playful lamb raifes emotions of tendernefs and love. We rejoice with the horfe, in his liberty and exemption from toil, while he ranges at large through enamelled paftures; and the frolics of the colt would afford unmixed delight, did we not recollect the bondage which he is foon to undergo. We are charmed with the fong of birds, foothed with the buzz of infects, and pleafed with the fportive motions of fifhes, becaufe thefe are expreffions of enjoyment; and we exult in the felicity of the whole animated creation. Thus an equal and extenfive benevolence is called forth into exertion; and having felt a common intereft in the gratifications of inferior beings, we fhall be no longer indifferent to their fufferings, or become wantonly inftrumental in producing them.

"It feems to be the intention of Providence, that the lower order of animals fhould be fubfervient to the comfort, convenience, and fuftenance of man. But his right of dominion extends no farther; and if this right be exercifed with mildnefs, humanity, and juftice, the fubjects of his power will be no lefs benefited

Natural Beauty.

ed than himſelf. For various ſpecies of living creatures are annually multiplied by human art, improved in their perceptive powers by human culture, and plentifully fed by human induſtry. The relation, therefore, is reciprocal between ſuch animals and man; and he may ſupply his own wants by the uſe of their labour, the produce of their bodies, and even the ſacrifice of their lives, whilſt he co-operates with all-gracious Heaven in promoting happineſs, the great end of exiſtence.

"But though it be true, that partial evil, with reſpect to different orders of ſenſitive beings, may be univerſal good; and that it is a wiſe and benevolent inſtitution of nature, to make deſtruction itſelf, within certain limitations, the cauſe of an increaſe of life and enjoyment; yet a generous perſon will extend his compaſſionate regards to every individual that ſuffers for his ſake: and whilſt he ſighs

Even for the kid or lamb that parts its life
Beneath the bloody knife,

he will naturally be ſolicitous to mitigate pain, both in duration and degree, by the gentleſt modes of inflicting it.

"We are inclined to believe, however, that this ſenſe of humanity would ſoon be obliterated, and that the heart would grow callous to every ſoft impreſſion, were it not for the benignant influence of the ſmiling face of nature. The count de Lauzun, when impriſoned by Louis XIV. in the caſtle of Pignerol, amuſed himſelf during a long period of time with catching flies, and delivering them to be devoured by a rapacious ſpider. Such an entertainment was equally ſingular and cruel; and inconſiſtent, we believe, with his former character, and his ſubſequent turn of mind. But his cell had no window, and received only a glimmering light from an aperture in the roof. In leſs unfavourable circumſtances, may we not preſume, that inſtead of ſporting with miſery, he would have releaſed the agonizing flies, and bid them enjoy that freedom of which he himſelf was bereaved?

"But the taſte for natural beauty is ſubſervient to higher purpoſes than thoſe which have been enumerated; and the cultivation of it not only refines and humanizes, but dignifies and exalts the affections. It elevates them to the admiration and love of that Being who is the author of all that is fair, ſublime, and good in the creation. Scepticiſm and irreligion are hardly compatible with the ſenſibility of heart which ariſes from a juſt and lively reliſh of the wiſdom, harmony, and order ſubſiſting in the world around us: and emotions of piety muſt ſpring up ſpontaneouſly in the boſom that is in uniſon with all animated nature. Actuated by this divine inſpiration, man finds a fane in every grove; and, glowing with devout fervour, he joins his ſong to the univerſal chorus, or muſes the praiſe of the Almighty, in more expreſſive ſilence. Thus they

"Whom Nature's works can charm, with God himſelf
Hold converſe: grow familiar, day by day,
With his conceptions; act upon his plan;
And form to his the reliſh of their ſouls."

On the whole then, it certainly appears, that the advantages reſulting from a taſte for natural beauties are great and important: it is equally certain, that as it is uſeful, ſo it is a continual ſource of real enjoyment; for a more rational pleaſure cannot poſſibly occupy the attention or captivate the affections of mankind, than that which ariſes from a due conſideration of the works of nature. Pleaſure, we know, is a neceſſary ingredient in human life, in order in ſome meaſure to counterbalance the pains, the evils, and liſtleſsneſſes, which are at times perhaps unavoidable, and in order to render life tolerable. It is the part then of the moraliſt, and it has been frequently his buſineſs, to point out and recommend ſuch pleaſures as are highly gratifying, and are yet perfectly innocent. The Spectator, whoſe works will be admired as long as the language in which they are written is underſtood, recommends ſtrongly and elegantly the pleaſure of a garden; and a later writer †, of no common degree of merit, and of very conſiderable fame, has an eſſay on the ſame ſubject, from which we ſhall ſelect a few obſervations, and ſo conclude the article. "Not he alone (ſays this elegant writer) is to be eſteemed a benefactor to mankind, who makes an uſeful diſcovery; but he alſo who can point out and recommend an innocent pleaſure. Of this kind are the pleaſures ariſing from the obſervation of nature; and they are highly agreeable to every taſte uncorrupted by vicious indulgence. Rural ſcenes of almoſt every kind are delightful to the mind of man. But the misfortune is, that the greater part are hurried on in the career of life with too great rapidity to be able to give attention to that which ſolicits no paſſion. The darkeſt habitation in the dirtieſt ſtreet of the metropolis, where money can be earned, has greater charms with many than the groves of Hagley.

† Dr Knox.

"The patron of refined pleaſure, the elegant Epicurus, fixed the ſeat of his enjoyment in a garden. He was of opinion, that a tranquil ſpot, furniſhed with the united ſweets of art and nature, was the beſt adapted to delicate repoſe. And even the ſeverer philoſophers of antiquity were wont to diſcourſe in the ſhade of a ſpreading tree, in ſome cultivated plantation. It is obvious, on intuition, that nature often intended ſolely to pleaſe the eye in her vegetable productions. She decorates the floweret that ſprings beneath our feet in all the perfections of external beauty. She has clothed the garden with a conſtant ſucceſſion of various hues. Even the leaves of the tree undergo a pleaſing viciſſitude. The freſh verdure which they exhibit in the ſpring, the various ſhades which they aſſume in ſummer, the yellow and ruſſet tinge of autumn, and the nakedneſs of winter, afford a conſtant pleaſure to a lively imagination. From the ſnowdrop to the moſs roſe, the flower garden diſplays an infinite variety of ſhape and colour. The taſte of the floriſt has been ridiculed as trifling; yet ſurely without reaſon. Did nature bring forth the tulip and the lily, the roſe and the honeyſuckle, to be neglected by the haughty pretender to ſuperior reaſon? To omit a ſingle ſocial duty for the cultivation of a polyanthus were ridiculous as well as criminal; but to paſs by the beauties laviſhed before us, without obſerving them, is no leſs ingratitude than ſtupidity. A bad heart finds little amuſement but in a communication with the active world, where ſcope is given for the indulgence of malignant

Natural Beauty. malignant paſſions; but an amiable diſpoſition is commonly known by a taſte for the beauties of the animal and the vegetable creation." In ſhort, ſince the world was made for our uſe, ſince the beauties of nature are alike diſplayed before all men, and ſince they are unqueſtionably an inexhauſtible fund of innocent amuſement; that ſubject muſt be of vaſt importance which enables us to reliſh them properly.

NATURAL HISTORY.

1 Definition. THE objects of nature may be conſidered under two points of view; 1ſt, With reſpect to their form, ſtructure, habits, and individual properties when viewed in a ſtate of inactivity; 2dly, With reſpect to the mutual changes which they produce when made to act on each other. Hence the ſtudy of nature may be divided into two parts, NATURAL HISTORY and NATURAL SCIENCE; the former conſidering bodies in comparatively an inactive ſtate, the latter in a ſtate of mutual action.

NATURAL HISTORY, then, is that part of natural knowledge which teaches us to diſtinguiſh and deſcribe the objects of nature, to examine their appearance, ſtructure, properties and uſes, and to collect, preſerve, and arrange them (A).

2 Immenſity of nature's works. I. When we take a general ſurvey of the objects with which we are ſurrounded, we are bewildered amidſt the number and variety that are every where preſented to our view. The air, the woods, the fields, the waters, teem with myriads of animals; a large proportion of the earth's ſurface is covered with a green mantle of luxuriant herbage, interſperſed with plants and flowers of a thouſand varied tints; and when we ſearch below this, when we explore the cloud-capt mountain, the gloomy mine, the ſequeſtered cavern, or the rocky cliff, we diſcover a great variety of mineral ſubſtances, either piled into irregular maſſes, or lying in uniform beds or layers, diſpoſed in veins or ſeams, or ſcattered at random through the other ſtoney matters.

To the caſual obſerver, the number and variety of theſe objects would appear almoſt infinite. He would conſider it equally impoſſible to enumerate them as to number the ſtars, or count the ſands on the ſea ſhore. This idea, however, ariſes from his ſeeing them in confuſion and diſorder. The naturaliſt, by ſeparating them into thoſe groups or claſſes, in which they often naturally preſent themſelves, has ſucceeded not only in diſtinguiſhing the ſeveral kinds from each other, but even in gueſſing pretty accurately at the number of ſpecies that have hitherto been diſcovered.

There are two objects which ſhould principally occupy the attention of the naturaliſt: 1ſt, To claſſify natural ſubſtances; 2dly, To examine their ſtructure.

The number of natural productions being confeſſedly very great, it is neceſſary to find out ſome means of diſtinguiſhing them from each other, and of recognizing them on ſeeing them anew. Theſe means are the peculiarities, or the aſſemblages of peculiarities, that excluſively belong to each body. Now there is ſcarcely any ſubſtance that has a ſimple character, that is, which can be diſtinguiſhed from every other ſubſtance by any one of its properties ſingly. It is only by the combination of ſeveral of theſe properties that we can diſtinguiſh an object from others which reſemble it in poſſeſſing ſome one or more of thoſe very properties; and the more numerous the ſpecies we compare, the more neceſſary it becomes to bring their properties together, in order to aſſign to each a character that may diſtinguiſh it from the reſt. Hence to diſtinguiſh a ſpecies, conſidered independently from all others that exiſt in nature, it is neceſſary to expreſs in its character almoſt the whole of its properties, and the more of theſe we take into the character, the more complete will be our deſcription of the object. But no man can acquire a ſufficiently accurate knowledge of all natural objects to enable him to give a complete deſcription of them: human life is too ſhort to admit of the completion of ſuch a taſk. All that can be expected from our limited faculties is to acquire a general knowledge of natural objects, confining our principal attention to ſuch as poſſeſs ſome ſtriking qualities, or appear convertible to the uſeful purpoſes of life. 3 Claſſification.

To gain this end, two modes of procedure have been adopted by naturaliſts. According to the firſt mode, we employ characters that proceed by degrees from particulars to generals. We begin by comparing together a certain number of ſpecies that bear the neareſt relation to each other. In drawing the characters of theſe ſpecies, it is requiſite to expreſs only thoſe differences, which, on a ſuppoſition that they are the moſt nearly related, form but a ſmall part of their properties; a number of ſpecies thus brought together conſtitutes what is called a *genus* or *tribe*. 4 *Methods* and *ſyſtems*.

The

(A) Some writers divide natural hiſtory into *general* and *particular*, which are thus defined by Cuvier. *General natural hiſtory* conſiders under a ſingle point of view, all natural bodies, and the common reſult of all their actions in the great whole of nature. It determines the laws of coexiſtence of their properties; it eſtabliſhes the degrees of reſemblance that exiſt between different bodies, and claſſes them according to theſe degrees. The *Particular natural hiſtory* of any body, to be perfect, ſhould comprehend, 1ſt, The deſcription of all the ſenſible properties of that body, and of all its parts: 2d, The mutual relations of theſe parts, the motions which they produce, and the changes which they undergo while they remain united; 3d, The active and paſſive relations of this body with every other body in the univerſe; and 4th, The explanation of all theſe phenomena. See *Tableau Elementaire d'Hiſtoire Naturelle*.

The remainder of these properties which are common to all the species of the genus combine to form the character, or rather the description, of the genus, distinguishing it from all those which might be formed by bringing together other species; but the number of these common properties being still very considerable, we repeat the same means in order to reduce the characters of the *genera* to smaller terms. We compare together only those genera which most nearly resemble each other, and the generic characters now employed must only express those differences which form but a small part of their common properties. Those properties, which are common to all the genera, compose a character that distinguishes this assemblage or group from all other groups or genera. Such an assemblage of genera is called an *order*.

Repeating the same operation, and bringing together such orders as are most nearly allied, we form a more general assemblage, called a *class*; and again uniting a certain number of classes, we form a higher division, to which naturalists have given the name of *kingdom*: this chain of divisions in which the higher links comprehend the lower, forms what is called a *method*. The other mode of procedure is to rise gradually from generals to particulars, beginning with the slightest and most obvious differences, thus forming the first division or kingdom; dividing each kingdom into classes, each class into orders, each order into genera, each genus into species, and each species into varieties. This descending series constitutes what is called a *system*, and is that which has been generally adopted by naturalists.

5 Illustration.

To illustrate this systematical classification of natural objects, let us select a familiar example. Among the various creatures that pass under our observation, a great number are possessed of life, of sensation, and voluntary motion; these we call *animals*, and of these we form the *animal kingdom*. On examining various groups of animals, we find that many have four extremities, and suckle their young by means of teats; these we call *quadrupeds* or *mammalia*. We have thus formed a *class of animals*. Again we find that of the mammalia some have hoofed feet and blunt fore-teeth, and feed almost entirely on vegetables. These will constitute an order of the class of mammalia, to which Linnæus has given the name of *belluæ*. Of this order a certain number of animals agree in having six fore-teeth in both jaws, and form a genus or tribe distinguished by this particular from the other animals of the same order, and commonly called the *horse* tribe. Lastly, In this tribe we find one species that has solid hoofs, a tail bristly at the end, an upright mane, and a black cross on the shoulder of the male. This species is the common *ass*.

6 Division of nature into kingdoms examined.

In framing an artificial system of natural history, most writers have agreed on the division of natural bodies into kingdoms, proceeding on the supposition that those marks which are to distinguish the objects of one kingdom from those of another are sufficiently fixed and certain.

Let us examine for a little how far this supposition agrees with nature's works as we find them.

The division of natural objects commonly adopted is into three kingdoms; the animal, vegetable, and mineral kingdoms. This division has been almost universally received, as perfectly consistent with nature; and is by most persons thought to be so clear and distinct, that they suppose it impossible to mistake in referring any particular object to its proper kingdom. This arises from their having noticed only such objects as bear evident marks of the division to which they belong; but if we draw their attention to a variety of other individuals, they will acknowledge themselves to be incompetent to the decision, or will erroneously refer to one division, what has, after accurate examination, been determined to belong to another.

There is one whole class of productions, called *zoophytes* by naturalists, which seem to form the connecting links between the different kingdoms. They are animals of the polypus kind, mostly covered with a calcareous crust, differing little in composition from the shells of lobsters, shrimps, and other shell-fish, and formed like them from an exudation or secretion on the surface of their bodies. These polypi are connected together by thousands, or even millions, and assume a great variety of appearances according to their arrangement: the same species, however, always assuming the same, or very nearly the same appearance. Some are connected together in form of stem and branches, as the *flustræ*, *sertulariæ*, *corallines* and others; many of which have their offspring in the egg state attached to them, and so situated as to bear exact resemblance to the seed-vessels of plants. These are altogether so like to many of the sea-plants, as to be generally confounded with them, under the title of sea-weeds; but the attentive naturalist may, by examining them in their natural state, perceive the tentacula or feelers of each polypus extended in its search for food, and hastily retracting within its shell upon the least alarm. Many of this description are found attached to oysters or other shell-fish; and often to stones and pebbles which are covered or occasionally wetted by the sea.

Other zoophytes assume less regular figures, and are much more firm and solid, resembling the productions of the mineral kingdom. Madrepores and millepores, called often *brainstones*, are of this kind. At first sight they look very like stones and pebbles, or like pieces of chalk or marble, but on an accurate inspection, any one may perceive marks of an organic structure; and when they are in a recent state, may detect the inhabitants of their numerous cells.

The above examples would suffice to prove, how insufficient is either a hasty examination or the judging by similarity of appearance, for determining to what kingdom of nature any particular object belongs. But there are many other productions to which few persons could without hesitation assign their places: For instance, where would we arrange the green powdery substance so common on paling; the spotted and streaked appearance on stones; the mould on cheese, or the green jelly-like matter that floats on the surface of the stagnant waters? Naturalists in general have assigned these productions to the vegetable kingdom; but Sennebier and a few others have maintained that some of them are animals.

According to some writers, the most philosophical notion which we can form on this subject is, that the division of natural objects into kingdoms is artificial, and that Nature, acknowledging no such bonds, passes imperceptibly from the animal to the vegetable, and from the

Claſſification.

the vegetable to the mineral world, without defining where one ceaſes or where the next begins.

As the appearances of natural productions are inſufficient, ſo are their properties and powers for determining which are animals or which vegetables, according to the received acceptation of the terms. If locomotion is allowed to be the characteriſtic of an animal, where ſhall we place the oyſter, or the zoophytes of which we have juſt been ſpeaking, or where ſome ſpecies of *ulva* and *conferva*, plants that ſwim about detached in water? If feeling or ſenſation be the teſt, who ſhall decide, that the ſenſitive plant (*mimoſa pudica*), poſſeſſes it not? and who determine that the *leaves* of the fly-trap, (*Dionæa muſcipula*), when they contract, and catch the fly as ſoon as it alights, do not feel the deſpoiler that comes to rob it of its honey? *

* *Skrimſhire's Eſſays on Natural Hiſtory*, vol. i.

Though theſe and ſimilar objections may certainly be made to the artificial diviſion of nature's works into kingdoms, yet it is convenient to have ſuch a diviſion; and even the very difficulty of eſtabliſhing to which kingdom any object belongs, is an additional ſpur to the genius and induſtry of the naturaliſt.

7 Diviſion of natural bodies into *organized* and *inorganic*.

The moſt natural diviſion of the works of nature is that which diſtinguiſhes them into organized and *inorganic* bodies; and on the whole, we have ſeen no attempt to eſtabliſh the differences between theſe ſo ſucceſsful as that adopted by M. Dumeril in his late ſcientific work, *Traité Elementaire d'Hiſtoire Naturelle.* "Some objects, ſays he, as animals and plants, have formerly conſtituted a part of other individuals, ſimilar to themſelves, from which they have been ſeparated at a certain period, under the form of eggs, of germs, or of little living creatures; and their exiſtence is evidently owing to this generation; they are *born*. Others, on the contrary, as ſtones, ſalts, water, may be formed by certain circumſtances, and even by ourſelves at pleaſure. They have not neceſſarily made a part of other ſimilar bodies; their exiſtence ſeems to depend on certain fortuitous circumſtances, that have produced the approximation of their conſtituent principles, and their origin might be referred to attraction. Theſe bodies are *formed.* Vegetables and animals in increaſing their ſize, only develope themſelves. Whatever may be their minuteneſs, we ſhall, on a careful examination, find them already formed, with their parts requiring only to be evolved. Their increaſe proceeds from within outwards by *intus-ſuſception.* Stones, and a great many other bodies, are augmented only by the ſame matter from which they are produced; their growth takes place always from without, by a ſort of aggregation.

"As the increaſe of the bodies which compoſe theſe two great ſubdiviſions is not alike in both, a duration very different ought to be the reſult of this diſſimilarity. In fact, minerals are ſuſceptible of indefinite increaſe, and their end is always indeterminate; it is vague, and depends on the circumſtances under which they are placed. Plants and animals ought, from the ſame circumſtances which favoured their developement, to ſtop when their extenſion has been carried to the higheſt degree ſo that the end or death of theſe bodies is fixed and neceſſary.

"The maſſes in which ſtones and other ſimilar bodies generally preſent themſelves, are angular, inſulated, and very variable in their ſize. The individuals which we call plants and animals, have always, and neceſſarily, a form that is conſtant, for the moſt part, rounded and ſymmetrical, and their extenſion is limited within certain bounds.

"There is this great difference between theſe bodies; that thoſe which increaſe by aggregation may be divided into molecules, or parts infinitely ſmall, bearing a very near reſemblance to the maſs from which they were taken; while in thoſe which develope themſelves, no portion can be taken away and exiſt by itſelf, at leaſt unleſs it develope new parts, which replace thoſe that are wanting.

"The bodies which do not develope themſelves, are in general formed of fluids or ſolids which remain conſtantly in the ſame points; they are compoſed of very few elements, which may be ſeparated and again reunited. The bodies which develope themſelves, on the contrary, are eſſentially compoſed of ſolids and fluids, which are always changing, and in a ſtate of renovation; they have always, and from neceſſity, more or leſs conſiſtence, they are penetrated and augmented by fluids, and after being decompoſed they can never be formed again ſuch as they were before *."

* *Dumeril Traité Elem.* tom. i. p. 5.

For the more convenient ſtudy of natural hiſtory, the whole ſubject may be divided into five great branches, viz. Meteorology, Hydrography, Mineralogy, Botany, and Zoology.

8 Diviſion of natural hiſtory.

1. Meteorology includes the deſcription of all thoſe phenomena which take place in the atmoſphere that ſurrounds our globe. In the preſent work it is conſidered under the articles METEOROLOGY, METEOROLITE, *Atmoſpheric* ELECTRICITY, CLOUD, MOON, *Influence of*, &c. 9 Meteorology.

2. Hydrography comprehends the natural hiſtory of the ſea, of rivers, lakes, and other collections of water that make up ſo large a part of the earth. Much of this ſubject will be found treated of under the article RIVER, and various parts of it have been diſcuſſed under CHEMISTRY and MINERALOGY. 10 Hydrography.

3. Mineralogy is that part of the ſubject which treats of the ſolid inorganic bodies that are found on the ſurface or in the bowels of the earth. It has been conſidered under the articles GEOLOGY and MINERALOGY. 11 Mineralogy.

4. Botany comprehends the natural hiſtory of vegetables. See BOTANY. 12 Botany.

5. Zoology includes the natural hiſtory of all animated beings, and is ſubdivided into many ſubordinate claſſes. 13 Zoology.

Theſe claſſes are different in number and denomination, according to the different ſyſtems of naturaliſts. Linnè, whom we have principally followed in this work, has arranged animals under ſix claſſes: viz. 1. *Mammalia*, or thoſe animals which ſuckle their young at *mammæ* or paps; ſee MAN, MAMMALIA and CETOLOGY. 2. *Aves*, or birds; ſee ORNITHOLOGY. 3. *Amphibia*, or thoſe animals which can live either on land or in water; ſee ERPETOLGY and OPHIOLOGY. 4. *Piſces*, or fiſhes; ſee ICHTHYOLOGY. 5. *Inſecta*, or inſects; ſee ENTOMOLOGY. And 6. *Vermes*, or worms; ſee HELMINTHOLOGY and CONCHOLOGY.

Later naturaliſts have divided animals into a greater number of claſſes, and have ſubdivided theſe differently. Of theſe arrngements, that of M. Cuvier ſeems the moſt deſerving of notice. After conſidering man, whom he very properly diſtinguiſhes from the other mammalia by alloting to him a ſeparate book, he divides the reſt 14 Cuvier's arrangement.

4 of

of the animal kingdom into nine claſſes, viz. MAMMIFEROUS animals, BIRDS, REPTILES, FISHES, MOLLUSCA, WORMS, CRUSTACEOUS animals, INSECTS and ZOOPHYTES.

We have already given an outline of four of theſe claſſes, viz. of the MAMMIFEROUS animals, under MAMMALIA, and of MOLLUSCA, WORMS and ZOOPHYTES, under HELMINTHOLOGY. To complete our view of Cuvier's arrangement, we ſhall here add an outline of the remaining five claſſes.

15 Of birds.

Cuvier divides birds into five orders, viz. RAPACIOUS birds or ACCIPITRES, PASSERINE birds, CLIMBERS or SCANSORES, GALLINACEOUS birds, WADERS or GRALLÆ, and ANSERINE birds.

1. The RAPACIOUS birds have ſhort feet, toes furniſhed with ſtrong claws, and a hooked bill. They are ſubdivided into three ſections; viz. *Nudicolles*, having the head and part of the neck without feathers; containing the vulture tribe. *Plumicolles*, having the head covered with feathers and a cere at the baſe of the bill, containing the falcon tribe; including *Griffons, Eagles, Sparrow-hawks, Buzzards, Kites* and *Falcons*. *Nyćterides*, having the head flattened backward from the front and the eyes directed forward; containing the *owl* tribe.

2. The PASSERINE birds are diſtinguiſhed by having four toes, three before and one behind, with the external toes wholly or partially united. They are ſubdivided into ſeven ſections: viz. *Creniroſtres*, having the bill grooved towards the end of the mandible; containing the Shrikes, Flycatchers, Thruſhes, Chatterers and Tanagers. *Dentiroſtres*, having a bill with notched edges; containing the Plant-clippers, Motmots, and Hornbills. *Pleniroſtres*, having the bill ſtraight, ſtrong, compreſſed and without a groove; containing the Grakles, Crows, Rollers, and Birds of Paradiſe. *Coniroſtres*, having the bill conical; containing the Orioles, Stares, Groſbeaks, Sparrows, and Buntings. *Subuliroſtres*, having the bill ſlender like an awl; containing the Titmice, Manakins, Larks, and Wagtails. *Planiroſtres*, having the bill ſhort, flattened horizontally, and opening very wide; containing the Swallows and Goat-ſuckers. *Tenuiroſtres*, having the bill ſlender, elongated and ſolid; containing the Nuthatches, Creepers, Humming birds, Hoopoes, Bee-eaters, King's-fiſhers and Todys.

3. The CLIMBERS have two toes before and two behind. They are ſubdivided into two ſections; viz. *Cuneiroſtres*, having a ſlender bill; containing Jacamars, Wood-peckers, Wry-necks, and Cuckoos. *Leviroſtres*, having the bill thick and light; containing the Anis, Touracoes, Muſophages, Curucuis, Barbets, Toucans and Parrots.

4. The GALLINACEOUS birds have the front toes united at their baſe by a ſhort membrane. They are ſubdivided into two ſections, viz. *Alectrides*, having common wings fitted for flying; containing the Pigeons, Grouſe, Peacocks, Pheaſants, Pintados, Turkeys, Curaſſows, Guans, Buſtards. *Brevipennes*, having wings too ſhort for flight; containing the Oſtrich, Caſſowary and Dodo tribes.

5. The WADERS have elevated and naked tarſi and the two outer toes united. They are ſubdivided into five ſections, viz. *Breviroſtres*, having the bill ſhort and thick; containing the Trumpeters, Screamers, Secretaries, Boat-bills, and Flamingos. *Cultriroſtres*, having the bill long, ſtrong, and like a knife; containing the Herons, Jabirus and Ibiſſes. *Latiroſtres*; having the bill long, weak, and flattened horizontally; containing the Spoonbills. *Longiroſtres*, having the bill ſlender, long and weak; containing the Avoſets, Plovers, Lapwings, Phalaropes, and Woodcocks. *Preſſiroſtres*, having the bill middle ſized and compreſſed, containing the Oyſter-Catchers, Rails, Coots and Jacanas.

6. The ANSERINE birds have the toes united by broad membranes. They are ſubdivided into four ſections, viz. *Pennipedes*, having all the four toes united; containing the Pelicans, Tropic-birds and Darters. *Macropteres*, having the thumb free, the bill not indented, and very long wings; containing the Terns, Gulls, Skimmers, Petrels and Albatroſſes. *Serriroſtres*, having the thumb free, the bill broad and ſerrated, and wings of a moderate ſize; containing the Ducks and Merganſers. *Brachypteres*, having the thumb either free or wanting, the bill not ſerrated, and the wings very ſhort, contaning the Grebes, Auks and Manchots.

16 Of reptiles.

The AMPHIBIA or REPTILES are divided into two orders, as follows.

1. Thoſe that have a heart with two auricles. This order is ſubdivided into two ſections, viz. *Chelonia*, having a back ſhell and the jaws inveſted with horn, containing the Tortoiſe tribe, including Turtles and Tortoiſes. *Sauria*, having a ſcaly body and teeth; containing the Lizard tribe, including the Crocodiles, Guanas, Dragons, Lizards, Skinks, and ſome others.

2. Thoſe that have a heart with one auricle. This order is alſo ſubdivided into two ſections, viz. *Ophidia*, having a ſcaly body, no feet, and always without branchiæ; containing the tribes of Anguis, Amphiſbæna, Cæcilia, Acrocordon, Angaha, Coluber or *Snake*, Boa, and Crotalus or *Rattle-Snake*. *Batrachia*, having a naked ſkin, feet and branchiæ in the young animals; containing the Frogs, Salamanders, and (according to Cuvier's original tables) the Siren.

17 Of fiſhes.

The fiſhes are divided into two orders, CARTILAGINOUS and BONY fiſhes.

I. Thoſe which have a Cartilaginous ſkeleton are divided into two ſections, viz. *Chondropterygii*, with fixed branchiæ; containing the Lampreys, Hags, Rays, Dog-fiſh and Sea-monſters. *Branchioſtegi*, with free branchiæ; containing the tribes Batrachus or *American Toad-fiſh*, Polyodon, Accipenſer or *Sturgeons*, Pegaſus, Syngnathus or *Pipe-fiſh*, Centriſcus or *Bellows-fiſh*, Baliſtes or *Horned-fiſh*, Oſtracion or *Trunk-fiſh*, Tetraodon or *Sun-fiſh*, Oveides, Mola or *Moles*. Diodon or *Porcupine-fiſh*, Lophius or *Frog-fiſh*, and Cyclopterus or *Lump-fiſh*.

2. The fiſhes with a bony ſkeleton are ſubdivided into four ſections, viz. *Apodes*, having no ventral fins; containing the tribes of Muræna or *Eels*, Gymnothorax, Synbranchus, Sphagebranchus, Gymnotus or *Electric-eels*, Trichiurus, Gymneterus, Ophidium, Ammodytes, or *Sand-eels*; Anarrhichas, or *Sea-wolves*; and Xiphias or *Sword fiſh*. *Jugulares*, having the ventral fins ſituated before the pectoral; containing the Haddocks, Blennys, Hunch-back, Dragonets, Sea-dragons, and Star-gazers. *Thoracici*, with the ventral fins ſituated below the pectoral; containing the Bull-heads, Scorpions, Gurnards, Gobys, Surmullets, Mackerel, Stickle-backs, Long-tails, Lonchiurus, Johnes, Sciænes, Dorees, Stromateus, Theuthis, Chætodon, Dorados,

Classification.

Bodians, Holocentrus, Lutiens, Perches, Anthias, Epinelephus, Wrasses, Breams, Scares, Flounders, Sea-serpents, Lepidopus, and Remoras. *Abdominales*, with the ventral fins situated behind the pectoral; containing the Mormyrus, Carps, Mullets, Flying-fish, Polynemus, Herrings, Atherines, Argentines, Salmons, Pikes, Loches, Anablapes, Silurus, Platysomatus, Armed-fish, Cuirass-fish, Amia, Acanthonotus, and Fistularia, or *Tobacco-pipe-fish*.

18 Of crustacea.

The CRUSTACEA are divided into two orders, as follows:

1. *Monoculi*, containing the tribes of Limulus, Calygus, Apus, Cyclops, and Polyphemus.

2. *Ecrevisses*, or *Crabs*, containing the tribes of Cancer, Inachus, Pagurus, Astacus, Palinurus, Scyllarus, and Squilla.

19 Of insects.

The INSECTS are distributed by Cuvier under two general orders, viz. Those with jaws, and those without jaws.

1. *Insects* with jaws are arranged under five sections, viz. GNATHAPTERA, NEUROPTERA, HYMENOPTERA, COLEOPTERA, and ORTHOPTERA. The GNATHAPTERA have no wings, and are subdivided into *Polygnathes*, having several pairs of jaws, containing the tribes of Physodes, Oniscus, and Cymothoa; *Millepedes*, with two jaws and feet at each ring of the body, containing the tribes of Julus and Scolopendra; *Araneides*, having the head joined to the corselets, eight feet, and abdomen without feet; *Seticaudes*, having the head distinct, six feet, and abdomen terminated by silken threads; *Ricinus*, with the head distinct, six feet, and the abdomen naked. The NEUROPTERA have four reticulated wings, and are subdivided into *Odonates*, having the mouth covered with the lip, and the wings extended during repose; *Tectipennes*, with the mouth saillant, and wings hidden below the body during repose; *Agnathes*, with a very small mouth, and no mandibles. The HYMENOPTERA have four veined wings, and of these some have the abdomen joined to the thorax by a pedicle; as the *Mellites*, having the lip prolonged into a trunk; the *Duplipennes*, having the upper wings folded lengthwise; the *Chrysides*, having the antennæ bent, and the abdomen hollow below; the *Anthophiles*, with the antennæ filiform, wings not folded, abdomen round, and lips short; the *Trouisseurs*, with setaceous antennæ, of 12 or 13 joints, rolling up spirally; the *Myrmeges*, with setaceous bent antennæ, and a rounded abdomen; the *Insectirodes*, with bent antennæ of 30 joints, and a prominent sting; *Cynipes*, with filiform antennæ and a spiral sting. Others of this section have the abdomen sessile as the *Uroceri*, with palpæ scarcely apparent, and a very prominent sting, and the *Tenthredos* with very prominent palpæ and a serrated sting. The COLEOPTERA have four wings, the uppermost of which are hard, and the lower fold transversely: they have either six palpæ, as the *Carnassiers*, with filiform or setaceous antennæ; or four palpæ; and of these latter some have the tarsus five jointed, as the *Lamellicornes*, with clavated antennæ, having the club lamellated; the *Clavicornes*, with the antennæ either perfoliated or solid; the *Brachelyteres*, with moniliform antennæ and short elytra; the *Woodpiercers*, with filiform antennæ and hard elytra; and the *Apalytres*, with filiform antennæ and soft elytra. Others have the tarsi four or five-jointed; as the *Lucifuges*, with variable antennæ and hard elytra; and the *Blistering-flies*, with variable antennæ and soft elytra. Others again have the tarsi four jointed; as the *Rostricornes*, with antennæ on the beak; the *Wood eaters*, with setiform antennæ; the *Teretiforms*, with clavated antennæ, and a body often cylindrical, and the club solid; the *Planiforms*, with granulated antennæ and a flattened body; and the *Herbivori*, with filiform or moniliform antennæ and a swollen body. A few have the tarsi three-jointed, as the *Coccinellæ*. The ORTHOPTERA have four wings, the upper hard and the lower folded longitudinally. They include the *Forficulæ*, having the anus terminated by a forceps; the *Blattæ*, with a flattened body and the head retiring below the corselet; the *Mantis* and *Spectres*, with a very long corselet; and the *Leapers*, with cylindrical body and long hinder legs formed for jumping.

2. The INSECTS without jaws are subdivided into HEMIPTERA, LEPIDOPTERA, DIPTERA, and APTERA. The HEMIPTERA have four wings frequently crossed, and a jointed beak; and include the *Frontirostres*, having the beak rising from the fore part of the head; the *Collirostres*, with the beak appearing to grow from the neck; and the *Planipennes*, with the wings not crossed and spreading. The LEPIDOPTERA have four wings covered with scales and a spiral trunk; they include the *Butterflies*, with the antennæ terminated by a solid mass; the *Hesperiæ*, with the antennæ curved at their extremity; the *Fusicornes*, with the antennæ swelling towards the middle, and the *Seticornes*, with setaceous antennæ. The DIPTERA have only two wings; and include the *Hydromies*, with filiform or plumose antennæ and a trunk; the *Sarcostomes*, with a fleshy retractile trunk, terminated by two lips; the *Sclerostomes*, with very short antennæ, a horned projecting sucker, but no trunk; and the *Gad-flies*, with short antennæ, and neither sucker nor trunk. The APTERA have no wings: they include the *Parasitical* insects, or *Fleas*, *Lice*, and *Mites*.

It is not surprising that naturalists of taste and genius, from the gradation that seems to take place among the works of nature, should have been led to form the notion that there exists in nature a regular series or *chain* of beings, the links of which, if we could discover them all, would be found to resemble each other so nearly, as only to exhibit to the superficial observer a few shades of difference. *Natura non per saltum movet*, has become a sort of axiom in natural history. 20 The notion of a chain of beings examined.

The notion of a *chain* of *being* is alluring, and does not want arguments in its favour. The Esquimaux Indian, or the inhabitant of Terra del Fuego, seems scarcely superior in form, and very little in intellect, to the Oran Otan; the *Platypus*, the flying *Lemur*, flying Squirrels, and, still more, the Bats, appear to form the connecting links between quadrupeds and birds; while the Seals, the *Walrusses*, and the whole order of *Cete*, connect the former with the fishes. In this latter class, the Flying Fish, in its capability of supporting itself in the air, seems to approach the feathered tribes, while some of these, as the Penguins, in their habits and manner of life, bear some distant resemblance to fishes. Again, the Siren and the Eels so nearly resemble each other, that it has been disputed whether the former should be reckoned among the *Amphibia* or the *Fishes*; while one species of Lizard, (*Lacerta lumbricoides*), is so like an earth-worm, as apparently to connect the *Amphibia* and the *Vermes*. Farther, the diminutive Humming-bird (*Trochilus exilis*), and the Humble

Classification.

Humble Bee, (*Apis terrestris*), are so nearly alike, both in size and manner of life, as to form no very exceptionable link of union between the birds and insects.

If we compare the vegetable tribes with some of the inferior classes of animals, we shall perceive many points of resemblance, which may seem to indicate a continuance of the same chain. Besides the *Mimosa pudica* and *Dionæa muscipula*, already mentioned, the *Hedysarum gyrans*, or moving plant, is a remarkable instance of the mobility of vegetables; the carrion flower (*Stapelia hirsuta*), and some species of *morel*, bear the odour of putrid animal substances; while on the other hand, the *Mantis siccifolia* might be mistaken for a dried leaf; several species of *Pennatula* (sea pens) and *Sertularia*, for ferns; the *Madrepora fungites* (mushroom madrepore), for a petrified mushroom; and the *Tubularia magnifica*, and *Actiniæ*, when expanded, for the most beautiful full-blown flowers.

Lastly, on comparing the mineral kingdom with the classes of organized beings, we find several so nearly resembling stones, as scarcely to be distinguished from them.

Though the view which we have given above, of the circumstances that have led naturalists to form the idea of a regular chain of beings, is specious; it will not bear the scrutiny of a strict examination. The resemblances which we have pointed out, are more apparent than real; and anatomy and chemistry, added to a more accurate acquaintance with the works of nature, have proved, that those links which, to superficial observers, appear most allied, are yet separated by considerable chasms. In fact, if we were to admit these resemblances as ever so accurate, they would lead us to form, not one chain, but many.

21 Number of species in nature.

It must be considered as a very difficult, though a very curious problem, to ascertain the number of species at present known throughout the several subdivisions of nature. From the different modes in which different naturalists have distributed the objects of their research, and from the additions that are perpetually made to our knowledge, it may be impossible to fix the precise number of known species at any given time; but we may make a tolerably near approximation to the truth; and this we shall now attempt, going through the several *kingdoms*, *classes*, and *orders*, as they have been treated of in the former parts of this work.

22 Animals.

I. IN THE ANIMAL KINGDOM.

A. Man,		5 species.
B. Mammalia.		
1. Primates,	100 *	
2. Bruta,	30 *	
3. Feræ,	184 *	
4. Glires,	124 *	
5. Pecora,	82 *	
6. Belluæ,	13 *	
7. Cete,	25 †	
		558 species.
C. Birds.		
1. Accipitres,	259	
2. Picæ,	757	
3. Anseres,	279	
4. Grallæ,	346	
5. Gallinæ,	127	
6. Passeres,	1038	
		2806 ‡
D. Amphibia.		
1. Reptiles,	176	
2. Serpents,	225	
		401 §
E. Fishes.		
1. Apodes,	40	
2. Jugulares,	52	
3. Thoracici,	443	
4. Abdominales,	200	
5. Brancheostegi,	82	
6. Chondropterigii,	70	
		887 **
F. Insects.		
1. Coleoptera,	5011	
2. Hemiptera,	1687	
3. Lepidoptera,	2900	
4. Neuroptera,	1097	
5. Hymenoptera,	1573	
6. Diptera,	1026	
7. Aptera,	744	
		14038 ††
G. Worms.		
1. Intestina,	406 ‡‡	
2. Mollusca,	433 ‡‡	
3. Testacea,	2672 *	
4. Zoophyta,	489 ‡‡	
5. Infusoria,	229 ‡‡	
		4229

* See *Mammalia*.
† See *Cetology*.
‡ *Turton*.
§ See *Erpetology*.
** *Turton*.
†† *Turton*.
‡‡ See *Helminthology*.
* See *Conchology*.

So that the number of species in this kingdom may be estimated at about 22924, or in round numbers about 23000 (B).

23 Vegetables.

II. IN THE VEGETABLE KINGDOM.

A. Monandria.		
1. Monogynia,	73	
2. Digynia,	10	
		83 species.
B. Diandria.		
1. Monogynia,	374	
2. Digynia,	5	
3. Trigynia,	52	
		431
C. Triandria.		
1. Monogynia,	477	
2. Digynia,	546	
3. Trigynia,	32	
		1055

D. Tetrandria,

(B) The numbers here given differ in several instances from those which we have seen in some late works on this subject. Thus, M. La Cépède, in a note to the discourse delivered by him at the close of his course of Natural History, states the numbers of some classes as follows: *Mammalia*, 416 species; *Birds*, 2534; *Reptiles*, 125; *Serpents*, 180; *Fishes*, 992; in all 4247.

Classification.

D. Tetrandria.

1. Monogynia, -	527	
2. Digynia, -	14	
3. Trigynia, -	521	
4. Tetragynia, -	51	
	——	593 species.

E. Pentandria.

1. Monogynia, -	1537	
2. Digynia, -	652	
3. Trigynia, -	121	
4. Tetragynia, -	8	
5. Pentagynia, -	173	
6. Decagynia, -	1	
7. Polygynia, -	2	
	——	2494

F. Hexandria.

1. Monogynia, -	699	
2. Digynia, -	5	
3. Trigynia, -	69	
4. Hexagynia, -	2	
5. Polygynia, -	10	
	——	785

G. Heptandria.

1. Monogynia, -	25	
2. Digynia, -	3	
3. Tetragynia, -	2	
4. Heptagynia, -	1	
	——	31

H. Octandria.

1. Monogynia, -	377	
2. Digynia, -	11	
3. Trigynia, -	95	
4. Tetragynia,	10	
	——	493

I. Enneandria.

1. Monogynia, -	40	
2. Trigynia, -	8	
3. Hexagynia, -	1	
	——	49

K. Decandria.

1. Monogynia, -	452	
2. Digynia, -	131	
3. Trigynia, -	142	
4. Pentagynia, -	205	
5. Decagynia, -	7	
	——	937

L. Dodecandria.

1. Monogynia, -	100	
2. Digynia, -	6	
3. Trigynia, -	138	
4. Tetragynia,	7	
5. Pentagynia, -	6	
6. Dodecagynia, -	14	
	——	271 species.

M. Icosandria.

1. Monogynia, -	133	
2. Digynia, -	16	
3. Trigynia, -	4	
4. Pentagynia, -	102	
5. Polygynia,	91	
	——	346

N. Polyandria.

1. Monogynia, -	259	
2. Digynia, -	11	
3. Trigynia, - -	31	
4. Tetragynia, -	20	
5. Pentagynia, -	12	
6. Polygynia, -	231	
	——	564 species.

Classification.

O. Didynamia.

1. Gymnospermia, -	441	
2. Angiospermia, -	640	
	——	1081

P. Tetradynamia.

1. Siliculosæ, -	168	
2. Siliquosæ, -	258	
	——	426

Q. Monadelphia.

1. Triandria, -	17	
2. Pentandria, -	134	
3. Heptandria, -	120	
4. Octandria, -	2	
5. Decandria, -	51	
6. Endecandria, -	4	
7. Dodecandria, -	33	
8. Polyandria, -	331	
	——	692

R. Diadelphia.

1. Pentandria, -	1	
2. Hexandria, -	15	
3. Octandria, -	42	
4. Decandria, -	652	—710

S. Polyadelphia.

1. Pentandria, -	3	
2. Dodecandria, -	3	
3. Icosandria, -	4	
4. Polyandria, -	55	
	——	65

T. Syngenesia.

1. Polygamia Æqualis,	439	
2. Pol. Superflua, -	441	
3. Pol. Frustranea, -	116	
4. Pol. Necessaria, -	97	
5. Pol. Segregata, -	22	
6. Monogamia, -	88	
	——	1194

V. Gynandria.

1. Diandria, -	155	
2. Triandria, -	6	
3. Tetrandria, - -	1	
4. Pentandria, -	42	
5. Hexandria, -	23	
6. Octandria, -	1	
7. Decandria,	7	
8. Dodecandria, -	1	
9. Polyandria, -	50	
	——	286

U. Monoecia.

1. Monandria, - -	16	
2. Diandria, - -	8	
3. Triandria, -	99	
4. Tetrandria, -	49	
5. Pentandria, - -	41	
6. Hexandria, -	4	
7. Heptandria, -	1	
8. Polyandria, -	52	
9. Monadelphia, -	78	

Classification.

10. Syngenesia,	46	
11. Gynandria,	4	
		398 species.

W. Dioecia.

1. Monandria,	1	
2. Diandria,	36	
3. Triandria,	17	
4. Tetrandria,	21	
5. Pentandria,	19	
6. Hexandria,	33	
7. Octandria,	7	
8. Enneandria,	4	
9. Decandria,	7	
10. Dodecandria,	14	
11. Polyandria,	19	
12. Monadelphia,	26	
13. Syngenesia,	5	
14. Gynandria,	9	
		219

X. Polygamia.

1. Monœcia,	181	
2. Diœcia,	26	
3. Triœcia,	16	
		223 species.

Y. Cryptogamia.

1. Filices,	267	
2. Musci,	268	
3. Algæ,	467	
4. Fungi,	465	
		1467
Z. Palmae,		14
	Total,	14,807 (c).

24 Minerals.

III. IN THE MINERAL KINGDOM.

Minerals are divided into four great classes, viz. Earths and Stones, Salts, Combustibles, and Metallic Ores.

A. Earths and Stones,

1. Diamond genus	1	
2. Zircon,	2	
3. Siliceous,	62	
4. Argillaceous,	29	
5. Magnesian,	17	
6. Calcareous,	22	
7. Barytic,	2	
8. Strontian,	2	
		137 species.

B. Salts.

1. Sulphates,	6	
2. Nitrates,	1	
3. Muriates,	3	
4. Carbonates,	2	
5. Borates,	2	
6. Fluates,	1	
		15

C. Combustibles,

1. Sulphur,	1	
2. Bituminous,	6	
3. Graphite,	2	
		9

D. Metallic Ores are divided into 24 genera, each metal forming a genus. - 106

Total, 267 species*.

Objects and utility of Natural History.

Hence, taking the whole number of known animals at 23,000, that of vegetables at 50,000, and that of minerals 267, the whole number of known species of natural objects will be 73,267.

25 Hints for studying

II. Though the classification of natural bodies is of the highest importance towards making us acquainted with unknown species, and distinguishing them from those which we already know; this alone is not sufficient to form a naturalist. His principal object should be to learn the habits, manners, and uses of the objects which he is studying; and he may perhaps be assisted in this object by the following observations.

26 Zoology;

1. In *Zoology*, or the natural history of the animal kingdom, it is necessary to ascertain both the distinctive characters of each individual animal, and its peculiar habits, properties and uses.

The naturalist first learns that the sheep, for instance, is in the class mammalia, being one of those animals that suckle their young; in the order pecora, because it is hoofed, and has no cutting teeth in the upper jaw; and that it is distinguished from other animals of the same order, by its having several blunt wedge-like incisive fore-teeth in the lower jaw only, hollow reclined horns, and no tusks.

This information would satisfy many, who call themselves naturalists; but it is far from being all that is required; the philosophical investigator of Nature inquires into its habits; as its food, its period of gestation, its season of lambing, the weather and climate most suited to its health and vigour. He endeavours to learn what produces the difference in its fleece, whether climate, food, or some peculiarity in the breed; and is anxious to ascertain what variety is most disposed to fatten, and what food effects this speedily; with many other very useful particulars.

The information of the first kind is of consequence and even necessary in many cases; but that of the latter is most useful.

If a traveller discover an animal possessing any useful property, or producing any useful drug, if he have not the first kind of information, he gives so confused and inaccurate a description of it, that others, mistaking the animal, discredit the author's account, and the world loses the benefit of his discovery.

27 Botany; and

2. *Botany*, or the natural history of the vegetable kingdom, in the usual acceptation of the term, implies only

* See *Mineralogy*.

(c) This number, drawn from the article Botany, compared with the three first volumes of Wildenow's edition of the *Species Plantarum*, and with Persoon's edition of the *Systema Vegetabilium*, of Linné, is certainly very far below the truth. Many years ago, the number of known species was reckoned at above twenty thousand, and there is reason to believe that it exceeds fifty thousand.

Objects and utility of Natural History.

only the knowledge of the diſtinctive characters of plants; and he who knows the greateſt number, and is moſt accurate in determining the different ſpecies, is accounted the beſt botaniſt.

This however conſtitutes but a ſmall part of the ſcience; there is another diſtinct department, which may properly be termed the philoſophy of botany, which is both more intereſting and more uſeful. This includes the knowledge of the ſtructure, or the anatomy of plants; and the knowledge of the uſes, or functions of their various parts, as of the leaves, the bark, the pith, the roots, the juices, &c.; which is called the phyſiology of plants. It includes alſo an acquaintance with the ſoil and climate adapted to different vegetables, their mode of propagation, and the various uſes to which their ſeveral parts or productions may be applied.

Botany, in the firſt ſenſe, which may be called practical botany, is ſubſervient, and abſolutely neceſſary to the ſtudy of the philoſophy of botany; for no one that is unacquainted with the claſſification of plants can either convey to others his own information, or himſelf receive the benefit of that of others, reſpecting either the ſtructure and economy, or the habits and the uſes of ſuch plants, as may have been inveſtigated.

If medical virtues are diſcovered in any vegetable production; without the accuracy of the practical botaniſt, to aſcertain and deſcribe the particular plant which affords it, the diſcovery is often loſt; or perhaps, what is worſe, the virtues are attributed to a different plant, and it is only by repeated failures, and in ſome caſes after much miſchief, that the error is detected.

It is evident that the ſame may happen to the agriculturiſt, the dyer, or any other artizan, who has diſcovered in the vegetable kingdom the means of improving his art, but has not botanical knowledge ſufficient to give an accurate character of the plant, to which he is indebted for his diſcovery.

28 Mineralogy.

3. In *Mineralogy*, or the natural hiſtory of the mineral kingdom, almoſt half the ſtudents are of that claſs, who content themſelves with collecting, and being able to arrange ſyſtematically the minerals they meet with. But in this department of natural hiſtory, as well as the other two, which we have conſidered, ſomething more than arrangement is required.

It is the man who can analyze, and ſeparate the component parts of mineral productions; who knows the art of aſſaying, and who knows *à priori* the probable ſite of a quarry, or a mine, and can tell the direction of a ſtratum of coal, or of marble, that we may call a mineralogiſt.

The natural hiſtory of the mineral kingdom includes geology, or the data upon which are founded the different theories of the formation of the earth. It includes the knowledge of thoſe facts, upon which the art of mining, and the art of ſeparating and purifying metals, is founded; and its object is to teach likewiſe the properties of thoſe metals, as well as of the earths, and other mineral productions, when ſeparated and in their ſimple ſtate.

29 Utility of the ſtudy.

With reſpect to *the utility of the ſtudy of natural hiſtory*, we have unavoidably given many inſtances of it, in conſidering the object of the ſcience. We need therefore add but few others.

The grazier knows the advantage of attending to the habits and diſtinctive marks of our domeſtic animals. It is natural hiſtory, though not often ſtudied ſcientifically, that teaches him what variety of ſheep to prefer; by what means to obtain a variety of cows, remarkable for their quantity of milk; how to chooſe the ſtock that is beſt adapted to his land, and what is the beſt food for them during winter.

30 To the grazier.

Much benefit is likely to accrue from the attention lately paid to the cultivation of what are termed the artificial graſſes. Inſtead of ſowing his hay ſeeds indiſcriminately, the grazier may ſelect only ſuch graſſes as are, by obſervation, found to be moſt ſuited to his ſoil and cattle.

31 To the farmer.

The farmer's knowledge of the proper ſucceſſion of crops, the beſt times for ſowing them, when to weed, and with what to manure, as well as how to deſtroy both weeds and inſects, is the knowledge of a naturaliſt; and ſurely he, who is ſcientifically acquainted with the growth of plants, knowing what part the ſoil acts in vegetation, and what is the aliment moſt required by them, will have great advantage over the mere empirical farmer, who has no better reaſon for what he does, than that his father did the ſame before him.

By ſtudying the natural hiſtory of inſects, we learn the habits of ſuch as are noxious and injurious, and thence derive the means of deſtroying them.

32 To the landed proprietor.

The mineralogiſt has often enriched individual proprietors of land, and benefited his country, by the diſcovery of mines; he is enabled to direct the planners of canals by warning them of obſtacles; and his knowledge has aided the phyſician in aſcertaining the virtues of minerals, and of mineral waters.

33 In the arts.

In the arts, a knowledge of natural hiſtory prevents that confuſion, and thoſe innumerable errors that muſt be committed, when the natural productions which are employed cannot be accurately diſcriminated from others.

It is to the naturaliſt that we are many times indebted for the introduction of foreign animals and foreign plants into our own country. Wheat, oats, barley, and other vegetables, which are now become neceſſary to our exiſtence, were not originally of Britiſh growth. The potato, now ſo general and ſo uſeful, was firſt introduced into this country by Gerard, a noted botaniſt, and was for ſome time cultivated in his garden as a rarity. The ſugar-cane, the bread-fruit tree, the farinaceous palms, the flax and hemp, have all been tranſported by naturaliſts of the preſent day, to regions where they never grew before.

Beſides the above, and many ſimilar inſtances of advantage to be derived from ſtudying the different branches of natural hiſtory, theſe two incalculable benefits neceſſarily ariſe to the ſtudent himſelf, from attending to the whole, or any part of the ſcience; namely, a power of abſtracting the mind, and reaſoning methodically; and a habit of contemplating the Creator in his works *.

Our limits do not permit us to enter further into the fertile topic of the utility and advantages of natural hiſtory. Its utility, in a moral and religious point of view, has been ably illuſtrated by Mr Ray, in his "Wiſdom of God;" by Mr Bingley, in the introduction

* *Skrimſhire's Eſſays.*

Mode of preserving specimens.

tion to his "Animal Biography;" and, in particular, by Dr Paley, in his "Natural Theology;" and to these works we must refer our readers.

34 Art of preserving specimens.

III. We have stated it to be one of the principal objects of natural history, to teach the mode of preserving specimens. This art, called by the French *Taxidermie*, is exceedingly curious, and would well deserve a much fuller consideration than we can here allot to it. We shall confine our attention on this subject entirely to the animal kingdom, and even here we must be very brief.

The art of preparing and mounting the skins of animals appears to be pretty old; but it made no great progress before the 17th century, when Reaumur made some attempts to preserve the specimens from the attacks of insects. In the *Journal de Physique* for 1773, there is a memoir addressed to the Royal Society of London, by M. Kuckhan, on the methods of preparing birds, which is very curious, but is liable to many objections. In the same volume is a memoir by Mauduit, principally respecting the means of preserving animal specimens from the attacks of insects. His preservatives are of a poisonous nature; and, of course, their use is dangerous, while they do not appear to have been attended with the expected success. The arsenical soap of Becœur, much celebrated about the same time, is liable to similar objections.

The latest, and probably the best work on this subject, is that published a few years ago by M. Nicolas; and from this the following observations are derived.

35 Instruments employed.

The instruments employed in the preparation of specimens are much the same as those used by anatomists in their ordinary dissections, consisting of small knives or scalpels, forceps or pincers of various forms, probes, needles, and pins or wires.

36 Preservatives against insects.

The preservatives employed by M. Nicolas to protect the specimens from insects, are principally of two kinds: 1. Sulphur, which he applies to the skins by means of fumigation, thus impregnating them with sulphurous acid; 2. A liquor for macerating the skins, another liquor for rubbing over the hair, and a pomatum for anointing the inside of the skin. The *first liquor* is prepared by steeping a pound and a half of powdered oak bark, and four ounces of powdered alum, in twenty English pints of cold water, for two days, taking care to shake the mixture from time to time.—The *pomatum* is prepared of a pound of white soap, half a pound of caustic potash, four ounces of powdered alum, two English pints of water, four ounces of oil of petroleum, and the same of camphire. The soap, cut into small pieces, is put into an earthen pipkin, over a moderate fire; the water poured over it; and when the whole is formed into a sort of soft paste, the alum and then the oil are added; the whole well stirred together, removed from the fire, and when it is nearly cold the camphire is added, being before hand rubbed down in a mortar with a little spirit of wine. The pomatum, thus prepared, must be kept in glass vessels, well stopt; and, when used, is to be lowered with water to the consistence of thin cream, and laid on the skins by means of a pencil brush.

The liquor employed for preserving the fur is prepared by infusing an ounce of white soap shred very small, two ounces of camphire broken into very small pieces, the same of *colocynth* or bitter-apple grossly powdered, in two English pints of spirit of wine, for four or five days, shaking the vessel from time to time, after which the liquor is to be filtered through blotting-paper.

M. Nicolas has given directions for preparing and preserving specimens of all the various classes of animals. We shall, as far as our limits permit, briefly follow him through each.

37 Directions for stuffing quadrupeds.

In skinning quadrupeds, he proposes to make an incision along the middle of the back, from the haunches to the shoulders, except in those animals whose skin is very thick and hard, or is set with spines, in which the opening must be made at the belly in the usual manner. In detaching the skin from the flesh, we must occasionally employ the knife, and as we proceed, must insert tow between the skin and flesh, to prevent soiling the fur. When the whole body is detached, and the skin drawn down as far as the ankles, the nose, and the tip of the tail, the whole body is to be cut away except the head and extremities, which are left to give a better form and support to the specimen. All the fleshy and fatty parts, the brain, and the eyes, however, must be cut away, and nothing left but the bones, the spaces between which and the skin must be stuffed with tow cut fine, and a little soft clay must be put within the orbits, in order to fix the artificial eyes.

Before stuffing, the skin is to be steeped for several days, from five to fifteen, according to the size of the animal, in the liquor first described, and after steeping, the inside is to be well anointed with the pomatum.

When the legs and head are stuffed, the cavity of the skull filled with very dry moss, and the eyes fixed, wires are to be passed through the inside of the body, the extremities, and the head and tail, in the following manner. Three iron wires of a moderate size, well annealed, at least twice as long as the animal, are to be twisted together for nearly half their length, and while one wire is left straight, the other two are to be bent at each end, so as to form a cross. When the skin is turned, ready for stuffing, these wires are to be placed within it in such a manner as that the straight wire shall pass through the head and tail, and the crossing wires through the extremities, coming out at the ball of each foot; and in this way after the cavity is filled up with tow, and the open part neatly stitched, the specimen may be fixed on a board in its natural position. Nothing remains now but to impregnate the fur with the bitter liquor last described, which is done by means of a sponge, with which the whole outside is to be well washed, then covered with folds of linen, and dried in the shade.

38 Directions for stuffing birds.

The art of preserving birds is perhaps the most curious part of the present subject, and is that to which the most attention has been given. M. Nicolas has explained at some length the mode recommended by M. Kuckhan in the *Journal de Physique*; that by Dr Lettsom, in the *Naturalist's and Traveller's Companion*; that of Mauduit, inserted in the fifth number of the *Encyclopédie Methodique*; and that of Dufresne, adopted by M. Daudin, and inserted in his *Traité d'Ornithologie*; after which he details his own.

He describes three methods of preparing birds, according as we can procure fresh-killed specimens, whole dried skins brought from abroad, or detached parts of several

Mode of preferving fpecimens.

feveral individuals of the fame fpecies. We fhall here confine ourfelves to the firft of thefe, as being beft adapted to the generality of our readers.

When a frefh-killed bird is procured, it is to be placed upon a table, upon its back, with the tail turned towards the operator, who, after having feparated with his fingers the feathers which cover the belly towards the right and left, is to make with a fcalpel, a longitudinal incifion through the fkin, from the point of the breaft-bone to about the middle of the belly. The edges of the fkin are now to be raifed with a pair of flat pincers, on each fide, carefully feparating the flefh as occafion may require, by the knife, and inferting a little cotton from time to time, to prevent foiling the feathers. In this way the fkin is to be detached from the fhoulders and neck, and as much as poffible of the body laid bare, after which a pretty ftrong thread is to be paffed through the noftrils, and tied under the lower mandible, leaving the ends of the thread when tied together, at leaft twice as long as the neck. Now, holding the bird by the thread, with the back turned towards him, the operator is to hold together the feathers on the two edges of the incifion as well as thofe that cover the breaft, and pufhing the head of the bird inwards with his thumb fo as to form the neck into an arch, is to cut this off near the body, detach from it the gullet and wind-pipe, and all the flefhy parts, both of the neck and head, by drawing the fkin as far back as poffible towards the beak, and cutting off the neck-bones clofe to the head; he is to empty the fkull with a little iron inftrument in the form of an ear-picker, and clean it properly with cotton. He is now to wrap cotton or tow about the head and neck, and to feparate the reft of the fkin, leaving the pinions and bones of the wings, and legs, and the tail, as directed for quadrupeds. After this has been done, the fkin is to be turned out like a glove, with all its feathers turned inwards, all the natural openings of the bird, as well as any fhot-holes, &c. made in killing the bird, are to be ftitched up with a needle and fine thread; then the whole fkin as well as the bones, are to be wafhed with a ftrong infufion of tan with a little alum, by means of a pencil-brufh, and the fkin inclofed in a covered veffel that it may not dry too haftily.

In ten or twelve hours time we may wafh the fkin and bones again with the aftringent liquor. Twice wafhing in this manner will be fufficient for very fmall birds, but thofe of a middling fize will require maceration in the firft liquor employed for quadrupeds during two days, and four or five days for thofe of larger fize.

The fkins being well impregnated with the aftringent liquor, are to be fmeared with the foapy pomatum, have artificial eyes fixed in the orbits by means of wax, and ftuffed and mounted much in the fame manner as quadrupeds, except that the wires employed for this purpofe are rather differently bended.

Great nicety is required in fixing the different parts of a bird in its natural pofition, and in arranging the feathers fmoothly and evenly. M. Nicolas directs thin plates of lead, to be placed fo as to fecure the wings in the proper pofition till the whole is completely arranged.

To preferve the feet and legs of birds, he anoints them with linfeed oil mixed with camphire, and applied a little warm.

3

The laft operation confifts in enveloping the bird with bandages of muflin or fine linen, pinned round the neck, breaft, body, and rump, as well to fecure the feathers in their places during drying, as to allow of their being drenched with the bitter liquor to preferve them from the attacks of infects.

Mode of preferving fpecimens.

39 Infects.

The different orders of infects require different modes of preparation. The following is a fummary of our author's mode of preferving each kind.

For the coleoptera and hemiptera.—One of thefe infects, as foon as caught, is to be carefully wrapt in very fine paper, with the ends of the paper curled round to prevent the animal from moving; and this roll of paper including the infect, is to be put into a little box of pafteboard till the infect-hunter returns home. Each infect is then to be held between the thumb and fore-finger of the left hand, the wings to be raifed by means of a pin, and held open with the middle finger, while the abdomen of the animal is flit open from the back, and the entrails abftracted by means of an iron wire, and the cavity as well as the edges of the wound are to be wafhed with the bitter fpirituous liquor defcribed in N° 36. by means of a very fine pencil. Then a fmall cotton plug impregnated with oil of petroleum is to be ftuffed into the cavity, with the point of a wire, till the cavity is fufficiently full, when the wings are to be fuffered to return to their natural fituation, and the infect is ready for mounting. For mounting thefe infects, M. Nicolas employs little fquares of card, through the middle and acrofs which he paffes a fmall iron wire well annealed, and about the fize of a harpficord ftring. A very fine needle is now to be paffed through the animal, as near as poffible to the corfelet; and after having covered the upright iron wire with a light coating of gum-water, he paffes it through the hole made by the needle, and fixes the animal in fuch a manner that its feet may reft upon the card.

For the lepidoptera.—He recommends them to be put, when caught, into a triangular piece of paper, and afterwards into a pafteboard box of the fame form, opening with a hinge. For mounting thefe infects it is fufficient to perforate their bodies with a fine needle, armed with a double thread impregnated with the bitter fpirituous liquor, making the needle enter by the head and come out at the end of the belly, and then cutting the thread with fciffars. The infect thus prepared is mounted by means of a card, as directed for the *coleoptera*, and a piece of wood about an inch long, feven or eight lines broad, and a proper thicknefs, is placed below the wings on each fide very near the body, and the wings are kept down by means of plates of lead. 40

In the preparation of fpecimens of fifhes, M. Nicolas prefers the method of Mauduit to that given by Dr Lettfom in the *Naturalift's and Traveller's Companion*; but as Mauduit's methods require much fkill and addrefs, he recommends the following, efpecially for the flat kinds of fifh. Fifhes.

He makes a longitudinal incifion with fciffars along the belly of the fifh from the anus to the lower mandible, and then gradually and carefully feparates the fkin from the flefh with the affiftance of the blade and flat handle of a fcalpel, till he has laid bare one fide of the animal. He then paffes to the other fide, proceeding in the fame manner to detach the fkin from that part, after which he feparates the head from the body with a pair

Mode of preserving specimens.

pair of sciſſars, and clears away the fleſhy parts attached to the head. He now detaches the ſkin from the back as far as the anus, and then laying the fiſh on the table, he paſſes the flat handle of the ſcalpel below the ſkin that covers the tail and neighbouring parts, in order to ſeparate it completely. This done, he puſhes the tail inwards, and with the aſſiſtance of the ſcalpel and drawing the ſkin very gently, he detaches this as near as poſſible to the end of the tail, which he then ſeparates with ſciſſars, thus leaving the ſkin with nothing attached to it but the head and extremity of the tail. It only remains now to clear away the ears and eyes, and properly clean the head.

The ſkin is now ſteeped for ſome days in the tanning liquor, then laid on a table, and when the head is properly arranged, a model of the body of the fiſh made of ſoft clay, mixed with fine ſand, is placed within the ſkin, which is made to fit neatly over it, is then bound with little bandages of linen, and ſuffered to dry. When the clay is quite dry and hard, and the ſkin has acquired ſo much firmneſs as to retain its proper form, it is to be gently beaten all over to break the clay, ſo that it may be withdrawn through the opening. When this is done, the whole inſide of the ſkin and head is to be ſmeared by means of a pencil bruſh with the ſoap pomatum. After which it is to be entirely filled with cut tow, and the opening ſtitched up as neatly as poſſible. Then artificial eyes are to be placed in the orbits by means of ſoft wax, and the whole body is to be covered with a coat of white varniſh prepared by digeſting four ounces of clear turpentine, three ounces of ſandarac, and one ounce of maſtich in tears, with eight ounces of oil of turpentine, and four ounces of ſpirit of wine, in a bottle placed in a water bath.

41 Reptiles.

In preparing ſpecimens of reptiles,—after what has been ſaid above, little direction will be required. The ſkin is to be ſtript backwards as far as the head, which is to be cut off and cleaned as in other ſpecimens; after which the ſkin is to be macerated, anointed within with pomatum, ſtuffed and varniſhed as before.

42 Cruſtacea.

The *cruſtacea*, including crabs, lobſters, ſtar-fiſh, and ſea-urchins, require but little preparation. In crabs the ſhell, and in lobſters the tail, is to be ſeparated from the reſt of the body; as much as poſſible of the meat is to be picked out from the body and large claws; the whole interior is to be ſmeared with the ſoap pomatum, and after having united the parts, the whole is to be ſuffered to dry.

The ſtar-fiſh and urchins, if taken alive, ſhould be killed by plunging them in ſpirit of wine, and afterwards drying them in the ſun or in an oven moderately heated.

43 Worms.

As to *worms* the only mode of preſerving the *molluſca*, or thoſe with naked bodies, is to keep them in ſpirits; and of the *teſtacea* or ſhell-fiſh, the only part thought worth preſerving is the ſhell; for the preparation of which, see CONCHOLOGY.

The above is but an imperfect abſtract of M. Nicolas's "*Methode de preparer et conſerver les Animaux de toutes les claſſes*," which is illuſtrated by plates, and is well deſerving the attention of collectors of ſpecimens.

There is alſo an excellent eſſay on this ſubject by Dufreſne, under *Taxidermie*, in the *Nouveau Dictionaire d'Hiſtoire Naturelle.*

Hiſtory.

44 Hiſtory of natural hiſtory.

It will be expected that in this introductory article on natural hiſtory, we ſhould ſay ſomething of its riſe and progreſs. Much of our obſervations on this ſubject have been anticipated in preceding articles on the particular branches of natural hiſtory, ſo that little remains for us to do in this place than to give a general ſketch of the early hiſtory of this branch of phyſics.

45 Jewiſh writers.

We have reaſon to believe that the works of nature have formed the favourite ſtudy among the ingenious and inquiſitive from the earlieſt ages of the world. From the continual alluſions to the Creator's works, and the beautiful metaphors drawn from them, which abound in the inſpired writings of the Jewiſh prophets and poets, eſpecially thoſe of Job, Iſaiah, Daniel and David, we know that theſe ſages were well acquainted with natural hiſtory, as far at leaſt as obſervation extended. Solomon, as we are told, was acquainted with all vegetables, "from the cedar of Lebanon to the hyſſop that ſpringeth out of the wall;" and probably ſo wiſe a man was well acquainted with the other kingdoms of nature. Some writers have gone ſo far as to aſſert that Ariſtotle and Theophraſtus learned natural hiſtory from the writings of Solomon, though on what data they ground this aſſertion, we are at a loſs to determine.

46 Ariſtotle.

The principal writers on natural hiſtory among the ancients, whoſe writings have come down to us are Ariſtotle, Theophraſtus and Pliny the elder. Of the firſt we may remark with Haller, that his writings on this ſubject exhibit a continued chain of phyſical and anatomical facts, which for the moſt part appear to have been the reſult of accurate obſervation. He relied leſs than any of the ancient naturaliſts on uncertain and fabulous report; he induſtriouſly collected and examined natural bodies, and appears to have himſelf diſſected many animals, eſpecially fiſhes, or at leaſt to have been preſent at their diſſection. There are even to be found in his writings, references by letters to figures which he employed to illuſtrate his obſervations.

47 Theophraſtus.

Theophraſtus wrote chiefly on the natural hiſtory of plants and foſſils, on winds, and on fire. His works have been edited by Heinſius, but, except in plants, they do not contain much that is worthy of our obſervation more than what is to be found in the writings of Ariſtotle.

48 Pliny.

The natural hiſtory of Pliny is a valuable repoſitory of ancient knowledge, which, notwithſtanding all its errors and extravagances, we may venture to call after the panegyric of his nephew, a comprehenſive and learned work, little leſs various than nature herſelf. The author in the dedication of his work to Veſpaſian, ſenſible of the defects with which it abounds, apologiſes for them, from the conſideration that the path which he took had been in a great meaſure untrodden, and held forth to the traveller few enticements; while ſome parts of his ſubject had been ſo often handled, that readers were become cloyed with them: that it was an arduous taſk to give what is old an appearance of novelty; to add weight and authority to what is new; to caſt a luſtre upon ſubjects that have been obſcured by time; to render acceptable what is become trite and diſguſting; to obtain credit to doubtful relations; and, in a word, to repreſent every thing according to nature, and with all its natural properties. His deſign muſt be acknowledged to be grand and noble, and when we conſider that the work was compoſed in the midſt of important engagements, History.

engagements, and chiefly at broken periods ſtolen from ſleep, we ſhall not wonder that it was imperfectly executed.

49 Ancients deficient in method.

The ancients had no idea of methodical or ſyſtematic diſtinctions. As they were acquainted with but few bodies in comparison with the moderns, and attended only to thoſe which were uſeful to man; they diſtinguiſhed them only by their uſual properties, their native country, their habitations, and the uſeful purpoſes to which they might be applied. From the few productions which they deſcribed, they were not led to perceive the neceſſity of ſearching among them for diſtinctive marks or relations, which may prevent their being confounded with each other. They doubtleſs believed that their deſcriptions were ſufficient, and that the names which they impoſed would deſcend with their cuſtoms to poſterity, without being affected by the diſorders and alterations that have changed the face of countries and the ſeat of empires. But the revolutions that have deſolated the faireſt regions of the globe, by inſulating or diſplacing their inhabitants, or by confounding them with one another, and altering their language, have frequently almoſt extinguiſhed the lamp of ſcience. After many ages of ignorance and barbarity, we find in the few works of the ancient naturaliſts, which have eſcaped the ravages of war and the devaſtations of civil diſcord, little more than uncertainty and obſcurity, with reſpect to thoſe ſpecies which they have deſcribed. Notwithſtanding the labours of numerous commentators, we do not certainly know what ſpecies of plant is the *cicuta* employed by the Greeks for the execution of criminals, and which terminated the life of Socrates. We cannot be ſure that the animals, which we find beſt characterized in the ancient writings, bore the names which we attribute to them; nor are we more certain with reſpect to the ancient nomenclature of minerals.

50 Riſe of methods.

As long as ſtudious men cultivated the ſciences only through the medium of the writings of the ancients, and attempted nothing beyond the interpretation of theſe, *natural hiſtory*, like every other branch of phyſics, remained obſcure and confuſed, and fiction or imagination took the place of facts; but when they perceived the advantage of ſtudying nature herſelf, and interrogating her by obſervation, methods were erected, and diſtinctive characters for the ſpecies introduced. This fortunate revolution took place in the 16th century. Cæſalpinus firſt attempted to reduce vegetables to claſſes, and diſtinguiſh them into tribes according to their form.—Geſner, beſides the fine hints that he firſt gave of the conſtant relation between the ſtructure of the ſeed and that of the other parts of plants, was the firſt who attempted any ſyſtematic and methodical arrangement of animals. In the 17th century, Moriſon, Ray, and Rivinus, improved on the hints of Cæſalpinus reſpecting the claſſification of vegetables; and Aldrovandus, Rhedi, and Swammerdam upon thoſe of Geſner reſpecting animals; and in a ſhort time this firſt impulſe given to the art of arranging and diſtinguiſhing natural bodies by conſtant characters, was communicated to all thoſe who were employed in the ſtudy of nature. Tournefort, profiting by all the attempts towards method and ſyſtem in the claſſification of vegetables that had been made before him, advanced a conſiderable ſtep in botany, by his beautiful method of diſtinguiſhing plants according to the form of their flowers and fruits, which he publiſhed towards the end of the 17th century.

51 Linné and Buffon.

The ſame year of the 18th century (1707) gave birth to two men who have advanced the ſcience of natural hiſtory far beyond any of their predeceſſors. We need ſcarcely mention the names of Linné, and Buffon. The Swediſh naturaliſt extended his enlarged views through every branch of natural hiſtory; he arranged in his *Syſtema Naturæ* and *Syſtema Vegetabilium* all the productions of nature, and diſtinguiſhed them by characters that were preciſe and ſimple; he created a new language for expreſſing with brevity all theſe characters, and thus preſented to the view, as in a compendious picture, all the properties of bodies. Buffon, proceeding in a different road, treated more copiouſly the moſt important parts of natural hiſtory, and of the animals that are moſt nearly allied to man, in a work which the fire of his genius and the brilliancy of his ſtyle have rendered a univerſal favourite. The rival of Ariſtotle and Pliny, whoſe genius he ſeems to have combined in the greatneſs of his views and extent of his plan, and altogether one of the firſt writers of his age, he inſpired a paſſion for the ſtudy of nature in numbers, who without his works would never have engaged in ſuch a ſtudy, and communicated to his countrymen that taſte which has ever ſince ſurvived him.

After what has been given in the particular treatiſes on natural hiſtory in this Encyclopædia, both as to the progreſs of the ſcience, and the principal works on each department of it, ſince the time of Linné and Buffon; it is unneceſſary for us to trace its progreſs beyond that period. The advances made within theſe few years are immenſe, our ſtock of information is prodigiouſly increaſed, and the modes of ſtudy greatly improved and facilitated. The labours of Cuvier, Geoffroy, Lacépède, Dumont, Dumeril, Lamarck, Duvernois, Sonnini, Bloch, Spallanzani, Eſper, Juſſieu, Wildenow, Werner, Patrin, St Fond, Brochant, Brongniart, Klaproth, Fourcroy, Vauquelin, Shaw, Latham, Bancroft, Cateſby, Ellis, Smith, Withering, Woodville, Kirwan, Playfair, Thomſon, Jameſon, &c. with the aſſiſtance to be derived from the *Annales de Muſeum National*, the *Naturaliſt's Miſcellany*, the *Linnæan Tranſactions*, and the ſplendid plates of Merian, Schreber, Curtis, Sowerby, Sotheby, &c. afford ample proofs of the induſtry and ſucceſs with which this delightful field has been cultivated, and of the rich harveſt that has been derived from the united efforts of ſo many men of genius and talents.

Natural Philosophy, is commonly defined to be that branch of knowledge which considers the powers and properties of natural bodies, and their mutual actions on one another. The province of moral philosophy is the mind of man; its inquiries and researches are into the intellectual world. Natural philosophy, on the other hand, is only concerned with the material part of the creation. The Moralist's business is to inquire into the nature of virtue, the causes and effects of vice; to propose remedies for it, and to point out the mode of attaining happiness, which only can be the result of virtuous conduct. The Naturalist, on the contrary, has nothing to do with spirit; his business is solely about body or matter; and he ought to have a solid and accurate knowledge of all material substances, together with their affections and properties; and if possible, he is to investigate the reasons of such and such appearances.—Indeed, the first and principal part of this science is, to collect all the manifest and sensible appearances of things, and reduce them into a body of natural history. Philosophy, it has often been said, and it is even now very generally thought, to mean an inquiry into all the causes of things; but experience informs us, that though we are acquainted with a good number of effects, we can trace but few of their causes; so that philosophy itself will really be found to be in general but a collection of facts. Still, however, it differs from natural history in its appropriated sense; the business of which is only to observe the appearances of natural bodies separately, and from these appearances to class them with other bodies: natural philosophy goes farther, and recites the action of two or more bodies of the same or different kinds upon one another; and though it can neither investigate nor point out the causes of those effects, whatever they are, yet, from mathematical reasoning combined with experience, it can be demonstrated, that in such circumstances such effects must always take place. There are evidently two ways of making observations on the material world: the first is, when we view things nearly as they happen to occur, without any design or intervention of our own; in which way, indeed, no great improvements can be expected in the art, because chance having the direction, only exhibits occasional or extemporary properties. The other method is, when, after a thorough acquaintance with bodies, we apply them to other bodies equally known, diligently attending to the result, and observing whether any thing new arises. Such seems to be in general the nature of our article; nor is it our intention to be much more particular at present. We must therefore refer our readers respectively to those parts of the subject, respecting which they wish for more satisfaction and minuter details. The ancient and modern definitions of the word *philosophy*, together with its origin, as well as the manner of philosophizing in former times as well as at present, with the gradual improvement of science, particularly natural, we shall introduce, we think, more properly under the words PHILOSOPHY and PHYSICS. We need only add under the present article, what however is well known, that natural philosophy was till lately divided only into four parts, commonly called the *four branches*, viz. 1. Mechanics; 2. Hydrostatics; 3. Optics; and 4. Astronomy; and these again are subdivided into various parts. Modern discoveries have added, however, two more parts to the number, viz. Magnetism and Electricity. It is remarkable, that in the English universities these two latter branches are never taken notice of in lecturing on natural philosophy, the old division being still retained, without any mention of these two important articles. The reason may be, that they are only subject to experiment, and not yet reduced to mathematical reasoning; which is the method of teaching philosophy in one of those celebrated seminaries. Of these branches of this extensive science, it is not our intention to take even a general view in this place. We must therefore refer our readers to each particular article, where they will find them treated at considerable length.

NATURALISATION, in *Law*, the act of naturalizing an alien, or putting him into the condition of a natural born subject, and entitling him to the rights and privileges thereof. But none can be naturalized unless they have received the sacrament within one month before the bringing in of the bill, and taken the oaths of allegiance and supremacy in the presence of the parliament. A person who is naturalized may have lands by descent, as heir at law, as well as obtain them by purchase; but he is disabled from being a member of the privy council or parliament; or from holding offices, 7 Jac. I. cap. 2. 12 Will. III. cap. 2. All children born out of the king's dominions, whose fathers were or are subjects of this kingdom at the time of their birth, are adjudged to be natural born subjects of this realm, except children of parents attainted of treason, or that are in the actual service of a foreign prince at enmity with us, 4 Geo. II. cap. 21. Every foreign seaman, who in time of war serves two years on board an English ship, is *ipso facto* naturalized, 13 Geo. II. cap. 3. And all foreign Protestants and Jews, upon their residing seven years in any of the British colonies, without being absent above two months at a time, or serving two years in a military capacity there, are upon taking the oaths naturalized to all intents and purposes, as if they had been born in this kingdom; and therefore are admissible to all such privileges, and no other, as Protestants or Jews born in this kingdom are entitled to. See ALIEN and DENIZEN.

In France before the Revolution, naturalization was the king's prerogative; in England it is only done by act of parliament. In the former of those places, before their government was overturned, Swiss, Savoyards, and Scots, did not require naturalization, being reputed regnicoles, or natives.

NATURALS, among *Physicians*, whatever naturally belongs to an animal, in opposition to non-naturals. See NON-NATURALS.

NATURE, according to Mr Boyle, has eight different significations; it being used, 1. For the author of nature, whom the schoolmen call *Natura Naturans*, being the same with God. 2. By the nature of a thing, we sometimes mean its essence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature with what accrues to him by birth; as when we say, that such a man is noble by nature. 4. Sometimes we take nature for an internal principle of motion; as when we say, that a a ſtone by nature falls to the earth. 5. Sometimes we underſtand by nature, the eſtabliſhed courſe of things. 6. Sometimes we take nature for an aggregate of powers belonging to a body, eſpecially a living one; in which ſenſe phyſicians ſay, that nature is ſtrong, weak, or ſpent; or that, in ſuch or ſuch diſeaſes, nature left to herſelf will perform the cure. 7. Sometimes we uſe the term nature for the univerſe, or whole ſyſtem of the corporeal works of God; as when it is ſaid of a phœnix, or chimera, that there is no ſuch thing in nature. 8. Sometimes too, and that moſt commonly, we expreſs by the word *nature*, a kind of ſemi-deity, or other ſtrange kind of being.

If, ſays the ſame philoſopher, I were to propoſe a notion of nature, leſs ambiguous than theſe already mentioned, and with regard to which many axioms relating to that word may be conveniently underſtood, I ſhould firſt diſtinguiſh between the univerſal and the particular nature of things. Univerſal nature I would define to be the aggregate of the bodies that make up the world in its preſent ſtate, conſidered as a principle, by virtue whereof they act and ſuffer, according to the laws of motion preſcribed by the Author of all things. And this makes way for the other ſubordinate notion; ſince the particular nature of an individual conſiſts in the general nature applied to a diſtinct portion of the univerſe; or, which is the ſame thing, it is a particular aſſemblage of the mechanical properties of matter, as figure, motion, &c.

Kingdoms of NATURE. See KINGDOMS.

Conduct or Operations of NATURE. See NATURAL *Hiſtory*.

NAVA, in *Ancient Geography*, (Tacitus); a river of Belgica, which runs north-eaſt into the left or weſt ſide of the Rhine. Now the *Nahe*, riſing at the village Naheweiler, on the borders of the biſhopric of Triers, running through the Lower Palatinate, the duchy of Simmeren, by the ſmall town of Bing, into the Rhine.

NAVAL, ſomething relating to a ſhip; whence,

NAVAL *Architecture*. See *Ship-Building*.

NAVAL *Camp*, in antiquity, a fortification, conſiſting of a ditch and parapet on the land ſide, or a wall built in the form of a ſemicircle, and extended from one point of the ſea to another. This was ſometimes defended with towers, and beautified with gates, through which they iſſued forth to attack their enemies. Homer hath left us a remarkable deſcription of the Grecian fortifications of this ſort, in the Trojan war, beginning at ver. 436. Iliad η.

> Then, to ſecure the naval camp and powers,
> They rais'd embattled walls with lofty towers:
> From ſpace to ſpace were ample gates around,
> For paſſing chariots; and a trench profound,
> Of large extent; and deep in earth below
> Strong piles infix'd ſtood adverſe to the foe.
>
> POPE's *Tranſl.*

Towards the ſea, or within it, they fixed great pales of wood, like thoſe in their artificial harbours: before theſe the veſſels of burden were placed in ſuch order, as that they might be inſtead of a wall, and give protection to thoſe within; in which manner Nicias is reported by Thucydides to have encamped himſelf: but this ſeems only to have been practiſed when the enemy was thought ſuperior in ſtrength, and raiſed great apprehenſions of danger in them. When their fortifications were thought ſtrong enough to defend them from the aſſaults of enemies, it was frequent to drag their ſhips to ſhore, which the Greeks called ἑνωλκειν, the Romans *ſubducere*. Around the ſhips the ſoldiers diſpoſed their tents, as appears everywhere in Homer: but this ſeems only to have been practiſed in winter, when their enemy's fleet was laid up and could not aſſault them; or in long ſieges, and when they lay in no danger from their enemies by ſea; as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a ſea-fight.

The adjacent places were uſually filled with inns and ſtews, well ſtocked with females, that proſtituted themſelves to the mariners, merchants, and artificers of all ſorts, who flocked thither in great numbers; this, however, appears to have happened only in times of peace.

NAVAL *Crown*, among the ancient Romans, a crown adorned with figures of prows of ſhips, conferred on perſons who in ſea engagements firſt boarded the enemy's veſſel. See CROWN.

NAVAL *Engagement*. See TACTICS, *Naval*.

NAVAL *Stores*, comprehend all thoſe particulars made uſe of, not only in the royal navy, but in every other kind of navigation; as timber and iron for ſhipping, pitch, tar, hemp, cordage, ſail cloth, gunpowder, ordnance, and fire arms of every ſort, ſhip chandlery wares, &c.

NAVAL *Tactics*, the military operations of fleets. See TACTICS, *Naval*.

NAVAN, a borough town of Ireland, in the county of Meath and province of Leinſter; ſituated about 23 miles north-weſt of Dublin, on the river Boyne. It conſiſts of two chief ſtreets, which interſect each other at right angles.—The tholſel, or town houſe, is a handſome ſtone building. This place was formerly in great repute, and walled in by Hugh de Lacy. An abbey for regular canons, dedicated to the Virgin Mary, was erected here; but whether antecedent to the end of the 12th century is not certain: about that period, however, it was either founded or re-edified by Joceline de Angulo or Nangle. In the burial ground are the remains of many ancient tombs. A barrack for horſe is now built on the ſite of the abbey.

NAVARRE, a province of Spain, part of the ancient kingdom of Navarre, erected ſoon after the invaſion of the Moors; and is otherwiſe called *Upper Navarre*, to diſtinguiſh it from Lower Navarre belonging to the French. It is bounded on the ſouth and eaſt by Arragon, on the north by the Pyrenees, and on the weſt by Old Caſtile and Biſcay; extending from ſouth to north about 80 miles, and from eaſt to weſt about 75. It abounds in ſheep and cattle; game of all kinds, as boars, ſtags, and roebucks; and in wild fowl, horſes, and honey; yielding alſo ſome grain, wine, oil, and a variety of minerals, medicinal waters, and hot baths. Some of the ancient chiefs of this country were called *Sobrarbores*, from the cuſtom, as it is ſuppoſed, which prevailed among ſome of thoſe free nations, of chooſing and ſwearing their

Navarre.

their princes under ſome particular tree. The name of the province is ſuppoſed to be a contraction of *Nava Errea*, ſignifying, in the language of the Vaſcones, its ancient inhabitants, "á land of valleys."—For the particulars of its hiſtory, ſee the article SPAIN.

NAVARRE, *Peter*, an officer of eminence in the 16th century, and particularly celebrated for his dexterity in the directing and ſpringing of mines. He was a native of Biſcay, and of low extraction. According to Paul Jove, who affirms that he had an account of the matter from his own mouth, he was firſt a ſailor; but being diſguſted with that employment, he ſought his fortune in Italy, when poverty compelled him to become footman to the cardinal of Arragon. He afterwards inliſted himſelf a ſoldier in the Houſtine army; and having ſerved there for ſome time, went to ſea again, and diſtinguiſhed himſelf by his courage. The reputation of his valour having reached the ears of Gonſalvo de Cordova, this general employed him in the war againſt Naples, and raiſed him to the rank of a captain. Having contributed greatly to the taking of that city by very opportunely ſpringing a mine, the emperor rewarded him for this ſignal ſervice with the earldom of Alveto, ſituated in that kingdom, and gave him the title of *Count of Navarre*. Having the command of a naval expedition againſt the Moors in Africa, he was at firſt very ſucceſsful, and took poſſeſſion of Oran, Tripoli, and ſome other places; but being afterwards ſhipwrecked on the iſland of Gerbes, the great heats and the Mooriſh cavalry deſtroyed a part of his army. Our hero was equally unfortunate in Italy: He was made priſoner at the famous battle of Ravenna in 1512, and languiſhed in France for the ſpace of two years. When finding that the king of Spain, who had been prejudiced againſt him by his courtiers, would do nothing towards his ranſom, he went into the ſervice of Francis I. who gave him the command of 20 companies of infantry, conſiſting of Gaſcons, Biſcayans, and the inhabitants of the Pyrenean mountains. He diſtinguiſhed himſelf in ſeveral ſucceſsful expeditions, until the year 1522, when having been ſent to the relief of the Genoeſe, he was taken by the Imperialiſts. They conducted him to Naples, where he remained a priſoner for three years in the Caſtel del Ovo. From this confinement he was releaſed by the treaty of Madrid, and afterwards fought at the ſiege of Naples under Laulric in 1528: but being again made priſoner at the unfortunate retreat from Averſa, he was conducted a ſecond time to the Caſtel del Ovo. Here the prince of Orange, having, by order of the emperor, cauſed ſeveral perſons of the *Angevine* faction to be beheaded, our hero would undoubtedly have ſuffered the ſame fate, if the governor, ſeeing his diſtreſſed ſituation, and feeling for the misfortunes of ſo great a man, had not ſaved him the ſhame of this laſt puniſhment by allowing him to die a natural death. Others pretend that he was ſtrangled in his bed, having arrived at a very advanced age. Paul Jove and Philip Thomaſini have written his life. This laſt informs us, that he was of a tall ſize, had a ſwarthy countenance, black eyes, beard, and hair. A duke of Seſſa, in the laſt century, being deſirous to honour his memory and that of the marſhal de Lautree, cauſed a monument to be erected to each of them in the church of Saint-Marie-le-Neuve at Naples, where they had been interred without any funeral honours.

Navarre ‖ Nave.

NAVARRE, *Martin*, ſurnamed *Azpilcucta*, becauſe he was born in the kingdom which bears that name, ſucceſſively profeſſor of juriſprudence at Toulouſe, Salamanca, and Coimbra, was conſulted from all quarters as the oracle of law. For a part of his knowledge he was indebted to the ſchools of Cahors and Toulouſe, in which he had ſtudied. His friend Barthelemi Carewza, a Dominican, and archbiſhop of Toledo, having been charged with hereſy by the court of inquiſition at Rome, Navarre ſet out at the age of 80 years to defend him. Pius V. appointed him aſſeſſor to Cardinal Francis Alciat, vice-penitentiary. Gregory XIII. never paſſed his gate without ſending for him; and ſometimes would converſe with him for an hour together on the ſtreet: he even deigned to viſit him, accompanied by ſeveral cardinals. Theſe honours did not render him more haughty. His character became ſo eminent, that even in his own time the greateſt encomium that could be paid to a man of learning was to ſay that he was a *Navarre*: this name thus included the idea of erudition, as that of Roſcius formerly marked an accompliſhed comedian. Azpilcucta was the oracle of the city of Rome, and of the whole Chriſtian world. For the influence which he had acquired, he was indebted not only to his knowledge, but alſo to his probity and virtue. Faithful to the duties which the church preſcribed, his temperance and frugality preſerved to him a vigorous conſtitution; and at a very advanced age his genius was equal to the ſevereſt ſtudy. His ſavings enabled him to give liberal aſſiſtance to the poor. His charities, indeed, were ſo great, that his mule, it is ſaid, would ſtop as ſoon as ſhe perceived a beggar. He died at Rome in 1586, at the age of 92. His works were collected and printed in 6 vols. folio at Lyons in 1597, and at Venice in 1602. They diſplay more learning than judgement, and are now very ſeldom conſulted. Navarre was uncle by the mother's ſide to St Francis of Sales. See SALES.

NAUCRARI, among the Athenians, was the name given to the chief magiſtrates of the Δημοι, "boroughs or townſhips," called Ναυκραριαι; becauſe each was obliged, beſides two horſemen, to furniſh out one ſhip for the public ſervice.

NAUCRATES, a Greek poet, who was employed by Artemiſia to write a panegyric upon Mauſolus.—An orator who endeavoured to alienate the cities of Lycia from the intereſt of Brutus.

NAUCRATIS, a city of Egypt on the left ſide of the Canopic mouth of the Nile. It was celebrated for its commerce, and no ſhip was permitted to land at any other place, but was obliged to ſail directly to the city, there to depoſite its cargo. It gave birth to Athenæus.

NAUCRATITES NOMOS, in *Ancient Geography*, (Pliny); a diviſion of the Delta, ſo called from that town *Naucratis*; though Ptolemy compriſes it under the Nomos Saites.

NAUCYDES, a ſtatuary who lived about four centuries before the Chriſtian era.

NAVE, in *Architecture*, the body of a church, where the people are diſpoſed, reaching from the balluſter, or rail of the door, to the chief choir. Some derive

Navel.

derive the word from the Greek ναὸς, "a temple;" and others from ναυς, "a ſhip," by reaſon the vault or roof of a church bears ſome reſemblance to a ſhip.

NAVEL, in *Anatomy*, the centre of the lower part of the abdomen; being that part where the umbilical veſſels paſſed out of the placenta of the mother. See ANATOMY *Index*.

Navel-wort, Navew.

Navel-Wort. See COTYLEDON. BOTANY *Index*.

NAVEW. See BRASSICA, BOTANY *Index*.

NAVIGATION,

IS the art of conducting or carrying a ſhip from one port to another.

HISTORY.

THE poets refer the invention of the art of navigation to Neptune, ſome to Bacchus, others to Hercules, others to Jaſon, and others to Janus, who is ſaid to have made the firſt ſhip. Hiſtorians aſcribe it to the Æginetes, the Phœnicians, Tyrians, and the ancient inhabitants of Britain. Some ſuppoſe, that the firſt hint was taken from the flight of the kite; others, as Oppian (*De Piſcibus*, lib. i.), from the fiſh called *nautilus*: others aſcribe it to accident.—Scripture refers the origin of ſo uſeful an invention to God himſelf, who gave the firſt ſpecimen thereof in the ark built by Noah under his direction. For the raillery which the good man underwent on account of his enterpriſe ſhows evidently enough that the world was then ignorant of any thing like navigation, and that they even thought it impoſſible.

However, profane hiſtory repreſents the Phœnicians, eſpecially thoſe of their capital Tyre, as the firſt navigators; being urged to ſeek a foreign commerce by the narrowneſs and poverty of a ſlip of ground they poſſeſſed along the coaſts; as well as by the conveniency of two or three good ports, and by their natural genius for traffic. Accordingly, Lebanon, and the other neighbouring mountains, furniſhing them with excellent wood for ſhip-building, in a ſhort time they were maſters of a numerous fleet; and conſtantly hazarding new navigations, and ſettling new trades, they ſoon arrived at an incredible pitch of opulence and populouſneſs: inſomuch as to be in a condition to ſend out colonies, the principal of which was that of Carthage; which, keeping up their Phœnician ſpirit of commerce, in time not only equalled Tyre itſelf, but vaſtly ſurpaſſed it; ſending its merchant fleets through Hercules's Pillars, now the ſtraits of Gibraltar, along the weſtern coaſts of Africa and Europe; and even, if we believe ſome authors, to America itſelf.

Tyre, whoſe immenſe riches and power are repreſented in ſuch lofty terms both by ſacred and profane authors, being deſtroyed by Alexander the Great, its navigation and commerce were transferred by the conqueror to Alexandria, a new city, admirably ſituated for thoſe purpoſes; propoſed for the capital of the empire of Aſia, which Alexander then meditated. And thus aroſe the navigation of the Egyptians; which was afterwards ſo much cultivated by the Ptolemies, that Tyre and Carthage were quite forgotten.

Egypt being reduced into a Roman province after the battle of Actium, its trade and navigation fell into the hands of Auguſtus; in whoſe time Alexandria was only inferior to Rome; and the magazines of the capital of the world were wholly ſupplied with merchandiſes from the capital of Egypt.

At length, Alexandria itſelf underwent the fate of Tyre and Carthage; being ſurpriſed by the Saracens, who, in ſpite of the emperor Heraclius, overſpread the northern coaſts of Africa, &c. whence the merchants being driven, Alexandria has ever ſince been in a languiſhing ſtate, though it ſtill has a conſiderable part of the commerce of the Chriſtian merchants trading to the Levant.

The fall of Rome and its empire drew along with it not only that of learning and the polite arts, but that of navigation; the barbarians, into whoſe hands it fell, contenting themſelves with the ſpoils of the induſtry of their predeceſſors.

But no ſooner were the more brave among thoſe nations well ſettled in their new provinces, ſome in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards; but they began to learn the advantages of navigation and commerce, and the methods of managing them, from the people they ſubdued; and this with ſo much ſucceſs, that in a little time ſome of them became able to give new leſſons, and ſet on foot new inſtitutions for its advantage. Thus it is to the Lombards we uſually aſcribe the invention and uſe of banks, book-keeping, exchanges, rechanges, &c.

It does not appear which of the European people, after the ſettlement of their new maſters, firſt betook themſelves to navigation and commerce. Some think it began with the French; though the Italians ſeem to have the juſteſt title to it; and are accordingly regarded as the reſtorers thereof, as well as of the polite arts which had been baniſhed together from the time the empire was torn aſunder. It is the people of Italy then, and particularly thoſe of Venice and Genoa, who have the glory of this reſtoration; and it is to their advantageous ſituation for navigation they in great meaſure owe their glory. In the bottom of the Adriatic were a great number of marſhy iſlands, only ſeparated by narrow channels, but thoſe well ſcreened, and almoſt inacceſſible, the reſidence of ſome fiſhermen, who here ſupported themſelves by a little trade in fiſh and ſalt, which they found in ſome of theſe iſlands. Thither the Veneti, a people inhabiting that part of Italy along the coaſts of the gulf, retired, when Alaric king of the Goths, and afterwards Attila king of the Huns, ravaged Italy.

Theſe new iſlanders, little imagining that this was to be their fixed reſidence, did not think of compoſing any body politic; but each of the 72 iſlands of this little archipelago continued a long time under its ſeveral maſters, and each made a diſtinct commonwealth. When their commerce was become conſiderable enough to give jealouſy to their neighbours, they began to think

think of uniting into a body. And it was this union, first begun in the sixth century, but not completed till the eighth, that laid the sure foundation of the future grandeur of the state of Venice. From the time of this union, their fleets of merchantmen were sent to all the ports of the Mediterranean; and at last to those of Egypt, particularly Cairo, a new city, built by the Saracen princes on the eastern banks of the Nile, where they traded for the spices and other products of the Indies. Thus they flourished, increased their commerce, their navigation, and their conquests on the terra firma, till the league of Cambray in 1508, when a number of jealous princes conspired to their ruin; which was the more easily effected by the diminution of their East India commerce, of which the Portuguese had got one part and the French another. Genoa, which had applied itself to navigation at the same time with Venice, and that with equal success, was a long time its dangerous rival, disputed with it the empire of the sea, and shared with it the trade of Egypt and other parts both of the east and west.

Jealousy soon began to break out; and the two republics coming to blows, there was almost continual war for three centuries before the superiority was ascertained; when, towards the end of the 14th century, the battle of Chioza ended the strife; the Genoese, who till then had usually the advantage, having now lost all; and the Venetians, almost become desperate, at one happy blow, beyond all expectation, secured to themselves the empire of the sea, and superiority in commerce.

About the same time that navigation was retrieved in the southern parts of Europe, a new society of merchants was formed in the north, which not only carried commerce to the greatest perfection it was capable of till the discovery of the East and West Indies, but also formed a new scheme of laws for the regulation therefore, which still obtain under the names of *Uses and Customs of the Sea*. This society is that famous league of the Hanse towns, commonly supposed to have begun about the year 1164. See *Hanse Towns*.

For the modern state of navigation in England, Holland, France, Spain, Portugal, &c. see Commerce, Company, &c.

We shall only add, that in examining the causes of commerce passing successively from the Venetians, Genoese, and Hanse towns, to the Portuguese and Spaniards, and from these again to the English and Dutch, it may be established as a maxim, that the relation between commerce and navigation, or, if we may be allowed to say it, their union, is so intimate, that the fall of the one inevitably draws after it that of the other; and that they will always either flourish or dwindle together. Hence so many laws, ordinances, statutes, &c. for its regulation; and hence particularly that celebrated act of navigation, which an eminent foreign author calls the *palladium* or *tutelar deity of the commerce of England;* which is the standing rule, not only of the British among themselves, but also of other nations with whom they traffic.

The art of navigation has been exceedingly improved in modern times, both with regard to the form of the vessels themselves, and with regard to the methods of working them. The use of rowers is now entirely superseded by the improvements made in the formation of the sails, rigging, &c. by which means ships can not only sail much faster than formerly, but can tack in any direction with the greatest facility. It is also very probable that the ancients were neither so well skilled in finding the latitudes, not in steering their vessels in places of difficult navigation, as the moderns. But the greatest advantage which the moderns have over the ancients is from the mariner's compass, by which they are enabled to find their way with as great facility in the midst of an immeasurable ocean, as the ancients could have done by creeping along the coast, and never going out of sight of land. Some people indeed contend, that this is no new invention, but that the ancients were acquainted with it. They say, that it was impossible for Solomon to have sent ships to Ophir, Tarshish, and Parvaim, which last they will have to be *Peru*, without this useful instrument. They insist, that it was impossible for the ancients to be acquainted with the attractive virtue of the magnet, and to be ignorant of its polarity. Nay, they affirm, that this property of the magnet is plainly mentioned in the book of Job, where the loadstone is mentioned by the name of *topaz*, or *the stone that turns itself.* But it is certain, that the Romans, who conquered Judea, were ignorant of this instrument; and it is very improbable, that such an useful invention, if once it had been commonly known to any nation, would have been forgot, or perfectly concealed from such a prudent people as the Romans, who were so much interested in the discovery of it.

Among those who admit that the mariner's compass is a modern invention, it has been much disputed who was the inventor. Some give the honour of it to Flavio Gioia of Amalfi in Campania *, who lived about the beginning of the 14th century; while others say that it came from the east, and was earlier known in Europe. But, at whatever time it was invented, it is certain, that the mariner's compass was not commonly used in navigation before the year 1420. In that year the science was considerably improved under the auspices of Henry duke of Visco, brother to the king of Portugal. In the year 1485, Roderick and Joseph, physicians to John II. king of Portugal, together with one Martin de Bohemia, a Portuguese, native of the island of Fayal, and scholar to Regiomontanus, calculated tables of the sun's declination for the use of sailors, and recommended the astrolabe for taking observations at sea. Of the instructions of Martin, the celebrated Christopher Columbus is said to have availed himself, and to have improved the Spaniards in the knowledge of the art; for the farther progress of which a lecture was afterwards founded at Seville by the emperor Charles V.

* See *Mariner's Compass*.

The discovery of the variation is claimed by Columbus, and by Sebastian Cabot. The former certainly did observe this variation without having heard of it from any other person, on the 14th of September 1492, and it is very probable that Cabot might do the same. At that time it was found that there was no variation at the Azores, where some geographers have thought proper to place the first meridian; though it hath since been observed that the variation alters in time.—The use of the cross staff now began to be introduced among sailors. This ancient instrument is described by John Werner of Nuremberg, in

his

his annotations on the first book of Ptolemy's Geography, printed in 1514. He recommends it for observing the distance between the moon and some star, in order thence to determine the longitude.

At this time the art of navigation was very imperfect, on account of the inaccuracies of the plane chart, which was the only one then known, and which, by its gross errors, must have greatly misled the mariner, especially in voyages far distant from the equator. Its precepts were probably at first only set down on the sea charts, as is the custom at this day: but at length there were two Spanish treatises published in 1545; one by Pedro de Medina; the other by Martin Cortes, which contained a complete system of the art, as far as it was then known. These seem to have been the oldest writers who fully handled the art; for Medina, in his dedication to Philip prince of Spain, laments that multitudes of ships daily perished at sea, because there were neither teachers of the art, nor books by which it might be learned; and Cortes, in his dedication, boasts to the emperor, that he was the first who had reduced navigation into a compendium, valuing himself much on what he had performed. Medina defended the plane chart; but he was opposed by Cortes, who showed its errors, and endeavoured to account for the variation of the compass, by supposing the needle to be influenced by a magnetic pole (which he called the *point attractive*), different from that of the world; which notion hath been farther prosecuted by others. Medina's book was soon translated into Italian, French, and Flemish, and served for a long time as a guide to foreign navigators. However, Cortes was the favourite author of the English nation, and was translated in 1561; while Medina's work was entirely neglected, though translated also within a short time of the other. At that time the system of navigation consisted of the following particulars, and others similar: An account of the Ptolemaic hypothesis, and the circles of the sphere; of the roundness of the earth, the longitudes, latitudes, climates, &c. and eclipses of the luminaries; a kalendar; the method of finding the prime, epact, moon's age, and tides; a description of the compass, an account of its variation, for the discovering of which Cortes said an instrument might easily be contrived; tables of the sun's declination for four years, in order to find the latitude from his meridian altitude; directions to find the same by certain stars; of the course of the sun and moon; the length of the days; of time and its divisions; the method of finding the hour of the day and night; and lastly, a description of the sea chart, on which to discover where the ship is, they made use of a small table, that showed, upon an alteration of one degree of the latitude, how many leagues were run in each rhumb, together with the departure from the meridian. Besides, some instruments were described, especially by Cortes; such as one to find the place and declination of the sun, with the days, and place of the moon; certain dials, the astrolabe, and cross staff; with a complex machine to discover the hour and latitude at once.

About the same time were made proposals for finding the longitude by observations of the moon.—In 1530, Gemma Frisius advised the keeping of the time by means of small clocks or watches, then, as he says, newly invented. He also contrived a new sort of cross staff, and an instrument called the *nautical quadrant*; which last was much praised by William Cunningham, in his *Astronomical Glass*, printed in the year 1559.

In 1537 Pedro Nunez, or Nonius, published a book in the Portuguese language, to explain a difficulty in navigation proposed to him by the commander Don Martin Alphonso de Susa. In this he exposes the errors of the plane chart, and likewise gives the solution of several curious astronomical problems; amongst which is that of determining the latitude from two observations of the sun's altitude and intermediate azimuth being given. He observed, that though the rhumbs are spiral lines, yet the direct course of a ship will always be in the arch of a great circle, whereby the angle with the meridians will continually change: all that the steersman can here do for the preserving of the original rhumb, is to correct these deviations as soon as they appear sensible. But thus the ship will in reality describe a course without the rhumb line intended; and therefore his calculations for assigning the latitude, where any rhumb line crosses the several meridians, will be in some measure erroneous. He invented a method of dividing a quadrant by means of concentric circles, which, after being much improved by Dr Halley, is used at present, and is called a *nonius*.

In 1577, Mr William Bourne published a treatise, in which, by considering the irregularities in the moon's motion, he shows the errors of the sailors in finding her age by the epact, and also in determining the hour from observing on what point of the compass the sun and moon appeared. He advises, in sailing towards the high latitudes, to keep the reckoning by the globe, as there the plane chart is most erroneous. He despairs of our ever being able to find the longitude, unless the variation of the compass should be occasioned by some such attractive point as Cortes had imagined; of which, however, he doubts: but as he had shown how to find the variation at all times, he advises to keep an account of the observations, as useful for finding the place of the ship; which advice was prosecuted at large by Simon Stevin, in a treatise published at Leyden in 1599; the substance of which was the same year printed at London in English by Mr Edward Wright, entitled the Haven-finding Art. In this ancient tract also is described the way by which our sailors estimate the rate of a ship in her course, by an instrument called the *log*. This was so named from the piece of wood or log that floats in the water while the time is reckoned during which the line that is fastened to it is veering out. The author of this contrivance is not known; neither was it taken notice of till 1607, in an East India voyage published by Purchas: but from this time it became famous, and was much taken notice of by almost all writers on navigation in every country; and it still continues to be used as at first, though many attempts have been made to improve it, and contrivances proposed to supply its place; many of which have succeeded in quiet water, but proved useless in a stormy sea.

In 1581 Michael Coignet, a native of Antwerp, published a treatise, in which he animadverted on Medina. In this he showed, that as the rhumbs are spirals,

rals, making endless revolutions about the poles, numerous errors must arise from their being represented by straight lines on the sea charts; but though he hoped to find a remedy for these errors, he was of opinion that the proposals of Nonius were scarcely practicable, and therefore in a great measure useless. In treating of the sun's declination, he took notice of the gradual decrease in the obliquity of the ecliptic; he also described the cross staff with three transverse pieces, as it is at present made, and which he owned to have been then in common use among the sailors. He likewise gave some instruments of his own invention; but all of them are now laid aside, excepting perhaps his nocturnal. He constructed a sea table to be used by such as sailed beyond the 60th degree of latitude; and at the end of the book is delivered a method of sailing on a parallel of latitude by means of a ring dial and a 24 hour glass. The same year the discovery of the dipping needle was made by Mr Robert Norman *. In his publication on that art he maintains, in opposition to Cortes, that the variation of the compass was caused by some point on the surface of the earth, and not in the heavens: he also made considerable improvements in the construction of compasses themselves; showing especially the danger of not fixing, on account of the variation, the wire directly under the *fleur de luce*; as compasses made in different countries have it placed differently. To this performance of Norman's is always prefixed a discourse on the variation of the magnetical needle, by Mr William Burrough, in which he shows how to determine the variation in many different ways. He also points out many errors in the practice of navigation at that time, and speaks in very severe terms concerning those who had published upon it.

* See *Dipping Needle.*

All this time the Spaniards continued to publish treatises on the art. In 1585 an excellent compendium was published by Roderico Zamorano; which contributed greatly towards the improvement of the art, particularly in the sea charts. Globes of an improved kind, and of a much larger size than those formerly used, were now constructed, and many improvements were made in other instruments; however, the plane chart continued still to be followed, though its errors were frequently complained of. Methods of removing these errors had indeed been sought after; and Gerard Mercator seems to have been the first who found the true method of doing this, so as to answer the purposes of seamen. His method was to represent the parallels both of latitude and longitude by parallel straight lines, but gradually to augment the former as they approached the pole. Thus the rhumbs, which otherwise ought to have been curves, were now also extended into straight lines; and thus a straight line drawn between any two places marked upon the chart would make an angle with the meridians, expressing the rhumb leading from the one to the other. But though, in 1569, Mercator published an universal map constructed in this manner, it doth not appear that he was acquainted with the principles on which this proceeded; and it is now generally believed, that the true principles on which the construction of what is called *Mercator's chart* depends, were first discovered by an Englishman, Mr Edward Wright.

Mr Wright supposes, but, according to the general opinion, without sufficient grounds, that this enlargement of the degrees of latitude was known and mentioned by Ptolemy, and that the same thing had also been spoken of by Cortes. The expressions of Ptolemy alluded to, relate indeed to the proportion between the distances of the parallels and meridians; but instead of proposing any gradual enlargement of the parallels of latitude in a general chart, he speaks only of particular maps; and advises not to confine a system of such maps to one and the same scale, but to plan them out by a different measure, as occasion might require: only with this precaution, that the degrees of longitude in each should bear some proportion to those of latitude; and this proportion is to be deduced from that which the magnitude of the respective parallels bears to a great circle of the sphere. He adds, that in particular maps, if this proportion be observed with regard to the middle parallel, the inconvenience will not be great though the meridians should be straight lines parallel to each other. Here he is said only to mean, that the maps should in some measure represent the figures of the countries for which they are drawn. In this sense Mercator, who drew maps for Ptolemy's tables, understood him; thinking it, however, an improvement not to regulate the meridians by one parallel, but by two; one distant from the northern, the other from the southern extremity of the map by a fourth part of the whole depth; by which means, in his maps, though the meridians are straight lines, yet they are generally drawn inclining to each other towards the poles. With regard to Cortes, he speaks only of the number of degrees of latitude, and not of the extent of them; nay, he gives express directions that they should all be laid down by equal measurement on a scale of leagues adapted to the map.

For some time after the appearance of Mercator's map, it was not rightly understood, and it was even thought to be entirely useless, if not detrimental.—However, about the year 1592, its utility began to be perceived; and seven years after, Mr Wright printed his famous treatise entitled, The Correction of certain Errors in Navigation, where he fully explained the reason of extending the length of the parallels of latitude, and the uses of it to navigators. In 1610, a second edition of Mr Wright's book was published with improvements. An excellent method was proposed of determining the magnitude of the earth; at the same time it was judiciously proposed to make our common measures in some proportion to a degree on its surface, that they might not depend on the uncertain length of a barley corn. Some of his other improvements were, "The table of latitudes for dividing the meridian computed to minutes;" whereas it had been only divided to every tenth minute. He also published a description of an instrument which he calls the *sea rings*; and by which the variation of the compass, altitude of the sun, and time of the day, may be determined readily at once in any place, provided the latitude is known. He showed also how to correct the errors arising from the eccentricity of the eye in observing by the cross-staff. He made a total amendment in the tables of the declinations and places of the sun and stars from his own observations made with a six foot quadrant in the years 1594, 95, 96, and 97. A sea quadrant to take altitudes by a forward or backward observation; and likewise with a contrivance for the ready finding the latitude

latitude by the height of the pole ſtar, when not upon the meridian. To this edition was ſubjoined a tranſlation of Zamorano's Compendium above mentioned, in which he corrected ſome miſtakes in the original; adding a large table of the variation of the compaſs obſerved in very different parts of the world, to ſhow that it was not occaſioned by any magnetical pole.

Theſe improvements ſoon became known abroad.—In 1608, a treatiſe entitled, *Hypomnemata Mathematica*, was publiſhed by Simon Stevin, for the uſe of Prince Maurice. In that part relating to navigation, the author having treated of ſailing on a great circle, and ſhown how to draw the rhumbs on a globe mechanically, ſets down Wright's two tables of latitudes and of rhumbs, in order to deſcribe theſe lines more accurately, pretending even to have diſcovered an error in Wright's table. But all Stevin's objections were fully anſwered by the author himſelf, who ſhowed that they aroſe from the groſs way of calculating made uſe of by the former.

In 1624, the learned Wellebrordus Snellius, profeſſor of mathematics at Leyden, publiſhed a treatiſe of navigation on Wright's plan, but ſomewhat obſcurely: and as he did not particularly mention all the diſcoveries of Wright, the latter was thought by ſome to have taken the hint of all his diſcoveries from Snellius. But this ſuppoſition is long ago refuted: and Wright enjoys the honour of thoſe diſcoveries which is juſtly his due.

Mr Wright having ſhown how to find the place of the ſhip on his chart, obſerved that the ſame might be performed more accurately by calculation: but conſidering, as he ſays, that the latitudes, and eſpecially the courſes at ſea, could not be determined ſo preciſely, he forbore ſetting down particular examples; as the mariner may be allowed to ſave himſelf this trouble, and only mark out upon his chart the ſhip's way, after the manner then uſually practiſed. However, in 1614, Mr Raphe Handſon, among his nautical queſtions ſubjoined to a tranſlation of Pitiſcus's trigonometry, ſolved very diſtinctly every caſe of navigation, by applying arithmetical calculations to Wright's table of latitudes, or of meridional parts, as it hath ſince been called. Though the method diſcovered by Wright for finding the change of longitude by a ſhip ſailing on a rhumb is the proper way of performing it. Handſon alſo propoſes two ways of approximation to it without the aſſiſtance of Wright's diviſion of the meridian line. The firſt was computed by the arithmetical mean between the coſines of both latitudes; the other by the ſame mean between the ſecants as an alternative, when Wright's book was not at hand; though this latter is wider from the truth than the firſt. By the ſame calculations alſo he ſhowed how much each of theſe compendiums deviates from the truth; and alſo how widely the computations on the erroneous principles of the plane chart differ from them all. The method, however, commonly uſed by our ſailors is commonly called the *middle latitude;* which, though it errs more than that by the arithmetical mean between the two coſines, is preferred on account of its being leſs operoſe: yet in high latitudes it is more eligible to uſe that of the arithmetical mean between the logarithmic coſines, equivalent to the geometrical mean between the coſines themſelves; a method ſince propoſed by Mr John Baſſat. The computation by the middle latitude will always fall ſhort of the true change of longitude; that by the geometrical mean will always exceed; but that by the arithmetical mean falls ſhort in latitudes above 45 degrees, and exceeds in leſſer latitudes. However, none of theſe methods will differ much from the truth when the change of latitude is ſufficiently ſmall.

About this time logarithms were invented by John Napier, baron of Merchiſton, in Scotland, and proved of the utmoſt ſervice to the art of navigation. From which Mr Edmund Gunter conſtructed a table of logarithmic ſines and tangents to every minute of the quadrant, which he publiſhed in 1620. In this work he applied to navigation, and other branches of mathematics, his admirable ruler known by the name of Gunter's ſcale †; on which are deſcribed lines of logarithms, of logarithmic ſines and tangents, of meridional parts, &c. He greatly improved the ſector for the ſame purpoſes. He ſhowed alſo how to take a back obſervation by the croſs ſtaff, whereby the error ariſing from the eccentricity of the eye is avoided. He deſcribed likewiſe another inſtrument, of his own invention, called the *croſs bow*, for taking altitudes of the ſun or ſtars, with ſome contrivances for the more ready collecting the latitude from the obſervation. The diſcoveries concerning logarithms were carried to France in 1624 by Mr Edmund Wingate, who publiſhed two ſmall tracts in that year at Paris. In one of theſe he taught the uſe of Gunter's ſcale; and in the other, of the tables of artificial ſines and tangents, as modelled according to Napier's laſt form, erroneouſly attributed by Wingate to Briggs.

† See *Gunter's Scale.*

Gunter's rule was projected into a circular arch by the Reverend Mr William Oughtred in 1633, and its uſes fully ſhown in a pamphlet entitled, *The Circles of Proportion*, where, in an appendix, are well treated ſeveral important points in navigation. It has alſo been made in the form of a ſliding ruler.

The logarithmic tables were firſt applied to the different caſes of ſailing by Mr Thomas Addiſon, in his treatiſe entitled, *Arithmetical Navigation*, printed in 1625. He alſo gives two traverſe tables, with their uſes; the one to quarter points of the compaſs, the other to degrees. Mr Henry Gellibrand publiſhed his diſcovery of the changes of the variation of the compaſs, in a ſmall quarto pamphlet, entitled, *A diſcourſe mathematical on the variation of the magnetical needle*, printed in 1635. This extraordinary phenomenon he found out by comparing the obſervations made at different times near the ſame place by Mr Burrough, Mr Gunter, and himſelf, all perſons of great ſkill and experience in theſe matters. This diſcovery was likewiſe ſoon known abroad; for Father Athanaſius Kircher, in his treatiſe entitled, *Magnes*, firſt printed at Rome in 1641, informs us, that he had been told it by Mr John Greaves; and then gives a letter of the famous Marinus Merſennus, containing a very diſtinct account of the ſame.

As altitudes of the ſun are taken on ſhipboard by obſerving his elevation above the viſible horizon; to obtain from thence the ſun's true altitude with correctneſs, Wright obſerves it to be neceſſary that the dip of the viſible horizon below the horizontal plane paſſing through the obſerver's eye ſhould be brought into the account,

account, which cannot be calculated without knowing the magnitude of the earth. Hence he was induced to propose different methods for finding this; but complains that the most effectual was out of his power to execute; and therefore contented himself with a rude attempt, in some measure sufficient for his purpose: and the dimensions of the earth deduced by him corresponded very well with the usual divisions of the log line; however, as he wrote not an express treatise on navigation, but only for the correcting such errors as prevailed in general practice, the log line did not fall under his notice. Mr Richard Norwood, however, put in execution the method recommended by Mr Wright as the most perfect for measuring the dimensions of the earth, with the true length of the degrees of a great circle upon it; and, in 1635, he actually measured the distance between London and York; from whence, and the summer solstitial altitudes of the sun observed on the meridian at both places, he found a degree on a great circle of the earth to contain 367,196 English feet, equal to 57,300 French fathoms or toises: which is very exact, as appears from many measures that have been made since that time. Of all this Mr Norwood gave a full account in this treatise called *The Seaman's Practice*, published in 1637. He there shows the reason why Snellius had failed in his attempt: he points out also various uses of his discovery, particularly for correcting the gross errors hitherto committed in the divisions of the log line. But necessary amendments have been little attended to by sailors, whose obstinacy in adhering to established errors has been complained of by the best writers on navigation. This improvement has at length, however, made its way into practice, and few navigators of reputation now make use of the old measure of 42 feet to a knot. In that treatise also Mr Norwood describes his own excellent method of setting down and perfecting a sea reckoning, by using a traverse table; which method he had followed and taught for many years. He shows also how to rectify the course by the variation of the compass being considered; as also how to discover currents, and to make proper allowance on their account. This treatise, and another on trigonometry, were continually reprinted, as the principal books for learning scientifically the art of navigation. What he had delivered, especially in the latter of them, concerning this subject, was contracted as a manuel for sailors, in a very small piece called his *Epitome;* which useful performance has gone through a great number of editions. No alterations were ever made in the Seaman's Practice till the 12th edition in 1676, when the following paragraph was inserted in a smaller character: "About the year 1672, Monsieur Picart has published an account in French, concerning the measure of the earth, a breviate whereof may be seen in the Philosophical Transactions, N° 112, wherein he concludes one degree to contain 365,184 English feet, nearly agreeing with Mr Norwood's experiment;" and this advertisement is continued through the subsequent editions as late as the year 1732.

About the year 1645, Mr Bond published in Norwood's Epitome a very great improvement in Wright's method, by a property in his meridian line, whereby its divisions are more scientifically assigned than the author himself was able to effect; which was from this theorem, that these divisions are analogous to the excesses of the logarithmic tangents of half the respective latitudes augmented by 45 degrees above the logarithm of the radius. This he afterwards explained more fully in the third edition of Gunter's works, printed in 1653; where, after observing that the logarithmic tangents from 45° upwards increase in the same manner that the secants added together do, if every half degree be accounted as a whole degree of Mercator's meridional line. His rule for computing the meridional parts belonging to any two latitudes, supposed on the same side of the equator, is to the following effect: "Take the logarithmic tangent, rejecting the radius, of half each latitude, augmented by 45 degrees; divide the difference of those numbers by the logarithmic tangent of 45° 30′, the radius being likewise rejected; and the quotient will be the meridional parts required, expressed in degrees." This rule is the immediate consequence from the general theorem, That the degrees of latitude bear to one degree (or 60 minutes, which in Wright's table stands for the meridional parts of one degree), the same proportion as the logarithmic tangent of half any latitude augmented by 45 degrees, and the radius neglected, to the like tangent of half a degree augmented by 45 degrees, with the radius likewise rejected. But here was farther wanting the demonstration of this general theorem, which was at length supplied by Mr James Gregory of Aberdeen in his *Exercitationes Geometricæ*, printed at London in 1668; and afterwards more concisely demonstrated, together with a scientific determination of the divisor, by Dr Halley in the Philosophical Transactions for 1695, N° 219. from the consideration of the spirals into which the rhumbs are transformed in the stereographic projection of the sphere upon the plane of the equinoctial; and which is rendered still more simple by Mr Roger Cotes, in his Logometria, first published in the Philosophical Transactions for 1714, N° 388. It is moreover added in Gunter's book, that if $\frac{1}{20}$th of this division, which does not sensibly differ from the logarithmic tangent of 45° 1′ 30″ (with the radius subtracted from it), be used, the quotient will exhibit the meridional parts expressed in leagues, and this is the divisor set down in Norwood's Epitome. After the same manner the meridional parts will be found in minutes, if the like logarithmic tangent of 45° 1′ 30″, diminished by the radius, be taken; that is, the number used by others being 12633, when the logarithmic tables consist of eight places of figures besides the index.

In an edition of the Seaman's Kalender, Mr Bond declared, that he had discovered the longitude by having found out the true theory of the magnetic variation; and to gain credit to his assertion, he foretold, that at London in 1657 there would be no variation of the compass, and from that time it would gradually increase the other way; which happened accordingly. Again, In the Philosophical Transactions for 1668, N° 40. he published a table of the variation for 49 years to come. Thus he acquired such reputation, that his treatise, entitled, *The Longitude Found*, was in 1676 published by the special command of Charles II. and approved by many celebrated mathematicians. It was not long, however, before it met with opposition; and in 1678 another treatise, entitled, *The Longitude not Found*, made its appearance; and as Mr Bond's hypothesis

potheſis did not in any manner anſwer its author's ſanguine expectations, the affair was undertaken by Dr Halley. The reſult of his ſpeculation was, that the magnetic needle is influenced by four poles; but this wonderful phenomenon ſeems hitherto to have eluded all our reſearches. In 1700, however, Dr Halley publiſhed a general map, with curve lines expreſſing the paths where the magnetic needle had the ſame variation; which was received with univerſal applauſe. But as the poſitions of theſe curves vary from time to time, they ſhould frequently be corrected by ſkilful perſons; as was done in 1644 and 1756, by Mr William Mountaine, and Mr James Dodſon, F. R. S. In the Philoſophical Tranſactions for 1690, Dr Halley alſo gave a diſſertation on the monſoons; containing many very uſeful obſervations for ſuch as ſail to places ſubject to theſe winds.

After the true principles of the art were ſettled by Wright, Bond, and Norwood, the authors on navigation became ſo numerous, that it would be impoſſible to enumerate them. New improvements were daily made, and every thing relative to it was ſettled with an accuracy nor only unknown to former ages, but which would have been reckoned utterly impoſſible. The earth being found to be a ſpheroid, and not a perfect ſphere, with the ſhorteſt diameter paſſing through the poles, a tract was publiſhed in 1741 by the Rev. Doctor Patrick Murdoch, wherein he accommodated Wright's ſailing to ſuch a figure; and Mr Colin Maclaurin, the ſame year, in the Philoſophical Tranſactions, N° 461. gave a rule for determining the meridional parts of a ſpheroid; which ſpeculation is farther treated of in his book of Fluxions, printed at Edinburgh in 1742.

Among the latter diſcoveries in navigation, that of finding the longitude both by lunar obſervations and by time-keepers is the principal. It is owing chiefly to the rewards offered by the Britiſh parliament that this has attained the preſent degree of perfection. We are indebted to Dr Maſkelyne for putting the firſt of theſe methods in practice, and for other important improvements in navigation. The time-keepers, conſtructed by Harriſon for this expreſs purpoſe, were found to anſwer ſo well, that he obtained the parliamentary reward.

The only works that have appeared of late on navigation are thoſe on the longitude and navigation by Dr Mackay, of which the following account is tranſcribed from the Anti-Jacobin Review for September 1804.

"This publication, (Dr Mackay's Treatiſe on Navigation) and that on the longitude by the ſame author, form the moſt correct and practical ſyſtem of navigation and nautical ſcience hitherto publiſhed in this country; they may be conſidered not only of individual utility, but of national importance."

THEORY OF NAVIGATION.

THE motion of a ſhip in the water is well known to depend on the action of the wind upon its ſails, regulated by the direction of the helm. As the water is a reſiſting medium, and the bulk of the ſhip very conſiderable, it thence follows that there is always a great reſiſtance on her fore-part; and when this reſiſtance becomes ſufficient to balance the moving force of the wind upon the ſails, the ſhip attains her utmoſt degree of velocity, and her motion is no longer accelerated. This velocity is different according to the different ſtrength of the wind; but the ſtronger the wind, the greater reſiſtance is made to the ſhip's paſſage through the water: and hence, though the wind ſhould blow ever ſo ſtrong, there is alſo a limit to the velocity of the ſhip: for the ſails and ropes can bear but a certain force of air; and when the reſiſtance on the fore-part becomes more than equivalent to their ſtrength, the velocity can be no longer increaſed, and the rigging gives way.

The direction of a ſhip's motion depends on the poſition of her ſails with regard to the wind, combined with the action of the rudder. The moſt natural direction of the ſhip is, when ſhe runs directly before the wind, the ſails are then diſpoſed, ſo as to be at right angles thereto. But this is not always the caſe, both on account of the variable nature of the winds, and the ſituation of the intended port, or of intermediate headlands or iſlands. When the wind therefore happens not to be favourable, the ſails are placed ſo as to make an oblique angle both with the direction of the ſhip and with the wind; and the ſails, together with the rudder, muſt be managed in ſuch a manner, that the direction of the ſhip may make an acute angle with that of the wind; and the ſhip making boards on different tacks, will by this means arrive at the intended port.

The reaſon of the ſhip's motion in this caſe is, that the water reſiſts the ſide more than the fore-part, and that in the ſame proportion as her length exceeds her breadth. This proportion is ſo conſiderable, that the ſhip continually flies off where the reſiſtance is leaſt, and that ſometimes with great ſwiftneſs. In this way of ſailing, however, there is a great limitation: for if the angle made by the keel with the direction of the wind be too acute, the ſhip cannot be kept in that poſition; neither is it poſſible for a large ſhip to make a more acute angle with the wind than about 6 points; though ſmall ſloops, it is ſaid, may make an angle of about 5 points with it. In all theſe caſes, however, the velocity of the ſhip is greatly retarded; and that not only on account of the obliquity of her motion, but by reaſon of what is called her *lee-way*. This is occaſioned by the yielding of the water on the lee-ſide of the ſhip, by which means the veſſel acquires a compound motion, partly in the direction of the wind, and partly in that which is neceſſary for attaining the deſired port.

It is perhaps impoſſible to lay down any mathematical principles on which the lee-way of a ſhip could be properly calculated; only we may ſee in general that it depends on the ſtrength of the wind, the roughneſs of the ſea, and the velocity of the ſhip. When the wind is not very ſtrong, the reſiſtance of the water on the lee-ſide bears a very great proportion to that of the current of air; and therefore it will yield but very little: however, ſuppoſing the ſhip to remain

remain in the ſame place, it is evident, that the water having once begun to yield, will continue to do ſo for ſome time, even though no additional force was applied to it; but as the wind continually applies the ſame force as at firſt, the lee-way of the ſhip muſt go on conſtantly increaſing till the reſiſtance of the water on the lee-ſide balances the force applied on the other, when it will become uniform, as doth the motion of a ſhip ſailing before the wind. If the ſhip changes her place with any degree of velocity, then every time ſhe moves her own length, a new quantity of water is to be put in motion, which hath not yet received any momentum, and which of conſequence will make a greater reſiſtance than it can do when the ſhip remains in the ſame place. In proportion to the ſwiftneſs of the ſhip, then, the lee-way will be the leſs: but if the wind is very ſtrong, the velocity of the ſhip bears but a ſmall proportion to that of the current of air; and the ſame effects muſt follow as though the ſhip moved ſlowly, and the wind was gentle; that is, the ſhip muſt make a great deal of lee-way.—The ſame thing happens when the ſea riſes high, whether the wind is ſtrong or not; for then the whole water of the ocean, as far as the ſwell reaches, has acquired a motion in a certain direction, and that to a very conſiderable depth. The mountainous waves will not fail to carry the ſhip very much out of her courſe; and this deviation will certainly be according to their velocity and magnitude. In all caſes of a rough ſea, therefore, a great deal of lee-way is made.—Another circumſtance alſo makes a variation in the quantity of the lee-way; namely, the lightneſs or heavineſs of the ſhip; it being evident, that when the ſhip ſinks deep in the water, a much greater quantity of that element is to be put in motion before ſhe can make any lee-way, than when ſhe ſwims on the ſurface. As therefore it is impoſſible to calculate all theſe things with mathematical exactneſs, it is plain that the real courſe of a ſhip is exceedingly difficult to be found, and frequent errors muſt be made, which can only be corrected by celeſtial obſervations.

In many places of the ocean there are *currents*, or places where the water, inſtead of remaining at reſt, runs with a very conſiderable velocity for a great way in ſome particular direction, and which will certainly carry the ſhip greatly out of her courſe. This occaſions an error of the ſame nature with the lee-way; and therefore, whenever a current is perceived, its direction and velocity ought to be determined, and the proper allowances made.

Another ſource of error in reckoning the courſe of a ſhip proceeds from the variation of the compaſs. There are few parts of the world where the needle points exactly north; and in thoſe where the variation is known, it is ſubject to very conſiderable alterations. By theſe means the courſe of the ſhip is miſtaken; for as the ſailors have no other ſtandard to direct them than the compaſs, if the needle, inſtead of pointing due north, ſhould point north-eaſt, a prodigious error would be occaſioned during the courſe of the voyage, and the ſhip would not come near the port to which ſhe was bound. To avoid errors of this kind, the only method is, to obſerve the ſun's amplitude and azimuth as frequently as poſſible, by which the variation of the compaſs will be perceived, and the proper allowances can then be made for errors in the courſe which this may have occaſioned.

Errors will ariſe in the reckoning of a ſhip, eſpecially when ſhe ſails in high latitudes, from the ſpheroidal figure of the earth; for as the polar diameter of our globe is found to be conſiderably ſhorter than the equatorial one, it thence follows, that the farther we remove from the equator, the longer are the degrees of latitude. Of conſequence, if a navigator aſſigns any certain number of miles for the length of a degree of latitude near the equator, he muſt vary that meaſure as he approaches towards the poles, otherwiſe he will imagine that he hath not ſailed ſo far as he actually hath done. It would therefore be neceſſary to have a table containing the length of a degree of latitude in every different parallel from the equator to either pole; as without this a troubleſome calculation muſt be made at every time the navigator makes a reckoning of his courſe. Such a table, however, hath not yet appeared; neither indeed does it ſeem to be an eaſy matter to make it, on account of the difficulty of meaſuring the length even of one or two degrees of latitude in different parts of the world. Sir Iſaac Newton firſt diſcovered this ſpheroidal figure of the earth; and ſhowed, from experiments on pendulums, that the polar diameter was to the equatorial one as 229 to 230. This proportion, however, hath not been admitted by ſucceeding calculators. The French mathematicians, who meaſured a degree on the meridian in Lapland, made the proportion between the equatorial and polar diameters to be as 1 to 0.9891. Thoſe who meaſured a degree at Quito in Peru, made the proportion 1 to 0.99624, or 266 to 265. M. Bouguer makes the proportion to be as 179 to 178; and M. Buffon, in one part of his theory of the earth, makes the equatorial diameter exceed the polar one by $\frac{1}{165}$ of the whole. According to M. du Sejour, this proportion is as 321 to 320; and M. de la Place, in his Memoir upon the Figure of Spheroids, has deduced the ſame proportion. From theſe variations it appears that the point is not exactly determined, and conſequently that any corrections which can be made with regard to the ſpheroidal figure of the earth muſt be very uncertain.

It is of conſequence to navigators in a long voyage to take the neareſt way to their port; but this is ſcarcely poſſible to be done. The ſhorteſt diſtance between any two points on the ſurface of a ſphere is meaſured by an arch of a great circle intercepted between them; and therefore it is adviſeable to direct the ſhip along a great circle of the earth's ſurface. But this is a matter of conſiderable difficulty, becauſe there are no fixed marks by which it can be readily known whether the ſhip ſails in the direction of a great circle or not. For this reaſon the ſailors commonly chooſe to direct their courſe by the rhumbs, or the bearing of the place by the compaſs. Theſe bearings do not point out the ſhorteſt diſtance between places; becauſe, on a globe, the rhumbs are ſpirals, and not arches of great circles. However, when the places lie directly under the equator, or exactly under the ſame meridian, the rhumb then coincides with the arch of a great circle, and of conſequence ſhows the neareſt way. The ſailing on the arch of a great circle is called *great circle ſailing;* and the caſes of it depend all on the ſolution of problems in ſpherical trigonometry.

PRACTICE of NAVIGATION.

BOOK I.

Containing the various Methods of Sailing.

INTRODUCTION.

The art of navigation depends upon aſtronomical and mathematical principles. The places of the ſun and fixed ſtars are deduced from obſervation and calculation, and arranged in tables, the uſe of which is abſolutely neceſſary in reducing obſervations taken at ſea, for the purpoſe of aſcertaining the latitude and longitude of the ſhip, and the variation of the compaſs. The problems in the various ſailings are reſolved either by trigonometrical calculation, or by tables or rules formed by the aſſiſtance of trigonometry. By mathematics, the neceſſary tables are conſtructed, and rules inveſtigated for performing the more difficult parts of navigation. For theſe ſeveral branches of ſcience, and for logarithmic tables, the reader is referred to the reſpective articles in this work. A few tables are given at the end of this article; but as the other tables neceſſary for the practice of navigation are to be found in almoſt every treatiſe on that ſubject, it therefore ſeems unneceſſary to inſert them in this place.

Chap. I. *Preliminary Principles.*

Sect. I. *Of the Latitude and Longitude of a Place.*

The ſituation of a place on the ſurface of the earth is eſtimated by its diſtance from two imaginary lines interſecting each other at right angles: The one of theſe is called the *equator*, and the other the *firſt meridian*. The ſituation of the equator is fixed, but that of the firſt meridian is arbitrary, and therefore different nations aſſume different firſt meridians. In Britain, we eſteem that to be the firſt meridian which paſſes through the royal obſervatory at Greenwich.

The equator divides the earth into two equal parts, called the *northern* and *ſouthern hemiſpheres;* and the latitude of a place is its diſtance from the equator, reckoned on a meridian in degrees and parts of a degree; and is either north or ſouth, according as it is in the northern or ſouthern hemiſphere.

The firſt meridian being continued round the globe, divides it into two equal parts, called the *eaſtern* and *weſtern hemiſpheres;* and the longitude of a place is that portion of the equator contained between the firſt meridian and the meridian of the given place, and is either eaſt or weſt; according as it is in the eaſtern or weſtern hemiſphere, reſpectively to the firſt meridian.

Prob. I. The latitudes of two places being given, to find the difference of latitude.

Rule. Subtract the leſs latitude from the greater, if the latitudes be of the ſame name, but add them if of contrary; and the remainder or ſum will be the difference of latitude.

Example 1. Required the difference of latitude between the Lizard, in latitude 49° 57′ N. and Cape St Vincent, in latitude 37° 2′ N?

Latitude of the Lizard	49° 57′ N.	
Latitude of Cape St Vincent	37 2 N.	
Difference of latitude	12 55	= 775 miles.

Ex. 2. What is the difference of latitude between Funchal, in latitude 32° 38′ N, and the Cape of Good Hope, in latitude 34° 29′ S?

Latitude of Funchal	32° 38′ N.	
Lat. of Cape of Good Hope	34 29 S.	
Difference of latitude	67 7	= 4027 miles.

Prob. II. Given the latitude of one place, and the difference of latitude between it and another place, to find the latitude of that place.

Rule. If the given latitude and the difference of latitude be of the ſame name, add them; but if of different names, ſubtract them, and the ſum or remainder will be the latitude required of the ſame name with the greater.

Ex. 1. A ſhip from latitude 39° 22′ N. ſailed due north 560 miles—Required the latitude come to?

Latitude ſailed from - - -	39° 22′ N.
Difference of latitude 560′ - - =	9 20 N.
Latitude come to - - - - -	48 42 N.

Ex. 2. A ſhip from latitude 7° 19′ N. ſailed 854 miles ſouth—Required the latitude come to?

Latitude ſailed from - - -	7° 19′ N.
Difference of latitude 854′ - =	14 14 S.
Latitude come to - - - - -	6 55 S.

Prob. III. The longitudes of two places being given, to find their difference of longitude.

Rule. If the longitudes of the given places are of the ſame name, ſubtract the leſs from the greater, and the remainder is the difference of longitude: but if the longitudes are of contrary names, their ſum is the difference of longitude. If this exceeds 180°, ſubtract it from 360°, and the remainder is the difference of longitude.

Ex. 1. Required the difference of longitude between Edinburgh and New York, their longitudes being 3° 14′ W. and 74° 10′ W. reſpectively?

Longitude of New York - -	74° 10′ W.
Longitude of Edinburgh - -	3 14 W.
Difference of longitude - - -	70 56

Ex. 2. What is the difference of longitude between Maſkelyne's Iſles, in longitude 167° 59′ E, and Olinde, in longitude 35° 5′ W?

Longitude

Longitude of Maſkelyne's Iſles -	167°	59′ E.
Longitude of Olinde - - -	35	5 W.
Sum - - - - - - -	203	4
Subtract from - - - - -	360	0
Difference of longitude - -	156	56

PROB. IV. Given the longitude of a place, and the difference of longitude between it and another place, to find the longitude of that place.

RULE. If the given longitude and the difference of longitude be of a contrary name, ſubtract the leſs from the greater, and the remainder is the longitude required of the ſame name with the greater quantity; but if they are of the ſame name, add them, and the ſum is the longitude ſought, of the ſame name with that given. If this ſum exceeds 180°, ſubtract it from 360°, the remainder is the required longitude of a contrary name to that given.

Ex. 1. A ſhip from longitude 9° 54′ E. ſailed weſterly till the difference of longitude was 23° 18′—Required the longitude come to?

Longitude ſailed from - - - -	9°	54′ E.
Difference of longitude - - - -	23	18 W.
Longitude come to - - - -	13	24 W.

Ex. 2. The longitude ſailed from is 25° 9′ W. and difference of longitude 18° 46′ W.—Required the longitude come to?

Longitude left - - - - -	25°	9′ W.
Difference of longitude - - - -	18	46 W.
Longitude in - - - - -	43	55 W.

SECT. II. *Of the Tides.*

THE theory of the tides has been explained under the article ASTRONOMY, and will again be farther illuſtrated under that of TIDES. In this place, therefore, it remains only to explain the method of calculating the time of high water at a given place.

As the tides depend upon the joint actions of the ſun and moon, and therefore upon the diſtance of theſe objects from the earth and from each other; and as, in the method generally employed to find the time of high water, whether by the mean time of new moon, or by the epacts, or tables deduced therefrom, the moon is ſuppoſed to be the ſole agent, and to have an uniform motion in the periphery of a circle, whoſe centre is that of the earth; it is hence obvious that method cannot be accurate, and by obſervation the error is ſometimes found to exceed two hours. That method is therefore rejected, and another given, in which the error will ſeldom exceed a few minutes, unleſs the tides are greatly influenced by the winds.

PROB. I. To reduce the times of the moon's phaſes as given in the Nautical Almanac to the meridian of a known place.

RULE. To the time of the propoſed phaſe, as given in the Nautical Almanac, apply the longitude of the place in time, by addition or ſubtraction, according as it is eaſt or weſt, and it will give the time of the phaſe at the given place.

Ex. 1. Required the time of new moon at Salonique in May 1793?

Time of new moon per Naut. Alm.	9^d	15^h	31′
Longitude of Salonique in time -	0	1	33 E.
Time of new moon required, in May	9	17	4

Ex. 2. What is the time of the laſt quarter of the moon at Reſolution Bay in October 1793?

Time of laſt quarter per Naut. Alm.	26^d	5^h	47′
Longitude in time - - - -	0	9	17 W.
Time at Reſolution bay of laſt quarter, October - - - -	25	20	30, or

26th day at 8^h 30′ A. M.

PROB. II. To find the time of high water at a known place.

RULE. In the Nautical Almanac ſeek in the given month, or in that immediately preceding or following it, for the time of that phaſe which happens neareſt to the given day: reduce the time of this phaſe to the meridian of the given place by Prob. I. and take the difference between the reduced time and the noon of the given day.

Find the equation anſwering to this difference in Table VII. which applied to the time of high water on the day of new or full moon at the given place according as the table directs, will give the approximate time of high water in the afternoon.

Now, take the interval between the reduced time of the phaſe and the approximate time of high water; find the correſponding equation, which applied as before to the ſyzigy time of high water, will give the time of the afternoon high water.

If the time of the morning high water is required, increaſe the laſt interval by 12 hours, if the given day falls before the phaſe, or diminiſh it by 12 hours when after that phaſe; and the equation to this time, applied to the ſyzigy time, gives the morning time of high water.

Ex 1. Required the morning and afternoon times of high water at Leith, 11th December 1793?

Neareſt phaſe to 11th Dec. is 1ſt quart.	9^d	20^h	29′
Longitude of Leith in time -	—0	0	13
Time at Leith of 1ſt quarter -	9	20	16
Given day - - - - -	11	0	0
Difference - - - - -	1	3	44
Time of H. W. at Leith-pier on ſyz.	0	2	20
Equat. from Tab. to 1^d 3^h 44′ -	+0	6	32
Approximate time of high water	11	8	52
Reduced time of 1ſt quarter -	9	20	16
Interval - - - - - -	1	12	36
Time of high water at Leith on ſyz.		2	20
Equat. from the Tab. to 1^d 12^h 36′		7	0
Time of high water at Leith		9	20 P.M.
Time of H. W. at Leith at full & change		2	20
Equat. to 1^d 12^h 36′—12^h=1^d 0^h 36′		6	22
High water at Leith, Dec. 11th, at		8	42 A.M.

The time of high water found by the common method is about an hour and a half ſooner.

Ex. 2. Required the time of high water at Funchal, 15th November 1793?

The

Tides.

The neareſt phaſe to 15th November is that of full moon, - - - - - - 17d 8h 46′
Longitude of Funchal in time, - 0 1 8 W.

Time of full moon at Funchal,	17	7	38
Given day, November	15	0	0
Difference,	2	7	38
Time of high water at Funchal at full and change,	0	12	4
Equation from the Table to 2d 7h 38′ before full moon,	—0	1	35
Approx. time of high water, Nov.	15	10	29
Reduced time of full moon,	17	7	38
Interval,	1	11	9
Time of high water at full and change,		12	4
Equation to 1d 11h before full moon,		0	56
Time of high water,		11	8P.M.

Equation to 1d 11h + 12h=1d 23h is 1h 15′, and 12h 4′—1h 15′=10h 49′=time of high water in the forenoon.

Ex. 3. Required the time of high water at Duſkey Bay, 24th October 1793?

The neareſt phaſe to the 24th October is the laſt quarter, - - - - - - 26d 5h 47′
Longitude of Duſkey Bay in time, +0 11 5 E.

Reduced time of firſt quarter of moon	26	16	52
Given day	24	0	0
Difference,	2	16	52
Time of high water at full and change,		10	57
Equation to 2d 16h 52′ before laſt quarter,	+	2	52
Approximate time of high water,		1	49
Change of equation to app. time 1h 49′			3
Time of high water in the afternoon,		1	52
Change of equation to 12 hours,			20
Time of high water in the morning,		1	32

Sect. III. *Of meaſuring a Ship's Run in a given Time.*

The method commonly uſed at ſea to find the diſtance ſailed in a given time, is by means of a log-line and half minute-glaſs. A deſcription of theſe is given under the articles Log and Log-line; which ſee.

It has been already obſerved, that the interval between each knot on the line ought to be 50 feet, in order to adapt it to a glaſs that runs 30 ſeconds. But although the line and glaſs be at any time perfectly adjuſted to each other, yet as the line ſhrinks after being wet, and as the weather has a conſiderable effect upon the glaſs, it will therefore be neceſſary to examine them from time to time; and the diſtance given by them muſt be corrected accordingly. The diſtance ſailed may, therefore, be affected by an error in the glaſs, or in the line, or in both. The true diſtance may, however, be found as follows.

Ship's Run.

Prob. I. The diſtance ſailed by the log, and the ſeconds run by the glaſs, being given, to find the true diſtance, the line being ſuppoſed right.

Rule.—Multiply the diſtance given by the log by 30, and divide the product by the ſeconds run by the glaſs, the quotient will be the true diſtance.

Ex. 1. The hourly rate of ſailing by the log is nine knots, and the glaſs is found to run out in 35 ſeconds. Required the true rate of ſailing?

9
30
35)270(7.7=true rate of ſailing.

Ex. 2. The diſtance ſailed by the log is 73 miles, and the glaſs runs out in 26 ſeconds. Sought the true diſtance?

73
30
26)2190(84.2 the true diſtance.

Prob. II. Given the diſtance ſailed by the log, and the meaſured interval between two adjacent knots on the line; to find the true diſtance, the glaſs running exactly 30 ſeconds.

Rule. Multiply twice the diſtance ſailed by the meaſured length of a knot, point off two figures to the right, and the remainder will be the true diſtance.

Ex. 1. The hourly rate of ſailing by the log is five knots, and the interval between knot and knot meaſures 53 feet. Required the true rate of ſailing?

Meaſured interval = 53
Twice hourly rate = 10
True rate of ſailing = 5.30

Ex. 2. The diſtance ſailed is 64 miles, by a log-line which meaſures 42 feet to a knot. Required the true diſtance?

Twice given diſtance, = 128
Meaſured interval, 42
256
512
True diſtance, 53.76

Prob. III. Given the length of a knot, the number of ſeconds run by the glaſs in half a minute, and the diſtance ſailed by the log; to find the true diſtance.

Rule. Multiply the diſtance ſailed by the log by ſix times the meaſured length of a knot, and divide the product by the ſeconds run by the glaſs; the quotient, pointing off one figure to the right, will be the true diſtance.

Example. The diſtance ſailed by the log is 159 miles, the meaſured length of a knot is 42 feet, and the glaſs runs 33 ſeconds in half a minute. Required the true diſtance?

Diſtance by the log, 159
Six times length of a knot=42×6= 252
318
795
318
Second run by the glaſs = 33)40068(121.4= true diſtance.

Chap.

Plane Sailing.

Chap. II. *Of Plane Sailing.*

Plane failing is the art of navigating a fhip upon principles deduced from the notion of the earth's being an extended plane. On this fuppofition the meridians are efteemed as parallel right lines. The parallels of latitude are at right angles to the meridians; the lengths of the degrees on the meridians, equator, and parallels of latitude, are everywhere equal; and the degrees of longitude are reckoned on the parallels of latitude as well as on the equator.—In this failing four things are principally concerned, namely, the *courfe*, *diftance*, *difference of latitude*, and *departure*.

The courfe is the angle contained between the meridian and the line defcribed by the fhip, and is ufually expreffed in points of the compafs.

The diftance is the number of miles a fhip has failed on a direct courfe in a given time.

The difference of latitude is the portion of a meridian contained between the parallels of latitude failed from and come to; and is reckoned either north or fouth, according as the courfe is in the northern or fouthern hemifphere.

The departure is the diftance of the fhip from the meridian of the place fhe left, reckoned on a parallel of latitude. In this failing, the departure and difference of longitude are efteemed equal.

Plate CCCLXIII. In order to illuftrate the above, let A (fig. 1.) reprefent the pofition of any given place, and AB the meridian paffing through that place; alfo let AC reprefent the line defcribed by a fhip, and C the point arrived at. From C draw CB perpendicular to AB. Now in the triangle ABC, the angle BAC reprefents the courfe, the fide AC the diftance, AB the difference of latitude, and BC the departure.

In conftructing a figure relating to a fhip's courfe, let the upper part of what the figure is to be drawn on reprefent the *north*, then the lower part will be *fouth*, the right-hand fide *eaft*, and the left-hand fide *weft*.

A north and fouth line is to be drawn to reprefent the meridian of the place from which the fhip failed; and the upper or lower part of this line, according as the courfe is foutherly or northerly, is to be marked as the pofition of that place. From this point as a centre, with the chord of 60°, an arch is to be defcribed from the meridian towards the right or left, according as the courfe is eafterly or wefterly; and the courfe, taken from the line of chords if given in degrees, but from the line of rhumbs if expreffed in points of the compafs, is to be laid upon this arch, beginning at the meridian. A line drawn through this point and that failed from, will reprefent the diftance, which if given muft be laid thereon, beginning at the point failed from. A line is to be drawn from the extremity of the diftance perpendicular to the meridian; and hence the difference of latitude and departure will be obtained.

If the difference of latitude is given, it is to be laid upon the meridian, beginning at the point reprefenting the place the fhip left; and a line drawn from the extremity of the difference of latitude perpendicular to the meridian, till it meets the diftance produced, will limit the figure.

If the departure is given, it is to be laid off on a parallel, and a line drawn through its extremity will limit the diftance. When either the diftance and difference of latitude, diftance and departure, or difference of latitude and departure, are given, the meafure of each is to be taken from a fcale of equal parts, and laid off on its refpective line, and the extremities connected. Hence the figure will be formed.

Prob. I. Given the courfe and diftance, to find the difference of latitude and departure.

Example. A fhip from St Helena, in latitude 15° 55′ S. failed S. W. by S. 158 miles. Required the latitude come to, and departure?

By Conftruction.

Draw the meridian AB (fig. 2.), and with the chord of 60° defcribe the arch *m n*, and make it equal to the rhumb of 3 points, and through *n* draw AC equal to 158 miles; from C, draw CB perpendicular to AB; then AB applied to the fcale from which AC was taken, will be found to meafure 131.4 and BC 87.8.

By Calculation.

To find the difference of latitude.

As radius	- - - - -		10.00000
is to the cofine of the courfe	3 points		9.91985
fo is the diftance	- 158	- -	2.19866
to the difference of latitude	131.4	-	2.11851

To find the departure.

As radius	- - - - -		10.00000
is to the fine of the courfe	- 3 points	-	9.74474
fo is the diftance	- - 158	-	2.19866
to the departure	- 87.8	-	1.94340

By Infpection.

In the traverfe table, the difference of latitude anfwering to the courfe 3 points, and diftance 158 miles, in a diftance column is 131.4, and departure 87.8.

By Gunter's Scale.

The extent from 8 points to 5 points, the complement of the courfe on the line of fine rhumbs (marked SR.) will reach from the diftance 158 to 131.4, the difference of latitude on the line of numbers; and the extent from 8 points to 3 points on fine rhumbs, will reach from 158 to 87.8, the departure on numbers (A).

Latitude St Helena	=	15° 55′ S.
Difference of latitude	-	2 11 S.
Latitude come to	-	18 6 S.

Prob. II. Given the courfe and difference of latitude, to find the diftance and departure.

Example.

(A) For the method of refolving the various problems in navigation, by the fliding gunter, the reader is referred to Dr Mackay's Treatife on the Defcription and Ufe of that Inftrument.

Plane Sailing.

Example. A ſhip from St George's, in latitude 38° 45′ north, ſailed SE¼S: and the latitude by obſervation was 35° 7′ N. Required the diſtance run, and departure?

Latitude St George's	-	38° 45′ N
Latitude come to	-	35 7 N
Difference of latitude	-	3 38=218 miles.

By Conſtruction.

Draw the portion of the meridian AB (fig. 3.) equal to 218 m.: from the centre A with the chord of 60° deſcribe the arch *m n*, which make equal to the rhumb of 3¼ points: through A *n* draw the line AC, and from B draw BC perpendicular to AB, and let it be produced till it meets AC in C. Then the diſtance AC being applied to the ſcale, will meaſure 282 m. and the departure BC 179 miles.

By Calculation.

To find the diſtance.

As radius - - - - -		10.00000
is to the ſecant of the courſe	3¼ points	10.11181
ſo is the difference of latitude -	218 m.	2.33846
to the diſtance - -	282 -	2.45027

To find the departure.

As radius - - - - -		10.00000
is to the tangent of the courſe	3¼ points -	9.91417
ſo is the difference of latitude	218 -	2.33846
to the departure - -	178.9 -	2.25253

By Inſpection.

Find the given difference of latitude 218 m. in a latitude column, under the courſe of 3¼ points; oppoſite to which, in a diſtance column, is 282 miles; a departure column is 178.9 m. the diſtance and departure required.

By Gunter's Scale.

Extend the compaſs from 4¾ points, the complement of the courſe, to 8 points on ſine rhumbs, that extent will reach from the difference of latitude 218 miles, to the diſtance 282 miles in numbers; and the extent from 4 points to the courſe 3¼ points on the line of tangent rhumbs (marked T. R.) will reach from 218 miles to 178.9, the departure on numbers.

Prob. III. Given courſe and departure, to find the diſtance and difference of latitude?

Example. A ſhip from Palma, in latitude 28° 37′ N. ſailed NW. by W. and made 192 miles of departure: Required the diſtance run, and latitude come to?

By Conſtruction.

Make the departure BC (fig. 4.) equal to 192 miles, draw BA perpendicular to BC, and from the centre C, with the chord of 60°, deſcribe the arch *m n*, which make equal to the rhumb of 3 points, the complement of the courſe; draw a line through C *n*, which produce till it meets BA in A: then the diſtance AC being meaſured, will be equal to 231 m. and the difference of latitude AB will be 128.3 miles.

By Calculation.

To find the diſtance.

As the ſine of the courſe	5 points	9.91985
is to radius - - - - -		10.00000
ſo is the departure - -	192	2.28330
to the diſtance - -	230.9 -	2.36345

To find the difference of latitude.

As the tangent of the courſe	5 points	10.17511
is to radius - - - - -		10.00000
ſo is the departure - -	192	2.28330
to the difference of latitude	128.3	2.10819

By Inſpection.

Find the departure 192 m. in its proper column above the given courſe 5 points; and oppoſite thereto is the diſtance 231 miles, and difference of latitude 138.3, in their reſpective columns.

By Gunter's Scale.

The extent from 5 points to 8 points on the line of ſine rhumbs, being laid from the departure 192 on numbers, will reach to the diſtance 231 on the ſame line; and the extent from 5 points to 4 points on the line of tangent rhumbs, will reach from the departure 192, to the difference of latitude 128.3 on numbers.

Latitude of Palma	- - -	28° 37′ N
Difference of latitude	- - -	2 8 N
Latitude come to	- - - -	30 45 N

Prob. IV. Given the diſtance and difference of latitude, to find the courſe and departure.

Example. A ſhip from a place in latitude 43° 13′ N, ſails between the north and eaſt 285 miles; and is then by obſervation found to be in latitude 46° 31′ N: Required the courſe and departure?

Latitude ſailed from	- -	43° 13′ N
Latitude by obſervation	- -	46 31 N
Difference of latitude	- -	3 18=198 miles.

By Conſtruction.

Draw the portion of the meridian AB (fig. 5.) equal to 198 miles; from B draw BC perpendicular to AB: then take the diſtance 285 miles from the ſcale, and with one foot of the compaſs in A deſcribe an arch interſecting BC in C, and join AC. With the chord of 60° deſcribe the arch *m n*, the portion of which, contained between the diſtance and difference of latitude, applied to the line of chords, will meaſure 46°, the courſe; and the departure BC being meaſured on the line of equal parts, will be found equal to 205 miles.

By Calculation.

To find the courſe.

As the diſtance - -	285 -	2.45484
is to the difference of latitude	198 -	2.29660
ſo is the radius - - - -		10.00000
to the coſine of the courſe -	46° 0′ -	9.84176

To

Plane Sailing.

To find the departure.

As radius			10.00000
is to the fine of the courfe	46° 0′	-	9.85693
fo is the diftance	285	-	2.45484
to the departure	205	-	2.31177

By Infpection.

Find the given diftance in the table in its proper column; and if the difference of latitude anfwering thereto is the fame as that given, namely, 198, then the departure will be found in its proper column, and the courfe at the top or bottom of the page, according as the difference of latitude is found in a column marked *lat.* at top or bottom. If the difference of latitude thus found does not agree with that given, turn over till the neareft thereto is found to anfwer to the given diftance. This is in the page marked 46 degrees at the bottom, which is the courfe, and the correfponding departure is 205 miles.

By Gunter's Scale.

The extent from the diftance 285 to the difference of latitude 198 on numbers, will reach from 90° to 44°, the complement of the courfe on fines; and the extent from 90° to the courfe 46° on the line of fines being laid from the diftance 285, will reach to the departure 205 on the line of numbers.

PROB. V. Given the diftance and departure, to find the courfe and difference of latitude.

Example. A fhip from Fort-Royal in the ifland of Grenada, in latitude 12° 9′ N, failed 260 miles between the fouth and weft, and made 190 miles of departure: Required the courfe and latitude come to?

By Conftruction.

Fig. 6. Draw BC (fig. 6.) perpendicular to AB, and equal to the given departure 190 miles; then from the centre C, with the diftance 260 miles, fweep an arch interfecting AB in A, and join AC. Now defcribe an arch from the centre A with the chord of 60°, and the portion *m n* of this arch, contained between the diftance and difference of latitude, meafured on the line of chords, will be 47° the courfe; and the difference of latitude AB applied to the fcale of equal parts, meafures $177\frac{1}{2}$ miles.

By Calculation.

To find the courfe.

As the diftance	260	-	2.41497
is to the departure	190	-	2.27875
fo is radius			10.00000
to the fine of the courfe	46° 57′	-	9.86378

To find the difference of latitude.

As radius			10.00000
is to the cofine of the courfe	46° 57′	-	9.83419
fo is the diftance	260	-	2.41497
to the difference of latitude	177.5	-	2.24916

By Infpection.

Seek in the traverfe table until the neareft to the given departure is found in the fame line with the given diftance 260. This is found to be in the page marked 47° at the bottom, which is the courfe; and the correfponding difference of latitude is 177.3.

By Gunter's Scale.

The extent of the compafs, from the diftance 260 to the departure 190 on the line of numbers, will reach from 90° to 47°, the courfe on the line of fines: and the extent from 90° to 43°, the complement of the courfe on fines, will reach from the diftance 260 to the difference of latitude $177\frac{1}{2}$ on the line of numbers.

Latitude Fort-Royal			12° 9′ N
Difference of latitude	177	-	=2 57 S
Latitude in			9 12 N

PROB. VI. Given difference of latitude and departure, fought courfe and diftance.

Example. A fhip from a port in latitude 7° 56′ S, failed between the fouth and eaft, till her departure is 132 miles; and is then by obfervation found to be in latitude 12° 3′ S. Required the courfe and diftance?

Latitude failed from	-	7° 56′ S.
Latitude in by obfervation	-	12 3 S.
Difference of latitude	-	4 7=247.

By Conftruction.

Draw the portion of the meridian AB (fig. 7.) equal to the difference of latitude 247 miles; from B draw BC perpendicular to AB, and equal to the given departure 132 miles, and join AC: then with the chord of 60° defcribe an arch from the centre A; and the portion *m n* of this arch being applied to the line of chords, will meafure about 28°; and the diftance AC, meafured on the line of equal parts, will be 280 miles. Fig. 7.

By Calculation.

To find the courfe.

As the difference of latitude	247	2.39270
is to the departure	132	2.12057
fo is radius		10.00000
to the tangent of the courfe	28° 7′	9.72787

To find the diftance.

As radius			10.00000
is to the fecant of the courfe	28° 7′	-	10.05454
fo is the difference of latitude	247	-	2.39270
to the diftance	280	-	2.44724

By Infpection.

Seek in the table till the given difference of latitude and departure, or the neareft thereto, are found together in their refpective columns, which will be under 28°, the required courfe; and the diftance anfwering thereto is 280 miles.

By Gunter's Scale.

The extent from the given difference of latitude 247 to the departure 132 on the line of numbers, will reach from 45° to 28°, the courfe on the line of tangents; and the extent from 62°, the complement of the courfe, to 90° on fines, will reach from the difference of latitude 247, to the diftance 280 on numbers.

CHAP. III. *Of Traverfe Sailing.*

IF a fhip fail upon two or more courfes in a given time, the irregular track fhe defcribes is called a *traverfe;* and to refolve a traverfe, is the method of reducing thefe feveral courfes, and the diftances run, into

Traverse Sailing.

to a single course and distance. The method chiefly used for this purpose at sea is by inspection, which shall therefore be principally adhered to; and is as follows.

Make a table of a breadth and depth sufficient to contain the several courses, &c. This table is to be divided into six columns: the courses are to be put in the first, and the corresponding distances in the second column; the third and fourth columns are to contain the differences of latitude, and the two last the departures.

Now, the several courses and their corresponding distances being properly arranged in the table, find the difference of latitude and departure answering to each in the traverse table; remembering that the difference of latitude is to be put in a north or south column, according as the course is in the northern or southern hemisphere; and that the departure is to be put in an east column if the course is easterly, but in a west column if the course is westerly: Observing also, that the departure is less than the difference of latitude when the course is less than 4 points or 45°; otherwise greater.

Add up the columns of northing, southing, easting, and westing, and set down the sum of each at its bottom; then the difference between the sums of the north and south columns will be the difference of latitude made good, of the same name with the greater; and the difference between the sums of the east and west columns, is the departure made good, of the same name with the greater sum.

Now, seek in the traverse table, till a difference of latitude and departure are found to agree as nearly as possible with those above; then the distance will be found on the same line, and the course at the top or bottom of the page, according as the difference of latitude is greater or less than the departure.

In order to resolve a traverse by construction, describe a circle with the chord of 60°, in which draw two diameters at right angles to each other, at whose extremities are to be marked the initials of the cardinal points, north being uppermost.

Lay off each course on the circumference, reckoned from its proper meridian; and from the centre to each point draw lines, which are to be marked with the proper number of the course.

On the first radius lay off the first distance from the centre; and through its extremity, and parallel to the second radius, draw the second distance of its proper length; through the extremity of the second distance, and parallel to the third radius, draw the third distance of its proper length; and thus proceed until all the distances are drawn.

A line drawn from the extremity of the last distance to the centre of the circle will represent the distance made good: and a line drawn from the same point perpendicular to the meridian, produced, if necessary, will represent the departure; and the portion of the meridian intercepted between the centre and departure, will be the difference of latitude made good.

EXAMPLES.

I. A ship from Fyal, in lat. 38° 32′ N, sailed as follows: ESE 163 miles, SW ½ W 110 miles, SE ¼ S 180 miles, and N by E 68 miles. Required the latitude come to, the course, and distance made good?

By Inspection.

Course.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
ESE	163	—	62.4	150.6	—
SW½W	110	—	69.8	—	85.0
SE¼S	180	—	144.5	107.2	—
N*b*E	68	66.7	—	13.3	—
		66.7	276.7	271.1	85.0
			66.7	85.0	
S41½E	281		210.0	186.1	

Latitude left	- -	38° 32′ N.
Difference of latitude	-	3 21 S.
Latitude come to	-	35 11 N.

By Construction.

With the chord of 60° describe the circle NE, SW (fig. 8.), the centre of which represents the place the ship sailed from: draw two diameters NS, EW at right angles to each other; the one representing the meridian, and the other the parallel of latitude of the place sailed from. Take each course from the line of rhumbs, lay it off on the circumference from its proper meridian, and number it in order 1, 2, 3, 4. Upon the first rhumb C1, lay off the first distance 163 miles from C to A; through it draw the second distance AB parallel to C2, and equal to 110 miles; through B draw BD equal to 180 miles, and parallel to C3; and draw DE parallel to C4, and equal to 68 miles. Now CE being joined, will represent the distance made good; which applied to the scale will measure 281 miles. The arch S*n*, which represents the course, being measured on the line of chords, will be found equal to 41½°. From E draw EF perpendicular to CS produced; then CF will be the difference of latitude, and FE the departure made good; which applied to the scale will be found to measure 210 and 186 miles respectively. Fig. 8.

As the method by construction is scarcely ever practised at sea, it, therefore, seems unnecessary to apply it to the solution of the following examples.

II. A ship from latitude 1° 38′ S. sailed as under. Required her present latitude, course, and distance made good?

Course.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
NW*b*N	43	35.8	—	—	23.9
WNW	78	29.9	—	—	72.1
SE*b*E	56	—	31.1	46.6	—
WSW½W	62	—	18.0	—	59.3
N¼E	85	84.1	—	12.5	—
		149.8	49.1	59.1	155.3
		49.1			59.1
N 44° W	139	100.7=1° 41′			96.2

Latitude left	-	1 38 S.
Latitude come to		0 3 N.

III.

Traverse Sailing.

III. Yesterday at noon we were in latitude 13° 12′ N, and since then have run as follows: SSE 36 miles, S 12 miles, NW ½ W 28 miles, W 30 miles, SW 42 miles, W*b*N 39 miles, and N 20 miles. Required our present latitude, departure, and direct course and distance?

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
SSE	3	—	33.3	3.8	—
S	162	—	12.0	—	—
NW½W	28	17.8	—	—	21.6
W	30	—	—	—	30.0
SW	42	—	29.7	—	29.7
W*b*N	39	7.6	—	—	38.2
N	20	20.0	—	—	—
		45.4	75.0	13.8	119.5
			45.4		13.8
S 74° W	110		29.6=0°30′		105.7
Yesterday's latitude		-	13 12 N		
Present latitude		-	12 42 N		

IV. The course per compass from Greigsness (B) to the May is SW ¼ S, distance 58 miles; from the May to the Staples S*b*E ¾ E, 44 miles; and from the Staples to Flamborough Head S*b*E, 110 miles. Required the course per compass, and distance from Greigsness to Flamborough Head?

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
SW ¼ S	58	—	43.0	—	38.9
S*b*E ¾ E	44	—	41.4	14.8	—
S*b*E	11	—	107.9	21.5	—
			192.3	36.3	38.9
					36.3
					2.6

Hence the course per compass is nearly S 1° W, and distance 192⅓ miles.

Chap. IV. *Of Parallel Sailing.*

Parallel Sailing.

The figure of the earth is spherical, and the meridians gradually approach each other, and meet at the poles. The difference of longitude between any two places is the angle at the pole contained between the meridians of those places; or it is the arch of the equator intercepted between the meridians of the given places; and the meridian distance between two places in the same parallel, is the arch thereof contained between their meridians. It hence follows, that the meridian distance, answering to the same difference of longitude, will be variable with the latitude of the parallel upon which it is reckoned; and the same difference of longitude will not answer to a given meridian distance when reckoned upon different parallels.

Parallel sailing is, therefore, the method of finding the distance between two places lying in the same parallel whose longitudes are known; or, to find the difference of longitude answering to a given distance, run in an east or west direction. This sailing is particularly useful in making low or small islands.

In order to illustrate the principles of parallel sailing, let C A B P (fig. 9.) represent a section of one fourth part of the earth, the arch A B P being part of a meridian; C A the equatorial, and C P the polar semi-axis. Also let B be the situation of any given place on the earth; and join BC, which will be equal to C A or C P (C). The arch A B, or angle A C B, is the measure of the latitude of the place B; and the arch B P, or angle B C P, is that of its complement. If B D be drawn from B perpendicular to C P, it will represent the cosine of latitude to the radius B C or C A. Fig. 9.

Now since circles and similar portions of circles are in the direct ratio of their radii; therefore,

As radius
Is to the cosine of latitude;
So is any given portion of the equator
To a similar portion of the given parallel.

But the difference of longitude is an arch of the equator; and the distance between any two places under the same parallel, is a similar portion of that parallel.

Hence R : cosine latitude :: Diff. longitude : Distance.

And by inversion,

Cosine latitude : R :: Distance : Diff. of longitude.

Also,

Diff. of longitude : Distance :: R : cos. latitude.

Prob. I. Given the latitude of a parallel, and the number of miles contained in a portion of the equator, to find the miles contained in a similar portion of that parallel.

Ex. 1. Required the number of miles contained in a degree of longitude in latitude 55° 58?

By Construction.

Draw the indefinite right line A B (fig. 10.); make the angle B A C equal to the given latitude 55° 58′, and A C equal to the number of miles contained in a degree of longitude at the equator, namely 60: from C draw CB perpendicular to AB; and AB being measured on the line of equal parts, will be found equal to 33.5, the miles required. Fig. 10.

(B) Greigsness is about 2½ miles distant from Aberdeen, in nearly a SE*b*E½E direction.

(C) This is not strictly true, as the figure of the earth is that of an oblate spheroid; and therefore the radius of curvature is variable with the latitude. The difference between CA and CP, according to Sir Isaac Newton's hypothesis, is about 17 miles.

Parallel Sailing.

By Calculation.

As radius - - - - -		10.00000
is to the cofine of latitude, -	55° 58′	9.74794
ſo is miles in a deg. of long. at eq.	60	1.77815
to the miles in a deg. in the given par.	33.58	1.52609

By Inſpection.

To 56°, the neareſt degree to the given latitude, and diſtance 60 miles, the correſponding difference of latitude is 33.6, which is the miles required.

By Gunter's Scale.

The extent from 90° to 34°, the complement of the given latitude on the line of ſines, will reach from 60 to 33.6 on the line of numbers.

There are two lines on the other ſide of the ſcale, with reſpect to Gunter's line, adapted to this particular purpoſe; one of which is entitled *chords*, and contains the ſeveral degrees of latitude: The other, marked M. L. ſignifying *miles of longitude*, is the *line of longitudes*, and ſhows the number of miles in a degree of longitude in each parallel. The uſe of theſe lines is therefore obvious.

Ex. 2. Required the diſtance between Treguier in France, in longitude 3° 14′ W, and Gaſpey Bay, in longitude 64° 27′ W, the common latitude being 48° 47′ N?

Longitude Treguier -	3° 14′ W
Longitude Gaſpey Bay -	64 27 W
Difference of longitude	61 13=3673′

As radius - - - - - -		10.00000
is to the cofine of latitude,	48° 47′ -	9.81882
ſo is the difference of longitude	3673 -	3.56502
to the diſtance . - -	2420 -	3.38384

Prob. II. Given the number of miles contained in a portion of a known parallel, to find the number of miles in a ſimilar portion of the equator.

Example. A ſhip from Cape Finiſterre, in latitude 42° 52′ N, and longitude 9° 17′ W, ſailed due weſt 342 miles. Required the longitude come to?

By Conſtruction.

Fig. 11. Draw the ſtraight line AB (fig. 11.) equal to the given diſtance 342 miles, and make the angle BAC equal to 42° 52′, the given latitude: from B draw BC perpendicular to AB, meeting AC in C; then AC applied to the ſcale will meaſure $466\frac{1}{2}$, the difference of longitude required.

By Calculation.

As radius - - - - -		10.00000
is to the ſecant of latitude, -	42° 52′ -	10.13493
ſo is the diſtance - -	342 -	2.53403
to the difference of longitude -	466.6	2.66896

By Inſpection.

The neareſt degree to the given latitude is 43°; under which, and oppoſite to 171, half the given diſtance in a latitude column, is 234, in a diſtance column, which doubled gives 468, the difference of longitude.

If the proportional part anſwering to the difference between the given latitude and that uſed, be applied to the above, the ſame reſult with that found by calculation will be obtained.

Parallel Sailing.

By Gunter's Scale.

The extent from 47° 8′, the complement of latitude to 90° on the line of ſines, being laid the ſame way from the diſtance 342, will reach to the difference of longitude $466\frac{1}{2}$ on the line of numbers.

Longitude Cape Finiſterre - -	9° 17′W
Difference of longitude - - -	7 47 W.
Longitude come to - - -	17 4W

Prob. III. Given the number of miles contained in any portion of the equator, and the miles in a ſimilar portion of a parallel; to find the latitude of that parallel.

Example. A ſhip ſailed due eaſt 358 miles, and was found by obſervation to have differed her longitude 8° 42′. Required the latitude of the parallel?

By Conſtruction.

Make the line AB (fig. 12.) equal to the given diſtance; to which let BC be drawn perpendicular, with an extent equal to 522′, the difference of longitude; deſcribe an arch from the centre A, cutting BC in C; then the angle BAC being meaſured by means of the line of chords, will be found equal to $46°\frac{2}{3}$, the required latitude. Fig. 12.

By Calculation.

As the diſtance - -	358 -	2.55388
is to the difference of longitude,	522 -	2.71767
ſo is radius - - - - -		10.00000
to the ſecant of the latitude, -	46° 42′	10.16379

By Inſpection.

As the difference of longitude and diſtance exceed the limits of the table, let therefore the half of each be taken; theſe are 261 and 179 reſpectively. Now, by entering the table with theſe quantities, the latitude will be found to be between 46 and 47 degrees. Therefore, to latitude 46°, and diſtance 261 miles, the correſponding difference of latitude is 181′.3, which exceeds the half of the given diſtance by 2′.3. Again, to latitude 47°, and diſtance 261, the difference of latitude is 170′.0, being 1′.0 leſs than the half of that given: therefore the change of diſtance anſwering to a change of 1° of latitude is 3′.3.

Now, as 3′.3 : 2′.3 :: 1° : 42′.

Hence the latitude required is 46° 42′.

By Gunter's Scale.

The extent from 522 to 358 on the line of numbers, will reach from 90° to about $43°\frac{1}{3}$, the complement of which $46\frac{2}{3}$ is the latitude required?

Prob. IV. Given the number of miles contained in the portion of a known parallel, to find the length of a ſimilar portion of another known parallel.

Example. From two ports in latitude 33° 58′ N, diſtance 348 miles, two ſhips ſail directly north till they are in latitude 48° 23′ N. Required their diſtance?

By Conſtruction.

Draw the lines CB, CE (fig. 13.), making angles with Fig. 13.

Parallel Sailing.

with CP equal to the complements of the given latitudes, namely, 56° 2′ and 41° 37′ respectively: make BD equal to the given distance 348 miles, and perpendicular to CP; now from the centre C, with the radius CB, describe an arch intersecting CE in E; then EF drawn from the point E, perpendicular to CP, will represent the distance required; which being applied to the scale, will measure $278\frac{1}{2}$ miles.

By Calculation.

As the cosine of the latitude left	33° 58′	9.91874
is to the cosine of the lat. come to	48 23	9.82226
so is the given distance -	348	2.54158
to the distance required -	278.6	2.44510

By Inspection.

Under 34°, and opposite to 174, half the given distance in a latitude column is 210 in a distance column; being half the difference of longitude answering thereto. Now, find the difference of latitude to distance 210 miles over 48° of latitude, which is 140′.5; from which 1′.1 (the proportional part answering to 23 minutes of latitude) being subtracted, gives 139′.4 which doubled is 278′.8, the distance required.

By Gunter's Scale.

The extent from 56° 2′, the complement of the latitude left, to 41° 37′, the complement of that come to, on the line of sines, being laid the same way from 348, will reach to $278\frac{1}{2}$, the distance sought on the line of numbers.

Prob. V. Given a certain portion of a known parallel, together with a similar portion of an unknown parallel; to find the latitude of that parallel.

Example. Two ships, in latitude 56° 0′ N, distant 180 miles, sail due south; and having come to the same parallel, are now 232 miles distant. The latitude of that parallel is required?

By Construction.

Fig. 14. Make DB (fig. 14.) equal to the first distance 180 miles, DM equal to the second 232, and the angle DBC equal to the given latitude 56°; from the centre C, with the radius CB, describe the arch BE; and through M draw ME parallel to CD, intersecting the arch BE in E; join EC and draw EF perpendicular to CD: then the angle FEC will be the latitude required; which being measured, will be found equal to 43° 53′.

By Calculation.

As the distance on the known parallel	180	2.25527
is to the distance on that required	232	2.36549
so is the cosine of the latitude left	56° 0′	9.74756
to the cosine of the latitude come to	43 53	9.85778

By Inspection.

To latitude 56°, and half the first distance 90 in a latitude column, the corresponding distance is 161, which is half the difference of longitude. Now 161, and 116, half the second distance, are found to agree between 43 and 44 degrees; therefore, to latitude 43° and distance 161, the corresponding difference of latitude is 117′.7; the excess of which above 116′ is 1′.7: and to latitude 44°, and distance 161, the difference of latitude is 115′.8: hence 117′.7—115.8=1′.9, the change answering to a difference of 1° of latitude.

Middle Latitude Sailing.

Therefore, 1′.9 : 1′.7 :: 1° : 53′

Hence, the latitude is 43° 53′.

By Gunter's Scale.

The extent from 180 to 232 on the line of numbers, being laid in the same direction on the line of sines, from 34°, the complement of the latitude sailed from, will reach to 46° 7′, the complement of the latitude come to.

Chap. V. *Of Middle Latitude Sailing.*

The earth is a sphere, and the meridians meet at the poles; and since a rhumb-line makes equal angles with every meridian, the line a ship describes is, therefore, that kind of a curve called a *spiral*.

Let AB (fig. 15.) be any given distance sailed upon an oblique rhumb, PBN, PAM the extreme meridians, MN a portion of the equator, and PCK, PEL two meridians intersecting the distance AB in the points CE infinitely near each other. If the arches BS, CD, and AR, be described parallel to the equator, it is hence evident, that AS is the difference of latitude, and the arch MN of the equator, the difference of longitude, answering to the given distance AB and course PAB. Fig. 15.

Now, since CE represents a very small portion of the distance AB, DE will be the correspondent portion of a meridian: hence the triangle EDC may be considered as rectilineal. If the distance be supposed to be divided into an infinite number of parts, each equal to CE, and upon these, triangles be constructed whose sides are portions of a meridian and parallel, it is evident these triangles will be equal and similar; for, besides the right angle, and hypothenuse which is the same in each, the course or angle CED is also the same. Hence, by the 12th of V. Euc. the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides DE, or the difference of latitude AS, as one of the hypothenuses CE is to the corresponding side DE. Now, let the triangle GIH (fig. 16.) be constructed similar to the triangle CDE, having the angle G equal to the course: then as GH : GI :: CE : DC :: AB : AS. Fig. 16.

Hence, if GH be made equal to the given distance AB, then GI will be the corresponding difference of latitude.

In like manner, the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides CD, as CE is to CD, or as GH to HI, because of the similar triangles.

The several parts of the same rectilineal triangle will, therefore, represent the course, distance, difference of latitude, and departure.

Although the parts HG, GI, and angle G of the rectilineal triangle GIH, are equal to the corresponding parts AB, AS, and angle A, of the triangle ASB upon the surface of the sphere; yet HI is not equal to BS, for HI is the sum of all the arcs CD; but CD is greater than OQ, and less than ZX: therefore HI is greater than BS, and less than AR. Hence the difference of longitude MN cannot be inferred from the departure reckoned either upon the parallel sailed from, or on that come to, but on some intermediate parallel

TV,

Middle Latitude Sailing.

TV, such that the arch TV is exactly equal to the departure: and in this case, the difference of longitude would be easily obtained. For TV is to MN as the sine PT to the sine PM; that is, as the cosine of latitude is to the radius.

The latitude of the parallel TV is not, however, easily determined with accuracy; various methods have, therefore, been taken in order to obtain it nearly, with as little trouble as possible: first, by taking the arithmetical mean of the two latitudes for that of the mean parallel: secondly, by using the arithmetical mean of the cosines of the latitudes: thirdly, by using the geometrical mean of the cosines of the latitudes: and lastly, by employing the parallel deduced from the mean of the meridional parts of the two latitudes. The first of these methods is that which is generally used.

Fig. 17. In order to illustrate the computations in middle latitude sailing, let the triangle ABC (fig. 17.) represent a figure in plane sailing, wherein AB is the difference of latitude, AC the distance, BC the departure, and the angle BAC the course. Also, let the triangle DBC be a figure in parallel sailing, in which DC is the difference of longitude, BC the meridian distance, and the angle DCB the middle latitude. In these triangles there is, therefore, one side BC common to both; and that triangle is to be first resolved in which two parts are given, and then the unknown parts of the other triangle will be easily obtained.

Prob. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

Example. Required the course and distance from the island of May, in latitude 56° 12′ N, and longitude 2° 37′ W, to the Naze of Norway, in latitude 57° 50′ N, and longitude 7° 27′ E?

Latitude isle of May	56° 12′ N	-	56° 12′
Latitude Naze of Norway	57 50 N	-	57 50
Difference of latitude	1. 38=98′	-	114. 2
Middle latitude	-	-	57. 1
Longitude isle of May	-	2 37 W	
Longitude Naze of Norway	-	7 27 E	
Difference of longitude	-	10 4=604′	

By Construction.

Fig. 18. Draw the right line AD (fig. 18.) to represent the meridian of the May; with the chord of 60° describe the arch *mn*, upon which lay off the chord of 32° 59, the complement of the middle latitude from *m* to *n*: from D through *n* draw the line DC equal to 604′, the difference of longitude, and from C draw CB perpendicular to AD: make BA equal to 98′, the difference of latitude, and join AC; which applied to the scale will measure 343 miles, the distance sought: and the angle A being measured by means of the line of chords, will be found equal to 73° 24′, the required course.

By Calculation.

To find the course (D).

As the difference of latitude	98′	-	1.99123
is to the difference of longitude	604	-	2.78104
so is the cosine of middle latitude	57° 1′	-	9.73591
to the tangent of the cosine	73 24	-	10.52572

To find the distance.

As radius	-	-	10.00000
is to the secant of the course	73° 24′	-	10.54411
so is the difference of latitude	98′	-	1.99123
to the distance	343	-	2.53534

By Inspection.

To middle latitude 57°, and 151 one-fourth of the difference of longitude in a distance column, the corresponding difference of latitude is 82.2.

Now 24.5, one-fourth of the difference of latitude, and 82.2, taken in a departure column, are found to agree nearest in table marked $6\frac{1}{2}$ points at the bottom, which is the course; and the corresponding distance $85\frac{3}{4}$ multiplied by 4 gives 343 miles, the distance required.

By Gunter's Scale.

The extent from 98 the difference of latitude, to 604 the difference of longitude on numbers, being laid the same way from 33°, the complement of the middle latitude on sines, will reach to a certain point beyond the termination of the line on the scale. Now the extent between this point and 90° on sines, will reach from 45° to 73° 24′, the course on the line of tangents. And the extent from 73° 24′ the course, to 33° the complement of the middle latitude on the line of sines, being laid the same way from 604 the difference of longitude, will reach to 343 the distance on the line of numbers.

The true course, therefore, from the island of May to the Naze of Norway is N 73° 24′ E, ENE$\frac{3}{4}$E nearly; but as the variation at the May is $2\frac{1}{4}$ points west, therefore, the course per compass from the May is E*b*S.

Prob. II. Given one latitude, course, and distance sailed, to find the other latitude and difference of longitude.

Example. A ship from Brest, in latitude 48° 23′ N, and longitude 4° 30′ W, sailed SW$\frac{1}{4}$W 238 miles. Required the latitude and longitude come to?

By Construction.

With the course and distance construct the triangle ABC (fig. 17.), and the difference of latitude AB being measured, will be found equal to 142 miles: hence the latitude come to is 46° 1′ N, and the middle latitude 47° 12′. Now make the angle DCB equal to Fig. 17.

(D) For R. : cosine mid. lat. :: Diff. of long. : Departure;
And diff. of lat. : Dep. :: R. : Tangent course.
Hence diff. of lat. : cosine mid. lat. :: diff. of long. : tang. course;
Or diff. of lat. : diff. of long. :: cosine mid. lat. : tang. course.

Middle Latitude Sailing.

to 47° 12′; and DC being meaſured, will be 281, the difference of longitude: hence the longitude come to is 9° 11′ W.

By Calculation.

To find the difference of latitude.

As radius	-	-	10.00000
is to the coſine of the courſe,	$4\frac{1}{4}$	-	9.77503
ſo is the diſtance,	238	-	2.37658
to the difference of latitude	141.8	-	2.15161
Latitude of Breſt,	48° 23′ N	-	48° 23′ N
Difference of lat.	2 22 S	- half	1 11 S
Lat. come to -	46° 1′ N.	Mid. lat.	47 12

To find the difference of longitude (E).

As the coſine of Mid. Lat.	47° 12′		9.83215
is to the ſine of the courſe	$4\frac{1}{4}$ points		9.90483
ſo is the diſtance	238	-	2.37658
to the difference of longitude	281.3	-	2.44926
Longitude of Breſt	-	-	4° 30′ W
Difference of longitude	-	-	4 41 W
Longitude come to	-	-	9 11 W.

By Inſpection.

To the courſe $4\frac{1}{4}$ points, and diſtance 238 miles, the difference of latitude is 141.8, and the departure 191.1. Hence the latitude come to is 46° 1′ N, and middle latitude 47° 12′. Then to middle latitude 47° 12′, and departure 191.1 in a latitude column, the correſponding diſtance is 281′, which is the difference of longitude.

By Gunter's Scale.

The extent from 8 points to $3\frac{3}{4}$ points, the complement of the courſe on ſine rhumbs, being laid the ſame way from the diſtance 238, will reach to the difference of latitude 142 on the line of numbers; and the extent from 42° 48′ the complement of the middle latitude, to 53° 26′, the courſe on the line of ſines, will reach from the diſtance 238 to the difference of longitude 281 on numbers.

PROB. III. Given both latitudes and courſe, required the diſtance and difference of longitude?

Example. A ſhip from St Antonio, in latitude 17° 0′ N, and longitude 24° 25′ W, ſailed NW, $\frac{3}{4}$ N, till by obſervation her latitude is found to be 28° 34′ N. Required the diſtance ſailed, and longitude come to?

Latitude St Antonio	17° 0 N	-	17° 0 N
Latitude by obſervation	28 34 N	-	28 34 N
Difference of lat.	11 34=694m.		45 34
		Middle lat.	22 47

By Conſtruction.

Fig. 19. Conſtruct the triangle ABC (fig. 19.), with the given courſe and difference of latitude, and make the angle BCD equal to the middle latitude. Now the diſtance AC and difference of longitude DC being meaſured, will be found equal to 864 and 558 reſpectively.

By Calculation.

To find the diſtance.

As radius,	-	-	10.00000
Is to the ſecant of the courſe	$3\frac{1}{4}$ points		10.09517
So is the difference of lat.	694	-	2.84136
To the diſtance -	864	-	2.93653

To find the difference of longitude.

As the coſine of middle latitude	22° 47′		9.96472
Is to the tangent of the courſe	$3\frac{1}{4}$ points		9.87020
So is the difference of latitude	694	-	2.84136
To the difference of longitude	558.3		2.74684
Longitude of St Antonio	-	-	24° 25′ W
Difference of longitude	-	-	9 18 W
Longitude come to	-	-	33 43 W

By Inſpection.

To courſe $3\frac{1}{4}$ points, and difference of latitude 231.3 one third of that given, the departure is 171.6 and diſtance 288, which multiplied by 3 is 864 miles.

Again to the middle latitude 22° 47′, or 23°, and departure 171.6 in a latitude column, the diſtance is 186, which multiplied by 3 is 558, the difference of longitude.

By Gunter's Scale.

The extent from $4\frac{3}{4}$ points, the complement of the courſe, to 8 points on the line of ſine rhumbs, will reach from the difference of latitude 694 to the diſtance 864 on numbers; and the extent from the courſe 36° 34′ to 67° 13′, the complement of middle latitude on ſines, will reach from the diſtance 864 to the difference of longitude 558 on numbers.

PROB. IV. Given one latitude, courſe, and departure, to find the other latitude, diſtance, and difference of longitude.

Example. A ſhip from latitude 26° 30′ N, and longitude 45° 30′ W, ſailed NE$\frac{1}{2}$N till her departure is 216 miles. Required the diſtance run, and latitude and longitude come to?

By Conſtruction.

With the courſe and departure conſtruct the triangle ABC (fig. 20.), and the diſtance and difference of latitude being meaſured, will be found equal to 340 and 263 reſpectively. Hence the latitude come to is 30° 53′, and middle latitude 28° 42′. Now make the angle BCD equal to the middle latitude, and the difference of longitude DC applied to the ſcale will meaſure 246′. Fig. 20.

By Calculation.

To find the diſtance.

As the ſine of the courſe	$3\frac{1}{2}$ points		9.80236
Is to radius	-	-	10.00000
So is the departure -	216	-	2.33445
To the diſtance -	340.5	-	2.53209

To

(E) This proportion is obvious, by conſidering the whole figure as an oblique-angled plane triangle.

Middle Latitude Sailing.

To find the difference of latitude.

As the tangent of the courſe	$3\frac{1}{2}$ points		9.91417
is to radius	-	-	10.00000
ſo is the departure	216	-	2.33445
to the difference of lat.	263.2	-	2.42028
Latitude ſailed from	26° 30′ N		26° 30′ N
Difference of latitude	4 23 N	half	2 12 N
Latitude come to	30 53 N.	Mid. lat.	28 42

To find the difference of longitude.

As radius	- - -	10.00000
is to the ſecant of the mid. lat.	28° 42′	10.05693
ſo is the departure	216	2.33445
to the difference of longitude	246.2	2.39138
Longitude left	- - -	45° 30′ W
Difference of longitude	- -	4 6 E
Longitude come to	- - -	41 24 W

By Inſpection.

Under the courſe $3\frac{1}{2}$ points, and oppoſite to 108, half the departure, the diſtance is 170, and difference of latitude $131\frac{1}{2}$; which doubled, give 340 and 263 for the diſtance and difference of latitude reſpectively.

Again, to middle latitude 28° 42′, and departure 108, the diſtance is 123; which doubled is 246 the difference of longitude.

By Gunter's Scale.

The extent from the courſe $3\frac{1}{2}$ points, on ſine rhumbs, to the departure 216 on numbers, will reach from 8 points on ſine rhumbs to about 340, the diſtance on numbers; and the ſame extent will reach from $4\frac{1}{2}$ points, the complement of the courſe, to 263, the difference of latitude on numbers; and the extent from 61° 18′ the complement of the middle latitude, to 90° on ſines, will reach from the departure 216 to the difference of longitude 246 on numbers.

Prob. V. Given both latitudes and diſtance; to find the courſe and difference of longitude.

Example. From Cape Sable, in latitude 43° 24, N, and longitude 65° 39′ W, a ſhip ſailed 246 miles on a direct courſe between the ſouth and eaſt, and is then by obſervation in latitude 40° 48′ N. Required the courſe and longitude in?

Latitude Cape Sable,	43° 24′N	43° 24′N
Latitude by obſervation,	40 48′N	40 48′N
Difference of latitude,	2 36=156′, ſum	24 12
	Middle latitude	42 6

By Conſtruction.

Fig. 21.

Make AB (fig. 21.) equal to 156 miles; draw BC perpendicular to AB, and make AC equal to 246 miles. Draw CD, making with CB an angle of 42° 6′ the middle latitude. Now DC will be found to meaſure 256, and the courſe or angle A will meaſure 50° 39′.

By Calculation.

To find the courſe.

As the diſtance	246	2.39093
is to the difference of latitude	156	2.19312
ſo is radius,	- - - - -	10.00000
to the coſine of the courſe	50° 39′	9.80219

4

To find the difference of longitude.

As the coſine of middle latitude	42° 6′	9.87039
is to the ſine of the courſe	50 39	9.88834
ſo is the diſtance	246	2.39093
to the difference of longitude	256.4	2.40888
Longitude Cape Sable,	- - -	65° 39′W
Difference of longitude	- - -	4 16′E
Longitude come to	- - -	61 23 W

By Inſpection.

The diſtance 246, and difference of latitude 156, are found to correſpond above $4\frac{1}{2}$ points, and the departure is 190.1. Now, to the middle latitude 42°, and departure 190.1 in a latitude column, the correſponding diſtance is 256, which is the difference of longitude required.

By Gunter's Scale.

The extent from 246 miles, the diſtance, to 156, the difference of latitude on numbers, will reach from 90° to about $39°\frac{1}{3}$, the complement of the courſe on the line of ſines: and the extent from 48°, the complement of the middle latitude, to $50°\frac{2}{3}$, the courſe on ſines, will reach from the diſtance 246m. to the difference of longitude 256m. on numbers.

Prob. VI. Given both latitudes and departure; ſought the courſe, diſtance, and difference of longitude.

Example. A ſhip from Cape St Vincent, in latitude 37° 2′N, longitude 9° 2′W, ſails between the ſouth and weſt; the latitude come to is 18° 16′N, and departure 838 miles. Required the courſe and diſtance run, and longitude come to?

Latitude Cape St Vincent,	37° 2′N	37° 2′
Latitude come to	18 16 N	18 16
Difference of latitude	18 46=2126 ſum	55 18
	Middle latitude	17 39

By Conſtruction.

Fig. 22.

Make AB (fig. 22.) equal to the difference of latitude 1126 miles, and BC equal to the departure 838, and join AC; draw CD ſo as to make an angle with CB equal to the middle latitude 27° 39′. Then the courſe being meaſured on chords is about $36°\frac{2}{3}$, and the diſtance and difference of longitude, meaſured on the line of equal parts, will be found to be 1403 and 946 reſpectively.

By Calculation.

To find the courſe.

As the difference of latitude	1126	3.05154
is to the departure	838	2.92324
ſo is radius	- - - - -	10.00000
to the tangent of the courſe	36° 39′	9.87170

To find the diſtance.

As radius	- - - - -	10.00000
is to the ſecant of the courſe	36° 39′	10.09566
ſo is the difference of latitude	1126	3.05154
to the diſtance	1403	3.14720

To

Middle Latitude Sailing.

To find the difference of longitude

As radius	- - - - -		10.00000
is to the fecant of mid. lat.	$27°$ $39'$		10.05266
fo is the departure	-	838	2.92324
to the difference of longitude		946	2.97590
Longitude Cape St Vincent	- -		$9°$ $2'$W
Difference of longitude	- - -		15 46 W
Longitude come to	- - -		24 48 W

By Infpection.

One tenth of the difference of latitude 112.6 and of the departure 83.8, are found to agree under $3\frac{1}{2}$ points, and the correfponding diftance is 140, which multiplied by 10 gives 1400 miles. And to middle latitude $27°\frac{2}{3}$, and 209.5 one fourth of the departure in a latitude column, the diftance is 236.5; which multiplied by 4 is 946, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 1126 to the departure 838 on numbers, will reach from 45° to $36°\frac{2}{3}$ the courfe on tangents; and the extent from $53°\frac{1}{3}$ the complement of the courfe to 90° on fines, will reach from 1126 to 1403 the diftance on numbers. Laftly, the extent from $62°\frac{1}{3}$ the complement of the middle latitude, to 90° on fines, will reach from the departure 838 to the difference of longitude 946 on numbers.

Prob. VII. Given one latitude, diftance, and departure, to find the other latitude, courfe, and difference of longitude.

Example. A fhip from Bourdeaux, in latitude 44° 50′ N, and longitude 0° 35′ W, failed between the north and weft 374 miles, and made 210 miles of wefting. Required the courfe, and the latitude and longitude come to?

By Conftruction.

Fig. 23. With the given diftance and departure make the triangle ABC (fig. 23.). Now the courfe being meafured on the line of chords is about $34°\frac{1}{6}$, and the difference of latitude on the line of numbers is 309 miles: hence the latitude come to, is 49° 59′ N, and middle latitude 47° 25′. Then make the angle BCD equal to 47° 25′, and DC being meafured will be 310 miles, the difference of longitude.

By Calculation.

To find the courfe.

As the diftance	- -	374	2.57287
is to the departure	- -	210	2.32222
fo is radius	- - - - -		10.00000
to the fine of the courfe		$34°$ $10'$	9.74935

To find the difference of latitude.

As radius	- - - - -			10.00000
is to the cofine of the courfe	$34°$ $10'$			9.91772
fo is the diftance	- -	374		2.57287
to the difference of latitude		309.4		2.49059
Latitude of Bourdeaux	$44°$ $50'$ N			$44°$ $50'$
Difference of latitude	5 9 N		half	2 33
Latitude come to	49 59 N		Mid. lat.	47 25

To find the difference of longitude.

As radius	- - - - -		10.00000
is to the fecant of mid. lat.	$47°$ $25'$		10.16963
fo is the departure	- -	210	2.32222
to the difference of longitude		310.3	2.49185
Longitude of Bourdeaux	- -		$0°$ $35'$ W
Difference of longitude	- - -		5 10 W
Longitude in	- - - -		5 45 W

By Infpection.

The half of the diftance 187, and of the departure 105, are found to agree neareft under 34°, and the difference of latitude anfwering thereto is 155; which doubled is 310 miles.

Again, to middle latitude 47° 25′, and departure 105 in a latitude column, the correfponding diftance is 155 miles, which doubled is 310 miles, the difference of longitude.

By Gunter's Scale.

The extent from the diftance 374 miles to the departure 210 miles on the line of numbers, will reach from 90° to 34° 10′, the courfe on the line of fines; and the extent from 90° to 55° 50′, the complement of the courfe on fines, will reach from the diftance 374 to the difference of latitude 309 miles on numbers.

Again, the extent from 42° 35′, the complement of the middle latitude, to 90° on fines, will reach from the departure 210 to the difference of longitude 310 on numbers.

Prob. VIII. Given one latitude, departure, and difference of longitude, to find the other latitude, courfe, and diftance.

Example. A fhip from latitude 54° 56′ N, longitude 1° 10′ W, failed between the north and eaft, till by obfervation fhe is found to be in longitude 5° 26′ E, and has made 220 miles of eafting. Required the latitude come to, courfe, and diftance run?

Longitude left	- - -	$1°$ $10'$ W
Longitude come to	- -	5 26 E
Difference of longitude	- -	6 36=396

By Conftruction.

Make BC (fig. 24.) equal to the departure 220, and CD equal to the difference of longitude 396:—then the middle latitude BCD being meafured, will be found equal to 59° 15′: hence the latitude come to is 57° 34′, and difference of latitude 158°. Now make AB equal to 158, and join AC, which applied to the fcale, will meafure 271 miles. Alfo the courfe BAC being meafured on chords will be found equal $54°\frac{1}{3}$. Fig. 24.

By Calculation.

To find the middle latitude.

As the departure	- -	220	2.34242
is to the diff. of longitude	-	396	2.59769
fo is radius	- - - -		10.00000
To the fecant of mid. lat.		$56°$ $15'$	10.25527
Double, mid. lat.	-	112 30	
Latitude left	- -	54 56	
Latitude come to	-	57 34	
Diff. of latitude	- -	2 38=158 miles	

To

Middle Latitude Sailing.

To find the course.

As the difference of latitude	158	2.19866
is to the departure - -	220	2.34242
so is radius - - - - -		10.00000
to the tangent of the course	54° 19′	10.14376

To find the distance.

As radius - - - - -		10.00000
is to the secant of the course	54° 19′	10.23410
so is the difference of latitude	158	2.19866
to the distance - -	270.9	2.43276

By Inspection.

As the difference of longitude and departure exceed the limits of the tables, let, therefore, their halves be taken; these are 198 and 110 respectively. Now these are found to agree exactly in the page marked 5 points at the bottom. Whence the middle latitude is 56° 15′, and difference of latitude 158 miles.

Again, the difference of latitude 158 and departure 220 will be found to agree nearly above 54° the course, and the distance on the same line is 271 miles.

By Gunter's Scale.

The extent from the difference of longitude 396 to the departure 220 on numbers, will reach from 90° to 33° 45′, the complement of the middle latitude on sines; and hence the difference of latitude is 158 miles. Now the extent from 158 to 220 on numbers, will reach from 45° to $54^\circ\frac{1}{3}$ on tangents; and the extent from the complement of the course $35^\circ\frac{2}{3}$ to 90° on sines, will reach from the difference of latitude 158 to the distance 271 on numbers.

Prob. IX. Given the course and distance sailed, and difference of longitude; to find both latitudes.

Example. A ship from a port in north latitude, sailed SE$\frac{3}{4}$S 438 miles, and differed her longitude 7° 28′. Required the latitude sailed from, and that come to?

By Construction.

Fig. 25. With the course and distance construct the triangle ABC (fig. 25.), and make DC equal to 448 the given difference of longitude. Now the middle latitude BCD will measure 48° 58′, and the difference of latitude AB 324 miles: hence the latitude left is 51° 40′, and that come to 46° 16′.

By Calculation.

To find the difference of latitude.

As radius - - - - -		10.00000
is to the cosine of the course	$3\frac{3}{4}$ pts.	9.86979
so is the distance - -	438	2.64147
to the difference of latitude	324.5	2.51126

To find the middle latitude.

As the difference of longitude	448	2.65128
is to the distance - -	438	2.64147
so is the sine of the course -	$3\frac{3}{4}$ pts.	9.82708
to the cosine of mid. latitude	48° 58′	9.81727
half difference of latitude	2 42	
Latitude sailed from -	51 40	
Latitude come to -	46 16	

By Inspection.

To the course $3\frac{3}{4}$ points, and half the distance 219 miles, the departure is 147.0, and difference of latitude 162.2; which doubled is 323.4. Again, to half the difference of longitude 224 in a distance column, the difference of latitude is 149.9 above 48°, and 146.9 over 49°.

Now, as 30 : 29 : : 60′ : 58′.

Hence the middle latitude is 48° 58′: the latitude sailed from is therefore 51° 40′, and latitude come to $46^\circ 16'$.

By Gunter's Scale.

The extent from 8 points to $4\frac{1}{4}$ points, the complement of the course on sine rhumbs, will reach from the distance 438 miles to the difference of latitude 3245 on numbers. And the extent from the difference of longitude 448, to the distance 438 on numbers, will reach from the course 42° 11′ to the complement of the middle latitude 41° 2′ on sines. Hence the latitude left is 51° 40′, and that come to 46° 16′.

Prob. X. To determine the difference of longitude made good upon compound courses, by middle latitude sailing.

Rule I. With the several courses and distances find the difference of latitude and departure made good, and the ship's present latitude, as in traverse sailing.

Now enter the traverse table with the given middle latitude, and the departure in a latitude column, the corresponding distance will be the difference of longitude, of the same name with the departure.

Example. A ship from Cape Clear, in latitude 51° 18′ N, longitude 9° 46′ W, sailed as follows:—SW*b*S 34 miles, W*b*N 63 miles, NNW 48 miles, and NE$\frac{1}{2}$E 85 miles. Required the latitude and longitude come to?

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
SW*b*S	54	—	44.9	—	30.0
W*b*N	63	12.3	—	—	61.8
NNW	48	44.4	—	—	18.4
NE$\frac{1}{2}$E	85	53.9	—	65.7	—
		110.6	44.9	65.7	110.2
		44.9	—	—	65.7
			—	—	
N 34° W	79	65.7 = 1 6N			44.5

Latitude of Cape Clear		51 18N
Latitude come to	-	52 24N
Sum	- -	103 42
Middle latitude	-	51 51

Now, to middle latitude 51° 51′ or 52°, and departure 44.5 in a latitude column, the difference of longitude is 72 in a distance column.

Longitude of Cape Clear	-	9 46 W
Difference of longitude	-	1 12 W
Longitude come to	-	10° 58′W

The above method is that always practised to find the difference of longitude made good in the course of of a day's run; and will, no doubt, give the difference of longitude tolerably exact in any probable run a ship may make in that time, especially near the equator. But in a high latitude, when the distances are considerable, this method is not to be depended on.—To illustrate this, let a ship be supposed to sail from latitude 57° N, as follows: E 240 miles, N 240 miles, W 240 miles, and S 240 miles: then, by the above method, the ship will be come to the same place she left. It will, however, appear evident from the following consideration, that this is by no means the case; for let two ships, from latitude 61° N, and distant 240 miles, sail directly south till they are in latitude 57° N; now their distance being computed by Problem IV. of Parallel Sailing, will be 269.6 miles; and, therefore, if the ship sailed as above, she will be 29.6 miles west of the place sailed from; and the error in longitude will be equal to $240 \times \overline{\text{secant } 61^\circ - \text{secant } 57^\circ} = 29.6 \times \text{secant } 57^\circ = 54.4$.

Theorems might be investigated for computing the errors to which the above method is liable. These corrections may, however, be avoided, by using the following method.

Rule II. Complete the traverse table as before, to which annex five columns: the first column is to contain the several latitudes the ship is in at the end of each course and distance; the second, the sums of each following pair of latitude; the third, half the sums, or middle latitudes; and the fourth and fifth columns are to contain the differences of longitude.

Now find the difference of longitude answering to each middle latitude and its corresponding departure, and put them in the east or west difference of longitude columns, according to the name of the departure. Then the difference of the sums of the east and west columns will be the difference of longitude made good, of the same name with the greater.

Example. A ship from Halliford in Iceland, in lat. 64° 30′ N, long. 27° 15′ W, sailed as follows: SSW 46 miles, SW 61 miles, S*b*W 59 miles, SE*b*E 86 miles, S*b*E½E 76 miles. Required the lat. and long. come to?

Traverse Table.

Courses.	Dist.	Diff. of Lat. N	Diff. of Lat. S	Departure. E	Departure. W
SSW	46	—	42.5	—	17.6
SW	61	—	43.1	—	43.1
S*b*W	59	—	57.9	—	11.5
SE*b*E	86	—	47.8	71.5	—
S*b*E½E	76	—	72.7	22.0	—
			264.0	93.5	72.2
				72.2	
				21.3	

By Rule I.

Latitude Halliford - -	64° 30′ N
Difference of latitude - -	4 24 S
Latitude in - - - - -	60 6 N
Sum - - - - - -	124 36
Middle latitude - - -	62 18

Now, to middle lat. 62 18, and departure 21.3, the difference of long. is 46 E.

Long. Halliford - -	27 15 W
Longitude in - - -	16 29

The error of comm. method, in this Ex. is 12′.

Longitude Table.

Successive Latitudes.	Sums.	Middle Latitudes.	Diff. of Longitude. E	Diff. of Longitude. W
64° 30′	—	—	—	—
63 48	128° 18′	64° 9′	—	40.4
63 5	126 53	63 27	—	96.4
62 7	125 12	62 36	—	25.0
61 19	123 26	61 43	150.9	—
60 6	121 25	60 43	45.0	—
			195.9	161.8
			161.8	

Difference of longitude -	34.1
Longitude Halliford -	27.15 W
Longitude in - -	26.41 W

Chap. VI. *Of Mercator's Sailing.*

It was observed in Middle Latitude Sailing, that the difference of longitude made upon an oblique rhumb could not be exactly determined by using the middle latitude. In Mercator's sailing, the difference of longitude is very easily found, and the several problems of sailing resolved with the utmost accuracy, by the assistance of Mercator's chart or equivalent tables.

In Mercator's chart, the meridians are straight lines parallel to each other; and the degrees of latitude, which at the equator are equal to those of longitude, increase with the distance of the parallel from the equator. The parts of the meridian thus increased are called *meridional parts*. A table of these parts was first constructed by Mr Edward Wright, by the continual addition of the secants of each minute of latitude.

For by parallel sailing,

R : cos. of lat. : : part of equat. : similar part of parallel.

Mercator's Sailing.

And because the equator and meridian on the globe are equal; therefore,

R : cos. lat. :: part of meridian : similar part of parallel.
Or sec. lat. : R :: part of merid. : similar part of parallel.

Hence, $\frac{\text{secant latitude}}{\text{part of meridian}} = \frac{\text{R}}{\text{part of parallel}}$.

But in Mercator's chart the parallels of latitude are equal, and radius is a constant quantity. If therefore, the latitude be assumed successively equal to '1', 2,' 3',' &c. and the corresponding parts of the enlarged meridian be represented by a, b, c, &c; then,

$$\frac{\text{secant } 1'}{\text{part of mer. } a} = \frac{\text{secant } 2'}{\text{part of mer. } b} = \frac{\text{secant } 3'}{\text{part of mer. } c}, \&c.$$

Hence secant $1'$: part of mer. a :: secant $2'$: part of mer. b :: secant $3'$: part of mer. c, &c.

Therefore by 12th V. Euclid,

Secant $1'$: part of mer. a :: secant $1'$ + secant $2'$ + secant $3'$, &c. : parts of $a + b +$ mer. c, &c.

That is, the meridional parts of any given latitude are equal to the sum of the secants of the minutes in that latitude (E).

Since CD : LK :: R : secant LD, fig. 15.
And in the triangle CED,
ED : CD :: R : tangent CED;
Therefore, ED : LK :: R^2 : secant LD $\times$ tangent CED

$$\text{Hence LK} = \frac{\text{ED} \times \text{sec.} \times \text{LD} \times \text{tang. CED}}{R^2} = \frac{\text{ED} \times \text{sec. LD}}{R} \times \frac{\text{tang. CED}}{R}.$$

But $\frac{\text{ED} \times \text{sec. LD}}{R}$ is the enlarged portion of the meridian answering to ED. Now the sum of all the quantities $\frac{\text{ED} \times \text{secant LD}}{R}$ corresponding to the sum of all the ED's contained in AS, will be the meridional parts answering to the difference of latitude AS; and MN is the sum of all the corresponding portions of the equator LK.

Whence MN = mer. diff. of lat. $\times$ tangent $\frac{\text{CED}}{R}$.

That is, the difference of longitude is equal to the meridional difference of latitude multiplied by the tangent of the course, and divided by the radius.

This equation answers to a right-angled rectilineal triangle, having an angle equal to the course; the adjacent side equal to the meridional difference of latitude, and the opposite side the difference of longitude. This triangle is, therefore, similar to a triangle constructed, with the course and difference of latitude, according to the principles of plane sailing, and the homologous sides will be proportional. Hence, if, in fig. 26. the angle A represents the course, AB the difference of latitude, and if AD be made equal to the meridional difference of latitude; then DE, drawn perpendicular to AD, meeting the distance produced to E, will be the difference of longitude.

Plate CCCLXIV. Fig. 26.

It is scarcely necessary to observe, that the meridional difference of latitude is found by the same rules as the proper difference of latitude; that is, if the given latitudes be of the same name, the difference of the corresponding meridional parts will be the meridional difference of latitude; but if the latitudes are of a contrary denomination, the sum of these parts will be the meridional difference of latitude.

Mercator's Sailing.

PROB. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

Ex. Required the course and distance between Cape Finisterre, in latitude 42° 52′ N, longitude 9° 17′ W, and Port Praya in the island of St Jago, in latitude 14° 54′ N, and longitude 23° 29′ W?

Lat. Cape Finisterre	42° 52′	Mer. parts	2852
Latitude Port Praya	14 54	Mer. parts	904
Difference of lat. =	27 58	Mer. diff. lat.	1948
	1678		

Longitude Cape Finisterre	9° 17′ W
Longitude Port Praya -	23 29 W
Diff. longitude - -	14 12=852.

By Construction.

Draw the straight line AD (fig. 26.) to represent the meridian of Cape Finisterre, upon which lay off AB, AD equal to 1678, and 1948, the proper and meridional differences of latitude; from D draw DE perpendicular to AD, and equal to the difference of longitude 852, join AE, and draw BC parallel to DE; then the difference AC will measure 1831 miles, and the course BAC 23° 37′ Fig. 26.

By Calculation.

To find the course.

As the meridian difference of lat.	1948	3.28959
is to the difference of longitude	852	2.93044
so is radius		10.00000
to the tangent of the course	23° 37′	9.64085

To find the distance.

As radius		10.00000
is to the secant of the course,	23° 37′	10.03798
so is the difference of latitude	1678	3.22479
to the distance	1831	3.26277

By Inspection.

As the meridian difference of latitude and difference of longitude are too large to be found in the tables, let the tenth of each be taken; these are 194.8 and 85.2 respectively. Now these are found to agree nearest under 24°; and to 167.8, one-tenth of the proper difference of latitude, the distance is about 183 miles, which multiplied by 10 is 1830 miles.

By Gunter's Scale.

The extent 1948, the meridional difference of latitude, to 852, the difference of longitude on the line of numbers, will reach from 45° to 23° 37′, the course on

(E) This is not strictly true; for instead of taking the sum of the secants of every minute in the distance of the given parallel from the equator, the sum of the secants of every point of latitude should be taken.

Mercator's Sailing.

on the line of tangents. And the extent from 66° 23′, the complement of the courſe to 90° on ſines, will reach from 1678, the proper difference of latitude, to 1831, the diſtance on the line of numbers.

PROB. II. Given the courſe and diſtance, ſailed from a place whoſe ſituation is known, to find the latitude and longitude of the place come to.

Example. A ſhip from Cape Hinlopen in Virginia, in latitude 38° 47′ N, longitude 75° 4′ W, ſailed 267 miles NE*b*N. Required the ſhip's preſent place?

By Conſtruction.

Fig. 27. With the courſe and diſtance ſailed, conſtruct the triangle ABC (fig. 27.); and the difference of latitude AB being meaſured, is 222 miles: hence the latitude come to is 42° 29′ N, and the meridional difference of latitude 293. Make AD equal to 293; and draw DE perpendicular to AD, and meeting AC produced in E: then, the difference of longitude DE being applied to the ſcale of equal parts will meaſure 196; the longitude come to is therefore 71° 48′ W.

By Calculation.

To find the difference of latitude.

As radius	- - - - -		10.00000
is to the coſine of the courſe,	-	3 points -	9.91985
ſo is the diſtance	- - -	267 - -	2.42651
to the difference of latitude	-	222 - - -	2.34636

Lat. Cape Hinlopen = 38° 47′ N. Mer. parts 2528
Difference of lat. - 3 42 N.

Latitude come to - 42 29 N. Mer. parts 2821

Meridional difference of latitude 293

To find the difference of longitude.

As radius	- - - - - -		10.00000
is to tangent of the courſe,	-	3 points -	9.82489
ſo is the mer. diff. of latitude	-	293 - -	2.46687
to the difference of longitude	-	195.8 - -	2.29176

Longitude Cape Hinlopen - - 75° 4′ W
Difference of longitude - - - 3 16 E

Longitude come to - - - - - 71 48 W

By Inſpection.

To the courſe 3 points, and diſtance 267 miles, the difference of latitude is 222 miles: hence the latitude in is 42° 29′, and the meridional difference of latitude 293. Again, to courſe 3 points, and 146.5 half the mer. difference of latitude, the departure is 97.9, which doubled is 195.8, the difference of longitude.

By Gunter's Scale.

The extent from 8 points to the complement of the courſe 5 points, on ſine rhumbs, will reach from the diſtance 267 to the difference of latitude 222 on numbers; and the extent from 4 points to 3 points on tangent rhumbs, will reach from the meridional difference of latitude 293 to the difference of longitude 196 on numbers.

PROB. III. Given the latitudes and bearing of two places; to find their diſtance and difference of longitude.

Example. A ſhip from Port Canſo in Nova Scotia, in latitude 45° 20′ N, longitude 60° 55′ W, ſailed SE ¼ S, and by obſervation is found to be in latitude 41° 14′ N. Required the diſtance ſailed, and longitude come to?

Lat. Port Canſo -	45° 20′ N	- Mer. parts -	3058
Lat. in by obſervation	41 14 N	- Mer. parts -	2720
Difference of lat. -	4 6 = 246	Mer. diff. lat. -	338

By Conſtruction.

Make AB (fig. 28.) equal to 246, and AD equal to 338; draw AE, making an angle with AD equal to 3¼ points, and draw BC, DE perpendicular to AD. Now AC being applied to the ſcale, will meaſure 332, and DE 306. Fig. 28.

By Calculation.

To find the diſtance.

As radius	- - - - - -		10.00000
is to the ſecant of the courſe,	-	3¼ points -	10.13021
ſo is the difference of latitude	-	246 - -	2.39093
to the diſtance	- -	332 - -	2.52114

To find the difference of longitude.

As radius	- - - - - -		10.00000
is to the tangent of the courſe,	-	3¼ points	- 9.95729
ſo is the mer. diff. of latitude	-	338 - -	2.52892
to the difference of longitude	-	306.3 - -	2.48621

Longitude Port Canſo - - 60° 55′ W
Difference of longitude - - 5 6 E

Longitude in - - - - 53 49 W

By Inſpection.

Under the courſe 3¼ points, and oppoſite to half the difference of latitude 123 in a latitude column is 166 in a diſtance column, which doubled is 332 the diſtance; and oppoſite to 169, half the meridional difference of latitude in a latitude column, is 153 in a departure column, which doubled is 306, the difference of longitude.

By Gunter's Scale.

The extent from the complement of the courſe 4¾ points to 8 points on ſine rhumbs, will reach from the difference of latitude 246 m. to the diſtance 332 on numbers; and the extent from 4 points, to the courſe 3¼ points on tangent rhumbs, will reach from the meridional difference of latitude 338 to the difference of longitude 306 on numbers.

PROB. IV. Given the latitude and longitude of the place ſailed from, the courſe and departure; to find the diſtance, and the latitude and longitude of the place come to.

Example. A ſhip ſailed from Sallee in latitude 33° 58′ N, longitude 6° 20′ W, the corrected courſe was NW*b*W ½ W, and departure 420 miles. Required the diſtance run, and the latitude and longitude come to?

By Conſtruction.

With the courſe and departure conſtruct the triangle ABC (fig. 29.); now AC and AB being meaſured, will be found to be equal to 476 and 224 reſpectively: hence Fig. 29.

Mercator's Sailing.

hence the latitude come to is 37° 42′ N, and meridional difference of latitude 276. Make AD equal to 276; and draw DE perpendicular thereto, meeting the distance produced in E; then DE applied to the scale will be found to measure 516′. The longitude in is, therefore, 14° 56′ W.

By Calculation.

To find the distance.

As radius	- - - - -		10.00000
is to the cosecant of the course	$5\frac{1}{2}$ pts	-	10.05457
so is the departure - -	420	-	2.62325
to the distance - -	476.2	-	2.67782

To find the difference of latitude.

As radius	- - - - - -		10.00000
is to the co-tangent of the course,	$5\frac{1}{2}$ pts	-	9.72796
so is the departure - -	420	-	2.62325
to the difference of latitude -	224.5		2.35121

Lat. of Sallee	33° 58′ N	Mer. parts 2169
Diff. of lat.	3 44 N	
Latitude in	37 42 N	Mer. parts 2445
Mer. difference of latitude -		276

To find the difference of longitude.

As radius	- - - - - -		10.00000
is to the tangent of the course	$5\frac{1}{2}$ pts	-	10.27204
so is the mer. diff. of latitude	276	- -	2.44091
to the difference of longitude	516 3	-	2.71295

Longitude of Sallee - -	6° 20′ W
Difference of longitude -	8 36 W
Longitude in - - -	14 56 W

By Inspection.

Above $5\frac{1}{2}$ points the course, and opposite to 210 half the departure, are 238 and 112; which doubled, we have 476 and 224, the distance and difference of latitude respectively. And to the same course, and opposite to 138, half the meridional difference of latitude, in a latitude column, is 258 in a departure column; which being doubled is 516, the difference of longitude.

By Gunter's Scale.

The extent from $5\frac{1}{2}$ points, the course on sine rhumbs, to the departure 420 on numbers will reach from 8 points on sine rhumbs to the distance 476 on numbers; and from the complement of the course $2\frac{1}{2}$ points on sine rhumbs, to the difference of latitude 224 on numbers.

Again, the extent from difference of latitude 224 to the meridional difference of latitude 276 on numbers, will reach from the departure 420 to the difference of longitude 516 on the same line.

Prob. V. Given the latitudes of two places, and their distance, to find the course and difference of longitude.

Example. A ship from St Mary's, in latitude 36° 57′ N, longitude 25° 9′ W, sailed on a direct course between the north and east 1162 miles, and is then by observation in latitude 49° 57′ N. Required the course steered, and longitude come to?

Lat. of St Mary's -	36° 57′ N	Mer. parts	3470
Lat. come to -	49 57 N	Mer. parts	2389
Difference of lat. -	13 0	Mer. diff. lat.	1081
	780		

By Construction.

Make AB (fig. 30.) equal to 780, and AD equal to 1081; draw BC, DE perpendicular to AD; make AC equal to 1162′, and through AC draw ACE. Then the course or angle A being measured, will be found equal to 47° 50′, and the difference of longitude DE will be 1194. Fig. 30.

By Calculation.

To find the course.

As the distance - - -	1162	-	3.06521
is to the difference of latitude, -	780	-	2.89209
so is radius - - - - -			10.00000
to the cosine of the course -	47° 50′	-	9.82688

To find the difference of longitude.

As radius - - - - -			10.00000
is to the tangent of the course,	47° 50′	-	10.04302
so is the mer. diff. of latitude	1081	-	3.03383
to the difference of longitude	1194	-	3.07685

Longitude of St Mary's -	25° 9′ W
Difference of longitude -	19 54 E
Longitude in - - -	5 15 W

By Inspection.

Because the distance and difference of latitude exceed the limits of the table, take the tenth of each; these are 116.2 and 78.0: Now these are found to agree nearest above $4\frac{1}{2}$ points, which is therefore the course; and to this course, and opposite to 108.1, one tenth of the meridional difference of latitude, in a latitude column, is 119.3 in a departure column, which multiplied by 10 is 1193, the difference of longitude.

By Gunter's Scale.

The extent from the distance 1162 m. to the difference of latitude 780 m. on numbers, will reach from 90° to 42° 10′ in the line of sines. And the extent 45°, to the course 47° 50′ on the line of tangents, will reach from the meridional difference of latitude 1081 to the difference of longitude 1194 on numbers.

Prob. VI. Given the latitudes of two places, and the departure, to find the course, distance, and difference of longitude.

Example. From Aberdeen, in latitude 57° 9′ N, longitude 2° 8′ W, a ship sailed between the south and east till her departure is 146 miles, and latitude come to 53° 32′ N. Required the course and distance run, and longitude come to?

Latitude Aberdeen	57° 9′ N	Mer. parts	4199
Latitude come to	53 32 N	Mer. parts	3817
Difference of latitude	3 37=217′	Mer. diff. lat.	382

By Construction.

With the difference of latitude 217 m. and departure 146 m. construct the triangle ABC (fig. 31.), make AD Fig. 31

Mercator's Sailing.

AD equal to 382, draw DE parallel to BC, and produce AC to E: Then the course BAC will measure 33° 56′, the distance AC 261, and the difference of longitude DE 257.

By Calculation.

To find the course.

As the difference of latitude	217	-	2.33646
is to the departure - -	146	-	2.16435
so is radius - - - - -			10.00000
to the tangent of the course -	33° 56′	-	9.82789

To find the distance.

As radius - - - - -			10.00000
is to the secant of the course -	33° 56′		10.08109
so is the difference of latitude -	217	-	2.33646
to the distance - - -	261.5	-	2.41755

To find the difference of longitude.

As the difference of latitude -	217	-	2.33646
is to the mer. diff. of latitude -	382	-	2.58206
so is the departure - -	146	-	2 16435
to the difference of longitude	257	-	2.40995
Longitude of Aberdeen - - -			2° 8′ W
Difference of longitude - - -			4 17 E
Longitude come to - - - -			2 9 E

By Inspection.

The difference of latitude 217, and departure 146, are found to agree nearest under 34°, and the corresponding distance is 262 miles. To the same course, and opposite to 190.7, the nearest to 191, half the meridional difference of latitude, is 128.6 in a departure column, which doubled is 257, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 217, to the departure 146 on numbers, will reach from 45° to about 34°, the course on the line of tangents; and the same extent will reach from the meridional difference of latitude 382 to 257, the difference of longitude on numbers.—Again, the extent from the course 34° to 90 on sines, will reach from the departure 146 to the distance 261 on numbers.

Prob. VII. Given one latitude, distance, and departure; to find the other latitude, course, and difference of longitude.

Example. A ship from Naples, in latitude 40° 51′ N, longitude 14° 14′ E, sailed 252 miles on a direct course between the south and west, and made 173 miles of westing. Required the course made good, and the latitude and longitude come to?

By Construction.

Fig. 32. With the distance and departure make the triangle ABC (fig. 32.) as formerly.—Now the course BAC being measured by means of a line of cords will be found equal to 43° 21′, and the difference of latitude applied to the scale of equal parts will measure 183′: hence the latitude come to is 37° 48′ N, and meridional difference of latitude 237.—Make AD equal to 237, and complete the figure, and the difference of longitude DE will measure 224′: hence the longitude in is 10° 30′ E.

Mercator's Sailing.

By Calculation.

To find the course.

As the distance - -	252	-	2.40140
is to the departure -	173	-	2.23805
so is radius - - - -			10.00000
to the sine of the course -	43° 21′	-	9.83665

To find the difference of latitude.

As radius - - - - -			10.00000
is to the cosine of the course	43° 21′	-	9.86164
so is the distance - -	252	-	2.40140
to the difference of latitude	183.2	-	2.26304
Latitude of Naples	40° 51′ N.	Mer. parts	2690
Difference of latitude	3 3 S.		
Latitude come to -	37 48 N.	Mer. parts	2453
Meridional difference of latitude -			237

To find the difference of longitude.

As radius - - - - -			10.00000
is to the tangent of the course	43° 21′	-	9.97497
so is the mer. diff. of latitude -	237	-	2.37475
to the difference of longitude -	223.7	-	2.34972
Longitude of Naples - - -			14° 14′ E
Difference of longitude - - -			3 44 W
Longitude in - - - -			10 30 E

By Inspection.

Under 43° and opposite to the distance 252 m. the departure is 171.8, and under 44°, and opposite to the same distance, the departure is 175.0.

Then as 3.2 : 1.2 : : 60′ : 22′.

Hence the course is 43° 22′.

Again, under 43° and opposite to 118.5, half the meridional difference of latitude in a latitude column, is 110.5 in a departure column; also under 44° and opposite to 118.5 is 114.4.

Then as 3.2 : 1.2 : : 3.9 : 1.5.

And 110.5+1.5=112, which doubled is 224, the difference of longitude.

By Gunter's Scale.

The extent from the distance 252 on numbers, to 90° on sines, will reach from the departure 173 on numbers, to the course $43\frac{1}{3}$ on sines; and the same extent that will reach from the complement of the course $46°\frac{2}{3}$ on sines will reach to the difference of latitude 183 on numbers.—Again, the extent from 45° to $43°\frac{1}{3}$ on tangents will reach from the meridional difference of latitude 237, to the difference of longitude 224, on numbers.

Prob. VIII. Given one latitude, course, and difference of longitude: to find the other latitude and distance.

Example. A ship from Tercera, in latitude 38° 45′N, longitude 27° 6′ W, sailed on a direct course, which, when corrected, was N 32° E, and is found by observation to be in longitude 18° 24′ W. Required the latitude come to, and distance sailed?

Longitude

Mercator's Sailing.

Longitude of Tercera	- -	27° 6′ W
Longitude in	- - - - -	18 24 W
Difference of longitude	- -	8 42=522

By Construction.

Fig. 33. Make the right-angled triangle ADE (fig. 33.) having the angle A equal to the courſe 32°, and the ſide DE equal to the difference of longitude 522: then AD will meaſure 835, which added to the meridional parts of the latitude left, will give thoſe of the latitude come to 48° 46′; hence, the difference of latitude is 601: make AB equal thereto, to which let BC be drawn perpendicular; then AC applied to the ſcale will meaſure 708 miles.

By Calculation.

To find the meridional difference of latitude.

As radius - - - - - -		10.00000
is to the co tangent of the courſe	32° 0′	10.20421
ſo is the difference of longitude	5 22	2.71767
to the mer. difference of latitude	8352	2.92188

Latitude of Tercera	38° 45′ N	Mer. parts	2526
		Mer. diff. of lat.	835
Latitude come to -	48 46 N	Mer. parts	3361

Difference of latitude 10 1=601 miles.

To find the diſtance.

As radius - - - - - -		10.00000
is to the ſecant of the courſe -	32° 0′ -	10.07158
ſo is the difference of latitude -	601 -	2.77887
to the diſtance - -	707.7 -	2.85045

By Inſpection.

To courſe 32°, and oppoſite to 130.5, one fourth of the given difference of longitude in a departure column, the difference of latitude is 208.8, which multiplied by 4 is 835, the meridional difference of latitude; hence the latitude in is 48° 46′ N, and difference of latitude 601.

Again, to the ſame courſe, and oppoſite to 200, one third of the difference of latitude, the diſtance is 236, which multiplied by 3 gives 708 miles.

By Gunter's Scale.

The extent from the courſe 32°, to 45° on tangents, will reach from the difference of longitude 522 to the meridional difference of latitude 835 on numbers.—And the extent from the complement of the courſe 58° to 90° on ſines, will reach from the difference of latitude 601, to the diſtance 708 miles on numbers.

PROB. IX. To find the difference of longitude made good upon compound courſes.

RULE. With the ſeveral courſes and diſtances, complete the Traverſe Table, and find the difference of latitude, departure, and courſe made good, and the latitude come to as in Traverſe Sailing. Find alſo the meridional difference of latitude.

Now to the courſe and meridional difference of latitude, in a latitude column, the correſponding departure will be the difference of longitude, which applied to the longitude left will give the ſhip's preſent longitude.

Example. A ſhip from port St Julian, in latitude 49° 10′ S, longitude 68° 44′ W, ſailed as follows; ESE 53 miles, SE*b*S 74 miles, E by N 68 m. SE*b*E½E 47 miles, and E 84 miles. Required the ſhip's preſent place?

Courſes.	Diſt.	Diff of Lat.		Departure.	
		N	S	E	W
ESE	53		20.3	49.0	
SE*by*S	74		61.5	41.1	
E*by*N	68	13.3		66.7	
SE*by*E½E	47		22.1	41.5	
E	84			84.0	
		13.3	103.9	282.3	
			13.3		
S 72° E	197		90.6=1° 31′		

Latitude left,	-	49 10 S	m. pt. 3397
Latitude come to	-	50 41 S	m. pt. 3539
Mer. difference of latitude	- -.		142

Now to courſe 72°, and oppoſite to 71, half the mer. difference of latitude in a latitude column, is 218.7 in a departure column, which doubled is 437, the difference of longitude.

Longitude of Port St Julian	-	68° 44′ W
Difference of longitude	-	7 17 E
Longitude come to	- -	61 27 W

Although the above method is that uſually employed at ſea to find the difference of longitude, yet as it has been already obſerved, it is not to be depended on, eſpecially in high latitudes, long diſtances, and a conſiderable variation in the courſes, in which caſe the following method becomes neceſſary.

RULE II. Complete the Traverſe Table as before, to which annex five columns. Now with the latitude left, and the ſeveral differences of latitude, find the ſucceſſive latitudes, which are to be placed in the firſt of the annexed columns; in the ſecond, the meridional parts correſponding to each latitude is to be put; and in the third, the meridional differences of latitude.

Then to each courſe, and correſponding meridional difference of latitude, find the difference of longitude, by PROB. IV. which place in the fourth or fifth columns, according as the coaſt is eaſterly or weſterly, and the difference between the ſums of theſe columns will be the difference of longitude made good upon the whole, of the ſame name with the greater.

REMARKS.

1. When the courſe is north or ſouth, there is no difference of longitude.

2. When the courſe is eaſt or weſt, the difference of longitude cannot be found by Mercator's Sailing; in this caſe the following rule is to be uſed.

To the neareſt degree to the given latitude taken as a courſe, find the diſtance anſwering to the departure in a latitude column: this diſtance will be the difference of longitude.

Ex.

Mercator's Sailing.

Ex. 1. Four days ago we took our departure from Faro-head, in latitude 58° 40′ N, and longitude 4° 50′ W, and since have sailed as follows: NW 32 miles, W 69 miles, WNW 93 miles, W*b*S 77 miles, SW 58 miles, and W¾S 49 miles.—Required our present latitude and longitude?

Traverse Table.

Courses.	Dist.	Diff of Lat. N	Diff of Lat. S	Departure. E	Departure. W
NW	32	22.6			22.6
W	69				69.0
WNW	93	35.6			85.9
W*b*S	77		15.0		75.5
SW	58		41.0		41.0
W¾S	49		7.2		48.5
		58.2	63.2		342.5
			58.2		
W 1° S	343		5.0		

Longitude Table.

Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude. E	Diff. of Longitude. W
58° 40′	4370			
59 3	4415	45		45.0
59 3	4415	0		134.0
59 38	4484	69		166.5
59 23	4454	30		151.0
58 42	4374	80		80.0
58 35	4361	13		88.0
				664.5

Longitude of Faro-head - - 4° 50′ W.
Difference of longitude - - 11 4 W.

Longitude in - - - - 15 54 W.

Ex. 2. A ship from latitude 78° 15′ N, longitude 28° 14′ E, sailed the following courses and distances. The latitude come to is required, and the longitude, by both methods: the bearing and distance of Hacluit's head-land, in latitude 79° 55′ N, longitude 11° 55′ E, is also required?

Traverse Table.

Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
WNW	154	58.9	—	—	142.3
SW	96	—	67.9	—	67.9
NW½W	89	56.4	—	—	68.8
N*b*E	110	107.9	—	21.5	—
NW¾N	56	45.0	—	—	33.4
S*b*E¾E	78	—	73.4	26.3	—
		268.2	141.3	47.8	312.4
		141.3			47.8
		126.9			264.6

By Rule I.

Latitude left 78° 15′ N. Mer. pts. 7817
Diff. of latitude 2 7 N.

Lat. come to - 80 22 N. Mer. pts. 8504

Meridional diff. of latitude - - 687
As difference of lat. - 126.9 - 2.10346
is to mer. diff. of lat. - 687 - 2.83696
so is the departure - 264.6 - 2.42256

to diff. of longit. - 1432 - 3.15606

23° 52′ W.
Longitude left - 28 14 E.

Longitude in - 4 22 E.

The error of this method, in the present example, is therefore 1° 23′.

Longitude Table.

Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude. E	Diff. of Longitude. W
78° 15′	7817		—	
79 14	8120	303	—	731.7
78 6	7774	346	—	346.0
79 2	8056	282	—	343.6
80 50	8676	620	123.6	—
81 35	8970	294	—	218.0
80 22	8504	466	166.7	—
			290.3	1639.3
				290.3
				1349.0

Longitude left - - 28° 14′ E.
Difference of longitude - - 22 29 W.

Longitude in - - - 5 45 E.

To find the bearing and distance of Hacluit's head-land.

Lat. H. H. = 79° 55′ N. M. P. 8347 Lon. 11° 55′ E.
Lat. ship. = 80 22 N. M. P. 8504 Lon. 5 45 E.

Diff. lat. 0 27 M. D. L. 157 D. L. 6 10

370

Now to 78.5 half the meridional difference of latitude, and 185.0 half the difference of longitude, the course 67°, and opposite to the difference of latitude 27, the distance is 69 miles.—Hence Hacluit's head-land bears S 67° E, distant 69 miles.

Method of resolving the Problems of Mercator's Sailing.

CHAP. VII. *Containing the Method of resolving the several Problems of Mercator's Sailing, by the Assistance of a Table of Logarithmic Tangents.*

PROB. I. Given one latitude, distance, and difference of longitude; to find the course, and other latitude.

RULE. To the arithmetical complement of the logarithm of the distance, add the logarithm of the difference of longitude in minutes, and the log. cosine of the given latitude, the sum rejecting radius will be the log. sine of the approximate course.

To the given latitude taken as a course in the traverse table, and half the difference of longitude in a distance column, the corresponding departure will be the first correction of the course, which is subtractive if the given latitude is the least of the two; otherwise, additive.

In Table A, under the complement of the course, and opposite to the first correction in the side column, is the second correction. In the same table find the number answering to the course at the top, and difference of longitude in the side column; and such part of this number being taken as is found in table B opposite to the given latitude, will be the third corrections. Now these two corrections, subtracted from the course corrected by the first correction, will give the true course.

Now the course and distance being known, the difference of latitude is found as formerly.

Table A.										Table B.	
Arc.	10°	20°	30°	40°	50°	60°	70°	80°	90°	Lat.	
1°	3′	1	1′	1′	0′	0′	0′	0′	0′	0°	$\frac{1}{3}$
2	12	6	4	2	2	1	1	0	0	10	$\frac{1}{3}$
3	27	13	8	6	4	3	2	1	0	20	$\frac{1}{6}+\frac{1}{7}$
4	47	23	14	10	7	5	3	1	0	30	$\frac{1}{6}+\frac{1}{8}$
5	74	36	23	16	11	8	5	2	0	40	$\frac{1}{6}+\frac{1}{10}$
6	107	52	33	22	16	11	7	3	0	50	$\frac{1}{4}$
7	145	70	44	30	21	15	9	4	0	60	$\frac{1}{5}$
8	190	92	58	40	28	19	12	6	0	70	$\frac{1}{6}+\frac{1}{50}$
										80, &c.	$\frac{1}{6}$

Example. From latitude 50° N, a ship sailed 290 miles between the south and west, and differed her longitude 5°. Required the course, and latitude come to?

Distance - -	290.	ar. co. log.	7.53760
Diff. of longitude -	300	log.	2.47712
Latitude - -	50° 0′	co. -	9.80807
Approximate course -	41 41	sine -	9.82279
To lat. 50°, and half diff. long. 150 in a dist. col. the first corr. in a dep. col. is 115 -			+1 55
Approximate course -	41 41		
Cor. - - - -	1 55		
In table A to co. course 48° and 1st corr. 1° 55′ the second direction is -			—0 2
To course 41° and diff. long. 5°, the number is 15, of which $\frac{1}{5}$ (Tab. B) being taken, gives			—0 3
True course - - - - -			S. 43 31 W

To find the difference of latitude.

As radius - - - - -		10.000000
is to the cosine of the course	43° 33′	9.86020
so is the distance - -	290	2.46240
to the difference of latitude -	210.2	2.32260
Latitude left - - - - - - -		50° 0′ N
Difference of latitude - - - -		3 30 S
Latitude come to - - - - -		46 30 N

This problem was proposed, and resolved, by Mr Robert Hues in his *Treatise on the Globes*, printed at London in the year 1639, p. 181.

It was afterwards proposed by Dr Halley, in the second volume of the *Miscellanea Curiosa*, p. 35. in the following words.

A ship sails from a given latitude, and, having run a certain number of leagues, has altered her longitude by a given angle; it is required to find the course steered. And he then adds—*The solution hereof would be very acceptable, if not to the public, at least to the author of this tract, being likely to open some further light into the mysteries of geometry.*

Since that time, this problem has been solved in an indirect manner, by several writers on navigation, and others:—As Monsieur Bouguer, in his *Nouveau Traité de Navigation*; Mr Robertson, in the second volume of his *Elements of Navigation*; Mr Emerson, in his *Theory of Navigation*, which accompanies his *Mathematical Principles of Geography*; Mr Israel Lyons, in the *Nautical Almanack* for 1772; and Monsieur Bezout, in his *Traité de Navigation*; and lately, Baron Maseres, with the assistance of Mr Attwood, has given the first direct solution of this problem. For a comparison of the various solutions which have hitherto been made of this problem, the reader is referred to that by Dr Mackay, in the fourth and sixth volumes of Baron Maseres's *Scriptores Logarithmici*.

It was intended in this place to have given rules, to make allowance for the spheroidal figure of the earth: but as the ratio of the polar to the equatorial semi-axis is not as yet determined with sufficient accuracy, neither is it known if both hemispheres be similar figures; therefore these rules would be grounded on assumption only, and might probably err more from the truth

Oblique Sailing.

truth than those adapted to the spherical hypothesis. This therefore is supposed to be a sufficient apology for not inserting them.

Chap. VIII. *Of Oblique Sailing.*

Oblique sailing is the application of oblique angled plane triangles to the solution of problems at sea. This sailing will be found particularly useful in going along shore, and in surveying coasts and harbours, &c.

Ex. 1. At 11h A. M. the Girdle Ness bore WNW, and at 2h P. M. it bore NW*b*N: the course during the interval S*b*W five knots an hour. Required the distance of the ship from the Ness at each station?

By Construction.

Fig. 34. Describe the circle NE, SW (fig. 34.), and draw the diameters NS, EW, at right angles to each other: from the centre C, which represents the first station, draw the WNW line CF; and from the same point draw CH, S*b*W, and equal to 15 miles the distance failed.—From H draw HF in a NW*b*N direction, and the point F will represent the Girdle Ness. Now the distances CF, HF will measure 19.1 and 26.5 miles respectively.

By Calculation.

In the triangle FCH are given the distance CH 15 miles, the angle FCH equal to 9 points, the interval between the S*b*W and WNW points, and the angle CHF equal to 4 points, being the supplement of the angle contained between the S*b*W and NW*b*N points; hence CFH is 3 points: to find the distances CF, HF.

To find the distance CF.

As the sine of CFH	3 points	9.74474
is to the sine of CHF	4 points	9.84948
so is the distance CH	15 miles	1.17609
to the distance CF	19.07	1.28083

To find the distance FH.

As the sine of CFH	3 points	9.74474
is to the sine of FCH	points	9.99157
so is the distance CH	15 miles	1.17609
to the distance FH	26.48	1.42292

Ex. 2. The distance between the SE point of the island of Jersey and the island of Brehaut is 13 leagues: and the correct bearing and distance of Cape Frehel from the island of Brehaut is SE*b*E 26 miles. It is also known that the SE point of Jersey bears NNE from Cape Frehel: from whence the distance of these two is required, together with the bearing of the same point from the island of Brehaut?

By Construction.

Fig. 35. Describe a circle, (fig. 35.) and draw two diameters at right angles, the extremities of which will represent the cardinal points, north being uppermost.—Let the centre B represent Brehaut, from which draw the SE*b*E line BF equal to 26 miles, and the point F will represent Cape Frehel, from which draw the NNE line FI; make BI equal to 39 miles: Then FI applied to the scale will measure $34\frac{1}{2}$ miles, and the inclination of BI to the meridian will be found equal to $63^{\circ}\frac{1}{3}$.

By Calculation.

In the triangle BIF are given BI and BF equal to 39 miles, and 26 miles respectively; and the angle BFI equal to 7 points: To find the side FI, and angle FBI.

To find the angle BIF.

As the distance BI	39	1.59106
is to the distance BF	26	1.41497
so is the sine of BFI	78° 45′	9.99157
to the sine of BIF	40 50	9.81548
Sum	119 35	
Angle FBI	60 25	
——EBF	33 45	
Difference, or EBI	26 40	

Bearing of Jersey from Brehaut N 63 20 E.

To find the distance FI.

As the sine of BFI	78° 45′	9.99157
is to the sine of FBI	60 25	9.93934
so is the distance BI	39 miles	1.59106
to the distance FI	34.58	1.53883

Ex. 3. At noon Dungeness bore per compass N*b*W, distance 5 leagues; and having run NW*b*W 7 knots an hour, at 5 P. M. we were up with Beachyhead. Required the bearing and distance of Beachyhead from Dungeness?

By Construction.

Describe a circle (fig. 36.) to represent the horizon; Fig. 36. from the centre C draw the N*b*W line CD equal to 15 miles; and the NW*b*W line CB equal to 35 miles; join DB, which applied to the scale will measure about $26\frac{1}{2}$ miles; and the inclination of DB to the meridian will be found equal to N $79^{\circ}\frac{3}{4}$W.

By Calculation.

In the triangle DCB are given the distances CD, CB equal to 15 and 35 miles respectively; and the angle BCD equal to 4 points; to find the angles B and D, and the distance BD.

To find the angles.

Distance CB=35,	sum of the ang.	16 points	
CD=15,	angle C	4	
Sum 50,	angles B and D	12	
Difference 20,	half sum	6 pts.	=67° 30′
As the sum of the distances		50	1.69897
is to their difference		20	1.30103
so is the tangent of half sum angles		67 30	10.38378
to the tangent of half their diff.		44 0	9.98484
Angle CDB		111 30	
Supplement		68 30	
Angle, NCD		11 15	
Magnetic bearing		N 79 45W.	

Or by allowing $2\frac{1}{4}$ points of westerly variation, the true bearing of Beachyhead from Dungeness will be W$\frac{3}{4}$S nearly.

To

Oblique Sailing.

To find the distance.

As the sine of CDB	-	111° 30′	-	9.96868
is to the sine of BCD	-	45.0	-	9.84948
so is the distance BC	-	35	-	1.54407
to the distance BD	-	-	26.6	1.42487

Ex. 4. Running up Channel E*b*S per compass at the rate of 5 knots an hour. At 11^h A. M. the Eddistone lighthouse bore N*b*E$\frac{1}{4}$E, and the Start point NE*b*E$\frac{1}{4}$E; and at 4 P. M. the Eddistone bore NW*b*N, and the Start N$\frac{3}{4}$E. Required the distance and bearing of the Start from the Eddistone, the variation being 2$\frac{1}{4}$ points W?

By Construction.

Fig. 37. Let the point C (fig. 37.) represent the first station, from which draw the N*b*E$\frac{1}{4}$E line CA, the NE*b*E$\frac{1}{4}$E line CB, and the E*b*S line CD, which make equal to 25 miles the distance run in the elapsed time; then from D draw the NE*b*N line DA intersecting CA in A, which represents the Eddistone; and from the same point draw the N$\frac{3}{4}$E line DB cutting CB in B, which therefore represents the Start. Now the distance AB applied to the scale will measure 22.9, and the bearing per compass BAF will measure 73°$\frac{1}{3}$.

By Calculation.

In the triangle CAD are given CD equal to 25 miles, the angle CAD equal to 4$\frac{1}{4}$ points, the distance between N*b*E$\frac{1}{4}$E and NW*b*N; and the angle ADC equal to 4 points, the distance between the NW*b*N and W*b*N points; to find the distance CA.

As the sine of CAD	-	4$\frac{1}{4}$ points	-	9.86979
is to the sine of CDA	-	4 points	-	9.84948
so is the distance CD		25 miles	-	1.39794
to the distance CA	-	23.86	- -	1.37763

In the triangle BCD, are given the distance CD 25 miles, the angle CBD 4$\frac{1}{2}$ points the interval between NE*b*E$\frac{1}{4}$ and N$\frac{3}{4}$E, and CDB 7$\frac{3}{4}$ points, the distance between W*b*N and N$\frac{3}{4}$E; to find the distance CD.

As the sine of CBD	-	4$\frac{1}{2}$ points	-	9.88819
is to the sine CDB	-	7$\frac{3}{4}$ points	-	9.99947
so is the distance CD	-	25 miles	-	1.39794
to the distance CB	-	32.3	-	1.50922

In the triangle CAB, the distances CA, CB, are given, together with the included angle ACB, equal to 4 points, the distance between N*b*E$\frac{1}{4}$E and NE*b*E$\frac{1}{4}$E; to find the angle CAB and distance AB.

Distance CB	32.3	Angle ACB	=45° 0′
Distance CA	23.86	Sum of CAB and ABC	135 0
Sum -	56.16	Half - -	67 30
Difference	8.44		

As the sum of the distances	56.16	-	1.74943
is to their difference -	8.44	-	0.92634
so is the tangent of half sum angles -	67 30	-	10.38278
to the tangent of half diff. angles -	19 56	-	9.55969
Angle CAB - -	87 26		
Angle CAF - -	14 4		

Bearing per compass - S 73 22 E or ESE$\frac{1}{2}$E; and the variation 2$\frac{1}{4}$ points being allowed to the left of ESE$\frac{1}{2}$E, gives E$\frac{3}{4}$N, the true bearing of the Start from the Eddistone.

To find the distance.

As the sine of CAB	-	87° 26′	-	9.99956
is to the sine of ACB	-	45 0	-	9.84948
so is the distance CB	-	32.3	-	1.50922
to the distance AB	- -	22.86		1.35914

Ex. 5. A ship from a port in latitude 57° 9′ N, longitude 2° 9′ W, sailed 82 miles on a direct course, and spoke a ship that had run 100 miles from a port in latitude 56° 21′ N, longitude 2° 50′ W.—Required the course of each ship, and the latitude and longitude come to?

Lat. -	57° 9′ N	Mer. parts 4199	Lon. 2° 9′ W
——	56 21 N	—— 4112	— 2 50 W
Diff. of lat.	48	Mer. diff. lat. 87	Diff. lon. 41

By Construction.

With the meridional difference of latitude, the difference of longitude, and difference of latitude, construct the triangles ADE, ABC (fig. 38.) as in Mercator's Sailing; then A will represent the northernmost, and C the southernmost port. The distance AC applied to the scale will measure 53 miles, and the bearing BCA will be 25°$\frac{1}{4}$. From the points A and C, with distances equal to 82 and 100 miles respectively, describe arches intersecting each other in M, which will therefore be the place of meeting.—Now the angle ABM, the ship's course from the southernmost port, will measure N 80°$\frac{1}{5}$ E; and the other ship's course, or angle BAM, will be 67°$\frac{4}{5}$, or ESE. From M draw the parallel MNP, and AN will be the difference of latitude made by the one ship, and CP that by the other ship: hence either of these being measured and applied to its correspondent latitude, will give 56° 38′, the latitude in. Make AF equal to 57, the meridional difference of latitude between the northernmost port and latitude in: from F draw FG perpendicular to AF, and produce AM to G, then FG will be the difference of longitude, which applied to the scale will measure 139: hence the longitude in, is 0° 10′ E. Fig. 38.

By Calculation.

In the triangle ADE, ABC, are given AD equal to 87, DE equal to 41, and AB equal to 48; to find the angle BAC and distance AC.

To find the bearing of the ports.

As the meridional diff. of lat.	87	-	1.93952
is to the diff. of long. -	41	-	1.61278
so is radius - - - - -		-	10.00000
to the tangent of the bearing	25° 14′	-	9.67326

To find the distance of the ports.

As radius - - - - -		-	10.00000
is to the secant of the bearing -	25° 14′	-	10.04355
so is the diff. of latitude	48	-	1.68124
to the distance -	53.06	-	1.72479

In the triangle AMC, the three sides are given to find the angles.

To

Oblique Sailing.

To find the angle ACM.

AM	- -	82		
MC	- -	100	ar. co. log. -	8.00000
AC	- -	53.06	ar. co. log. -	8.27523
Sum	- -	235.06	log. -	2.07015
Half	- -	117.53	log. -	1.55059
Difference	-	53.53		
				19.89597
		27 29	- cosine	9.94798
Angle ACM		54 58		
Angle BAC		25 14		
Southernmost ship's course		N 80 12 E		

To find the angle MAC.

As AM - - -	82	-	1.91381
is to MC - - -	100	-	2.00000
so is the sine of ACM -	54 58	-	9.91319
to the sine of MAC -	93 3	-	9.99938
Angle BAC -	25 14		
Northernmost ship's course -	S 67 49 E, or ESE.		

In the right-angled triangle AMN, given AM, and the angle MAN, to find the differences of latitude AN.

As radius - - - - -			10.00000
is to the cosine of the course	67° 49′	- -	9.57700
so is the distance	82	- -	1.91381
to the diff. of lat.	30.96	-	1.49081
Latitude of northernmost port	57 9	Mer. parts	4199
Latitude in -	56 38	Mer. parts	4142
Meridional difference of latitude		-	57

To find the difference of longitude FG.

As radius - - - - - -			10.00000
is to the tangent of the course -	67° 49′	-	10.38960
so is the mer. diff. of lat.	57	- -	1.75587
to the diff. of long.	139.8	-	2.14547
Longitude left - -	2° 9′ W		
Difference of longitude -	2 20 E		
Longitude in - -	0 11		

Chap. IX. *Of Windward Sailing.*

Windward sailing is, when a ship by reason of a contrary wind is obliged to sail on different tacks in order to gain her intended port; and the object of this sailing is to find the proper course and distance to be run on each tack.

Ex. 1. A ship is bound to a port 48 miles directly to the windward, the wind being SSW, which it is intended to reach on two boards; and the ship can lie within six points of the wind. Required the course and distance on each tack?

Windward Sailing.

By Construction.

Draw the SSW line CB (fig. 39.) equal to 48 miles. Make the angles ACB, ABC, each equal to 6 points. Hence the first course will be W, and the second SE: also the distance CA, or AB, applied to the scale will measure $62\frac{3}{4}$ miles, the distance to be sailed on each board. Fig. 39.

By Calculation.

From A draw AD perpendicular to BC; then in the triangle ADC are given CD, equal to 24 miles; and the angle ACD, equal to 6 points, to find the distance AC.

As radius - - - - -			10.00000
is to the secant of C -	6 points	-	10.41716
so is CD - -	24 miles	-	1.38021
to CA - -	62.7	-	1.79737

Ex. 2. The wind at NW, a ship bound to a port 64 miles to the windward, proposes to reach it on three boards; two on the starboard, and one on the larboard tack, and each within 5 points of the wind. Required the course and distance on each tack?

By Construction.

Draw the NW line CA (fig. 40.) equal to 64 miles; from C draw CB W*b*S, and from A draw AD parallel thereto, and in an opposite direction; bisect AC in E, and draw BED parallel to the N*b*E rhumb, meeting CB, AD in the points B and D: then CB=AD applied to the scale will measure $36\frac{1}{4}$ miles, and BD=2CB=$72\frac{1}{2}$ miles. Fig. 40.

By Calculation.

From B draw BF perpendicular to AC; then in the triangle BFC are given the angle BCF equal to 5 points, and CF equal to one fourth of CA=16 m. to find CB.

As radius - - - - -			10.00000
is to the secant of BCF -	5 points	-	10.25526
so is CF - - -	16 m.	-	1.20412
to CB - - -	36.25	-	1.55938

Ex. 3. A ship which can lie within $5\frac{1}{2}$ points of the wind, is bound to a port 36 miles to the windward, the wind being NE*b*N, which it is intended to reach on four boards, the first being on the larboard tack. Required the course and distance on each?

By Construction.

Draw the NE*b*N line CA (fig. 41.) equal to 36 miles, and bisect it in B; from C and B draw lines parallel to the E$\frac{1}{2}$S rhumb; and from A and B draw lines parallel to the SSE$\frac{1}{2}$E point, meeting the former in the points D and E. Now the distances AD, BD, BE, and CE, are equal; and any one of them applied to the scale will measure 19.1 miles. Fig. 41.

By Calculation.

From E draw EF perpendicular to AC; and in the triangle CFE are given CF=9 m. and the angle FCE =$5\frac{1}{2}$ points, to find CE.

As

Windward Sailing.

As radius			10.00000
is to the ſecant of FCE		$5\frac{1}{2}$ points	10.32661
ſo is CF		9 miles	0.95424
to the diſtance CE		19.1 miles	1.28085

Ex. 4. A ſhip bound to a port bearing N*b*W diſtant 40 miles, with the wind at N*b*E$\frac{1}{2}$E, intends to reach it on two boards. Required the courſe and diſtance on each tack, the ſhip lying within $5\frac{1}{2}$ points of the wind?

By Conſtruction.

Fig. 42. Draw the N*b*W line CA (fig. 42.) equal to 40 miles; and becauſe the wind is N*b*E$\frac{1}{2}$E, and the ſhip can lie within $5\frac{1}{2}$ points of the wind, the courſe on the larboard tack will be E*b*N, and on the ſtarboard NW. Therefore, from the centre C draw the E*b*N line CB, and from it draw the NW line AB, meeting CB in B; then CB and AB applied to the ſcale will meaſure 26.7 and 48.1 m. reſpectively.

By Calculation.

In the triangle ACB, given AC=40 miles, and the angles A, B, and C, equal to 3, 5, and 8 points reſpectively, to find AB and BC.

To find the diſtance CB.

As the ſine of B		5 points	9.91985
is to the ſine of A		3 points	9.74474
ſo is the diſtance CA		40 miles	1.60206
to the diſtance CB		26.73	1.42695

To find the diſtance AB.

As the ſine of B		5 points	9.91985
is to the ſine of C		8 points	10.00000
ſo is the diſtance CA		40 miles	1.60206
to the diſtance AB		48.11	1.68221

Ex. 5. A ſhip cloſe hauled within 5 points of the wind, and making one point of leeway, is bound to a port bearing SSW, diſtant 54 miles, the wind being S*b*E: It is intended to make the port at three boards, the firſt of which muſt be on the larboard tack in order to avoid a reef of rocks. Required the courſe and diſtance on each tack?

By Conſtruction.

Fig. 43. Draw the SSW line CA (fig. 43.) equal to 54 m. and as the wind is S*b*E, and the ſhip makes her courſe good within 6 points of the wind, therefore the courſe on the larboard tack will be SW*b*W, and on the ſtarboard E*b*S: hence from C draw the SW*b*W line CB, and from A draw AD parallel thereto; biſect CA in E, and draw BED parallel to the E*b*S line; then will CB and AD be the diſtances on the larboard tack, which applied to the ſcale, each will be found to meaſure 37.4; and the diſtance on the ſtarboard tack BD will meaſure 42.4 miles.

By Calculation.

The triangles CBE, EAD are equal and ſimilar: hence in the firſt of theſe are given CE, equal to 27 miles, half the diſtance between the ſhip and port; the angles C, B, and E, equal to 3, 4, and 9 points reſpectively, to find CB and BE.

Current Sailing.

To find CB, the diſtance on the larboard tack.

As to the ſine of B		4 points	9.84948
is to the ſine of E		9 points	9.99157
ſo is the diſtance CE		27 miles	1.43136
to the diſtance BC		37.45	1.57345

To find BE half the diſtance on the ſtarboard tack.

As the ſine of B		4 points	9.84948
is to the ſine of C		3 points	9.74474
ſo is the diſtance CE		27 miles	1.43136
to the diſtance BE		21.21	1.32662
Whole diſtance AC		42.42	

Ex. 6. A ſhip plying to the windward, with the wind at NNE, after ſailing 51 miles on each of two tacks, is found by obſervation to have made 36 miles of difference of latitude. How near the wind did ſhe make her way good?

By Conſtruction.

Make CA (fig. 44.) equal to 36 miles; draw AB perpendicular to CA, and draw the NNE line CB, meeting AB in B; make CD, BD each equal to 51 miles, and theſe being meaſured, will be found equal to 6 points. Fig. 44.

By Calculation.

In the triangles CAB, BCD, are given AB equal to 36 m. CD=BD=51, and the angle ACB equal to 2 points; to find the angle BCD.

As the diſtance CD		51	1.70757
is to the diff. of latitude CA		18	1.25527
ſo is the ſecant of ACB		2 points	10.63438
to the coſine of BCD		67° 32′	9.58208

Chap. X. *Of Current Sailing.*

The computations in the preceding chapters have been performed upon the aſſumption that the water has no motion. This may no doubt anſwer tolerably well in thoſe places where the ebbings and flowings are regular, as then the effect of the tide will be nearly counterbalanced. But in places where there is a conſtant current or ſetting of the ſea towards the ſame point, an allowance for the change of the ſhip's place ariſing therefrom muſt be made: And the method of reſolving theſe problems, in which the effect of a current, or heave of the ſea, is taken into conſideration, is called *current ſailing*.

In a calm, it is evident a ſhip will be carried in the direction and with the velocity of the current. Hence, if a ſhip ſails in the direction of the current, her rate will be augmented by the rate of the current; but if ſailing directly againſt it, the diſtance made good will be equal to the difference between the ſhip's rate as given by the log and that of the current. And the abſolute motion of the ſhip will be a-head, if her rate exceeds that of the current; but if leſs, the ſhip will make ſternway. If the ſhip's courſe be oblique to the current, the diſtance made good in a given time will be repreſented by the third ſide of a triangle, whereof the diſtance given by the log, and the drift of the current in the ſame time, are the other ſides; and the true courſe will be the angle contained between the meridian and the line actually deſcribed by the ſhip.

4

Ex.

Current Sailing.

Ex. 1. A ſhip ſailed NNE at the rate of 8 knots an hour, during 18 hours, in a current ſetting NW*b*W 2½ miles an hour. Required the courſe and diſtance made good?

By Conſtruction.

Plate CCCLXV. Fig. 45.

Draw the NNE line CA (fig. 45.) equal to 18×8 =144 miles; and from A draw AB parallel to the NW*b*W rhumb, and equal to 18×2½=45 miles: now BC being joined will be the diſtance, and NCB the courſe. The firſt of theſe will meaſure 159 miles, and the ſecond 6° 23′.

By Calculation.

In the triangle ACB, are given AC=144 miles, AB=45 miles, and the angle CAB=9 points, to find BAC and BC.

To find the courſe made good.

Diſt. AC	- 144	Ang. BAC=9 pts		=101° 15′
Diſt. AB	- 45			
		B+C	-	78 45
Sum	- 189			
Diff.	- 99	$\frac{B+C}{2}$	-	39 22½

As the ſum of the ſides -	189 -	2.27646
is to the difference of the ſides	99 -	1.99563
ſo is the tan. of half ſum angles	39 22½	9.91417
to the tan. of half diff. angles -	23 15½	9.63334

Angle ACB -	16 7
Angle ACN -	22 30
Courſe made good	N 6 23

To find the diſtance.

As the ſine of ACB -	16° 7′ -	9.44341
is to the ſine of CAB -	101 15 -	9.99157
ſo is the diſtance AB -	45 -	1.65321
to the diſtance CB -	159 -	2.20137

Ex. 2. A ſhip from a port in latitude 42° 52′ N, ſailed S*b*W½W 17 miles in 7 hours, in a current ſetting between the north and weſt; and then the ſame port bore ENE, and the ſhip's latitude by obſervation was 42° 42′ N. Required the ſetting and drift of the current?

By Conſtruction.

Fig. 46.

Draw the S*b*W½W line CA (fig. 46.) equal to 17 miles, and make CB equal to 10 miles, the difference of latitude: through B draw the parallel of latitude BD, and draw the WSW line CD, interſecting BD in D: AD being joined, will repreſent the drift of the current, which applied to the ſcale will meaſure 20.2, and the angle DAE will be its ſetting, and will be found equal to 72°.

By Calculation.

In the triangle CBD, given CB=10 miles, and the angle BCD=6 points; to find the diſtance CD.

As radius -	-	10.00000
is to the ſecant of BCD -	6 points	10.41710
ſo is the diff. of lat. CB -	10 miles	1.00000
to the diſtance CD -	26.13	1.41710

Again, In the triangle ACD are given the diſtance AC=17 miles, CD=26.13, and the angle ACD 4½ points; to find the remaining parts.

Current Sailing.

To find the ſetting of the current.

Diſtance DC=26.13		Angle ACD=4½ points.	
Diſtance AC=17. 0		CAD+CDA 11½	
Sum -	43.13	$\frac{CAD+CDA}{2}$	=5¾=64° 41′
Difference -	9.13		

As the ſum of the ſides -	43.13 -	1.63478
is to the differ. of the ſides -	9.13 -	0.96047
ſo is tang. half ſum angles -	64° 41′ -	10.32509
to tang. half diff. angles -	24 6 -	9.65078

Angle CAD - - -	88 47
Angle CAE=ACB=1½ pt.	= 16 52
Setting of the current EAD	= 71 55

To find the drift of the current.

As the ſine of CAD -	88° 47′ -	9.99990
is to the ſine of ACD -	4½ points	9.88819
ſo is the diſtance CD -	26.13 -	1.41710
to the drift of current AD	20.2 -	1.30539

Hence the hourly rate of the current is $\frac{20.2}{7}=2.9$ knots.

Ex. 3. A ſhip, from latitude 38° 20′ N, ſailed 24 hours in a current ſetting NW*b*N, and by account is in latitude 38° 42′ N, having made 44 miles of eaſting; but the latitude by obſervation is 38° 58′ N. Required the courſe and diſtance made good, and the drift of the current.

By Conſtruction.

Make CE (fig. 47.) equal to 22 miles, the difference of latitude by D, R, and EA=54 miles, the departure, and join CA; make CD=38 miles, the difference of latitude by obſervation; draw the parallel of latitude DB, and from A draw the NW*b*N line AB, interſecting DB in B, and AB will be the drift of the current in 24 hours: CB being joined, will be the diſtance made good, and the angle DCB the true courſe. Now, AB and CB applied to the ſcale, will meaſure 19.2 and 50.5 reſpectively; and the angle DCB will be 41°¼. Fig. 47.

By Calculation.

From B draw BF perpendicular to AE, then in the the triangle AFB are given BF=16 miles, and the angle ABF=3 points; to find AB and AF.

To find the drift of the current AB.

As radius - - - - -	-	10.00000
is to the ſecant of ABF -	3 points -	10.08015
ſo is BF - - -	16 miles -	1.20412
to the drift of the current AB	19.24 -	1.28427

Hence the hourly rate $=\frac{19.24}{24}=0.8$.

To find AF.

As radius - - - - -	-	10.00000
is to the tangent of ABF -	3 points -	9.82489
ſo is BF - - -	16 points -	1.20412
to AF - - -	10.69 -	1.02901
Departure by account EA -	44.	
True departure	EF=DB=33.31	

Now,

Current Sailing.

Now, in the triangle CDB are given the difference of latitude and departure; to find the courſe and diſtance.

To find the courſe.

As the difference of latitude CD	38.	-	1.57978
is to the departure DB	- 33.31	-	1.52257
ſo is radius	-	-	10.00000
to the tangent of the courſe	- 41° 14′	-	9.94279

To find the diſtance.

As radius	-	-	10.00000
is to the ſecant of the courſe	- 41° 14′		10.12376
ſo is the difference of latitude	- 38	-	1.57978
to the diſtance	- - - 50.53		1.70354

Ex. 4. In the Straits of Sunda, at 2 P. M. ſteering SE*b*S at the rate of 5 knots an hour, I paſſed cloſe by the ſmall iſlands off Hog point. At 6, not having changed our courſe, came to anchor on the Java ſhore. Upon ſetting the ſaid iſland from this anchoring place, I find it bears due north, its diſtance by the chart being 22 miles. It follows from hence, that our courſe has been affected by a current. Required its velocity and direction?

By Conſtruction.

Fig. 48. From A (fig. 48.) draw the SE*b*S line AB=20, which will repreſent the ſhip's apparent track through the water; draw AC equal to 22 miles ſouth, and C will be the ſhip's real place; and BC being joined will be the current's drift in four hours; which applied to the ſcale will meaſure 12.3; from A draw AD parallel to BC, and the angle CAD will be the direction of the current, and will be found to meaſure $64^{\circ}\frac{1}{5}$.

By Calculation.

In the triangle ABC, given AB=20 m. AC=22 m. and the included angle A=3 points; to find the remaining parts.

To find the ſetting of the current.

Diſtance AC=22 m. Included angle =3 points.

AB=20		B+C=13
Sum - 42		$\frac{B+C}{2}=6\frac{1}{2}$ p$=73.7\frac{1}{2}$
Difference - 2		

As the ſum of the ſides	- 42	-	1.62325
is to the diff. of the ſides	- 2	-	0.30103
ſo is the tang. of half ſum angles	73° 7′½	-	10.51806
to tang. of half diff. angles	8.55½		9.19584

Setting of the current S 64 12W, or SW*b*W¼W.

To find the drift of the current.

As the ſine of ACB	64° 12′	-	9.95440
is to the ſine of BAC	33 45	-	9.74474
ſo is the diſtance AB	- 20	-	1.30103
to the velocity of cur. BC	12 34	-	1.09137

and $\frac{12.34}{4}=3.1$, its hourly rate.

Example 5. A ſhip bound from Dover to Calais, lying 21 miles to the SE*b*E½E, and the flood tide ſetting NE½E 2½ miles an hour. Required the courſe ſhe muſt ſteer, and the diſtance run by the log at 6 knots an hour to reach her port?

Instruments to ſolve Problems in Sailing without Calculation.

By Conſtruction.

In the poſition of the SE*b*E½E rhumb, draw DC =21 miles (fig. 49.); draw DE NE½E=2½ miles; from E with 6 miles cut DC in F; draw DB parallel to EF, meeting CB drawn parallel to DE: then the diſtance DB applied to the ſcale will meaſure 19.4, and the courſe SDB will be SE½S. Fig. 49.

By Calculation.

In the triangle DBF, given DE=2½ miles, EF =6 miles, and the angle EDF=6 points; to find the angle DFE=CBD.

As the hourly rate of ſailing -	6m.	0.77815
is to the hourly rate of current	2½m.	0.39794
ſo is the ſine of EDF=6 points	67° 30′	9.96562
to the ſine of DFE - -	22 38	9.58541
Angle - SDC=5½ points =	61 52	
Courſe SDB - -	39 14=SE½S.	

In the triangle DBC, given DC=21 miles, the angle BDC=DFE=22° 38′, and the angle DCB= DEF=6 points; to find the diſtance DB.

As the ſine of DBC	- 89° 52′	-	9 99999
is to the ſine of DCB	- 67 30	-	9.96562
ſo is the true diſtance DC	21 m.		1.32222
to the diſtance by the log DB.	21 m.		1.28785

Chap. XI. *Inſtruments propoſed to ſolve the various Problems in Sailing, independent of Calculation.*

Various methods, beſide thoſe already given, have been propoſed to ſave the trouble of calculation.— One of theſe methods is by means of an inſtrument compoſed of rulers, ſo diſpoſed as to form a right-angled triangle, having numbers in a regular progreſſion marked on their ſides. Theſe inſtruments are made of different materials, ſuch as paper, wood, braſs, &c. and are differently conſtructed, according to the fancy of the inventor. Among inſtruments of this kind, that by John Cooke, Eſq. ſeems to be the beſt. A number of other inſtruments, very differently conſtructed, have been propoſed for the ſame purpoſe; of theſe, however, we ſhall only take notice of the rectangular inſtrument, by A. Mackay, LL.D. F.R.S.E. &c.

I. *Of* Cooke's *Triangular Inſtrument.*

Deſcription. The ſtock *a b c d* (fig. 50.) is a parallelopiped: The length from *a* to *b* is two feet, the breadth from *a* to *d* two inches, and the depth is one inch and a half. The ſtock is perforated longitudinally, ſo as to be capable of containing within it *e f*, a cylindrical piece of wood one inch diameter; *g h* is an aperture on the ſurface of the ſtock about a quarter of an inch wide, which diſcloſes one twelfth part of the ſurface of the cylinder contained; the edge *dc* is divided into twelve parts, each of theſe is ſubdivided into ſix parts, and each of theſe again into ten parts. The ſurface of the cylinder is divided longitudinally into twelve parts, and on each of them is engraved a portion Fig. 50.

Instruments to solve Problems in Sailing, without Calculation.

portion of a line of meridional parts 22 feet long, which contains the meridional parts for every minute from the equator as far towards the pole as navigation is practicable; and the smallest division on it is not less than $\frac{1}{20}$th of an inch. By rolling and sliding this cylinder, any part of any line on it may be brought into any position which may be required: the box *i* is engrooved into the edge of the stock *a b*, so that it may move freely from *a* to *b*; a limb from this box extends to *k*, which serves to mark that degree of the perpendicular *i l* which is parallel to the centre of the semicircle *m*; *i l* is two feet long, and graduated on both edges as the stock; it is perpendicular to the stock, and is fixed in the box *i*, by which it may be moved from *a* to *b*; *o p n* is a semicircle of six inches radius, engraved, as appears in the plate, which slides freely from *c* to *d* in a groove in the edge of the stock *c d*; *m q* is the index moving on the centre *m*, the edge of which marks the course on the semicircle; it is two feet long, and divided into 72 parts; and these are subdivided in the same manner as those on the stock and perpendicular, to which they are equal; *r* is a vernier attached to the index to show minutes; *S* is a vernier composed of concentric semicircles, which slides along the edge *q m*, to the intersection of the perpendicular and index, where it serves as a vernier to both; below *x* is a small piece of ivory, with a mark on it to point out the degree of the line *d c*, which is perpendicularly under the centre of the semicircle. Fig. 51. is a view of the back part of the instrument.

Fig. 51.

Use. The method of working every case which occurs in navigation, is to make the instrument similar to that ideal triangle which is composed of the difference of latitude, departure, and distance; or, to that composed of the meridional difference of latitude, difference of longitude, and enlarged distance; or, to that composed of the difference of longitude, departure, and sine of the middle latitude; which is done by means of the data procured from the compass, log-line, and quadrant: whence it follows, from the nature of similar triangles, or from the relation which exists between the sides of triangles and the sines of their opposite angles, that the parts of the instrument become proportional to those which they represent; and will ascertain the length of the lines, or the extent of the angles sought, by its graduations.

In the practice of this instrument, a small square is necessary in order to bring the centre of the semicircle perpendicularly over the meridional degree corresponding to the latitude.

Plane Sailing.

PROB. I. The course and distance sailed being given, to find the difference of latitude and departure.

Example. A ship from latitude 24° 18′ N, sailed NW*b*N 168 miles. Required the latitude come to, and departure?

Set the centre of the semicircle perpendicularly over the given latitude 24° 18′, and the index to the course 3 points; move the perpendicular until it cut the index at the given distance 168; then at the point of intersection on the perpendicular is 93.3 miles, the departure, and on the base, by the edge of the box, is 26° 38′, the latitude come to.

PROB. II. Both latitudes and course given, to find the distance and departure.

Example. Let the latitude sailed from be 43° 50′ N, that come to 47° 8′ N, and the course NNE. Required the distance and departure?

Move the centre of the semicircle to the latitude left 43° 50′, and the edge of the box to the latitude come to 47° 8′; fix the index at the given course 2 points: then at the point of intersection of the index and perpendicular is the distance 214 miles on the index, and the departure 82 miles on the perpendicular.

PROB. III. Given the course and departure, to find the distance and difference of latitude.

Example. Let the latitude sailed from be 32° 38′ N, the course SW*b*S, and the departure 200 miles. Required the distance and latitude come to?

Move the centre of the semicircle to the latitude left 32° 38′, set the index to the given course 3 points, and move the perpendicular till the given departure 200 cuts the index; at this point on the index is 360 miles, and the edge of the box will cut the latitude come to 27° 39′ N.

PROB. IV. Given the difference of latitude and distance, to find the course and departure.

Example. Let the latitude left be 17° 10′ N, the latitude come to 21° 40′ N, and the distance sailed on a direct course between the north and west 300 miles. Required the course and departure?

Move the semicircle and box to the given latitudes, and the index until the distance found thereon meets the perpendicular; then at the point of contact on the perpendicular is 130.8, the departure, and on the semicircle by the index is 25° 50′, the course.

PROB. V. The distance and departure given, to find the course and difference of latitude.

Example. The distance sailed is 246 miles between the south and east, the departure is 138 miles, and the latitude left 51° 10′ N. Required the course and latitude come to?

Set the centre of the semicircle to 51° 10′, the latitude sailed from; find the distance 246 on the index, and the departure 138 on the perpendicular; then move both till these points meet, and the course 34° 10′ will be found on the semicircle by the index, and the latitude in 47° 47′ N, by the edge of the box.

PROB. VI. Both latitudes and departure given, to find the course and distance.

Example. A ship from latitude 43° 10′ N, sailed between the north and west till she is in latitude 47° 14′ N, and has made 170 miles of departure. Required the course and distance?

Move the centre of the semicircle over 43° 10′, and the edge of the box to 47° 14′; find the departure on the perpendicular, and bring the edge of the index thereto; now at the point of intersection is the distance 297.4 miles on the index, and the course 34° 52′ on the semicircle.

Traverse Sailing.

Example. A ship from latitude 46° 48′ N, sailed SSW½W 24 miles, S*b*W 36 miles, and S½E 40 miles.

miles. Required the latitude in, together with the direct courſe and diſtance ?

Set the ſemicircle to the latitude ſailed from 46° 48′, and the index to the courſe SSW$\frac{1}{2}$W ; mark the diſtance 24 on the index, and bring the perpendicular to meet it ; then the index will cut the departure 11.3 on the perpendicular, and the perpendicular will cut the latitude 46° 27′ N on the baſe. For the next courſe and diſtance, bring the ſemicircle to the latitude marked by the perpendicular, and lay down the courſe S*b*W : if it be towards the firſt meridian, move the laſt marked departure until it meets the index, and the limb of the box will mark the preſent departure ; but if the courſe be from the firſt meridian, bring the laſt departure 11.3 to the limb of the box, the index will mark the departure made good 18.3 on the perpendicular, and the latitude arrived at 40° 52′ will be marked on the baſe by the perpendicular : proceed in the ſame manner with all the courſes of which the traverſe conſiſts, then the difference of latitude 1° 36′ will be intercepted between the latitude ſailed from 46° 48′, and the latitude come to 45° 12′ laſt marked by the perpendicular ; and alſo the departure made good will be intercepted between that point on the perpendicular where the firſt departure commenced, and that where the laſt terminated. Now, with the difference of latitude 1° 36′ and the departure, the courſe will be S 8° 30′ W, and diſtance 97 miles, by laſt problem in Plane Sailing.

Parallel Sailing.

Prob. I. The difference of longitude between two places in one parallel of latitude given, to find the diſtance between them.

Example. Let the common latitude be 49° 30′ N, and the difference of longitude 3° 30′. Required the diſtance ?

Set the index to 40° 30′, the complement of the latitude on the ſemicircle ; mark the difference of longitude in miles on the index ; then move the perpendicular until it meets the termination of the difference of longitude on the index, and the part of the perpendicular intercepted between the limb of the box and the point of interſection will be the diſtance 136.4 miles.

Prob. II. The diſtance between two places in one parallel of latitude given, to find the difference of longitude between them.

Example. Let the latitude of the given parallel be 49° 30′ N, the diſtance ſailed 136.4 E. Required the difference of longitude ?

Set the index to the complement of the latitude 40° 30′, and mark the diſtance ſailed on the perpendicular ; then move it until it meets the index, and the point of interſection will ſhow the difference of longitude 210′ or 3° 30′ on the index.

Prob. III. Given the diſtance ſailed on a parallel, and the difference of longitude, to find the latitude of that parallel.

Example. The diſtance ſailed due eaſt is 136.4, and the difference of longitude 3° 30′. Required the latitude of the parallel ?

Find the difference of longitude 210 on the index, and the diſtance 136.4 on the perpendicular, and move both until theſe numbers meet, and the complement of the latitude 4° 30′ will be ſhown by the index on the ſemicircle.

Mercator's and Middle Latitude Sailing.

Prob. I. The latitudes and longitudes of two places given, to find the direct courſe and diſtance between them.

Example. Required the courſe and diſtance between two places whoſe latitudes and longitudes are 50° 30′ N, 19° 0′ W, and 54° 30′ N, 15° 30′ W, reſpectively ?

By Mercator's Sailing.

To find the courſe.

Move the centre of the ſemicircle perpendicularly over the meridional degree anſwering to latitude 50° 50′ N, then move the box until the edge of the perpendicular cuts the meridional parts of the other latitude 54° 30′ N, and move the index until it cuts the difference of longitude 3° 30′ on the perpendicular, and the index will mark the courſe 30° 10′, or NNE$\frac{3}{4}$E nearly on the ſemicircle.

To find the diſtance.

Screw the index to this courſe, and move the centre of the ſemicircle to the latitude 50° 50′ N, and the edge of the perpendicular to the latitude 54° 30′ N, then the perpendicular will cut the diſtance 254.7 on the index.

By Middle Latitude Sailing.

To find the departure.

Move the centre of the ſemicircle to the latitude 50° 50′, and the edge of the index to the complement of the middle latitude 37° 20′ on the ſemicircle ; then move the box until the edge of the perpendicular interſects the termination of the difference of longitude 210 miles on the index, which point of interſection will mark the departure 128 on the perpendicular.

To find the courſe and diſtance.

Move the edge of the perpendicular to the other latitude 54° 30′, and the index until it cuts the departure 128 on the perpendicular ; then will the perpendicular mark the diſtance on the index 254.7 miles, and the index will mark the courſe on the ſemicircle 30° 10′, or NNE$\frac{3}{4}$E nearly.

Prob. II. Both latitudes and courſe given, to find the diſtance and difference of longitude.

Example. A ſhip from latitude 50° 50′ N, longitude 19° 0′ W, ſailed N 30° 10′ E, until ſhe is in latitude 54° 30′ N. Required the diſtance and difference of longitude ?

By Mercator's Sailing.

To find the difference of longitude.

Move the box and ſemicircle as in the former problem to the meridional parts of the given latitudes, then ſet the index to the courſe, and it will mark the difference of longitude 3° 30′ on the perpendicular : Hence the longitude in is 15° 30′ W.

To find the diſtance.

Move the perpendicular and ſemicircle to the given latitudes, and put the index to the given courſe ; then the perpendicular will cut the diſtance 254.7 miles on the index.

By

Instruments to solve Problems in Sailing, without Calculation.

By Middle Latitude Sailing.

To find the distance and departure.

Move the semicircle and perpendicular to the given latitudes, and the index to the course; then the perpendicular will show the departure 128 miles, and the index the distance 254.7 miles at the point of intersection.

To find the difference of longitude.

Set the index to the complement of the middle latitude on the semicircle, and move the box until the termination of the departure on the perpendicular meets the index, which will mark the difference of longitude thereon 210 m. or 3° 30′.

Prob. III. Both latitudes and distance given, to find the course and difference of longitude.

Example. From latitude 50° 50′ N, longitude 19° 0′ W, a ship sailed 254.7 miles between the north and east, and by observation is in latitude 54° 30′ N. Required the course and difference of longitude?

By Mercator's Sailing.

To find the course.

Move the perpendicular and semicircle to the given latitudes, and the index until the distance sailed marked on it meets the perpendicular; then the index will mark the course N 30° 10′ E on the semicircle.

To find the difference of longitude.

Screw the index to the course, move the perpendicular and semicircle to the meridional parts of the given latitudes, and the space intercepted between the limb of the box and the index will be the difference of longitude 3° 30′.

By Middle Latitude Sailing.

To find the departure and course.

Move the semicircle and perpendicular to the given latitudes, and the index until the distance sailed on it cuts the perpendicular; then the perpendicular will show the departure 128 miles, and the semicircle the course N 30° 10′ E.

To find the difference of longitude.

Set the index to 37° 20′, the complement of the middle latitude on the semicircle, and move the perpendicular until the termination of the departure on it cuts the index: then the point of intersection will mark the difference of longitude 210 miles on the index.

Prob. IV. Both latitudes and departure given, to find the course, distance, and difference of longitude.

Example. Let the latitude and longitude sailed from be 56° 40′ S and 28° 55′ E respectively, the latitude come to 61° 20′ S, and departure 172 miles. Required the course, distance, and difference of longitude?

By Mercator's Sailing.

To find the course and distance.

Move the perpendicular and semicircle to the given latitude (H); then move the index till it meets the extremity of the departure on the perpendicular; the distance will be marked on the index 329, and the course S 31° 35′ E, or SSE¾E nearly, on the semicircle.

Instruments to solve Problems in Sailing, without Calculation.

To find the difference of longitude.

Move the perpendicular and semicircle to the meridional parts of the given latitudes, and the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The course and distance are found as before.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the semicircle, and move the perpendicular until the departure marked on it cuts the index, and this point of intersection will mark the difference of longitude on the index 335 m. or 5° 35′.

Prob. V. One latitude, course, and distance given, to find the difference of latitude and difference of longitude.

Example. Let the latitude left be 56° 40′ S, longitude 28° 55′ E, the course S 31° 35′ E, and distance 329m. Required the latitude and longitude come to?

By Mercator's Sailing.

To find the latitude come to.

Set the semicircle to the latitude sailed from, and the index to the course, and bring the perpendicular to the distance, which at the same time will mark the latitude come to 61° 20′ S.

To find the difference of longitude.

Screw the index to the course, and move the semicircle and perpendicular to the meridional parts of both latitudes; then the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The latitude arrived at is found as above.

To find the departure.

The semicircle and perpendicular being set to both latitudes, and the index to the course, it will show the departure 172.7 on the perpendicular.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the semicircle, and move the perpendicular until the departure marked on it cuts the index, and the division on the index at the point of intersection will be the difference of longitude 335.

Prob. VI. One latitude, course, and departure given, to find the distance, difference of latitude, and difference of longitude.

Example. Let the latitude sailed from be 56° 40′ N, longitude 28° 35′ W, the course N 31° 35′ W, and departure 172.7. Required the distance, and the latitude and longitude come to?

By Mercator's Sailing.

To find the distance and latitude come to.

Move the semicircle to the latitude left, and the index to the course; mark the departure on the perpendicular,

(H) In southern latitudes, the end of the cylinder where the numbers begin must be turned towards the north pointed out by the semicircle; and in northern latitudes, it must be reversed.

Instrument to solve Problems in Sailing, without Calculation.

dicular, and move it until the termination thereof meets the index, then the point of interſection will ſhow the diſtance 329 miles on the index, and the perpendicular will ſhow the latitude arrived at 61° 20′ N on the baſe.

To find the difference of longitude.

Screw the index, and move the perpendicular and ſemicircle to the meridional parts of both latitudes, then the index will cut the difference of longitude 5° 35′ on the perpendicular.

By Middle Latitude Sailing.

Find the diſtance ſailed and latitude in as above, and the difference of longitude as in Problem IV. by middle latitude ſailing.

PROB. VII. One latitude, the diſtance ſailed, and departure given, to find the courſe, difference of latitude, and difference of longitude.

Example. The latitude ſailed from is 48° 30′ N, and longitude 14° 40′ W; the diſtance run is 345 miles between the ſouth and eaſt, and the departure 200 miles. Required the courſe, and the latitude and longitude come to?

By Mercator's Sailing.

To find the courſe and latitude come to.

Move the ſemicircle to the latitude left, mark the diſtance on the index, and the departure on the perpendicular, move both until theſe points meet; then will the index ſhow the courſe S 35° 26′ E on the ſemicircle, and the latitude come to 43° 49′ on the baſe.

The difference of longitude is found as in the preceding problem.

By Middle Latitude Sailing.

The courſe and latitude come to are found as above, and the difference of longitude as in Problem IV. by middle latitude ſailing.

II. *Of* DR. MACKAY's *Rectangular Inſtrument.*

Plate CCCLXVI. Fig. 52.

Deſcription. Fig. 52. is a repreſentation of this inſtrument, of about one-third of the original ſize.—The length CA is divided into 100 equal parts, and the breadth CB into 70; but in this plate every ſecond diviſion only is marked, in order to avoid confuſion; through theſe diviſions parallels are drawn, terminating at the oppoſite ſides of the inſtrument. Upon the upper and right hand ſides are two ſcales; the firſt contains the degrees of the quadrant, and the other the points and quarters of the compaſs. M is an index moveable about the centre C, and divided in the ſame manner as the ſides (1). Fig. 53. is a portion of the enlarged meridian, ſo conſtructed that the firſt degree is equal to three diviſions on the inſtrument; and therefore, in the uſe of this line, each diviſion on the inſtrument is to be accounted 20 minutes. The ſize of the plate would not admit of the continuation of of the line.

Uſe. From a bare inſpection of this inſtrument, it is evident that any triangle whatever may be formed on it. In applying it to nautical problems, the courſe is to be found at top, or right-hand ſide, in the column of degrees or points, according as it is expreſſed; the diſtance is to be found on the index, the difference of latitude at either ſide column, and the departure at the head or foot of the inſtrument. The numbers in theſe columns may repreſent miles, leagues, &c.; but when uſed in conjunction with the enlarged meridional line, then 10 is to be accounted 100 miles, 20 is to be eſteemed 200 miles, and ſo on, each number being increaſed in a tenfold ratio; and the intermediate numbers are to be reckoned accordingly.

Instruments to ſolve Problems in Sailing, without Calculation.

Plane Sailing.

PROB. I. The courſe and diſtance ſailed given, to find the difference of latitude and departure.

Example. Let the courſe be NE½N, diſtance 44 miles. Required the difference of latitude and departure?

Move the index until the graduated edge be over 3½ points, and find the given diſtance 44 miles on the index: this diſtance will be found to cut the parallel of 34 miles, the difference of latitude in the ſide column, and that of 28 miles, the departure at the top.

PROB. II. Given the courſe and difference of latitude, to find the diſtance and departure.

Example. Required the diſtance and departure anſwering to the courſe 28°, and difference of latitude 60 miles?

Lay the index over the given courſe 28°: find the difference of latitude 60 miles in the ſide column; its parallel will cut the index at 68 miles, the diſtance and the correſponding departure at the top is 32 miles.

PROB. III. The courſe and departure given, to find the diſtance and difference of latitude.

Example. Let the courſe be SSW and the departure 36 miles. Required the diſtance and difference of latitude?

Lay the index over two points; find the departure at the top, and its parallel will cut the index at 94 miles the diſtance, and the difference of latitude on the ſide column is 87 miles.

PROB. IV. Given the diſtance and difference of latitude, to find the courſe and departure.

Example. The diſtance is 35 leagues, and the difference of latitude 30 leagues. Required the courſe and departure?

Bring 35 leagues on the index to the parallel of 30 leagues in the ſide; then the departure at the top is 18 leagues, and the courſe by the edge of the index on the line of rhumbs is 2¼ points.

PROB. V. Given the diſtance and departure, to find the courſe and difference of latitude.

Example. Let the diſtance be 58 miles, and the departure

(1) In the original inſtrument are two ſlips, divided like the ſide and end of the inſtrument. One of theſe ſlips is moveable in a direction parallel to the ſide of the inſtrument, and the other parallel to the end.

parture 15 miles. Required the course and difference of latitude?

Move the index until 58 found thereon cuts the parallel of 15 from the top: this will be found to intersect the parallel of 56 miles, the difference of latitude; and the course by the edge of the ruler is 15°.

PROB. VI. The difference of latitude and departure being given, to find the course and distance.

Example. Let the difference of latitude be 30 miles, the departure 28 miles. Required the course and distance.

Bring the index to the intersection of the parallels of 30 and 28; then the distance on the index is 41 miles, and the course by its edge is 43°.

Traverse Sailing.

Find the difference of latitude and departure answering to each course and distance by Problem I. of Plane Sailing, and from thence find the difference of latitude and departure made good; with which find the course and distance by the last problem.

An example is unnecessary.

Parallel Sailing.

PROB. I. Given the difference of longitude between two places on the same parallel, to find the distance between them.

Example. Let the latitude of a parallel be 48°, and the difference of longitude between two places on it 3° 40′. Required their distance?

Put the index to 48°, the given latitude, and find the difference of longitude 220 on the index, and the corresponding parallel from the side will be 147, the distance required.

PROB. II. The latitude of a parallel, and the distance between two places on that parallel, being given, to find the difference of longitude between them.

Example. The latitude of a parallel is 56°, and the distance between two places on it 200 miles. Required their difference of longitude?

Put the index to the given latitude, and find the distance in the side column, and the intersection of its parallel with the index will give 358, the difference of longitude sought.

PROB. III. Given the distance and difference of longitude between two places on the same parallel, to find the latitude of that parallel.

Example. The number of miles in a degree of longitude is 46.5. Required the latitude of the parallel?

Bring 60 on the index to cut the parallel of 46.5 from the side, then the edge of the index will give 39° 11′, the latitude required.

Middle Latitude and Mercator's Sailing.

PROB. I. The latitudes and longitudes of two places being given, to find the course and distance between them.

Example. Required the course and distance between Genoa, in latitude 44° 25′ N, longitude 8° 36′ E, and Palermo, in latitude 38° 10′ N, longitude 13° 38, E?

By Mercator's Sailing.

Take the interval between 38° 10′ and 44° 25′ on the enlarged meridian, which laid off from C upwards will reach to 500; now find the difference of longitude 302 at the top, and bring the divided edge of the index to the intersection of the corresponding parallels, and the index will show the course 31° 8′ on the line of degrees; then find the difference of the latitude 375 on the side column, and its parallel will intersect the index at 438, the distance.

By Middle Latitude Sailing.

Put the index to 41° 18′, the complement of the middle latitude on degrees, and the difference of longitude 302 on the index will intersect the parallel of 227, the departure, in the side column. Now move the index to the intersection of the parallels of 375 and 227, the first being found in the side column, and the other at top or bottom; then the distance answering thereto on the index will be 438, and the course on the scale of degrees is 41° 10′.

PROB. II. Given one latitude, course, and distance, to find the other latitude and difference of longitude.

Example. Let the latitude and longitude sailed from be 39° 22′ N, and 12° 8′ W respectively, the course NNW½W, and distance 500 miles. Required the latitude and longitude come to?

By Mercator's Sailing.

Put the index to the course 2½ points, and find the distance 500 miles thereon; then the corresponding difference of latitude will be 441 miles, and the departure 235½ miles, hence the latitude in is 46° 43′ N. Now take the interval between the latitudes of 39° 22′ and 46° 43′ on the enlarged meridian, which laid off from C will reach to about 605, the parallel of which will intersect the vertical parallel of the difference of longitude 323 at the edge of the index: hence the longitude in is 17° 31′ W.

By Middle Latitude Sailing.

Find the difference of latitude and departure as before, and hence the latitude in is 46° 43′ N, and the middle latitude 43° 3′. Now put the index to 43° 3′, and the horizontal parallel of the departure 235½ will intersect the index at 322, the difference of longitude.

PROB. III. Both latitudes and course given, to find the distance and difference of longitude.

Example. The latitude sailed from is 22° 54′ S, and longitude 42° 40′ W, the course is SE by E, and latitude come to 26° 8′ S. Required the distance sailed, and longitude in?

By Mercator's Sailing.

Bring the index to 5 points, the given course, and the parallel of 194, the difference of latitude found in the side column will intersect the index at 349, the distance; and it will cut the vertical parallel of 290, the departure.

Take the interval between the given latitudes 22° 54′ and 26° 8′ on the enlarged meridian; lay off that extent from the centre on the side column, and it will reach to 213: the parallel of this number will intersect the vertical parallel of 319, the difference of longitude. Hence the longitude in is 37° 21′ W.

By

Instruments to solve Problems in Sailing, without Calculation

By Middle Latitude Sailing.

With the given course and difference of latitude find the distance and departure as before; then bring the index to the middle latitude 24° 31′; find the departure 290 in the side column, and its parallel will intersect the index at 319, the difference of longitude.

Prob. IV. One latitude, course, and departure, given, to find the other latitude, distance, and difference of longitude.

Example. The latitude and longitude left are 20° 30′ N. and 49° 17′ W, respectively; the course is NE$\frac{3}{4}$N, and departure 212 miles. Required the latitude and longitude come to, and distance sailed?

By Mercator's Sailing.

Put the index to the given course $3\frac{1}{4}$ points, and the vertical parallel of 212 will cut the index at 356, the distance, and the horizontal parallel of 286, the difference of latitude; the latitude come to is therefore 25° 16′ N.

Now take the interval between the latitudes 20° 30′, and 25° 16′ on the enlarged meridian, which laid off from the centre C will reach to 311; and this parallel will intersect the vertical parallel of the difference of longitude 230, at the edge of the index. Hence the longitude in is 45° 27′ W.

By Middle Latitude Sailing.

Find the distance and difference of latitude as directed above; then bring the index to 22° 53′, the middle latitude, and the horizontal parallel of 212, the departure, will intersect the index at 230, the difference of longitude.

Prob. V. Both latitudes and distance given, to find the course and difference of longitude.

Example. The distance sailed is 500 miles between the north and west; the latitude and longitude left are 40° 10′ N, and 9° 20′ W respectively, and the latitude in is 46° 40′ N. Required the course and longitude in?

By Mercator's Sailing.

Bring the distance 500 on the index to intersect the horizontal parallel of the difference of latitude 390; then the course 38° 44′ is found on the line of degrees by the edge of the index, and the vertical parallel of the above point of intersection is that answering to 313, the departure.

Take the interval between the latitudes 40° 10′, and 46° 40′, which lay off from the centre C, and its horizontal parallel will intersect the vertical parallel of 431, the difference of longitude, by the edge of the index, it being in the same position as before. Hence the longitude in is 16° 31′ W.

By Middle Latitude Sailing.

The course and departure are found as formerly, and the middle latitude is 43° 25′, to which bring the edge of the index, and the horizontal parallel of 313, the departure, will intersect the index at 431 the difference of longitude.

Prob. VI. Both latitudes and departure given, to find the course, distance, and difference of longitude.

Example. Let the latitude sailed from be 42° 52′ N, long. 9° 17′ W, the departure 250 miles W, and the latitude come to 36° 18′ N. Required the course and distance sailed, and the longitude come to?

By Mercator's Sailing.

Find the point of intersection of the horizontal parallel of 394, the difference of latitude, and the vertical parallel of 250, the departure; to this point bring the index, and the corresponding division thereon will be 467 miles, and the course on the scale of degrees by the edge of the index will be 32° 24′.

Take the interval between the latitudes on the enlarged meridian; which being laid off from the centre will reach to 512: now the horizontal parallel of 512 will cut the vertical parallel of 325, the difference of longitude, at the edge of the index. The longitude come to is therefore 14° 42′ W.

By Middle Latitude Sailing.

The course and distance are to be found in the same manner as above. Then bring the index to 39° 35′, the middle latitude, and the horizontal parallel of 250 will intersect the edge of the index at $324\frac{1}{2}$, the difference of longitude.

Prob. VII. Given one latitude, distance, and departure, to find the other latitude, course, and difference of longitude.

Example. A ship from latitude 32° 38′ N, longitude 17° 6′ W, sailed 586 miles between the south and west, and made 336 miles of departure:—Required the course, and the latitude and longitude come to?

By Mercator's Sailing.

Move the index till the distance 586 intersects the vertical parallel of the departure 336; then the corresponding horizontal parallel will be 480, the difference of latitude, and the course 35°. Hence the latitude in is 24° 38′ N.

Now take the interval between the latitudes on the enlarged meridian, which laid off from the centre will reach to 547, the horizontal parallel of which will cut the vertical parallel of 383, the difference of longitude. The longitude in is therefore 23° 29′ W.

By Middle Latitude Sailing.

Find the course and difference of latitude as before, and hence the middle latitude is 28° 38′, to which bring the index, and the horizontal parallel of 336, the departure, will intersect the index at 383, the difference of longitude.

It seems unnecessary to enlarge any further on the use of this instrument, as the above will make it sufficiently understood.

Sea-Charts

Chap. XII. *Of Sea-Charts.*

The charts usually employed in the practice of navigation, are of two kinds, namely, *Plane* and *Mercator's Charts*. The first of these is adapted to represent a portion of the earth's surface near the equator; and the last for all portions of the earth's surface. For a particular description of these, reference has already been made from the article Chart, to those of Plane and Mercator: and as these charts are particularly described under the above articles, it is therefore sufficient in this place to describe their use.

3 *Use*

Sea Charts.

Use of the Plane Chart.

Prob. I. To find the latitude of a place on the chart.

Rule. Take the leaſt diſtance between the given place and the neareſt parallel of latitude; now this diſtance applied the ſame way on the graduated meridian, from the extremity of the parallel, will give the latitude of the propoſed place.

Thus the diſtance between Bonaviſta and the parallel of 15 degrees, being laid from that parallel upon the graduated meridian, will reach to $16^\circ\ 5'$, the latitude required.

Prob. II. To find the courſe and diſtance between two given places on the chart.

Rule. Lay a ruler over the given places, and take the neareſt diſtance between the centre of any of the compaſſes on the chart and the edge of the ruler; move this extent along, ſo as one point of the compaſs may touch the edge of the rule, and the ſtraight line joining their points may be perpendicular thereto; then will the other point ſhow the courſe: The interval between the places, being applied to the ſcale, will give the required diſtance.

Thus the courſe from Palma to St Vincent will be found to be about SSW $\frac{3}{4}$ W, and the diſtance $13^\circ\frac{1}{4}$ or 795 m.

Prob. III. The courſe and diſtance ſailed from a known place being given, to find the ſhip's place on the chart.

Rule. Lay a ruler over the place ſailed from, parallel to the rhumb, expreſſing the given courſe; take the diſtance from the ſcale, and lay it off from the given place by the edge of the ruler; and it will give the point repreſenting the ſhip's preſent place.

Thus, ſuppoſe a ſhip had ſailed SW*b*W 160 miles from Cape Palmas; then by proceeding as above, it will be found that ſhe is in latitude $2^\circ\ 57'$ N.

The various other problems that may be reſolved by means of this chart require no further explanation, being only the conſtruction of the remaining problems in Plane Sailing on the chart.

Uſe of Mercator's Chart.

The method of finding the latitude and longitude of a place, and the courſe or bearing between two given places by this chart, is performed exactly in the manner as in the Plane Chart, which ſee.

Prob. I. To find the diſtance between two given places on the chart.

Case I. When the given places are under the ſame meridian.

Rule. The difference or ſum of their latitudes, according as they are on the ſame or on oppoſite ſides of the equator, will be the diſtance required.

Case II. When the given places are under the ſame parallel.

Rule. If that parallel be the equator, the difference or ſum of their longitudes is the diſtance; otherwiſe, take half the interval between the places, lay it off upwards and downwards on the meridian from the given parallel, and the intercepted degrees will be the diſtance between the places.

Or, take an equal extent of a few degrees from the meridian on each ſide of the parallel, and the number of extents, and parts of an extent, contained between the places, being multiplied by the length of an extent, will give the required diſtance.

Method of finding the Latitude and Longitude at Sea.

Case III. When the given places differ both in latitude and longitude.

Rule. Find the difference of latitude between the given places, and take it from the equator or graduated parallel; then lay a ruler over the two places, and move one point of the compaſs along the edge of the ruler until the other point juſt touches a parallel; then the diſtance between the place where the point of the compaſs reſted by the edge of the ruler, and the point of interſection of the ruler and parallel, being applied to the equator, will give the diſtance between the places in degrees and parts of a degree, which multiplied by 60 will reduce it to miles.

Prob. II. Given the latitude and longitude in, to find the ſhip's place on the chart.

Rule. Lay a ruler over the given latitude, and lay off the given longitude from the firſt meridian by the edge of the ruler, and the ſhip's preſent place will be obtained.

Prob. III. Given the courſe ſailed from a known place, and the latitude in, to find the ſhip's preſent place on the chart.

Rule. Lay a ruler over the place ſailed from, in the direction of the given courſe, and its interſection with the parallel of latitude arrived at will be the ſhip's preſent place.

Prob. IV. Given the latitude of the place left and the courſe and diſtance ſailed, to find the ſhip's preſent place on the chart.

Rule. The ruler being laid over the place ſailed from, and in the direction of the given courſe, take the diſtance ſailed from the equator, put one point of the compaſs at the interſection of any parallel with the ruler, and the other point of the compaſs will reach to a certain place by the edge of the ruler. Now this point remaining in the ſame poſition, draw in the other point of the compaſs until it juſt touch the above parallel when ſweeped round: apply this extent to the equator, and it will give the difference of latitude. Hence the latitude in will be known, and the interſection of the correſponding parallel with the edge of the ruler will be the ſhip's preſent place.

The other problems of Mercator's Sailing may be very eaſily reſolved by this chart; but as they are of leſs uſe than thoſe given, they are, therefore, omitted, and may ſerve as an exerciſe to the ſtudent.

BOOK II.

Containing the method of finding the Latitude and Longitude of a Ship at Sea, and the Variation of the Compaſs.

Chap. I. *Of Hadley's Quadrant.*

Hadley's quadrant is the chief inſtrument in uſe at preſent for obſerving altitudes at ſea. The form of this inſtrument, according to the preſent mode of conſtruction,

Method of finding the Latitude and Longitude at Sea.

construction, is an octagonal sector of a circle, and therefore contains 45 degrees; but because of the double reflection, the limb is divided into 90 degrees. See ASTRONOMY and QUADRANT. Fig. 54. represents a quadrant of the common construction, of which the following are the principal parts.

Plate CCCLXVII Fig. 54.

1. ABC, the frame of the quadrant.
2. BC, the arch or limb.
3. D, the index; *a b*, the subdividing scale.
4. E, the index-glass.
5. F, the fore horizon-glass.
6. G, the back horizon-glass.
7. K, the coloured or dark glasses.
8. HI, the vanes or sights.

Of the Frame of the Quadrant.

The frame of the quadrant consists of an arch BC, firmly attached to the two radii AB, AC, which are bound together by the braces L M, in order to strengthen it, and prevent it from warping.

Of the Index D.

The index is a flat bar of brass, and turns on the centre of the octant: at the lower end of the index there is an oblong opening; to one side of this opening the vernier scale is fixed, to subdivide the divisions of the arch; at the end of the index there is a piece of brass, which bends under the arch, carrying a spring to make the subdividing scale lie close to the divisions. It is also furnished with a screw to fix the index in any desired position. The best instruments have an adjusting screw fitted to the index, that it may be moved more slowly, and with greater regularity and accuracy, than by the hand. It is proper, however, to observe, that the index must be previously fixed near its right position by the above-mentioned screw.

Of the Index Glass E.

Upon the index, and near its axis of motion, is fixed a plane speculum, or mirror of glass quicksilvered. It is set in a brass frame, and is placed so that its face is perpendicular to the plane of the instrument. This mirror being fixed to the index moves along with it, and has its direction changed by the motion thereof; and the intention of this glass is to receive the image of the sun, or any other object, and reflect it upon either of the two horizon-glasses, according to the nature of the observation.

The brass frame with the glass is fixed to the index by the screw *c*; the other screw serves to re-place it in a perpendicular position, if by any accident it has been deranged.

Of the Horizon Glasses F, G.

On the radius AB of the octant are two small speculums: the surface of the upper one is parallel to the index glass, and that of the lower one perpendicular thereto, when *o* on the index coincides with *o* on the limb. These mirrors receive the reflected rays, and transmit them to the observer.

The horizon-glasses are not entirely quicksilvered; the upper one F is only silvered on its lower half, or that next the plane of the quadrant, the other half being left transparent, and the back part of the frame cut away, that nothing may impede the sight through the unsilvered part of the glass. The edge of the foil of this glass is nearly parallel to the plane of the instrument, and ought to be very sharp, and without a flaw. The other horizon-glass is silvered at both ends. In the middle there is a transparent slit, through which the horizon may be seen.

Each of these glasses is set in a brass frame, to which there is an axis passing through the wood work, and is fitted to a lever on the under side of the quadrant, by which the glass may be turned a few degrees on its axis, in order to set it parallel to the index-glass. The lever has a contrivance to turn it slowly, and a button to fix it. To set the glasses perpendicular to the plane of the instrument, there are two sunk screws, one before and one behind each glass: these screws pass through the plate on which the frame is fixed into another plate; so that by loosening one and tightening the other of these screws, the direction of the frame with its mirror may be altered, and set perpendicular to the plane of the instrument.

Of the Coloured Glasses K.

There are usually three coloured glasses, two of which are tinged red and the other green. They are used to prevent the solar rays from hurting the eye at the time of observation. These glasses are set in a frame, which turns on a centre, so that they may be used separately or together as the brightness of the sun may require. The green glass is particularly useful in observations of the moon; it may be also used in observations of the sun, if that object be very faint. In the fore-observation, these glasses are fixed as in fig. 54.; but when the back observation is used, they are removed to N.

Of the two Sight Vanes, H, I.

Each of these vanes is a perforated piece of brass, designed to direct the sight parallel to the plane of the quadrant. That which is fixed at I is used for the fore, and the other for the back, observation. The vane I has two holes, one exactly at the height of the silvered part of the horizon-glass, the other a little higher, to direct the sight to the middle of the transparent part of the mirror.

Of the divisions on the Limb of the Quadrant.

The limb of the quadrant is divided from right to left into 90 primary divisions, which are to be considered as degrees, and each degree is subdivided into three equal parts, which are therefore of 20 minutes each: the intermediate minutes are obtained by means of the scale of divisions at the end of the index.

Of the Vernier, or Subdividing Scale.

The dividing scale contains a space equal to 21 divisions of the limb, and is divided into 20 equal parts. Hence the difference between a division on the dividing scale and a division on the limb is one twentieth of a division on the limb, or one minute. The degree and minute pointed out by the dividing scale may be easily found thus.

Observe what minute on the dividing scale coincides with a division on the limb; this division being added to the degree and part of a degree on the limb, immediately

Method of finding the Latitude and Longitude at Sea.

diately preceding the first division on the dividing scale, will be the degree and minute required.

Thus suppose the fourteenth minute on the dividing scale coincided with a division on the limb, and that the preceding division on the limb to *o* on the vernier was 56° 40′; hence the division shown by the vernier is 56° 54′. A magnifying glass will assist the observer to read off the coinciding divisions with more accuracy.

Adjustments of Hadley's Quadrant.

The adjustments of the quadrant consist in placing the mirrors perpendicular to the plane of the instrument. The fore horizon-glass must be set parallel to the speculum, and the planes of the speculum and back horizon glass produced must be perpendicular to each other when the index is at *o*.

Adjustment I. To set the index-glass perpendicular to the plane of the quadrant.

Fig. 55. and 56. *Method* 1. Set the index towards the middle of the limb, and hold the quadrant so that its plane may be nearly parallel to the horizon: then look into the index-glass; and if the portion of the limb seen by reflection appears in the same plane with that seen directly, the speculum is perpendicular to the plane of the instrument. If they do not appear in the same plane, the error is to be rectified by altering the position of the screws behind the frame of the glass.

Method 2. This is performed by means of the two adjusting tools, fig. 55, 56, which are two wooden frames, having two lines on each, exactly at the same distance from the bottom.

Place the quadrant in a horizontal position on a table; put the index about the middle of the arch; turn back the dark glasses; place one of the above-mentioned tools near one end of the arch, and the other at the opposite end, the side with the lines being towards the index-glass; then look into the index-glass, directing the sight parallel to the plane of the instrument, and one of the tools will be seen by direct vision, and the other by reflection. By moving the index a little, they may be brought exactly together. If the lines coincide, the position of the mirror is right; if not, they must be made to coincide by altering the screws behind the frame, as before.

Adjustment II. To set the fore horizon-glass perpendicular to the plane of the instrument.

Set the index to *o*; hold the plane of the quadrant parallel to the horizon; direct the sight to the horizon, and if the horizons seen directly and by reflection are apparently in the same straight line, the fore horizon-glass is perpendicular to the plane of the instrument; if not, one of the horizons will appear higher than the other. Now if the horizon seen by reflection is higher than that seen directly, release the nearest screw in the pedestal of the glass, and screw up that on the farther side, till the direct and reflected horizons appear to make one continued straight line. But if the reflected horizon is lower than that seen directly, unscrew the farthest, and screw up the nearest screw till the coincidence of the horizons is perfect, observing to leave both screws equally tight, and the fore horizon-glass will be perpendicular to the plane of the quadrant.

Adjustment III. To set the fore horizon-glass parallel to the index-glass, the index being at *o*.

Method of finding the Latitude and Longitude at Sea.

Set *o* on the index exactly to *o* on the limb, and fix it in that position by the screw at the under side; hold the plane of the quadrant in a vertical position, and direct the sight to a well defined part of the horizon; then if the horizon seen in the silvered part coincides with that seen through the transparent part, the horizon-glass is adjusted; but if the horizons do not coincide, unscrew the milled screw in the middle of the lever on the other side of the quadrant, and turn the nut at the end of the lever until both horizons coincide, and fix the lever in this position by tightening the milled screw.

As the position of the glass is liable to be altered by fixing the lever, it will therefore be necessary to re-examine it, and if the horizons do not coincide, it will be necessary either to repeat the adjustment, or rather to find the error of adjustment, or, as it is usually called, the *index-error;* which may be done thus:

Direct the sight to the horizon, and move the index until the reflected horizon coincides with that seen directly; then the difference between *o* on the limb and *o* on the vernier is the index error; which is additive when the beginning of the vernier is to the right of *o* on the limb, otherwise subtractive.

Adjustment IV. To set the back horizon-glass perpendicular to the plane of the instrument.

Put the index to *o;* hold the plane of the quadrant parallel to the horizon, and direct the sight to the horizon through the back sight vane. Now if the reflected horizon is in the same straight line with that seen through the transparent part, the glass is perpendicular to the plane of the instrument. If the horizons do not unite, turn the sunk screws in the pedestal of the glass until they are apparently in the same straight line.

Adjustment V. To set the back horizon-glass perpendicular to the plane of the index-glass produced, the index being at *o*.

Let the index be put as much to the right of *o* as twice the dip of the horizon amounts to; hold the quadrant in a vertical position, and apply the eye to the back vane; then if the reflected horizon coincides with that seen directly, the glass is adjusted; if they do not coincide, the screw in the middle of the lever on the other side of the quadrant must be released, and the nut at its extremity turned till both horizons coincide. It may be observed, that the reflected horizon will be inverted; that is, the sea will be apparently uppermost and the sky lowermost.

As this method of adjustment is esteemed troublesome, and is often found to be very difficult to perform at sea, various contrivances have therefore been proposed to render this adjustment more simple. Some of these are the following.

1. Mr Dollond's method of adjusting the back horizon-glass.

In this method an index is applied to the back horizon-glass, by which it may be moved so as to be parallel to the index-glass, when *o* on the vernier coincides with *o* on the limb. When this is effected, the index of the back horizon-glass is to be moved exactly 90° from its former position, which is known by means of a divided arch for that purpose; and then the plane of the back horizon-glass will be perpendicular to the plane of the index-glass produced.

2. Mr

Method of finding the Latitude and Longitude at Sea.

2. Mr Blair's method of adjusting the back horizon-glass.

All that is required in this method is to polish the lower edge of the index-glass, and expose it to view. The back horizon-glass is adjusted by means of a reflection from this polished edge, in the very same method as the fore horizon glass is adjusted by the common method.

Fig. 57. In order to illustrate this, let R I H E (fig. 57.) represent a pencil of rays emitted from the object R, incident on the index-glass I, from which it is reflected to the fore horizon-glass H, and thence to the eye at E. By this double reflection, an image of the object is formed at *r*. RHE represents another pencil from the same object R, coming directly through the fore horizon-glass to the eye at E; so that the doubly reflected image *r* appears coincident with the object R itself, seen directly.

When this coincidence is perfect, and the object R so very distant as to make the angle IRH insensible, the position of the speculums I and H will differ insensibly from parallelism; that is, the quadrant will be adjusted for the fore observation. Now it is from the ease and accuracy with which this adjustment can at any time be made, that the fore-observation derives its superiority over the back-observation. But by grinding the edge of the index glass perpendicular to its reflecting surface, and polishing it, the observation is rendered capable of an adjustment equally easy and accurate as the fore horizon-glass: for by a pencil of rays emitted from the object S, incident on the reflecting edge of the index-glass D, thence reflected to the back horizon-glass B, and from that to the eye at *e*, an image will be formed at *s*; which image being made to coincide with the object S itself, seen directly, ascertains the position of the back horizon glass relative to the index-glass, with the same precision, and in a manner equally direct, as the former operation does that of the fore horizon-glass.

Directions for adjusting the Back Horizon-Glass.

The method of adjusting the quadrant for the back-observation is this. If it is to be done without making use of the telescope, place the index at *o*, and, applying the eye to the hole in the sight vane (K), or tube for directing the sight, direct it through the back horizon-glass to the horizon, if that is the object to be used for adjusting. The two horizons are then to be made to coincide, holding the quadrant first in a vertical and then in an horizontal position; by which means both adjustments will be effected as in the fore-observation.

There will be no difficulty in finding the reflected horizon, if the observer first directs his eye to that part of the horizon-glass where he observes the image of the polished edge of the index-glass, which will appear double. When the direct horizon is made to appear in this case, the reflected one will be seen close by it, unless the instrument wants a great adjustment. In this case, a little motion of the back horizon-glass backwards and forwards will presently bring it in view.

When the horizon, or any obscure terrestrial object, is to be made use of for adjusting by means of the reflecting edge, there is a precaution to be taken, without which the observer will sometimes meet with what will appear an unaccountable difficulty; for if the sky, or other object behind him, should happen to be pretty bright, he will not be able to discern the horizon at all. This arises from the image of the object behind him, which is reflected from the silvered surface of the index-glass, appearing to coincide with the horizon; in which case, the bright picture of the former, which is formed in the bottom of the eye, prevents the fainter impression of the latter from being perceived. This will be avoided, either by applying a black screen over the silvered surface of the index-glass, or, without being at this trouble, by standing at a door or window, so that only the dark objects within can be reflected from the index-glass: but if the observation is to be made in the open air, a hat, or any such dark obstacle, held before the silvered surface of the index-glass, will very effectually remove this inconvenience.

It may be remarked, that some observers, instead of making the principal adjustment, place the speculums parallel, by moving the index without altering the position of the horizon-glass: and the difference between *o* on the vernier and *o* on the limb is the index error, which must be subtracted from all angles measured by the back-observation, when *o* on the index, is to the right of *o* on the limb; and added when to the left.

3. Mr Wright's method of adjusting the back horizon-glass of his improved patent quadrant.

Fig. 58. is a representation of the quadrant complete in all its parts for use. A, is the reflecting surface of the index-glass, which is made of the usual length, and $\frac{9}{10}$ of an inch broad. The bottom part is covered in front by the brass frame, and the reflecting surface is $\frac{7}{10}$ on the back. B, the fore horizon-glass, placed as usual: O, the back horizon-glass, now placed under the fore sight-vane on the first radius of the quadrant I: C, the sight-vane of the fore horizon-glass: D, the sight-vane of the back horizon-glass: E, the coloured glasses in a brass frame, in the proper place for the fore observation: F, a hole in the frame to receive the coloured glasses when an observation is to be taken with the back horizon-glass in the common way, by turning the back to the sun: G, a hole in the frame of the farthest radius K, to receive the coloured glasses when an observation is to be taken by the new method; which is by looking through the lower hole in the sight-vane of the back horizon-glass, directly at Fig. 58.

(K) Besides the hole in the sight vane, commonly made, there must be another nearer to the horizon-glass, and so placed that an eye directed through it to the centre of the horizon-glass shall there perceive the image of the polished edge of the index-glass. This hole must not be made small like the other, but equal to the ordinary size of the pupil of the eye, there being on some occasions no light to spare.

Method of finding the Latitude and Longitude at Sea.

at the sun in the line of sight DN; the horizon from behind will then be reflected from the back of the index-glass to the horizon-glass, and from thence to the eye. (See fig. 62.). H, a brass clamp on the upper end of the index, having a milled screw underneath, which fastens the round plate to the index when required. (See fig. 59.). IK, the graduated arch of the quadrant divided into 90 degrees: L, the brass index which moves over the graduated arch: M, the vernier to subdivide the divisions on the arch into single minutes of a degree.

Fig. 59. Fig. 59. shows the upper part of the index L on a larger scale, with part of the brass frame that fastens the index-glass, and the three adjusting screws D to adjust its axis vertical to the plane of the quadrant: B, the centre on which the milled plate O moves over the index: The dotted line BF is the distance it is required to move: K, the adjusting screw to stop it in its proper place for adjusting the back observation-glass: G, a piece of brass fastened to the index opposite to the clamp H, to keep the plate O always close to the index L.

Fig. 60. Fig. 60. represents the parallel position of the index and horizon glasses after adjustment by the sun: BC, a ray from the sun incident on the index-glass C, and from thence reflected to the fore horizon-glass D, and again to the eye at E, in the line DE, where the eye sees the sun at A by direct vision, and the image by reflection, in one; the parallel lines AE and BC being so near to each other, that no apparent angle can be observed in the planes of the index and horizon-glass, when adjusted by a distant object.

Fig. 61. In fig. 61. the index-glass is removed 45 degrees from the plane of the fore horizon glass, and fixed in its proper place for adjusting the back horizon-glass parallel to its plane, in the same manner as the fore horizon-glass is adjusted.

Fig. 62. In fig. 62. the index-glass (after the adjustment of the fore and back horizon-glasses) is carried forward by the index on the arch 90 degrees, and makes an angle of 45° with the plane of the fore horizon-glass, and is at right angles to the plane of the back horizon-glass. The eye at E now sees the sun in the horizon at H, reflected by the index and horizon-glasses from the zenith at Z, the image and object being 90 degrees distant. The back horizon K is now reflected from the back surface of the index-glass C to the horizon-glass M, and from thence to the eye at D, in a right line with the fore horizon F. In order to make an exact contact of the fore and back horizons at F, the index must be advanced beyond the 90th degree on the arch, by a quantity equal to twice the dip of the horizon.

The quadrant is adjusted for the fore-observation as usual, having previously fixed the index-glass in its proper place by the milled screw at H, as represented in fig. 59.

To adjust the Quadrant for the Back-observation.

Fasten the index to 90° on the limb; loosen the screw H (fig. 59.), and turn the plate O by the milled edge until the end of the adjusting screw K touch the edge of the clamp M; and by means of a distant object observe if the glasses are then parallel, as at fig 60.: if they are, fasten the screw H; if not, with a screw-driver turn the screw K gently to the right or left to make them perfect, and then fasten the screw. Now remove the index back to O on the limb, and the index-glass will be parallel to the back horizon-glass E, fig. 61.; If not, make them so by turning the adjusting screw of the glass E, the eye being at the upper hole in the sight-vane D, and the sight directed to the horizon, or any distant object in the direction DN (fig. 58.) Now the index remaining in this position, the index-glass is to be returned, to stop at the pin E, and it will be parallel to the fore horizon-glass as at first: then the quadrant will be adjusted for both methods of observation.

To observe the Sun's Altitude by the Back-observation.

Remove the coloured glasses to G (fig. 58.), and look through the lower hole in the sight-vane D, in the line of direction DN, directly to the sun, and move the index forward on the arch exactly in the same manner as in the fore-observation: make the contact of the sun's limb and the back horizon exact, and the degrees and minutes shown by the index on the limb is the sun's zenith distance. It may be observed, that the horizon will be inverted. If the sun's lower limb be observed, the semidiameter is to be subtracted from the zenith distance; but if the upper limb is observed, the semidiameter is to be added.

The observation may be made in the usual manner, by turning the back to the sun. In this case the coloured glasses are to be shifted to F, and proceed according to the directions formerly given.

Use of Hadley's Quadrant.

The altitude of any object is determined by the position of the index on the limb, when by reflection that object appears to be in contact with the horizon.

If the object whose altitude is to be observed be the sun, and if so bright that its image may be seen in the transparent part of the fore horizon-glass, the eye is to be applied to the upper hole in the sight-vane; otherwise, to the lower hole: and in this case, the quadrant is to be held so that the sun may be bisected by the line of separation of the silvered and transparent parts of the glass. The moon is to be kept as nearly as possible in the same position; and the image of the star is to be observed in the silvered part of the glass adjacent to the line of separation of the two parts.

There are two different methods of taking observations with the quadrant. In the first of these the face of the observer is directed towards that part of the horizon immediately under the sun, and is therefore called the *fore observation*. In the other method, the observer's back is to the sun, and it is hence called the *back-observation*. This last method of observation is to be used only when the horizon under the sun is obscured, or rendered indistinct by fog or any other impediment.

In taking the sun's altitude, whether by the fore or back observation, the observer must turn the quadrant about upon the axis of vision, and at the same time turn himself about upon his heel, so as to keep the sun always in that part of the horizon-glass which is at the same distance as the eye from the plane of the quadrant. In this way the reflected sun will describe an arch of a parallel circle round the true sun, whose convex side will

Method of finding the Latitude and Longitude at Sea.

will be downwards in the fore-obſervation and upwards in the back; and conſequently, when by moving the index, the loweſt point of the arch in the fore-obſervation, or higheſt in the back, is made to touch the horizon, the quadrant will ſtand in a vertical plane, and the altitude above the viſible horizon will be properly obſerved. The reaſon of theſe operations may be thus explained: The image of the ſun being always kept in the axis of viſion, the index will always ſhow on the quadrant the diſtance between the ſun and any object ſeen directly which its image appears to touch; therefore, as long as the index remains unmoved, the image of the ſun will deſcribe an arch everywhere equidiſtant from the ſun in the heavens, and conſequently a parallel circle about the ſun, as a pole. Such a tranſlation of the ſun's image can only be produced by the quadrant's being turned about upon a line drawn from the eye to the ſun, as an axis. A motion of rotation upon this line may be reſolved into two, one upon the axis of viſion, and the other upon a line on the quadrant perpendicular to the axis of viſion; and conſequently a proper combination of theſe two motions will keep the image of the ſun conſtantly in the axis of viſion, and cauſe both jointly to run over a parallel circle about the ſun in the heavens: but when the quadrant is vertical, a line thereon perpendicular to the axis of viſion, becomes a vertical axis; and as a ſmall motion of the quadrant is all that is wanted, it will never differ much in practice from a vertical axis. The obſerver is directed to perform two motions rather than the ſingle one equivalent to them on a line drawn from the eye to the ſun; becauſe we are not capable, while looking towards the horizon, of judging how to turn the quadrant about upon the elevated line going to the ſun as an axis, by any other means than by combining the two motions above mentioned, ſo as to keep the ſun's image always in the proper part of the horizon-glaſs. When the ſun is near the horizon, the line going from the eye to the ſun will not be far removed from the axis of viſion; and conſequently the principal motion of the quadrant will be performed on the axis of viſion, and the part of motion made on the vertical axis will be but ſmall. On the contrary, when the ſun is near the zenith, the line going to the ſun is not far removed from a vertical line, and conſequently the principal motion of the quadrant will be performed on a vertical axis, by the obſerver's turning himſelf about, and the part of the motion made on the axis of viſion will be but ſmall. In intermediate altitudes of the ſun, the motions of the quadrant on the axis of viſion, and on the vertical axis, will be more equally divided.

Obſervations taken with the quadrant are liable to errors, ariſing from the bending and elaſticity of the index, and the reſiſtance it meets with in turning round its centre: whence the extremity of the index, on being puſhed along the arch, will ſenſibly advance before the index-glaſs begins to move, and may be ſeen to recoil when the force acting on it is removed. Mr Hadley ſeems to have been apprehenſive that his inſtrument would be liable to errors from this cauſe; and in order to avoid them, gives particular directions that the index be made broad at the end next the centre, and that the centre, or axis itſelf, have as eaſy a motion as is conſiſtent with ſteadineſs; that is, an entire freedom from looſeneſs, or *ſhake* as the workmen term it. By ſtrictly complying with theſe directions the error in queſtion may indeed be greatly diminiſhed; ſo far, perhaps, as to render it nearly inſenſible, where the index is made ſtrong, and the proper medium between the two extremes of a ſhake at the centre on one hand, and too much ſtiffneſs there on the other, is nicely hit; but it cannot be entirely corrected. For to more or leſs of bending the index will always be ſubject; and ſome degree of reſiſtance will remain at the centre, unleſs the friction there could be totally removed, which is impoſſible.

Of the reality of the error to which he is liable from this cauſe, the obſerver, if he is provided with a quadrant furniſhed with a ſcrew for moving the index gradually, may thus ſatisfy himſelf. After finiſhing the obſervation, lay the quadrant on a table, and note the angle; then cautiouſly looſen the ſcrew which faſtens the index, and it will immediately, if the quadrant is not remarkably well conſtructed, be ſeen to ſtart from its former ſituation, more or leſs according to the perfection of the joint and the ſtrength of the index, This ſtarting, which is owing to the index recoiling after being releaſed from the confined ſtate it was in during the obſervation, will ſometimes amount to ſeveral minutes; and its direction will be oppoſite to that in which the index was moved by the ſcrew at the time of finiſhing the obſervation. But how far it affects the truth of the obſervation, depends on the manner in which the index was moved in ſetting it to *o*, for adjuſting the inſtrument; or in finiſhing the obſervations neceſſary for finding the index error.

The eaſieſt and beſt rule to avoid theſe errors ſeems to be this: In all obſervations made by Hadley's quadrant, let the obſerver take notice conſtantly to finiſh his obſervations, by moving the index in the ſame direction which was uſed in ſetting it to *o* for adjuſting; or in the obſervations neceſſary for finding the index error. If this rule is obſerved, the error ariſing from the ſpring of the index will be obviated. For as the index was bent the ſame way, and in the ſame degree in adjuſting as in obſerving, the truth of the obſervations will not be affected by this bending.

To take Altitudes by the Fore-obſervation.

I. *Of the Sun.*

Turn down either of the coloured glaſſes before the horizon-glaſs, according to the brightneſs of the ſun; direct the ſight to that part of the horizon which is under the ſun, and move the index until the coloured image of the ſun appear in the horizon-glaſs; then give the quadrant a ſlow vibratory motion about the axis of viſion; move the index until the lower or upper limb of the ſun is in contact with the horizon, at the loweſt part of the arch deſcribed by this motion; and the degrees and minutes ſhown by the index on the limb will be the altitude of the ſun.

II. *Of the Moon.*

Put the index to *o*, turn down the green glaſs, place the eye at the lower hole in the ſight-vane, and obſerve the moon in the ſilvered part of the horizon-glaſs; move the index gradually, and follow the moon's reflected image until the enlightened limb is in contact with

Method of finding the Latitude and Longitude at Sea.

with the horizon, at the lower part of the arch described by the vibratory motion as before, and the index will show the altitude of the observed limb of the moon. If the observation is made in the day-time, the coloured glass is unnecessary.

III. *Of a Star or Planet.*

THE index being put to *o*, direct the sight to the star through the lower hole in the sight-vane and transparent part of the horizon-glass; move the plane of the quadrant a very little to the left, and the image of the star will be seen in the silvered part of the glass. Now move the index, and the image of the star will appear to descend; continue moving the index gradually until the star is in contact with the horizon at the lowest part of the arch described; and the degrees and minutes shown by the index on the limb will be the altitude of the star.

To take Altitudes by the Back-observation.

I. *Of the Sun.*

PUT the stem of the coloured glasses into the perforation between the horizon-glasses, turn down either according to the brightness of the sun, and hold the quadrant vertically; then direct the sight through the hole in the back sight-vane, and the transparent slit in the horizon-glass to that part of the horizon which is opposite to the sun; now move the index till the sun is in the silvered part of the glass, and by giving the quadrant a vibratory motion, the axis of which is that of vision, the image of the sun will describe an arch whose convex side is upwards; bring the limb of the sun, when in the upper part of this arch, in contact with the horizon; and the index will show the altitude of the other limb of the sun.

II. *Of the Moon.*

THE altitude of the moon is observed in the same manner as that of the sun, with this difference only, that the use of the coloured glass is unnecessary unless the moon is very bright; and that the enlightened limb, whether it be the upper or lower, is to be brought in contact with the horizon.

III. *Of a Star or Planet.*

Look directly to the star through the vane and transparent slit in the horizon-glass, move the index until the opposite horizon, with respect to the star, is seen in the silvered part of the glass; and make the contact perfect as formerly. If the altitude of the star is known nearly, the index may be set to that altitude, the sight directed to the opposite horizon, and the observation made as before.

SECT. II. *Of finding the Latitude of a Place.*

The observation necessary for ascertaining the latitude of a place, is that of the meridional altitude of a known celestial object; or two altitudes when the object is out of the meridian. The latitude is deduced with more certainty and with less trouble from the first of these methods, than from the second; and the sun, for various reasons, is the object most proper for this purpose at sea. It, however, frequently happens, that by the interposition of clouds, the sun is obscured at noon; and by this means the meridian altitude is lost. In this case, therefore, the method by double altitudes becomes necessary. The latitude may be deduced from three altitudes of an unknown object, or from double altitudes, the apparent times of observation being given.

The altitude of the limb of an object observed at sea, requires four separate corrections in order to obtain the true altitude of its centre: these are for *semidiameter*, *dip*, *refraction*, and *parallax*. (See ASTRONOMY, and the respective articles). The first and last of these corrections vanish when the observed object is a fixed star.

When the altitude of the lower limb of any object is observed, its semidiameter is to be added thereto in order to obtain the central altitude; but if the upper limb be observed, the semidiameter is to be subtracted. If the altitude be taken by the back-observation, the contrary rule is to be applied. The dip is to be subtracted from, or added to, the observed altitude, according as the fore or back-observation is used. The refraction is always to be subtracted from, and the parallax added to, the observed altitude.

PROB. I. To reduce the sun's declination to any given meridian.

RULE. Find the number in Table IX. answering to the longitude in the table nearest to that given, and to the nearest day of the month. Now, if the longitude is west, and the declination increasing, that is, from the 20th of March to the 22d of June, and from the 22d of September to the 22d of December, the above number is to be added to the declination: during the other part of the year, or while the declination is decreasing, this number is to be subtracted. In east longitude, the contrary rule is to be applied.

Ex. 1. Required the sun's declination at noon 16th April 1810, in longitude 84° W?

Sun's declination at noon at Greenwich	9° 59.'2 N
Number from Table IX. - -	+ 5.0
Reduced declination - - -	10 4.2

Ex. 2. Required the sun's declination at noon 22d March 1793, in longitude 151° E?

Sun's declination at noon at Greenwich	0° 53′ N
Equation from Table X. -	— 10
Reduced declination - -	0 43 N

PROB. II. Given the sun's meridian altitude, to find the latitude of the place of observation.

RULE. The sun's semidiameter is to be added to, or subtracted from, the observed altitude, according as the lower or upper limb is observed; the dip answering to the height from Table V. is to be subtracted if the fore-observation is used; otherwise, it is to be added; and the refraction answering to the altitude from Table IV. is to be subtracted: hence the true altitude of the sun's centre will be obtained. Call the altitude south or north, according as the sun is south or north at the time of observation; which subtracted from 90°, will give the zenith distance of a contrary denomination.

Reduce the sun's declination to the meridian of the place of observation, by Prob. I.; then the sum or difference

ference of the zenith distance and declination, according as they are of the same or of a contrary denomination, will be the latitude of the place of observation, of the same name with the greater quantity.

Ex. 1. October 19. 1810, in longitude 32° E, the meridian altitude of the sun's lower limb was 48° 53′ S, height of the eye 18 feet. Required the latitude?

Obs. alt. sun's lower limb	48° 53′ S	Sun's dec. 19. Oct. noon.	9° 51′ S
Semidiameter	+0 16	Equation Table IX.	— 2
Dip and refraction	—0 5	Reduced declin.	9 49 S
True alt. sun's centre	49 4 S	Zenith distance	40 56 N
		Latitude	31 7 N

Ex. 2. November 16. 1812, in longitude 158° W, the meridian altitude of the sun's lower limb was 87° 37′ N, height of the eye 10 feet. Required the latitude?

Obs. alt. sun's low. limb	87° 37′ N.	Sun's dec. noon.	18° 48′ S
Semidiameter	+0 16	Equation tab.	+0 8
Dip and refract.	—0 3	Reduced dec.	19 5 S
True alt. sun's centre	87 50 N.	Zenith distance	2 10 S
		Latitude	21 6 S

Ex. 3. December 19. 1811, being nearly under the meridian of Greenwich, the altitude of the sun's upper limb at noon was 4° 30′ S, height of the eye 20 feet. Required the latitude?

Observed altitude of the sun's upper limb	4° 30′ S
Sun's semidiameter	0 16
Dip and refraction	0 15
True altitude of the sun's centre	3 59 S
Zenith distance	86 1 N
Declination	23 25 S
Latitude	62 36 N

Ex. 4. August 23. 1812, in longitude 107° E, the meridian altitude of the sun's lower limb by the back-observation was 61° 8′ N, and the height of the eye 14 feet. Required the latitude?

Observed altitude sun's upper limb	61° 8′ N
Sun's semidiameter	—0 16
Dip	+0 $3\frac{1}{2}$
Refraction	—0 $\frac{1}{2}$
True altitude of sun's centre	60 55 N
Zenith distance	29 5 S
Reduced declination	11 26 N
Latitude	17 39 S

The dip in Table V. answers to an entirely open and unobstructed horizon. It, however, frequently happens, that the sun is over the land at the time of observation, and the ship nearer to the land than the visible horizon would be if unconfined. In this case, the dip will be different from what it would otherwise have been, and is to be taken from Table VI. in which the height is expressed at the top, and the distance from the land in the side column in nautical miles.—Seamen, in general, can estimate the distance of any object from the ship with sufficient exactness for this purpose, especially when that distance is not greater than six miles, which is the greatest distance of the visible horizon from an observer on the deck of any ship.

Prob. III. Given the meridian altitude of a fixed star, to find the latitude of the place of observation.

Rule. Correct the altitude of the star by dip and refraction, and find the zenith distance of the star as formerly; take the declination of the star from Table XI. and reduce it to the time of observation. Now, the sum or difference of the zenith distance and declination of the star, according as they are of the same or of a contrary name, will be the latitude of the place of observation.

Ex. 1. December 1. 1810, the meridian altitude of Sirius was 59° 50′ S, height of the eye 14 feet. Required the latitude?

Observed altitude of Sirius	59° 50′ S
Dip and refraction	—0 4
True altitude	59 46 S
Zenith distance	30 14 N
Declination	16 28 S
Latitude	13 46 N

Ex. 2. February 17. 1797, the meridian altitude of Procyon was 71° 15′ N, the height of the eye 10 feet. Required the latitude?

Observed altitude of Procyon	71° 15′ N
Dip and refraction	—0 3
True altitude	71 12 N
Zenith distance	18 48 S
Declination	5 43 N
Latitude	13 5 S

Prob. IV. Given the meridian altitude of a planet, to find the latitude of the place of observation.

Rule. Compute the true altitude of the planet as directed in last problem (which is sufficiently accurate for altitudes taken at sea); take its declination from the Nautical Almanac, page iv. of the month, and reduce it to the time and meridian of the place of observation; then the sum or difference of the zenith distance and declination of the planet will be the latitude as before.

Ex. 1. August 7. 1812, the meridian altitude of Saturn was 68° 42′ N, and height of the eye 15 feet. Required the latitude?

Observed altitude of Saturn	68° 42′ N
Dip and refraction	—0 4
True altitude	68 38 N
Zenith distance	21 22 S
Declination	22 42 S
Latitude	44 6 S

Ex. 2. October 15. 1812, the meridian altitude of Jupiter was 81° 5′ S, height of the eye 18 feet. Required the latitude?

Observed

Method of finding the Latitude and Longitude at Sea

Observed altitude of Jupiter	81° 5′ S
Dip	—0 3
True altitude	81 2 S
Zenith distance	8 58 N
Declination	19 4 S
Latitude	10 6 S

PROB. V. Given the meridian altitude of the moon, to find the latitude of the place of observation.

RULE. Take the number † answering to the ship's longitude, and daily variation of the moon's passing the meridian; which being applied to the time of passage given in the Nautical Almanac, will give the time of the moon's passage over the meridian of the ship.

† Dr Mackay's Treatise on the Longitude, Tab. XX.

Reduce this time to the meridian of Greenwich; and by means of the Nautical Almanac find the moon's declination, horizontal parallax, and semidiameter at the reduced time.

Apply the semidiameter and dip to the observed altitude of the limb, and the apparent altitude of the moon's centre will be obtained; to which add the correction answering to the apparent altitude and horizontal parallax ‡, and the sum will be the true altitude of the moon's centre; which subtracted from 90°, the remainder is the zenith distance, and the sum or difference of the zenith distance and declination, according as they are of the same or of a contrary name, will be the latitude of the place of observation.

‡ Ditto, Tab. XX.

Ex. 1. December 24. 1792, in longitude 30° W, the meridian altitude of the moon's lower limb was 81 15′ N, height of the eye 12 feet. Required the latitude?

Time of pass. over the mer. of Greenwich	= 9h 19′
Equation Table XX.	+0 4
Time of pass. over mer. ship	9 23
Longitude in time	2 0
Reduced time	11 23
Moon's dec. at midnight, Table IX.	=14° 53′ N
Eq. to time from midnight	— 0 4
Reduced declination	14 49 N
Moon's hor. par.	55′ 25″
Moon's semidiameter	15 6
Augmentation	+ 0 14
Aug. semidiameter	15 20

Observed altitude of the moon's lower limb	81° 15′ N
Semidiameter	+ 0 15
Dip	— 0 3
Apparent altitude of the moon's centre	81 27 N
Correction	+0 8
True altitude of moon's centre	81 35 N
Zenith distance	8 25 S
Declination	14 49 N
Latitude	6 42 N

Remark. If the object be on the meridian below the pole at the time of observation, then the sum of the true altitude and the complement of the declination is the latitude, of the same name as the declination or altitude.

Ex. 1. July 2. 1812, in longitude 15° W, the altitude of the sun's lower limb at midnight was 8° 58′, height of the eye 18 feet. Required the latitude?

Observed altitude sun's lower limb	8° 58′
Semidiameter	+0 16
Dip and refraction	—0 10
True altitude of sun's centre	9 4 N
Compl. declin. reduced to time and place	66 57 N
Latitude	76 1 N

PROB. VI. Given the latitude by account, the declination and two observed altitudes of the sun, and the interval of time between them, to find the true latitude.

RULE. To the log. secant of the latitude by account, add the log. secant of the sun's declination; the sum, rejecting 20 from the index, is the *logarithm ratio.* To this add the log. of the difference of the natural sines of the two altitudes, and the log. of the half elapsed time from its proper column.

Find this sum in column of middle time, and take out the time answering thereto; the difference between which and the half elapsed time will be the time from noon when the greater altitude was observed.

Take the log. answering to this time from column of rising, from which subtract the log. ratio, the remainder is the logarithm of a natural number; which being added to the natural sine of the greater altitude, the sum is the natural cosine of the meridian zenith distance; from which and the sun's declination the latitude is obtained as formerly.

If the latitude thus found differs considerably from that by account, the operation is to be repeated, using the computed latitude in place of that by account (L).

Ex. 1.

(L) This method is only an approximation, and ought to be used under certain restrictions; namely,

The observations must be taken between nine o'clock in the forenoon and three in the afternoon. If both observations be in the forenoon, or both in the afternoon, the interval must not be less than the distance of the time of observation of the greatest altitude from noon. If one observation be in the forenoon and the other in the afternoon, the interval must not exceed four hours and a half; and in all cases, the nearer the greater altitude is to noon the better.

If the sun's meridian zenith distance be less than the latitude, the limitations are still more contracted. If the latitude be double the meridian zenith distance, the observations must be taken between half past nine in the morning and half past two in the afternoon, and the interval must not exceed three hours and a half. The observations must be taken still nearer to noon, if the latitude exceed the zenith distance in a greater proportion. See Maskelyne's British Mariner's Guide, Dr Mackay's Treatises on the Longitude and Navigation, &c. and Requisite Tables, 2d edit.

Method of finding the Latitude and Longitude at Sea.

Example 1. July 9. 1811. in latitude by account 27° N, at 10h 29′ A. M. per watch, the corrected altitude of the sun was 65° 24′, and at 12h 31′, the altitude was 74° 8′. Required the true latitude?

Times *per* wat.	Alt. N.	Sines.	Lat. by acc.	37° 0′ Secant	0.09765
10h 29′	65° 24′	90924	Declination	22 28 Secant	0.03428
12 31	74 8	96190	Logarithm ratio	-	0.13193
2 2	Differ.	5266	Logarithm	-	3.72148
1 1			Half elapsed time	-	0.57999
31 10″			Middle time	- - -	4.43340
29 50			Rising	- - -	2.92740
				Log. ratio	0.13193
Natural number	- -	624	-		2.79547
Greatest altitude	74° 8′ N sine	96190			
Mer. zenith dist.	14 30 N cosine	96814			
Declination	22 28				
Latitude -	36 58 N.				

Ex. 2. October 17. 1812, in latitude 43° 24′ N. by account, at 0h 38′ P. M. the correct altitude of the sun's centre was 36° 5′, and at 2h 46′ P. M. the altitude was 24° 49′. Required the latitude?

Times *per* wat.	Alt. N.	Sines.	Lat. by acc.	43° 24′ Secant	0.13872
0h 38′	36° 5′	58896	Declination	9 18 Secant	0.00575
2 46	24 49	41972	Logarithm ratio	-	0.14447
2 8	Differ.	16924	Log.	- -	4.22850
1 4	-		Half elapsed time	- -	0.55966
1 41 20″	-		Middle time	- -	4.93263
37 20			Rising	. - -	3.12184
				Log. ratio	0.14447
Natural number	- -	649			2.97737
Greatest altitude -	36° 5′ N. sine	58896			
Mer. zen. distance	53 15 N. cosine	59845			
Declination -	9 18				
Latitude - -	43 57 N.				

Ex. 3. In latitude 49° 48′ N. by account, the sun's declination being 9° 37′ S. at 0h 32′ P. M. per watch, the altitude of the sun's lower limb was 28° 32′, and at 2h 41′ it was 19° 25′, the height of the eye 12 feet. Required the true latitude?

First observed altit.	28° 32′	Second altitude	19° 25′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refr.	—0 6
True altitude	28 43	True altitude	19 35

Time *per* wat.	Alt. N.	Sines.	Lat. by acc	49° 48′ Secant.	0.19013
0h 32′	28° 43′	48048	Declination	9 37 Secant.	0.00615
2 41	19 35	33518	Log. ratio	- -	0.09628
2 9	Difference	14530	Log.	- -	4.16227
1 4 30″	-		Half elapsed time	-	0.55637
1 37 0	-		Middle time	- -	4.91492
32 30	-		Rising	- -	3.00164
Natural number	-	639	-		2.80536
Mer. zen. dist.	60° 52′ N. cosine	48687			
Declination	9 37 S.				
Latitude	51 15 N.				

As the latitude by computation differs 1° 27′ from that by account, the operation must be repeated.

Computed latitude	51° 15′	Secant	0.20348
Declination	9 37	Secant	0.00615
Logarithm ratio	- -		0.20963
Difference of nat. sines	14530	Log.	4.16227
Half elapsed time	1h 4′ 30″	Log.	0.55637
Middle time	1 40 20	Log.	4.92827
Rising -	0 35 50	Log.	3.08630
Natural number	- - 753		2.87667
Gr. altitude	28° 43′ N. sine 48048		
Mer. zen. dist.	60 47 N. cosine 48801		
Declination	9 37		
Latitude	51 10 N.		

As this latitude differs only 5′ from that used in the computation, it may therefore be depended on as the true latitude.

PROB. VII. Given the latitude by account, the sun's declination, two observed altitudes, the elapsed time, and the course and distance run between the observations; to find the ship's latitude at the time of observation of the greater altitude.

RULE. Find the angle contained between the ship's course and the sun's bearing at the time of observation of the least altitude, with which enter the Traverse Table as a course, and the difference of latitude answering to the distance made good will be the reduction of altitude.

Now, if the least altitude be observed in the forenoon, the reduction of altitude is to be applied thereto by addition or subtraction, according as the angle between the ship's course and the sun's bearing is less or more than eight points. If the least altitude be observed in the afternoon, the contrary rule is to be used.

The difference of longitude in time between the observations is to be applied to the elapsed time by addition or subtraction, according as it is east or west. This is, however, in many cases so inconsiderable as to be neglected.

With the corrected altitudes and interval, the latitude by account and sun's declination at the time of observation of the greatest altitude, the computation is to be performed by the last problem.

Ex. 1. July 6. 1793, in latitude 58° 14′ N by account, and longitude 16° E, at 10h 54′ A. M. per watch, the altitude of the sun's lower limb was 53° 17′, and at 1h 17′ P. M. the altitude was 52° 51′, and bearing per compass SW*b*W; the ship's course during the elapsed time was S*b*W½W, and the hourly rate of sailing 8 knots, the height of the eye 16 feet. Required the true latitude at the time of observation of the greater altitude?

Sun's bear. at 2d. ob. SW*b*W. Interval bet. observ. 2h 23′
Ship's course S*b*W½W Dist. run=2h 23×8=19m.

Contained angle 3½ points.

Now

Method of finding the Latitude and Longitude at Sea.

Now to course 3½ points, and distance 19 miles, the difference of latitude is 14.7 or 15 miles.

First observed alt.	53° 17′	Second observed alt.	52° 51′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refract.	—0 4	Dip and refraction	—0 4
True altitude	53 29	Reduction	—0 15
		Reduced altitude	52 48

Time of ob. of gr. alt.	10h 54′ A.M.	Sun's dec.	22°39′N.
Longitude in time	1 4	Eq. to r. t.	+ 1
Reduced time	9 50 A.M.	Red. decl.	22 40 N.

Time *per* wat.	Alt. N.	Sines.	Lat. by acc. 58° 14′	Secant.	0.27863
10h 54′	53° 29′	80368	Declination 22 40	Secant.	0.03491
1 17	52 48	79653	Logarithm ratio		0.31354
2 23	Difference	715		Log.	2.85431
1 11, 30″	-		Half elapsed time	-	0.51294
5 30	-		Middle time	-	3.68079
1 6 0	-		Rising	- -	3.61469
			Log. ratio		0.31354
Natural number	-	-	2001		3.30115
Greatest altitude	53° 29′ N.	sine	80368		
Mer. zen. distance	34 33 N.	cosine	82369		
Declination	22 40 N.				
Latitude -	57 13 N.				

Since the computed latitude differs so much from that by account, it will be necessary to repeat the operation.

Computed latitude		57° 13′	Secant	0.26643
Declination		22 40	Secant	0.03491
Logarithm ratio	-	-		0.30134
Difference of natural sines		715	Log.	2.85431
Half elapsed time	1h 11′	30″	Log.	0.51294
Middle time		5 20	Log.	3.66859
Rising -	1 6	10	Log.	3.61686
Logarithm ratio	-	-		0.30134
Natural number	-	- 2068		3.31552
Greatest altitude	53° 29′ N. sine	80368		
Mer. zen. dist.	34 29 N. cosine	82436		
Declination	22 40 N.			
Latitude	57 9 N.			

As this latitude differs only 4 miles from that used in the computation, it may therefore be depended on as the true latitude.

Remark. If the sun come very near the zenith, the sines of the altitude will vary so little as to make it uncertain which ought to be taken as that belonging to the natural sine of the meridian altitude. In this case, the following method will be found preferable.

To the log. rising of the time from noon found as before, add the log. secant of half the sum of the estimate meridian altitude, and greatest observed altitude; from which subtract the log. ratio, its index being increased by 10, and the remainder will be the log. sine of an arch; which added to the greatest altitude will give the sun's meridian altitude.

Ex. 2. December 21st 1793, in latitude 22° 40′ S, by account, at 11h 57′ the correct altitude of the sun's centre was 89° 10′, and at 12h 4′ 40″, the altitude was 88° 50′. Required the true latitude?

Times *per* Wat.	Alt. N.	Sines.	Lat. by acc. 22° 40′	Sec.	0.03491
11h 57′ 0″	89° 10′	99989	Declination 23 28	Sec.	0.03749
12 4 40	88 50	99979	Logarithm ratio	-	0.07240
0 7 10	Difference	10	log.	-	1.00000
0 3 50	Half elapsed time		-	-	1.77663
0 0 50	Middle time		-	-	2 84903
0 3 0	Rising	-	-	-	9 93254

Comp. of lat. by acc.	67° 20′			
Declination -	23 28			
Sum -	90 48			
Estimate mer. altitude	89 12	} 89° 11′	sec.	11.84609
Greatest altitude -	89 10			
				12.77893
Logarithm ratio + 5	-		-	5.07240
Arch - -	0 17		sine	7.70653
Greatest altitude -	89 10			
Meridian altitude	89 27	zen. dist.		0° 33′ N
		declination		23 28 S
		latitude		22 55 S

This differing from the assumed latitude, the work must be repeated.

Latitude -	22° 55′	-	secant	0.03571
Declination	23 28	-	secant	0.03749
Logarithm ratio	-	-		0.07320
Difference of natural sines,	1°		log.	1.00000
Half elapsed time	3′ 50″			1.77663
Middle time -	0 50	-		2.84983
Rising -	3 0	-		0.93284
mp. of lat.	67° 5′			
Declination -	23 28			
Sum -	90 33			
Mer. alt.	89 27	} 89° 18′½	sec.	11.91827
Greatest alt.	89 10			
				12.85111
Log. ratio + 5	-	-		5.07320
Arch -	0 21	-		7.77791
Greatest altitude	89 10			
Merid. altitude	89 31	zen. dist.		0° 29′
		Declination		23 28
		Latitude		22 59 S

If the work be repeated with this last latitude, the latter part only may be altered.

Latitude -	22° 59′	secant	0.03592
Declination -	23 28	secant	0.03749
Est. mer. alt.	89 31	log. ratio	0.07341
Greatest altitude	89 10	ar. com.—5	4.92659
Sum -	178 41		
Half -	89 20½	secant	1.93972
Rising -	0h 3′ 0″	-	0.93284
Arch -	0 22	sine	7.79915
Greatest altitude	89 10		
Meridian altitude	89 32		
Zenith distance	0 28		
Declination -	23 28		
Latitude -	23 0 S.		

Prob. VIII. Given the altitudes of two known stars, observed at the same or at different times; and if at different times, the interval between the observations; to find the latitude.

Rule. If both altitudes be observed at the same time, call the difference between their right ascensions the reduced interval.

But if the altitudes be taken at different times, reduce the interval between the observations to sidereal time, by adding thereto the proportional part answering to the interval, and 3′ 56″, the daily acceleration of the fixed stars. Now to the right ascension of the first observed star, add the interval in sidereal time, and the difference between this sum and the right ascension of the other star will be the reduced interval.

To the logarithm rising of the reduced interval, add the logarithmic cosines of the stars declinations; subtract the natural number answering to the sum of these logarithms from the natural cosine of the difference or sum of the stars declinations, according as they are of the same or of a contrary name, and the remainder will be the natural sine of arch first.

To the logarithmic cosine of arch first add the logarithmic secant of declination of the star having the least polar distance, and the logarithm half elapsed time of the reduced interval, the sum will be the logarithm half elapsed time of arch second.

From the natural cosine of the difference between arch first and the altitude of the star having the greatest polar distance, subtract the natural sine of the altitude of the other star, and find the logarithm of the remainder; to which add the logarithm secant of arch first, and the logarithmic secant of the altitude of the star having the greatest polar distance, the sum will be the logarithm rising of arch third. The difference between arches second and third is arch fourth.

To the logarithm rising of arch fourth add the logarithmic cosines of the declination and altitude of the star having the greatest polar distance; subtract the corresponding natural number from the natural cosine of the difference between the altitude and declination, the polar distance being less than 90°; otherwise, from their sum, and the remainder will be the natural sine of the latitude.

Ex. January 1st 1793, the true altitude of Capella was 69° 23′, and at the same instant the true altitude of Sirius was 16° 19′. Required the latitude?

Right ascension of Capella		5h 1′ 25″	
Right ascension of Sirius		6 36 1	
Interval		1 34 36	
Interval -	1h 34′ 36″	rising	3.92270
Capella's declin.	45° 46′ N	cosine	9.84360
Sirius's declin.	16 27 S	cosine	9.98185
Sum -	62 13 N	cosine 46613	
		5599	3.74815
Arch first	24 13 N	sine 41014	cos. 9.96000
Capella's declin.	45 46	secant	0.15640
Interval -	1h 34′ 36″	H. E. time	0.39670
Arch second	1 11 28	H. E. time	0.51310
Arch first	24 13	secant	0.04000
Sirius's altitude	16 19	secant	0.01785
Difference	7 54N.	cosine 99051	
Capella's altitude	69 23N	sine 93596	
		5455	3.73679
Arch third	1h 21′ 20″	rising	3.79464
Arch second	1 11 28		
Arch fourth -	9 52	rising	1.96708
Sirius's declin. -	16 27	cosine	9.98185
altitude	16 19	cosine	9.98215
Sum -	32 46 N	cos. 84088	
		85	1.93008
Latitude	57 9 N	sine 84003	

Chap. II. *Containing the Method of finding the Longitude at Sea by Lunar Observations.*

Sect. I. *Introduction.*

The observations necessary to determine the longitude by this method are, the distance between the sun and moon, or the moon and a fixed star near the ecliptic, together with the altitude of each. The stars used in the Nautical Almanack for this purpose are the following: namely, *α Arietis*, *Aldebaran*, *Pollux*, *Regulus*, *Spica Virginis*, *Antares*, *α Aquilæ*, *Fomalhaut*, and *α Pegasi*; and the distances of the moon's centre from the sun, and from one or more of these stars, are contained in the viii. ix. x. and xi. pages of the month, at the beginning of every third hour apparent time, by the meridian of Greenwich. The distance between the moon and the sun, or one of these stars, is observed with a sextant; and the altitudes of the objects are taken as usual with a Hadley's quadrant.

In the practice of this method, it will be found convenient to be provided with three assistants, two of these are to take the altitudes of the sun and moon, or moon and star, at the same time the principal observer is taking the distance between the objects; and the third assistant is to observe the time, and write down

Of finding the Longitude at Sea by Lunar Observations.

down the obfervations. In order to obtain accuracy, it will be neceffary to obferve feveral diftances, and the correfponding altitudes; the intervals of time between them being as fhort as poffible; and the fum of each divided by the number will give the mean diftance and mean altitudes; from which the time of obfervation at Greenwich is to be computed by the rules to be explained.

If the fun or ftar from which the moon's diftance is obferved be at a proper diftance from the meridian, the time at the fhip may be inferred from the altitude obferved at the fame time with the diftance: in this cafe, the watch is not neceffary; but if that object be near the meridian, the watch is abfolutely neceffary, in order to connect the obfervations for afcertaining the apparent time at the fhip and at Greenwich with each other.

An obferver without any affiftants may very eafily take all the obfervations, by firft taking the altitudes of the objects, then the diftance, and again their altitudes, and reduce the altitudes to the time of obfervation of the diftance; or, by a fingle obfervation of the diftance, the apparent time being known, the longitude may be determined.

A fet of obfervations of the diftance between the moon and a ftar, and their altitudes, may be taken with accuracy during the time of the evening or morning twilight; and the obferver, though not much acquainted with the ftars, will not find it difficult to diftinguifh the ftar from which the moon's diftance is to be obferved. For the time of obfervation nearly, and the fhip's longitude by account being known, the eftimate time at Greenwich may be found; and by entering the Nautical Almanac with the reduced time, the diftance between the moon and given ftar will be found nearly. Now fet the index of the fextant to this diftance, and hold the plane of the inftrument fo as to be nearly at right angles to the line joining the moon's cufps, direct the fight to the moon, and by giving the fextant a flow vibratory motion, the axis of which being that of vifion, the ftar, which is ufually one of the brighteft in that part of the heavens, will be feen in the tranfparent part of the horizon glafs.

Sect. II. *Of the Sextant.*

This inftrument is conftructed for the exprefs purpofe of meafuring with accuracy the angular diftance between the fun and moon, or between the moon and a fixed ftar, in order to afcertain the longitude of a place by lunar obfervations. It is, therefore, made with more care than the quadrant, and has fome additional appendages that are wanting in that inftrument.

Plate CCCLXVIII. Fig. 63. reprefents the fextant, fo framed as not to be liable to bend. The arch AA is divided into 120 degrees; each degree is divided into three parts; each of thefe parts, therefore, contains 20 minutes, which are again fubdivided by the vernier into every half minute or 30 feconds. The vernier is numbered at every fifth of the longer divifions, from the right towards the left, with 5, 10, 15, and 20; the firft divifion to the right being the beginning of the fcale.

In order to obferve with accuracy, and make the images come precifely in contact, an adjufting fcrew B is added to the index, which may thereby be moved with greater accuracy than it can be by hand; but this fcrew does not act until the index is fixed by the finger fcrew C. Care fhould be taken not to force the adjufting fcrew when it arrives at either extremity of its adjuftment. When the index is to be moved any confiderable quantity, the fcrew C at the back of the fextant muft be loofened; but when the index is brought nearly to the divifion required, this back fcrew fhould be tightened, and then the index may be moved gradually by the adjufting fcrew.

There are four tinged glaffes D, each of which is fet in a feparate frame that turns on a centre. They are ufed to defend the eye from the brightnefs of the folar image and the glare of the moon, and may be ufed feparately or together as occafion requires.

There are three more fuch glaffes placed behind the horizon glafs at E, to weaken the rays of the fun or moon when they are viewed directly through the horizon glafs. The paler glafs is fometimes ufed in obferving altitudes at fea, to take off the ftrong glare of the horizon.

The frame of the index glafs I is firmly fixed by a ftrong cock to the centre plate of the index. The horizon glafs F is fixed in a frame that turns on the axes or pivots, which move in an exterior frame; the holes in which the pivots move may be tightened by four fcrews in the exterior frame. G is a fcrew by which the horizon glafs may be fet perpendicular to the plane of the inftrument: fhould this fcrew become loofe, or move too eafy, it may be eafily tightened by turning the capftan headed fcrew H, which is on one fide of the focket through which the ftern of the finger fcrew paffes.

The fextant is furnifhed with a plain tube (fig. 64.) without any glaffes; and to render the objects ftill more diftinct, it has two telefcopes, one (fig. 65.) reprefenting the objects erect, or in their natural pofition: the longer one (fig. 66.) fhows them inverted; it has a large field of view, and other advantages, and a little ufe will foon accuftom the obferver to the inverted pofition, and the inftrument will be as readily managed by it as by the plain tube alone. By a telefcope the contact of the images is more perfectly diftinguifhed; and by the place of the images in the field of the telefcope, it is eafy to perceive whether the fextant is held in the proper place for obfervation. By fliding the tube that contains the eye-glaffes in the infide of the other tube, the object is fuited to different eyes, and made to appear perfectly diftinct and well defined. Fig. 64. Fig. 65. Fig. 66.

The telefcopes are to be fcrewed into a circular ring at K; this ring refts on two points againft an exterior ring, and is held thereto by two fcrews: by turning one or other of thefe fcrews, and tightening the other, the axis of the telefcope may be fet parallel to the plane of the fextant. The exterior ring is fixed on a triangular brafs ftem that flides in a focket, and by means of a fcrew at the back of the quadrant may be raifed or lowered fo as to move the centre of the telefcope to point to that part of the horizon glafs which fhall be judged the moft fit for obfervation. Fig. 67. is a circular head, with tinged glaffes to fcrew on the eye end of either of the telefcopes or the plain tube. The glaffes are contained in a circular plate which Fig. 67.

Of finding the Longitude at Sea by Lunar Observations.

which has four holes; three of these are fitted with tinged glasses, the fourth is open. By pressing the finger against the projecting edge of this plate, and turning it round, the open hole, or any of the tinged glasses, may be brought between the eye-glass of the telescope and the eye.

Fig. 68. Fig. 68. is a magnifying glass, to assist the observer to read off the angle with more accuracy: and fig. 69. a screw-driver.

Mr Hoppe of Church-street, Minorics, London, has lately contrived a sextant, with two arches, which is, therefore, preferable to the common sextant.

Adjustments of the Sextant.

The adjustments of a sextant are, to set the mirrors perpendicular to its plane and parallel to each other when the index is at zero, and to set the axis of the telescope parallel to the plane of the instrument. The three first of these adjustments are performed nearly in the same manner as directed in the section on the quadrant: as however the sextant is provided with a set of coloured glasses placed behind the horizon glass, the index error may be more accurately determined by measuring the sun's diameter twice, with the index placed alternately before and behind the beginning of the divisions: half the difference of these two measures will be the index error, which must be added to, or subtracted from, all observations, according as the diameter measured with the index to the left of *o* is less or greater than the diameter measured with the index to the right of the beginning of the divisions.

Adjustment IV. *To set the Axis of the Telescope parallel to the Plane of the Instrument.*

Turn the eye end of the telescope until the two wires are parallel to the plane of the instrument; and let two distant objects be selected, as two stars of the first magnitude, whose distance is not less than 90° or 100°; make the contact of these objects as perfect as possible at the wire nearest the plane of the instrument; fix the index in this position; move the sextant till the objects are seen at the other wire, and if the same points are in contact, the axis of the telescope is parallel to the plane of the sextant; but if the objects are apparently separated, or do partly cover each other, correct half the error by the screws in the circular part of the supporter, one of which is above and the other between the telescope and sextant: turn the adjusting screw at the end of the index till the limbs are in contact; then bring the objects to the wire next the instrument; and if the limbs are in contact, the axis of the telescope is adjusted; if not, proceed as at the other wire, and continue till no error remains.

It is sometimes necessary to know the angular distance between the wires of the telescope; to find which, place the wires perpendicular to the plane of the sextant, hold the instrument vertical, direct the sight to the horizon, and move the sextant in its own plane till the horizon and upper wire coincide; keep the sextant in this position, and move the index till the reflected horizon is covered by the lower wire: and the division shown by the index of the limb, corrected by the index error, will be the angular distance between the wires. Other and better methods will readily occur to the observer at land.

Use of the Sextant.

When the distance between the moon and the sun or a star is to be observed, the sextant must be held so that its plane may pass through the eye of the observer and both objects; and the reflected image of the most luminous of the two is to be brought in contact with the other seen directly. To effect this, therefore, it is evident, that when the brightest object is to the right of the other, the face of the sextant must be held upwards; but if to the left, downwards. When the face of the sextant is held upwards, the instrument should be supported with the right hand, and the index moved with the left hand. But when the face of the sextant is from the observer, it should be held with the left hand, and the motion of the index regulated by the right hand.

Sometimes a sitting posture will be found very convenient for the observer, particularly when the reflected object is to the right of the direct one; in this case, the instrument is supported by the right hand, the elbow may rest on the right knee, the right leg at the same time resting on the left knee.

If the sextant is provided with a ball and socket, and a staff, one of whose ends is attached thereto, and the other rests in a belt fastened round the body of the observer, the greater part of the weight of the instrument will by this means be supported by his body.

To observe the Distance between the Moon and any Celestial Object.

1. Between the Sun and Moon.

Put the telescope in its place, and the wires parallel to the plane of the instrument; and if the sun is very bright, raise the plate before the silvered part of the speculum; direct the telescope to the transparent part of the horizon glass, or to the line of separation of the silvered and transparent parts according to the brightness of the sun, and turn down one of the coloured glasses; then hold the sextant so that its plane produced may pass through the sun and moon, having its face either upwards or downwards according as the sun is to the right or left of the moon; direct the sight through the telescope to the moon, and move the index till the limb of the sun is nearly in contact with the enlightened limb of the moon; now fasten the index, and by a gentle motion of the instrument make the image of the sun move alternately past the moon; and, when in that position where the limbs are nearest each other, make the coincidence of the limbs perfect by means of the adjusting screw: this being effected, read off the degrees and parts of a degree shown by the index on the limb, using the magnifying glass; and thus the angular distance between the nearest limbs of the sun and moon is obtained.

2. Between the Moon and a Star.

Direct the middle of the field of the telescope to the line of separation of the silvered and transparent parts of the horizon glass; if the moon is very bright, turn down the lightest coloured glass; and hold the sextant so that its plane may be parallel to that passing through the eye of the observer and both objects; its face being upwards if the moon is to the right of the star, but if to the left, the face is to be held from the observer; now direct the sight through the telescope to the star, and move

Of finding the Longitude at Sea by Lunar Observations.

move the index till the moon appears by the reflection to be nearly in contact with the ftar; faften the index, and turn the adjufting fcrew till the coincidence of the ftar and enlightened limb of the moon is perfect: and the degrees and parts of a degree fhown by the index will be the obferved diftance between the moon's enlightened limb and the ftar.

The contact of the limbs muft always be obferved in the middle between the parallel wires.

It is fometimes difficult for thofe not much accuftomed to obfervations of this kind, to find the reflected image in the horizon glafs: it will perhaps in this cafe be found more convenient to look directly to the object, and, by moving the index, to make its image coincide with that feen directly.

Sect. III. *Of the Circular Inftrument of Reflexion.*

This inftrument was propofed with a view to correct the errors to which the fextant is liable; particularly the error arifing from the inaccuracy of the divifions on the limb. It confifts of the following parts; a circular ring or limb, two moveable indices, two mirrors, a telefcope, coloured glaffes, &c.

The limb of this inftrument is a complete circle of metal, and is connected with a perforated central plate by fix radii: it is divided into 720 degrees; each degree is divided into three equal parts; and the divifion is carried to minutes by means of the index fcale as ufual.

The two indices are moveable about the fame axis, which paffes exactly through the centre of the inftrument:—the firft index carries the central mirror, and the other the telefcope and horizon glafs; each index being provided with an adjufting fcrew for regulating its motion, and a fcale for fhowing the divifions on the limb.

The central mirror is placed on the firft index immediately above the centre of the inftrument, and its plane makes an angle of about 30° with the middle line of the index. The four fcrews in its pedeftal for making its plane perpendicular to that of the inftrument have fquare heads, and are therefore eafily turned either way by a key for that purpofe.

The horizon glafs is placed on the fecond index near the limb, fo that as few as poffible may be intercepted of the rays proceeding from the reflected object when to the left. The perpendicular pofition of this glafs is rectified in the fame manner as that of the horizon glafs of a fextant, to which it is fimilar. It has another motion, whereby its plane may be difpofed fo as to make a proper angle with the axis of the telefcope, and a line joining its centre, and that of the central mirror.

The telefcope is attached to the other end of the index. It is an achromatic aftronomical one, and therefore inverts objects; it has two parallel wires in the common focus of the glaffes, whofe angular diftance is between two and three degrees; and which, at the time of obfervation, muft be placed parallel to the plane of the inftrument. This is eafily done, by making the mark on the eye-piece coincide with that on the tube. The telefcope is moveable by two fcrews in a vertical direction with regard to the plane of the inftrument, but is not capable of receiving a lateral motion.

There are two fets of coloured glaffes, each fet containing four, and differing in fhade from each other. The glaffes of the larger fet, which belongs to the central mirror, fhould have each about half the degree of fhade with which the correfpondent glafs of the fet belonging to the horizon mirror is tinged. Thefe glaffes are kept tight in their places by fmall preffing fcrews, and make an angle of about 85° with the plane of the inftrument; by which means the image from the coloured glafs is not reflected to the telefcope. When the angle to be meafured is between 5° and 34°, one of the glaffes of the largeft fet is to be placed before the horizon glafs.

The handle is of wood, and is fcrewed to the back of the inftrument, immediately under the centre, with which it is to be held at the time of obfervation.

Fig. 70. is a plan of the inftrument, wherein the limb is reprefented by the divided circular plate; A is the central mirror; *a a*, the places which receive the ftems *a a* of the glafs, fig. 73.; EF, the firft or central index with its fcale and adjufting fcrew; MN, the fecond or horizon index; GH, the telefcope; IK, the fcrews for moving it towards or from the plane of the inftrument; C, the plane of the coloured glafs, fig. 72.; and D, its place in certain obfervations, Fig. 70.

Fig. 71. is a fection of the inftrument, wherein the feveral parts are referred to by the fame letters as in fig. 70.: Fig. 72. reprefents one of the horizon coloured glaffes; and fig. 73. one of the central coloured glaffes: Fig. 74. is the key for turning the adjufting fcrews of the mirrors: Fig. 75. is the handle: Fig. 76. a fection of one of the radii towards its middle: Fig. 77. is ufed in fome terreftrial obfervations for diminifhing the light of the direct object, whofe place at the time of obfervation is D: Fig. 78. is the tool for adjufting the central mirror; and for rectifying the pofition of the telefcope with regard to the plane of the inftrument, there is another tool exactly of the fame fize. The height of thefe is nearly equal to that of the middle of the central mirror. Fig. 71.

Adjuftments of the Circular Inftrument.

I. *To fet the horizon glafs fo that none of the rays from the central mirror fhall be reflected to the telefcope from the horizon mirror, without paffing through the coloured glafs belonging to this laft mirror.*—Place the coloured glafs before the horizon mirror; direct the telefcope to the filvered part of that mirror, and make it nearly parallel to the plane of the inftrument; move the firft index; and if the rays from the central mirror to the horizon glafs, and from thence to the telefcope, have all the fame degree of fhade with that of the coloured glafs ufed, the horizon glafs is in its proper pofition; otherwife the pedeftal of the glafs muft be turned until the uncoloured images difappear.

II. Place the two adjufting tools on the limb, about 350° of the inftrument diftant, one on each fide of the divifion on the left, anfwering to the plane of the central mirror produced: then the eye being placed at the upper edge of the neareft tool, move the central index till one half only of the reflected image of this tool is feen in the central mirror towards the left, and move the other tool till its half to the right is hid by the fame edge of the mirror; then, if the upper edges of both tools are apparently in the fame ftraight line, the

Of finding the Longitude at Sea by Lunar Observations.

the central mirror is perpendicular to the plane of the instrument; if not, bring them into this position by the screws in the pedestal of the mirror.

III. *To set the horizon mirror perpendicular to the plane of the instrument.*—The central mirror being previously adjusted, direct the sight through the telescope to any well-defined distant object; then if, by moving the central index, the reflected image passes exactly over the direct object, the mirror is perpendicular; if not, its position must be rectified by means of the screws in the pedestal of the glass.

A planet, or star of the first magnitude, will be found a very proper object for this purpose.

IV. *To make the line of collimation parallel to the plane of the instrument.*—Lay the instrument horizontally on a table; place the two adjusting tools on the limb, towards the extremities of one of the diameters of the instrument; and at about 15 or 20 feet distant let a well defined mark be placed, so as to be in the same straight line with the tops of the tools; then raise or lower the telescope till the plane, passing through its axis and the tops of the tools, is parallel to the plane of the instrument, and direct it to the fixed object; turn either or both of the screws of the telescope till the mark is apparently in the middle between the wires; then is the telescope adjusted; and the difference, if any, between the divisions pointed out by the indices of the screws will be the error of the indices. Hence this adjustment may in future be easily made.

In this process the eye tube must be so placed as to obtain distinct vision.

V. *To find that division to which the second index being placed the mirrors will be parallel, the central index being at zero.*—Having placed the first index exactly to *o*, direct the telescope to the horizon mirror, so that its field may be bisected by the line of separation of the silvered and transparent parts of that mirror; hold the instrument vertically, and move the second index until the direct and reflected horizons agree; and the division shown by the index will be that required.

This adjustment may be performed by measuring the sun's diameter in contrary directions, or by making the reflected and direct images of a star or planet to coincide.

Use of the Circular Instrument.

To observe the Distance between the Sun and Moon.

I. The sun being to the right of the moon.

Set a proper coloured glass before the central mirror, if the distance between the objects is less than 35°; but if above that quantity, place a coloured glass before the horizon mirror: make the mirrors parallel, the first index being at *o*, and hold the instrument so that its plane may be directed to the objects, with its face downwards, or from the observer: direct the sight through the telescope to the moon; move the second index, according to the order of the divisions on the limb, till the nearest limbs of the sun and moon are almost in contact: fasten that index, and make the coincidence of the limbs perfect by the adjusting screw belonging thereto: then invert the instrument, and move the central index towards the second by a quantity equal to twice the arch passed over by that index: direct the plane of the instrument to the objects: look directly to the moon, and the sun will be seen in the field of the telescope: fasten the central index, and make the contact of the same two limbs exact by means of the adjusting screw: Then half the angle shown by the central index will be the distance between the nearest limbs of the sun and moon.

II. The sun being to the left of the moon.

Hold the instrument with its face upwards, so that its plane may pass through both objects; direct the telescope to the moon, and make its limb coincide with the nearest limb of the sun's reflected image, by moving the second index: now put the instrument in an opposite position; direct its plane to the objects, and the sight to the moon, the central index being previously moved towards the second by a quantity equal to twice the measured distance; and make the same two limbs that were before observed coincide exactly, by turning the adjusting screw of the first index: then half the angle shown by the first index will be the angular distance between the observed limbs of the sun and moon. This instrument has of late been greatly improved by Captain Mendoza.

To observe the Angular Distance between the Moon and a Fixed Star or Planet.

I. The star being to the right of the moon.

In this case the star is to be considered as the direct object; and the enlightened limb of the moon's reflected image is to be brought in contact with the star or planet, both by a direct and inverted position of the instrument, exactly in the same manner as described in the last article. If the moon's image is very bright, the lightest tinged glass is to be used.

II. The star being to the left of the moon.

Proceed in the same manner as directed for observing the distance between the sun and moon, the sun being to the right of the moon, using the lightest tinged glass, if necessary.

Sect. IV. *Of the Method of determining the Longitude from Observation.*

Prob. I. To convert degrees or parts of the equator into time.

Rule. Multiply the degrees and parts of a degree by 4, beginning at the lowest denomination, and the product will be the corresponding time. Observing that minutes multiplied by 4 produce seconds of time, and degrees multiplied by 4 give minutes.

Ex. 1. Let 26° 45′ be reduced to time.

$$\begin{array}{r} 26^\circ\ 45' \\ 4 \\ \hline 1h\ 47'\ 0''=\text{time required.} \end{array}$$

Ex. 2. Reduce 83° 37′ to time.

$$\begin{array}{r} 83^\circ\ 37' \\ 4 \\ \hline \text{Corresponding time}=5\quad 34\quad 28 \end{array}$$

Prob. II. To convert time into degrees.

Rule. Multiply the given time by 10, to which add the half of the product. The sum will be the corresponding degrees.

Ex.

Fig. 1.

Fig. 2.

Fig. 3.

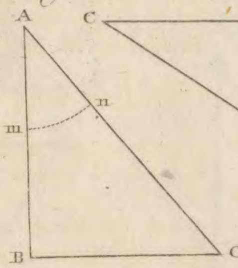


Fig. 4.

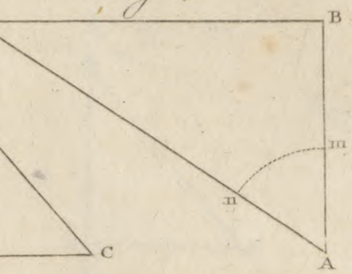


Fig. 5.

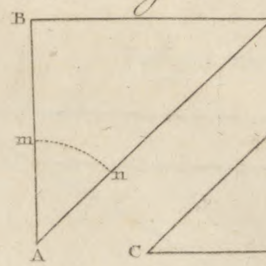


Fig. 6.

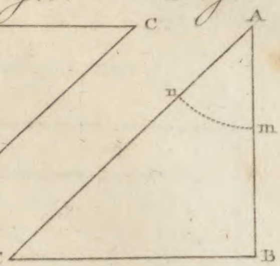


Fig. 7.

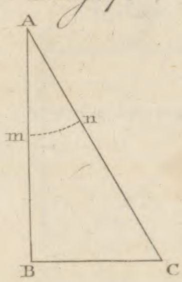


Fig. 8.

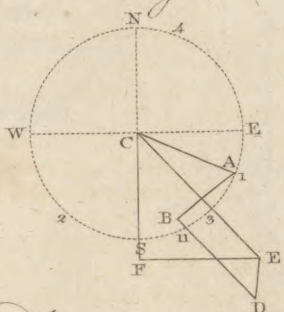


Fig. 9.

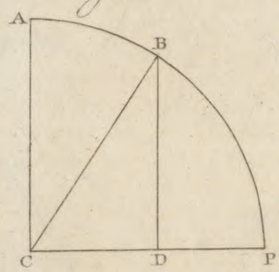


Fig. 10.

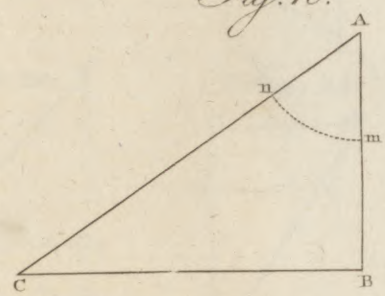


Fig. 11.

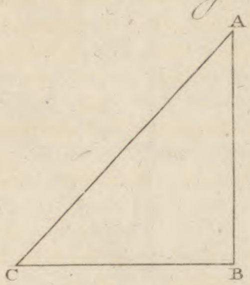


Fig. 12.

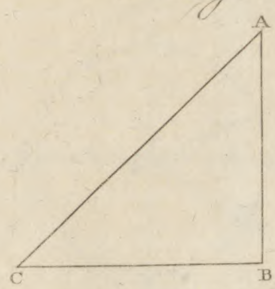


Fig. 13.

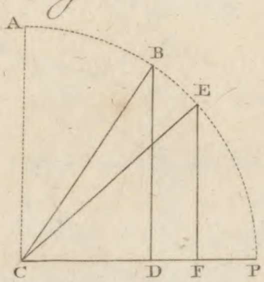


Fig. 14.

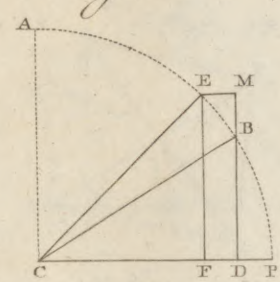


Fig. 15.

Fig. 16.

Fig. 17.

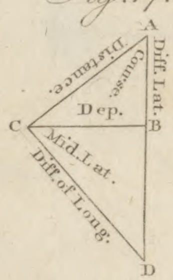


Fig. 18.

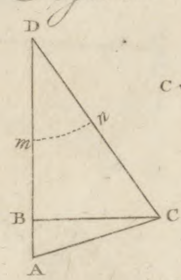


Fig. 19.

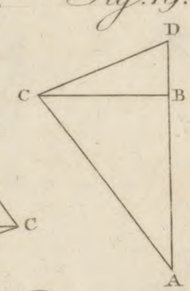


Fig. 20.

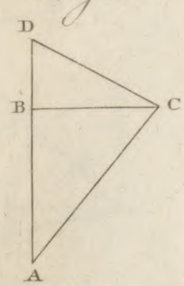


Fig. 21.

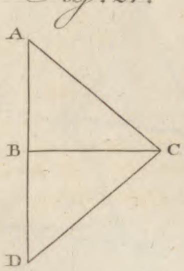


Fig. 22.

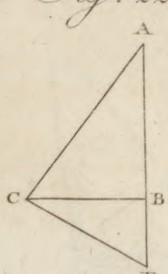


Fig. 23.

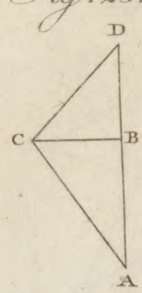


Fig. 24.

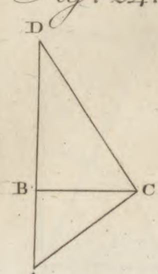
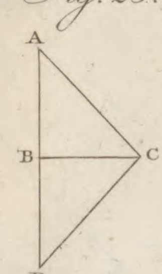
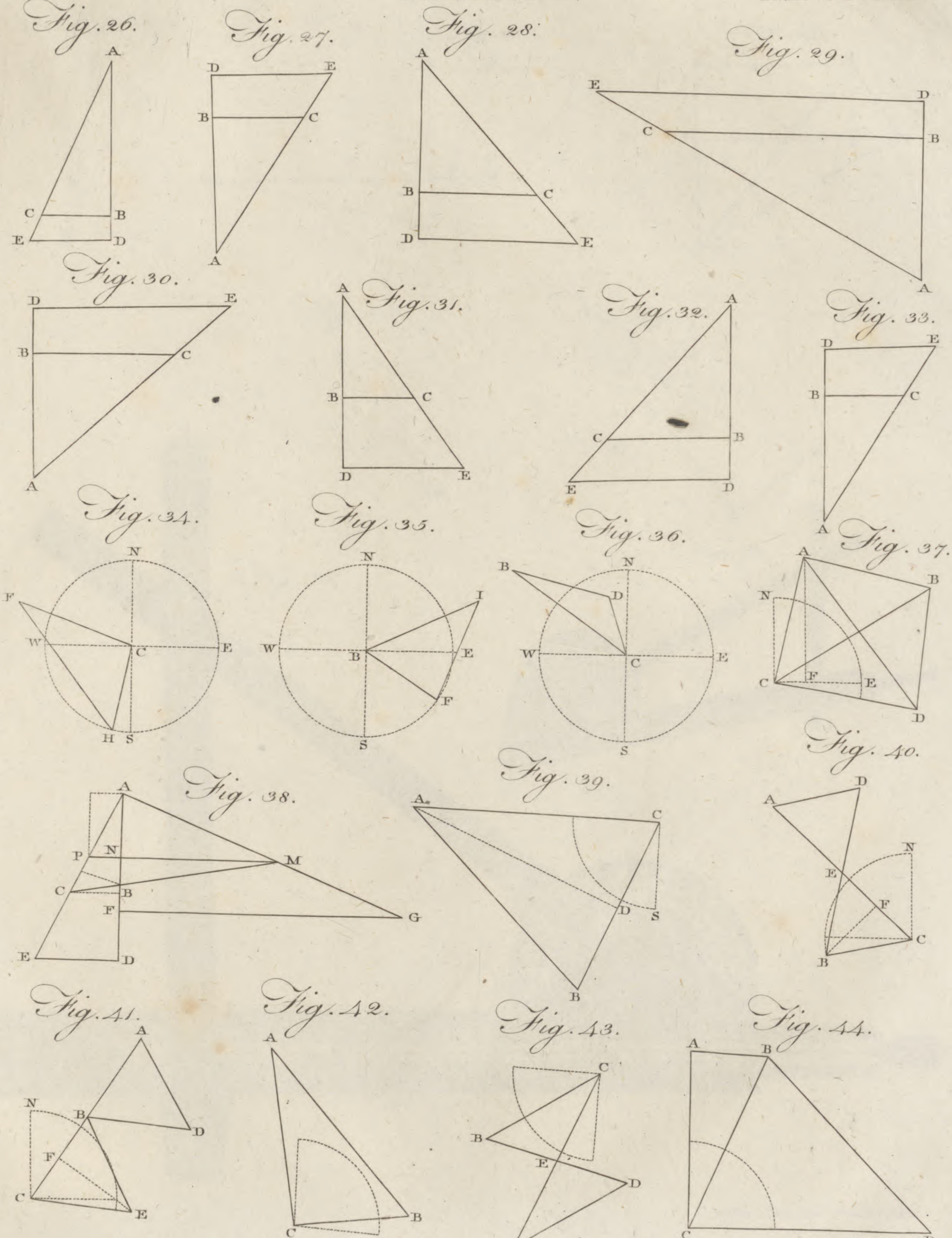


Fig. 25.



A. Bell Prin. Wal. Sculptor fecit.



A. Bell Prin. Wal. Sculptor fecit.

Fig. 45.

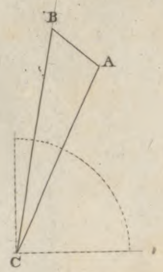


Fig. 46.

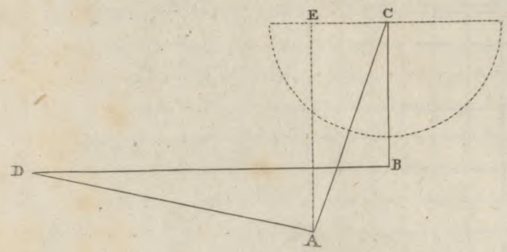


Fig. 47.

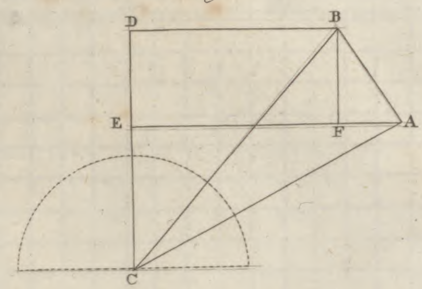


Fig. 48.

Fig. 49.

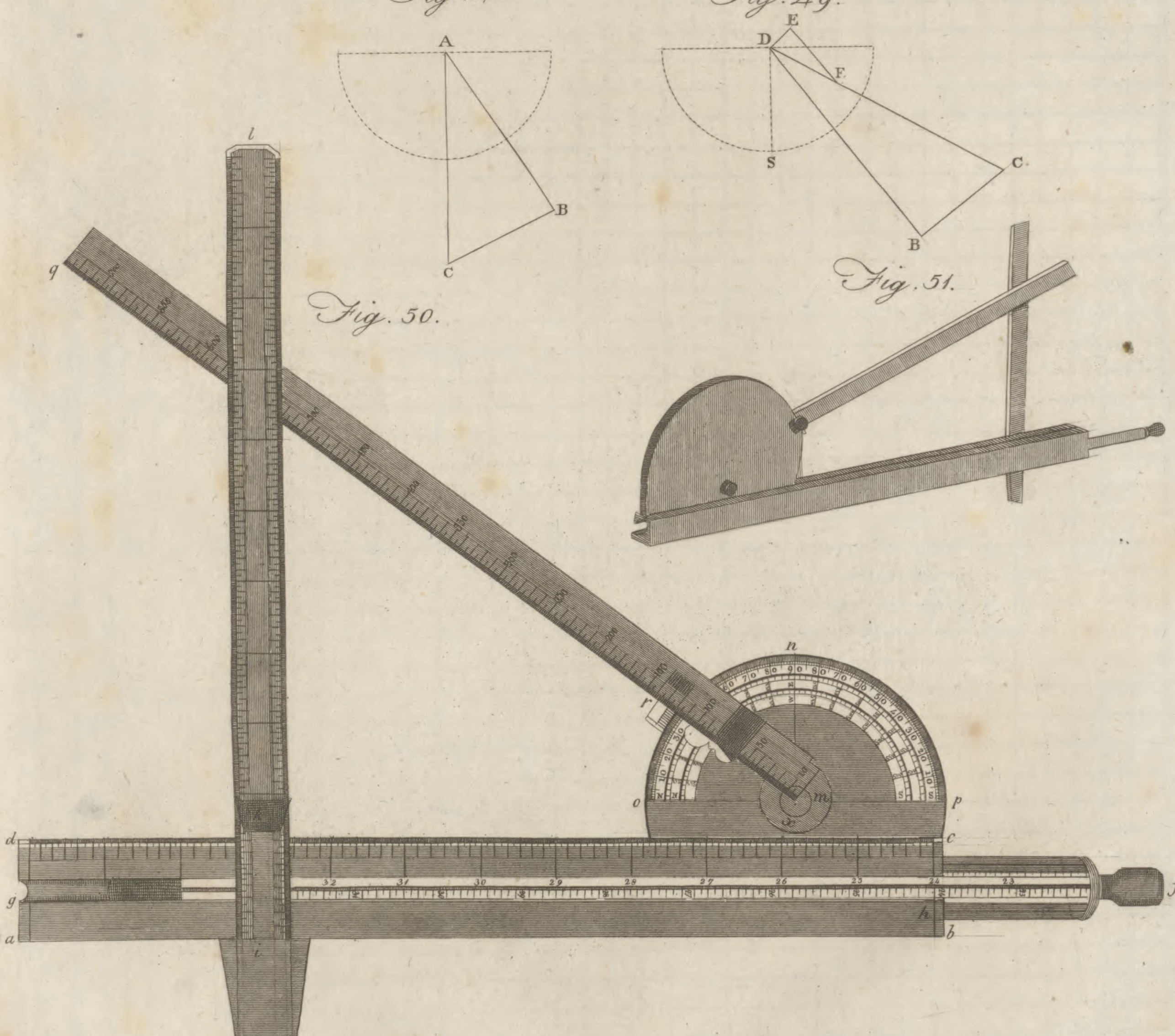
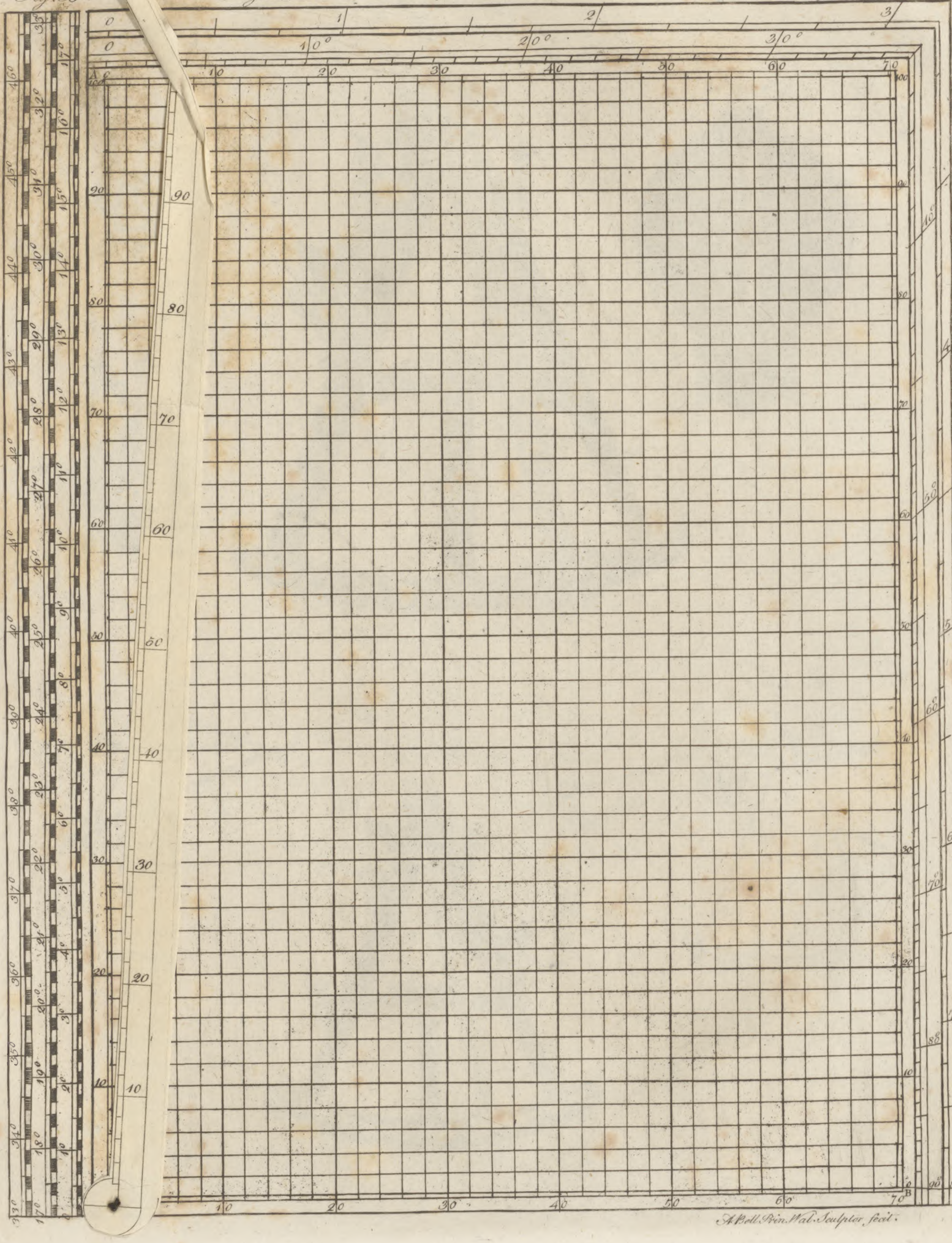


Fig. 50.

Fig. 51.

A. Bell Prin. Wal. Sculptor fecit.

Fig. 53. Fig. 52.



A. Bell. Prin. Wal. Sculptor fecit.

NAVIGATION.

Fig. 54

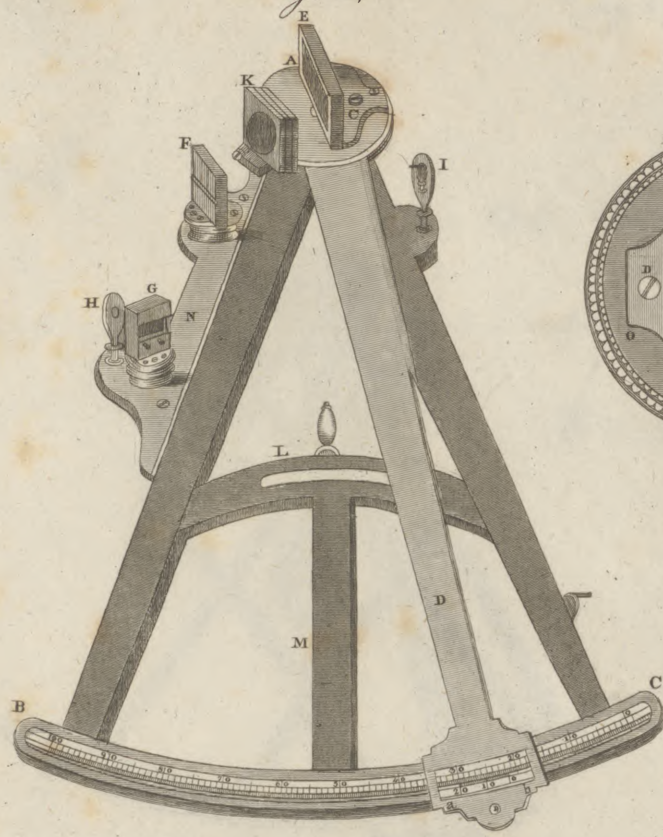


Fig. 55

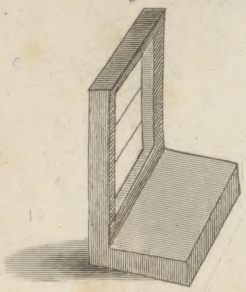


Fig. 59

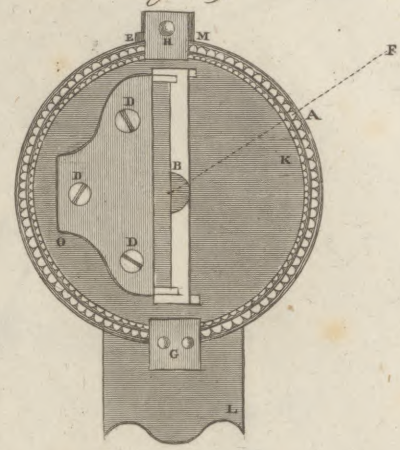


Fig. 56

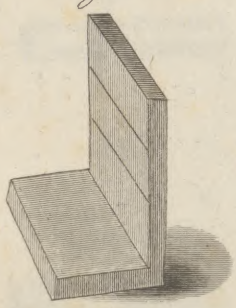


Fig. 57

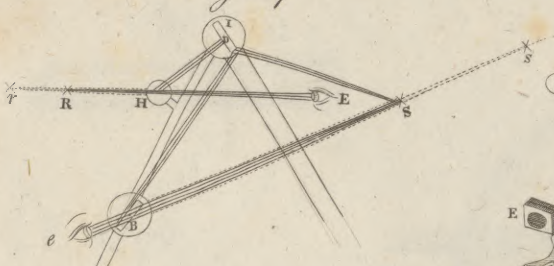


Fig. 58

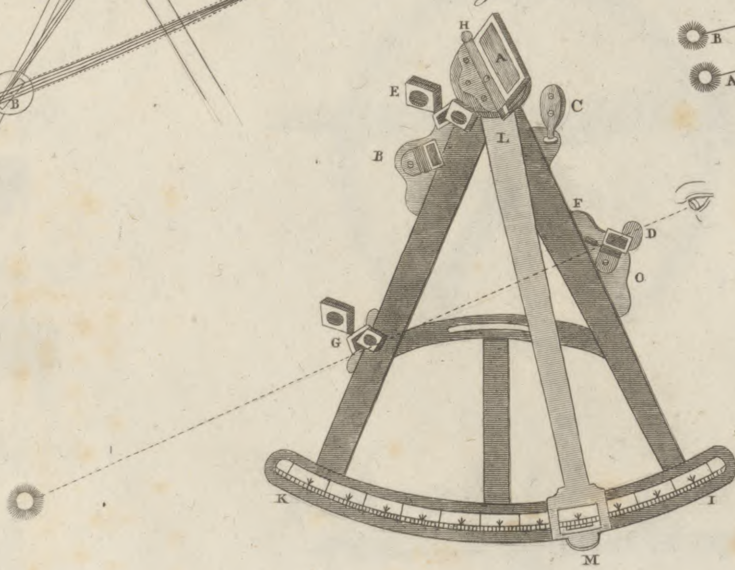
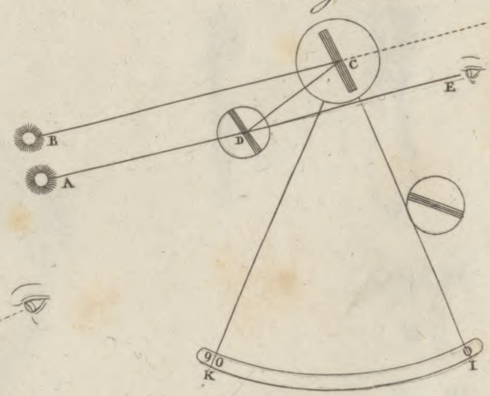


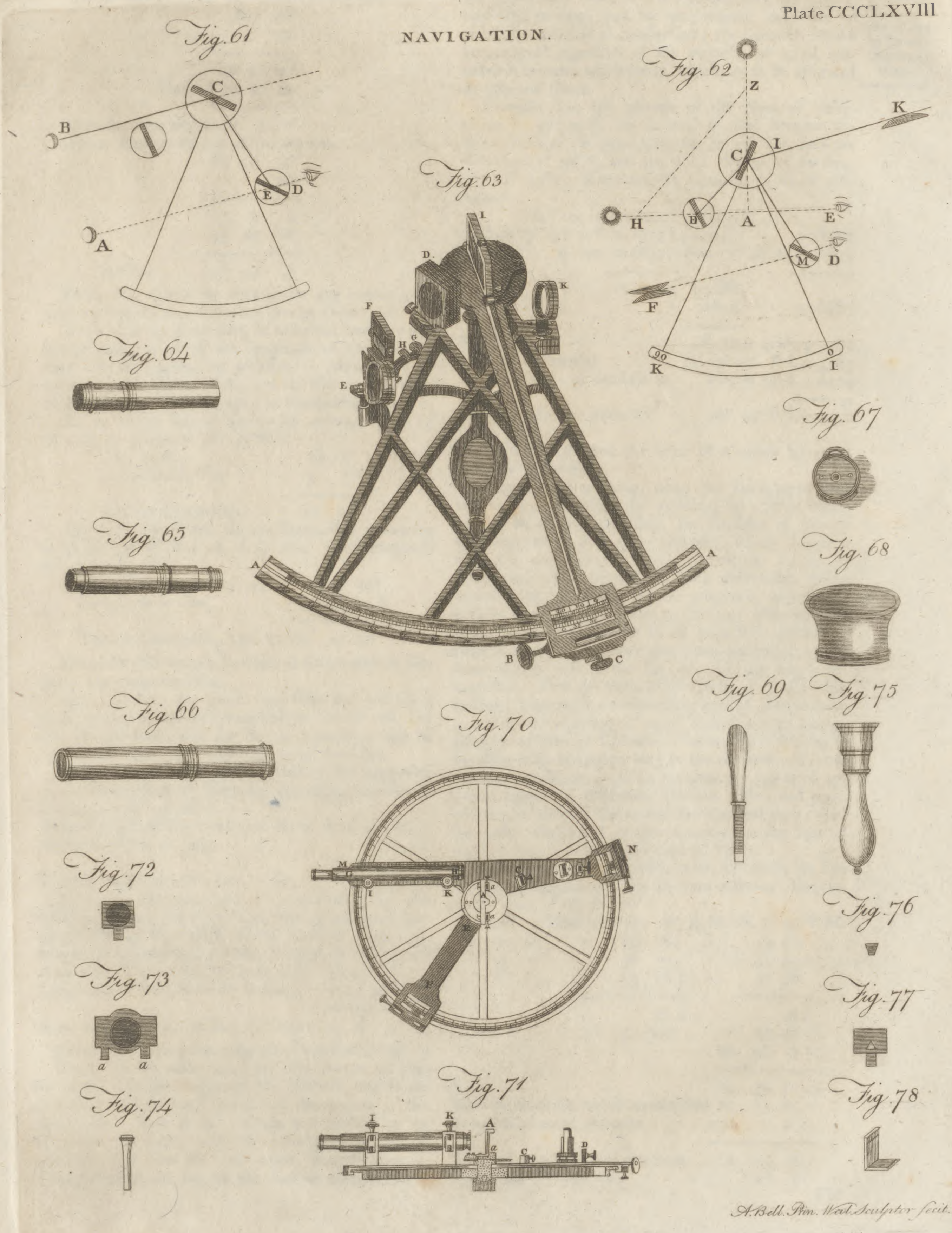
Fig. 60



A. Bell Prin. Wal. Sculptor fecit.

Plate CCCLXVIII

NAVIGATION.



A. Bell. Prin. Wall. Sculptor fecit.

Of finding the Longitude at Sea by Lunar Obfervations.

Ex. 1. Let 3h 4′ 28″ be reduced to degrees.

	3h	4′	28″
			10
	30	44	40
Half =	15	22	20
Correfponding deg. =	46	7	0

Ex. 2. Reduce 8h 42′ 36″ to degrees.

	8h	42′	36″
			10
	87	6	0
	43	33	0
Anfwer	130	39	0

PROB. III. Given the time under any known meridian, to find the correfponding time at Greenwich.

RULE. Let the given time be reckoned from the preceding noon, to which the longitude of the place in time is to be applied by addition or fubtraction, according as it is eaft or weft; and the fum or difference will be the correfponding time at Greenwich.

Ex. 1. What time at Greenwich anfwers to 6h 15′ at a fhip in longitude 76° 45′W?

Time at fhip - -	6h	15′
Longitude in time -	5	7W.
Time at Greenwich,	11	22

Ex. 2. Required the time at Greenwich anfwering to 5h 46′ 39″ of May 1ft, at Canton, whofe longitude is 113° 2′ 15″ E.?

Time at Canton, May 1ft,	5h	46′	39″
Longitude in time, -	7	32	9 E
Time at Greenwich, April 30.	22	14	30

PROB. IV. To reduce the time at Greenwich to that under any given meridian.

RULE. Reckon the given time from the preceding noon, to which add the longitude in time if eaft, but fubtract it if weft; and the fum or remainder will be the correfponding time under the given meridian.

Ex. 1. What is the expected time of the beginning of the lunar eclipfe of February 25. 1793, at a fhip in longitude 109° 48′ E.?

Beg. of eclipfe at Greenwich per. Naut. Alm.	9h	23′	45′
Ship's longitude in time, - -	7	19	12
Time of beginning of eclipfe at fhip,	16	42	57

Ex. 2. At what time may the immerfion of the firft fatellite of Jupiter be obferved at Port St Julian, in longitude 68° 44′ W, which by the Nautical Almanack, happens at Greenwich 24th March 1792, at 17h 53′ 1″?

App. time of immerfion at Greenwich,	17h	53′	1″
Longitude of Port St Julian in time,	4	34	56W.
App. time of immer. at Port St Julian,	13	18	5

PROB. V. To find the equation of equal altitudes.

RULE. To the cofecant of half the interval of time in degrees add the tangent of the latitude, and to the cotangent of half the interval add the tangent of the declination. Now if the latitude and declination be of a contrary name, add the correfponding natural numbers; but if of the fame name, fubtract them.—Then to the ar. co. log. of this fum or difference add the proportional logarithm of one-fourth of the interval expreffed in time, and the proportional logarithm of the daily variation of declination; the fum will be the proportional logarithm of the equation of equal altitudes in minutes and feconds, which are to be efteemed feconds and thirds.

Of finding the Longitude at Sea by Lunar Obfervations.

Example. Let the latitude of the place of obfervation be 57° 9′ N, the interval of time between the obfervations of the equal altitudes 5h 17′, the fun's declination 17° 48′ S, and the daily change of declination 16′ 19″½: Required the equation of equal altitudes?

Half the interval = 2h 38′½ = 39° 37′.

½ int. = 39° 37′	coft.	0.19542	cotang.		0.08209
Lat. 57 9	tan.	0.18997	dec. 17° 48′	ta.	9.50659
		0.38539	2.4288		
			3879		9.58868

Sum - - - - -	2.8167 ar. co. lo. 9.5503
One fourth interval -	1h 19′ 15″ P.L. 0.3563
Daily variation of declination -	16′ 19″½ P.L. 1.0424
Equation of equal altitudes	20″ 14‴ P.L. 0.9490

PROB. VI. To find the error of a watch by equal altitudes of the fun.

RULE. In the morning, when the fun is more than two hours diftant from the meridian, let a fet of obfervations be taken, confifting, for the fake of greater accuracy, of at leaft three altitudes, which, together with the correfponding times per watch, are to be wrote regularly, the time of each obfervation being increafed by 12 hours. In the afternoon, obferve the inftants when the fun comes to the fame altitudes, and write down each oppofite to its refpective altitude.—Now half the fum of any two times anfwering to the fame altitude will be the time of noon per watch uncorrected. Find the mean of all the times of noon thus deduced from each correfponding pair of obfervations, to which the equation of equal altitudes is to be applied by addition or fubtraction according as the fun is receding from or approaching to the elevated pole, and the fum or difference will be the time per watch of apparent noon, the difference between which and noon will be the error of the watch for apparent time; and the watch will be faft or flow according as the time of noon thereby is more or lefs than 12 hours.

Example. January 29. 1786, in lat. 57° 9′ N, the following equal altitudes of the fun were obferved: Required the error of the watch?

Alt. = 8°	5′	Time	21h	35′	8″	A.M.	2h	55′	43″	P.M.
8	10	-		36	8	-		54	42	
8	20	-		38	9	-		52	41.2	
8	25	-		39	12.5	-		51	38	
					37.5				4.2	
			21	37	9.37		2	53	41.05	
							21	37	9.37	
Sum - - - - - -							24	30	50.42	
Time of noon per watch uncorrected							12	15	25.2	
Equation of equal altitudes -							=0	0	20.2	
Time per watch of apparent noon							12	15	5.	
Watch faft - - - -								15	5.	

The

Of finding the Longitude at Sea by Lunar Obſervations.

The mean time of noon per watch is found by applying the equation of time with a contrary ſine.

In practice it will be found convenient to put the index of the quadrant to a certain diviſion, and to wait till either limb of the ſun attains that altitude.

Prob. VII. Given the latitude of a place, the altitude and declination of the ſun, to find the apparent time, and the error of the watch.

Rule. If the latitude and declination are of different names, let their ſum be taken; otherwiſe, their difference. From the natural coſine of this ſum or difference ſubtract the natural ſine of the corrected altitude, and find the logarithm of the remainder; to which add the log. ſecants of the latitude and declination: the ſum will be the log. riſing of the horary diſtance of the object from the meridian, and hence the apparent time will be known.

Of finding the Longitude at Sea by Lunar Obſervations.

Ex. 1. September 15. 1792, in latitude 33° 56′ S, and longitude 18° 22′ E, the mean of the times per watch was 8h 12′ 10″ A. M. and that of the altitudes of the ſun's lower limb 24° 48′; height of the eye 24 feet. Required the error of the watch?

Obſ. alt. Sun's lower limb	24° 48′	Sun's declin. at noon per Nautical Almanack	2° 40′.5 S
Semidiameter	+ 16.0	Equation to 3h 48 A. M.	+ 3.7
Dip	— 4.7	to 18° 22′ Eaſt	+ 1.2
Correction	— 1.9	Reduced declination	2 45.4 S
True altitude Sun's centre	24 57.4		
Latitude	33 56	ſecant	0.08109
Declination	2 45.4	ſecant	0.00050
Sum	36 41.4	nat. coſine 80188	
Sun's altitude	24 57.4	nat. ſine 42193	
		Difference 37995 log.	4.57973
Sun's meridian diſtance	3h 48′ 51″	riſing	4.66132
Apparent time	8 11 9		
Time per watch	8 12 10		
Watch faſt	1 1		

Ex. 2. May 6. 1793, in latitude 56° 4′ N, and longitude 38° 30′ W, at 4h 37′ 4″ P. M. per watch the altitude of the ſun's lower limb was 25° 6′.1, and height of the eye 18 feet. Required the error of the watch for apparent time?

Altitude ſun's lower limb	= 25° 6′.1	Sun's declin. per Nautical Almanack	16° 44′.3
Semidiameter	+ 15.9	Equation to 4h 37′ P. M.	+ 3.4
Dip	— 4.1	to 38° 30′W.	+ 1.8
Correction	— 1.9	Reduced declination	16 49.5
True alt. ſun's centre	25 16.0		
Latitude	56 4.0 N.	ſecant	0.25319
Declination	16 49.5 N.	ſecant	0.01900
Difference	39 14.5	nat. coſine 77448	
Sun's altitude	25 16.0	nat. ſine 42683	
		Difference 34765	4.54114
Apparent time	4h 38′ 12″	riſing	4.81333
Time per watch	4 37 4		
Watch ſlow	1 8		

Prob. VIII. Given the latitude of a place, the altitude of a known fixed ſtar, and the ſun's right aſcenſion, to find the apparent time of obſervation and error of the watch.

Rule. Correct the obſerved altitude of the ſtar, and reduce its right aſcenſion and declination to the time of obſervation.

With the latitude of the place, the true altitude and declination of the ſtar, compute its horary diſtance from the meridian by laſt problem; which being added to, or ſubtracted from, its right aſcenſion, according as it was obſerved in the weſtern or eaſtern hemiſphere, the ſum or remainder will be the right aſcenſion of the meridian.

From the right aſcenſion of the meridian ſubtract the ſun's right aſcenſion, as given in the Nautical Almanack

Of finding the Longitude at Sea by Lunar Observations.

nack for the noon of the given day, and the remainder will be the approximate time of obfervation; from which fubtract the proportional part of the daily variation of right afcenfion anfwering thereto, and let the proportional part anfwering to the longitude be added or fubtracted, according as the longitude is eaft or weft, and the refult will be the apparent time of obfervation; and hence the error of the watch will be known.

Ex. 1. December 12. 1792, in lat. 37° 46′ N, and longitude 21° 15′ E, the altitude of Arcturus eaft of the meridian was 34° 6′.4, the height of the eye 10 feet. Required the apparent time of obfervation?

Obferved alt. of Arcturus	34° 6′.4		
Dip and refraction	— 4.4		
True altitude	34 2.0		
Latitude	37 46.0 N	fec. 0.10209	
Declination	20 14.4 N	fec. 0.02778	
Difference	17 31.6	N. co. 95358	
Altitude of Arcturus	34 2.0	N. fine 55968	
	Difference	39390	4.59539
Arcturus's merid. dift.	4h 8′ 10″	rifing	4.72526
right af.	14 6 13		
Right af. of merid.	9 58 3		
Sun's right af.	17 21 59		
Approximate time	16 36 4		
Eq. to approx. time	— 3 3		
Eq. to longitude	+ 16		
Ap. time of obf.	16 33 17		

Ex. 2. January 29. 1792, in latitude 53° 24′ N, and longitude 25° 18′ W, by account, at 14h 58′ 38″, the altitude of Procyon weft of the meridian was 19° 58′; height of the eye 20 feet. Required the error of the watch?

Obf. alt. of Procyon	19° 58′		
Dip and refraction	7		
True altitude	19 51		
Latitude	53 24	fecant	0.22459
Declination	5 45	fecant	0.00219
Difference	47 39	nat. cof. 67366	
Altitude of Procyon	19 51	nat. fine 33956	
	Difference	33410	4.52388
Procyon's merid. dift.	4h 16′ 24″	rifing	4.75066
right af.	7 28 24		
Right af. of merid.	11 44 48		
Sun's right af.	20 47 22		
Approximate time	14 57 26		
Eq. to ap. time	—0 2 36		
Eq. to long.	— 0 17		
Apparent time	14 54 33		
Time per watch	14 58 38		
Watch faft	0 4 5		

Prob. IX. Given the altitude of the moon, the latitude of a place, and the apparent time at Greenwich; to find the apparent time at the place of obfervation.

Rule. Correct the altitude of the moon's limb by Problem V. p. 731, and reduce its right afcenfion and declination, and the fun's right afcenfion, to the Greenwich time of obfervation. Now with the latitude of the place, the declination and altitude of the moon, compute its meridian diftance as before: Which being applied to its right afcenfion by addition or fubtraction, according as it is in the weftern or eaftern hemifphere, will give the right afcenfion of the meridian. Then the fun's right afcenfion fubtracted from the right afcenfion of the meridian, will give the apparent time of obfervation.

Example. March 3. 1792, in latitude 51° 38′ N, at 11 h 29′ 7″ P. M. per watch, the altitude of the moon's lower limb was 37° 31′, the height of the eye being 10 feet, and the time at Greenwich 13 h 43′. Required the error of the watch?

Moon's right afcenfion at Green. time		7h 22′ 54″
declination		17° 0 N
Sun's right afcenfion		23h 2′ 0″

Altitude of the moon's lower limb	=37° 31′			
Semidiameter	+ 15			
Dip	— 3			
Correction	+ 42			
Corrected alt. of moon's centre	38 25			
Latitude	51 38 N	fecant		0.20712
Declination	17 0 N	fecant		0.01940
Difference	34 38	Nat. cofine	82281	
Moon's altitude	38 25	Nat. fine	62138	
		Difference	20143	4.30412
Moon's meridian diftance	3° 14′ 36″	rifing		4.53064
right afcenfion	7 22 54			
Right afcenfion of meridian	10 37 30			
Sun's right afcenfion	23 2 0			
Apparent time at fhip	11 35 30			
Time per watch	11 29 7			
Watch flow	6 23			

Of finding the Longitude at Sea by Lunar Observations.

Prob X. Given the apparent diſtance between the moon and the ſun or a fixed ſtar, to find the true diſtance.

Rule. To the logarithmic difference anſwering to the moon's apparent altitude and horizontal parallax, add the logarithmic ſines of half the ſum, and half the difference of the apparent diſtance and difference of the apparent altitudes; half the ſum will be the logarithmic coſine of an arch: now add the logarithm ſines of the ſum and difference of this arch, and half the difference of the true altitudes, and half the ſum will be the logarithmic coſine of half the true diſtance.

Of finding the Longitude at Sea by Lunar Obſervations.

Example. Let the apparent altitude of the moon's centre be 48° 22′, that of the ſun's 27° 43′, the apparent central diſtance 81° 23′ 40″, and the moon's horizontal parallax 58′ 45″. Required the true diſtance?

Apparent altitude ſun's centre	27° 43′ 0″	Apparent altitude moon's centre			48° 22′ 0″
Correction	— 1 40	Correction			+ 38 26
Sun's true altitude	27 41 20	Moon's true altitude			49 0 26
Sun's apparent altitude	27 43	Sun's true altitude			27 41 20
Moon's apparent altitude	48 22	Difference			21 19 6
Difference	20 39	Half			10 39 33
Apparent diſtance	81 23 40	Logarithmic difference			9.994638
Sum	102 2 40	Half	51° 1′ 20″	Sine	9.890639
Difference	60 44 40	Half	30 22 20	Sine	9.703820
Half difference true altitudes	10 39 33				19.589097
Arch	51 27 29			coſine	9.794548
Sum	62 7 2			ſine	9.946417
Difference	40 47 56			ſine	9.815183
					19.761600
	40 32 16			coſine	9.880800
	2				
True diſtance	81 4 32				

Prob. XI. To find the time at Greenwich anſwering to a given diſtance between the moon and the ſun, or one of the ſtars, uſed in the Nautical Almanack.

Rule. If the given diſtance is found in the Nautical Almanack oppoſite to the given day of the month, or to that which immediately precedes or follows it, the time is found at the top of the page. But if this diſtance is not found exactly in the ephemeris, ſubtract the prop. log. of the difference between the diſtances which immediately precede and follow the given diſtance, from the prop. log. of the difference between the given and preceding diſtances; the remainder will be the prop. log. of the exceſs of the time correſponding to the given diſtance, above that anſwering to the preceding diſtance: And hence the apparent time at Greenwich is known.

Example. September 21. 1792, the true diſtance between the centres of the ſun and moon was 68° 13′ 8″. Required the apparent time at Greenwich?

Given diſtance	68° 13′ 8″		
Diſt. at ix. hours	67 53 27	Diff.=0° 19′ 41″	P. log. 9612
Diſt. at xii hours	69 30 6	Diff.=1 36 39	P. log. 2701
Exceſs		0 36 39	P. log. 6911
Preceding time		9 0 0	
App. time at Greenwich		9 36 39	

Prob. XII. The latitude of a place and its longitude by account being given, together with the diſtance between, and the altitude of the moon and the ſun, or one of the ſtars in the Nautical Almanack; to find the true longitude of the place of obſervation.

Rule. Reduce the eſtimate time of obſervation to the meridian of Greenwich by Problem III. and to this time, take from the Nautical Almanack, page 7. of the month, the moon's horizontal parallax and ſemidiameter. Increaſe the ſemidiameter by the augmentation anſwering to the moon's altitude.

Find the apparent and true altitudes of each object's centre, and the apparent central diſtance; with which compute the true diſtance by Problem X. and find the apparent time at Greenwich anſwering thereto by the laſt problem.

If the ſun or ſtar be at a proper diſtance from the meridian at the time of obſervation of the diſtance, compute the apparent time at the ſhip. If not, the error of the watch may be found from obſervations taken either before or after that of the diſtance; or the apparent time may be inferred from the moon's altitude taken with the diſtance, by Problem IX.

The difference between the apparent times of obſervation at the ſhip and Greenwich, will be the longitude of the ſhip in time; which is eaſt or weſt according as the time at the ſhip is later or earlier than the Greenwich time.

Ex. 1. March 17. 1792, in latitude 34° 53′ N, and longitude by account 27° W, about 9h A. M. the diſtance between the neareſt limbs of the ſun and moon was 68° 3′¼; the altitude of the ſun's lower limb 33° 18′; that

Of finding the Longitude at Sea by Lunar Observations.

that of the moon's upper limb 31° 3′; and the height of the eye 12 feet. Required the true longitude of the ship?

Time at ship	9h 0′	A. M.
Longitude in time	1 48	
Reduced time	10 48	A. M.
Altitude moon's upper limb	31 3 0	
Aug. semidiameter	— 16 10	
Dip	— 3 18	
Apparent altitude	30 43 23	
Correction	+ 49 26	
Moon's true altitude	31 32 49	

Dist. sun and moon's nearest limbs	68° 3′ 15″
Sun's semidiameter	+ 16 6
Moon's semidiameter	+ 16 10
Augmentation	+ 0 9
Apparent central distance	68 35 40
Altitude sun's lower limb	33 18
Sun's semidiameter	+ 16 6
Dip	— 3 18
Sun's apparent altitude	33 30 48
Correction	—0 1 19
Sun's true altitude	33 29 29
Moon's true altitude	31 32 49
Difference	1 56 40
Half	0 58 20

Sun's apparent altitude	33° 30′ 48″			
Moon's apparent altitude	30 43 23			
Difference	2 47 25			
Apparent distance	68 35 40	Logarithmic difference		9.996336
Sum	71 23 5	Half 35° 41′ 32″½	Sine	9.765991
Difference	65 48 15	Half 32 54 7½	Sine	9.734964
				19.497291
			Cosine	9.748645
Half difference true altitudes	0 58 20			
Arch	55 54 12			
Sum	56 52 32		Sine	9.922977
Difference	54 55 52		Sine	9.912998
				19.835975
Half true distance	34 6 53		Cosine	9.917987
	2			
True distance	68 13 46			
Distance at XXI hours	69 11 20	Difference 0° 57′ 34″	P. log.	4951
Distance at noon	67 32 38	Difference 1 38 42	P. log.	2610
Proportional part		1 45 0	Per log.	2341
Preceding time		21 0 0		
Apparent time at Greenwich		22 45 0		

Latitude	34° 53′ .0 N		Secant	0.08602
Declination	0 57 .9 S		Secant	0.00006
Sum	35 50 .9	Nat. cosine 81057		
Sun's altitude	33 29 .5	Nat. sine 55181		
Difference		25876		4.41291
Time from noon	3h 7′ 13″		Rising	4.49899
Apparent time	20 52 47			
App. time at Green.	22 45 0			
Longitude in time	1 52 13=28° 3′¼ W.			

Of finding the Longitude at Sea by Lunar Observations.

Example 2. September 2. 1792, in latitude 13° 57′ N, and longitude by account 56° E, several observations of the moon and altair were taken; the mean of the times per watch was 1h 18′ 59″ A. M. that of the distance between altair and the moon's nearest limb 58° 45′ 26″; the mean of the altitude of the moon's lower limb 70° 33′; and that of altair 25° 27′ .4; height of the eye 13 feet. Required the true longitude?

Of finding the Longitude at Sea by Lunar Observations.

Time per watch	1h 18′ 59″ A. M.	Distance moon and altair			58° 45′ 26″
Longitude in time	3 44 0	Augmented semidiameter			+0 16 28
Reduced time	9 34 59	Apparent central distance			59 1 54
Altitude moon	70° 33′	Altitude of altair			25 27 .4
Semidiameter and dip	—0 13	Dip			—0 3 .4
Apparent alt. moon	70 20	Apparent altitude altair			25 24 0
Correction	+0 19 40	Refraction			—0 2 0
True altitude moon	70 39 40	True altitude altair			25 22 0
Moon's apparent alt.	70 20	Moon's true altitude			70 39 40
Altair's apparent alt.	25 24	Difference			45 17 40
Difference	44 56	Half			22 38 50
Apparent distance	59 1 54	Logarithmic difference			9.993101
Sum	103 57 54	Half	51° 58′ 57″	Sine	9.896428
Difference	14 5 54	Half	7 2 57	Sine	9.088919
Half diff. true alt.	22 38 50				18.978448
Arch	72 1 57			Cosine	9.489224
Sum	94 40 47			Sine	9.998548
Difference	49 23 7			Sine	9.880301
					19.878849
Half true distance	29 33 48½			Cosine	9.939424
	2				
True distance	59 7 37				
Distance at IX hours	58 51 17	Difference	0° 16′ 20″	P. log.	1.0422
— at XII hours	60 24 34	Difference	1 33 17	P. log.	0.2855
Proportional part			0 31 31	P. log.	0.7567
Preceding time			9 0 0		
Apparent time at Greenwich			9 31 31		
Latitude	13 57 N.		Secant		0.01300
Declination	8 19.8 N.		Secant		0.00461
Difference	5 37.2	Nat. cosine	99519		
Altitude altair	25 22.	Nat. sine	42841		
Difference			56678		4.75341
Altair's meridian distance	4h 23′ 14″	Rising			4.77102
—— right ascension	19 40 40				
Right ascension meridian	0 3 54				
Sun's right ascension	10 46 17				
Apparent time at ship	13 17 37				
Apparent time at Greenwich	9 31 31				
Longitude in time	4 46 6 = 56° 31½′ East.				

For various other methods of determining the longitude of a place, the reader is referred to Dr Mackay's Treatise on the Theory and Practice of finding the Longitude at Sea or Land.

Ex. 3.

Chap. III. *Of the Variation of the Compafs.*

The variation of the compafs is the deviation of the points of the mariner's compafs from the correfponding points of the horizon; and is denominated *eaft* or *weft* variation, according as the north point of the compafs is to the eaft or weft of the true north point of the horizon.

A particular account of the variation, and of the feveral inftruments ufed for determining it from obfervation, may be feen under the articles Azimuth, Compass, and Variation: and for the method of communicating magnetifm to compafs needles, fee Magnetism.

Prob. I. Given the latitude of a place, and the fun's magnetic amplitude, to find the variation of the compafs.

Rule. To the log. fecant of the latitude, add the log. fine of the fun's declination, the fum will be the log. cofine of the true amplitude; to be reckoned from the north or fouth according as the declination is north or fouth.

The difference between the true and obferved amplitudes, reckoned from the fame point, and if of the fame name, is the variation; but if of a different name, their fum is the variation.

If the obfervation be made in the eaftern hemifphere, the variation will be eaft or weft according as the obferved amplitude is nearer to or more remote from the north than the true amplitude. The contrary rule holds good in obfervations taken in the weftern hemifphere.

Ex. 1. May 15. 1794, in latitude 33° 10′ N, longitude 18′ W, about 5h A. M. the fun was obferved to rife E*b*N. Required the variation?

Sun's dec. May 15. at noon	18° 58′ N.		
Equation to 7h from noon	—0 4		
——— to 18° W	+0 1		
Reduced declination	18 55	Sine	9.51080
Latitude - - -	33 10	Secant	0.07723
True amplitude -	N 67 13 E	Cofine	9.58803
True amplitude -	N 67 13 E	Cofine	9.58803
Obferved amplitude -	N 78 45 E		
Variation - -	11 32		

11 32; which is *weft*, becaufe the obferved amplitude is more diftant from the north than the true amplitude; the obfervation being made in the eaftern hemifphere.

Ex. 2. December 20. 1793, in latitude 31° 38′ S, longitude 83° W, the fun was obferved to fet SW. Required the variation?

Latitude -	31° 38′	Secant -	0.06985
Declination -	23 28	Sine -	9.60012
True amplitude	S 62 7 W	Cofine -	9.66997
Obferved ampl.	S 45 0 W		
Variation -	17 7		

17 7; which is *eaft*, as the obferved amplitude is farther from the north than the true amplitude, the obfervation being made at funfetting.

It may be remarked, that the fun's amplitude ought to be obferved at the inftant the altitude of its lower limb is equal to the fum of 15 minutes and the dip of the horizon. Thus, if an obferver be elevated 18 feet above the furface of the fea, the amplitude fhould be taken at the inftant the altitude of the fun's lower limb is 19 minutes.

Prob. II. Given the magnetic azimuth, the altitude and declination of the fun, together with the latitude of the place of obfervation; to find the variation of the compafs.

Rule. Reduce the fun's declination to the time and place of obfervation, and compute the true altitude of the fun's centre.

Find the fum of the fun's polar diftance and altitude and the latitude of the place, take the difference between the half of this fum and the polar diftance.

To the log. fecant of the altitude add the log. fecant of the latitude, the log. cofine of the half fum, and the log. cofine of the difference; half the fum of thefe will be the log. fine of half the fun's true azimuth, to be reckoned from the fouth in north latitude, but from the north in fouth latitude.

The difference between the true and obferved azimuths will be the variation as formerly.

Ex. 1. November 18. 1793, in latitude 50° 22′ N, longitude 24° 30′ W, about three quarters paft eight A. M. the altitude of the fun's lower limb was 8° 10′, and bearing per compafs S, 23° 18′ E; height of the eye 20 feet. Required the variation of the compafs?

Sun's declin. 18th Nov. at noon	19° 25′ S.	Obferved alt. fun's lower limb -	=° 10′
Equation to $3\frac{1}{4}$h from noon	— 2	Semidiameter - - -	+ 16
——— to 24° 30′ W -	+ 1	Dip and refraction - -	— 10
Reduced declination . -	19 24	True altitude . - -	8 16
Polar diftance - -	109 24		
Altitude - - -	8 16	- Secant -	0.00454
Latitude - - -	50 22	- Secant -	0.19527
Sum - - -	168 2		
Half - - -	84 1	- Cofine -	9.01803
Difference - - -	25 23	- Cofine -	9.95591
			19.17375
Half true azimuth -	22 43	- Sine - -	9.58687 Half

Variation of the Compass. | Ship's Journal.

Half true azimuth	22° 43′	Sine	9.58687
	2		
True azimuth	S 45 26 E.		
Observed azimuth	S 23 18 E.		
Vaziation	22 8 W.		

Ex. 2. January 3. 1794, in latitude 33° 52′ N, 53° 15′ E longitude, about half past three the altitude of the sun's lower limb 41° 18′, and azimuth S 50° 25′ W, the height of the eye being 20 feet. Required the variation?

Sun's declination at noon	21° 24′ S.	Observed alt. sun's lower limb	=41° 18′
Equation to time from noon	— 2	Sun's semidiameter	+ 16
——— to longitude	+ 2	Dip and refraction	— 6
Reduced declination	21 24 S.	True altitude	41 28
Polar distance	111 24		
Altitude	41 28	Secant	0.12532
Latitude	33 52	Secant	0.08075
Sum	186 44		
Half	93 22	Cosine	8.76883
Difference	18 2	Cosine	9.97558
			18.95048
	17 23	Sine	9.47524
	2		
True azimuth	S. 34 46 W.		
Observed azimuth	S. 50 25 W.		
Variation	15 39 W.		

Chap. IV. *Of a Ship's Journal.*

A journal is a regular and exact register of all the various transactions that happen aboard a ship whether at sea or land, and more particularly that which concerns a ship's way, from whence her place at noon or any other time may be justly ascertained.

That part of the account which is kept at sea is called *sea work;* and the remarks taken down while the ship is in port are called *harbour work.*

At sea, the day begins at noon, and ends at the noon of the following day: the first 12 hours, or those contained between noon and midnight, are denoted by P. M. signifying *after mid day;* and the other 12 hours, or those from midnight to noon, are denoted by A. M. signifying *before mid day.* A day's work marked Wednesday March 6. began on Tuesday at noon, and ended on Wednesday at noon. The days of the week are usually represented by astronomical characters. Thus ☉ represents Sunday; ☽ Monday; ♂ Tuesday; ☿ Wednesday; ♃ Thursday; ♀ Friday; and ♄ Saturday.

When a ship is bound to a port so situated that she will be out of sight of land, the bearing and distance of the port must be found. This may be done by Mercator's or Middle-latitude Sailing; but the most expeditious method is by a chart. If islands, capes, or headlands intervene, it will be necessary to find the several courses and distances between each successively. The true course between the places must be reduced to the course per compass, by allowing the variation to the right or left of the true course, according as it is west or east.

At the time of leaving the land, the bearing of some known place is to be observed, and its distance is usually found by estimation. As perhaps the distance thus found will be liable to some error, particularly in hazy or foggy weather, or when that distance is considerable, it will therefore be proper to use the following method for this purpose.

Let the bearing be observed of the place from which the departure is to be taken; and the ship having run a certain distance on a direct course, the bearing of the same place is to be again observed. Now having one side of a plain triangle, namely the distance sailed, and all the angles, the other distances may be found by Prob. I. of Oblique-Sailing.

The method of finding the course and distance sailed in a given time is by the compass, the log-line, and half-minute-glass. These have been already described. In the royal navy, and in ships in the service of the East India Company, the log is hove once every hour; but in most other trading vessels only every two hours.

The several courses and distances sailed in the course of 24 hours, or between noon and noon, and whatever remarks are thought worthy of notice, are set down with chalk on a board painted black, called the *log-board,* which is usually divided into six columns: the first column on the left hand contains the hours from noon to noon; the second and third the knots and parts of a knot sailed every hour, or every two hours, according as the log is marked; the fourth column contains the courses steered; the fifth the winds; and in the sixth the various

Ship's Journal.

various remarks and phenomena are written. The log-board is tranfcribed every day at noon into the log-book, which is ruled and divided after the fame manner.

The courfes fteered muft be corrected by the variation of the compafs and leeway. If the variation is weft, it muft be allowed to the left hand of the courfe fteered; but if eaft, to the right hand, in order to obtain the true courfe. The leeway is to be allowed to the right or left of the courfe fteered according as the fhip is on the larboard or ftarboard tack. The method of finding the variation, which fhould be determined daily if poffible, is given in the preceding chapter; and the leeway may be underftood from what follows.

When a fhip is clofe hauled, that part of the wind which acts upon the hull and rigging, together with a confiderable part of the force which is exerted on the fails, tends to drive her to the leeward. But fince the bow of a fhip expofes lefs furface to the water than her fide, the refiftance will be lefs in the firft cafe than in the fecond; the velocity in the direction of her head will therefore in moft cafes be greater than the velocity in the direction of her fide; and the fhip's real courfe will be between the two directions. The angle formed between the line of her apparent courfe and the line fhe really defcribes through the water is called the *angle of leeway*, or fimply the *leeway*.

There are many circumftances which prevent the laying down rules for the allowance of leeway. The conftruction of different veffels, their trim with regard to the nature and quantity of their cargo, the pofition and magnitude of the fail fet, and the velocity of the fhip, together with the fwell of the fea, are all fufceptible of great variation, and very much affect the leeway. The following rules, are, however, ufually given for this purpofe.

1. When a fhip is clofe hauled, has all her fails fet, the water fmooth, with a light breeze of wind, fhe is then fuppofed to make little or no leeway.

2. Allow one point when the top-gallant fails are handed.

3. Allow two points when under clofe reefed topfails.

4. Allow two points and a half when one top-fail is handed.

5. Allow three points and a half when both top-fails are handed.

6. Allow four points when the fore courfe is handed.

7. Allow five points when under the main-fail only.

8. Allow fix points when under balanced mizen.

9. Allow feven points when under bare poles.

Thefe allowances may be of fome ufe to work up the day's work of a journal which has been neglected; but a prudent navigator will never be guilty of this neglect. A very good method of eftimating the leeway is to obferve the bearing of the fhip's wake as frequently as may be judged neceffary; which may be conveniently enough done by drawing a fmall femicircle on the tafferel, with its diameter at right angles to the fhip's length, and dividing its circumference into points and quarters. The angle contained between the femidiameter which points right aft, and that which points in the direction of the wake, is the leeway. But the beft and moft rational way of bringing the leeway into the day's log is to have a compafs or femicircle on the tafferel, as before defcribed, with a low crutch or fwivel in its centre; after heaving the log, the line may be flipped into the crutch juft before it is drawn in, and the angle it makes on the limb with the line drawn right aft will fhow the leeway very accurately; which as a neceffary article, ought to be entered into a feparate column againft the hourly diftance on the log-board.

In hard blowing weather, with a contrary wind and a high fea, it is impoffible to gain any advantage by failing. In fuch cafes, therefore, the object is to avoid as much as poffible being driven back. With this intention it is ufual to lie to under no more fail than is fufficient to prevent the violent rolling which the veffel would otherwife acquire, to the endangering her mafts, and ftraining her timbers, &c. When a fhip is brought to, the tiller is put clofe over to the leeward, which brings her head round to the wind. The wind having then very little power on the fails, the fhip lofes her way through the water; which ceafing to act on the rudder, her head falls off from the wind, the fail which fhe has fet fills, and gives her frefh way through the water; which acting on the rudder brings her head again to the wind. Thus the fhip has a kind of vibratory motion, coming up to the wind and falling off from it again alternately. Now the middle point between thofe upon which fhe comes up and falls off is taken for her apparent courfe; and the leeway and variation is to be allowed from thence, to find the true courfe.

The fetting and drift of currents, and the heave of the fea are to be marked down. Thefe are to be corrected by variation only.

The computation made from the feveral courfes corrected as above, and their correfponding diftances, is called a *day's work;* and the fhip's place, as deduced therefrom, is called her place by *account*, or *dead reckoning*.

It is almoft conftantly found that the latitude by account does not agree with that by obfervation. From an attentive confideration of the nature and form of the common log, that its place is alterable by the weight of the line, by currents, and other caufes, and alfo the errors to which the courfe is liable, from the very often wrong pofition of the compafs in the binnacle, the variation not being well afcertained, an exact agreement of the latitudes cannot be expected.

When the difference of longitude is to be found by dead reckoning, if then the latitudes by account and obfervation difagree, feveral writers on navigation have propofed to apply a conjectural correction to the departure or difference of longitude. Thus, if the courfe be near the meridian, the error is wholly attributed to the diftance, and the departure is to be increafed or diminifhed accordingly: if near the parallel, the courfe only is fuppofed to be erroneous; and if the courfe is towards the middle of the quadrant, the courfe and diftance are both affumed wrong. This laft correction will, according to different authors, place the fhip upon oppofite fides of her meridian by account. As thefe corrections are, therefore, no better than gueffing, they fhould be abfolutely rejected.

If the latitudes are not found to agree, the navigator ought to examine his log-line and half-minute-glafs, and correct the diftance accordingly. He is then to confider if the variation and leeway have been properly afcertained; if not, the courfes are to be again corrected, and

Ship's Journal.

and no other alteration whatever is to be made on them. He is next to obſerve if the ſhip's place has been affected by a current or heave of the ſea, and to allow for them according to the beſt of his judgement. By applying theſe corrections, the latitudes will generally be found to agree tolerably well; and the longitude is not to receive any farther alteration.

It will be proper, however, for the navigator to determine the longitude of the ſhip from obſervation as often as poſſible; and the reckoning is to be carried forward in the uſual manner from the laſt good obſervation; yet it will perhaps be very ſatisfactory to keep a ſeparate account of the longitude by dead reckoning.

General Rules for working a Day's Work.

Correct the ſeveral courſes for variation and leeway; place them, and the correſponding diſtances, in a table prepared for that purpoſe. From whence, by Traverſe Sailing, find the difference of latitude and departure made good: hence the correſponding courſe and diſtance, and the ſhip's preſent latitude, will be known.

Find the middle latitude at the top or bottom of the Traverſe Table, and the diſtance, anſwering to the departure found in a latitude column, will be the difference of longitude: Or, the departure anſwering to the courſe made good, and the meridional difference of latitude in a latitude column, is the difference of longitude. The ſum, or difference of which, and the longitude left, according as they are of the ſame or of a contrary name, will be the ſhip's preſent longitude of the ſame name with the greater.

Compute the difference of latitude between the ſhip and the intended port, or any other place whoſe bearing and diſtance may be required: find alſo the meridional difference of latitude and the difference of longitude. Now the courſe anſwering the meridional difference of latitude found in a latitude column, and the difference of longitude in a departure column, will be the bearing of the place, and the diſtance anſwering to the difference of latitude will be the diſtance of the ſhip from the propoſed place. If theſe numbers exceed the limits of the Table, it will be neceſſary to take aliquot parts of them; and the diſtance is to be multiplied by the number by which the difference of latitude is divided.

It will ſometimes be neceſſary to keep an account of the meridian diſtance, eſpecially in the Baltic or Mediterranean trade, where charts are uſed in which the longitude is not marked. The meridian diſtance on the firſt day is that day's departure; and any other day it is equal to the ſum or difference of the preceding day's meridian diſtance and the day's departure, according as they are of the ſame or of a contrary denomination.

A Journal

Ship's Journal.

A JOURNAL of a VOYAGE from London to Funchal in Madeira, in his Majesty's Ship the Resolution, A——— M——— Commander, anno 1793.

Days of month.	Winds.	Remarks on board his Majesty's ship Resolution, 1793.
♄ Sep. 28.	SW	Strong gales and heavy rain. At 3 P. M. sent down topgallant yards; at 11 A. M. the pilot came on board.
☉ Sept. 29.	SW	Moderate and cloudy, with rain. At 10 A. M. cast loose from the sheer hulk at Deptford; got up topgallant yards, and made sail down the river. At noon running through Blackwall reach.
☽ Sept. 30.	SW Variable.	The first part moderate, the latter squally with rain. At half past one anchored at the Galleons, and moored ship with near a whole cable each way in 5 fathoms, a quarter of a mile off shore. At 3 A. M. strong gales: got down topgallant yards. A. M. the people employed working up junk. Bent the sheet cable.
♂ Octob. 1.	SSW SW	Fresh gales and squally. P. M. received the remainder of the boatswain's and carpenter's stores on board. The clerk of the cheque mustered the ship's company.
☿ Octob. 2.	Variable NbE	Variable weather with rain. At noon weighed and made sail; at 5 anchored in Long-reach in 8 fathoms. Received the powder on board. At 6 A. M. weighed and got down the river. At 10 A. M. past the Nore; brought too and hoisted in the boats: double reefed the topsails, and made sail for the Downs. At noon running for the flats of Margate.
♃ Octob. 3.	NbE N	First part stormy weather; latter moderate and clear. At 4 P. M. got through Margate Roads. At 5 run through the Downs; and at 6 anchored in Dover Road, in 10 fathoms muddy ground. Dover Castle bore north, and the South Foreland NEbE½E off shore 1¼ miles. Discharged the pilot. Employed making points, &c. for the sails. Scaled the guns.
♀ Octob. 4.	N NNE	Moderate and fair. Employed working up junk. Received from Deal a cutter of 17 feet, with materials. A. M. strong gales and squally, with rain; got down topgallant yards.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♄ Oct. 5. 1793.
1				NNE	Fresh gales with rain.
2					Hove short.
3					Weighed and made sail.
4	4				
5	6		WSW		
6	7				
7	7				
8	7				Shortened sail.—Dungeness light NEbE.
9	6	4	WbN	NE	
10	6				
11	6				
12	6				Fresh breezes and cloudy.
1	6				
2	6				
3	6				
4	6				Ditto weather.
5	6				
6	6				Got up topgallant yards.
7	6				Set studding sails.
8	7				Ditto weather.
9	7	5			
10	7	5			
11	7	6			
12	8				St Alban's Head N¼E.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☉ October 6. 1793.
1	8		W*b*N	NE	A freſh ſteady gale.
2	8				
3	8				
4	8				Do. weather.
5	8				Spoke the Ranger of London, from Carolina.
6	8				Took in ſtudding ſails.
7	8				
8	8				Do. weather.
9	8				
10	8				
11	8				Eddiſtone light N*b*W.
12	8				Do. weather.
1	8				Eddiſtone light NE.
2	7	5			
3	7	5			
4	7				Do. weather.
5	7		W*b*S		
6	7				Set lower ſtudding ſails.
7	7	4			
8	7	6			Freſh breeze and clear weather.
9	7	3			
10	7	5			
11	7	2			
12	7				Do. weather.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obſ.	D. Long.	W. Lon. by Acc.	W. Lon. by Obſ.	W. Var.		
S. 52° ½ W.	93	57	74	49° 11′	49° 9′	114′ W.	6° 18		2¼ pts.		

As there is no land in ſight this day at noon, and from the courſe and diſtance run ſince the laſt bearing of the Eddiſtone light was taken, it is not to be ſuppoſed that any part of England will be ſeen, the departure is therefore taken from the Eddiſtone; and the diſtance of the ſhip from that place is found by reſolving an oblique angled plane triangle, in which all the angles are given, and one ſide, namely, the diſtance run (16 miles) between the obſervations. Hence the diſtance of the Eddiſtone at the time the laſt bearing of the light was taken will be found equal to 18 miles; and as the bearing of the Eddiſtone from the ſhip at that time was NE, the ſhip's bearing from the Eddiſtone was SE. Now the variation 2¼ points W, being allowed to the left of SW, gives S*b*W¼W, the true courſe. The other courſes are in like manner to be corrected, and inſerted in the following table, together with their reſpective diſtances, beginning at 10 o'clock A. M. the time when the laſt bearing of the Eddiſtone was taken. The difference of latitude, departure, courſe, and diſtance made good, are to be found by Traverſe Sailing.

Courſes.	Diſt.	Diff. of Lat. N.	Diff. of Lat. S.	Departure. E.	Departure. W.
S*b*W¼W	18		17.0		6.1
W*b*S½S	22		5.3		21.3
SW¾W	58		34.6		46.6
S 52½°W	93		56.9=57m.		74.0

Latitude of Eddiſtone	-	58 8N.
Latitude by account	-	49 11N.
Sum - - - -	-	99 19
Middle latitude -	-	49 40

Now to middle latitude as a courſe, and the departure 74m. in a latitude column, the difference of long. in a diſtance column is 114 = 1° 54′W.

Longitude of Eddiſtone	-	4 24 W.
Longitude in by account	-	6 18 W.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 7. 1793
1	6	5	WSW	NE	Fresh breezes.
2	6	5			Sounded 62; fine sand.
3	6				Moderate and cloudy.
4	5	3			Unbent the cables, and coiled them.
5	5			N	Took in studding sails.
6	5				
7	5				Do. weather.
8	4	7			
9	4	5			
10	4	5			
11	4				Do. weather.
12	4				
1	4				
2	4				
3	4				Light breeze.
4	4		SW*b*W	NW	
5	3				A sail S*b*E.
6	3				
7	3				Hazy weather.
8	3		SW	Var.	
9	3				
10	3				
11	3				
12	2				Do. weather.

Course.	Dist.	D.L	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. by acc.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S. 38° W.	99	78	92	47° 51′		93 W.	7° 51′		$2\frac{1}{4}$ pts.	S $23°\frac{1}{2}$ W.	974 m.

The courses being corrected for variation, and the distances summed up, the work will be as under.

Courses.	Dist.	Diff of Lat.		Departure.	
		N.	S.	E.	W.
SW$\frac{1}{4}$S	77		57.0		51.7
SSW$\frac{3}{4}$W	12		10.3		6.2
S*b*W$\frac{3}{4}$W	11		10.4		3.7
S 38° W	99		77.7		61.6

		1° 8′
Yesterday's lat. by obser.	=	49 9 N
Latitude by account	=	47 51 N
Sum	- -	97 0
Middle latitude	-	48 30

To middle latitude $48\frac{1}{2}°$, and departure 61.6 in a latitude column, the corresponding difference of longitude in a distance column is 93′ = 1° 33′ W.

Yesterday's longitude	-	9 18 W.
Longitude in by account	-	7 51 W.

It is now necessary to find the bearing and distance of the intended port, namely, Funchal; but as that place is on the opposite side of the island with respect to the ship, it is therefore more proper to find the bearing of the east or west end of Madeira; the east end is, however, preferable. But as the small island of Porto Sancto lies a little to the NE of the east end of Madeira, it therefore seems more eligible to find the bearing and distance of that island.

To find the bearing and distance of Porto Sancto.

Latitude of Ship	47° 51′N.	Mer. parts	3278	Longitude of ship	7° 51′W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Lon. Porto Sancto	16 25 W.
Difference of latitude	14 53 = 893.	M. D. Lat.	1181	Difference of long.	8 34 = 514.

The course answering to the meridional difference of latitude and difference of longitude is about $23°\frac{1}{2}$, and the distance corresponding to the difference of latitude is 974 miles. Now as Porto Sancto lies to the southward and westward of the ship, the course is therefore S $23°\frac{1}{2}$W: and the variation, because W, being allowed to the right hand, gives SW$\frac{1}{4}$W nearly, the bearing per compass; and which is the course that ought to be steered.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♂ October 8. 1793.
1	2		SW	NW	Little wind and cloudy.
2	1			Variable.	
3					Tried the current, and found none.
4			Ship's head to the SW		
5					Calm.
6					
7					Calm; a long swell from the SW.
8			Ship's head from SW to SSE		
9					
10	1		WSW	S	
11	1				
12	2				Light airs and hazy.
1	2				
2	2				
3	2				
4	3				Moderate wind and cloudy.
5	3		W	S*b*W	
6	4				Set top-gallant sails.
7	5				
8	5				
9	5				
10	5		W$\frac{1}{2}$N	SSW	
11	5				By double altitudes of the sun, the latitude
12	5				was found to be 47° 28′ N.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 61° W	51	25	45	47° 28′	47° 28′	67′ W.	8° 38′		2 points.	S 21° W	932

The several courses corrected will be as under.

Courses.	Dist.	Diff. of Latit. N.	Diff. of Latit. S.	Departure. E.	Departure. W.
SSW	3		2.8		1.1
SW	23		9.2		9.2
WSW	22		8.4		20.3
W*b*S$\frac{1}{2}$S	15		4.4		14.4
S 61° W	51		24.8 = 25		45.0

Yesterday's latitude	47	51
Latitude by account	47	26
Sum . -		77
Middle latitude -	47	39

To middle latitude 37$\frac{2}{3}$°, and departure 45′ in a latitude column, the difference of longitude in a distance column is 67′ = 1° 7′W.

Yesterday's longitude	7	51 W.
Longitude in by account	8	58 W.

To find the bearing and distance of Porto Sancto.

Latitude of ship	47° 28 N.	Mer. parts 3244	Longitude	8° 58′W.
Lat. of Porto Sancto	32 58 N.	Mer. parts 2097	Longitude	16 25 W.
Difference of latitude	14 30=870	M. D. lat. 1147	D. longitude	7 27=447′.

Hence the bearing of Porto Sancto is S 21° W, and distance 932 miles. The course per compass is therefore SW nearly.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 9. 1793.
1	5		W*l*N	SW*b*S	Squally with rain.
2	5				Handed top-gallant sails.
3	5	5			In first reef topsails.
4	5	4			Dark gloomy weather. Tacked ship.
5	5	6	SE*b*S		
6	5				In 2d reef topsails, and down top-gallant yards.
7	4				
8	4				Stormy weather; in fore and mizen top-sails and 3d reef main top-sail. Handed the main top-sail, bent the main stay-sail, and brought to with it and the mizen; reefed the mainsail; at 10, wore and lay to under the mainsail, got down top-gallant masts; at 12 set the foresail, and balanced the mizen.
9	3				
10			up SE*b*S off ESE		
11	}		up WSW off WNW		
12					
1	3		W*b*W		
2	3	6			
3	3	5	WNW	SW	The sea stove in several half ports.
4	3	5			
5	4				The swell abates a little.
6	4		W*b*N	SW*b*S	
7	3	2			The swell abates fast.
8	3	4			Up top-gallant masts.
9	3	4	W	SSW	
10	4				Set the top-sails.
11	5				
12	5				Clear weather; good observation.

Course.	Dist.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
W*b*N½N	43	12	41	47° 40′	47° 39′	61′	9° 59′		2 points.		

There is no leeway allowed until 2 o'clock P. M. when the top-gallant sails are taken in; from 2 to 3 one point is allowed; from 3 to 6, one and a half points are allowed; from 6 to 8, one and three-fourth points are allowed; from 8 to 9, three points; from 9 to 10, four and a half points; from 10 to 12, five points; from 12 to 10 A. M. three and a half points; and from thence to noon two points leeway are allowed. Now the several courses being corrected by variation and leeway will be as under; but as the corrected courses from 2 to 3 P. M. and from 10 to 12 A. M. are the same, namely, west; this, therefore, is inserted in the table, together with the sum of the distances, as a single course and distance. In like manner the courses from 12 to 2, and from 5 to 8, being the same, are inserted as a single course and distance.

Courses.	Dist.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
W*b*S	10		2.0		9.8
W	15.5				15.5
W½N	5.4	0.5			5.4
E*b*S½S	10.6		3.1	10.1	
E*b*S¼S	8		1.9	7.8	
E	3			3.0	
NE*b*E	1	0.6		0.8	
NW*b*W	2	1.1			1.7
NW*b*W½W	17.2	8.1			15.2
NW½W	11	7.0			8.5
W*b*N½N	7.4	2.1			7.1
		19.4	7.0	21.7	63.2
		7.0			21.7
W*b*N½N	43	12.4			41.5

Yest. latitude 47 28 N.

Lat. by account 47 40 N.

To middle latitude 37° 34′, and departure 41.5 the difference of longitude is 61′ = 1° 1′W.

Yesterday's longitude 8 58 W.

Longitude in by account 9 59 W.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♃ October 10. 1793.
1	5	3	W	SSW	Fresh gales with rain.
2	5	7			
3	6				
4	6				Do. weather.
5	6				Out 3d reef topsails.
6	6				Lost a log and line.
7	5	6			
8	5	4			Do. weather.
9	5	5			
10	5	2			
11	5				
12	5				Do. weather.
1	5	5			
2	5				
3	5				
4	4				Moderate and cloudy, out all reefs.
5	4		WSW	S	
6	4				Sprung fore topgallant yard, got up another.
7	4	3			
8	4	4	SW*b*W	SSE	Do. weather.
9	4	6			A sail NE.
10	5	3			Employed working up junk.
11	5	4		SE*b*S	A swell from the NW, which by estimation has
12	5				set ship 7 miles in the opposite direction.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 74° W.	108	36	104	47° 9′		153′ W.	12° 31′		2 Points.	S 12° W.	870 m.

Two points leeway are allowed on the first course, one on the second; and as the ship is 7 points from the wind on the third course, there is no leeway allowed on it. The opposite point to NW, that from which the swell set, with the variation allowed upon it, is the last course in the Traverse Table.

Courses.	Dist.	Diff. of Lat. N.	Diff. of Lat. S.	Departure. E.	Departure. W.
W	86.2				86.2
SW*b*W	12.3		6.8		10.2
SW*b*S	24.7		20.5		13.7
ESE	7		1.7	6.5	
S 74 W	108		30.0	6.5	110.1
Yesterday's latitude		47 39			6.5
Latitude by account		47 9			103.6
Sum	-		48		
Middle latitude		47 24			

To middle latitude 47 24, and departure 103.6, the difference of longitude is 153′ = 2° 33′ W.

Yesterday's longitude	9 59 W.
Longitude in	12 32 W.

To find the bearing and distance of Porto Sancto.

Latitude of ship	-	47 9′	Mer. parts	-	3216	Longitude	= 12° 32′ W
Lat. Porto Sancto		32 58	Mer. parts	-	2097	Longitude	. 16 25 W
Difference of latitude		14 11 = 851′ M. D. lat.			1119	D. longitude	3 53 = 233

Hence the bearing of Porto Sancto is S 12° W, and distance 870 miles; the course per compass is therefore about SW*b*W. 4

A Journal

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♀ October 11. 1793.
1	4		SW*b*S	ESE	Moderate wind and fair weather.
2	3				Shortened sail and set up the topmast rigging.
3	2				
4	3				Do. weather.
5	4				Variation per amplitude 21° W.
6	4	6			
7	4	4			
8	4	5			A fine steady breeze.
9	5			E	By an observation of the moon's distance from
10	5				α Pegasi, the ship's longitude at half past 8
11	5				was 12° 28′ W.
12	5	2			Clear weather.
1	5	7			
2	6				
3	6			ENE	
4	6				Do. weather
5	6	2			
6	6				
7	6	3			
8	6				Set studding sails, &c.
9	7				
10	7				One sail in sight.
11	8				
12	8				Do. weather, good observation.

Course.	Dist.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. Observed.	Port Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S 12° 45′ W.	128	125	28	45° 4′	44° 59′	41° W.	13° 13′	12° 59′	21°	S 12° W.	737 miles.

The observed variation 21° being allowed to the left of SW*b*S gives S 12° 45′ W, the corrected course, and the distance summed up is 127.9, or 128 miles. Hence the difference of latitude is 124.8, and the departure 28.2. The latitude by account is therefore 45° 4′ N, and the middle latitude 46° 6′, to which, and the departure 28.2 in a latitude column, the difference of longitude in a distance column is 41′ W; which being added to 12° 32′W, the yesterday's longitude gives 13° 13′ W, the longitude in by account. But the longitude by observation was 12° 28′ W at half past 8 P. M.; since that time the ship has run 96 miles; hence the departure in that interval is 21.2 m. Now half the difference of latitude 47 m. added to 44° 59′, the latitude by observation at noon, the sum 45° 46′ is the middle latitude; with which and the departure 21.2, the difference of longitude is found to be 31′ W; which, therefore, added to 12° 28′, the longitude observed, the sum is 12° 59′ W, the longitude by observation reduced to noon.

To find the bearing and distance of Porto Sancto.

Latitude ship - -	44° 59′ N.	Mer. parts -	3028	Longitude -	12° 59′W
Lat. Porto Sancto -	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W
Difference of latitude -	12 1=721	M. D. lat.	931	D. longitude - -	3 26=206′

Hence the bearing of Porto Sancto is S 12° W, and distance 737 miles. The course to be steered is therefore S 33° W, or SW*b*S nearly.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Course.	Winds.	Remarks, ♄ October 12. 1993.
1	8		SWbS.	EbN	Fresh gales, and cloudy.
2	7	5			
3	8				
4	8	6			Do. weather.
5	8	4			
6	8				Hauled down studding sails.
7	7	5			
8	7	3			Do. weather.
9	7	4			
10	7	2			
11	7	6			
12	7	5		ENE	A steady gale and fine weather.
1	7				
2	7	5			
3	7				
4	7	3			Do. weather.
5	7	2			
6	7				
7	7	4			Out studding sails alow and aloft.
8	8				Variation per azimuth 20° 14′ W.
9	8				A sail in the SW quarter.
10	8				
11	7	6			Sailmaker altering a lower studding sail.
12	8				Fine weather, and cloudy.

Course.	Dist.	D.L.	Dep.	N. Latitude by		D. Long.	W. Lon. by		W. Var. Obs.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S 13° 31′ W.	183	178	43	42° 1′		59′ W.	14° 12′	13° 58′	20° 14′	S 12° W.	555 m.

The course corrected by variation is S 25° 31′ W, and the distance run is 183 miles; hence the difference of latitude is 177.9, and the departure 42.8.

Yesterday's latitude by observation	44° 59 N.	Mer. parts - - -	3028
Difference of latitude - -	2 58 S.		
Latitude in by account -	42 1 N.	Mer. parts - - -	2783
Meridional difference of latitude - - - - - - - - - - - -			245

Now to course $13\frac{1}{2}^{\circ}$, and meridional difference of latitude 245 in a latitude column, the difference of longitude in a departure column is 59′ W: hence the longitudes of yesterday by account and observation, reduced to the noon of this day, will be 14° 12′ W and 13° 58′ respectively.

To find the bearing and distance of Porto Sancto.

Latitude ship -	42° 1′ N.	Mer. parts -	2783	Longitude -	13° 58 W
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W
Difference of latitude	9 3=543	M. D. latitude	686	D. Longitude	2 27=147.

The meridional difference of latitude and difference of longitude will be found to agree nearest under 12, the correct bearing of Porto Sancto; and the variation being allowed to the right hand of S 12° W, gives S $32\frac{1}{4}^{\circ}$ W, the bearing per compass; and the distance answering to the difference of latitude 543, under 12 degrees, is 555 miles.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ☉ October 13. 1793.
1	8		SW*b*S	ENE	A ſteady gale, and fine weather.
2	8	5			
3	8	6			At 34 minutes paſt three, the diſtance between the neareſt limbs of the ſun and moon, together with the altitude of each, were obſerved; from whence the ſhip's longitude at that time is 14° 1′ W.
4	8				
5	8				
6	8				
7	8				
8	7				Hauled in the lower ſtudding-ſails.
9	7				At 9^h 22′, by an obſervation of the moon's diſtance from α Pegaſi, the longitude was 14° 20′ W.
10	7				
11	7				
12	7				Freſh gales, and clear.
1	7			ESE	
2	8				
3	7				
4	7				Do. weather.
5	7				
6	7				
7	8				Variation per amplitude 19° 51′ W.
8	8	5			Do. per azimuth 19° 28′ W. Set ſtudding-ſails.
9	8	4			
10	8	2			Carried away a fore-top-maſt-ſtudding-ſail boom, got up another.
11	8				
12	7	4			Freſh gales. Took in ſtudding-ſails.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var. by Obſ.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S*b*W¼W	184	178	45	39° 3′		59′ W.	15° 11′	14° 52′	1¾ pts.		

The mean of the variation is about 1¾ points W: hence the courſe corrected is S*b*W¼W; with which and the diſtance run 184 miles, the difference of latitude is 178.5, and the departure 44.7.

Yeſterday's latitude - - - 42° 1′N. Mer. parts - - - 2783
Difference of latitude - - - 2 58 S.

Latitude in by account - - 39 3 N. Mer. parts - - - 2549

Meridional difference of latitude - - - - - - - - 234

Now, to courſe 1¾ points, and meridional difference of latitude 234, the difference of longitude is about 59m.; which, added to the yeſterday's longitude by account 14° 12′W, the ſum 15° 11′W is the longitude in by account at noon. The longitudes by obſervation are reduced to noon as follow:

The diſtance run between noon and 3^h 34′ P. M. is 29 miles; to which, and the courſe 1¾ points, the difference of latitude is - - - - 28′
Yeſterday's latitude at noon - - 42° 1′N.

Latitude at time of obſervation - - 41 33 N. Mer. parts - - - 2746
Latitude at noon - - - 39 3 N. Mer. parts - - 2549

Meridional difference of latitude - - - - - - - 197

Then, to courſe 1¾ points, and meridional difference of latitude 197 in a latitude column, the difference of longitude in a departure column is 49′W; which added to 14° 1′W, the longitude by obſervation, the ſum 14° 50′W is the longitude reduced to noon.

Again, The diſtance run between the preceding noon and 9^h 22′ P. M. is 75 miles: hence the correſponding difference of latitude is 72.8, or 73 miles; the ſhip's latitude at that time is therefore 40° 48′ N.

Latitude at time of obſervation - 40° 48′N. Mer. parts. - - - 2686
Latitude at noon - - - 39 3 N. Mer. parts. - - 2549

Meridional difference of latitude - - - - - - - 137

Now, with the corrected courſe, and meridional difference of latitude, the difference of longitude is 34′ W; which added to 14° 20′W, the ſum is 14° 54′W, the reduced longitude. The mean of which and the former reduced longitude is 14° 52′W, the correct longitude.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 14. 1793.
1	8		SW*b*S	E*b*S	Fresh gales and hazy, single reefed topsails.
2	7	5			
3	7	5			Got down topgallant yards.
4	7				Do. weather, and a confused swell running.
5	7	4	SSW		
6	7	1			
7	7				
8	6	5			More moderate.
9	6				
10	5			Variable	
11	5				
12	4				Do. with lightning all round the compass.
1	3				
2	3				
3	3	5	SW*b*S	SE*b*S	
4	4				Squally, with rain.
5	5				
6	4				
7	2	5			
8	2		SW	SSE	Moderate weather; out reefs, and up topgallant yards.
9	3				
10	3	5			
11	4	5	WSW	S	At 11 h 10′ A. M. the latitude from double altitudes of the sun was 37° 10′. Clear weather.
12	5				

Course.	Dist.	D.L.	Dep.	N. Latitude by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S 16° W	116	111	32	37° 12′	37° 8′	41 W.	15° 52′	15° 33′	1¼ pts.	S 10° W.	254 m.

As the ship is close hauled from 2 o'clock A. M. 1¼ points leeway are allowed upon that course and a point on the two following courses.

Courses.	Dist.	Diff. of Lat. N.	Diff. of Lat. S.	Departure E.	Departure W.
S*b*W¼W	30		29.1		7.3
S¼W	54		53.9		2.7
SSW½W	19		16.8		9.0
SW¾S	8.5		6.8		5.1
SW*b*W¼W	9.5		4.9		8.1
S 16° W	116		111.5 = 1° 51′		32.2

Yesterday's latitude 39 3 } M. lat. 38° 7′
Latitude in by account 37 12 }

To middle latitude 38°, and departure 32.2 in a latitude column, the difference of longitude in a distance column is 41′.

	by account	by ob.
Yesterday's lon.	15° 11′ W.	14° 52′ W.
Difference of longitude	41 W.	41 W.
Longitude in	15 22	15 33 W.

The latitude by observation at 11 h 10′ A. M. is 37° 10′, and from that time till noon the ship has run about 4 miles. Hence the corresponding difference of latitude is 2 miles, which subtracted from the latitude observed, gives 37° 8′, the latitude reduced to noon.

To find the bearing and distance of Porto Sancto.

Latitude of ship	37° 8′ N.	Mer. parts.	2403	Longitude	15° 33′ W.
Latitude Porto Sancto	32 58 N.	Mer. parts.	2097	Longitude	16 25 W.
Difference of latitude	4 10 = 250	M. D. lat.	306	Diff. longitude	52

Hence the bearing of Porto Sancto is S 10° W, or SSW¼W nearly, per compass, and the distance is 254 miles.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♂ October 15. 1793.
1	4		W*b*S	S*b*W	Moderate and clear weather.
2	4				
3	3	6			Employed working points and rope-bands.
4	3				Ditto weather.
5	3	4			
6	3		W*b*N	SW*b*S	
7	3				
8	3	2			Fine clear weather.
9	4				
10	4				
11	3	5			
12	3	3		Variable.	Ditto weather.
1	3				
2	4		W		
3	3				
4	2		WNW		
5	2	4	NW*b*W	SW*b*W	
6	3				
7	3				Variation per mean of several azimuths 18° 0′ W.
8	3	6			Ditto weather. Tacked ship.
9	4		S*b*E		
10	5				Sail-makers making wind-sails.
11	5	4			
12	5	6			A fine steady breeze. Cloudy.

Course.	Dist.	D.L.	Dep.	N. Lat. by Acc.	N. Lat. by Obs.	D. Long.	W. Long. by Account.	W. Long. by Observ.	W. Var. by Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 68° W	56	21	52	36° 47′		65′ W	16° 57′	16° 38′	18°	S$\frac{1}{4}$E	229

Half a point of leeway is allowed on each course; but as the variation is expressed in degrees, it will be more convenient and accurate to reduce the several courses into one, leeway only being allowed upon them. The course thus found is then to be corrected for variation, with which and the distance made good the difference of latitude and departure are to be found.

Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
W$\frac{1}{2}$S	18		1.8		17.9
W*b*N$\frac{1}{2}$N	27	7.8			25.8
W$\frac{1}{2}$N	7	0.7			7.0
NW*b*W$\frac{1}{2}$W	2	0.9			1.8
NW$\frac{1}{2}$W	12	7.6			9.3
S*b*E$\frac{1}{2}$E	20		19.1	5.8	
		17.0	20.9	5.8	61.8
			17.0		5.8
S 86° W.	56		3.9		56.0
Var. 18 W.					

Tr. cour. S 68 W. to which and the distance 56 m. the difference of latitude is 21 m. and the departure 51.9 m. Hence the latitude in at noon is 36° 47′ W, and middle latitude 36° 58′, to which and the departure 51.9 in a latitude column, the difference of longitude in distance column is 65° W.

	By acc.		By obs.
Yesterday's long. by acc.	15° 52′ W.	By obs.	15° 33′ W.
Difference of longitude	1 5 W.		1 5 W.
Longitude in	16 57		16 38 W.

To find the bearing and distance of Porto Sancto.

Latitude ship -	36° 47′ N.	Mer. pts	2376	Longitude	16° 38′ W.
Lat. of Porto Sancto	32 58 N.	Mer. pts	2097	Longitude	16 25 W.
Dist. of latitude -	3 49=229	M. D. Lat.	279	D. Longitude	0 13

Hence the course is S$\frac{1}{4}$E, distance 229 miles; and the course per compass is S*b*W$\frac{3}{4}$W nearly.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courfes.	Winds.	Remarks, ☿ October 16. 1793.
1	6		S*b*E.	SW*b*W.	Frefh gales.
2	6	4			
3	7		S.	W.	
4	7				Do. and cloudy.
5	7				
6	7	4			
7	7	6			
8	7				A fteady frefh gale.
9	8		S*b*W.	NW.	
10	8				
11	8				
12	8				D. weather.
1	8				
2	8				
3	8				
4	9				D. weather.
5	9		S*b*W½W.		
6	9			N.	
7	9				Variation *per* amplitude 1½ points W.
8	8	5			
9	9				People employed occafionally.
10	9			NE*b*E.	
11	7				
12	8				Do. weather. Obferved fun's meridian altitude.

Courfe.	Dift.	D.L	Dep.	N. Latit. by		D. Long.	W. Long. by		W. Var. Obf.	Porto Sancto's	
				Acc.	Obf.		Acc.	Obf.		Bearing.	Diftance.
S 8° E	186	185	26	33° 42′	33° 46′	31′ E.	16° 26′	16° 7′	1½ pts.	S 17° W.	50 miles.

Half a point of leeway is allowed on the firft courfe; which, and the others, are corrected for variation as ufual.

Courfes.	Dift.	Diff. of latit.		Departure.	
		N.	S.	E.	W.
SE*b*S	12.4		10.3	6.9	
S*b*E½E.	43.		41.2	12.5	
S½E	65		64.7	6.4	
S.	68.5		68.5		
S8°E.	18.6		184.7	25.8	

	3° 5′
Yefterday's latitude	36 47 N.
Latitude by account -	33 42 N.
Sum - - - -	70 29
Middle latitude - -	35 15

To the middle latitude and the departure, the difference of longitude in a diftance column is 31′ E.

	by acc.		by obf.
Yefterday's long.	16° 57′ W.		16° 38′ W.
Difference of long.	0 31 E.	-	0 31 E.
Longitude in	16 26 W.	-	16 7 W.

To find the bearing and diftance of Porto Sancto.

Latitude fhip -	33° 46′ N.	Mer. parts -	2155	Longitude -	16° 7′ W.
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W.
Difference of latitude	48	Mer. diff. lat.	58	Diff. long. - -	18

Hence the bearing of Porto Sancto is S 17° W. diftance 50 miles.

A Journal from London towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♃ October 17. 1793.
1	5		SSW.	NE*b*E.	Moderate wind and clear.
2	5				Saw the iſland of Porto Sancto, SW*b*S.
3	5		S.		Hauled up to round the eaſt end of Porto Sancto.
4	5				Bent the cables.
5	5				
6	6				
7	6				
8	7				Squally weather.
9	8		SW*b*W		Porto Sancto SW*b*S.
10	7				
11	7		SW*b*W		
12	6				Ditto with rain. Porto Sancto NE.
1	6		SSW.		The Deſerters SW*b*S.
2	5				
3	6				
4	7				The Deſerters WSW. 3 or 4 leagues.
5	6				
6			Various.		Hauled up round the eaſt end of the Deſerters.
7					
8			NNW.		Violent ſqualls ; clewed up all at times.
9			NW*b*N.		
10					Running into Funchal Roads.
11					Anchored in Funchal Road, with the beſt bower in 30 fathoms black ſand and mud. Brazen head E*b*S$\frac{1}{2}$S, Loo Rock NW, the Great Church NNE, and the ſouthermoſt Deſerter SE$\frac{1}{2}$S ; off ſhore two-thirds of a mile. Saluted the fort with 13 guns ; returned by ditto. Found here his majeſty's ſhip Venus, and 7 Engliſh merchant ſhips.
12					

This journal is performed by inſpection agreeable to the precepts given. Other methods might have been uſed for the ſame purpoſe ; for which the two inſtruments already deſcribed and explained ſeem well adapted. We cannot, however, omit recommending the ſliding gunter, which will be found very expeditious, not only in performing a day's work, but alſo in reſolving moſt other nautical problems. See *Sliding-Gunter*.

It will be found very ſatisfactory to lay down the ſhip's place on a chart at the noon of each day, and her ſituation with reſpect to the place bound to, and the neareſt land will be obvious. The bearing and diſtance of the intended or any other port, and other requiſites, may be eaſily found by the chart as already explained ; and indeed, every day's work may be performed on the chart ; and thus the uſe of tables ſuperſeded.

EXPLANATION of the TABLES.

Table I. *To reduce points of the compaſs to degrees, and converſely.*

The two firſt and two laſt columns of this table contain the ſeveral points and quarter-points of the compaſs ; the third column contains the correſponding number of points and quarters ; and the fourth, the degrees &c. anſwering thereto. The manner of uſing this table is obvious.

Table II. *The miles and parts of a mile in a degree of longitude at every degree of latitude.*

The firſt column contains degrees of latitude, and the ſecond the correſponding miles in a degree of longitude ; the other columns are a continuation of the firſt and ſecond. If the given latitude conſiſts of degrees and minutes, a proportional part of the difference between the miles anſwering to the given and following degrees of latitude is to be ſubtracted from the miles anſwering to the given degree.

Example. Required the number of miles in a degree of longitude, in latitude $57^\circ\ 9'$?

The difference between the miles anſwering to the latitudes of 57° and 58° is 0.89 ?

Then as $60' : 9' :: 0.89 : 0.13$
Miles anſwering to 57° 32.68
Miles anſwering to $57^\circ\ 9'$ 32.55

This table may be uſed in Parallel and Middle Latitude Sailing.

Table III. *Of the Sun's Semidiameter.*

This table contains the angle ſubtended by the ſun's ſemidiameter at the earth, for every ſixth day of the year. The months and days are contained in the firſt column, and the ſemidiameter expreſſed in minutes and ſeconds in the ſecond column. It is uſeful in correcting altitudes of the ſun's limb, and diſtances between the ſun's limb and the moon.

Table

Explanation of the Tables.

TABLE IV. *Of the Refraction in Altitude.*

The refraction is necessary for correcting altitudes and distances observed at sea; it is always to be subtracted from the observed altitude, or added to the zenith distance. This table is adapted to a mean state of the atmosphere in Britain, namely, to 29.6 inches of the barometer, and 50° of the thermometer. If the height of the mercury in these instruments be different from the mean, a correction is necessary to reduce the tabular to the true refraction. See REFRACTION.

TABLES V. VI. *Of the Dip of the Horizon.*

The first of these tables contain the dip answering to a free or unobstructed horizon; and the numbers therein, as well as in the other table, are to be subtracted from the observed altitude, when the fore-observation is used; but added, in the back-observation.

When the sun is over the land, and the ship nearer it than the visible horizon when unconfined: in this case, the sun's limb is to be brought in contact with the line of separation of the sea and land; the distance of that place from the ship is to be found by estimation or otherwise; and the dip answering thereto, and the height of the eye, is to be taken from Table VI.

TABLE VII. *Of the Correction to be applied to the time of high water at full and change of the moon, to find the time of high water on any other day of the moon.*

The use of this table is fully explained at Section II. Chap I. Book I. of this article.

TABLES VIII. IX. X. *Of the Sun's Declination*, &c.

The first of these tables contains the sun's declination, expressed in degrees, minutes, and tenths of a minute, for four successive years, namely, 1793, 1794, 1795, and 1796: and by means of Table X. may easily be reduced to a future period; observing that, after the 28th of February 1800, the declination answering to the day preceding that given is to be taken.

Ex. I. Required the sun's declination May 1. 1816?

May 1. 1812 is four years after the same day in 1812.

Sun's declination May 1. 1812	-	15° 6′.7 N
Equation from Table X.	- -	+0 0.6
Sun's declination May 1. 1799	-	15 7.3 N

Ex. II. Required the sun's declination August 20. 1805?

The given year is 12 years after 1793, and the time is after the end of February 1800.

Now, Sun's dec. August 19. 1793	-	12° 34′.6
Equation from Table X. to 12 years		—0 1.9
Sun's declination August 20. 1805	-	12 32.7

The declination in Table VIII. is adapted to the meridian of Greenwich, and Table IX. is intended to reduce it to any other meridian, and to any given time of the day under that meridian. The titles at the top and bottom of this table direct when the reduction is to be added or subtracted.

TABLE XI. *Of the Right Ascensions and Declinations of Fixed Stars.*

This table contains the right ascensions and declinations of 60 principal fixed stars, adapted to the beginning of the year 1793. Columns fourth and sixth contain the annual variation arising from the precession of the equinoxes, and the proper motion of the stars; which serves to reduce the place of a star to a period a few years after the epoch of the table with sufficient accuracy. When the place of a star is wanted, after the beginning of 1793, the variation in right ascension is additive; and that in declination is to be applied according to its sign. The contrary rule is to be used when the given time is before 1793.

Example. Required the right ascension and declination of Bellatrix, May 1. 1798.

Right ascension January 1. 1793	=	5h 14′ 3″
Variation = 3″.21 × $5\frac{1}{3}$ y.	=	+0 0 17
Right Ascension, May 1. 1798	=	5 14 20
Declination		6° 8′ 53″N
Variation = 4″ × $5\frac{1}{3}$ y.	=	+0 0 21
Declination May 1. 1798	=	6 9 14 N

The various other tables necessary in the practice of navigation are to be found in most treatises on that subject. Those used in this article are in Mackay's Treatises on the Longitude and Navigation.

TABLE

TABLE I. *To reduce Points of the Compass to Degrees, and conversely.*

North-east Quadrant.	South-east Quadrant.	Points.	D.	M.	S.	South-west Quadrant.	North-west Quadrant.
North.	South.	0 0	0	0	0	South.	North.
N¼E	S¼E	0 ¼	2	48	45	S¼W	N¼W
N½E	S½E	0 ½	5	37	30	S½W	N½W
N¾E	S¾E	0 ¾	8	26	15	S¾W	N¾W
N*b*E	S*b*E	1 0	11	15	0	S*b*W	N*b*W
N*b*E¼E	S*b*E¼E	1 ¼	14	3	45	S*b*W¼W	N*b*W¼W
N*b*E½E	S*b*E½E	1 ½	16	52	30	S*b*W½W	N*b*W½W
N*b*E¾E	S*b*E¾E	1 ¾	19	41	15	S*b*W¾W	N*b*W¾W
NNE	SSE	2 0	22	30	0	SSW	NNW
NNE¼E	SSE¼E	2 ¼	25	18	45	SSW¼W	NNW¼W
NNE½E	SSE½E	2 ½	28	7	30	SSW½W	NNW½W
NNE¾E	SSE¾E	2 ¾	30	56	15	SSW¾W	NNW¾W
NE*b*N	SE*b*S	3 0	33	45	0	SW*b*S	NW*b*N
NE¾N	SE¾S	3 ¼	36	33	45	SW¾S	NW¾N
NE½N	SE½S	3 ½	39	22	30	SW½S	NW½N
NE¼N	SE¼S	3 ¾	42	11	15	SW¼S	NW¼N
NE	SE	4 0	45	0	0	SW	NW
NE¼E	SE¼E	4 ¼	47	48	45	SW¼W	NW¼W
NE½E	SE½E	4 ½	50	37	30	SW½W	NW½W
NE¾E	SE¾E	4 ¾	53	26	15	SW¾W	NW¾W
NE*b*E	SE*b*E	5 0	56	15	0	SW*b*W	NW*b*W
NE*b*E¼E	SE*b*E¼E	5 ¼	59	3	45	SW*b*W¼W	NW*b*W¼W
NE*b*E½E	SE*b*E½E	5 ½	61	52	30	SW*b*W½W	NW*b*W½W
NE*b*E¾E	SE*b*E¾E	5 ¾	64	41	15	SW*b*W¾W	NW*b*W¾W
ENE	ESE	5 0	67	30	0	WSW	WNW
E*b*N¾N	E*b*S¾S	5 ¼	70	18	45	W*b*S¾S	W*b*N¾N
E*b*N½N	E*b*S½S	5 ½	73	7	30	W*b*S½S	W*b*N½N
E*b*N¼N	E*b*S¼S	5 ¾	75	56	15	W*b*S¼S	W*b*N¼N
E*b*N	E*b*S	7 0	78	45	0	W*b*S	W*b*N
E¾N	E¾S	7 ¼	81	33	45	W¾S	W¾N
E½N	E½S	7 ½	84	22	30	W½S	W½N
E¼N	E¼S	7 ¾	87	11	15	W¼S	W¼N
East.	East	8 0	90	0	0	West.	West.

TABLE II. *The Miles and Parts of a Mile in a Degree of Longitude at every Degree of Latitude.*

D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.D.	Miles.	D.L.	Miles.	D.L.	Miles.
1	59.99	16	57.67	31	51.43	46	41.68	61	29 09	76	14.51
2	59.97	17	57.36	32	50.88	47	40.92	62	28.17	77	13.50
3	59.92	18	57.06	33	50.32	48	40.15	63	27.24	78	12.48
4	59.86	19	56.73	34	49.74	49	39.36	64	26.30	79	11.45
5	59.77	20	56.38	35	49.15	50	38.57	65	25.36	80	10.42
6	59.67	21	56.01	36	48.54	51	37.76	66	24 41	81	9.38
7	59.56	22	55.63	37	47.92	52	36.94	67	23.45	82	8.35
8	59.44	23	55.23	38	47.28	53	36.11	68	22 48	83	7.32
9	59.26	24	54.81	39	46.62	54	35.26	69	21.50	84	6 28
10	59.08	25	54.38	40	45.95	55	34.41	70	20.52	85	5.23
11	58.89	26	53.93	41	45.28	56	33.55	71	19.54	86	4.18
12	58.68	27	53.46	42	44.95	57	32.68	72	18.54	87	3.14
13	58.46	28	52.97	43	43.88	58	31.79	73	17.54	88	2.09
14	58.22	29	52.47	44	43.16	59	30.90	74	16.53	89	1.05
15	57.95	30	51.96	45	42.43	60	30 00	75	15.52	90	0.00

TABLE III. *Sun's Semidia.*

Mon.	Day.	Sun's Semidiam.	
January.	1	16′	19
	7	16	19
	13	16	19
	19	16	18
	25	16	17
February.	1	16	16
	7	16	15
	13	16	14
	19	16	13
	25	16	12
March.	1	16	10
	7	16	9
	13	16	7
	19	16	9
	25	16	4
April.	1	16	2
	7	16	1
	13	15	59
	19	15	57
	25	15	56
May.	1	15	54
	7	15	53
	13	15	52
	19	15	51
	25	15	50
June.	1	15	49
	7	15	48
	13	15	47
	19	15	47
	25	15	47
July.	1	15	47
	7	15	47
	13	15	47
	19	15	48
	25	15	48
August.	1	15	49
	7	15	50
	13	15	51
	19	15	52
	25	15	53
September.	1	15	55
	7	15	56
	13	15	58
	19	15	59
	25	16	1
October.	1	16	3
	7	16	4
	13	16	6
	19	16	8
	25	16	9
November.	1	16	11
	7	16	13
	13	16	14
	19	16	15
	25	16	16
December.	1	16	17
	7	16	18
	13	16	18
	19	16	19
	25	16	19

Table IV.
Refraction in Altitude.

App. Alt.	Refrac.	App. Alt.	Refrac.	App. Alt	Refrac.
D. M.	M. S.	D. M.	M. S.	D.	M. S.
0 0	33 0	6 30	7 51	30	1 38
0 5	32 10	6 40	7 40	31	1 35
0 10	31 22	6 50	7 30	32	1 31
0 15	30 35	7 0	7 20	33	1 28
0 20	29 50	7 10	7 11	34	1 24
0 25	29 6	7 20	7 2	35	1 21
0 30	28 22	7 39	6 53	36	1 18
0 35	27 41	7 40	6 45	37	1 16
0 40	27 0	7 50	6 37	38	1 13
0 45	26 20	8 0	6 29	39	1 10
0 50	25 42	8 10	6 22	40	1 8
0 55	25 5	8 20	6 15	41	1 5
1 0	24 49	8 30	6 8	42	1 3
1 5	23 54	8 40	6 1	43	1 1
1 10	23 20	8 50	5 55	44	0 59
1 15	22 47	9 0	5 48	45	0 57
1 20	22 15	9 10	5 42	46	0 55
1 25	21 44	9 20	5 36	47	0 53
1 30	21 15	9 30	5 31	48	0 51
1 35	20 46	9 40	5 25	49	0 49
1 40	20 18	9 50	5 20	50	0 48
1 45	19 51	10 0	5 15	51	0 46
1 50	19 25	10 15	5 7	52	0 44
1 55	19 0	10 30	5 0	53	0 43
2 0	18 35	10 45	4 53	54	0 41
2 5	18 11	11 0	4 47	55	0 40
2 10	17 48	11 15	4 40	56	0 38
2 15	17 26	11 30	4 34	57	0 37
2 20	17 4	11 45	4 29	58	0 35
2 25	16 44	12 0	4 23	59	0 34
2 30	16 24	12 20	4 16	60	0 33
2 35	16 4	12 40	4 9	61	0 32
2 40	15 45	13 0	4 3	62	0 30
2 45	15 27	13 20	3 57	63	0 29
2 50	15 9	13 40	3 51	64	0 28
2 55	14 52	14 0	3 45	65	0 26
3 0	14 36	14 20	3 40	66	0 25
3 5	14 20	14 40	3 35	67	0 24
3 10	14 4	15 0	3 30	68	0 23
3 15	13 49	15 30	3 24	69	0 22
3 20	13 34	16 0	3 17	70	0 21
3 25	13 20	16 30	3 10	71	0 19
3 30	13 6	17 0	3 4	72	0 18
3 40	12 40	17 30	2 59	73	0 17
3 50	12 15	18 0	2 54	74	0 16
4 0	11 51	18 30	2 49	75	0 15
4 10	11 29	19 0	2 44	76	0 14
4 20	11 8	19 30	2 39	77	0 13
4 30	10 48	20 0	2 35	78	0 12
4 40	10 29	20 30	2 31	79	0 11
4 50	10 11	21 0	2 27	80	0 10
5 0	9 54	21 30	2 24	81	0 9
5 10	9 38	22 0	2 20	82	0 8
5 20	9 23	23 0	2 14	83	0 7
5 30	9 8	24 0	2 7	84	0 6
5 40	8 54	25 0	2 2	85	0 5
5 50	8 41	26 0	1 56	86	0 4
6 0	8 28	27 0	1 51	87	0 3
6 10	8 15	28 0	1 47	88	0 2
6 20	8 3	29 0	1 42	89	0 1

Table V.
Dip of the Horizon.

Height of eye.	Dip. of Horizon.	Height of eye.	Dip. of Horizon.	Height of eye.	Dip. of Horizon.	Height of eye.	Dip. of Horizon.
Feet.	M. S.	Feet.	M. S.	Feet.	M. S.	Feet.	M. S.
1	0 57	11	3 10	21	4 22	35	5 39
2	1 21	12	3 18	22	4 28	40	6 2
3	1 39	13	3 26	23	4 34	45	6 24
4	1 55	14	3 34	24	4 40	50	6 44
5	2 8	15	3 42	25	4 46	55	7 4
6	2 20	16	3 49	26	4 52	60	7 23
7	2 31	17	3 56	27	4 58	70	7 59
8	2 42	18	4 3	28	5 3	80	8 32
9	2 52	19	4 10	29	5 9	90	9 3
10	3 1	20	4 16	30	5 14	100	9 33

Table VI.

Dip of the Sea at different distances from the Observer.

Dist. of land in sea miles.	Height of the eye above the sea in feet.							
	5	10	15	20	25	30	35	40
	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.
	M.	M.	M.	M.	M.	M.	M.	M.
0 ¼	11	22	34	45	56	68	79	90
0 ½	6	11	17	22	28	34	39	45
0 ¾	4	8	12	15	19	23	27	30
1 0	4	6	9	12	15	17	20	23
1 ¼	3	5	7	9	12	14	16	19
1 ½	3	4	6	8	10	11	14	15
2 0	2	3	5	6	8	10	11	12
2 ½	2	3	5	6	7	8	9	10
3 0	2	3	4	5	6	7	8	8
3 ½	2	3	4	5	6	6	7	7
4 0	2	3	4	4	5	6	7	7
5 0	2	3	4	4	5	5	6	6
6 0	2	3	4	4	5	5	6	6

Table VII.

The Correction to be applied to the time of High-water at Full and Change of the Moon, to find the time of High-water on any other day.

Interval of Time.	After New or Full Moon.	Before 1st or 3d Quarter.	After 1st or 3d Quarter.	Before New or Full Moon.
	Additive.	Additive.	Additive.	Subtractive.
D. H.	H. M.	H. M.	H. M.	H. M.
0 0	0 0	5 6	5 6	0 0
0 6	0 8	4 51	5 22	0 9
1 12	0 17	4 37	5 40	0 18
0 18	0 26	4 23	6 0	0 27
1 0	0 36	4 9	6 20	0 37
1 6	0 45	3 56	6 39	0 47
1 12	0 54	3 44	6 58	0 57
1 18	1 2	3 32	7 18	1 7
2 0	1 11	3 21	7 37	1 17
2 6	1 19	3 11	7 56	1 28
2 12	1 28	3 1	8 14	1 39
2 18	1 37	2 50	8 31	1 51
3 0	1 46	2 40	8 47	2 4
3 6	1 54	2 30	9 2	2 16
3 12	2 3	2 21	9 17	2 29
3 18	2 12	2 12	9 31	2 44
4 0	2 21	2 3	9 44	2 58

TABLE

TABLE VIII. *Sun's Declination for* 1809, *being the first after leap year.*

Days.	January	February	March	April.	May.	June.	July	August.	September.	October.	November.	December.
1	23° 1'6 S	17° 7'5 S	7° 37'1 S	4° 29'7N	15° 2'0N	22° 2'5N	23° 8'8N	18° 5'7N	8° 21'9N	3° 7'4S.	14° 24'3S.	21° 48'7S.
2	22 56.4	16 50.3	7 14.3	4 52.8	15 20.0	22 10.6	23 4.7	17 50.5	8 0.0	3 30.7	14 43.5	21 57.9
3	22 50.8	16 32.8	6 51.4	5 15.8	15 37.9	22 18.3	23 0.1	17 35.0	7 38.1	3 54.0	15 2.4	22 6.6
4	22 44.7	16 15.0	6 28.4	5 38.7	15 55.4	22 25.6	22 55.2	17 19.2	7 16.0	4 17.3	15 21.1	22 14.9
5	22 38.2	15 56.9	6 5.2	6 1.5	16 12.7	22 32.4	22 49.9	17 3.2	6 53.8	4 40.4	15 39.6	22 22.8
6	22 31.2	15 38.6	5 42.0	6 24.2	16 29.7	22 38.9	22 44.1	16 46.8	6 31.4	5 3 6	15 57.7	22 30.3
7	22 23.8	15 19.9	5 18.8	6 46.8	16 46.5	22 45.0	22 38.0	16 30.2	6 9.0	5 26.7	16 15.7	22 37.3
8	22 15.9	15 1.1	4 55.4	7 9.3	17 2.9	22 50.7	22 31.5	16 13.3	5 46.4	5 49.7	16 33.3	22 43.9
9	22 7.6	14 41.9	4 32.0	7 31.7	17 19 1	22 56.0	22 24.6	15 56.2	5 23.8	6 12.6	16 50.7	22 50.0
10	21 58.9	14 22.6	4 8 6	7 53.9	17 35 0	23 0.9	22 17.3	15 38.8	5 1.0	6 35.4	17 7.8	22 55.7
11	21 49.7	14 2.9	3 45.0	8 16.0	17 50.6	23 5.3	22 9 6	15 21.2	4 38.2	6 58.2	17 24.6	23 0.9
12	21 40.1	13 43.1	3 21.5	8 38.0	18 5.9	23 9.4	22 1.5	15 3.3	4 15.3	7 20.9	17 41.0	23 5.6
13	21 30.1	13 23.0	2 57.9	8 59.9	18 20.9	23 13.1	21 53.0	14 45.1	3 52.3	7 43.4	17 57.2	23 10.0
14	21 19.7	13 2.7	2 34.2	9 21.6	18 35.6	23 16.4	21 44.2	14 26.7	3 29.3	8 5.9	18 13.1	23 13.8
15	21 8.9	13 42.3	2 10.6	9 43.1	18 50.0	23 19.2	21 35.0	14 8.1	3 6.2	8 28.2	18 28.6	23 17.2
16	20 57.6	12 21.5	1 46.9	10 4.5	19 4.1	23 21.7	21 25.4	13 49.3	2 43.0	8 50.4	18 43.9	23 20.0
17	20 46.0	12 0.6	1 23.2	10 25.7	19 17.9	23 23.7	21 15.5	13 30.3	2 19.8	9 12.5	18 58.7	23 22.5
18	20 33.9	11 39.6	0 59.5	10 46.7	19 31.3	23 25.3	21 5.3	13 11.0	1 56.6	9 34.5	19 13.3	23 24.5
19	20 21.5	11 18.3	0 35.7	11 7.5	19 44.4	23 26.5	20 54.6	12 51.5	1 33.3	9 56.3	19 27.5	23 26.0
20	20 8.7	10 56.9	0 12.0	11 28.3	19 57.1	23 27.3	20 43.6	12 31.9	1 10.0	10 18.0	19 41.3	23 27.0
21	19 55.5	10 35.2	0 11.6N	11 48.8	20 9.5	23 27.7	20 32.3	12 12.0	0 46.6	10 39.5	19 54.8	23 27.6
22	19 42.0	10 13.5	0 35.3	12 9.0	20 21.6	23 27.7	20 20.6	11 51.9	0 23.2	11 0.9	20 7.9	23 27.7
23	19 28.0	9 51.5	0 58.9	12 29.1	20 33.3	23 27.2	20 8.5	11 31.7	0 0.2S.	11 22.0	20 20.7	23 27.3
24	19 13.8	9 29.5	1 22.5	12 49.0	20 44.7	23 26.3	19 56.2	11 11.3	0 23.6	11 43.0	20 33.0	23 26.4
25	18 59.2	9 7.3	1 46.1	13 8.7	20 55.7	23 25.0	19 43.5	10 50.7	0 47.0	12 3.9	20 45.0	23 25.1
26	18 44.2	8 44.9	2 9.7	13 28.2	21 6.4	23 23.4	19 30.5	10 29.9	1 10.4	12 24.6	20 56.6	23 23.3
27	18 28.9	8 22.4	2 33.2	13 47.4	21 16.7	23 21.3	19 17.1	10 9.0	1 33.9	12 45.0	21 7.9	23 21.0
28	18 13.2	7 59.8	2 56.6	14 6.4	21 26.6	23 18.8	19 3.4	9 47.9	1 57.3	13 5.3	21 18.7	23 18.3
29	17 57.3		3 20.0	14 25.2	21 36.1	23 15.9	18 49.5	9 26.6	2 20.7	13 25.4	21 29.1	23 15.1
30	17 41.0		3 43.3	14 43.7	21 45.3	23 12.5	18 35.2	9 5.2	2 44.0	13 45.2	21 39.1	23 11.5
31	17 24.4		4 6.5		21 54.1		18 20.6	8 43.6		14 4.9		23 7.3

TABLE VIII. *The Sun's Declination for* 1810, *being the second after leap year.*

Days	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 2'7S.	17° 11'6S.	7° 42'7S.	4° 24'0N	14° 57'5N	22° 0'5N	23° 9'7N	18° 9'3N	8° 27'1N	3° 1'8S.	14° 19.6S.	21° 46'4S.
2	22 57.7	16 54.5	7 19.9	4 47.1	15 15.6	22 8.6	23 5.7	17 54.2	8 5.3	3 25.1	14 38.8	21 55.7
3	22 52.1	16 37.0	6 57.0	5 10.1	15 33.5	22 16.4	23 1.3	17 38.7	7 43.4	3 48.4	14 57.8	22 4.5
4	22 46.2	16 19.3	6 34.0	5 33.1	15 51.1	22 23.7	22 56.4	17 23.0	7 21.3	4 11.7	15 16.6	22 12.9
5	22 39.7	16 1.3	6 10.9	5 55.9	16 8.5	22 30.7	22 51.2	17 7.0	6 59.1	4 34.9	15 35.1	22 20.9
6	22 32.9	15 43.0	5 47.7	6 18.7	16 25.6	22 37.3	22 45.5	16 50.7	6 36.8	4 58.0	15 53.3	22 28.5
7	22 25.6	15 24.4	5 24.5	6 41.3	16 42.4	22 43.5	22 39.5	16 34.2	6 14.4	5 21.1	16 11.3	22 35.6
8	22 17.8	15 5.6	5 1.1	7 3.9	16 58.9	22 49.3	22 33.0	16 17.4	5 51.9	5 44.1	16 29.0	22 42.3
9	22 9.6	14 46.5	5 37.7	7 26.3	17 15.2	22 54.7	22 26.7	16 0.3	5 29.3	6 7.0	16 46.5	22 48.5
10	22 1.0	14 27.2	5 14.2	7 48.5	17 31.1	22 59.7	22 19.0	15 43.0	5 6.6	6 29.9	17 3 6	22 54.3
11	21 51.9	14 7.7	3 50.7	8 10.7	17 46.8	23 4.3	22 11.4	15 25.4	4 43.8	6 52.6	17 20.4	22 59.6
12	21 42.6	13 47.9	3 27.2	8 32.7	18 2.2	23 8.4	22 3.5	15 7.6	4 20.9	7 15.3	17 37.0	23 4.5
13	21 32.5	13 27.9	3 3.6	8 54.5	18 17.3	23 12.2	21 55.1	14 49.5	3 58.0	7 37.9	17 53.2	23 8.9
14	21 22.2	13 7.7	2 40.0	9 16.3	18 32.0	23 15.6	21 46.4	14 31.2	3 35.0	8 0.4	18 9.2	23 12.9
15	21 11.5	12 47.2	2 16.3	9 37.8	18 46.5	23 18.5	21 37.3	14 12.7	3 11.9	8 22.7	18 24.8	23 16.4
16	21 0.3	12 26.6	1 52.7	9 59.2	19 0.6	23 21.1	21 27.8	13 53.9	2 48.8	8 44.9	18 40.1	23 19.4
17	20 48.8	12 5.8	1 29.0	10 20.4	19 14.5	23 23.2	21 18.0	13 35.0	2 25.6	9 7.0	18 55.0	23 21.9
18	20 36.9	11 44.7	1 5.3	10 41.5	19 28 0	23 24.9	21 7.8	13 15.8	2 2.3	9 29.0	19 9.7	23 24.0
19	20 24.5	11 23.5	0 41.6	11 2.4	19 41.1	23 26.2	20 57.3	12 56.3	1 39.1	9 50.9	19 24.0	23 25.6
20	20 11.8	11 2.1	0 18.0	11 23.1	19 54.0	23 27.1	20 46.3	12 36.7	1 15.7	10 12.6	19 37.9	23 26.8
21	19 58.7	10 40.6	0 5.7	11 43.6	20 6.4	23 27.6	20 35.1	12 16.9	0 52.4	10 34.2	19 51.5	23 27.5
22	19 45.3	10 18.9	0 29.3	12 4.0	20 18.6	23 27.7	20 23.5	12 56.9	0 29.0	10 55.6	20 4.7	23 27.7
23	19 31.5	9 57.0	0 53.0	12 24.1	20 30.4	23 27.3	20 11.5	11 36.7	0 5.6	11 16.8	20 17.5	23 27.4
24	19 17.3	9 34.9	1 16.7	12 44.0	20 41.9	23 26.5	19 59.3	11 16.3	0 17.8S.	11 37.9	20 30.0	23 26.7
25	19 2.8	9 12.8	1 40.2	13 3.7	20 53.0	23 25.4	19 46.6	10 55.7	0 41.3	11 58.8	20 42.1	23 25.5
26	18 47.9	8 50.5	2 3.8	13 23.3	21 3.7	23 23.8	19 33.7	10 35.0	1 4.7	12 19.5	20 53.8	23 23.8
27	18 32.5	8 28.0	2 27.3	13 42.6	21 14.1	23 21.8	19 20.3	10 14.0	1 28.2	12 40.0	21 5.1	23 21.5
28	18 17.1	8 5.4	2 50.7	14 1.6	21 24.1	23 19.4	19 6.8	9 53.0	1 51.6	13 0.4	21 16.0	23 19.0
29	18 1.2		3 14.2	14 20.5	21 33.8	23 16.6	18 52.9	9 31.7	2 15.0	13 20.5	21 26.6	23 15.9
30	17 45.0		3 37.5	14 39.1	21 43.0	23 13.4	18 38.7	9 10.3	2 38.4	13 30.4	21 36.7	23 12.4
31	17 28.5		4 0.7		21 52.0		18 24.1	8 48.8		14 0.1		23 8.4

TABLE VIII. *Sun's Declination for* 1811, *being the third after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 3'9 S	17° 15'7 S	7° 48'2 S	4° 18'4N	14° 53'1N	21° 58'5N	23° 10'6N	18° 12'8N	8° 32'3N	2° 56'1 S	14° 14'8 S	21° 44'0 S
2	22 58.9	16 58.6	7 25.4	4 41.5	15 11.3	22 6.7	23 6.7	17 57.8	8 10.6	3 19.4	14 34.1	21 53.4
3	22 53.5	16 41.3	7 2.6	5 4.6	15 29.2	22 14.6	23 2.3	17 42.4	7 48.7	3 42.7	14 53.1	22 2.3
4	22 47.7	16 23.6	6 39.6	5 27.5	15 46.9	22 22.0	22 57.6	17 26.8	7 26.6	4 5.9	15 11.9	22 10.9
5	22 41.3	15 5.7	6 16.5	5 50.4	16 4.3	22 29.1	22 52.4	17 10.9	7 4.5	4 29.2	15 30.5	22 18.9
6	22 34.6	15 47.5	5 53.4	6 13.1	16 21.4	22 35.8	22 46.9	16 54.7	6 42.2	4 52.3	15 48.8	22 26.6
7	22 27.4	15 29.0	5 30.1	6 35.8	16 38.3	22 42.0	22 41.0	16 38.2	6 19.9	5 15.4	16 6.9	22 33.9
8	22 19.7	15 10.3	5 6.8	6 58.3	16 54.9	22 47.9	22 34.6	16 21.5	5 57.4	5 38.4	16 24.6	22 40.7
9	22 11.6	14 51.3	4 43.5	7 20.7	17 11.2	22 53.4	22 27.9	16 4.5	5 34.8	6 1.3	16 42.1	22 47.0
10	22 3.1	14 32.0	4 20.4	7 43.0	17 27.3	22 58.5	22 20.8	15 47.2	5 12.1	6 24.2	16 59.3	22 52.9
11	21 54.2	14 12.5	3 56.5	8 5.2	17 43.0	23 3.2	22 13.3	15 29.7	4 49.3	6 47.0	17 16.3	22 58.3
12	21 44.8	13 52.8	3 33.0	8 27.3	17 58.4	23 7.4	22 5.4	15 11.9	4 26.5	7 9.7	17 32.9	23 3.3
13	21 35.0	13 32.9	3 9.5	8 49.2	18 13.6	23 11.3	21 57.2	14 53.9	4 3.5	7 32.3	17 49.3	23 7.9
14	21 24.8	13 12.7	3 45.9	9 10.9	18 28.5	23 14.8	21 48.5	14 35.6	3 40.6	7 54.9	18 5.3	23 11.9
15	21 14.1	12 52.3	2 22.2	9 32.5	18 43.0	23 17.9	21 39.5	14 17.2	3 17.5	8 17.3	18 21.0	23 15.5
16	21 3.1	12 31.7	1 58.6	9 54.0	18 57.2	23 20.5	21 30.1	13 58.5	2 54.3	8 39.5	18 36.4	23 18.7
17	20 51.7	12 10.9	1 34.9	10 15.3	19 11.1	23 22.7	21 20.4	13 39.5	2 31.2	9 1.7	18 51.4	23 21.3
18	20 39.9	11 49.9	1 11.2	10 36.4	19 24.7	23 24.5	21 10.3	13 20.3	2 7.9	9 23.7	19 6.1	23 23.5
19	20 27.6	11 28.8	0 47.5	10 57.3	19 37.9	23 25.9	20 59.8	13 1.0	1 44.6	9 45.6	19 20.5	23 25.3
20	20 15.0	11 7.4	0 23.8	11 18.1	19 50.9	23 26.9	20 48.9	12 41.4	1 21.3	[illegible] 7.4	19 34.5	23 26.5
21	22 0	10 45.9	0 0	11 38.7	20 3.5	23 27.5	20 37.8	12 21.6	0 57.9	10 29.0	19 48.2	23 27.4
22	19 48.6	10 24.2	0 23.6N	11 59.0	20 15.7	23 27.7	20 26.2	12 1.6	0 34.5	10 50.4	20 1.5	23 27.7
23	19 34.9	10 2.3	0 47.2	12 19.3	20 27.6	23 27.4	20 14.4	11 41.5	0 11.1	11 11.7	20 14.4	23 27.5
24	19 20.8	9 40.3	1 10.9	12 39.3	20 39.2	23 26.8	20 2.2	11 21.1	0 12.3 S	11 32.8	20 27.1	23 26.9
25	19 6.3	9 18.1	2 34.5	12 59.0	20 50.4	23 25.7	19 49.6	11 0.6	0 35.7	11 53.8	10 39.2	23 25.8
26	18 51.5	8 55.8	1 58.0	13 18.6	21 1.2	23 24.2	19 36.7	10 39.9	0 59.1	12 14.5	20 51.0	23 24.2
27	18 36.3	8 33.4	2 21.6	13 38.0	21 11.7	23 22.2	19 23.5	10 19.0	1 22.5	12 35.0	21 2.4	23 22.2
28	18 20.9	8 10.9	2 45.1	13 57.1	21 21.8	23 20.0	19 10.0	9 58.0	1 45.9	12 55.4	21 13.4	23 19.7
29	18 5.0		3 8.5	14 16.0	21 31.5	23 17.3	18 56.2	9 36.8	2 9.3	13 15.6	21 24.0	23 16.7
30	17 48.9		3 31.9	14 34.7	21 40.9	23 14.2	18 42.0	9 15.5	2 32.7	13 55.5	21 34.2	23 13.3
31	17 32.5		3 55.2		21 49.9		18 27.6	8 54.0		13 55.3		23 9.4

TABLE VIII. *Sun's Declination for* 1812, *being leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 4'9 S	17° 19'8 S	7° 31'0 S	4° 35'7N	15° 6'7N	22° 4'6N	23° 7'6N	18° 1'5N	8° 15'9N	3° 13'7 S	14° 29'3 S	21° 51'0 S
2	23 0.0	17 2.8	7 8.2	4 58.8	15 24.7	22 12.5	23 3.3	17 46.2	7 54.0	3 37.0	14 48.5	22 0.1
3	22 54.8	16 45.5	6 4.53	5 21.8	15 42.4	22 20.1	22 58.7	17 30.6	7 32.0	4 0.3	15 7.4	22 8.7
4	22 49.0	16 27.9	6 22.2	5 44.7	15 59.9	22 27.3	22 53.6	17 14.7	7 9.9	4 23.5	15 26.0	22 17.0
5	22 42.9	16 10.1	5 59.1	6 7.5	16 17.1	22 34.0	22 48.2	16 58.6	6 47.7	4 46.7	15 44.4	22 24.7
6	22 36.2	15 51.9	5 35.9	6 30.2	16 34.0	22 40.4	22 42.3	16 42.2	6 25.3	5 9.8	16 2.5	22 32.0
7	22 29.1	15 33.5	5 12.6	6 52.8	16 50.8	22 46.4	22 36.1	16 25.5	6 2.8	5 32.9	16 20.3	22 39.0
8	22 21.6	15 14.8	4 49.2	7 15.2	17 7.2	22 52.0	22 29.5	16 8.6	5 40.3	5 55.8	16 37.9	22 45.4
9	22 13.6	14 55.9	4 25.8	7 37.6	17 23.3	22 57.2	22 22.4	15 51.4	5 17.6	6 18.7	16 55.2	22 51.4
10	22 5.2	14 36.5	4 2.3	7 59.8	17 39.1	23 2.0	22 15.0	15 33.9	4 54.8	6 41.5	17 12.2	22 57.0
11	21 56.3	14 17.3	3 38.8	8 21.9	17 54.6	23 6.3	22 7.3	15 16.2	4 32.0	7 4.3	17 28.9	23 2.0
12	21 47.0	13 57.6	3 15.2	8 43.8	18 9.9	23 10.3	21 59.0	14 58.2	4 9.1	7 26.9	17 45.3	23 6.7
13	21 37.3	13 37.7	2 51.6	9 5.6	18 24.8	23 13.9	21 50.5	14 40.0	3 46.1	7 49.4	18 1.4	23 10.9
14	21 27.2	13 17.5	2 27.9	9 27.3	18 39.4	23 17.0	21 41.6	14 21.6	3 23.0	8 11.8	18 17.2	23 14.6
15	21 16.7	12 57.2	2 4.3	9 48.8	18 53.7	23 19.7	21 32.3	14 2.9	2 59.9	8 34.1	18 32.6	23 17.8
16	21 5.7	12 36.7	1 40.6	10 10.1	19 7.7	23 22.1	21 22.7	13 44.0	2 36.8	8 56.3	18 47.7	23 20.6
17	20 54.4	12 15.9	1 16.9	10 31.3	19 21.3	23 24.0	21 12.6	13 25.0	2 13.6	9 18.4	19 2.5	23 23.0
18	20 42.6	11 55.0	0 53.2	10 52.2	19 34.7	23 26.5	21 2.3	13 5.7	1 50.3	9 40.3	19 17.0	23 24.8
19	20 30.5	11 33.8	0 29.5	11 13.0	19 47.7	23 26.6	20 51.5	12 46.2	1 27.0	10 2.0	19 31.0	23 26.2
20	20 18.0	11 12.5	0 5.8	11 33.6	20 0.3	23 27.3	20 40.4	12 26.4	1 3.7	10 23.7	19 44.8	23 27.1
21	20 5.0	10 51.0	0 17.9N	11 54.0	20 12.7	23 27.6	20 29.0	12 6.5	0 40.3	19 45.1	19 58.2	23 27.5
22	19 51.8	10 29.4	0 41.5	12 14.3	20 24.6	23 27.4	20 17.2	11 46.4	0 16.9	11 6.4	20 11.2	23 27.5
23	19 38.2	10 7.6	1 5.2	12 34.3	20 36.3	23 26.9	20 5.1	11 26.1	0 6.5	11 27.6	20 23.9	23 27.0
24	19 24.1	9 45.6	1 28.8	12 54.2	20 47.5	23 25.9	19 52.7	11 5.7	0 29.9	11 48.6	20 36.1	23 26.0
25	19 9.8	9 23.5	1 52.3	13 13.8	20 58.4	23 24.5	19 39.9	10 45.0	0 53.3	12 9.4	20 48.0	23 24.5
26	18 55.0	9 1.3	2 15.8	13 33.2	21 9.0	23 22.7	19 26.8	10 24.2	1 16.7	12 30.0	20 59.5	23 22.6
27	18 40.0	8 38.9	2 39.3	13 52.3	21 19.2	23 20.5	19 13.3	10 3.2	1 40.1	12 50.4	21 10.6	23 20.3
28	18 24.6	8 16.4	3 2.7	14 11.3	21 29.0	23 17.9	18 59.6	9 42.0	2 3.5	13 10.6	21 21.4	23 17.4
29	18 8.9	7 53.8	3 26.1	14 30.0	21 38.5	23 14.8	18 45.5	9 20.7	2 26.9	13 30.6	21 31.7	23 14.0
30	17 52.9		3 49.4	14 48.5	21 47.6	23 11.4	18 31.1	8 59.3	2 50.3	13 50.4	21 41.6	23 10.3
31	17 36.5		4 12.6		21 56.3		18 16.4	8 37.7		14 10.0		23 6.0

TABLE IX. *To reduce the Sun's Declination to any other Meridian, and to any given Time under that Meridian.*

Add in W. Sub. in E.		Sub. in W. Add in E.		LONGITUDE. 10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°	Add in W. Sub. in E.		Sub. in W. Add in E.	
December.	21	December.	21	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	0'0	00	0'0	0'0	0'0	0'0	0'0	21	June.	21	June.
	20		22	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	20		22	
	19		23	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	19		23	
	18		24	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.6	0.6	0.6	18		24	
	17		25	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	17		25	
	16		26	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1 0	1.0	1.1	16		26	
	15		27	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3	15		27	
	14		28	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	14		28	
	13		29	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	13		29	
	12		30	0.1	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	12		30	
December.	11		31	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.2	11	June.	1	July.
	19	January.	1	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	10		2	
	9		2	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	9		3	
	8		3	0.1	0.3	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8	8		4	
	7		4	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.7	2.9	3.1	7		5	
	6		5	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	6		6	
	5		6	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	5		7	
	4		7	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2 7	2.9	3.1	3.3	3.5	3.7	4		8	
	3		8	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3 9	3		9	
	2		9	0.2	0.4	0.7	0.9	1.1	1.4	1.6	1.8	2.0	2.3	2.5	2.7	3.0	3.2	3.4	3.6	3.9	4.1	2		10	
	1	January.	10	0.2	0.5	0.7	0.9	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.3	3.6	3.8	4.1	4.3	1		11	July.
November.	30		11	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	4.0	4.2	4.5	31	May.	12	
	29		12	0.3	0.5	0.8	1.0	1.3	1.6	1.8	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.9	4.2	4.4	4.7	30		13	
	28		13	0.3	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.4	2.7	3.0	3.3	3.5	3.8	4.1	4.3	4.6	4.9	29		14	
	27		14	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8	3.1	3.4	3.7	4.0	4.2	4 5	4.8	5.1	28		15	
	26		15	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	27		16	
	25		16	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.6	4.9	5.2	5.5	26		17	
	24		17	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.7	25		18	
	23		18	0.3	0.6	1.0	1.3	1.6	1.9	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.5	5.8	24		19	
	22		19	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.1	4.3	4.7	5.0	5.4	5.7	6.0	23		20	
November.	21	January.	20	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.4	3.8	4.1	4.5	4.8	5.2	5.5	5.9	6.2	22	May.	21	July.
	20		21	0.4	0.7	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7	6.0	6.4	21		22	
	19		22	0.4	0.7	1.1	1.5	1.8	2.2	2.5	2.9	3.3	3.6	4.0	4.4	4.7	5.1	5.5	5.8	6.2	6.6	20		23	
	18		23	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0	6.4	6.7	19		24	
	17		24	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.4	3.8	4.2	4.6	5.0	5.4	5.7	6.1	6.5	6.9	18		25	
	16		25	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.3	6.7	7.1	17		26	
	15		26	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	16		27	
	14		27	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1	4.5	4.9	5.3	5.8	6.2	6.6	7.0	7.4	15		28	
	13		28	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.2	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.6	14		29	
	11		30	0.4	0.9	1.3	1.7	2.2	2.6	3.1	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.6	7.0	7.4	7.9	12		31	
November.	9	February.	1	0.4	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.4	6.8	7.3	7.7	8.2	10	May.	2	August.
	7		3	0.5	0.9	1.4	1.9	2.3	2.8	3.3	3.8	4.2	4.7	5.2	5.6	6.1	6.6	7.0	7.5	8.0	8.5	8		4	
	5		5	0.5	1.0	1.4	1.9	2.4	2.9	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.7	8 2	8.7	6		6	
	3		7	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7 0	7.5	8.0	8.5	9.0	4		8	
	1		9	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.2	8.7	9.2	2		10	
October.	30		11	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.3	5.8	6.3	6.8	7.3	7.9	8.4	8.9	9.5	30	April.	12	
	28		13	0.5	1.1	1.6	2.1	2.7	3.2	3.8	4.3	4.8	5.4	5.9	6.5	7.0	7.5	8.1	8.6	9.1	9.7	28		14	
	26		15	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.4	4.9	5.5	6.0	6.6	7.2	7.7	8.2	8.8	9.3	9.9	26		16	
	24		17	0.6	1.1	1.7	2.2	2.8	3.4	3.9	4.5	5.0	5.6	6.2	6.7	7.3	7.9	8.4	9.0	9.6	10.1	24		18	
	21		20	0.6	1.1	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.8	10.4	21		21	
October.	18		23	0.6	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.9	9.5	10.0	10.6	18	April.	24	August.
	15		26	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.9	8.5	9.1	9.7	10.3	10.9	15		27	
	12	March.	1	0.6	1.2	1.8	2.5	3.1	3.7	4.3	4.9	5.5	6.2	6.8	7.4	8.0	8.6	9.2	9.8	10.5	11.1	12		30	
	9		4	0.6	1.2	1.9	2.5	3.1	3.7	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.3	9		2	September.
	6		7	0.6	1.3	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.3	7.0	7.6	8.2	8.9	9.5	10.1	10.8	11.4	6		5	
September.	3		10	0.6	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.8	6.4	7.0	7.7	8.3	9.0	9.6	10.3	10.9	11.5	3		8	
	30		13	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.7	8.4	9.0	9.7	10.3	11.0	11.6	31	March.	11	
	27		16	0.7	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.0	11.7	28		14	
	24		19	0.7	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	25		17	
	21		22	0.7	1.3	2.0	2.6	3.3	3.9	4.6	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	22		20	
Add aft. N. Sub. bef. N.		Sub. aft. N. Add bef. N.		$0^h\frac{2}{3}$	$1^h\frac{1}{3}$	2^h0	$2^h\frac{2}{3}$	$3^h\frac{1}{3}$	4^h0	$4^h\frac{2}{3}$	$5^h\frac{1}{3}$	6^h0	$6^h\frac{2}{3}$	$7^h\frac{1}{3}$	8^h0	$8^h\frac{2}{3}$	$9^h\frac{1}{3}$	10^h0	$10^h\frac{2}{3}$	$11^h\frac{1}{3}$	12^h0	Add aft. N. Sub. bef. N.		Sub. aft. N. Add bef. N.	
				Time from Noon.																					

TABLE X. *Change of Sun's Dec.*

Month.	Days.	Complete Years. 4	8	12	16
January.	1	0' —1	0' —3	0' —4	0' —6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .8	1 .3	1 .7
February.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .7	2 .3
	19	0 .6	1 .2	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
March.	1	0 .7	1 .3	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .8
	25	0 + 7	1 + 4	2 + 1	2 + 8
April.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
May.	1	0 .6	1 .1	1 .7	2 .3
	7	0 .5	1 .0	1 .6	2 .1
	13	0 .5	0 .9	1 .4	1 .9
	19	0 .4	0 .8	1 .2	1 .6
	25	0 .3	0 .7	1 .0	1 .3
June.	1	0 .3	0 .5	0 .8	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	25	0 —1	0 —1	0 —2	0 —3
July.	1	0 .1	0 .3	0 .4	0 .6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .9	1 .3	1 .7
August.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .8	2 .4
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
September.	1	0 .7	1 .4	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .8
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .9
	25	0 + 7	1 + 4	2 + 1	2 + 8
October.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .0	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
November.	1	0 .5	1 .1	1 .6	2 .2
	7	0 .5	1 .0	1 .5	2 .0
	13	0 .4	0 .9	1 .3	1 .8
	19	0 .4	0 .8	1 .2	1 .5
	25	0 .3	0 .7	1 .0	1 .3
December.	1	0 .2	0 .5	0 .7	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .3	0 .3	0 .4
	19	0 .0	0 .1	0 .1	0 .3
	25	0 —1	0 —1	0 —1	0 —2

TABLE XI. *The Right Ascensions and Declinations of the Principal fixed Stars, adapted to the beginning of the Year* 1810.

Names of Stars.	Mag.	Right Ascen. in Time.			Ann. Var.	Declination.			Ann. Vari.
γ Pegasi -	2	0h	3'	57"	3".06	14°	7'	35"N	+20".0
β Ceti -	2	0	34	2	3 .01	19	3	36 S	—19 .8
Alrucabah, pole star	2.3	0	54	15	12 .42	88	17	41 N	+19 .6
Mirach -	2	0	59	7	3 .31	34	36	45 N	×19 .4
Achernar -	1	1	30	38	2 .25	58	11	19 S	—18 .5
Almaach -	2	1	52	16	3 .62	41	24	47 N	+17 .7
Menkar -	2	1	52	20	3 .11	3	20	27 N	+14 .7
Algol -	Var.	2	56	0	3 .85	40	12	53 N	+14 .5
Algenib -	1	3	10	49	4 .21	49	9	31 N	+13 .6
Aldebaran	2	4	25	1	3 .42	16	7	6 N	+ 8 .2
Capella -	1	5	2	40	4 .41	45	47	41 N	+ 5 .1
Rigel -	1	5	5	19	2 .87	8	25	48 S	— 4 .8
β Tauri -	2	5	14	17	3 .78	28	26	10 N	+ 4 .1
Bellatrix -	2	5	14	57	3 .21	6	10	1 N	+ 4 .0
δ Orionis -	2	5	22	20	3 .07	0	26	53 S	— 3 .4
ε Orionis -	2	5	26	35	3 .04	1	19	57 S	— 3 .0
ζ Orionis -	2	5	31	11	3 .03	2	3	8 S	— 2 .6
α Columbæ -	2	5	32	45	2 .17	34	10	54 S	— 2 .4
Betelguese -	1	5	44	53	3 .24	7	21	40 N	+ 1 .4
β Canis Majoris	2.3	6	14	22	2 .65	17	52	16 S	+ 1 .2
Canopus -	1	6	19	43	1 .33	51	35	44 S	+ 1 .7
Sirius -	1	6	36	46	2 .65	15	27	48 S	+ 4 .3
δ Canis Majoris	2	7	0	40	2 .44	26	6	0 S	+ 5 .2
Castor -	1.2	7	22	27	3 .85	32	17	33 N	— 6 .9
Procyon -	1.2	7	29	20	3 .14	5	42	56 N	— 7 .5
Pollux -	2.3	7	32	48	3 .69	28	27	28 N	— 7 .9
ζ Navis -	2	7	56	44	2 .11	39	28	20 S	+ 9 .7
γ Navis -	2	8	3	41	1 .85	46	46	39 S	+10 .3
Acubens -	3	8	48	4	3 .30	12	35	19 N	—13 .4
β Navis -	1	9	11	6	0 .75	68	56	13 S	+14 .8
Alphard -	2	9	18	14	2 .93	7	50	25 S	+15 .2
Regulus -	1	9	58	14	3 .20	12	53	29 N	—17 .2
η Navis -	2	10	37	43	2 .30	58	41	20 S	+18 .7
β Ursæ Majoris -	2	10	50	17	3 .71	57	23	53 N	—19 .1
Dubhe -	2	10	51	54	3 .85	62	46	43 N	—19 .1
β Leonis -	2	11	39	21	3 .06	15	37	9 N	—19 .9
γ Ursæ Majoris -	2	11	47	45	3 .22	54	44	7 N	—20 .0
α Crucis -	1	12	16	9	3 .24	62	2	46 S	+20 .0
γ Crucis -	2	12	20	42	3 .24	52	2	42 S	+20 .0
β Crucis -	2	12	36	44	3 .41	58	38	55 S	+19 .8
Aliath -	2	12	45	36	2 .67	57	10	48 N	—19 .7
Spica Virginis -	1	13	15	11	3 .13	10	9	54 S	+19 .0
ζ Ursæ Majoris -	2	13	16	23	2 .43	55	54	8 N	—19 .0
Benetnach -	2	13	40	4	2 .40	50	15	58 N	—18 .2
β Centauri -	1.2	13	50	32	4 .11	59	26	51 S	+17 .8
Arcturus -	1	14	6	59	2 .72	20	10	34 N	—19 .1
α Centauri -	1	14	27	16	4 .45	60	3	17 S	+16 .1
Alphacca -	2	15	26	38	2 .53	27	21	44 N	—12 .5
β Scorpii -	2	15	54	26	3 .47	10	16	29 S	+10 .5
Antares -	1	16	17	45	3 .64	25	59	49 S	+ 8 .7
Ras. Algethi -	2	17	5	59	2 .73	14	36	57 N	— 4 .8
Ras. Alhague -	2	17	26	7	2 .77	12	42	37 N	— 3 .0
Vega -	1	18	30	30	2 .02	38	36	35 N	+ 2 .6
Altair -	1.2	19	41	30	2 .92	8	22	13 N	+ 8 .5
Deneb -	2	20	34	56	2 .03	44	36	13 N	+12 .5
Gruis -	2	21	56	11	3 .85	48	1	58 S	—17 .1
Fomalhaut -	1	22	47	6	3 .33	30	48	14 S	—19 .0
Scheat -	2	22	54	34	2 .87	27	3	7 N	+19 .2
Markab -	2	22	55	17	2 .96	27	3	7 N	+19 .2
α Andromedæ	2	23	58	34	3 .07	28	2	31 N	+20 .0

Inland Navigation.

Navigation of the Ancients. See Phoenicia and Trade.

Inland Navigation, the method of conveying commodities from one part of a country to another by means of rivers, lakes, canals, or arms of the fea. See Canal.

We have already, under Canal, taken notice of a method propofed by Dr Anderfon of raifing and lowering veffels by means of mechanical powers, inftead of dams and locks. We fhall defcribe another mechanical contrivance propofed by Mr Leach for the fame purpofe. This machinery is compounded of an inclined plane and wheel in axis. The inclined plane is a parallelogram whofe length reaches from the end of one canal to the beginning of another, or to the fea or navigable river, to which the veffel is next to be conveyed; the breadth ought to be 22½ feet. It may be made of good oak or deal plank, and fufficiently ftrong to bear the weight to be laid upon it; and it muft be very ftrongly fupported by beams of oak or other wood. It ought to be divided in the middle by a ledge or rib of 12 inches fquare, the fide ribs being nine by 12 inches. The elevation muft depend upon particular circumftances. Fig. 1. fhows the inclined part of the machine; AB being the wooden part juft defcribed, placed between the fide of the hill W and the navigable river F. According to the dimenfions already given, the two paths A and B on which the veffels move are exactly ten feet wide. G reprefents the canal, brought perhaps from the diftance of feveral miles to the top of the precipice WW. At the end of the canal, and quite acrofs from R to R, muft be built a very ftrong wall; in which are two fluices with flood gates at K and L, to let out the water occafionally. Between the head of the plane AB, and the end of the canal G, is a horizontal platform divided into two parts, as is reprefented in the figure by the letters HI. At the end of the canal are fix rollers M and N, of ufe in carrying the boats and lighters in and out of the canal. Near the end of the canal, at S, and T, are two other fluices, with their flood-gates, for letting out a quantity of fluid to drive the other part of the machine. O and P reprefent the two ends of the towing paths, one on each fide of the canal.

Plate CCCLXIX. fig. 1.

Fig. 2.

Fig. 2. fhows the vehicle by which the lighters are conveyed up and down the inclined plane, by the two paths A and B, fig. 1. AA (fig. 2.) reprefents part of the inclined plane, B the vehicle in the pofition in which it rolls up and down the two paths. C is the body of the vehicle, which is made hollow, to contain a quantity of water occafionally ufed as a counterbalance for its correfponding vehicle. DDD are three rollers between the bottom of the vehicle and the plane, for the purpofe of rolling the boats up and down. HHH are fix rollers: four by the horizontal part of the vehicle on which the boat E is to reft in its paffage up and down the plane; the other two rollers are in a moveable part, which is faftened to the body of the vehicle with a pair of very ftrong hinges; and in the paffage of the vehicle up and down the plane, it turns up between the head of the boat and the plane, preventing the former from rubbing againft the plane. When the vehicle gets up to the top, this moveable part falls down on the platform marked HI, becoming parallel with the horizontal part of the vehicle; after which it ferves for a launch and paffage to place the boat upon the rollers MN (fig. 1.) at the end of the canal. This paffage part of the vehicle, together with the three rollers at the end of the canal, is likewife of great ufe in towing a boat out of the canal, in order to place it on the horizontal part. At the bottom of the cavity of the vehicle is a large hole F, with a valve opening inwardly. Through this hole the water enters when the vehicle finks into the navigable river F, for the purpofe of receiving a boat on the top or horizontal part of the vehicle till it is quite full and then will fink entirely under water, while the boat is towed in on the horizontal part. A fmall rope K is faftened to the valve, on purpofe to lift it up and to keep it fo, while the vehicle and boat are afcending up the plane out of the canal; that fo the water may difcharge itfelf till as much as is neceffary be got out, or till it becomes an equal balance for the correfponding vehicle and its contents, which are defcending by the other path. Hence we fee, that every machine muft have two of thefe vehicles furnifhed with rollers as already defcribed, and fo conftructed that one may be as nearly as poffible a counterbalance to the other. As it is neceffary that the vehicles fhould be water tight, the infides of them muft be caulked very tight; and they fhould be capacious enough to hold as much water as will balance the largeft boat with its contents. Here it may be obferved, that every veffel will be balanced by as many cubic feet of water as it difplaces by being put into the water when loaded. The quantity may eafily be known, by obferving how far the boat finks in the water, and calculating the bulk of the part immerfed.

The machine which puts the vehicles in motion, may either be conftructed with an under-fhot or breaft-water wheel: or by an over-fhot water-wheel: or by two walking-wheels, for men to walk in as in cranes, &c.

Fig. 3. fhows a front view of the under-fhot water-wheel movement; where A is the end of the axis or cylinder of the cog or fpur wheel; the diameter of which axis is four feet, and its length not lefs than 22 feet, as it muft be extended quite acrofs the canal from one fide to the other, and placed on the top of very ftrong fupporters on each fide of the canal, about feven feet above the furface of the water, as the loaded boat is to pafs backwards and forwards under the cylinder, and at a convenient diftance from the wall RR (fig. 1.), and placed between the two fluices S and T; on the end of which cylinder is the cog-wheel B (fig. 3.) The wheel B is fuppofed to be 20 feet of diameter, having on its edge 120 cogs; and underneath the cog-wheel is the breaft-water one C, 24 feet in diameter, from the tip of one aller-board to the tip of its oppofite. On the end of the axis of the water-wheel D is a trundle two feet and a half in diameter, with 15 rounds and ftaves contained therein. This muft be placed between the two fluices S and T, to let the water out of the canal; which, falling on the float-boards, will turn the wheel round from the right hand towards the left, when the fluice on the left hand of the wheel is opened; but the contrary way when that of the right is opened.—The water falling

Fig. 3.

Inland Navigation.

falling upon the boards passes along with the wheel in the circular cavity EGF, and is discharged at G, whatever way the wheel may turn.

To the axis or cylinder of this machine, which must always be horizontal, are fixed a pair of strong ropes; the ends of each pair fastened to the upper part of the cylinder; it being necessary that they should act in contrary directions. Each must extend the whole length of the plane, and their strength must be proportioned to the weight necessary to be sustained. The two vehicles already mentioned are fastened to the other ends of the ropes; so that one pair of the ropes are wound up by the cylinder turning one way, and the other by its turning the contrary way. Thus when one of the vehicles is at the upper part of the path A, ready to discharge its boat and cargo into the upper canal, the other boat will be at the foot of the path B, all under water in the lower canal, and ready for the reception of a boat to be towed in on the horizontal part of it; so that as one vehicle rolls up on one side of the plane, the other will roll down on the other side, and *vice versa*.

Fig. 1.

Fig. 4.

Fig. 4. shows the movement by means of an overshot water-wheel. It consists of a water-wheel C, and two spur or cog wheels A and B. The water-wheel is 18 feet in diameter, and has two rows of buckets placed contrariwise to one another, that it may turn round in contrary directions, according as the one or the other sluice, S, or T, is opened. On its axis F is a trundle of three feet diameter, having 18 rounds or staves which fall into the cogs of the second spur-wheel B, causing it to turn round in a direction contrary to that of the water-wheel. This second wheel is likewise 18 feet in diameter, with a trundle of three feet having 18 rounds or staves.—The diameter of the upper spur-wheel A is also 18 feet, but the diameter of its axis is. six feet. On the edge of the wheel are 108 cogs. These fall in between the staves of the axis of the other spur-wheel; and thus the third wheel turns round the same way with the water wheel C. The cylinder of this upper spur-wheel must be placed across the canal betwixt the two sluices, on very strong supporters, as explained in the former movement, and the two pair of ropes in the same manner.

Fig. 5.

The movement of the walking wheel is shown (fig. 5.). A1 and A2 are two wheels for men to walk in, each of them 24 feet in diameter. B1 and B2 are the axes or cylinders of the two wheels, of equal lengths; viz. 11 feet each, and four in diameter.—At one end of each of the two cylinders C1 and C2, is a wheel of the same diameter with the cylinder. On the edges of these wheels are teeth of an equal number in each wheel; and as the teeth of the wheels mutually fall into each other, the revolutions of both must be performed in the same time. By this contrivance also the cylinders will turn different ways; and the ropes on the two different cylinders will constantly one pair be wound up, and the other wound down, by the natural moving of the machine. DDD is the frame that supports the whole, which must be made very firm and secure.

Let us now suppose, that there is a boat in the upper canal to be brought down, but none to go up for a balance. In this case, as one of the vehicles must be at the top to receive the boat, the other will be at the bottom to take in water. Let then any of the movements just described be set to work, and it is plain, that as the upper vehicle with its boat descends, the under vehicle will ascend with the water; the valve being in the mean time lifted up till a sufficient quantity of water has flowed out, to make the one nearly a counterbalance to the other; so that the vessel may slide down gently and without any violence.

Inland Navigation || Naumachia.

If it happens that a boat is to go up while none is to come down, one of the vehicles being at the foot of the plane under water, and in readiness to have the boat towed upon its horizontal part, one of the sluices at K or L is to be opened, and a quantity of water let into the cistern of the upper vehicle sufficient to counterbalance the boat with its contents which is to ascend. This being done, the machine is set to work, the valve of the under vehicle kept open till the water is all discharged; and then the boat will roll up to the top of the plane.

From this description of the canal and machinery for raising and lowering the vessels, the reader can be at no loss to understand the principles on which it depends. It would be superfluous to adduce examples, or follow our author through his calculations relative to particular cases. We shall only observe, that the difference of time in which vessels may be raised or lowered by the machinery just described, in comparison with what can be done in the common way by dams and locks, must give a very favourable idea of the new method. According to Mr Leach's computations, a boat with its cargo weighing 10 tons might be raised by the walking machine in 12 or 14 minutes, by the under-shot wheel in 15 minutes, and by the over-shot wheel in 30 minutes; and that through a space of no less than 30 fathoms measured on the inclined plane, or 114 feet perpendicular.

NAVIGATORS ISLANDS. See OPOUN.

NAULUM, in Roman antiquity, a piece of money put into the mouth of a person deceased to enable him to pay Charon the ferryman for his passage. It was to be of the current coin of the reigning emperor; so that from this money the time of the person's death may be known. The sum for poor men was a farthing, but the rich in general were very liberal to Charon, as appears from the number of coins often found in the neighbourhood of Rome on opening the graves of great men. Charon was looked upon as a very morose and obstinate old fellow, who would not carry over any man without his fare: and hence the proverbial use of that verse in Juvenal,

Furor est post omnia perdere naulum.

A similar custom took place among the Greeks: The money put into the mouth of the deceased was by them called Δανακη.

NAUMACHIA, in antiquity, a show or spectacle among the ancient Romans, representing a sea fight. These mock sea fights are supposed to have originated at the time of the first Punic war, when the Romans first instructed their men in the knowledge of naval affairs. Afterwards they were intended to entertain the populace, as well as to improve the seamen. They were often, like other shows, exhibited at the expence of individuals, to increase their popularity.

In

INLAND NAVIGATION.

Fig. 1.

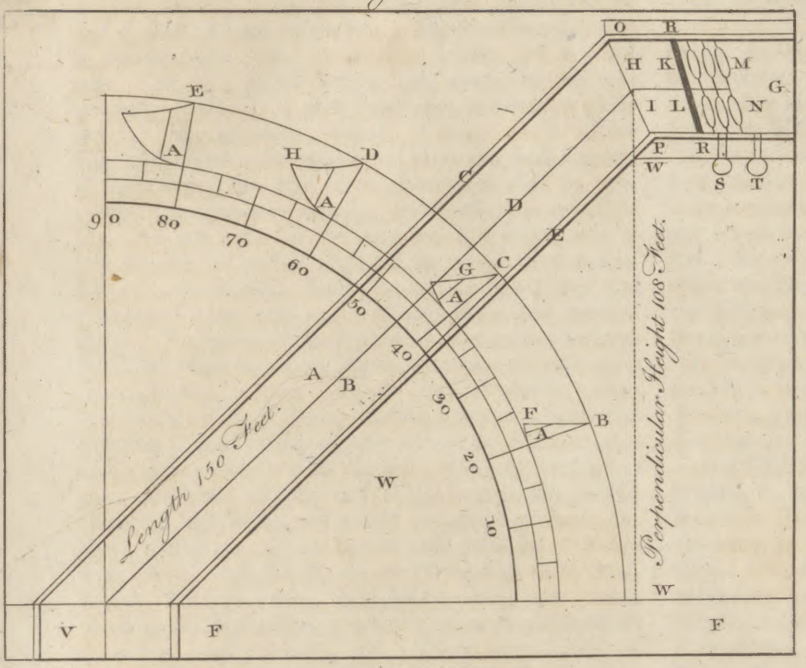


Fig. 2.

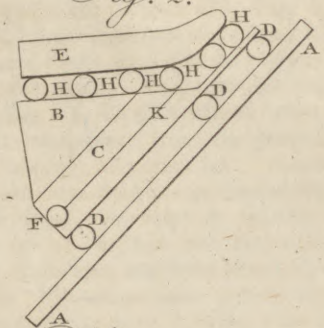


Fig. 3.

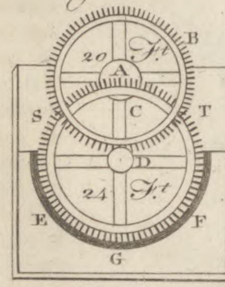


Fig. 4.

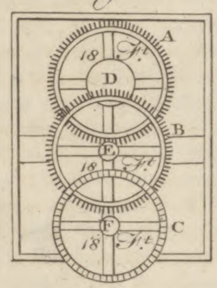
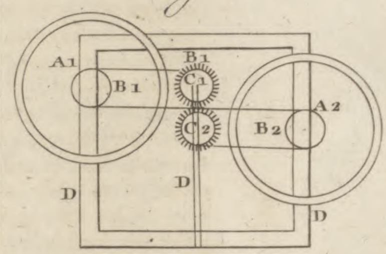


Fig. 5.



NAPIER'S RODS.

Fig. 1.

1	1	2	3	4	5	6	7	8	9	0
2	/2	/4	/6	/8	1/0	1/2	1/4	1/6	1/8	/0
3	/3	/6	/9	1/2	1/5	1/8	2/1	2/4	2/7	/0
4	/4	/8	1/2	1/6	2/0	2/4	2/8	3/2	3/6	/0
5	/5	1/0	1/5	2/0	2/5	3/0	3/5	4/0	4/5	/0
6	/6	1/2	1/8	2/4	3/0	3/6	4/2	4/8	5/4	/0
7	/7	1/4	2/1	2/8	3/5	4/2	4/9	5/6	6/3	/0
8	/8	1/6	2/4	3/2	4/0	4/8	5/6	6/4	7/2	/0
9	/9	1/8	2/7	3/6	4/5	5/4	6/3	7/2	8/1	/0

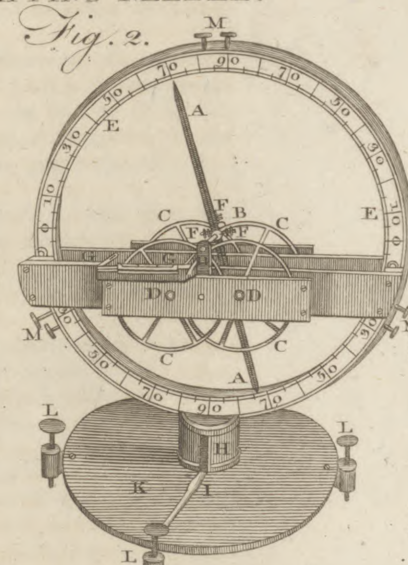
Fig. 2.

1	4	7	6	8
2	/8	1/4	1/2	1/6
3	1/2	2/1	1/8	2/4
4	1/6	2/8	2/4	3/2
5	2/0	3/5	3/0	4/0
6	2/4	4/2	3/6	4/8
7	2/8	4/9	4/2	5/6
8	3/2	5/6	4/8	6/4
9	3/6	6/3	5/4	7/2

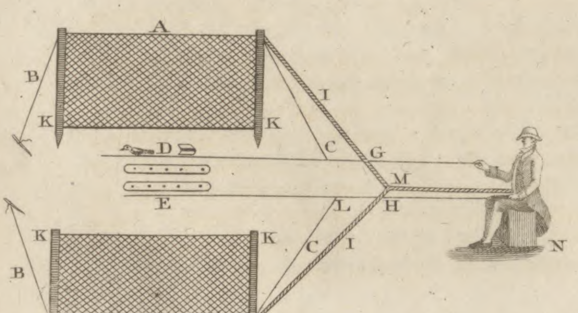
DIPPING NEEDLE.

Fig. 1.

Fig. 2.



DAY NET.



NEWTONIAN PHILOSOPHY.

Fig. 1.

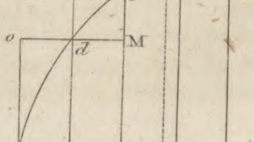
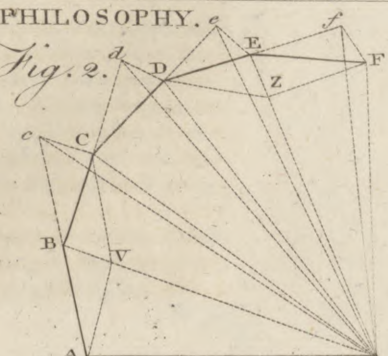


Fig. 2.



A. Bell Prin. Wal. Sculptor fecit.

In these spectacles they sometimes strove to excel each other in swiftness; and sometimes engaged in a warlike manner. The naumachiæ of Claudius indeed was a most savage diversion. The combatants used to destroy each other to amuse a tyrant and a cruel mob. As they passed before him, they used this melancholy greeting, "*Ave Imperator, morituri te salutant.*" The emperor replied, "*Avete vos.*" This they understood as an answer of kindness, and a grant of their lives; but they soon discovered that it proceeded from wanton cruelty, and barbarous insensibility. In the time of the emperor Domitian, such a vast number of vessels engaged as would have nearly formed two regular fleets for a real fight, and the channel of water was equal in magnitude to a natural river. The emperor Heliogabalus is reported to have filled the channel where the vessels were to ride with wine instead of water. Tritons and sea monsters were frequently exhibited during the engagement. Suetonius and Dio Cassius inform us, that at one of these sea fights of Domitian a violent shower fell; the emperor, however, continued till the end of the engagement, often changing his clothes, nor would he suffer any one to depart; and as the rain continued for several hours, many were seized with distempers, and some even died, Suet. cap. 4. Dio. lib. lxvii. Naumachiæ were also places fitted up for these shows, a sort of circi or amphitheatres, with seats and porticoes, &c. There were several of them at Rome; three built by Augustus, one by Claudius, another by Domitian, and another by Nero: which served for the reverse of his medals. Claudius used the lake Fucinus as a naumachia.

NAUMBURG, a town of Germany, in the circle of Upper Saxony, capital of the county of Saxe-Naumburg, situated on the river Sala, in E. Long. 11. 20. N. Lat. 51. 12.

NAUPACTUS, or NAUPACTUM, in *Ancient Geography*, a city of Ætolia, at the mouth of the Evenus. The word is derived from ναυς and πηγνυμι, because it was there that the Heraclidæ built the first ship which carried them to Peloponnesus. It first belonged to the Locri Ozolæ, and afterwards fell into the hands of the Athenians, who gave it to the Messenians, who had been driven from Peloponnesus by the Lacedemonians. It became the property of the Lacedemonians after the battle of Ægospotamos, and it was restored to the Locri. Philip of Macedon afterwards took it, and gave it to the Ætolians; from which circumstance it has generally been called one of the chief cities of their country. E. Long. 22. 20. N. Lat. 38. 0.

There was on the shore a temple of Neptune, and near it a cave filled with offerings, and dedicated to Venus, where widows resorted to request new husbands of the goddess. Pausan. lib. x. p. 898.

NAUPLIA, in *Ancient Geography*, a maritime city of Peloponnesus. It was the naval station of the Argives. The fountain Canathos was in its neighbourhood.

NAUPLIUS, in fabulous history, a son of Neptune and Amymone, king of Eubœa. He was the father of the famous Palamedes, who was so unjustly sacrificed to the artifice and resentment of Ulysses by the Greeks at the Trojan war. The death of Palamedes highly enraged Nauplius; and to revenge the injustice of the Grecian princes, he endeavoured to debauch their wives, and ruin their characters. When the Greeks returned from the Trojan war, Nauplius was pleased to see them distressed in a storm on the coasts of Eubœa; and to make their disaster still more universal, he lighted fires on such places are were surrounded with the most dangerous rocks, that the fleet might be shipwrecked upon the coast. This had the desired effect; but Nauplius was so disappointed when he saw Ulysses and Diomedes escape from the general distress, that he threw himself into the sea. According to some mythologists there were two persons of this name; one a native of Argos, who went to Colchis with Jason. He was son of Neptune and Amymone.—The other was king of Eubœa, and lived about the time of the Trojan war. He was, as some observe, son of Clytonas, one of the descendants of Nauplius the Argonaut. The Argonaut was remarkable for his knowledge of sea affairs and of astronomy. He built the town of Nauplia, and sold Auge daughter of Aleus to King Teuthras, to screen her from her father's resentment.

NAUPORTUS, or NAUPORTUM, in *Ancient Geography*, a town on a cognominal river, towards its source, in Pannonia Superior. The reason of the name, according to Pliny, is, that the ship Argo, after coming up the Danube, the Save, and the Laubach, was thence carried on men's shoulders over the Alps into the Adriatic. The river Nauportus rises in the Alps, near Longaticum, at the distance of six miles from the town Nauportum; which was a colony of the Taurisci, a people on the confines of Noricum. Now *Upper Laubach* in Carinthia, on the river Laubach. E. Long. 14. 40. N. Lat. 46. 28.

NAUSCOPY, the art of discovering the approach of ships or the neighbourhood of land at a considerable distance. This pretended art was discovered by M. Bottineau, employed in the king and company's service in the island of France, from the year 1782 to 1784; the account of it is as follows:

"This knowledge is not derived either from the undulation of the waves, or from the subtility of sight, or from any particular sensation; but merely from observation of the *horizon*, which discovers signs indicating the proximity of ships or of land.

"On the *approximation* of a ship toward the land, or towards another ship, there appears in the atmosphere a *meteor* of a particular nature, visible to every one without any *painful attention*. It is not by any kind of accident that this meteor appears under these circumstances; on the contrary, it is the necessary result of the approximation of one vessel towards another, or towards the land. The existence of the *meteor*, and the knowledge of its different modifications, are what constitute the certainty and the precision of my informations.

"If I am asked, how it is possible that the approach of a ship towards land should give birth to any *meteor* whatsoever in the atmosphere, and what connexion there can be between two objects at such a distance from each other? I reply, that I am not obliged to give an account of the *hows* and the *wherefores*: that it is sufficient for me to have discovered the fact, without being obliged to account for its principle."

The writer concludes, by desiring to be called on for experimental proofs, and by promising in future a complete treatise of Nauscopy, with maps, plates, &c.

This

This complete treatise, as far as we know, has not yet been published, nor do we expect ever to see such a treatise on the subject as will satisfy the minds of those who are persuaded that every effect must have an adequate cause. The whole seems to be the work of fancy.

NAUSEA, or SICKNESS; a retching or propensity and endeavour to vomit, arising from something which irritates the stomach.

NAUTILUS, a genus of animals belonging to the order of vermes testacea. See CONCHOLOGY *Index*.

NAVY, the fleet or shipping of a prince or state. See MARINE.

The management of the British navy royal, under the lord high admiral of Great Britain, is intrusted to principal officers and commissioners of the navy, who hold their place by patent. The principal officers of the navy are four, viz. the treasurer, whose business it is to receive money out of the exchequer, and to pay all the charges of the navy, by warrant from the principal officers: comptroller, who attends and controuls all payment of wages, is to know the rates of stores, to examine and audit all accounts, &c.: surveyor, who is to know the states of all stores, and see wants supplied; to estimate repairs, charge boatswains, &c. with what stores they receive, and at the end of each voyage to state and audit accounts: clerk of the acts, whose business it is to record all orders, contracts, bills, warrants, &c.

The commissioners of the navy are five: The first executes that part of the comptroller's duty which relates to the comptrolling the victualler's accounts; the second, another part of the said comptroller's duty relating to the account of the storekeepers of the yard; the third has the direction of the navy at the port of Portsmouth; the fourth has the same at Chatham; and the fifth at Plymouth. There are also other commissioners at large, the number more or less according to the exigencies of public affairs; and since the increase of the royal navy, these have several clerks under them, with salaries allowed by the king.

The victualling of the royal navy hath formerly been undertaken by contract; but is now managed by commissioners, who hold their office on Tower-hill, London. The navy office is where the whole business concerning the navy is managed by the principal officers and commissioners.

The royal navy of Great Britain is now in a very flourishing state, having been diligently kept up in late reigns, as the natural strength of the kingdom. When it is complete, it is divided into three squadrons, distinguished by the colours of the flags carried by the respective admirals belonging to the same, viz. *red*, *white*, and *blue*; the principal commander of which bears the title of *admiral*; and each has under him a vice admiral and a rear admiral, who are likewise flag officers.

NAVY Exercise. See EXERCISE.

NAVY Discipline, or *Regulations*. See *MARITIME State*.

NAWORTH CASTLE, in Cumberland, 10 miles from Carlisle, near the Gelt. This castle is still entire and inhabited. It is a large pile, square, and built round a court. On the north it stands over the river Ithing, at a great height, the banks shagged with wood. The whole house is a very irregular building; the rooms numerous, accessible by 16 staircases, with most frequent and sudden ascents and descents, &c.—The great hall has a gallery at one end, adorned with four vast crests carved in wood, viz. a griffin and dolphin, with the scollops; an unicorn, and an ox with a coronet round his neck. In front is a figure in wood of an armed man; two others, perhaps vassals, in short jackets and caps. The top and upper end of the room is painted in squares, representing the Saxon kings and heroes. This castle was built by one of the Dacres about the reign of Henry III. In the garden walls were stones with Roman inscriptions, which the late earl of Carlisle gave to Sir Thomas Robinson, and were by him removed to his museum at Rooksby: On one of these stones is this inscription, *peditum centum quinquaginta Britannorum;* whence it appears that the Romans, when in possession of Britain, sometimes indulged the national troops with the favour of garrisoning their own territories.

NAXIA, or NAXOS, a considerable island of the Archipelago, 25 miles in length, and 88 in circumference. The whole island is covered with orange, olive, lemon, cedar, citron, pomegranate, fig, and mulberry trees; and there are a great many springs and brooks. This island has no harbour; and yet they carry on a considerable trade in barley, wine, figs, cotton, silk, flax, cheese, salt, oxen, sheep, mules, and oil. They burn only oil of mastich, though olive oil is exceedingly cheap. It is inhabited both by Greeks and Latins, who live in great dread of the Turks; for when the meanest of their ship's appear here, they always wear red caps like galley-slaves, and tremble before the lowest officer; but as soon as they are gone, they put on their caps of velvet. The ladies are so vain, that when they return out of the country, they have 40 women in their train, half on foot and half on asses, one of whom carries a napkin or two, another a petticoat, another a pair of stockings, and so on; which is a very ridiculous sight to strangers. There are four archbishops sees in this island, and a great many villages; but so thin of people, that the whole island does not contain above 8000 inhabitants. The highest mountain is *Zia*, which signifies "the mountain of Jupiter." There are but few antiquities, except some small remains of the temple of Bacchus. Some say they have mines of gold and silver; however, there is one of emery, which is so common here and so cheap, that the English often ballast their ships therewith.

NAXOS, or *Naxia*, a considerable town, and capital of the isle of Naxos, over against the isle of Paros, with a castle and two archbishops sees, the one Greek and the other Latin. The greatest part of the inhabitants are Greeks. E. Long. 25. 51. N. Lat. 37. 8.

NAXUS, now NAXIA, formerly *Strongyle*, *Dia*, *Dionysias*, *Callipolis*, and *Little Sicily*. It was called *Strongyle*, from a Greek word, signifying "round," though in reality it is rather square than round. The names of *Dia* or *Divine*, and *Dionysias*, were given it as being consecrated in a peculiar manner to the fabulous god Dionysus or Bacchus. The appellation of *Callipolis*, Pliny and Solinus derive from the metropolis of the island, formerly a most beautiful city, which

Naxus. which is the import of the word Callipolis. The great fertility of the country gave rife to the name of *Little Sicily*, Naxus being the moft fruitful of all the Cyclades, as Agathamerus informs us, and no lefs fertile than Sicily itfelf. As for the name of *Naxus*, fome affert that it was borrowed from one Naxus, under whofe conduct the Carians poffeffed themfelves of the ifland; others pretend it received its name from Naxus, the fon of Endymion. Stephanus, Suidas, and Phavorinus, derive the name of *Naxos*, from the Greek word *naxai*, fignifying, "to facrifice," and will have it to have been fo called from the many facrifices offered here to Bacchus. With thefe Bochart agrees, as to its being called *Naxos* from the facrifices performed here in honour of Bacchus, but will have the word *naxos* to be a corruption of the Phœnician *nacfa*, or *nicfa*, fignifying "a facrifice, offering." Naxos is, according to Pliny, 75, but reckoned by the prefent inhabitants 100 miles in compafs. It has Paros to the weft, Myconos and Delos to the north, and Ios to the fouth. This ifland is the moft fruitful of the Archipelago, and was formerly famed for the excellent wines it produced. Archilochus, as quoted by Athenæus, compares them to the nectar of the gods; and Afclepiades, cited by Stephanus, affures us, that Bacchus took more delight in Naxos than in any other place whatfoever, having himfelf taught the inhabitants to cultivate their vines. The wine of Naxos maintains to this day its ancient reputation, being by fome deemed the beft of the Levant. Befides wine, this ifland abounds with all forts of delicious fruits, the plains being covered with orange, olive, lemon, cedar, citron, pomegranate, mulberry, and fig trees. It was formerly famous for quarries of that fort of marble which the Greeks called *ophites*, from its being green, and fpeckled with white fpots like the fkin of a ferpent. The beft emerald is found here on the mountains near the weftern coaft, whence the neighbouring cape is called by the Italians *capo fmeriglio*, or the emerald cape. As to the inhabitants of Naxos, Diodorus relates that the ifland was firft peopled by the Thracians. Thefe were in a little time fubdued by a body of Theffalians, who having poffeffed the ifland for the fpace of 200 years and upwards, were compelled to abandon it by a drought and famine.

After the Trojan war, the Carians fettled here, and called the ifland *Naxos*, from their king, who was the fon of Polemon. He was fucceeded by his fon Leucippus, and Leucippus by his fon Smardius, in whofe reign Thefeus, coming out of Crete, landed here with Ariadne, whom he was, in his fleep, commanded by Bacchus to leave in this ifland. In procefs of time a colony of Cnidians and Rhodians fettled here under the conduct of Hippothous and Xuthus: and laft of all the Ionians, who, in time, poffeffed the whole ifland; whence the Naxians are, by Herodotus, called *Ionians*, and ranged among the Athenian colonies. E. Long. 26. 5. N. Lat. 36. 30. It is about 105 miles in circumference, and about 30 broad.

Naxus, in *Ancient Geography*, a town of Crete, famous for its hones, called *lapis Naxius*. Another of Sicily, built by the Chalcidians; fituated on the fouth fide of Mount Taurus, deftroyed by Dionyfius the tyrant: from its ruins Tauromenium, built by Timoleon, either arofe or was increafed, (Plutarch).

Nayres, Nazareth.

NAYRES, the nobility of the Malabar coaft. We may with truth affirm that they are the oldeft nobility in the world; for the moft ancient writers mention them, and quote the law that permits the Nayre ladies to have many hufbands; every one being allowed four. Their houfes, which ftand fingle, have as many doors as the lady has hufbands. When one of them vifits her, he walks round the houfe, ftriking with his fabre on his buckler: he then opens his door, and leaves a domeftic with his arms in a kind of porch, who ferves to inform others that the lady is engaged. It is faid, that one day in the week the four doors are all opened, and all her hufbands vifit her, and dine together with her. Each hufband gives a fum of money, or portion, at the time of marriage; and the wife only has the charge of the children. The Nayres, even the Samorin, and the other princes, have no other heirs than the children of their fifters. This law was eftablifhed, that the Nayres, having no family, might be always ready to march againft the enemy. When the nephews are of age to bear arms, they follow their uncles. The name of *father* is unknown to a Nayre child. He fpeaks of the hufbands of his mother and of his uncles, but never of his father.

NAZARETH, a little city in the tribe of Zebulun, in Lower Galilee, to the weft of Tabor, and to the eaft of Ptolemais. Eufebius fays, it is 15 miles from Legion towards the eaft. This city is much celebrated in the Scriptures, for having been the ufual place of the refidence of Jefus Chrift for the firft 33 years of his life, Luke, ii. 51. It was there our Saviour became incarnate, where he lived in obedience to Jofeph and Mary, and from whence he took the name of a Nazarean. After he had begun to execute his miffion, he preached there fometimes in the fynagogue, *Id.* iv. 16. But becaufe his countrymen had no faith in him, and were offended at the meannefs of his original, he did not many miracles there, Matth. xiii. 54, 58. nor would he dwell therein; fo he fixed his habitation at Capernaum for the latter part of his life, *Id.* iv. 13. The city of Nazareth was fituated upon an eminence; and on one fide there was a precipice, from whence the Nazareans one day had a defign of throwing down our Saviour, becaufe he upbraided them with their incredulity, Luke iv. 29.

St Epiphanius fays, that in his time Nazareth was only a village, and that to the reign of Conftantine it was inhabited by Jews alone, exclufive of all Chriftians. Adamnanus, a writer of the feventh age, fays, that in his time there were two great churches to be feen at Nazareth, one in the midft of the city, built upon two arches, in the place where our Saviour's houfe had ftood. Under the two arches now mentioned, was a very fine fountain, which furnifhed water to the whole city, and from whence water was drawn alfo by the help of a pulley for the ufe of the church above. The fecond church of Nazareth was built in a place where the houfe ftood wherein the angel Gabriel revealed to the virgin Mary the myftery of our Lord's incarnation; and we are affured that the church of Incarnation, which is fupported by two arches, is ftill in being to this

Nazareth, Nazarite.

this day. Mr Maundrell tells us, that there is a convent built over what is ſaid to be the place of annunciation; for the chamber where ſhe received the angel's ſalutation was about 500 years ago removed from Nazareth, and, according to the Roman legends, tranſported by angels to Loretto, then a ſmall village in the pope's dominions, now become a biſhop's ſee.—However, Calmet's opinion (which is certainly the true one) upon the different tranſlations of this famous houſe of Loretto, is, that they were no other than ſo many different buildings made upon the model of the church of Nazareth, juſt as in ſeveral places ſepulchres have been built upon the model of that at Jeruſalem. Mariti tells us, that in the eaſtern part of the city ſtands the church dedicated to the Bleſſed Virgin: the zeal of the Cœnobites raiſed it from the ruins of that which had been deſtroyed by the Saracens. It is a very handſome building, and conſiſts of three naves; in the middle of which is the principal altar; to which there is an aſcent by two magnificent ſtairs, much admired for their iron balluſtrades, the work of an ingenious monk of the convent. The deſcent to the grotto or annunciation chapel below is by ſteps of beautiful marble, cut with great taſte. Two beautiful columns of oriental granite ſtrike the eye of the obſerver in the entrance. They appear to have been conſtructed both to ſupport and ornament the grotto. The altar of this ſubterranean chapel is extremely elegant; and the different kinds of marble with which it is ornamented, receive an additional luſtre from the combined light of ſeveral ſilver lamps preſented by Chriſtian princes. On ſolemn feſtivals, the walls and the pilaſters are ornamented with various pieces of tapeſtry, repreſenting the myſteries of the virgin; a ſuperb preſent from the Houſe of Auſtria. In the weſtern part of the city ſtands a Chriſtian church, built, as it is ſaid, on the ſite of the ancient ſynagogue where Jeſus ſhowed the Jews the accompliſhment of the prophecies in his perſon. This place ſerved a long time as a ſhelter for flocks, but at preſent it is in good repair. In the neighbourhood may be ſeen a fountain of excellent water, which is, however, eſteemed by the people on another account. They conjecture that it was contiguous to the habitation of the virgin, and that it was uſed by her. At ſome diſtance is a large ſtone of a round form, called *Chriſt's Table*. It is pretended that he came hither more than once with his diſciples to eat. The inhabitants of Nazareth pay it a kind of worſhip, burning perfumes and incenſe around it. It is ſituated in 35° E. Long. and in 32° N. Lat.; and formerly held the third rank under the patriarch of Jeruſalem. At preſent it is part of the domains of the chief of Acre. The ancient city, after the ravages of fanaticiſm, was reduced to a miſerable hamlet, containing only a few Arab huts.—Under the protection of Daher Omar, however, it recovered very conſiderably, and is now of far more importance.

NAZARITE, or NAZAREAN, or *Nazarines*, a term which may ſignify, 1. One that is of Nazareth, or any native of this city. 2. It was given to Jeſus Chriſt and his diſciples, and is commonly taken in a ſenſe of deriſion and contempt in ſuch authors as have written againſt chriſtianity. 3. It has been taken for a ſect of heretics called Nazareans. 4. For a Nazarite, a man that has laid himſelf under the obligation of a vow to obſerve the rules of Nazariteſhip, whether it be for his whole life, as Samſon and John the Baptiſt, or only for a time, as thoſe mentioned in Numbers vi. 18, 19, 20. Amos ii. 11, 12. Laſtly, The name Nazarite, in ſome paſſages of Scripture, denotes a man of particular diſtinction and great dignity in the court of ſome prince. But we muſt ſpeak of theſe ſeveral ſorts of Nazarites ſomething more diſtinctly.

Nazarite.

The name of Nazarene belongs to Jeſus Chriſt, not only becauſe of his having lived the greateſt part of his life at Nazareth, and becauſe this city has always been conſidered as his country, but alſo becauſe the prophets had foretold that he ſhould be called a Nazarene, Matth. ii. 23. "And he came and dwelt in a city "called Nazareth, that it might be fulfilled which was "ſpoken by the prophets, He ſhall be called a Naza"rene." We find no particular place in the prophets in which it is ſaid that the Meſſiah ſhould be called a Nazarene; and St Matthew only quotes the prophets in general. Perhaps he would inſinuate, that the conſecration of the Nazarites, and the great purity of which they made profeſſion, was a type and a ſort of prophecy of thoſe of our Saviour, or elſe that the name נזיר *Nazir* or *Nazarite* given to the patriarch Joſeph, Gen. xlix. 26. Deut. xxxiii. 16. was a prophecy which was to be fulfilled in the perſon of Jeſus Chriſt, of whom Joſeph was a figure. Laſtly, St Jerome was of opinion, that St Matthew here alludes to that paſſage of Iſaiah xi. 1. and lx. 21. "And "there ſhall come forth a rod out of the ſtem of Jeſſe, "and a branch (in Hebrew *Nezer*) ſhall grow out of "his roots." This branch or *Nezer*, and this rod, are certainly intended to denote Jeſus Chriſt, by the general conſent of all the fathers and interpreters.

When the word Nazarean is put for the heretics known by this name, it denotes Chriſtians converted from Judaiſm, whoſe chief error conſiſted in defending the neceſſity or expediency of the works of the law, and who obſtinately adhered to the practice of the Jewiſh ceremonies. The name of Nazarenes at firſt had nothing odious in it, and it was often given to the firſt Chriſtians. The fathers frequently mention the goſpel of the Nazarenes, which differs nothing from that of St Matthew, which was either in Hebrew or Syriac, for the uſe of the firſt converts, but was afterwards corrupted by the Ebionites. Theſe Nazareans preſerved this firſt goſpel in its primitive purity. Some of them were ſtill in being in the time of St Jerome, who does not reproach them with any error. They were very zealous obſervers of the law of Moſes, but held the traditions of the Phariſees in very great contempt.

Nazarite, when put to ſignify thoſe under the ancient law who made a vow of obſerving a more than ordinary degree of purity (Numb. *ubi. cit.*), denotes a man or woman who engage themſelves by a vow to abſtain from wine and all intoxicating liquors, to let their hair grow without cutting or ſhaving, not to enter into any houſe that was polluted by having a dead corpſe in it, nor to be preſent at any funeral. And if by chance any one ſhould have died in their preſence, they began again the whole ceremony of their conſecration and Nazariteſhip. This ceremony generally laſted eight days, ſometimes a month, and ſometimes their whole lives. When the time of their Nazariteſhip

Nazarite. ſhip was accompliſhed, the prieſt brought the perſon to the door of the temple, who there offered to the Lord a he lamb for a burnt-offering, a ſhe lamb for an expiatory ſacrifice, and a ram for a peace-offering. They offered likewiſe loaves and cakes, with wine neceſſary for the libations. After all this was ſacrificed and offered to the Lord, the prieſt or ſome other ſhaved the head of the Nazarite at the door of the tabernacle, and burnt his hair, throwing it upon the fire of the altar. Then the prieſt put into the hand of the Nazarite the ſhoulder of the ram roaſted, with a loaf and a cake, which the Nazarite returning into the hands of the prieſt, he offered them to the Lord, lifting them up in the preſence of the Nazarite. And from this time he might again drink wine, his Nazariteſhip being now accompliſhed.

As to thoſe that were perpetual Nazarites, as were Samſon and John the Baptiſt, it appears thar they were conſecrated to their Nazariteſhip by their parents, and continued all their lives in this ſtate, without drinking wine or cutting their hair.

Thoſe that made a vow of Nazariteſhip out of Paleſtine, and could not come to the temple when their vow was expired, contented themſelves with obſerving the abſtinence required by the law, and after that cutting their hair in the place where they were: as to the offerings and ſacrifices preſcribed by Moſes, which were to be offered at the temple by themſelves, or by others for them, they deferred this till they could have a convenient opportunity. Hence it was, that St Paul being at Corinth, and having made the vow of a Nazarite, he had his hair cut off at Cenchrea, and put off fulfilling the reſt of his vow till he ſhould arrive at Jeruſalem, Acts. xviii. 18. When a perſon found that he was not in a condition to make a vow of Nazariteſhip, or had not leiſure to perform the ceremonies belonging to it, he contented himſelf by contributing to the expence of the ſacrifice and offerings of thoſe that had made and fulfilled this vow; and by this means he became a partaker in the merit of ſuch Nazariteſhip. When St Paul came to Jeruſalem, in the year of Chriſt 58, the apoſtle St James the Leſs, with the other brethren, ſaid to him, Acts xxi. 23, 24. that to quiet the minds of the converted Jews, who had been informed that he everywhere preached up the entire abolition of the law of Moſes, he ought to join himſelf to four of the faithful who had a vow of Nazariteſhip upon them, and contribute to the charge of the ceremony at the ſhaving of their heads; by which the new converts would perceive that he continued to keep the law, and that what they had heard of him was not true.

The Hebrew word *Nazir*, or Nazarite, which is made uſe of to expreſs a man exalted to great dignity, as it is ſaid of the patriarch Joſeph, Gen. xlix. 26. and Deut. xxxiii. 16. "that he was ſeparate from his brethren," as it is in our tranſlation; or as the Vulgate and others underſtand the Hebrew, "that he was a Nazarite among his brethren," is variouſly underſtood. Some think that the Hebrew word בזיר *Nazir*, in theſe places, ſignifies one who is crowned, choſen, ſeparated, or diſtinguiſhed: the word כזיד *Nazir* ſignifies a crown. The Septuagint tranſlate this word a chief, or him that is honoured. Calmet thinks that this was a term of dignity in the courts of eaſtern princes, and that at this day in the court of Perſia the word *Nazir* ſignifies the ſuperintendant general of the king's houſehold, the chief officer of the crown, the high ſteward of his family, treaſures, and revenues; and that in this ſenſe Joſeph was the Nazir of the court of Pharaoh. Le Clerc tranſlates the *Nazir*, a prince, and calls Joſeph "the prince of his brethren," in the two places already quoted. Mr Pool declares in favour of this laſt tranſlation. See *Joſeph. Chardin. Chryſoſt. St Jerome, &c.*

Nazianzen || Neapolis.

NAZIANZEN. See *Gregory Nazianzen.*

NAZIM, the lord lieutenant, viceroy, or governor of a province in Hindoltan; the ſame as *Subahdar*, or *Nabob*.

NEALED, among ſeamen, is uſed when the ſounding is deep water cloſe to the ſhore; as alſo when the ſhore is ſandy, clayey, oozy, or foul and rocky ground.

NEALING, or rather ANNEALING, a term uſed for the preparing of ſeveral matters, by heating or baking them in the oven, or the like.

Nealing of glaſs, is the baking of glaſs, to dry, harden, and give it the due conſiſtence, after it has been blown, and faſhioned into the proper works.—This is uſually performed in a kind of a tower called the *leer*, built over the melting furnace. See GLASS.

Nealing of glaſs is alſo uſed for the art of ſtaining glaſs with metalline colours. "One fine uſe of ſilver (ſays Mr Boyle) was only diſcovered ſince the art of annealing upon glaſs came to be practiſed. For prepared ſilver, or even the crude metal, being burnt on a glaſs plate, will tinge it of a fine yellow or golden colour. And there are ſeveral mineral earths, and other coarſe matters, of uſe in this art, which by means of fire impart tranſparent colours to glaſs, and ſometimes very different ones from thoſe of the bodies themſelves.

Nealing of ſteel, is the heating it in the fire to a blood-red heat, and then taking it out, and letting it cool gently of itſelf. This is done to make it ſofter, in order to engrave or punch upon it. See TEMPERING and ENGRAVING.

Nealing is alſo uſed for the art or act of burning or baking earthen or other ware in an oven. The miners at Mendip, when they meet with a rock they cannot cut through, anneal it by laying on wood and coal, and contriving the fire ſo that they quit the mine before the operation begins, it being dangerous to enter it again before it be quite cleared of the ſmoke.

Nealing of tile is uſed in ancient ſtatutes for the burning of tile. The word is formed of the Saxon *onælan, accendere*, to light, burn.

NEAP or NEEP TIDES, are thoſe tides which happen when the moon is in the middle of the ſecond and fourth quarters. The neap tides are low tides, in reſpect of their oppoſites the ſpring tides. As the higheſt of the ſpring tides is three days after the full or change, ſo the loweſt of the neap is four days before the full or change. On which occaſion the ſeamen ſay that it is deep neap.

NEAPED. When a ſhip wants water, ſo that ſhe cannot get out of the harbour, off the ground, or out of the dock, the ſeaman ſay ſhe is *neaped*, or *beneaped*.

NEAPOLIS, in *Ancient Geography*, a city of the Higher Egypt, in the Nomos Panopolitanus, between Thebæ to the ſouth, and Panopolis to the north, on the eaſt ſide of the Nile; otherwiſe called *Cacœne*. A second Neapolis of Babylonia, situated near the Euphrates on the south side.—A third of Campania, an ancient town and a colony from Cumæ. See Velleius, Pliny, Strabo); accounted a Greek city, and a great stickler for Greek usages, (See Livy, Tacitus). Its hot baths were in nothing inferior to those of Baiæ, according to Strabo: at two miles distance from it stands the monument of Virgil, held in religious veneration by learned posterity. The Younger Pliny relates, that Virgil's birth day was more religiously observed by Silius Italicus than his own, especially at Naples, where he resorted to his tomb as to a temple. The city is washed by the river Sebethus. Virgil feigns the nymph Sebethis to preside over the stream. Now *Naples*, capital of the kingdom of that name. See NAPLES.—A fourth, Neapolis of Caria, near the Meander, (Ptolemy).—A fifth, an inland town of Cyrenaica, situated between Ptolemais and Arsinoe, (Ptolemy); and to be distinguished from the Cænopolis, or Neapolis, on the east border of the same province, (id.) A sixth of Ionia, (Strabo); which belonged first to the Ephesians, but afterwards to the Samians, who exchanged Marathesium, a more distant city, for a nearer.—A seventh, Neapolis of Macedonia Adjecta, situated at the distance of 12 miles to the east of Philippi, (Antonine).—An eighth, Neapolis of Pisidia, on the borders of Galatia, situated between Amblada and Pappa, (Ptolemy).—A ninth of Samaria, the ancient *Sichem*, which see; so called upon its restoration by the Romans, (Coin, Pliny, Josephus).—A tenth of Sardinia, situated on the south-west side of the island, 30 miles to the north of Metalla; now called *Neapoli*.—An eleventh, of the Regio Syrtica, called also *Leptis*.—A twelfth, of Zeugitana on the Mediterranean, to the east of Clypea, and south of the Promontorium Mercurii.

NEAT, or NET *Weight*, the weight of a commodity alone, clear of the cask, bag, case, or even filth. See NET.

NEBEL, or NABLUM, a musical instrument among the Jews. See NABLUM.

NEBIO, or NEBBIO, a ruined city of Italy, on the north side of the island of Corsica, with a bishop's see, whose bishop resides at San Fiorenzo, from which it is a mile distant.

NEBO, in *Ancient Geography*, a very high mountain, a part of the mountains of Abarim, and their highest top, whither Moses was ordered to ascend to take a view of the land of Canaan, and there die. Situated in the land of Moab over against Jericho: with a cognominal town at its foot (Isaiah) belonging to the Reubenites, which afterwards returned to the Moabites; in Jerome's time desolate; eight miles to the south of Heshbon.

NEBO, or *Nabo*. See NABO.

NEBUCHADNEZZAR. See NABUCHADNEZZAR.

NEBULY, or NEBULEE, in *Heraldry*, is when a coat is charged with several little figures, in form of words running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved.

NECESSITY, whatever is done by a cause or power that is irresistible; in which sense it is opposed to freedom. Man is a necessary agent, if all his actions be so determined by the causes preceding each action, that not one past action could possibly not have come to pass, or have been otherwise than it hath been; nor one future action can possibly not come to pass, or be otherwise than it shall be. But he is a free agent, if he be able, at any time, under the circumstances and causes he then is, to do different things; or, in other words, if he be not unavoidably determined in every point of time, by the circumstances he is in, and the causes he is under, to do that one thing he does, and not possibly to do any other thing. Whether man is a necessary or a free agent, is a question which has been debated with much ingenuity by writers of the first eminence, from Hobbes and Clarke, to Priestley and Gregory. See METAPHYSICS, Part III. chap. v. and PREDESTINATION.

NECESSITY, in *Mythology*, a power superior to all other powers, and equally irresistible by gods and by men. Herodotus, as he is quoted by Cudworth, mentions an oracle which declared that "God himself could not shun his destined fate." And among the fragments of Philemon collected by Le Clerc, is the following sentence:

Δουλοι βασιλεων εσμεν, οἱ βασιλεις θεων, ὁ θεος αναγκης.

"We are subject to kings, kings to the gods, and God to Necessity." Hence it is, that, in the Iliad, we find Jove himself, the sire of gods and men, regretting that he was restrained by *Necessity* from rescuing his favourite son from the sword of Patroclus. Nay to such a height was this impiety carried in the earliest ages of Greece, that we find Hesiod and Homer teaching that the gods themselves were generated by *Necessity*, of Night and Chaos.

This power, though always represented as blind and unintelligent, was however worshipped as a goddess, bearing in her hand large iron nails, wedges, anchors, and melted lead *, as emblems of the inflexible severity of her nature. "In the city of Corinth she had a temple, in which the goddess *Violence* likewise resided, and into which no person was ever permitted to enter but the priest who officiated *in sacris* †."

* *Horace*, lib. i. ode 35.

† *Pausanias in Corinth.* cap. iv.

Learned men have exercised their ingenuity in vain attempts to trace this portentous notion to its origin. Some, who wished to interpret it in a pious sense, have supposed that the gods who are subject to *Necessity* were only those who were the ministers of the supreme *numen*; and that by *necessity* itself was meant nothing more than divine providence. But this is not consistent with Hesiod and Homer's Generation of the Gods, or with the epithets *sæva necessitas*, *dura necessitas*, by which this power was perpetually distinguished. Others, and among them Mosheim, have supposed that this monstrous fable was invented by the Pagan priests, and diligently inculcated upon the minds of the people, in order to excuse the villanies of the objects of their worship. For, says he, who could be indignant at Jupiter's numberless adulteries, after it was known that in all his actions he was the servant of blind Necessity: In the thefts of *Mercury*, the whoredoms of *Venus*, and the frequent squabbles of the other gods, there could be no moral turpitude, if they were under the influence of a superior power.

Numina cum videas duris obnoxia fatis,
Invidia possis exonerare deos ‡.

‡ *Martial. Epigram.* lib. ix. N. 88. Ed. Amstel. 1701.

This

Necessity. This account of the matter is at least as plausible as any other which is usually given; but the real case undoubtedly was, that when men "did not like to retain God in their knowledge, God gave them over to a reprobate mind to do those things which are not convenient; when their foolish heart was darkened, and professing themselves to be wise, they became fools." See PARCÆ.

NECESSITY, in *Law*, as it implies a defect of will, excuses from the guilt of crimes. See CRIME.

Compulsion and inevitable *necessity* are a constraint upon the will, whereby a man is urged to do that which his judgement disapproves; and which, it is to be presumed, his will (if left to itself) would reject. As punishments are therefore only inflicted for the abuse of that free will which God has given to man, it is highly just and equitable that a man should be excused for those acts which are done through unavoidable force and compulsion.

1. Of this nature, in the first place, is the obligation of *civil subjection*, whereby the inferior is constrained by the superior to act contrary to what his own reason and inclination would suggest: as when a legislator establishes iniquity by a law, and commands the subject to do an act contrary to religion or sound morality. How far this excuse will be admitted *in foro conscientiæ*, or whether the inferior in this case is not bound to obey the divine rather than the human law, it is not our business to decide; though, among the casuists, it is believed the question will hardly bear a doubt. But, however that may be, obedience to the laws in being is undoubtedly a sufficient extenuation of civil guilt before the municipal tribunal. The sheriff who burnt Latimer and Ridley, in the bigotted days of Queen Mary, was not liable to punishment from Elizabeth for executing so horrid an office; being justified by the commands of that magistracy which endeavoured to restore Superstition, under the holy auspices of its merciless sister, Persecution.

As to persons in private relations, the principal case where constraint of a superior is allowed as an excuse for criminal misconduct, is with regard to the matrimonial subjection of the wife to her husband: for neither a son nor a servant are excused for the commission of any crime, whether capital or otherwise, by the command or coercion of the parent or master; though in some cases the command or authority of the husband, either express or implied, will privilege the wife from punishment, even from capital offences. And therefore, if a woman commit theft, burglary, or other civil offences against the laws of society, by the coercion of her husband, or even in his company, which the law construes a coercion, she is not guilty of any crime; being considered as acting by compulsion, and not of her own will. This doctrine is at least 1000 years old in this kingdom, being to be found among the laws of King Ina the West Saxon. And it appears, that among the northern nations on the continent, this privilege extended to any woman transgressing in concert with a man, and to any servant that committed a joint offence with a freeman: the male or freeman only was punished, the female or slave dismissed; *procul dubio quod alterum libertas, alterum necessitas impelleret.* But (besides that, in our law, which is a stranger to slavery, no impunity is given to servants, who are as much free agents as their masters) even with regard to wives, this rule admits of an exception in crimes that are *mala in se*, and prohibited by the law of nature; as murder, and the like: not only because these are of a deeper dye, but also, since in a state of nature no one is in subjection to another, it would be unreasonable to screen an offender from the punishment due to natural crimes, by the refinements and subordinations of civil society. In treason also (the highest crime which a member of society can, as such, be guilty of), no plea in coverture shall excuse the wife; no presumption of the husband's coercion shall extenuate her guilt: as well because of the odiousness and dangerous consequence of the crime itself, as because the husband, having broken through the most sacred tie of social community by rebellion against the state, has no right to that obedience from a wife, which he himself as a subject has forgotten to pay. In inferior misdemeanours also, we may remark another exception, that a wife may be indicted and set in the pillory with her husband, for keeping a brothel: for this is an offence touching the domestic economy or government of the house, in which the wife has a principal share; and is also such an offence as the law presumes to be generally conducted by the intrigues of the female sex. And in all cases where the wife offends alone, without the company or coercion of her husband, she is responsible for her offence as much as any femme-sole.

2. Another species of compulsion or necessity is what our law calls *duress per minas*; or threats and menaces, which induce a fear of death or other bodily harm, and which take away for that reason the guilt of many crimes and misdemeanors, at least before the human tribunal. But then that fear which compels a man to do an unwarrantable action ought to be just and well grounded; such, "*qui cadere possit in virum constantem, non timidum et meticulosum*," as Bracton expresses it, in the words of the civil law. Therefore, in time of war or rebellion, a man may be justified in doing many treasonable acts by compulsion of the enemy or rebels, which would admit of no excuse in the time of peace. This, however, seems only, or at least principally, to hold as to positive crimes, so created by the laws of society, and which therefore society may excuse; but not as to natural offences, so declared by the law of God, wherein human magistrates are only the executioners of divine punishment. And therefore though a man be violently assaulted, and hath no other possible means of escaping death but by killing an innocent person, this fear and force shall not acquit him of murder; for he ought rather to die himself than escape by the murder of an innocent. But in such a case he is permitted to kill the assailant; for there the law of nature, and self-defence its primary canon, have made him his own protector.

3. There is a third species of necessity, which may be distinguished from the actual compulsion of external force or fear; being the result of reason and reflection, which act upon and constrain a man's will, and oblige him to do an action which without such obligation would be criminal. And that is, when a man has his choice of two evils set before him, and, being under a necessity of choosing one, he chooses the least

pernicious

Necessity

pernicious of the two. Here the will cannot be said freely to exert itself, being rather passive than active; or, if active, it is rather in rejecting the greater evil than in choosing the less. Of this sort is that necessity, where a man by the commandment of the law is bound to arrest another for any capital offence, or to disperse a riot, and resistance is made to his authority: it is here justifiable, and even necessary, to beat, to wound, or perhaps to kill, the offenders, rather than permit the murderer to escape, or the riot to continue. For the preservation of the peace of the kingdom, and the apprehending of notorious malefactors, are of the utmost consequence to the public; and therefore excuse the felony, which the killing would otherwise amount to.

4. There is yet another case of necessity, which has occasioned great speculation among the writers upon general law; viz. whether a man in extreme want of food or clothing may justify stealing either, to relieve his present necessities. And this both Grotius and Puffendorff, together with many other of the foreign jurists, hold in the affirmative; maintaining by many ingenious, humane, and plausible reasons, that in such cases the community of goods, by a kind of tacit concession of society, is revived. And some even of our lawyers have held the same; though it seems to be an unwarranted doctrine, borrowed from the notions of some civilians; at least it is now antiquated, the law of England admitting no such excuse at present. And this its doctrine is agreeable not only to the sentiments of many of the wisest ancients, particularly Cicero, who holds, That *suum cuique incommodum ferendum est, potius quam de alterius commodis detrahendum*; but also to the Jewish law, as certified by King Solomon himself: "If a thief steal to satisfy his soul when he is hungry, he shall restore sevenfold, and shall give all the substance of his house:" which was the ordinary punishment for theft in that kingdom. And this is founded upon the highest reason: for men's properties would be under a strange insecurity, if liable to be invaded according to the wants of others; of which wants no man can possibly be an adequate judge but the party himself who pleads them. In England especially, there would be a peculiar impropriety in admitting so dubious an abuse: for by the laws such sufficient provision is made for the poor by the power of the civil magistrate, that it is impossible that the most needy stranger should ever be reduced to the necessity of thieving to support nature. The case of a stranger is, by the way, the strongest instance put to Baron Puffendorff, and whereon he builds his principal arguments: which, however they may hold upon the continent, where the parsimonious industry of the natives orders every one to work or starve, yet must lose all their weight and efficacy in England, where charity is reduced to a system, and interwoven in our very constitution. Therefore our laws ought by no means to be taxed with being unmerciful, for denying this privilege to the necessitous; especially when we consider, that the king, on the representation of his ministers of justice, hath a power to soften the law, and to extend mercy in cases of peculiar hardship. An advantage which is wanting in many states, particularly those which are democratical: and these have in its stead introduced and adopted, in the body of the law itself, a multitude of circumstances tending to alleviate its rigour. But the founders of our constitution thought it better to vest in the crown the power of pardoning particular objects of compassion, than to countenance and establish theft by one general undistinguishing law.

Necho, Neck.

NECHO, king of Egypt, began his reign 690 B. C. and was killed eight years after by Sabacon king of Ethiopia. Psammiticus his son succeeded him, and was the father, as Herodotus informs us, of Necho II. who reigned in the 616 B. C. This Necho II. is celebrated in history for attempting, though in vain, to cut a canal from the Nile to the Arabian gulf. He carried his arms as far as the Euphrates, and conquered the city of Carchemish. This prince is not only known in Scripture under the name of *Necho*, but also in profane history. He no sooner succeeded to the crown than he raised great land armies, and fitted out vast fleets, as well upon the Mediterranean as upon the Red Sea: he gave battle to the Syrians near the city of Migdol; routed them, and made himself master of the city of Cadytis. The learned, however, are not agreed about this city Cadytis. Some will have it to be Cades in Arabia Petræa, others Jerusalem; and others say it is the city of Cedes, or Kedesh, in Galilee, in the tribe of Naphtali.

The Scriptures acquaint us with the whole expedition of Necho in all its particulars, 2 King xxiii. 29. &c. and 2 Chr. xxxv. 20, 21, &c. In the year of the world 3394, this prince having drawn out his army into the field to make war with the Assyrians or Babylonians, and to take the city of Carchemish, otherwise called *Circusium*, upon the Euphrates, Josiah king of Judah, who was a tributary to the king of Babylon, marched to oppose his passage. Necho, who had no designs against him, sent to tell him, "What have I to do with you, king of Judah? It is not against you that I am come forth, but against another people, against whom the Lord has commanded me to make war. Leave off therefore to set yourself against me for fear the Lord should punish you for your resistance." But Josiah would not hearken to the remonstrances of Necho, but gave him battle at Megiddo, where he received the wound of which he died. The people of Jerusalem set up Jehoahaz for king of Judah, and Necho soon passed forwards, without making any longer stay in Judea.

But at his return from his expedition, which was very successful, he halted at Riblah in Syria; and sending for Jehoahaz king of the Jews, he deposed him, loaded him with chains, and sent him into Egypt. Then coming to Jerusalem, he set up Eliakim, or Jehoiakim, in his place, and exacted the payment of 100 talents of silver and one talent of gold from the country. Jeremiah (xlvi. 2.) acquaints us, that the city of Carchemish was taken from Necho by Nebuchadnezzar king of Babylon, in the fourth year of Jehoiakim king of Judah; so that Necho did not enjoy his conquest above four years. Josephus adds, that the king of Babylon pursuing his victory, brought under his dominion all the country which is between the Euphrates and Egypt, excepting Judea. Thus Necho was again reduced within the limits of his own country.

NECK, in *Anatomy*, is the slender part situated between

Necrolium || Necromancy. tween the head and trunk of the body. See ANATOMY.

NECROLIUM, a word used by some of the alchemical writers to express a remedy almost always capable of averting death, and continuing life to its utmost period.

NECROLOGY, *necrologium*, formed of νεκρος, "dead," and λογος, "discourse or enumeration," a book anciently kept in churches and monasteries, wherein were registered the benefactors of the same, the time of their deaths, and the days of their commemoration; as also the deaths of the priors, abbots, religious, canons, &c. This was otherwise called *calender* and *obituary*.

NECROMANCY, the art of revealing future events by a pretended communication with the dead.

This superstitious and impious imposture appears to have had its origin at a very early period in Egypt, and to have been thence propagated in every nation with the manners of which history has made us acquainted. The conquests of Sesostris might introduce it into India; the Israelites would naturally borrow it from the people among whom they sojourned 400 years; and it would easily find its way into Phœnicia, from the vicinity of that country to the land of its nativity. From the Egyptians and Phœnicians it was adopted, with the other rites of paganism, by the Greeks; and it was imported into Rome with Grecian literature and Grecian manners. It was not however confined to the pagan nations of antiquity: it spread itself through all the modern nations of Europe, and took such deep root as to be long retained even after those nations were converted to the Christian faith.

Of its early antiquity we have complete evidence in the writings of Moses, where it is severely condemned as an abomination to the Lord *; and though it appears to have been even then spread into Phœnicia, we might yet conclude its birth-place to have been Egypt, because, at their *exody*, the Israelites were corrupted only by Egyptian superstitions, and because necromancy seems to be one of those whoredoms which the prophet Ezekiel represents his countrymen as having brought with them from Egypt, and continued to practise till they were carried captives into Babylon.

* Deut. xviii. 10, 11, 12.

If from sacred we proceed to consult profane authors, we shall find them not only affirming Egypt to have been the birthplace of necromancy, but in some degree accounting for the origin of so impious a delusion. From Diodorus the Sicilian † we learn, that the Grecian fable of *Charon* the ferryman of hell, of *Styx*, *Cocytus*, the *Elysian Fields*, *Tartarus*, the judgement of *Minos* and *Rhadamanthus*, &c. with the whole scenery of the infernal regions, were imported from Egypt into Greece. The ancient Egyptians, and indeed all the people of the east, made use of caves for burying places, which were well suited to the solemn sadness of the surviving friends, and proper receptacles for those who were never more to behold the light. In Egypt, many of those subterraneous cavities, being dug out of the natural rock, still remain, and command the admiration of travellers; and near to the pyramids in particular there are some apartments of a wonderful fabric, which though they extend in length 4400 feet, and are about 30 feet in depth, appear to have been, if not entirely dug, at least reduced to form by the chisel or pickaxe of the artist.

† Lib. i. § 2.

From the practice of burying in such caverns sprung the opinion that the infernal mansions were situated somewhere near the centre of the earth, which by the Egyptians was believed to be not very distant from its surface ‡. In these dreary mansions, it was very easy for such adepts as the priests of Egypt to fabricate Erebus, Tartarus, the Elysian Fields, and all those scenes which were displayed before the initiated (see MYSTERIES), and by them described to the million of the people. As it was in those dark abodes that necromancy was practised, it would be no difficult matter for such magicians as withstood Moses to impose so far upon the credulous vulgar, as to make them believe, that in consequence of their invocations they actually saw the ghosts of their friends ascend out of the earth. It appears from the book of Exodus, that the Israelitish women were, even in the wilderness, well acquainted with the use of the mirror, which was therefore undoubtedly known to the Egyptians. But a mirror of a particular form and properly illuminated at the instant required, might easily be made to reflect, in a cavern from which all other light was carefully excluded, the image of the deceased, who was called upon by the necromancer; and we can readily conceive, that with respect to the question to be proposed, a person might be concealed, prepared to give such ambiguous answers as would satisfy the inquirer, and at the same time save the credit of the oracle. The terrified imaginations of the spectators would aid the delusion, and make a very slight resemblance pass for the ghost or ειδωλον of their departed friend; or the necromancer might assign plausible reasons why a spectre, after having dwelt for some time in the infernal regions, should lose something of its resemblance to the body which it animated. Such juggling tricks, though performed by artists less accomplished than Jannes and Jambres, have gained credit among people much more enlightened than the Egyptians can possibly have been when the science of necromancy was invented by their priests.

‡ *Bryant's Analysis of Mythology.*

That the Israelites, notwithstanding the prohibition of their legislator, continued to practise the rites of necromancy, is apparent from Saul's transaction with the witch of Endor (see MAGIC). From the same transaction, it is likewise apparent that the witches of Israel, and therefore in all probability the necromancers of Egypt, pretended to evocate the ghosts of the dead by a *demon* or *familiar spirit*, which they had at their command to employ upon every emergency. This demon was called OB; and therefore Saul desires his servants to find him a woman who was mistress of an OB (A). It

(A) The original, or radical, signification of this word occurs in Job xxxii. ver. 19.; where Elihu compares his belly to new bottles, which he calls *oboth*, the plural of *ob*. But as bottles were then made of leather, new bottles filled with wine and ready to burst, as Elihu describes them, would of course be of a form nearly globular.

Necromancy.

It is probable that thoſe wretched impoſtors had in their pay ſome perſons who occaſionally acted the part of the demon, and when the execution of the plot required their agency, emitted, by means of a cavity dug for that purpoſe, a low hollow voice from below the ground. Hence we find Iſaiah, in his denunciations againſt Ariel †, ſaying, "Thou ſhalt be brought down, and ſhalt ſpeak out of the ground; and thy ſpeech ſhall be low out of the duſt, and thy voice ſhall be as of one that hath a familiar ſpirit (an OB) out of the ground, and thy ſpeech ſhall whiſper out of the duſt."

† Chap. xxix. 4.

But though the Egyptian prieſts were undoubtedly the inventors of the whole myſtery of necromancy, and though it was from them imported into Greece by the SELLI or prieſts of Dodona, it does not appear that the Grecian necromancers pretended to be maſters of OBS or familiar ſpirits. Mopſus, Orpheus, Linus, Eumolpus, &c. who either travelled into Egypt in queſt of knowledge, or were actually natives of that country, inſtructed the early Greeks in this occult ſcience: but whatever might be the practice of theſe apoſtles themſelves, their diſciples profeſſed to do all the feats of magic by performing certain rites, by offering certain ſacrifices, by muttering a certain form of words, by charms, ſpells, and exorciſms. By theſe they pretended to evocate the dead as certainly as the Egyptians and Jews did by their *familiar ſpirits*. By a ſmall diſplay of critical learning this might be eaſily proved from the popular ſtory of Orpheus and Eurydice, which certainly was founded on one of theſe necromantic deceptions exhibited in a cave near Dodona, where the prieſts had a *hades* or infernal manſion, in humble imitation of thoſe with which the firſt of them were well acquainted in Egypt. It is indeed evident, without the aid of criticiſm: no man of any letters is ignorant, that whatever ſuperſtitions of this kind prevailed among the Romans were borrowed from the Greeks. But we all know that Virgil makes one of his ſhepherds, by means of certain herbs, poiſons, and ſenſeleſs charms, raiſe up ghoſts from the bottoms of their graves; and Lucan has fabricated a ſtory of this kind, which may be conſidered as an exact parallel to the witch of Endor. Juſt before the battle of Pharſalia he makes ‡ young Pompey travel by night to a Theſſalian ſorcereſs, and anxiouſly inquire of her the iſſue of the war. This female necromancer, by a tedious proceſs of charms and incantations, conjures up the ghoſt of a ſoldier who had been lately ſlain. The phantom, after a long preamble, denounces a prediction much of the ſame kind with that which the king of Iſrael received from Samuel at Endor; and though we have elſewhere ſhown, that nothing but the ſpirit of God could have foreſeen the inevitable deſtruction of Saul, his ſons, and his army (ſee MAGIC), it was very eaſy for any man of tolerable ſagacity to foreſee the defeat of Pompey's raw and undiſciplined troops by the hardy veterans of the victorious Cæſar.

‡ Lib. vi. ver. 570. et ſeq.

It would be endleſs to enumerate all the fallacious evocations of ghoſts, and the ambiguous reſponſes returned by thoſe pretended ſpirits, of which we have accounts from the poets and hiſtorians of the celebrated nations of antiquity. We ſhall therefore proceed to mention a few which occur in the fabulous hiſtory of more modern nations, and then leave the ſubject to the meditation of our readers. In Mallet's Northern Antiquities, we have the following account of a necromantic exploit, between which, and the deſcent of the ancient heroes into hell, it is impoſſible not to remark a ſtriking ſimilitude.

"Odin the ſovereign of man ariſes. He ſaddles his horſe Sleipner; he mounts, and is conveyed to the ſubterraneous abode of *Hela*. The dog which guards the gates of death meets him. His breaſt and his jaws are ſtained with blood. He opens his voracious mouth to bite, and barks a long time at the father of magic. Odin purſues his way; and the infernal cavern reſounds and trembles under his horſe's hoofs. At length he reaches the deep abode of death, and ſtops near the eaſtern gate, where ſtands the tomb of the propheteſs. He ſings with a voice adapted to call up the dead; he looks towards the world; he engraves Runic characters on her tomb; he utters myſterious words; and he demands an anſwer, until the propheteſs is conſtrained to ariſe and thus utter the words of the dead.—"Who is this unknown that dares to diſturb my repoſe, and drag me from the grave, in which I have been dead ſo long, all covered with ſnow, and moiſtened with the rains?" &c.

The Gaelic druids pretended to be maſters of the ſame ſecret. This is evident from the name of a ſpecies of divination, not uncommon among the Scotch Highlanders ſo lately as in the beginning of the 18th century. By a gentleman excellently verſed in the antiquities of that people, and a ſteady friend to the writer of this article, we have been informed, that not many years ago ſome of the Highlanders relied implicitly upon certain oracular reſponſes, called in their language *taghairm*. This word ſeems to be compounded of *ta*, which in ſome parts of the Highlands is ſtill uſed to denote a ſpirit or ghoſt, and *ghairm*, which ſignifies *calling upon* or invoking. *Taghairm*, therefore, in its original import, is *necromancy* in the moſt proper ſenſe of that word.

There were different kinds of *taghairm*, of which one was very lately practiſed in *Skye*. The diviner covered himſelf with a cow's hide, and repaired at night to ſome deep-ſounding cave, whither the perſon who conſulted

---

lar. Hence it may be inferred that the original import of *ob* was *round* or *globular*: but *b* and *p* being labials, are often changed into each other; and therefore, from the Hebrew *ob* is derived the Greek ὀψ, *oculus*, ὀπτομαι, *video*, and the Latin *ops*, a name under which the earth was worſhipped. *Upis* was a name of Diana or the moon: the father of one of the Dianas was likewiſe *Upis*; but this *Upis* was undoubtedly the ſun. Now the difference between *upis* and *opis* is nothing; hence we are led to believe, that as they are all derived from *ob*, this word was employed by the early idolaters of Egypt to denote the firſt and greateſt of Pagan gods, the ſun. If ſo, thoſe wretches who pretended to be miſtreſſes of *obs*, were exactly the ſame kind of impoſtors with the Pythoneſſes of the Greeks.

Necromancy. sulted him followed soon after without any attendants. At the mouth of the cave he proposed aloud the questions of which he wanted solutions; and the man within pronounced the responses in a tone of voice similar to that with which the OBS, or pretended demons of antiquity, gave from beneath the ground their oracular answers. That in the latter days of *taghairm*, the Gaelic diviners pretended to evocate ghosts, and from them to extort solutions of difficulties proposed, we have no positive evidence; but that such was the original pretence there can be little doubt, when we reflect either upon the place where this species of divination was practised, or upon the import of the word by which it was denominated.

As we have been led to mention *taghairm*, we shall beg leave to make a few observations on another species of it, called *taghairm an uisge*, or "*taghairm* by water." This too was last practised in the Isle of Skye, by a man of the name of *M'Cuidhean*, whose ancestors had long been famous for the art. He lived near a beautiful cascade on a small river; and when consulted on any matter of consequence, he covered his whole body with a cow's hide, that necessary implement of Highland divination, and placed himself between the water of the cascade and the rock over which it flowed. Then another man with a heavy pole gave repeated strokes to the water, and the diviner behind it crying out now and then in Gaelic, "Is this a stock of arn?" This operation was continued till M'Cuidhean was perceived to be frantic or furious, when he was considered as in a condition to answer the most important questions. He was frequently consulted about futurity; and though he could not, in the proper sense of the word, be called a *necromancer*, his responses were listened to as proceeding from something more than human. A degree of frenzy, either real or affected, seems to have accompanied the predictions of certain kinds of diviners in all ages; and we cannot help remarking the similarity between the madness of M'Cuidhean and that of the Sibyl in the sixth book of the Æneid; though we cannot suppose the one to have been borrowed from the other.

At, Phœbi nondum patiens, immanis in antro
Bacchatur vates, magnum si pectore possit
Excussisse Deum: tanto magis ille fatigat
Os rabidum, fera corda domans, fingitque premendo.

Struggling in vain, impatient of her load,
And lab'ring underneath the pond'rous god;
The more she strove to shake him from her breast,
With more and far superior force he press'd.
DRYDEN.

That all these pretences, whether ancient or modern, to the power of divination by means of familiar spirits, or by the art of necromancy, were groundless as well as impious, it would be affronting the understandings of our readers to offer any proof. Under the article MAGIC we have said enough on the subject, and perhaps more than enough, to those who know that demons, if they have any existence, and the departed spirits of good and bad men, are all under the controul of Him who governs the intellectual as well as material world by fixed and equal laws.—These details of superstition, however, will not be useless, if, by showing how poor and wretched a creature man becomes when left to his own inventions, they shall make any one grateful for the benefits of good government, and the blessings of revealed religion.

Necropolis || Nectarium.

NECROPOLIS, a suburb of Alexandria in Egypt. It signifies "the City of the Dead;" wherein there were temples, gardens, and superb mausoleums. Here Cleopatra is said to have applied the aspic to her breast, to prevent being led in triumph by Augustus, who endeavoured to save her.

NECROSIS, νεκρωσις, in *Medicine*, a complete mortification of any part; called also *sideratio* and *sphacelus*.

NECTANEBUS, or NECTANABIS, a king of Egypt, who defended his country against the Persians. His grandson of the same name made an alliance with Agesilaus king of Sparta, and with his assistance he quelled a rebellion of his subjects. Some time after he was joined by the Sidonians, Phœnicians, and inhabitants of Cyprus, who had revolted from the king of Persia. This powerful confederacy was soon attacked by Darius the king of Persia, who marched at the head of his troops. Nectanebus, to defend his frontiers against so dangerous an enemy, levied 20,000 mercenary soldiers in Greece, the same number in Libya, and 60,000 were furnished in Egypt. This numerous body was not equal to the Persian forces, and Nectanebus, defeated in a battle, gave up all hopes of resistance, and fled into Ethiopia, where he found a safe asylum. His kingdom of Egypt became from that time tributary to the king of Persia.

NECTAR, among ancient poets, the drink of the fabulous deities of the heathens; in contradistinction from their solid food, which was called *ambrosia*.

NECTARINE, a fruit differing in nothing from the common peach, of which it is a species, but in having a smoother rind and a firmer pulp. See PERSICA.

NECTARIUM, from *nectar*, the fabled "drink of the gods;" defined by Linnæus to be a part of the corolla, or appendage to the petals, appropriated for containing the honey, a species of vegetable salt under a fluid form, that oozes from the plant, and is the principal food of bees and other insects.

Notwithstanding this definition, which seems to consider the nectarium as necessary a part of the corolla as the petals, it is certain that all flowers are not provided with this appendage, neither indeed is it essential to fructification.

There is, besides, a manifest impropriety in terming the nectarium a part of the corolla. Linnæus might, with equal propriety, have termed it a part or appendage of the stamina, calyx, or pointal, as the appearance in question is confined to no particular part of the flower, but is as various in point of situation as of form. The truth is, the term *nectarium* is exceedingly vague; and, if any determinate meaning can be affixed to it, is expressive of all the singularities which are observed in the different parts of flowers. *Milne's Bot. Dict.*

The tube, or lower part of flowers with one petal, Linnæus considers as a true nectarium, because it is generally found to contain the sweet liquor formerly mentioned. This liquor Pontedera compares to that called *amnios* in pregnant animals, which enters the fertile or impregnated seeds: but that this is not at least

least its sole use, is evident from this circumstance, that the honey or liquor in question is to be found in flowers where there are either no seeds, or those which, from the want of male organs, cannot be impregnated. Thus the male flowers of nettle and willow, the female flowers of sea-side laurel and black bryony, the male and female flowers of clutia, kiggelaria, and butcher's broom, all abound with the honey or nectar alluded to.

Vaillant was of opinion, that the nectarium was an essential part of the corolla; for which reason he distinguished the singular appearances in fennel flower and columbine by the name of *petals*: the coloured leaves which are now termed the *petals* he denominates the *flower cup*.

That the nectarium, however, is frequently distinct from the petals, is evident both from the well known examples just mentioned, as likewise from the flowers of monkshood, hellebore, isopyrum, fennel flower of Crete, barrenwort, grass of Parnassus, chocolate nut, cherleria, and sauvagesia.

These general observations being premised, we proceed to take a nearer and more particular view of the principal diversities, both in form and situation, of this striking appendage to the flower. 1. In many flowers the nectarium is shaped like a spur or horn; and that either in flowers of one petal, as valerian, water milfoil (*utricularia*), butterwort, and calves-snout; or in such as have more than one, as larkspur, violet, fumitory, balsam, and orchis. 2. In the following plants, the nectarium is properly a part of the corolla, as lying within the substance of the petals: ranunculus, lily, iris, crown imperial, water leaf, mouse tail, ananas or pine apple, dog's-tooth violet, piperidge bush, vallisneria, hermannia, uvularia, and swertia. 3. The nectarium is frequently placed in a series or row within the petals, though entirely unconnected with their substance. In this situation it often resembles a cup, as in narcissus. A nectarium of this kind is said by Linnæus to crown the corolla. The following are examples: daffodil, sea daffodil, campion, viscous campion, swallow-wort, stapelia, cynanchum, nepenthes, cherleria, balsam-tree, African spiræa, witch-hazel, olax, and passion-flower. 4. In Indian-cress, buckler, mustard, Barbadoes cherry, and monotropa, the nectarium is situated upon or makes part of the calyx. 5. The nectarium in bastard flower-fence is seated upon the antheræ or tops of the stamina; whence the name *adenanthera*, or *glandular anthera*, which has been given to this genus of plants. In the following list it is placed upon the filaments; bean-caper, bay, fraxinella, marvel of Peru, bell-flower, lead-wort, roella, and commelina. 6. In hyacinth, flowering-rush, stock July flower, and rocket, the nectarium is placed upon the seed-bud. 7. In honey-flower, orpine, buckwheat, collinsonia, lathræa, navelwort, mercury, clutia, kiggelaria, sea-side laurel, and African spiræa, it is attached to the common receptacle. Lastly, In ginger, nettle, dyer's weed, heart-seed, costus, turmeric, grewia, bastard-orpine, vanelloe, shrew-tree, and willow, the nectarium is of a very singular construction, and cannot properly fall under any of the foregoing heads.

In discriminating the genera, the nectarium often furnishes an essential character.

Plants which have the nectarium distinct from the petals, that is, not lodged within their substance, ar affirmed by Linnæus to be generally poisonous. The following are adduced as examples: monkshood, hellebore, columbine, fennel-flower, grass of Parnassus, barren-wort, oleander, marvel of Peru, bean-caper, succulent swallow-wort, fraxinella, and honey-flower.

NECUIA, in *Botany*, a name given by the ancient Greeks to a species of mullein.

The Greeks and Romans both used the stalks of a peculiar kind of mullein, called *thryallis* by Nicander. For the making of wicks of lamps we have a kind of mullein called *lychnites*, and candle-wick mullein, from the λυχνιτις of Dioscorides; but it is not certain that ours is the same plant.

The ancients used the stalks of many different plants for the wicks of their candles and lamps. The rush, stripped of its bark, was as commonly in use with them as with us for this purpose; and they also used the nettle, this mullein, and many other plants, whose stalks were composed of tough filaments, for the same purpose; beating them out like hemp, and when dry dipping them in melted resin, and other such inflammable substances. When thus prepared, they are readily inflammable, like our flambeau; and this mullein, having stalks more long and large, and more firm than all the others, was used to make those lights with which they set fire to the funeral pile, for consuming the ashes of their dead friends.

NECYDALIS, a genus of insects belonging to the order of coleoptera. See ENTOMOLOGY *Index*.

NEEDHAM, JOHN TUBERVILLE, was born at London the 10th of September in the year 1713. His parents were descended from ancient and noble families. His father, who had once possessed a considerable patrimony at Hilston, in the county of Monmouth, was of the younger and Catholic branch of the Needham family: the head of the elder and Protestant branch was Lord Kilmory, created viscount in the year 1625. The father of Mr Needham died young, and left but a small fortune to his four children. His eldest son, who is the subject of this article, prosecuted his studies under the secular clergy of the English college of Douay, where he took orders, taught rhetoric for several years, gave eminent proofs of sagacity and genius, and surpassed all the other professors of that seminary in the knowledge of experimental philosophy. In 1740, he was engaged by his superiors in the service of the English mission, and was intrusted with the direction of the school erected at Twyford, near Winchester, for the education of the Roman Catholic youth. In 1744, he was appointed professor of philosophy in the English college at Lisbon, where, on account of his bad health, he remained only 15 months. After his return, he passed several years at London and Paris, which were principally employed in microscopical observations, and in other branches of experimental philosophy. The results of these observations and experiments were published in the Philosophical Transactions of the Royal Society of London in 1749, and in a volume in 12mo at Paris in 1750; and an account of them was also given by M. de Buffon, in the first volumes of his Natural History. There was an intimate connexion between this illustrious French naturalist and Mr Needham: they made their experiments and observations together;

Needham ‖ Needle.

gether; though the refults and fyftems which they deduced from the fame objects and operations were totally different. Mr Needman was admitted to a place in the Royal Society of London in the year 1747, and in the Antiquarian Society fome time after. From the year 1751 to 1767 he was chiefly employed in finifhing the education of feveral Englifh and Irifh noblemen, by attending them as tutor in their travels through France, Italy, and other countries. He then retired from this wandering life to the Englifh feminary at Paris, and in 1768 was chofen by the Royal Academy of Sciences in that city a correfponding member.

When the regency of the Auftrian Netherlands, in order to the revival of philofophy and literature in that country, formed the project of an Imperial academy, which was preceded by the erection of a fmall literary fociety to prepare the way for its execution, Mr Needham was invited to Bruffels by Count Cobentzel and the prefident Neny, and was appointed fucceffively chief director of both thefe foundations. He held this place, together with fome ecclefiaftical preferments in the Low Countries, until his death, which happened the 30th of December 1781. "His piety, temperance, and purity of manners (we follow the expreffions of the abbé Mann) were eminent: his attachment to the doctrines and duties of Chriftianity was inviolable. His zealous oppofition to modern infidels was indefatigable, and even paffionate. His probity was untainted. He was incapable of every fpecies of duplicity; his beneficence was univerfal, and his unfufpicious candour rendered him often a dupe to perfidy." Thefe and other good qualities the panegyrift attributes to his deceafed friend; and the learned authors of the Monthly Review, to whom Mr Needham was known, admit the juftnefs of the panegyric. He was undoubtedly (fay they), both an honeft man and a worthy citizen; but though his death be a real lofs to the literary world, yet he died feafonably for himfelf; for had he lived to fee Jofeph II. and the Great, making fo free with the paint, patches, and trinkets of the mother church, confifcating her lands, abolifhing her convents, fuppreffing her holidays, introducing common fenfe into her worfhip, erecting political conductors to difperfe the thunder of the Vatican, and achieving many other things in this ftyle of improvement, it would have vexed full fore his feeling heart. For this honeft man was narrow even to fuperftition and bigotry in his religious fyftem; and we never knew a man in whom there was fuch an unaccountable mixture of implicit faith and philofophical curiofity as in Mr Needham. He was a keen and judicious obferver of nature, had a peculiar dexterity in confirming his obfervations by experiments, and he was always occupied (fometimes indeed with too much fancy and precipitation) in generalizing facts, and reducing them to his fyftem. "His pen (fays Abbé Mann) was neither remarkable for fecundity nor method: his writings are rather the great lines of a fubject expreffed with energy, and thrown upon paper in a hurry, than finifhed treatifes." His works are well known both in Britain and in France.

Needham, a town in Suffolk, 73 miles from London, ftands on the Orwell, 9 miles from Ipfwich, in the road to Huntingdonfhire.

NEEDLE, a very common little inftrument or utenfil made of fteel, pointed at one end, and pierced at the other, ufed in fewing, embroidery, tapeftry, &c.

Needle.

Needles make a very confiderable article in commerce, though there is fcarce any commodity cheaper, the confumption of them being almoft incredible.—The fizes are from N° 1. the largeft, to N° 25, the fmalleft. In the manufacture of needles, German and Hungarian fteel is of moft repute.

In the making of them, the firft thing is to pafs the fteel through a coal fire, and under a hammer, to bring it out of its fquare figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing iron, and returned into the fire, and drawn through a fecond hole of the iron fmaller than the firft; and thus fucceffively from hole to hole, till it has acquired the degree of finenefs required for that fpecies of needles; obferving every time it is to be drawn, that it be greafed over with lard, to render it more manageable. The fteel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. Thefe pieces are flattened at one end on the anvil, in order to form the head and eye: they are then put into the fire to foften them farther; and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well-tempered fteel, and laid on a leaden block to bring out, with another puncheon, the little piece of fteel remaining in the eye. The corners are then filed off the fquare of the heads, and a little cavity filed on each fide of the flat of the head; this done, the point is formed with a file, and the whole filed over: they are then laid to heat red hot on a long narrow iron, crooked at one end, in a charcoal fire; and when taken out thence, are thrown into a bafon of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them foft; the medium is learned by experience. When they are thus hardened, they are laid in an iron fhovel, on a fire more or lefs brifk in proportion to the thicknefs of the needles; taking care to move them from time to time. This ferves to temper them, and take off their brittlenefs; great care here too muft be taken of the degree of heat. They are then ftraightened one after another with the hammer, the coldnefs of the water ufed in hardening them, having twifted the greateft part of them.

The next procefs is the polifhing them. To do this, they take 12,000 or 15,000 needles, and range them in little heaps againft each other on a piece of new buckram fprinkled with emery duft. The needles thus difpofed, emery-duft is thrown over them, which is again fprinkled with oil of olives; at laft the whole is made up into a roll, well bound at both ends. This roll is then laid on a polifhing table, and over it a thick plank loaded with ftones, which two men work backwards and forwards a day and a half, or two days, fucceffively; by which means the roll thus continually agitated by the weight and motion of the plank over it, the needles withinfide being rubbed againft each other with oil and emery, are infenfibly polifhed. After polifhing they are taken out, and the filth wafhed off them with hot water and foap: they are then wiped in hot bran, a little moiftened, placed with the needles in a round box, fufpended in the air by a cord, which is kept ftirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden veſſels, to have the good ſeparated from thoſe whoſe points or eyes have been broken either in poliſhing or wiping; the points are then all turned the ſame way, and ſmoothed with an emery ſtone turned with a wheel. This operation finiſhes them, and there remains nothing but to make them into packets of 250 each. Needles were firſt made in England by a native of India, in 1545, but the art was loſt at his death; it was, however, recovered by Chriſtopher Greening in 1560, who was ſettled with his three children, Elizabeth, John, and Thomas, by Mr Damar, anceſtor of the preſent Lord Milton, at Long Crendon in Bucks, where the manufactory has been carried on from that time to this preſent day.

Plate CCCLXIX. fig. 1. *Dipping-Needle*, or *Inclinatory Needle*, a magnetical needle, ſo hung, as that, inſtead of playing horizontally, and pointing out north and ſouth, one end dips, or inclines to the horizon, and the other points to a certain degree of elevation above it.

The dipping-needle was invented in the year 1576, by one Robert Norman, a compaſs-maker at Wapping. The occaſion of the diſcovery, according to his own account, was, that it being his cuſtom to finiſh and hang the needles of his compaſſes before he touched them, he always found, that immediately after the touch, the north-point would bend or incline downward, under the horizon; inſomuch that, to balance the needle again, he was always forced to put a piece of wax on the ſouth end as a counterpoiſe. The conſtancy of this effect led him at length to obſerve the preciſe quantity of the dip, or to meaſure the greateſt angle which the needle would make with the horizon; and this at London he found to be 71° 50′. In 1723 Mr Graham made a great many obſervations on the dipping needle, and found the angle to be between 74 and 75 degrees. Mr Nairne, in 1772 found it to be ſomewhat above 72°. It is not certain whether the dip varies, as well as the horizontal direction, in the ſame place. The trifling difference between Mr Norman and Mr Nairne would lead us to imagine that the dip was unalterable; but Mr Graham, who was a very accurate obſerver, makes the difference more conſiderable. It is certain, however, from a great number of experiments and obſervations, that the dip is variable in different latitudes, and that it increaſes in going northwards. It appears from a table of obſervations made with the marine dipping-needle in a voyage towards the north pole in 1733, that in lat. 60. 18. the dip was 75°; and in lat. 70. 45. it was 77° 52′; in lat. 80. 12. it was 81° 52′; and in lat. 80. 27. it was 82° 2½′.

Several authors have endeavoured to apply this diſcovery of the dip to the finding of the latitude; and Mr Bond attempted to apply it to the finding of the longitude alſo; but for want of obſervations and experiments he could not make any progreſs. The affair was farther proſecuted by Mr Whiſton, who publiſhed a treatiſe on the longitude, and for ſome time imagined it was poſſible to find it exactly by means of the dip of the needle; yet he at laſt deſpaired of it, for the following reaſons; 1. The weakneſs of the magnetic power. 2. The concuſſion of the ſhip, which he found it exceedingly difficult to avoid ſo much as was neceſſary for the accuracy of the experiments. 3. The principal objection was an irregularity in the motions of all magnetic needles, both horizontal and dipping, by which they, within the compaſs of about a degree, vary uncertainly backward and forward; even ſometimes in a few hours time, without any evident cauſe. For a particular account of theſe variations, both of the horizontal and dipping needle, ſee the article Variation.

Mr Nairne made a dipping needle in 1772 for the Board of Longitude, which was uſed in the voyage towards the north pole. This is repreſented at fig. 2. The needle AA is 12 inches long, and its axis, the ends BB of which are made of gold, alloyed with copper, reſts on friction wheels CCCC, of four inches diameter, each end on two friction wheels; which wheels are balanced with great care. The ends of the axis of the friction wheels are likewiſe of gold alloyed with copper, and moved in ſmall holes made in bell metal; and oppoſite to the ends of the axes of the needle and the friction wheels, are flat agates, ſet in at DDD, finely poliſhed. The magnetic needle vibrates within a circle of bell metal, EEE, divided into degrees and half degrees; and a line, paſſing through the middle of the needle to the ends, points to the diviſions. The needle of this inſtrument was balanced before it was made magnetical; but by means of a croſs, the ends of which are FFFF, (contrived by the reverend Mr Mitchell) fixed on the axis of the needle, on the arms of which are cut very fine ſcrews to receive ſmall buttons, that may be ſcrewed nearer or farther from the axis, the needles may be adjuſted both ways to a great nicety, after being made magnetical, by reverſing the poles, and changing the ſides of the needle. GG are two levels, by which the line of 0 degrees of the inſtrument is ſet horizontal, by means of the four adjuſting ſcrews LLLL; H is the perpendicular axis, by which the inſtrument may be turned, that the divided face of the circle may front the eaſt or weſt; to this axis may be fixed an index I, which points to an oppoſite line on the horizontal plate K when the inſtrument is turned half round; MMMM are ſcrews which hold the glaſs cover to keep the needle from being diſturbed by the wind. When this needle is conſtructed for ſea, it is ſuſpended by an univerſal joint on a triangular ſtand, and adjuſted vertically by a plumb line and button above the divided circle and the dovetail work at the upper 90; and the diviſions on the circle are adjuſted ſo as to be perpendicular to the horizon by the ſame plumb line, and an adjoining ſcrew; and when it is adjuſted, a pointer annexed to a ſcrew, which ſerves to move the divided circle, is fixed at the loweſt 90. Whenever the inſtrument is uſed to find the dip, it muſt be ſo placed that the needle may vibrate exactly in the magnetic meridian. Fig. 2.

Magnetical Needle, in *Navigation*, a needle touched with a loadſtone, and ſuſtained on a pivot or centre; on which playing at liberty, it directs itſelf to certain points in or under the horizon; whence the magnetical needle is of two kinds, viz. horizontal or inclinatory. See the article Magnet.

Horizontal needles are thoſe equally balanced on each ſide of the pivot that ſuſtains them, and which, playing horizontally with their two extremes, point out the north and ſouth points of the horizon. For their application and uſe, ſee the article Compass.

In the conſtruction of the horizontal needle, a piece of pure ſteel is provided; of a length not exceeding ſix inches,

inches, left its weight should impede its volubility; very thin, to take its verticity the better; and not pierced with any holes, or the like, for ornament sake, which prevent the equable diffusion of the magnetic virtue. A perforation is then made, in the middle of its length, and a brass cap or head soldered on, whose inner cavity is conical, so as to play freely on a style or pivot headed with a fine steel point. The north point of the needle in our hemisphere is made a little lighter than the southern; the touch always destroying the balance, if well adjusted before, and rendering the north end heavier than the south, and thus occasioning the needle to dip.

The method of giving the needle its verticity or directive faculty has been shown already under the article MAGNET; but if, after touching, the needle be out of its equilibrium, something must be filed off from the heavier side, till it balance evenly.

Needles in sea compasses are usually made of a rhomboidal or oblong form; we have given their structure already under the article COMPASS.

The needle is not found to point precisely to the north, except in very few places; but deviates from it more or less in different places, and that too at different times; which deviation is called its *declination* or *variation from the meridian*. See the article VARIATION.

Surgeons NEEDLES are generally made crooked, and their points triangular; however they are of different forms and sizes, and bear different names, according to the purposes they are used for.

The largest are needles for amputation; the next, needles for wounds; the finest, needles for sutures. They have others, very short and flat, for tendons; others, still shorter, and the eye placed in the middle, for tying together of vessels, &c. Needles for couching cataracts are of various kinds; all of which have a small, broad, and sharp point or tongue, and some with a sulcus at the point. Surgeons have sometimes used two needles in this operation; one with a sharp point for perforating the coats of the eye, and another with a more obtuse point for depressing or couching the opaque crystalline lens; but care should be taken in the use of any of these, that they be first well polished with cloth or leather, before they are applied to the eye.

Mr Warner observes, that the blade of the couching needle should be at least a third part larger than those generally used upon this occasion, as great advantages will be found in the depressing of the cataract, by the increased breadth of the blade of that instrument. The handle, also, if made somewhat shorter than usual, will enable the operator to perform with greater steadiness, than he can do with a larger handled instrument.

It is to be observed, that needles of silver pierce more easily in stitching arteries after an amputation, than those made of steel.

NEEDLE Fish. See SYGNATHUS, ICHTHYOLOGY *Index*.

NEEDLES, sharp pointed rocks north of the isle of Wight. They are situated at the western extremity of the island, which is an acute point of high land, from which they have been disjoined by the washing of the sea. There were of these lofty white rocks formerly three, but about 14 years ago the tallest of them, called *Lot's Wife*, which rose 120 feet above low water mark, and in its shape resembling a needle, being undermined by the constant efforts of the waves, was thrown down, and totally disappeared.

NEEDS, or St NEOTS, six miles from Huntingdon, 58 miles from London, so called from the monument of a saint of that name in it, who was burnt by the Danes, is a large well built town, having a handsome strong church, with a very fine steeple, and a stone bridge over the Ouse.

NEEDWOOD FOREST, in Staffordshire, between the Trent, Dove, and Blythe, and near Utoxeter, is said to exceed all the forests in England in the excellency of its soil and the fineness of its turf.

NE EXEAT REGNO, in *Law*, is a writ to restrain a person from going out of the kingdom without the king's license. F. N. B. 85. It may be directed to the sheriff, to make the party find surety that he will not depart the realm, and on refusal to commit him to prison: or it may be directed to the party himself; and if he then goes, he may be fined. And this writ is granted on a suit being commenced against a man in the chancery, when the plaintiff fears the defendant will fly to some other country; and thereby avoid the justice and equity of the court; which hath been sometimes practised: and when thus granted, the party must give bonds to the master of the rolls, in the penalty of 1000l. or some other large sum, for yielding obedience to it; or satisfy the court, by answer, affidavit, or otherwise, that he hath no design of leaving the kingdom, and give security.

NEFASTI DIES, in Roman antiquity, an appellation given to those days wherein it was not allowed to administer justice, or hold courts. They were so called because, *non fari licebat*, the prætor was not allowed to pronounce the three solemn words or formulas of the law, *do*, *dico*, *addico*, I give, I appoint, I adjudge. These days were distinguished in the calendar by the letter N. for *nefastus*; or N. P. *Nefastus Primo*, when the day was only *nefastus* in the forenoon, or first part. The days of a mixed kind were called *intercisi*.

NEGAPATAN, a town of Asia, in the peninsula on this side the Ganges, and on the coast of Coromandel. It was first a colony of the Portuguese, but was taken from them by the Dutch, and now forms part of the British territory. It is situated in E. Long. 79. 10. N. Lat. 11. 15.

NEGATION, in *Logic*, an act of the mind affirming one thing to be different from another; as that the soul is not matter. See LOGIC.

NEGATIVE, in general, something that implies a negation: thus we say, negative quantities, negative powers, negative signs, &c.

NEGATIVE Sign. The use of the negative sign, in algebra, is attended with several consequences that at first sight are admitted with difficulty, and has sometimes given occasion to notions that seem to have no real foundation. This sign implies, that the real value of the quantity represented by the letter to which it is prefixed is to be subtracted; and it serves, with the positive sign, to keep in view what elements or parts enter into the composition of quantities, and in what

Negative Signs.

what manner, whether as increments or decrements, (that is, whether by addition or ſubtraction), which is of the greateſt uſe in this art.

In conſequence of this, it ſerves to expreſs a quantity of an oppoſite quality to the poſitive, as a line in a contrary poſition; a motion with an oppoſite direction; or a centrifugal force in oppoſition to gravity; and thus often ſaves the trouble of diſtinguiſhing and demonſtrating ſeparately, the various caſes of proportions, and preſerves their analogy in view. But as the proportions of lines depend on their magnitude only, without regard to their poſition, and motions and forces are ſaid to be equal, or unequal, in any given ratio, without regard to their directions; and, in general, the proportion of quantity relates to their magnitude only, without determining whether they are to be conſidered as increments or decrements; ſo there is no ground to imagine any other proportion of $-b$ and $+a$ (or of -1 and 1) than that of the real magnitudes of the quantities repreſented by b and a, whether theſe quantities are, in any particular caſe, to be added or ſubtracted. It is the ſame thing to ſubtract the decrement, as to add an equal increment, or to ſubtract $-b$ from $a-b$, as to add $+b$ to it: and becauſe multiplying a quantity by a negative number implies only a repeated ſubtraction of it, the multiplying $-b$ by $-n$, is ſubtracting $-b$ as often as there are units in n; and is therefore equivalent to adding $+b$ ſo many times, or the ſame as adding $+nb$. But if we infer from this, that 1 is to $-n$ as $-b$ to nb, according to the rule, that unit is to one of the factors as the other factor is to the product, there is no ground to imagine, that there is any myſtery in this, or any other meaning than that the real magnitudes repreſented by 1, n, b, and nb are proportional. For that rule relates only to the magnitude of the factors and product, without determining whether any factor, or the product, is to be added or ſubtracted. But this likewiſe muſt be determined in algebraic computations; and this is the proper uſe of the rules concerning the ſigns, without which the operation could not proceed. Becauſe a quantity to be ſubtracted is never produced in compoſition by any repeated addition of a poſitive, or repeated ſubtraction of a negative, a negative ſquare number is never produced by compoſition from the root. Hence $\sqrt{-1}$, or the ſquare root of a negative, implies an imaginary quantity; and in reſolution, is a mark or character of the impoſſible caſes of a problem, unleſs it is compenſated by another imaginary ſymbol or ſuppoſition, when the whole expreſſion may have a real ſignification. Thus $1+\sqrt{-1}$, and $1-\sqrt{-1}$, taken ſeparately, are imaginary, but their ſum is 2; as the conditions that ſeparately would render the ſolution of a problem impoſſible, in ſome caſes deſtroy each others effect when conjoined. In the purſuit of general concluſions, and of ſimple forms repreſenting them, expreſſions of this kind muſt ſometimes ariſe where the imaginary ſymbol is compenſated in a manner that is not always ſo obvious.

By proper ſubſtitutions, however, the expreſſion may be transformed into another, wherein each particular term may have a real ſignification as well as the whole expreſſion. The theorems that are ſometimes briefly diſcovered by the uſe of this ſymbol, may be demonſtrated without it by the inverſe operation, or ſome other way; and though ſuch ſymbols are of ſome uſe in the computations by the method of fluxions, its evidence cannot be ſaid to depend upon arts of this kind. See ALGEBRA and FLUXIONS.

Negative Electricity || Negro.

NEGATIVE Electricity. See the article ELECTRICITY, *paſſim.* See alſo *POSITIVE Electricity.*

NEGINOTH. This term is read before ſome of the Pſalms, as Pſalm lxvii. It ſignifies *ſtring inſtruments of muſic*, to be played on by the fingers, or women muſicians; and the titles of theſe pſalms where this word is found, may be thus tranſlated, *A pſalm of David to the maſter of muſic, who preſides over the ſtring inſtruments.*

NEGOMBO, a ſea port town of Aſia, on the weſt coaſt of Ceylon. It has a fort built by the Portugueſe, which was taken from them by the Dutch in 1640. E. Long. 80. 25. N. Lat. 17. 0.

NEGRIL POINT, the moſt weſterly promontory of the iſland of Jamaica.

NEGRO, *Homo pelli nigra*, a name given to a variety of the human ſpecies, who are entirely black, and are found in the torrid zone, eſpecially in that part of Africa which lies within the tropics. In the complexion of Negroes we meet with many various ſhades; but they likewiſe differ far from other men in all the features of their face. Round cheeks, high cheek-bones, a forehead ſomewhat elevated, a ſhort broad, flat noſe, thick lips, ſmall ears, uglineſs, and irregularity of ſhape, characterize their external appearance. The negro women have the loins greatly depreſſed, and very large buttocks, which gives the back the ſhape of a ſaddle. Vices the moſt notorious ſeem to be the portion of this unhappy race; idleneſs, treachery, revenge, cruelty, impudence, ſtealing, lying, profanity, debauchery, naſtineſs, and intemperance, are ſaid to have extinguiſhed the principles of natural law, and to have ſilenced the reproofs of conſcience. They are ſtrangers to every ſentiment of compaſſion, and are an awful example of the corruption of man when left to himſelf.

The origin of the negroes, and the cauſe of their remarkable difference from the reſt of the human ſpecies, has much perplexed the naturaliſts. Mr Boyle has obſerved, that it cannot be produced by the heat of the climate: for though the heat of the ſun may darken the colour of the ſkin, yet experience does not ſhow that it is ſufficient to produce a new blackneſs like that of the negroes.

In Africa itſelf, many nations of Ethiopia are not black; nor were there any blacks originally in the Weſt Indies. In many parts of Aſia under the ſame parallel with the African region inhabited by the blacks, the people are but tawny. He adds, that there are negroes in Africa beyond the ſouthern tropic; and that a river ſometimes parts nations, one of which is black, and the other only tawny. Dr Barriere alleges that the gall of negroes is black, and being mixed with their blood is depoſited between the ſkin and ſcarf-ſkin. However Dr Mitchel of Virginia, in the Philoſophical Tranſactions, N° 476. has endeavoured by many learned arguments to prove, that the influence of the ſun in hot countries, and the manner of life of their inhabitants, are the remote cauſes of the colour of the negroes, Indians, &c. Lord Kames, on

Negro.

on the other hand, and such philosophers as he, whose genius and imagination are too lively to submit to a dry and painful investigation of facts, have contended that no physical cause is sufficient to change the colour, and what we call the regular features of white men, to the dark hue and deformity of the woolly-headed negro. Their arguments have been examined with much acuteness and ingenuity by Dr Stanhope Smith of New Jersey, Dr Hunter, and Professor Zimmerman, who have made it in a high degree probable, that the action of the sun is the original and chief cause of the black colour, as well as distorted features of the negro. See AMERICA, N° 48—51. and COMPLEXION.

True negroes are found in no quarter of the globe where the heat of the climate is not very great. They exist nowhere but in the torrid zone, and only in three regions situated in that zone, viz. in Senegal, in Guinea, and on the western shores of Africa, in Nubia, and the Papous land, or what is called *New Guinea*. In all these regions the atmosphere is scorching, and the heat excessive. The inhabitants of the north are whitest; and as we advance southwards towards the line, and those countries on which the sun's rays fall more perpendicularly, the complexion gradually assumes a darker shade. And the same men, whose colour has been rendered black by the powerful action of the sun, if they remove to the north, gradually become whiter (at least their posterity), and lose their burnt colour. Whites when transported into the burning regions of the torrid zone, are the first subject to fever; the skin of the face, hands, and feet, becomes burnt, hardens and falls off in scales. Hitherto the colour of negroes appears to be only local, extrinsic, and accidental, and their short frizzled and sparse hair is to be accounted for in the very same manner.

Climate possesses great and evident influences on the hair, not only of men, but of all other animals. If in one case these transmutations are acknowledged to be consistent with identity of kind, they ought not in the other to be esteemed criterions of different species. Nature has adapted the pliancy of her work to the situations in which she may require it to be placed. The beaver and sheep removed to the warm latitudes exchange, the one its fur, and the other its wool, for a coarse hair that preserves the animal in a more moderate temperature. The coarse and black shag of the bear is converted, in the arctic regions, into the finest and whitest fur. The colour of the hair is likewise changed by climate. The bear is white under the arctic circle; and, in high northern latitudes, foxes, hares, and rabbits, are found white. Similar effects of climate are discernible on mankind. The hair of the Danes is generally red; of the English, fair or brown; and of the French, commonly black. The hair of all people of colour is black, and that of the African negroes is likewise sparse and curled in a manner peculiar to themselves; but this peculiarity is analogous to the effect which a warm climate has on almost every other animal. Cold, by obstructing the perspiration, tends to throw out the perspirable matter accumulated at the skin in an additional coat of hair. A warm climate, by opening the pores, evaporates this matter before it can be concreted into the substance of hair; and the laxness and aperture of the pores render the hair liable to be easily eradicated by innumerable incidents. Its curl may result in part from the nature of the secretion by which it is nourished, and in part from external heat. That it depends in some degree on the quality of the secretion is rendered highly probable from its appearance on the chin and other parts of the human body. Climate is as much distinguished by the nature and proportion of the secretions as by the degree of heat. (See PHYSIOLOGY, sect. 6.) Whatever be the nutriment of the hair, it is evidently combined in the torrid zone of Africa with some fluid of a highly volatile or ardent quality, which produces the rank smell of many African nations. Saline secretions tend to curl and to burn the hair. The evaporation of any volatile spirit would render its surface dry and disposed to contract; whilst the centre continuing distended by the vital motion, these opposite dilatations and contractions would necessarily produce a curve, and make the hair grow involved. External and violent heat parching the extremities of the hair, tends likewise to involve it. A hair held near the fire instantly coils itself up. Africa is the hottest country on the globe; and the influence of its heat, either external or internal, or both, in giving the peculiar form to the hair of the natives, appears, not only from its sparseness and its curl, but from its colour. It is not of a shining, but of an adust black; and its extremities tend to brown, as if it had been scorched by the fire.

The peculiarities of the negro features and form may likewise be accounted for from the excessive heat of the climate and the state of African society. Being savages, they have no arts to protect them from the rays of a burning sun. The heat and serenity of the sky preserving the lives of the children without much care of the parents, they seem of course to be, in the interior parts of the country, negligent of their offspring. Able themselves to endure the extremes of that ardent climate, they inure their children to it from their most tender age. They suffer them to roll in the dust and sand beneath the direct rays of a vertical sun. The mother, if she be engaged, lays down the infant on the first spot she finds, and is seldom at the pains to seek the miserable shelter of a barren shrub, which is all that the interior country affords. When we reflect on the influence of a glare of light upon the eye, and on the contortions of countenance produced by our efforts to repel or prevent it, we need not wonder, that the pliant features of a negro infant should, by constant exposure, acquire that permanent irregularity which we term their characteristic ugliness. But besides the climate, food and clothing and modes of life have prodigious effects on the human form and features. This is apparent even in polished societies, where the poor and labouring part of the community are much more coarse in their features, and ill formed in their limbs, than persons of better fortune and more liberal means of subsistence. What an immense difference exists in Scotland, for instance, between the chiefs and the commonalty of the Highland clans? If they had been separately found in different countries, they would have been ranged by some philosophers under different species. A similar distinction takes place between the nobility and peasantry of France, of Spain, of Italy, and of Germany.

That food and clothing, and the different modes of life, have as great an influence upon the shapes and features of the Africans as upon the natives of Europe, is evident

Negro.

evident from the different appearances of the negroes in the fouthern republics of America according to the ftations in which they are employed. " The field flaves (fays Dr Smith) are badly fed, clothed, and lodged. They live in fmall huts on the plantations, where they labour, remote from the fociety and example of their fuperiors. Living by themfelves, they retain many of the cuftoms and manners of their African anceftors. The domeftic fervants, on the other hand, who are kept near the perfons, or employed in the families of their mafters, are treated with great lenity; their fervice is light; they are fed and clothed like their fuperiors; they fee their manners, adopt their habits, and infenfibly receive the fame ideas of elegance and beauty. The field flaves are, in confequence, flow in changing the afpect and figure of Africa. The domeftic fervants have advanced far before them in acquiring the agreeable and regular features, and the expreffive countenance of civil fociety. The former are frequently ill-fhaped. They preferve, in a great degree, the African lips, nofe, and hair. Their genius is dull, and their countenance fleepy and ftupid. The latter are ftraight and well proportioned; their hair extended to three, four, and fometimes even to fix or eight inches; the fize and fhape of the mouth handfome, their features regular, their capacity good, and their look animated."

Upon the whole, we hope that the reader, who fhall candidly weigh in his own mind what we have faid at prefent and under the article COMPLEXION, will agree with us, that the black colour in the torrid zone, the fparfe crifp hair of the negroes, and the peculiarities of their features and form, proceed from caufes altogether extrinfic; that they depend on local temperature and the ftate of fociety; and that they are as accidental as the various fhades of colour which characterize the different nations of Europe. If the whites be confidered as the ftock whence all others have fprung, it is eafy to conceive how they have degenerated into negroes. Some have conjectured that the complete change may have taken place at the end of three centuries, whilft others have thought that it could not be effected in lefs than double that period. Such conjectures can be formed from no certain data; and a much greater length of time is undoubtedly neceffary before negroes, when tranfplanted into our temperate countries, can entirely lofe their black colour. By croffing the breed with whites, every taint of the negro colour may be expelled, we believe, from the fifth generation (A).

But the moft ferious charge brought againft the poor negroes is, that of the *vices* faid to be natural to them. If they be indeed fuch as their enemies reprefent them, treacherous, cruel, revengeful, and intemperate, by a neceffity of *nature*, they muft be a different race from the whites; for though all thefe vices abound in Europe, it is evident that they proceed not from nature, but from wrong education, which gives to the youthful mind fuch deep impreffions as no future exertions can completely eradicate. Let us inquire cooly if the vices of the negroes may not have a fimilar origin.

In every part of Africa with which the nations of Europe have any commerce, flavery prevails of the worft kind. Three-fourths of the people are flaves to the reft, and the children are born to no other inheritance. " Moft parts of the coaft differ in their governments; fome are abfolute monarchies, whilft others draw near to an ariftocracy. In both the authority of the chief or chiefs is unlimited, extending to life, and it is exercifed as often as criminal cafes require, unlefs death is commuted into flavery; in which cafe the offender is fold, and if the fhipping will not buy the criminal, he is immediately put to death. Fathers of free condition have power to fell their children, but this power is very feldom enforced." In Congo, however, a father † will fell a fon or daughter, or perhaps both, for a piece of cloth, a collar or girdle of coral or beads, and often for a bottle of wine or brandy. A hufband may have as many wives as he pleafes, and repudiate or even fell them, though with child, at his pleafure. The wives and concubines, though it be a capital crime for the former to break the conjugal faith, have a way to rid themfelves of their hufbands, if they have fet their affections upon a new gallant, by accufing them of fome crime for which the punifhment is death. In a word, the bulk of the people in every ftate of Africa are born flaves to great men, reared as fuch, held as property, and as property fold (fee SLAVERY.) There are indeed many circumftances by which a free man may become a flave: fuch as being in debt, and not able to pay; and in fome of fuch cafes, if the debt be large, not only the debtor, but his family likewife, become the flaves of his creditor, and may be fold. Adultery is commonly punifhed in the fame manner, both the offending parties being fold, and the purchafe-money paid to the injured hufband. *Obi*, or pretended witchcraft (in which all the negroes firmly believe, fee WITCHCRAFT), is another, and a very common offence, for which flavery is adjudged the lawful punifhment; and it extends to all the family of the offender. There are various other crimes which fubject the offender and his

Edwards's Hiftory of the Weft Indies, vol. ii.

† *Mod. Univer. Hiftory*, vol. xiii. p. 55.

Edwards's Hiftory of the Weft Indies.

(A) 1. A white man with a negro woman, or a negro man with a white woman, produce a mulatto, half white and half black, or of a yellow-blackifh colour, with black, fhort, frizzled hair. 2. A white man with a mulatto woman, or a negro with a mulatto woman, produce a *quadroon*, three fourths white and one fourth black, or three fourths black and one fourth white, or of a lighter yellow than the former. In America, they give the name of *cabres* to thofe who are defcended from a black man and a mulatto woman, or a mulatto man and a black woman, who are three fourths black and one fourth white, and who are not fo black as a negro, but blacker than a mulatto. 3. A white man with a quadroon woman, or a negro with a quadroon woman, produce a *meftizo*, feventh eighths white and one eighth black, or feven eighths black and one eighth white. 4. A white man with a meftizo woman, or a negro with a meftizo woman, produce, the one almoft a perfect white, the other almoft a perfect black, called a *quinteroon*. This is the laft gradation, there being no vifible difference between the fair quinteroons and the whites: and the children of a white and quinteroon confider themfelves as free from all taint of the negro race.

Negro.

his children to be sold; and it is more than probable, that if there were no buyers, the poor wretches would be murdered without mercy.

In such a state of society, what dispositions can be looked for in the people, but cruelty, treachery, and revenge? Even in the civilized nations of Europe, blessed with the lights of law, science, and religion, some of the lower orders of the community consider it as a very trivial crime to defraud their superiors; whilst almost all look up to them with stupid malevolence or rancorous envy. That a depressed people, when they get power into their hands, are revengeful and cruel, the present age affords a dreadful proof in the conduct of the demagogues of a neighbouring nation; and is it wonderful that the negroes of Africa, unacquainted with moral principles, blinded by the cruellest and most absurd superstitions, and whose customs tend to eradicate from the mind all natural affection, should sometimes display to their lordly masters of European extraction the same spirit that has been so generally displayed by the lower orders of Frenchmen to their ecclesiastics, their nobles, and the family of their murdered sovereign! When we consider that the majority of the negroes groan under the cruellest slavery, both in their own country and in every other where they are to be found in considerable numbers, it can excite no surprise that they are in general treacherous, cruel, and vindictive. Such are the caprices of their tyrants at home, that they could not preserve their own lives or the lives of their families for any length of time, but by a perpetual vigilance, which must necessarily degenerate, first into cunning, and afterwards into treachery; and it is not conceivable that habits formed in Africa should be instantly thrown off in the West Indies, where they are the property of men whom some of them must consider as a different race of beings.

But the truth is, that the ill qualities of the negroes have been greatly exaggerated. Mr Edwards, in his valuable History of the West Indies, assures us that the Mandingo negroes display such gentleness of disposition and demeanour, as would seem the result of early education and discipline, were it not that, generally speaking, they are more prone to theft than any of the African tribes. It has been supposed that this propensity, among other vices, is natural to a state of slavery, which degrades and corrupts the human mind in a deplorable manner; but why the Mandingoes should have become more vicious in this respect than the rest of the natives of Africa in the same condition of life, is a question he cannot answer.

"The circumstances which (according to the same author) distinguish the Koromantyn or Gold Coast negroes from all others, are firmness both of body and mind; a ferociousness of disposition; but withal, activity, courage, and a stubbornness, or what an ancient Roman would have deemed an elevation of soul, which prompts them to enterprises of difficulty and danger, and enables them to meet death, in its most horrid shape, with fortitude or indifference. They sometimes take to labour with great promptitude and alacrity, and have constitutions well adapted for it; for many of them have undoubtedly been slaves in Africa. But as the Gold Coast is inhabited by various tribes, which are engaged in perpetual warfare and hostility with each other, there cannot be a doubt that many of the captives taken in battle, and sold in the European settlements, were of free condition in their native country, and perhaps the owners of slaves themselves. It is not wonderful that such men should endeavour, even by means the most desperate, to regain the freedom of which they have been deprived; nor do I conceive that any further circumstances are necessary to prompt them to action, than that of being sold into captivity in a distant country. One cannot surely but lament (says our author) that a people thus naturally intrepid, should be sunk into so deplorable a state of barbarity and superstition; and that their spirits should ever be broken down by the yoke of slavery. Whatever may be alleged concerning their ferociousness and implacability in their present notions of right and wrong, I am persuaded that they possess qualities which are capable of, and well deserve, cultivation and improvement.

"Very different from the Koromantyns are the negroes imported from the Bight of Benin, and known in the West Indies by the name of Eboes. So great is their constitutional timidity and despondency of mind, as to occasion them very frequently to seek, in a voluntary death, a refuge from their own melancholy reflections. They require therefore the gentlest and mildest treatment to reconcile them to their situation; but if their confidence be once obtained, they manifest as great fidelity, affection, and gratitude, as can reasonably be expected from men in a state of slavery. The females of this nation are better labourers than the men, probably from having been more hardly treated in Africa.

"The natives of Whidah, who, in the West Indies, are generally called *Papaws*, are unquestionably the most docile and best disposed slaves that are imported from any part of Africa. Without the fierce and savage manners of the Koromantyn negroes, they are also happily exempt from the timid and desponding temper of the Eboes. The cheerful acquiescence with which these people apply to the labours of the field, and their constitutional aptitude for such employment, arise, without doubt, from the great attention paid to agriculture in their native country. Bosman speaks with rapture of the improved state of the soil, the number of villages, and the industry, riches, and obliging manners of the natives. He observes, however, that they are much greater thieves than those of the Gold Coast, and very unlike them in another respect, namely, in the dread of pain, and the apprehension of death. They are, says he, so very apprehensive of death, that they are unwilling to hear it mentioned, for fear *that* alone should hasten their end; and no man dares to speak of death in the presence of the king, or any great man, under the penalty of suffering it himself, as a punishment for his presumption. He relates, further, that they are addicted to gaming beyond any people of Africa. All these propensities are observable in the character of the Papaws in a state of slavery in the West Indies. That punishment which excites the Koromantyn to rebel, and drives the Ebo negro to suicide, is received by the Papaws as the chastisement of legal authority, to which it is their duty to submit patiently. The case seems to be, that the generality of these people are in a state of absolute slavery in Africa, and, having been habituated to a life of labour, they submit to a change of situation with little reluctance."

Having

Having recited fuch obfervations as occurred to him on contemplating the various tribes of negroes from each other, Mr Edwards thus eftimates their general character, influenced as they are by circumftances which foon efface the native and original impreffions which diftinguifh one nation from another when newly imported into the Weft Indies.

"Notwithftanding what has been related of the firmnefs and courage of the natives of the Gold Coaft, it is certain that the negroes in general in our iflands (fuch of them at leaft as have been any length of time in a ftate of fervitude) are of a diftruftful and cowardly difpofition. So degrading is the nature of flavery, that fortitude of mind is loft as free agency is reftrained. To the fame caufe probably muft be imputed their propenfity to conceal or violate the truth; which is fo general, that the vice of falfehood is one of the moft prominent features in their character. If a negro is afked even an indifferent queftion by his mafter, he feldom gives an immediate reply; but, affecting not to underftand what is faid, compels a repetition of the queftion, that he may have time to confider, not what is the true anfwer, but what is the moft politic one for him to give. The pronenefs obfervable in many of them to the vice of theft has already been noticed; and I am afraid (fays our author), that evil communication makes it almoft general. It is no eafy matter, I confefs, to difcriminate thofe circumftances which are the refult of proximate caufes, from thofe which are the effects of national cuftoms and early habits in favage life; but I am afraid that cowardice and diffimulation have been the properties of flavery in all ages, and will continue to be fo to the end of the world. It is a fituation that neceffarily fuppreffes many of the beft affections of the human heart.—If it calls forth any latent virtues, they are thofe of fympathy and compaffion towards perfons in the fame condition of life; and accordingly we find that the negroes in general are ftrongly attached to their countrymen, but above all, to fuch of their companions as came in the fame fhip with them from Africa. This is a ftriking circumftance: the term *fhipmate* is underftood among them as fignifying a relationfhip of the moft endearing nature; perhaps as recalling the time when the fufferers were cut off together from their common country and kindred, and awakening reciprocal fympathy from the remembrance of mutual affliction. But their benevolence, with a very few exceptions, extends no further. The fofter virtues are feldom found in the bofom of the enflaved African. Give him fufficient authority, and he becomes the moft remorfelefs of tyrants. Of all the degrees of wretchednefs endured by the fons of men, the greateft, affuredly, is the mifery which is felt by thofe who are unhappily doomed to be the flaves of flaves; a moft unnatural relation, which fometimes takes place in the fugar plantations. The fame obfervation may be made concerning their conduct towards the animal creation. Their treatment of cattle under their direction is brutal beyond belief. Even the ufeful and focial qualities of the dog fecure to him no kind ufage from an African mafter. One of the moft pleafing traits in their character is the refpect and attention which they pay to their aged countrymen. The whole body of negroes on a plantation muft be reduced to a deplorable ftate of wretchednefs, if, at any time, they fuffer their aged companions to want the common neceffaries of life, or even many of its comforts, as far as they can procure them. They feem to be actuated on thefe occafions by a kind of involuntary impulfe, operating as a primitive law of nature, which fcorns to wait the cold dictates of reafon: among them, it is the exercife of a common duty, which courts no obfervation, and looks for no applaufe."

As the colour, and features, and moral qualities of the negroes may be thus eafily accounted for by the influence of climate and the modes of favage life, fo there is good reafon to believe that their intellectual endowments are equal to thofe of the whites who have been found in the fame circumftances. Of thofe imitative arts in which perfection can be attained only in an improved ftate of fociety, it is natural to fuppofe that they have but little knowledge; but the fabric and colours of the Guinea cloths are a proof of their native ingenuity. In the Weft Indies many of them are expert carpenters, fome watchmakers, and one or two have fuccefsfully practifed phyfic; whilft others have figured both in Latin and in Englifh poetry, fo that we cannot doubt but that "God, who, made the world, hath made of one blood all nations of men," and animated them with minds equally rational.

NEGROLAND, or Nigritia, a country of Africa, lying next to Guinea towards the north, and extending from 18° of weft to 23° of eaft longitude, and from 9° to 20° of north latitude. On the north it is bounded by Zaara or the Defert; on the eaft, by countries unknown; on the fouth, by Guinea; and on the weft, by the Atlantic ocean; and is watered by the great river Niger or Senegal, which runs through it from eaft to weft. The Europeans have fettlements on the coafts of this country, efpecially near the mouths of the Niger and Gambia, which laft is fuppofed to be a branch of the former. A great many nations inhabit the banks of the rivers; fome Pagans, fome Mohammedans, of different languages, and independent of one another. The country is fruitful, efpecially along the rivers; abounding in rice, Guinea grain, and Indian corn, where it is cultivated; and with cocoa nuts, plantains, pulfe, palm trees, and tropical fruits; nor is it deftitute of cattle, and a variety of other animals, particularly fuch as abound in Guinea. See Guinea.

Negroland is fertilized by the overflowing of its rivers the Senegal and Gambia, as Egypt is by the Nile. It hath not yet been afcertained whether the Gambia is a branch of the Senegal or not. As far as the Europeans have penetrated up the country, they appear to be diftinct; and the Mandingo negroes report that the Gambia has a different origin. The entrance into the Niger, or Senegal river, is narrow and fomewhat difficult, by reafon of its immoveable bar, and fandy fhoals, as well as the feveral iflands at the mouth of it, and the feveral canals and marfhes that clog it: but after failing up eight or ten leagues, it is found broad and deep, and fit to carry large veffels; and, excepting about five or fix leagues on each fide above the mouth, which is fandy and barren ground, the banks are covered with ftately trees and villages, and the country in general is fertile and well watered; for, like the Nile, this river overflows its banks for many leagues, and enriches the land to a great degree,

gree, though, for want of ſkill, the inhabitants do not reap the advantages which they might obtain from its fertility. The people on both ſides of the river live as near to it as they can, and feed great herds of cattle, ſowing large and ſmall millet, the former of which is called by us *Turkey wheat*, in great quantities, and with great increaſe. If the river fails of overflowing at its uſual ſeaſon, a great ſcarcity enſues in the adjacent country; and, even when it overflows regularly, it breeds ſuch vaſt flights of graſhoppers and inſects, as quite darken the air, and frequently devour the whole produce of the ſoil: in which caſe the people kill thoſe inſects and eat them; which they do either by pounding in leather bags, and then boiling them in milk, or, which is reckoned the more delicious method, by frying or broiling them over a light blaze in a fryingpan full of holes. Thus the legs and wings of the inſects are burnt off, and the reſt of the body is ſufficiently roaſted to be eaten as a dainty, which they look upon to be very wholeſome and nouriſhing.

To the eaſt, north-eaſt, and ſouth-eaſt of the iſland of Senegal, the country, as far as it is known, is overrun with woods and marſhes: the Senegal, Gambia, and Sherbro, which are looked upon by ſome as branches of one immenſe river, paſſing through it in their way to the Atlantic ocean. During the rainy months, which begin in July, and continue to October, they lay the whole country under water; and indeed the ſudden riſe of theſe rivers is incredible to ſuch as are not acquainted with the violent rains that fall between the tropics. At Galam, 900 miles from the mouth of the Senegal, the waters riſe 150 feet perpendicular from the bed of the river. At the iſland of Senegal, the river riſes gradually, during the rainy ſeaſon, above 20 feet perpendicular over part of that flat coaſt; which of itſelf ſo freſhens the water, that ſhips lying at anchor, at the diſtance of three leagues from its mouth, generally make uſe of it, and fill their water there for their voyage home. When the rains are at an end, which ſoon happens in October, the intenſe heat of the ſun uſually dries up thoſe ſtagnating waters which lie on the higher parts, and the remainder from lakes and marſhes, in which are found all ſorts of dead animals. At laſt, thoſe two are quite dried up; and then the effluvia that ariſe are almoſt quite inſupportable. At this ſeaſon the winds blow ſo hot from the land, that they may be compared to the heat proceeding from the mouth of an oven, and they bring with them an intolerable ſmell. The wolves, tigers, lions, and other wild beaſts, then reſort to the river, ſteeping their body under water, and only their ſnout above it for the ſake of breathing. The birds ſoar to an immenſe height in the air, and fly a vaſt way over the ſea, where they continue till the wind changes, and comes from the weſt.

Negroes, White. See Heliophobi and Albino.

NEGROMANCY. See Necromancy.

NEGROPONT, anciently *Eubœa*, an iſland of the Archipelago, ſtretching along the eaſtern coaſt of Achaia or Livadia, from which it is ſeparated by a narrow channel called the *Euripus*. This ſtrait is ſo narrow, that the iſland is joined to the continent by a bridge thrown over it; and here, it is thought, there was formerly an iſthmus. The irregularity of the tides in the Euripus hath from the remoteſt antiquity been very remarkable, and this irregularity is found to be connected with the age of the moon. From the three laſt days of the old moon to the eighth day of the new moon, and from the 14th to the 20th day incluſive, they are regular; but on the other days they are irregular, flowing 12, 13, or 14 times in the ſpace of 24 hours, and ebbing as often. The iſland is 90 miles long and 25 broad in the wideſt part; and produces corn, oil, fruit, and cattle, in great abundance. The only place in the iſland worth notice is the capital, which is alſo called *Negropont;* and which is walled, and contains about 15,000 inhabitants; but the Chriſtians are ſaid to be much more numerous than the Turks. The captain baſhaw, or admiral of Turkey, who is alſo governor of the city, the iſland, and the adjacent continent of Greece, reſides here: and the harbour, which is very ſafe and ſpacious, is ſeldom without a fleet of galleys, ready to be put to ſea againſt the pirates and the Malteſe. A part of the bridge between the city and the coaſt of Greece, conſiſts of a draw bridge no longer than juſt to let a galley paſs through.

NEHEMIAH, or Neemias, ſon of Hachaliah, was born at Babylon during the captivity, (Neh. i. 1, 2, &c.) He was, according to ſome, of the race of the prieſts, but, according to others, of the tribe of Judah and the royal family. Thoſe who maintain the firſt opinion, ſupport it by a paſſage in Ezra, (x. 10.) where he is called a prieſt; but thoſe who believe that he was of the race of the kings of Judah, ſay, 1ſt, That Nehemiah having governed the republic of the Jews for a conſiderable time, there is great probability he was of that tribe of which the kings always were. 2dly, Nehemiah mentions his brethren Hanani, and ſome other Jews, who coming to Babylon during the captivity, acquainted him with the ſad condition of their country. 3dly, The office of cupbearer to the king of Perſia, to which Nehemiah was promoted, is a further proof that he was of an illuſtrious family. 4thly, He excuſes himſelf from entering into the inner part of the temple, probably becauſe he was only a laic, (Neh. vi. 11.) "Should ſuch a man as I flee? And who is there that, being as I am, would go into the temple to ſave his life?"

The Scripture (Ezra ii. 63. Nehem. vii. 65.) calls him תרשתא *tirſhatha*, that is to ſay, "cup-bearer; for he had this employment at the court of Artaxerxes Longimanus. He had an exceeding great tenderneſs for the country of his fathers, though he had never ſeen it; and one day, as ſome Jews newly come from Jeruſalem acquainted him with the miſerable eſtate of that city, that its walls were beat down, its gates burnt, and the Jews were become a reproach among all nations; he was ſenſibly affected with this relation; he faſted, prayed, and humbled himſelf before the Lord, that he would be favourable to the deſign he had then conceived of aſking the king's permiſſion to rebuild Jeruſalem. The courſe of his attendance at court being come, he preſented the cup to the king according to cuſtom; but with a countenance ſad and dejected; which the king obſerving, entertained ſome ſuſpicion, as if he might have had ſome bad deſign; but Nehemiah (ii.) diſcovering the occaſion of his diſquiet, Artaxerxes gave him leave to go to Jeruſalem, and repair its walls and gates; but, however, upon this condition, that he ſhould

Nehemiah. should return to court at a time appointed. Letters were made out, directed to the governors beyond the Euphrates, with orders to furnish Nehemiah with timbers necessary for covering the towers and gates of the city, and the house designed for Nehemiah himself, who was now appointed governor of Judea, in the year of the world 3350.

Nehemiah being arrived at Jerusalem with the king's commission, went round the city; and having viewed the condition of the walls, assembled the chief of the people, produced his commission, and exhorted them to undertake the reparation of the gates and walls of the city. He found every person ready to obey him; whereupon he immediately began the work. The enemies of the Jews observing these works in such forwardness, made use of all the means in their power to deter Nehemiah from this undertaking, and made several attempts to surprise him; but finding that their designs were discovered, and that the Jews kept upon their guard, they had recourse to craft and stratagem, endeavouring to draw him into an ambuscade in the fields, where they pretended they would finish the dispute at an amicable conference: but Nehemiah gave them to understand, that the work he had begun required his personal attendance; and therefore he could not come to them. He sent the same answer to four several messages that they sent one after another on the same subject, (*Id.* iv. and vi.).

Sanballat, the chief of the enemies of the Jews, together with his associates, wrote word, that a report was spread that the Jews were building the walls of Jerusalem only with a design to make it a place of strength, to support them in an intended revolt; that it was said also that Nehemiah had suborned false prophets to favour his designs, and to encourage the people to choose him king; and to stop the course of these rumours, he advised him to come to him, that they might confer together, and take such resolutions as should be found convenient. Nehemiah gave himself no trouble on this account, but returned for answer, that all those accusations were false and made at random. About the same time he discovered, that a false prophet, called *Shemaiah*, had been corrupted by his enemies, and that some of the chief of the city were secretly in confederacy with them. Yet all this did not discourage him; he went on with his work, and happily completed it in two and fifty days after it had been begun.

Then he made a dedication of the walls, of the towers, and of the gates of Jerusalem, with the solemnity and magnificence that such a work required. He separated the priests, the Levites, and the princes of the people, into two companies, one of which walked to the south and the other to the north, on the top of the walls. These two companies were to meet at the temple. The procession was accompanied with music both vocal and instrumental: and when they were all come to the temple, they there read the law, offered sacrifices, and made great rejoicings. And as the feast of tabernacles happened at the same time, it was celebrated with great solemnity, (*Id.* viii.). Nehemiah observing that the compass of the city was too large for its inhabitants, he ordered that the chief of the nation should fix their dwelling in the city; and caused them to draw lots, by which a tenth part of the whole people of Judah were to dwell at Jerusalem, (*Id.* xi.). Then he applied himself to the reformation of such abuses as had crept into the administration of the public affairs. He curbed the inhumanity of the great ones, who held in a state of slavery the sons and daughters of those who were poor or unfortunate, keeping their lands in possession, which these poor people had been obliged either to mortgage or to sell to the rich. Another abuse there was, which Ezra had in vain attempted to redress, that they had contracted marriages with strange and idolatrous women. Nehemiah undertook to dissolve these marriages, succeeded in it, and sent away all such women as had been taken against the express command of the law, (*Id.* ix). Having likewise observed, that the priests and Levites were obliged to take refuge wherever they could, and so the ministry of the temple was not attended or performed with that decency it ought, because they did not receive the revenues that the law had appointed for their subsistence; he obliged the people punctually to pay the ministers of the Lord what was due to them, and enjoined the priests and Levites duly to attend on their respective duties, and to discharge their functions, (*Id.* xiii. 10, 11, &c.) He enforced the observation of the sabbath, which had been much neglected at Jerusalem, and would not permit strangers to come in to buy and sell, but kept the gates of the city shut all that day. And, to perpetuate as much as was possible these good regulations which he had newly established, he engaged the chief men of the nation solemnly to renew the covenant with the Lord. This ceremony was performed in the temple, and an instrument was drawn up, which was signed by the principal men, both priests and people (*Id.* ix. x.), in the year of the world 3551.

We read in the books of Maccabees (2 Macc. i. 19, 20, 21. &c.), that Nehemiah sent to search for the holy fire, which before the captivity of Babylon the priests had hid in a dry and deep pit; but not finding any fire there, but instead thereof a thick and muddy water, he sprinkled this upon the altar; whereupon the wood which had been sprinkled with this water took fire presently as soon as the sun began to appear. Which miracle coming to the knowledge of the king of Persia, he caused the place to be encompassed with walls where the fire had been hid, and granted great favours and privileges to the priests. It is recorded in the same books, (2 Macc. ii. 13, 14.). That Nehemiah erected a library, wherein he placed whatever he could find, either of the books of the prophets, of David, or of such princes as had made presents to the temple. Lastly, He returned to Babylon (*Id.* v. 14. and xiii. 6.) according to the promise he had made to King Artaxerxes, about the thirty-second year of this prince, in the year 3563. From thence he returned again to Jerusalem, where he died in peace, about the year 3580, having governed the people of Judah for about thirty years.

The book which in the English Bible, as also in the Hebrew, has the name of *Nehemiah*, in the Latin Bible is called the book of *Esdras;* and it must be confessed, that though this author speaks in the first person, and though at first reading one would think that he had writ it day by day as the transactions occurred, yet there are some things in this book which could not have been written by Nehemiah himself; for example, memorials are quoted wherein were registered the names of of the priests in the time of Jonathan the son of Eliashib, and even to the times of the high priest Jaddus, who met Alexander the Great. These therefore must have been added afterwards.

It may well be questioned, whether this Nehemiah be the same that is mentioned in Ezra, (ii. 2. and Neh. vii. 7.) as one that returned from the Babylonish captivity under Zerubbabel; since from the first year of Cyrus to the twentieth of Artaxerxes Longimanus, there are no less than ninety-two years intervening; so that Nehemiah must at this time have been a very old man, upon the lowest computation an hundred, consequently utterly incapable of being the king's cup-bearer, of taking a journey from Shushan to Jerusalem, and of behaving there with all the courage and activity that is recorded of him. Upon this presumption, therefore, we may conclude that this was a different person, though of the same name, and that Tirshatha (the other name by which he is called, Ezra ii. 63. and Neh. vii. 65.) denotes the title of his office, and both in the Persian and Chaldean tongues was the general name given to the king's deputies and governors.

NEHOW, one of the Sandwich islands, discovered by Captain Cook in his last voyage to the Pacific ocean: these islands are eleven in number, and are situated from 18° 44′ to 22° 15′ N. Lat. and from 154° 56′ to 160° 24′ W. Long.

NEIGHBOUR, 1. One who dwells or is seated near to another (2 Kings iv. 3.) 2. Every man to whom we have an opportunity of doing good (Matt. xxii. 39.) 3. A fellow labourer of one and the same people (Acts vii. 27.) 4. A friend (Job xvi. 21.) At the time of our Saviour, the Pharisees had restrained the word neighbour to signify those of their own nation only, or their own friends; being of opinion that to hate their enemy was not forbidden by their law. But our Saviour informed them, that the whole world were their neighbours; that they ought not to do to another what they would not have done to themselves; and that this charity ought to be extended even to their enemies, (Matt. v. 43. Luke x. 29, &c.)

NEISSE, a town of Silesia in Germany, and the residence of the bishop of Breslaw, who has a magnificent palace here. The air is very wholesome, and provisions are cheap; the inhabitants carry on a great trade in wine and linen. This place suffered greatly by an inundation and fire in 1729. It was taken by the Prussians in 1741, who augmented the fortifications after the peace in 1742, and built a citadel to which they gave the name of *Prussia*. It is seated on a river of the same name, in E. Long. 17. 35. N. Lat, 50. 32.

NEIUS MONS, in *Ancient Geography*, at the foot of which stood Ithaca, a town of the island of that name, (Homer).

NELSON, The Right Honourable VISCOUNT, one of the most celebrated naval commanders, was the son of the reverend Edmund Nelson, and was born at Burnham Thorpe, in Norfolk, where his father was rector, in the year 1758. He received his education at the school of North Walsham; but we are unacquainted with the particulars relative to his childhood, and whether the progress he made in his studies was in any respect extraordinary. It is certain, however, that he discovered a strong predilection for the naval profession at a very early period, and having quitted school at the age of twelve years, went on board the Raisonable of 64 guns, commanded by his mother's brother, Captain Maurice Suckling.

In the month of April 1773, a voyage of discovery to the north pole was undertaken by the honourable Constantine John Phipps, afterwards Lord Mulgrave, in consequence of an application by the Royal Society to Lord Sandwich; and although the instructions which were issued, prohibited all boys from being received on board, yet the enterprising spirit of Horatio Nelson earnestly solicited to be appointed cockswain to Captain Lutwidge, rather than submit to be left behind; and his unsubdued spirit so forcibly struck the captain, that his wish was complied with.

When the ship returned to England in the month of October 1773, Mr Nelson having received information that a squadron was fitting out for the East Indies, employed all his interest to be appointed to one of the ships. It was not long before he was placed in the Seahorse of 20 guns, commanded by the celebrated Captain Farmer, and stationed in the fore-top to keep watch, but soon after removed to the quarter-deck.

He obtained the professional order of lieutenant on the 8th of April, 1777, and received his commission the next day, as second of the Lowestoffe of 32 guns, Captain William Locker, in which ship he arrived at Jamaica; but feeling that his glowing mind was circumscribed in so small a frigate, he requested the command of a schooner, which acted as tender to the Lowestoffe, thus availing himself of the opportunity of becoming an experienced pilot for every intricate passage through the islands, situated on the northern side of Hispaniola.

When Sir Peter Parker arrived at Jamaica in the year 1778, Lieutenant Nelson was nominated by that gallant admiral to be the third of his own flag ship, the Bristol, and by rotation he soon became the first. In this ship his services terminated in the rank of a lieutenant.

On the 11th of June, 1779, he obtained the rank of post-captain; and during the nine years he had been in the service he not only became an able officer by his constant attention to every part of his duty, and his keen observation, but he also laid the foundation of being a pilot of distinguished eminence. The first ship to which he was appointed after being made a post captain, was the Hinchinbroke. On the arrival of Count d'Estaign at Hispaniola, as an attack upon Jamaica was immediately apprehended, Captain Nelson was intrusted with the command of the batteries of Port Royal, with the concurring approbation of the British admiral and general. In the month of January 1780, it was resolved on to reduce Fort Juan, on the river St John, in the gulf of Mexico, when Captain Nelson was made choice of to command the naval department, and that of the military was committed to Major Polson. In accomplishing the object of this arduous and interesting undertaking, Nelson's usual intrepidity was again exhibited. Having quitted the ship under his command, he superintended the transporting of the troops in boats, 300 miles up a river, which none but Spaniards had ever navigated since the time of the buccaneers.

His great and vigorous exertions were represented by Major Polson to General Dalling in their true colours, Nelfon. nor was his gallantry paffed over by that officer in filence. After ftorming an out-work belonging to the enemy, he conftructed batteries, and fought the Spaniards; and it is to his conduct in the reduction of Fort Juan that the fuccefs of Britain has been juftly and chiefly afcribed. He was next appointed to the Janus, at that time ftationed at Jamaica; on his arrival at which place every medical affiftance was given him which his fituation required; but as his health ftill continued on the decline, he deemed it expedient to return to England in his majefty's fhip Lion, the honourable William Cornwallis commander, to whofe unremitting care and attention he owed the prefervation of his life. He obtained the command of the Albemarle in the month of Auguft, 1781, which put his delicate conftitution to the fevereft trial, as he was ftationed during the whole of the enfuing winter in the North feas.

He failed from Quebec in the month of October, 1782, with a convoy to New York, where he had an opportunity of joining the fleet under Sir Samuel Hood; and in the month following he failed with him to the Weft Indies, where he was honourably employed until the termination of hoftilities. He foon after received orders to repair to England, being directed to attend in his way, his royal highnefs Prince William Henry on his vifit to the Havannah. When he reached England, the Albemarle was paid off at Portfmouth on the 31ft July, 1783. During the autumn of that year he paid a vifit to France, where he continued till the fpring of the enfuing year, when he received the command of the Boreas frigate of 28 guns, and his deftination was the Leeward iflands, where he continued until June 1787, and was then ordered to repair to England. In the month of March the fame year he was married to the amiable and accomplifhed widow of Dr Nefbit, of the ifland of Nevis. When the Boreas frigate was paid off at Sheernefs on the 30th November, 1787, he retired to the parfonage-houfe of Burnham Thorpe, which had been conferred upon him by his father for a place of refidence, there to enjoy the confolations which refult from domeftic felicity.

He again came forward on the 30th of January 1793, to fhine forth more confpicuous as a naval officer than he had ever done before, at which time he received the command of the Agamemnon of 64 guns, being foon placed under the orders of that truly great and illuftrious character, Lord Hood, who at that period was deftined to command in the Mediterranean. The unlimited confidence repofed in him by this noble and gallant admiral, is an inconteftable evidence of the high eftimation in which his courage and naval abilities were held. If his fuperior defigned to attack batteries, or cut fhips out of the harbours in which they were moored; if troops were to be landed in perilous fituations, or paffages of extreme difficulty to be explored, the great Nelfon took the lead on every fuch occafion, feconded by the brave officers and crew belonging to the Agamemnon. Toulon, Baftia, and Calvi, witneffed his gallant and intrepid deportment, of which Lord Hood did not fail to make honourable mention. At the fiege of Calvi Captain Nelfon loft the fight of his right eye, a fhot from the battery of the enemy having ftruck that of which he had the command, and driven fome particles of fand againft his face with irrefiftible impetuofity.

When Lord Hood left his ftation in the Mediterranean in the month of October, 1794, the command devolved on Admiral Hotham, who honoured our hero with an equal fhare of his confidence and efteem. On the 13th and 14th of March, and 13th of July 1795, he again rendered himfelf confpicuous in the actions which then took place with the French fleet; and foon after he was chofen by Admiral Hotham to cooperate with General De Vins, on the coaft of Genoa, in which fervice he continued fo long as Hotham retained the command, who was fuperfeded by Sir John Jervis. This officer fo much applauded the conduct of Captain Nelfon, that he received the honour of wearing a pendant of diftinction; and in the month of May he was removed from the Agamemnon to the Captain of 74 guns. On the 11th of Auguft he had a captain appointed under him.

From April to October 1795, Commodore Nelfon was continually employed in the moft active and arduous fervice, the blockade of Leghorn, the taking of Porto Ferrajo, with the ifland of Caprea, and finally in the evacuation of Baftia. In December 1796 he hoifted his broad pendant on board La Minerve frigate, and was difpatched with that fhip, and La Blanche, to Porto Ferrajo, to bring the naval ftores left there to Gibraltar, which the fleet was in much want of. While on this fervice in the night of the 17th December, he fell in with two Spanifh frigates, one of which he immediately attacked, and ordered the Blanche to bear down to engage the other. About half paft ten the commodore brought his fhip to clofe action, which continued without interruption till half paft one, when the Spanifh frigate of 40 guns, 28 of which were 18 pounders, ftruck to La Minerve.

After various other active and important fervices during the three preceding months, Sir Horatio Nelfon, in April 1797, hoifted his flag on board the Captain of 74 guns as rear-admiral of the blue, and in the end of May he fhifted his flag from the Captain to the Thefeus, when he was appointed to the command of the inner fquadron at the blockade of Cadiz. While on this fervice he exhibited another remarkable proof of his undaunted perfonal courage. In the attack on the Spanifh gun-boats in July, he was boarded in his barge, which had only the ufual complement of 10 men, and the cockfwain. The commander of the Spanifh gunboats, in a barge with 30 men and officers, made a defperate attack on the admiral and his brave companions. The conflict remained long doubtful, but after 18 of the Spaniards were killed, and almoft the whole of the remainder wounded, the rear-admiral and his brave crew fucceeded in carrying this fuperior force.

On the 15th of July the fame year, Admiral Nelfon was detached with a fmall fquadron to attack the town of Santa Cruz in the ifland of Teneriffe. A thoufand men, including marines, were landed in the courfe of a dark night, made themfelves mafters of the town, and retained poffeffion of it for feven hours; but finding it impoffible to ftorm the citadel, they prepared for their retreat, which the Spaniards allowed them to make unmolefted, agreeable to the ftipulations which had been entered into. In this unfortunate attack the brave Nelfon loft his arm by a cannon fhot.

But a more fplendid fcene of the life of our hero is now opening. On the 13th of April 1798 he was detached

Nelson. tached from Earl St Vincent's fleet, in purfuit of the French to the coaft of Egypt, with 12 fail of the line and one 50 gun fhip, while the enemy's fleet confifted of 13 fail of the line and four frigates, protected by the batteries on the fhore, and feveral gun-boats. This memorable action commenced at funfet, and terminated glorioufly for the honour of our hero and that of the Britifh navy. Nine fail of the line fell into the hands of the conqueror, two were burnt, and two effected their efcape. The brave Nelfon was wounded in the action, believing himfelf to have been fhot through the head; but after his wound was examined by the furgeon, it was happily found not to be mortal, a circumftance which diffufed the moft lively fatisfaction through the whole fleet. To the honour of this great man it ought to be mentioned, that even under the conviction of approaching diffolution, he prepared for the interefting change with calmnefs and fortitude, defired his chaplain to recommend him to Lady Nelfon, appointed the brave Hardy to the rank of poft-captain and to the command of a fhip, and took an affectionate leave of Captain Louis.

The French admiral's fhip, L'Orient, was blown up during the action. From the mainmaft of this fhip Captain Hallowell ordered a coffin to be conftructed, which was prefented to Admiral Nelfon, and gratefully accepted by the hero, as a token of affectionate regard. For fome months he had it placed upright in his cabin; but in confequence of the entreaties of an old fervant, the admiral was at length prevailed on to allow it to be removed. Our readers will not be furprifed that Lord Nelfon fhould now be regarded as the great defence of the empire, and the fupport of her national glory. It is to his gallantry and naval fkill that we are indebted for the victory of Copenhagen, and the annihilation of that formidable northern confederacy which menaced the profperity, the commerce, the very exiftence of the reft of Europe.

One of the moft important fervices which Lord Nelfon performed, was the purfuit of the combined fleets of France and Spain to the Weft Indies. This fleet had failed from Cadiz on the 10th of April, and it was at firft conjectured that Egypt was the place of their deftination. In confequence of this conjecture, Lord Nelfon failed in purfuit of the enemy for the coaft of Egypt; and, having miffed his object, after reconnoitring that coaft, he paffed the ftraits of Gibraltar, and anchored in Lagos bay on the 10th of May; foon after which he failed for the Weft Indies with ten fhips of the line; arrived off Barbadoes on the 4th of June; and having touched at Tobago, Trinidad, and Grenada, at the latter of which places he was informed that the combined fleet had been feen on the 6th off Dominica; he reached at Antigua on the 12th, where he received information that the enemy had been feen on the 8th ftanding to the northward. Lord Nelfon, without the lofs of a moment, continued the purfuit of the enemy on their return to Europe, where they arrived about the end of July; and after taking in provifions and water at Gibraltar, and reconnoitring the harbour of Cadiz; he returned to England, where he arrived in the Victory, on the 18th of Auguft, after having been engaged for nearly four months in one of the moft arduous, and, at the fame time, one of the moft important and beneficial, although, in its immediate object, unfuccefsful enterprifes, for which his life was diftinguifhed. His lordfhip had now been abfent from England more than two years, on the Mediterranean ftation. Nelfon.

The concluding fcene of this extraordinary man's naval career, kindles emotions of admiration and regret; and at once excites both tranfport and extreme of forrow. Perhaps no action, in point of fplendour and magnanimity, can equal that which deprived his country of one of the greateft heroes it ever produced. Britons appear to be fenfible of its vaft importance; yet it is not improbable that pofterity will confider it as ftill more fplendid, their love and admiration not being damped by the poignant recollection that they perfonally faw the man by whofe lofs it was accomplifhed. When Lord Nelfon perceived that, in confequence of his manœuvres, he had reduced the enemy to the abfolute neceffity of engaging him, he exclaimed in the prefence of Captain Hardy and the other officers who furrounded him on the quarter deck; "Now they cannot efcape us; I think we fhall at leaft make fure of twenty of them.—I fhall probably lofe a leg, but that will be purchafing a victory cheaply." But alas! amidft the inexpreffible fatisfaction and delight, which a victory fo fplendid could not fail to infpire, he has left us to lament that it was purchafed by the lofs of a life fo incomparably valuable.

His lordfhip's flag fhip fell on board the Redoubtable, by which means he was expofed to the fire of the mufketry from the tops; and the infignia of his grandeur and dignity, it is fuppofed, fingled him out to the aims of the enemy, which in the iffue were too fatally fuccefsful. His fecretary was cut in two by his fide with a chain fhot, and foon after a ball grazed his lordfhip's fhoulder, entered his left breaft, and paffed through his lungs. He lived about three hours after this tragical event, during which he remained perfectly recollected, and he difplayed the fame heroic magnanimity in the arms of death, which had fo eminently diftinguifhed him through the whole of his career. His laft words to Captain Hardy were, "I know I am dying. I could have wifhed to furvive to breathe my laft upon Britifh ground, but the will of God be done!" In a few moments he expired. His laft fignal ought not, and will not be forgotten, which was by telegraph,—"That England expected every man would do his duty." He fpoke in raptures concerning the event of the day only a fhort time before his diffolution, and fent word to Admiral Collingwood, defiring that he would make his affectionate farewell to all his brother feamen throughout the fleet. In this manner died, in the 47th year of his age, the greateft commander that perhaps ever adorned the Britifh navy, leaving behind him a name dear to Great Britain, and an example of heroifm which will infpire his companions in arms to emulate his virtues, that they too may live in the remembrance of a grateful pofterity.

His fingular plan of attack on this memorable occafion was communicated by his lordfhip to all his captains, who unanimoufly gave it as their opinion that it could not poffibly fail of fuccefs, being concerted with fuch confummate wifdom; and they even pledged their lives for the favourable refult of it. His titles were, Vifcount Nelfon, and Duke of Bronte.—The united parliament voted him a penfion of 3000l. a year, to continue during his own life and his two next heirs; the

East

Nelson ‖ Nemean Games.

East India company made him a prefent of 10,000l.; the grand fignior gave him a diamond aigrette worth 4000l.; the emperor of Ruffia gave him a diamond box worth 2500l.; the king of Naples made him prefents to the amount of 5000l. together with the dukedom of Bronté, and an eftate of 3000l. per annum. Thus all Europe confpired to teftify the eftimation in which they held this diftinguifhed hero; and the numerous monuments which have been, and ftill are erecting to his memory throughout the Britifh empire, will continue lafting evidences of the efteem in which he was held by his grateful country. Parliament alfo voted a fum for the purchafe of an eftate for his heirs, and his majefty conferred the title of earl on his immediate fucceffor.

Nor were his talents wholly confined to the knowledge of naval tactics, for it is known that as a fenator he was highly refpectable, although he enjoyed few opportunities of coming forward in that capacity. When he did, his fpeeches were heard by their lordfhips with refpect, and the moft profound attention. The few fpecimens we have of his abilities as a politician, afford no mean proof that if he had devoted as much of his time to thofe ftudies as he did to his peculiar profeffion, he would have made a diftinguifhed figure in the houfe of peers.

NEMAUSIS, or Nemausum, in *Ancient Geography*, the capital of the Arecomici in Gallia Narbonenfis; a colony, (Coin), with the furname *Augufta*, (Infcription). In it ftands a Roman amphitheatre, which is ftill almoft entire. Now *Nifmes* in Languedoc.

NEMEA (Strabo, Livy); a river of Achaia, running between Sicyon and Corinth, the common boundary of both territories, and falling into the Corinthian bay.

Nemea, in *Ancient Geography*, fituated between Cleonæ and Philus in Argolis; whether town, diftrict, or other thing, uncertain; there a grove ftood in which the Argives celebrated the Nemean games, and there happened all the fabulous circumftances of the Nemean lion. The diftrict Nemea is called *Bembinadia*, (Pliny; a village, *Bembina*, ftanding near Nemea, (Strabo). Stephanus places Nemea in Elis; though not in Elis, but on its borders; Pliny, erroneoufly, in Arcadia. In the adjoining mountain is ftill fhown the den of the lion, diftant 15 ftadia from the place *Nemea*, (Paufanias); in which ftands a confiderable temple of Jupiter Nemæus and Cleonæus, from the vicinity of thefe two places. This place gave name to the Nemæan games, celebrated every third year.

NEMEAN games, fo called from Nemea, a village between the cities of Cleonæ and Philus, where they were celebrated every third year. The exercifes were chariot-races, and all the parts of the Pentathlum. Thefe games were inftituted in memory of Opheltes or Archemorus the fon of Euphetes and Creufa, and who was nurfed by Hypfipele; who leaving him in a meadow while fhe went to fhow the befiegers of Thebes a fountain, at her return found him dead, and a ferpent twined about his neck: whence the fountain, before called *Langia*, was named *Archemorus*; and the captains, to comfort Hypfipele, inftituted thefe games.—Others afcribe their inftitution to Hercules, after his victory over the Nemean lion. Others allow, that they were inftituted firft in honour of Archemorus; but intermitted, and revived again by Hercules. The victors were crowned with parfley, an herb ufed at funerals, and feigned to have fprung from Archemorus's blood. The Argives prefided at thefe games.

Nemefianus ‖ Nemefius.

NEMESIANUS, Aurelius Olympius, a Latin poet who was born at Carthage, and flourifhed about the year 281, under the emperor Carus, and his fons Carinus and Numerian: the laft of which emperors was fo fond of poetry, that he contefted the glory with Nemefianus, who had written a poem upon fifhing and maritime affairs. We have ftill remaining a poem of our author called *Cynegeticon*, and four eclogues: they were publifhed by Paulus Manutius in 1538; by Barthelet in 1613; at Leyden in 1653; with the notes of Janus Vlitias. Giraldi hath preferved a fragment of Nemefianus, which was communicated to him by Sannazarius, to whom we are obliged for our poet's works: for having found them written in Gothic characters, he procured them to be put into the Roman, and then fent them to Paulus Manutius. Although this poem hath acquired fome reputation, it is greatly inferior to thofe of Oppian and Gratian upon the fame fubject; yet Nemefianus's ftyle is natural enough, and has fome degree of elegance. The world was fo much poffeffed with an opinion of his poem in the eighth century, that it was read among the claffics in the public fchools, particularly in the time of Charlemagne, as appears from a letter of the celebrated Hincmar bifhop of Rheims, to his nephew Hincmar of Laon.

NEMESIS, in Pagan worfhip, the daughter of Jupiter and Neceffity, or, according to others, of Oceanus and Nox, had the care of revenging the crimes which human juftice left unpunifhed. She was alfo called *Adraftæa*, becaufe Adraftus king of Argos firft raifed an altar to her; and *Rhamnufia*, from her having a magnificent temple at Rhamnus in Attica. She had likewife a temple at Rome in the Capitol. She is reprefented with a ftern countenance, holding a whip in one hand and a pair of fcales in the other.

NEMESIUS, a Greek philofopher who embraced Chriftianity, and was made bifhop of Emefa in Phœnicia, where he had his birth; he flourifhed in the beginning of the fifth century. There is a work of his extant, entitled *De Natura Hominis*, in which he refutes the fatality of the Stoics and the errors of the Manichees, the Apollianarifts, and the Eunomians; but he efpoufes the opinion of Origin concerning the pre-exiftence of fouls. (A). This treatife was tranflated by Valla, and printed in 1535. Another verfion was afterwards made of it by Ellebodius, and printed in 1665; it is alfo inferted in the *Bibliotheca Patrum*, in Greek and Latin. Laftly, Another edition was publifhed at Oxford in 1671, folio, with a learned preface, wherein the editor endeavours to prove, from a paffage in this book, that the

(A) It is much more probable that he and Origen both brought their opinion with them from the fchools of philofophy, than that either of them borrowed it from the other. See Metaphysics, Part III. Chap. IV.

the circulation of the blood was known to Nemesius; which, however was since shown to be a mistake by Dr Freind, in his *History of Physic*.

NEMINE CONTRADICENTE, "none contradicting it;" a term chiefly used in parliament when any thing is carried without opposition.

NEMOURS, a town of the Isle of France, in the Gatinois, formerly with the title of a duchy. It is seated on the river Loing, in E. Long. 2. 45. N. Lat. 48. 15.

NENAGH, a post and fair town of Ireland, in the county of Tipperary, and province of Munster, 75 miles from Dublin. It is situated on a branch of the river Shannon which runs into Lough-Derg. Here stand the ruins of an old castle called Nenagh-round. Also those of an hospital founded in the year 1200, for canons following the rule of St Augustin. It was dedicated to St John the Baptist, and was usually called *Teachon*, or St John's house. In the reign of Henry III. a friary for conventual Franciscans was also founded here, and esteemed the richest foundation of that order in the kingdom. Here is a barrack for two troops of horse. This town was burnt on St Stephen's day 1348, by the Irish. The fairs held here are four.

NENIA, or NÆNIA, in the ancient poetry, a kind of funeral song sung to the music of flutes at the obsequies of the dead. Authors represent them as sorry compositions, sung by hired women mourners called *Præficæ*. The first rise of these Nenia is ascribed to the physicians. In the heathen antiquity, the goddess of tears and funerals was called *Nenia;* whom some suppose to have given that name to the funeral song, and others to have taken her name from it.

NEOCESARIA, (Pliny), a town of Pontus on the south or the left side of the Lycus. About the year 342, when Leontius and Sallustius were consuls, it was entirely ruined by a dreadful earthquake, no edifice having withstood the violence of the shock, except the church and the bishop's habitation, who was saved, with the clergy and some other pious persons, while the rest of the inhabitants were buried in its ruins.

NEOMAGUS, (Ptolemy); NOVIOMAGUS, (Antonine); a town of the Regni in Britain: now thought to be Guildford in Surry, (Lhuyd); or Croydon, (Talbot). But Camden takes it to be Woodcote, two miles to the south of Croydon, where traces of an ancient town are still to be seen.

NEOMAGUS, (Ptolemy); *Noviomagus*, (Antonine); a town of the Treviri on the Moselle. Now *Numagen* 14 miles east, below Triers.

NEOMAGUS, (Ptolemy); *Noviomagus Lexoviorum*, (Antonine); a town of Gallia Celtica. Now *Lifeux*, in Normandy.

NEOMAGUS, (Ptolemy); *Noviomagus Nemetum*, (Antonine). Now *Spire*, a city of the Palatinate, on the left or west side of the Rhine.

NEOMAGUS, (Ptolemy); a town of Gallia Narbonensis, on the confines of the Tricastini. Now *Nyons* in Dauphiné.

NEOMENIA, or NOUMENIA, a festival of the ancient Greeks, at the beginning of every lunar month, which, as the name imports, was observed upon the day of the new moon, in honour of all the gods, but especially Apollo, who was called *Neomenios*, because the sun is the fountain of light; and whatever distinction of times and seasons may be taken from other planets, yet they are all owing to him as the original of those borrowed rays by which they shine.

The games and public entertainments at these festivals were made by the rich, to whose tables the poor flocked in great numbers. The Athenians at these times offered solemn prayers and sacrifices for the prosperity of their country during the ensuing month. See GAMES.

The Jews had also their neomenia, or feast of the new moon, on which peculiar sacrifices were appointed: and on this day they had a sort of family entertainment and rejoicing. The most celebrated neomenia of all others was that at the beginning of the civil year, or first day of the month Tisri, on which no servile labour was performed: they then offered particular burnt sacrifices, and sounded the trumpets of the temple. The modern Jews keep the neomenia only as a feast of devotion, which any one may observe or not as he pleases.

NEOPHYTES, "new plants;" a name given by the ancient Christians to those heathens who had newly embraced the faith; such persons being considered as regenerated, or born anew by baptism. The term *neophytes* has been also used for new priests, or those just admitted into orders, and sometimes for the novices in monasteries. It is still applied to the converts made by the missionaries among the infidels.

NEPA, a genus of insects belonging to the order of hemiptera. See ENTOMOLOGY *Index*.

NEPAL, a kingdom of India, to the north-east of the city of Patna, at the distance of about 12 days journey. The roads in the mountains are both narrow and dangerous, but in the plains they are allowed to be good. Some parts of it are obnoxious to a putrid fever, of which those who are seized with it die in a few days; but the people in the plains are not obnoxious to it. The plain is about 200 miles in circumference, and the only entrance to it is by the mountains. It contains three principal cities; *Cat'hmandu*, having about 18,000 houses; *Lelit Pattan* contains 24,000; and *B'hatgan* 12,000 families. Besides these there are many large and populous towns, the chief of which are *Timi* and *Cipoli*. The religion of the inhabitants, like that of most other countries in a state little removed from barbarism, abounds with a number of absurd rites and ceremonies, which it would be superfluous to enumerate; but many of them adopt that of the Brahmins, the moral part of which, in many respects, must be allowed to be excellent.

The temple of Baghero in the city of Lelit Pattan, is said to be superior to the king's palace, on account of the immense quantities of gold, silver, and jewels which it contains; and the waters of a river about three miles from Cat'hmandu are considered as holy, to which people of rank are conveyed in the prospect of death. This kingdom is believed to be of very great antiquity, as its language and independence have been preserved from time immemorial; yet the dissensions of its nobles completely ruined it not many years ago, who could not agree about the choice of a proper successor on the death of their sovereign.

NEPENTHES, a genus of plants belonging to the gynandria class; and in the natural method ranking among those of which the order is doubtful. See BOTANY *Index*.

NEPETA, Catmint, or *Nep*, a genus of plants belonging to the didynamia claſs, and in the natural method ranking under the 42d order, *Verticillatæ*. See Botany *Index*.

NEPHELIUM, a genus of plants belonging to the monœcia claſs. See Botany *Index*.

NEPHEW, a term relative to uncle and aunt, ſignifying a brother's or ſiſter's ſon; who, according to the civil law, is in the third degree of conſanguinity, but according to the canon in the ſecond.

NEPHRITIC, ſomething that relates to the kidneys. See Kidney.

Nephritic Wood, (lignum nephriticum), a wood of a very denſe and compact texture, and of a fine grain, brought to us from New Spain in ſmall blocks, in its natural ſtate, and covered with its bark.

This wood is ſaid to be a good diuretic; and we are told it is uſed among the Indians in all diſeaſes of the kidneys and bladder, and in ſuppreſſion of urine, from whatever cauſe. It is alſo recommended in fevers, and in obſtructions of the viſcera. The way of taking it among the Indians is only an infuſion in cold water. Theſe uſes are not however properly aſcertained. See Guilandina, Botany *Index*.

Nephritic Stone. See *Jade*, Mineralogy *Index*.

NEPHRITICS, in *Pharmacy*, medicines proper for diſeaſes of the kidneys. See Materia Medica *Index*.

NEPHRITIS, or inflammation of the kidneys. See Medicine *Index*.

NEPOS, Cornelius, a celebrated Latin biographer, who flouriſhed in the time of Julius Cæſar, and lived, according to St Jerome, to the ſixth year of Auguſtus. He was an Italian, if we may credit Catullus, and born at Hoſtilia, a ſmall town in the territory of Verona, in Ciſalpine Gaul. Auſonius, however, will have it that he was born in the Gauls: and in that they may both be in the right, provided that under the name of *Gaul* is comprehended *Gallia Ciſalpina*, which is in Italy. Leander Alberti thinks Nepos's country was Verona; and he is ſure that he was either born in that city or neighbourhood. For the reſt, Cicero and Atticus were friends of our author; who wrote the lives of the Greek hiſtorians, as he himſelf atteſts in that of Dion, ſpeaking of Philiſtus. What he ſays, alſo, in the lives of Cato and Hannibal, proves that he had alſo written the lives of the Latin captains and hiſtorians. He wrote ſome other excellent works which are loſt.

All that we have left of his at preſent is, "The Lives of the illuſtrious Greek and Roman Captains;" which were a long time aſcribed to Æmilius Probus, who publiſhed them, as it is ſaid, under his own name, to inſinuate himſelf thereby into the favour of the emperor Theodoſius; but, in the courſe of time, the fraud has been diſcovered, although ſeveral learned perſons have confounded the two authors. This piece has been tranſlated into French by the Sieur de Claveret, with a dedication to the duke of Longueville, in 1663; and again by M. le Gras, then of the congregation of the Oratory at Paris, 1729, 12mo. We have an excellent tranſlation of it into Engliſh, by ſeveral hands at Oxford, which has gone through ſeveral editions.

NEPTUNE, in Pagan worſhip, the god of the ſea, was the ſon of Saturn and Veſta or Ops, and the brother of Jupiter and Pluto. He aſſiſted Jupiter in his expeditions; on which that god, when he arrived at the ſupreme power, aſſigned him the ſea and the iſlands for his empire. He was, however, expelled from heaven with Apollo for conſpiring againſt Jupiter, when they were both employed by Laomedon king of Phrygia in building the walls of Troy; but that prince diſmiſſing Neptune without a reward, he ſent a ſea monſter to lay waſte the country, on which he was obliged to expoſe his daughter Heſione. He is ſaid to have been the firſt inventor of horſemanſhip and chariot racing; on which account Mithridates king of Pontus threw chariots drawn by four horſes into the ſea in honour of this god; and the Romans inſtituted horſe races in the circus at his feſtival, during which all other horſes left working, and the mules were adorned with wreaths of flowers.

In a conteſt with Minerva he produced a horſe by ſtriking the earth with his trident; and on another occaſion, in a trial of ſkill with Minerva and Vulcan, produced a bull, whence that animal was ſacrificed to him. His favourite wife was Amphytrite, whom he long courted in vain, till ſending a dolphin to intercede for him, he met with ſucceſs; on which he rewarded the dolphin by placing him among the ſtars. He had alſo two other wives, one of whom was called *Salaſia* from the ſalt water; the other *Venilia* from the ebbing and flowing of the tides. He had likewiſe many concubines, by whom he had a great number of children. He is repreſented with black hair, with a garment of an azure or ſea green; holding his trident in his hand, and ſeated in a large ſhell drawn by ſea horſes; attended by the ſea gods Palemon, Glaucus, and Phorcys, and the ſea goddeſſes Thetis, Melita, and Panopæa, and a long train of tritons and ſea nymphs.

This deity was known in Egypt by the name of *Cenobus* or *Canopus*, and was worſhipped as the *numen aquarum* or ſpirit of the Nile. His emblem was the figure of certain vaſes or pitchers, with which the Egyptians filtrated the water of their ſacred river, in order to purify and render it fit for uſe. From the mouth of each of theſe vaſes, which were charged with hieroglyphics, aroſe the head and ſometimes the head and hands, of a man or woman. Such are the emblems which ſtill remain of the Egyptian Neptune or Canobus; and it was by this emblem that the tutelar god of Egypt vanquiſhed the god of Chaldea in the ridiculous manner mentioned by Ruffinus in his Eccleſiaſtical Hiſtory *.

* Lib. 2. cap. 26.

"The Chaldeans (ſays he) who adored the fire, carried their god into various countries that he might try his ſtrength in conteſts with other gods. He vanquiſhed, as we may eaſily conceive, the images made of gold, ſilver, braſs, and wood, &c. by reducing them to aſhes; and thus the worſhip of fire was everywhere eſtabliſhed. The prieſt of Canobus, unwilling, as became him, to admit the ſuperiority of ſtrange gods, contrived to make his god vanquiſh the god of Chaldæa in a pitched battle. The vaſes which were worſhipped as the emblems of Canobus being uſed for filtering the waters of the Nile, were of courſe perforated on all ſides with very ſmall holes. This faithful prieſt having ſtopped all the holes in one of theſe

these with wax, and painted the vase of different colours for a reason which the reader will admit to be a good one, filled it up with water, and fitted to its mouth the head of an idol. This emblem of Canobus was then placed in a small fire brought by the Chaldæans as the emblem of their god; and thus the gods of Egypt and Chaldæa were forced into battle. The contest, however, was of short duration. The heat melting the wax made way for the water to run out, which quickly extinguished the fire; and thus Canobus vanquished the god of the Chaldeans." Ridiculous as this story is, it is perfectly suitable to the genius of Paganism, and the mean artifices of the Pagan priesthood; but we suspect that the historian laboured under one mistake, and substituted the Chaldæans instead of the Persians. See POLYTHEISM.

NEREIDS, in the Pagan theology, sea nymphs, daughters of Nereus and Doris.—The Nereids were esteemed very handsome; insomuch that Cassiope, the wife of Cepheus king of Ethiopia, having triumphed over all the beauties of the age, and daring to vie with the Nereids, they were so enraged that they sent a prodigious sea monster into the country; and, to appease them, she was commanded by the oracle to expose her daughter Andromeda, bound to a rock, to be devoured by the monster. In ancient monuments, the Nereids are represented riding upon sea horses; sometimes with an entire human form, and at other times with the tail of a fish.

NEREIS, a genus of animals belonging to the order of vermes mollusca. See HELMINTHOLOGY *Index*.

NEREUS, in fabulous history, a marine deity, was son of Oceanus and Thetis. He settled in the Ægean sea, was considered as a prophet, and had the power of assuming what form he pleased. He married his sister Doris, by whom he had 50 daughters called the *Nereids*, who constantly attended on Neptune, and when he went abroad surrounded his chariot.

NERI, ANTHONY, a learned writer who published a curious book printed at Florence 1612, in 4to, with this title *Dell' Arte Verraria Libri VII.*; or *the Art of Glassmaking*.

NERIUM, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY and DYEING *Index*.

NERO, CLAUDIUS DOMITIUS CÆSAR, a celebrated Roman emperor, son of Caius Domitius Ahenobarbus and Agrippina the daughter of Germanicus. He was adopted by the emperor Claudius, A. D. 50, and four years after he succeeded to him on the throne. In the beginning of his reign he showed several marks of the greatest kindness and condescension, affability, complaisance, and popularity. The object of his administration seemed to be the good of his people; and when he was desired to sign his name to a list of malefactors that were to be executed, he exclaimed, *Would to heaven I could not write!* He hated flattery; and when the senate had liberally commended the wisdom of his government, he desired them to keep their praises till he deserved them. These promising virtues soon, however, proved to be artificial: Nero soon displayed the real propensities of his nature. He delivered himself from the sway of his mother, and at last ordered her to be murdered. This unnatural act of barbarity might astonish some, but Nero had his devoted adherents; and when he declared that he had taken away his mother's life to save himself from ruin, the senate applauded his measures, and the people signified their approbation. Many of his courtiers shared her unhappy fate; and Nero sacrificed to his fury or caprice all such as obstructed his pleasure or diverted his inclination. In the night he generally went from his palace to visit the meanest taverns, and all the scenes of debauchery which Rome contained. In this nocturnal riot he was fond of insulting the people in the streets; and his attempts to offer violence to the wife of a Roman senator nearly cost him his life. He also turned actor, and openly appeared on the Roman stage in the meanest characters. In his attempts to excel in music, and to conquer the disadvantages of a hoarse disagreeable voice, he moderated his meals, and often passed the day without eating. The Olympian games attracted his notice: he went into Greece, and presented himself a candidate for the public honour. He was defeated in wrestling; but the flattery of the spectators adjudged him the victory, and he returned to Rome with all the splendour and pomp of an eastern conqueror, drawn in the chariot of Augustus, and attended by a band of musicians, actors, and stage dancers from every part of the empire. These private and public amusements of the emperor were indeed innocent; his character only was injured, and not the lives of the people. His conduct, however, soon became more abominable: he disguised himself in the habit of a woman, and was publicly married to one of his eunuchs. This violence to nature and decency was soon exchanged for another: Nero resumed his sex, and celebrated his nuptials with one of his meanest catamites: and it was on this occasion that one of the Romans observed that the world would have been happy if Nero's father had had such a wife. But his cruelty was now displayed in a still higher degree, for he sacrificed to his wantonness his wife Octavia Poppæa, and the celebrated writers, Seneca, Lucan, Petronius, &c. Nor did the Christians escape his barbarity. He had heard of the burning of Troy; and as he wished to renew that dismal scene, he caused Rome to be set on fire in different places. The conflagration became soon universal, and during nine successive days the fire continued. All was desolation: nothing was heard but the lamentations of mothers whose children had perished in the flames, the groans of the dying, and the continual fall of palaces and buildings. Nero was the only one who enjoyed the general consternation. He placed himself on the top of a high tower, and he sung on his lyre the destruction of Troy, a dreadful scene which his barbarity had realized before his eyes. He attempted to avert the public odium from his head by a pretended commiseration of the miseries of his subjects. He began to repair the streets and the public buildings at his own expence. He built himself a celebrated palace, which he called his golden house. It was liberally adorned with gold, with precious stones, and with every thing rare and exquisite. It contained spacious fields, artificial lakes, woods, gardens, orchards, and whatever exhibited a beautiful scene. The entrance of this edifice could admit a large colossus of the emperor 120 feet high; the galleries were each a mile long, and the whole was covered with gold.

gold. The roofs of the dining halls reprefented the firmament, in motion as well as in figure; and continually turned round night and day, fhowering down all forts of perfumes and fweet waters. When this grand edifice, which, according to Pliny, extended all round the city, was finifhed, Nero faid, that now hé could lodge like a man. His profufion was not lefs remarkable in all his other actions. When he went a fifhing, his nets were of gold and filk. He never appeared twice in the fame garment; and when he took a voyage, there were thoufands of fervants to take care of his wardrobe. This continuation of debauchery and extravagance at laft roufed the people. Many confpiracies were formed againft him; but they were generally difcovered, and fuch as were acceffory fuffered the fevereft punifhments. The moft dangerous confpiracy againft Nero's life was that of Pifo, from which he was faved by the confeffion of a flave. The confpiracy of Galba proved more fuccefsful, who, when he was informed that his plot was known to Nero, declared himfelf emperor. The unpopularity of Nero favoured his caufe; he was acknowledged by all the Roman empire, and the fenate condemned the tyrant to be dragged naked through the ftreets of Rome, and whipped to death, and afterwards to be thrown down from the Tarpeian rock like the meaneft malefactor. This, however, was not executed; for Nero prevented it by a voluntary death. He killed himfelf, A. D. 68, in the 32d year of his age, after a reign of 13 years and eight months. Rome was filled with acclamations on the occafion; and the citizens, more ftrongly to indicate their joy, wore caps, fuch as were generally ufed by flaves who had received their freedom. Their vengeance was not only exercifed againft the ftatues of the deceafed monfter, but many of his friends were the object of the public refentment; and many were crufhed to pieces in fuch a violent manner, that one of the fenators, amid the univerfal joy, faid that he was afraid they fhould foon have caufe to wifh for Nero. The tyrant, as he expired, requefted that his head might not be cut off from his body, and expofed to the infolence of the populace, but that the whole might be burned on the funeral pile. His requeft was granted by one of Galba's freedmen, and his obfequies were performed with the ufual ceremonies. Though his death feemed to be the fource of general gladnefs, yet many of his favourites lamented his fall, and were grieved to fee that their pleafures and amufements were ftopped by the death of this patron of debauchery and extravagance. Even the king of Parthia fent ambaffadors to Rome, to condole with the Romans, and to beg that they would honour and revere the memory of Nero. His ftatues were alfo crowned with garlands of flowers; and many imagined that he was not dead, but that he would foon make his appearance and take vengeance on his enemies. It will be fufficient to obferve, in finifhing the character of this tyrannical monfter, that the name of Nero is even now ufed emphatically to exprefs a barbarous and unfeeling oppreffor. Pliny calls him the common enemy and fury of mankind; and fo indeed he has been called by all writers, who exhibit Nero as a pattern of the moft execrable barbarity and unpardonable wantonnefs. The fame Pliny furnifhes us with this fingular anecdote of him: "Nero had ordered himfelf to be painted under the figure of a coloffus, upon cloth or canvas, 120 feet in height." He adds, "that this prepofterous picture, when it was finifhed, met with its fate from lightning, which confumed it, and involved likewife the moft beautiful part of the gardens where it was placed in the conflagration."

NERVA, Cocceius, a Roman emperor after Domitian, who was the laft of the 12 Cæfars. He was a native of Narnia in Umbria; his family however was originally of Crete. Dion Caffius fays he was born on the 17th of March, in the 18th year of Tiberius's reign, and of the Chriftian era the 32d. Nero in the 12th year of his reign made him prætor, and erected a ftatue for him in the palace on account of his poems (for he was one of the beft poets of his age), fome of which were infcribed to him. He was conful in 71 with Vefpafian, and in 90 with Domitian.

Ancient authors uniformly celebrate him as a prince of a moft mild and humane temper, of great moderation and generofity, who looked on his office as emperor, not as if it was for his own advantage, but for that of his people; and whilft he reigned, which was however but for a fhort time, he made the happinefs of his fubjects his only end and purfuit. He narrowly efcaped death under Domitian; was naturally of a weak and timorous difpofition; and, as fome fay, addicted to exceffive drinking. The Romans unanimoufly chofe him emperor; and they had no caufe to repent of their choice, for he was conftantly attentive to what could make them happy; he was generous, merciful, and difinterefted. An inftance of his great lenity appears in his pardoning Calpurnius Craffus who confpired againft him. In fhort, he omitted nothing that might contribute to the reftoring of the empire to its former luftre: recalling thofe who had been banifhed for religion, and redreffing all grievances that came to his knowledge. He however found his ftrength failing, and that it would be impoffible for him to finifh his defigns, in confequence of which he adopted Trajan. After his death, which happened in the year 98, he was ranked among the gods. He was the firft Roman emperor of foreign extraction.

NERVES, in *Anatomy*, certain white gliftening cords, proceeding from the brain and fpinal marrow, and dividing into very fmall branches, which are fent off throughout all parts of the body; and which are found to be the organs of fenfation and motion. See Anatomy *Index*.

NERVOUS fluid. See Anatomy *Index*.

NESSUS, in fabulous hiftory, a celebrated Centaur, fon of Ixion and a Cloud. He offered violence to Dejanira, whom Hercules had entrufted to his care, with orders to carry her acrofs the river Evenus. Hercules faw the diftrefs of his wife from the oppofite fhore of the river, and immediately he let fly one of his poifoned arrows, which ftruck the Centaur to the heart. Neffus, as he expired, gave the tunic he then wore to Dejanira, affuring her that from the poifoned blood which had flowed from his wounds, it had received the power of calling a hufband away from unlawful loves. Dejanira received it with pleafure, and this mournful prefent caufed the death of Hercules.——A river which feparates Thrace from Macedonia. It is alfo called *Nefus*, *Neftos*, and *Neftus*.

NEST.

Neft, Neftor.

NEST. See Nidus.

Eatable Birds Nests. See *Birds Nefts.*

NESTOR, in fabulous hiftory, a fon of Neleus and Chloris, nephew to Pelias and grandfon to Neptune. He had eleven brothers, who were all killed with his father by Hercules. His tender age detained him at home, and was the caufe of his prefervation. The conqueror fpared his life and placed him upon the throne of Pylos. He married Eurydice the daughter of Clymenus; or, according to others, Anaxibia the daughter of Atreus. He foon diftinguifhed himfelf in the field of battle; and was prefent at the nuptials of Perithous, when a bloody engagement took place between the Lapithæ and Centaurs. As king of Pylos and Meffenia he led his fubjects to the Trojan war, where he diftinguifhed himfelf among the reft of the Grecian chiefs, by eloquence, addrefs, wifdom, juftice, and uncommon prudence. Homer difplays his character as the moft perfect of all his heroes; and Agamemnon exclaims, that if he had 20 generals like Neftor, he fhould foon fee the walls of Troy reduced to afhes. After the Trojan war Neftor retired to Greece, where he enjoyed in the bofom of his family the peace and tranquillity which were due to his wifdom and to his age. The manner and the time of his death are unknown: the ancients are all agreed that he lived three generations of men; which length of time is fuppofed to be 300 years, though more probably only 90 years, allowing 30 years for each generation. From that circumftance, therefore, it was ufual among the Greeks and the Latins, when they wifhed a long and happy life to their friends, to wifh them to fee the years of Neftor. He had many children; two daughters, Pifidice and Polycafte; and feven fons, Perfeus, Straticus, Aretus, Echephron, Pififtratus, Antilochus, and Thrafymedes. Neftor was one of the Argonauts, according to Valerius Flaccus, v. 380, &c.—A poet of Lycaonia in the age of the emperor Severus. He was father to Pifander, who under the emperor Alexander wrote fome fabulous ftories——One of the body guards of Alexander.

Nestor, whofe fecular name is not known, was a native of Ruffia, and the earlieft hiftorian of the north. He was born in 1056 at Bielozero; and in the 19th year of his age he affumed the monaftic habit in the convent of Petcherfki at Kiof, and took the name of *Neftor*. He there made a confiderable proficiency in the Greek language: but feems to have formed his ftyle and manner rather from the Byzantine hiftorians, Cedrenus, Zonaras, and Syncellus, than from the ancient claffics. The time of Neftor's death is not afcertained; but he is fuppofed to have lived to an advanced age, and to have died about the year 1115.

His great work is his Chronicle, to which he has prefixed an introduction, which after a fhort fketch of the early ftate of the world, taken from the Byzantine writers, contains a geographical defcription of Ruffia and the adjacent regions; an account of the Sclavonian nations, their manners, their emigrations from the banks of the Danube, their difperfion, and fettlement in the feveral countries wherein their defcendants are now eftablifhed. He then enters upon a chronological feries of the Ruffian annals, from the year 858 to about 1113. His ftyle is fimple and unadorned, fuch as fuits a mere recorder of facts; but his chronological exactnefs, though it renders his narrative dry and tedious, contributes to afcertain the era and authenticity of the events which he relates.

Neftorians.

It is remarkable (fays Mr Coxe, from whom we have taken this narrative), that an author of fuch importance, whofe name frequently occurs in the early Ruffian books, fhould have remained in obfcurity above 600 years; and been fcarcely known to his modern countrymen, the origin and actions of whofe anceftors he records with fuch circumftantial exactnefs. A copy of his Chronicle was given in 1668 by Prince Radzivil to the library of Konigfburg, where it lay unnoticed till Peter the Great, in his paffage through that town, ordered a tranfcript of it to be fent to Peterfburgh. But it ftill was not known as the performance of Neftor: for when Muller in 1732 publifhed the firft part of a German tranflation, he mentioned it as the work of the abbot Theodofius of Kiof; an error which arofe from the following circumftance: The ingenious editor not being at that time fufficiently acquainted with the Sclavonian tongue, employed an interpreter, who, by miftaking a letter in the title, fuppofed it to have been written by a perfon whofe name was Theodofius. This ridiculous blunder was foon circulated, and copied by many foreign writers, even long after it had been candidly acknowledged and corrected by Muller.

NESTORIANS, a fect of ancient Chriftians, ftill faid to be fubfifting in fome parts of the Levant; whofe diftinguifhing tenet is, that Mary is not the mother of God. They take their name from Neftorius bifhop of Conftantinople, whofe doctrines were fpread with much zeal through Syria, Egypt, and Perfia.

One of the chief promoters of the Neftorian caufe was Barfumas, created bifhop of Nifibis, A. D. 435. Such was his zeal and fuccefs, that the Neftorians, who ftill remain in Chaldea, Perfia, Affyria, and the adjacent countries, confider him alone as their parent and founder. By him Pherozes the Perfian monarch was perfuaded to expel thofe Chriftians who adopted the opinions of the Greeks, and to admit the Neftorians in their place, putting them in poffeffion of the principal feat of ecclefiaftical authority in Perfia, the fee of Seleucia, which the patriarch of the Neftorians has always filled even down to our time.—Barfumas alfo erected a fchool at Nifibis, from which proceeded thofe Neftorian doctors who in the fifth and fixth centuries fpread abroad their tenets through Egypt, Syria, Arabia, India, Tartary, and China.

He differed confiderably from Neftorius, holding that there are two perfons in Jefus Chrift, as well as that the Virgin was not his mother, as God, but only as man.

The abettors of this doctrine refufe the title Neftorians; alleging that it had been handed down from the earlieft times of the Chriftian church.

In the tenth century, the Neftorians in Chaldea, whence they are fometimes called *Chaldeans*, extended their fpiritual conquefts beyond Mount Imaus, and introduced the Chriftian religion into Tartary properly fo called, and efpecially into that country called *Karit*, bordering on the northern part of China. The prince of that country, whom the Neftorians converted to the Chriftian faith, affumed, according to the vulgar tradition, the name of *John* after his baptifm, to which he added the surname of *Presbyter*, from a principle of modesty; whence it is said his successors were each of them called *Prester John* until the time of Gengis Khan. But Mosheim observes, that the famous Prester John did not begin to reign in that part of Asia before the conclusion of the 11th century. The Nestorians formed so considerable a body of Christians, that the missionaries of Rome were industrious in their endeavours to reduce them under the papal yoke. Innocent IV, in 1246, and Nicolas IV. in 1278, used their utmost efforts for this purpose, but without success. Till the time of Pope Julius III. the Nestorians acknowledged but one patriarch, who resided first at Bagdad, and afterwards at Mousul; but a division arising among them, in 1551 the patriarchate became divided, at least for a time, and a new patriarch was consecrated by that pope, whose successors fixed their residence in the city of Ormus in the mountainous part of Persia, where they still continue, distinguished by the name of *Simeon;* and so far down as the last century, these patriarchs persevered in their communion with the church of Rome, but seem at present to have withdrawn themselves from it. The great Nestorian pontiffs, who form the opposite party, and look with a hostile eye on this little patriarch, have since the year 1559 been distinguished by the general denomination of Elias, and reside constantly in the city of Mousul. Their spiritual dominion is very extensive, takes in a great part of Asia, and comprehends also within its circuit the Arabian Nestorians, and also the Christians of St Thomas, who dwell along the coast of Malabar. It is observed, to the lasting honour of the Nestorians, that of all the Christian societies established in the East, they have been the most careful and successful in avoiding a multitude of superstitious opinions and practices that have infected the Greek and Latin churches. About the middle of the 17th century, the Romish missionaries gained over to their communion a small number of Nestorians, whom they formed into a congregation or church; the patriarchs or bishops of which reside in the city of Amida, or Diarbekir, and all assume the denomination of *Joseph*. Nevertheless the Nestorians in general persevere to our own times in their refusal to enter into the communion of the Romish church, notwithstanding the earnest entreaties and alluring offers that have been made by the pope's legate to conquer their inflexible constancy.

NESTORIUS, from whom the sect of Nestorian Christians derive their name, was born in Germanica a city of Syria. He received his education at Antioch, where he was likewise baptized; and soon after his baptism he withdrew himself to a monastery in the suburbs of that city. Upon his being admitted to the order of priesthood, he quickly acquired so great reputation by the eloquence of his preaching, and the regularity of his life, that by the emperor Theodosius he was deemed a fit person to fill the second see in the Christian church, and was accordingly consecrated bishop of Constantinople in the year 429.

In one of his first sermons after his promotion, he publicly declared his intention to *make war upon heretics;* and with that intolerant spirit which has so often disgraced the preachers of the mild religion of Jesus, he called upon the emperor to *free the earth from heretics*, promising to give him heaven as a reward for his zeal. To this spiritual motive he added one, that, though carnal, he possibly judged of equal force:—"Join with me (said he) in war against them, and I will assist you against the Persians." Although the wiser and better part of his audience were amazed to see a man, before he had tasted (as the historian * expresses himself) the water of his city, declare that he would persecute all who were not of his opinion; yet the majority of the people approved of this discourse, and encouraged him to execute his purpose. Accordingly, five days after his consecration, he attempted to demolish the church in which the Arians secretly held their assemblies; and he succeeded so far in his design, that these people, growing desperate, set it on fire themselves, and consumed with it some of the neighbouring houses. This fire excited great commotions in the city, and Nestorius was ever afterwards called an *incendiary*.

* *Socrates.*

From the Arians he turned his persecution against the Novatians, but was stopped in his career by the interposition of the emperor. He then let loose his fury upon those Christians of *Asia*, *Lydia*, and *Caria*, who celebrated the feast of Easter upon the 14th day of the moon; and for this unimportant deviation from the Catholic practice, many of those people were murdered by his agents both at Miletum and Sardis.—One cannot be sorry that such a relentless persecutor should himself be afterwards condemned as a heretic, for holding an opinion which no man who speaks or thinks with philosophic accuracy will now venture to controvert. This obnoxious tenet which produced a schism in the church, and was condemned by a general council, was nothing more than that "the Virgin Mary cannot with propriety be called the mother of God." The people being accustomed to hear this expression, were much inflamed against their bishop, imagining that he had revived the error of *Paulus Samosetenus* and *Photinus*, who taught that Jesus Christ was a mere man. The monks declared openly against him, and, with some of the most considerable men in Constantinople, separated themselves from his communion. Several bishops wrote to him earnest persuasives to acknowledge that Mary was the mother of God; and when he would not comply, they procured his condemnation in the council of Ephesus, which deprived him of his see. He then retired to his ancient monastery at Antioch, whence he was taken four years afterwards by the emperor's order, and banished in 435 to Tarsus. That city being taken and destroyed by the barbarians, he was removed to Panopolis, a city of Thebais; where he was not suffered to remain long, but was compelled to go from place to place, till, being in one of his journeys mortally bruised by a fall, death relieved him from the fury of his persecutors.

If we examine such of his writings as remain, we shall find that he was very unjustly condemned. It appears that he rejected the errors of *Ebion*, *Paulus Samosetenus*, and *Photinus;* that he maintained in express terms, that the divine Word was united to the human nature in Jesus Christ in the most strict and intimate sense possible; that these two natures, in this state of union, make but one Christ and one person; that the properties of the Divine and human natures may both be attributed to this person; and that Jesus Christ may be said to have been born of a virgin, to have suffered and

Neftus, Net.

and died; but he never would admit that God could be faid to have been born, to have fuffered, or to have died.—When we confider that every perfon partakes of the fubftance of his mother, and that it is this which conftitutes the parental and filial relation between them, it is indeed furprifing that the expreffion "Mother of God" fhould ever have been admitted into the Chriftian church, or that any man who underftands the meaning of the words fhould condemn Neftorius for not having ufed them.

NESTUS, or NESSUS, a river which feparates Thrace from Macedonia. It falls into the Ægean fea near the ifland Thafos. It is fometimes called *Nefus* and *Neffus*.

NET, a device for catching fifh and fowl. See the article FISHERY.

The taking fowls by nets is the readieft and moft advantageous of all others, where numbers are to be taken. The making the nets is very eafy, and what every true fportfman ought to be able to do for himfelf. All the neceffary tools are wooden needles, of which there fhould be feveral of different fizes, fome round and others flat; a pair of round pointed and flat fciffars; and a wheel to wind off the thread. The packthread is to be of different ftrength and thicknefs, according to the fort of birds to be taken; and the general fize of the mefhes, if not for very fmall birds, is two inches from point to point. The nets fhould neither be made too deep nor too long, for they are then difficult to manage; and they muft be verged on each fide with twifted thread. The natural colour of the thread is too bright and pale, and is therefore in many cafes to be altered. The moft ufual colour is the ruffet; which is to be obtained by plunging the net, after it is made, into a tanners pit, and letting it lie there till it be fufficiently tinged: this is of a double fervice to the net, fince it preferves the thread as well as alters the colour. The green colour is given by chopping fome green wheat and boiling it in water, and then foaking the net in this green tincture. The yellow colour is given in the fame manner with the decoction of celandine; which gives a pale ftraw-colour, which is the colour of ftubble in the harveft-time. The brown nets are to be ufed on ploughed lands, the green on grafs grounds, and the yellow on ftubble lands.

Day-NET, among fowlers, a net generally ufed for taking fuch fmall birds as play in the air, and will ftoop either to prey, gig, or the like; as larks, linnets, buntings, &c. The time of the year for ufing this net is from Auguft to November; and the beft time is very early in the morning: and it is to be obferved, that the milder the air, and the brighter the fun is, the better will be the fport, and of longer continuance. The place where this net fhould be laid, ought to be plain champaign, either on fhort ftubbles, green lays, or flat meadows, near corn fields, and fomewhat remote from towns and villages: you muft be fure to let your net lie clofe to the ground, that the birds creep not out and make their efcape.—The net is made of a fine packthread with a fmall mefh, not exceeding half an inch fquare; it muft be three fathoms long, and but one broad: it muft be verged about with a fmall but ftrong cord; and the two ends extended upon two fmall long poles, fuitable to the breadth of the net, with four ftakes, tail-ftrings, and drawing-lines.—This net is compofed of two, which muft be exactly alike; and are to be laid oppofite to one another, fo even and clofe, that when they are drawn and pulled over, the fides muft meet and touch each other. You muft ftake this net down with ftrong ftakes, very ftiff on their lines, fo that you may with a nimble touch caft them to and fro at pleafure; then faften your drawing-cord or hand-lines (of which there muft be a dozen at leaft, and each two yards long) to the upper end of the foremoft ftaves: and fo extend them of fuch a ftraitnefs, that with a little ftrength they may rife up in the nets and caft them over.

Sportfman's Dictionary.

Net.

Your nets being thus laid, place your gigs, or playing-wantons, about 20 or 30 paces beyond, and as much on this fide your nets: the gigs muft be faftened to the tops of long poles, and turned into the wind, fo as they may play to make a noife therein. Thefe gigs are a fort of toys made of long goofe-feathers, like fhuttle-cocks, and with little fmall tunnels of wood running in broad and flat fwan-quills, made round like a fmall hoop; and fo, with longer ftrings faftened to a pole, will, with any fmall wind or air, move after fuch a manner, that birds will come in great flocks to play about them.

When you have placed your gigs, then place your ftale; which is a fmall ftake of wood, to prick down into the earth, having in it a mortice-hole, in which a fmall and flender piece of wood, about two feet long, is faftened, fo as it may move up and down at pleafure: and faften to this longer ftick a fmall line, which, running through a hole in the ftick abovementioned, and fo coming up to the place where you are to fit, you may, by drawing the line up and down with your right hand, raife up the longer ftick as you fee occafion.

Faften a live lark, or fuch like bird, to this longer ftick, which, with the line making it to ftir up and down by your pulling, will entice the birds to come to your net.

There is another ftale, or enticement, to draw on thefe birds, called a *looking-glafs;* which is a round ftake of wood, as big as man's arm, made very fharp at the end, to thruft it into the ground: they make it very hollow in the upper part, above five fingers deep; into which hollow they place a three-fquare piece of wood about a foot long, and each two inches broad, lying upon the top of the ftake, and going with a foot into the hollownefs: which foot muft have a great knob at the top, and another at the bottom, with a deep flendernefs between; to which flendernefs you are to faften a fmall packthread, which, running through a hole in the fide of the ftake, muft come up to the place where you fit. The three-fquare piece of wood which lies on the top of the ftake, muft be of fuch a poife and evennefs, and the foot of the focket fo fmooth and round, that it may whirl and turn round upon the leaft touch; winding the packthread fo many times about it, which being fuddenly drawn, and as fuddenly let go, will keep the engine in a conftant rotatory motion: then faften with glue on the uppermoft flat fquares of the three-fquare piece, about 20 fmall pieces of looking-glafs, and paint all the fquare wood between them of a light and lively red; which, in the

Net, Netherlands.

the continual motion, will give ſuch a reflection, that the birds will play about to admiration until they are taken.

Both this and the other ſtale are to be placed in the middle between the two nets, about two or three feet diſtance from each other; ſo that, in the falling of the nets, the cords may not touch or annoy them: neither muſt they ſtand one before or after another; the glaſs being kept in a continual motion, and the bird very often fluttering. Having placed your nets in this manner, as alſo your gigs and ſtales, go to the further end of your long drawing lines and ſtale lines; and, having placed yourſelf, lay the main drawing line acroſs your thigh, and, with your left, pull the ſtale line to ſhow the birds; and when you perceive them to play near and about your nets and ſtales, then pull the net over with both hands, with a quick but not too haſty motion; for otherwiſe your ſport will be ſpoiled.

Plate CCCLXIX.

See Plate CCCLXIX. where A ſhows the bodies of the main net, and how they ought to be laid. B, the tail lines, or the hinder lines, ſtaked to the ground. C, the fore lines ſtaked alſo to the ground. D, the bird ſtale. E, the looking-glaſs ſtale. G, the line which draws the bird ſtale. H, the line that draws the glaſs ſtale. I, the drawing, double lines of the nets, which pulls them over. K, the ſtakes which ſtake down the four nether points of the nets and the two tail lines. L, the ſtakes that ſtake down the fore lines. M, the ſingle line, with the wooden button to pull the net over with. N, the ſtake that ſtakes down the ſingle line, and where the man ſhould ſit; and O, the gig.

Net, *Neat*, in commerce, ſomething pure, and unadulterated with any foreign mixture.

Thus, wines are ſaid to be *net* when not falſified or balderdaſhed; and coffee, rice, pepper, &c. are *net* when the filth and ordures are ſeparated from them. See Neat.

A diamond is ſaid to be *net* when it has no ſtains or flaws; a cryſtal, when tranſparent throughout.

Net is alſo uſed for what remains after the tare has been taken out of the weight of any merchandiſe, i. e. when it is weighed clear of all package. See Tare.

Thus we ſay, a barrel of cochineal weighs 450 pounds; the tare is 50 pounds, and there remain *net* 400 pounds.

Net Produce, a term uſed to expreſs what any commodity has yielded, all tare and charges deducted.

The merchants ſometimes uſe the Italian words *netto proceduto*, for net produce.

NETHERLANDS, anciently called *Belgia*, but ſince denominated *Low Countries* or *Netherlands*, from their low ſituation, are ſituated between 2° and 7° of eaſt longitude, and between 50° and 53° 30′ of north latitude: and are bounded by the German ſea on the north, Germany on the eaſt, by Lorrain and France on the ſouth, and by another part of France and the Britiſh ſeas on the weſt; extending near 300 miles in length from north to ſouth, and 200 miles in breadth from eaſt to weſt. They conſiſt of 17 provinces; 10 of which are called the *Auſtrian and French Netherlands*, and the other ſeven the *United Provinces*.

The greateſt part of the Netherlands was conquered by the Romans; and that part which lies towards Gaul continued in their ſubjection till the decline of that empire; after which the Franks became maſters of it; and, under the French monarchy, it was part of the kingdom of Metz or Auſtraſia.

Netherlands.

Towards the end of the 15th century Maximilian of Auſtria, ſon of the emperor Ferdinand III. acquired, by marrying the only daughter of the duke of Burgundy, the duchies of Brabant, Limburg, and Luxemburg; the counties of Flanders, Burgundy, Hainault, Holland, Zealand, and Namur; and the lordſhip of Frieſland. Philip of Auſtria, ſon to Maximilian and Mary, married Jane the daughter of Ferdinand king of Arragon and of Iſabella queen of Caſtile; by which means their ſon Charles inherited not only almoſt all Spain and the great countries then lately diſcovered in America, but alſo thoſe noble provinces of the Netherlands, and was choſen emperor under the name of *Charles V.* Towards the latter end of the 1527, he added to his dominions the temporalities of the biſhoprick of Utrecht on both ſides of the Yſſel; and Henry of Bavaria, being diſtreſſed through war with the duke of Guelderland, and tired with the continued rebellion of his own ſubjects, ſurrendered to the emperor the temporalities of his dioceſe, which was confirmed by the pope, and the ſtates of the country. In 1536, Charles V. bought of Charles of Egmond the reverſion of the duchy of Guelderland and of the county of Zutphen, in caſe that prince ſhould die without iſſue. The ſame year the city of Groningen took the oath of allegiance, and ſubmitted to Charles V. and in 1543 he put a garriſon into the city of Cambray, and built a citadel there. Having thus united the 17 provinces, as it were in one body, he ordered that they ſhould continue for ever under the ſame prince, without being ever ſeparated or diſmembered; for which purpoſe he publiſhed in November 1549, with the conſent and at the requeſt of the ſtates of all the provinces, a perpetual and irrevocable edict or law, by which it was enacted, that in order to keep all thoſe provinces together under one and the ſame prince, the right of repreſentation, with regard to the ſucceſſion of a prince or princeſs, ſhould take place for ever, both in a direct and collateral line, notwithſtanding the common laws of ſome provinces to the contrary. Charles had even a mind to incorporate theſe provinces with the Germanic body, and to make of them a circle of the empire, under the title of the circle of Burgundy, in order thereby to engage the princes of the empire to concern themſelves for the preſervation of thoſe provinces. But the Netherlands, always jealous of their liberty, did not ſeem to like that incorporation; and when they were demanded to pay their ſhare towards the expences of the empire, they refuſed it: whereupon the princes of Germany refuſed, in their turn, to take any part in the wars in Flanders, and looked upon thoſe provinces as by no means belonging to the Germanic body.

Philip of Auſtria and his ſon Charles, who were born in the Netherlands, had for theſe provinces that natural affection which men uſe to have for their native country; and, knowing how jealous the inhabitants were of their liberty, and of the privileges granted to them by their former princes, they took great care to preſerve them, and ſuffered willingly that the ſtates, who were the guardians of the people's liberty and privileges, ſhould

ſhould in a manner ſhare the ſupreme authority with them. Philip II. ſon to the emperor Charles V. had not the ſame affection for the Netherlands, nor thoſe generous ſentiments which his father had endeavoured to inſpire him with. Being born in Spain of a Portugueſe woman, he had no regard but for his native country; and, when he removed out of the Netherlands, he left them to the weak government of a woman, to the proud and haughty ſpirit of Cardinal de Grenville, and to the wild ambition of ſome lords of theſe provinces, who availing themſelves of the imprudent conduct and continual blunders of the council of Spain, found their private intereſt in the diſturbances they could not fail to produce. Philip II. alſo, inſtead of the mild and moderate meaſures which his predeceſſors had ſucceſsfully employed on many occaſions, as beſt ſuiting the genius and temper of the people, had recourſe to the moſt violent and cruel proceedings; which, far from curing the evil, ſerved only to exaſperate it the more and render it incurable. The Spaniards, whom he ſent thither, being born and educated in an abſolute monarchy, jealous of the liberties and envious of the riches of the people, broke through all their privileges, and uſed them almoſt after the ſame manner as they had done the inhabitants of their new and ill-gotten dominions in America. This treatment occaſioned a general inſurrection. The counts Hoorn, Egmont, and the prince of Orange, appeared at the head of it, and Luther's reformation gaining ground about the ſame time in the Netherlands, his diſciples joined the malecontents: whereupon King Philip introduced a kind of inquiſition in order to ſuppreſs them, and many thouſands were put to death by that court, beſides thoſe that periſhed by the ſword; for theſe perſecutions and encroachments had occaſioned a civil war, in which ſeveral battles were fought. The counts Hoorn and Egmont were taken and beheaded: but the prince of Orange, retiring into Holland, with the aſſiſtance of England and France, preſerved Holland and ſome of the adjacent provinces, which entered into a treaty for their mutual defence at Utrecht in 1579, and they have ever ſince been ſtyled the *United Provinces;* but the other provinces were reduced to the obedience of Spain by the duke of Alva and other Spaniſh generals. However, their ancient privileges were in a great meaſure reſtored; every province was allowed its great council or parliament, whoſe concurrence was required to the making of laws, and raiſing money for the government, though theſe aſſemblies were too often obliged to follow the dictates of the court.

The emperor Joſeph II. endeavoured to deprive them even of the form of their free conſtitution; and he might very probably have ſucceeded, had he not attempted at the ſame time a reformation of the church. The Auſtrian Netherlands are wholly Catholic, and ſo bigotted to the Romiſh ſuperſtition, that though they had tamely ſubmitted to many encroachments of the archducal houſe on their civil rights, no ſooner did the monarch encroach upon the property of the holy mother church than they reſiſted his authority, and claimed all their ancient privileges political and religious. The ſame attachment to their ancient faith and worſhip made them very lately contribute to expel from their territories the French whom they had invited to relieve them from the Auſtrian yoke. Thus her religious bigotry for once ſaved a free people from the iron rod of deſpotiſm on the one hand, and the cruelties of frantic democrates on the other. The provinces under the government of France were, till the late revolution, under the ſame ſevere arbitrary dominion as the other ſubjects of that crown, and they now experience the ſame miſeries with the reſt of the republic.

The Spaniards continued poſſeſſed of almoſt eight of theſe provinces, until the duke of Marlborough, general of the allies, gained the memorable victory of Ramillies. After which Bruſſels the capital, and great part of theſe provinces, acknowledged Charles VI. (afterwards emperor) their ſovereign; and his daughter, the late empreſs queen, remained poſſeſſed of them till the war that followed the death of her father, when the French made an entire conqueſt of them, except part of the province of Luxemburg; but they were reſtored by the peace of Aix-la-Chapelle in 1748, and the French retained only Artois, the Cambreſis, part of Flanders, part of Hainault, and part of Luxemburg, of which they have had the dominion now upwards of eighty years.

The ſoil is generally fruitful, but differs in the ſeveral parts. The climate alſo differs in the ſeveral provinces; in thoſe towards the ſouth it does not differ much from that of England, though the ſeaſons are more regular. In the northern provinces the winter is generally very ſharp, and the ſummer ſultry hot; but the extreme cold and exceſſive heat ſeldom continue above five or ſix weeks. The air is reckoned very wholeſome, but is ſubject to thick fogs in winter, through the moiſtneſs of the country, which would be very noxious, were it not for the dry eaſterly winds, which, blowing off a long continent for two or three months in the year, clear the air, and occaſion very ſharp froſts in January and February; during which, the ports, rivers, and canals, are commonly ſhut up. The face of the country is low and flat; for, except ſome ſmall hills and a few riſing grounds in Utrecht and Guelderland, and in the parts lying towards Germany, there is no hill to be ſeen in the whole 17 provinces. This is the reaſon why they have been called the Low Countries. French Flanders abounds in grain, vegetables, flax, and cattle, but is in want of wood. For the hiſtory of the events which took place in the Netherlands during the French revolution, by which they were united to France, ſee FRANCE.

For the *Dutch Netherlands*, ſee *UNITED Provinces*.

NETHINIMS, among the Jews, the poſterity of the Gibeonites, who were condemned by Joſhua to be hewers of wood and drawers of water for the houſe of God.

NETOPION, a name given by the ancients to a very fragrant and coſtly ointment, conſiſting of a great number of the fineſt ſpicy ingredients. Hippocrates, in his Treatiſe of the Diſeaſes of Women, frequently preſcribes the netopion in diſeaſes of the uterus; and in other places he ſpeaks of its being poured into the ear as a remedy for deafneſs; theſe compoſitions, by their attenuating qualities, dividing the viſcous and thick humours. The word *netopion* is alſo ſometimes uſed to expreſs the *unguentum Ægyptiacum*, and ſometimes ſimply for oil of almonds.

NETTINGS, in a ſhip, a ſort of grates made of ſmall ropes ſeized together with rope yarn or twine, and fixed

fixed on the quarters and in the tops; they are ſometimes ſtretched upon the ledges from the waſte trees to the roof trees, from the top of the forecaſtle to the poop, and ſometimes are laid in the waſte of a ſhip to ſerve inſtead of gratings.

NETTLE. See URTICA, BOTANY *Index*.

Sea-NETTLE. See MEDUSA, HELMINTHOLOGY *Index*, and *ANIMAL-Flower.*

NETTLE-Tree. See CELTIS, BOTANY *Index*.

NETTUNO, a handſome town of Italy, in the Campagna di Roma. It is but thinly peopled, though ſeated in a fertile ſoil. The inhabitants are almoſt all hunters. E. Long. 12. 57. N. Lat. 41. 30.

NEVA, a river at Peterſburgh, in Ruſſia. The views upon the banks exhibit the grandeſt and moſt lively ſcenes. The river is in moſt places broader than the Thames at London. It is deep, rapid, and tranſparent as cryſtal, and its banks are lined on each ſide with a continued range of handſome buildings. On the north ſide the fortreſs, the academy of ſciences and that of art are the moſt ſtriking objects; on the oppoſite ſide are the imperial palace, the admiralty, the manſions of many Ruſſian nobles, and the Engliſh line, ſo called becauſe (a few houſes excepted) the whole row is occupied by the Engliſh merchants. In front of theſe buildings, on the ſouth ſide, is the quay, which ſtretches for three miles, except where it is interrupted by the admiralty; and the Neva, during the whole of that ſpace, has been lately embanked at the expence of the empreſs, by a wall, parapet, and pavement of hewn granite; a moſt elegant and durable monument of imperial munificence. There is a communication between the oppoſite ſides of the river by a bridge of pontoons, which when any thing is apprehended from the force of ice ruſhing down the ſtream, can be, and is generally indeed, removed. The great depth of the river, it appears, prevents the building of a ſtone bridge; and, if it could be built, there is no reaſon to ſuppoſe it could poſſibly reſiſt the force of thoſe vaſt ſhoals of ice which in the beginning of winter come down this rapid river. An attempt, however, has been made to remedy this inconvenience; and a Ruſſian peaſant has actually projected the plan of throwing a wooden bridge of one arch acroſs it, which in its narroweſt part is 980 feet in breadth. As we think this is a matter of very conſiderable importance, as well as of curioſity, we ſhall give the following copious account of the plan and its author, in Mr Coxe's own words; who tells us that the artiſt had then executed a model 98 feet in length, which he ſaw and examined with conſiderable attention.

"The bridge is upon the ſame principle with that of Shaffhauſen, excepting that the mechaniſm is more complicated, and that the road is not ſo level. I ſhall attempt to deſcribe it by ſuppoſing it finiſhed, as that will convey the beſt idea of the plan. The bridge is roofed at the top, and covered at the ſides; it is formed by four frames of timber, two on each ſide, compoſed of various beams or truſſes, which ſupport the whole machine. The road is not, as is uſual, carried over the top of the arch, but is ſuſpended in the middle.

"The following proportions I noted down with the greateſt exactneſs at the time when they were explained to me by the artiſt.

Length of the abutment on the north end,	658 feet.
Span of the arch, - - - -	980
Length of the abutment on the ſouth end,	658
Length of the whole ſtructure, including the abutments, - - -	2296
The plane of the road upon its firſt aſcent makes an angle of five degrees with the ordinary ſurface of the river.	
Mean level of the river to the top of the bridge in the centre, - -	168
Ditto to the bottom of the bridge in the centre, - - - -	126
Height of the bridge from the bottom to the top in the centre, - -	42
Height from the bottom of the bridge in the centre to the road, - -	7
Height from the bottom of ditto to the water, - - - - -	84
Height from the water to the ſpring of the arch, - - - - -	56

So that there is a difference of 35 feet between the road at the ſpring of the arch and the road at the centre; in other words, an aſcent of 35 feet in half 980, or in the ſpace of 490 feet, which is little more than eight tenths of an inch to a foot. The bridge is broadeſt towards the ſides, and diminiſhes towards the centre.

In the broadeſt part it is - - -	168 feet.
In the centre or naroweſt - -	42
The breadth of the road is - -	28

"The artiſt informed me, that to complete the bridge would require 49,650 iron nails, 12,908 large trees, 5500 beams to ſtrengthen them; and that it would coſt 300,000 rubles or 60,000l. He ſpeaks of this bold project with the uſual warmth of genius; and is perfectly convinced that it would be practicable. I muſt own that I am of the ſame opinion, though I hazard it with great diffidence. What a noble effect would be produced by a bridge ſtriking acroſs the Neva, with an arch 980 feet wide, and towering 168 feet from the ſurface of the water! The deſcription of ſuch a bridge ſeems almoſt chimerical; and yet upon inſpection of the model we become reconciled to the idea. But whether the execution of this ſtupendous work may be deemed poſſible or not, the model itſelf is worthy of attention, and reflects the higheſt honour on the inventive faculties of that unimproved genius. It is ſo compactly conſtructed, and of ſuch uniform ſolidity, that it has ſupported 3540 pood, or 127,440 pounds, without having in the leaſt ſwerved from its direction, which I am told is far more, in proportion to its ſize, than the bridge if completed would have occaſion to ſuſtain from the preſſure of the carriages added to its own weight.

"The perſon who projected this plan is a common Ruſſian peaſant. This extraordinary genius was apprentice to a ſhopkeeper at Niſhnei Novogorod: oppoſite to his dwelling was a wooden clock, which excited his curioſity. By repeated examination he comprehended the internal ſtructure, and without any aſſiſtance formed one exactly ſimilar in its proportion and materials. His ſucceſs in this firſt eſſay urged him to undertake the conſtruction of metal clocks and watches.

watches. The empress, hearing of these wonderful exertions of his native genius, took him under her protection, and sent him to England; from whence, on account of the difficulties attending his ignorance of the language, he soon returned to Russia. I saw a repeating watch of his workmanship at the Academy of Sciences: it is about the bigness of an egg; in the inside is represented the tomb of our Saviour, with the stone at the entrance, and the centinels upon duty: suddenly the stone is removed, the centinels fall down, the angels appear, the women enter the sepulchre, and the same chant is heard which is performed on Easter-eve. These are trifling, although curious performances; but the very planning of the bridge was a most sublime conception. This person, whose name is *Kulibin*, bears the appearance of a Russian peasant: he has a long beard, and wears the common dress of the country. He receives a pension from the empress, and is encouraged to follow the bent of his mechanical genius (A).

NEVEL, or NEBEL, in the Jewish antiquities, a kind of musical instrument. See NABLUM.

NEVERS, a town of France, in the department of Nievre, and situated in E. Long. 3. 14. N. Lat. 46. 59. on the river Loire, which here receives the rivulet *Nievre*, from which this city derives its name. It is a a place of great antiquity, supposed to be Cæsar's Noviodunum in Æduis, where he erected magazines for his armies. Francis I. made it a duchy and peerage in 1521, in favour of Francis of Cleves, to whom it came by marriage. It devolved afterwards to the house of Mantua, and then to the Palatine family, who in 1651 sold it to Cardinal Mazarine. The cardinal obtained a title of duke and peer for his nephew Philip Mancini, in whose family it continued till the late revolution. The town is fortified with walls, defended with many high towers and deep ditches, and is the seat of a bishopric, suffragan of Sens, as likewise of a bailiwic and chamber of accounts. There is a stone bridge on the Loire, with 20 arches, a draw-bridge on each side, and towers to defend them. This town is famous for its manufacture of glass and earthen ware, and is said to contain about 8000 inhabitants. In the centre of Nevers, on the summit of a hill, is built the palace of the ancient dukes. It appears to have been constructed in the sixteenth century, and exhibits a model of the beauty and delicacy of Gothic architecture. The apartments are hung with tapestry of 200 years old, which have an air of grotesque and rude magnificence.

NEUCHATTEL, a town of Swisserland, capital of a county of the same name. There are several ancient ruins near it, which show its former extent; and there are two large churches, besides a castle where the governor resides. The town contains about 3000 inhabitants. It is situated partly on a small plain, between Mount Jura and the lake of Neuchattel, which is 17 miles long and five broad; the side of the harbour is the usual walk of the inhabitants. Part of it too is built upon the side of the mountain; whence some of its streets are very steep. In this small place several public works have lately been executed, which Mr Coxe thinks are far beyond the revenues, or even the wants, of such a little state. Among these he instances a superb causeway and a town-house "built (says he) of such solid materials, as if it was intended to survive to the most distant posterity, and to rival the duration of the much-famed Roman capitol." At the beginning of the 18th century, commerce was very little followed in this town, owing to an absurd opinion which prevailed among the inhabitants of its being disgraceful; but this prejudice is now extinguished, and the town in a much more flourishing situation than before. The chief article of exportation is wine, which is much esteemed; and manufactures of printed linens and cottons have been established with considerable success. The flourishing state of Neuchattel is principally owing to the benefactions of Mr David Pury, late banker of the court at Lisbon. He was born at Neuchattel in 1709; but having received his education there, he quitted it in great poverty, and repaired to Geneva, where he served his apprenticeship, but in what line is not mentioned. From Geneva he went to London, where he acted as clerk to a dealer in precious stones, and acquired great reputation by estimating the value of diamonds at sight. After a long residence in England he went to Lisbon, where he carried on a very extensive commerce: and having been appointed court-banker, his fortune rapidly increased. His generosity, however, kept pace with his wealth; and he not only remitted large sums to Neuchattel while living, but left his country his heir when he died. His contributions in all are estimated by Mr Coxe at 200,000l.; a considerable part of which has been employed in constructing the public works already mentioned. Neuchattel has a grand and little council: the first is composed of 40 persons, with two masters of the keys; the little council consists of 24 members, comprehending the mayor, who is president. These two councils assemble regularly every month. The ecclesiastics likewise assemble every month, to consult on affairs belonging to the church, and to fill up the places of ministers that die. They choose a dean every year, who is president of the general assemblies, which are called *classes*; and sometimes he is confirmed in this dignity. E. Long. 7. 10. N. Lat. 47. 5.

NEUCHATTEL, a sovereign county of Swisserland, bounded on the west by the Franche Compte, on the north by the bishopric of Basle, and on the east and south

(A) We have given this detail in Mr Coxe's own words, as it appears to us to deserve attention on account of the greatness of the project, which would have excited admiration had it been attempted by one enlightened by science and liberal arts, much more when it comes through the humble medium of a Russian peasant. It was never executed, as we are just informed by a gentleman who left St Petersburgh about the beginning of June 1793; but the model remains, and is still shown. The same gentleman (we quote his own words) adds, "that every mechanic thinks it practicable; and that the general belief is, that the empress would have built it, had she not found use for all her money in carrying on her warlike and diplomatic transactions with other courts."

south by the cantons of Berne and Friburg. This principality of Neuchattel and Vallengin extend from the lake of Neuchattel to the borders of Franche Compte, being in length about 12 leagues, and six in breadth. The plain with the lower part of the mountains is occupied by the district of Neuchattel, but Vallengin is totally enclosed by Jura. Parallel chains of these mountains run from east to west, forming several valleys in the most elevated parts. The lower grounds of this chain consist of arable lands and vineyards; the higher of large tracts of forest, which in many parts have been cleared and converted into pasture grounds, intermixed with fields of barley and oats. The inhabitants are numerous, and remarkable for their genius, politeness, and active industry. It contains three cities, one town, 90 villages, and about 300 houses dispersed in the mountains. The inhabitants are all Protestants, except two Roman catholic villages: and in 1529 they entered into a strict alliance with the cantons of Berne, Friburg, Soleure, and Lucern. The air is healthy and temperate, but the soil not everywhere equally fertile: however, there are large vineyards, which produce white and red wine, which last is excellent. The pastures on the mountains feed a great number of cattle; there are plenty of deer in the forests; the lakes and rivers abound with fish. The mildness of the government, and agreeable situation of the inhabitants in general in these districts, is evident from the great increase of population in the space of 32 years. In 1752 they contained only 28,017 subjects and 4318 aliens: but in 1784 the number was augmented to 31,576 subjects and 9704 aliens; being an increase of near a fourth part in that time. The facility with which the burghership of Neuchattel is acquired, may also be accounted one of the means of augmenting its population; for between the years 1760 and 1770, the magistrates admitted 41 persons to this privilege; from 1770 to 1780, 46; from 1780 to 1785, 51; in all 138; many of whom had children before they purchased their burghership, and 38 of them were foreigners, either German, French, or Dutch. This country has experienced similar changes with the rest of Switzerland during the usurpation of the French.

NEUFCHATTEAU, a commercial town of France, in the department of the Vosges; formerly having an abbey of the nuns of St Clair, a commandery of Malta, and several convents of monks and nuns. It is seated in a fertile soil, which produces corn, wine, and all the necessaries of life, on the river Mouzon. E. Long. 5. 45. N. Lat. 48. 20.

NEVIS, one of the Caribbee islands, lying about seven leagues north of Montserrat, and separated from St Christopher's by a narrow channel. It makes a beautiful appearance from the sea, being a large conical mountain covered with fine trees, of an easy ascent on every side, and entirely cultivated. The circumference is about 21 miles, with a considerable tract of level ground all around. The climate in the lower part is reckoned to be warmer than Barbadoes, but it is more temperate towards the summit. The soil is very fine in the lower part, but grows coarser as we ascend. The productions are nearly the same with those of St Christopher's. There are three pretty good roads or bays, with small towns in their vicinity; Charles Town, Moreton bay, and Newcastle. This pleasant island was settled under the auspices of Sir Thomas Warner from St Christopher's. His successor, Governor Lake, was considered as the Solon of this little country, in which he disposed of every thing with such prudence, wisdom, and justice, as procured him a high reputation with the French as well as English. In the Dutch war they met with some disturbance from the French; but by being covered by an English squadron, the enemy were obliged to desist from their intended invasion, after a smart engagement in sight of the island. Sir William Stapleton sometimes resided here, and Sir Nathaniel Johnson constantly, at which time the inhabitants of Nevis were computed at 30,000. In the war immediately after the revolution, they exerted themselves gallantly, and and had two regiments of 300 men each. In that of Queen Anne they behaved equally well, though they were less fortunate; for the French landing with a superior force, and having inveigled most of their slaves, they were forced to capitulate. About 4000 of these slaves the French carried away and sold to the Spaniards, to work in their mines. The parliament, after making due inquiry into the losses they had sustained, voted them about a third part of the sum in which they had suffered. These losses by war, an epidemic disease, and repeated hurricanes, exceedingly diminished the number of the people. They are now thought not to exceed 2000 or 3000 whites, and 6000 blacks. There is here a lieutenant governor, with a council, and an assembly, which is composed of three members from each of the five parishes into which the island is divided. The commodities are cotton and sugar; and about 20 sail of ships are annually employed in this trade.

NEURADA, in *Botany*, a genus of plants belonging to the decandria class, and in the natural method ranking under the 13th order, *Succulentæ*. See BOTANY *Index*.

NEUROGRAPHY, signifies a description of the nerves. See ANATOMY.

NEUROPTERA, the name of one of the orders into which the class of insects is divided according to the Linnæan classification. See ENTOMOLOGY *Index*.

NEUTER, a person indifferent, who has espoused neither party, and is neither friend nor foe.

A judge ought to be neuter in the causes he judges; in questions, where reason appears neuter, a man should ever incline to the side of the unhappy.

NEUTER, in *Grammar*, denotes a sort of gender of nouns, which are neither masculine nor feminine. See GENDER.

The Latins have three kinds of genders, masculine, feminine, and neuter. In English, and other modern tongues, there is no such thing as neuter nouns. See NOUN.

Verbs NEUTER, by some grammarians called *intransitive verbs*, are those which govern nothing, and that are neither active nor positive. See VERB.

When the action expressed by the verb has no object to fall upon, but the verb alone supplies the whole idea of the action; the verb is said to be *neuter*: as, I sleep, thou yawnest, he sneezes, we walk, ye run, they stand still.

Some divide verbs neuter into, 1. Such as do not signify any action, but a quality; as *albet*, "it is white;" or or a ſituation, as *ſedet*, " he ſits;" or have ſome relation to place; as *adeſt*, " he is preſent;" or to ſome other ſtate or attribute, as *regnat*, " he rules," &c. And, 2. Thoſe that do ſignify actions, though thoſe ſuch as do not paſs into any ſubject different from the actor; as to dine, to ſup, to play, &c.

But this latter kind ſometimes ceaſe to be *neuter*, and commence active; eſpecially in Greek and Latin, when a ſubject is given them: as, *vivere vitam*, *ambulare viam*, *pugnare pugnam*. Thus the old French poets ſay, *Soupirer ſon tourment;* the Engliſh, to *ſigh his woes*, &c.

But this is obſerved only to obtain where ſomething particular is to be expreſſed, not contained in the verb: as, *vivere vitam beatam*, to live a happy life; *pugnare bonam pugnam*, to fight a good fight, &c.

According to the abbot de Dangeau, *verbs neuter* may be divided into *active* and *paſſive;* the firſt, thoſe that form their tenſes in Engliſh, by the auxiliary verb *to have;* in French, by *avoir*. The ſecond, thoſe that form them in Engliſh with the verb *to be;* in French *être*.—Thus, to ſleep, to yawn, *dormir* and *eternuer*, are *neuters active*.—To come, and to arrive, are *neuters paſſive*.

Neutral Salts, in *Chemiſtry*, compounded of an acid with any other ſubſtance capable of uniting with it and deſtroying its acidity, as ſulphuric acid and ſoda, or Glauber's ſalt, muriatic acid and ſoda, or common ſalt.

NEUTRALITY, the ſtate of a perſon or thing that is neuter, or that takes part with neither ſide.

NEW-ABBEY, ſituated near Kilcullen bridge in the county of Kildare, and province of Leinſter, in Ireland. It was founded by Rowland Euſtace, of a great and ancient family in this county; the tower is ſtill ſtanding, and ſome part of the abbey; the ruins of the reſt have contributed to build ſeveral dwellings near it. In the inſide Rowland Euſtace and his lady lie buried; their figures, clothed in armour, are to be ſeen there. Near this is a handſome ſeat of the Carter family, on the oppoſite ſide of the river Liffey.

NEWARK *upon Trent*, in the county of Nottingham, is a great thoroughfare in the York road, 124 miles from London. It has bridges over the Trent, which forms an iſland here, by dividing itſelf into two ſtreams two miles above the town, which meet again two miles below it. A magnificent caſtle was built here in the reign of King Stephen, which held out ſtoutly in the barons wars for King John, who died here, October 19. 1216; and it alſo ſtood out for King Charles I. to the laſt; but after he had put himſelf into the hands of the Scots army then before it, the governor by his order ſurrendered it, after which it was demoliſhed.—It was ſituated near the river; the walls of the towers are very thick, and of a very great height; and were there no hiſtorical teſtimony, theſe remains are ſufficient evidence that it was formerly of great importance. In the court before theſe ruins is a very fine bowling green, and near it a manufactory of ſacking. The town being ſubject to inundations from the river Trent, and often from that circumſtance made impaſſable, a turnpike road, at the inſtigation of a publican, was made about twenty years ago, ſo high as to be paſſed with ſafety in the greateſt floods, by arches of brick being made in ſeveral places to carry off the water, conſtructed by Mr Smeaton, at the expence of 12,000l. Near the town there is a bridge conſtructed for the ſame purpoſe, made moſtly upon dry land, conſiſting of nine arches. Its church, which is reckoned one of the fineſt in the kingdom, was built by Henry VI. and has a lofty ſpire.

NEWBOROUGH, or NEWBURGH, in the iſle of Angleſey, North Wales, diſtant from London 254 miles, though but a ſmall town, ſituated over againſt Caernarvon in North Wales, about 17 miles ſouth-weſt from Beaumaris, is governed by a mayor, two bailiffs, and a recorder. Its Welſh name is *Rhôſſir, or Rhoſvair.*

NEWBURG, the name of ſeveral towns of Germany, two of which are the chief towns of duchies of the ſame name; one in Bavaria, and the other in the Palatinate.

NEWBURY, a town in the county of Berks in England, 16 miles from Reading, and 56 from London, aroſe on the decay of Spinham-Land. Notwithſtanding its name ſignifies *New-Borough*, it is as old almoſt as the Conqueſt. It made ſo much broad cloth formerly, that in the reign of Henry VIII. here flouriſhed John Winſcomb, commonly called *Jack of Newbury*, one of the greateſt clothiers that ever was in England, who kept 100 looms in his houſe; and in the expedition to Flowden Field againſt the Scots, marched with 100 of his own men, all armed and clothed at his own expence; and he built all the weſt part of the church. Alſo Mr Kenric, the ſon of a clothier here, though afterwards a merchant in London, left 4000l. to the town, as well as 7500l. to Reading, to encourage the woollen manufactory. It makes a great quantity of ſhalloons and druggets, but not near ſo much broad cloth now as formerly; yet it is a flouriſhing town, with ſpacious ſtreets, and a large market place, in which is the guild-hall. In the neighbourhood, on the banks of the Kennet, there is a ſtratum of petrified wood dug out for firing, where they frequently find trunks of large oaks yet undecayed, with petrified hazel nuts, fir cones, &c. with the bones and horns of ſtags, antelopes, &c. tuſks of boars, and heads of beavers. The river Kennet, which abounds with excellent trout, eels, and cray-fiſh, runs through the town; and here is plenty of all other proviſions. It was made a corporation by Queen Elizabeth, and is governed by a mayor, high ſteward, aldermen, &c.

NEWCASTLE-*under-Line*, a town in England, in the county of Stafford, on a branch of the Trent, is 15 miles north of Stafford, 33 ſouth ſouth-eaſt of Warrington, and 149 from London: had a caſtle, now in ruins; and is ſo called from an older caſtle, which formerly ſtood two miles off, at Cheſterton-under-Line. It was incorporated by King Henry I. and again by Queen Elizabeth and King Charles II. and is governed by a mayor, two juſtices, two bailiffs, and 24 common council. The clothing trade flouriſhes here; but its chief manufactory is hats, here being an incorporated company of felt-makers. A great quantity of ſtone ware is made near this place.

NEWCASTLE *on Tyne*, the capital of the county of Northumberland in England, 15 miles north of Durham, 94 north of York, 63 ſouth by eaſt of Berwick, 60 eaſt of Carliſle, and 271 from London, ſtands at the end of the Picts wall, on the north ſide of the Tyne, over-

Newcaſtle on Tyne.

over which it has a ſtately bridge into the biſhopric of Durham, in which its ſuburb called *Gateſide* is ſituated; for the liberties of Newcaſtle extend no farther than the great iron gate upon the bridge which has the arms of the biſhop of Durham carved on the eaſt ſide and thoſe of Newcaſtle on the weſt ſide. W. Long. 1. 27. N. Lat. 55. 3. It is admitted to have been a Roman ſtation, though no evidence at preſent appears, except at Pandon-gate, whoſe ſuperſtructure is of different workmanſhip and model from any others of the town, the arches being circular. The Carpenter's tower is alſo of Roman original. In the Saxons time it was called *Moncaſter*, from the monks here, who all fled when it was depopulated by the Danes; and afterwards *Newcaſtle*, from a caſtle built here by William the Conqueror's ſon, Robert, in 1080, to defend the country againſt the Scots, whoſe kings had this town before the Norman conqueſt, and ſometimes reſided here.—Several monaſteries and houſes were built here ſoon after the caſtle; and it was greatly enlarged and enriched by a good trade to the coaſts of Germany, and by the ſale of its coal to other parts of England; for which, and for other merchandiſe, it is become the great emporium of the north of England, it being the neateſt and largeſt town in thoſe parts, next to York. In the reign of Edward I. it was burnt by the Scots; but a very rich burgher who was taken priſoner, ſoon ranſomed himſelf for a good ſum of money, and began the firſt fortifications of the place, which he extended from Sand-gate to Pampedon, and thence to the Auſtin friars gate; which the townſmen finiſhed, and encompaſſed with ſtout walls, which extended two miles, wherein are ſeven gates and many turrets, with ſeveral caſements bomb-proof. To which two other gates were added in more modern times, viz. Bridge-gate and Sand-gate: the wall between them was afterwards removed to open the quay. Edward III. granted the corporation the duties and cuſtoms of the town for ſeven years, to enable them to complete the fortification. It is a borough at leaſt as ancient as King Richard II. who granted that a ſword ſhould be carried before the mayor; and King Henry VI. made it a town and county incorporate of itſelf, independent of Northumberland. Henry VII. built a monaſtery here for the Franciſcans. Beſides which, it had ſeveral religious foundations, ſeveral of which ſtructures have been converted to companies halls and private reſidences. In the reign of Henry VIII. this place is ſaid to have exceeded in the ſtrength and magnificence of its works all the cities of England, and moſt places in Europe. The town is governed by a mayor, 12 aldermen, a recorder, ſheriff, town clerk, a clerk of the chambers, two coroners, eight chamberlains, a ſword-bearer, a water bailiff, and ſeven ſerjeants at mace. Its ſituation, eſpecially the moſt buſy part of it towards the river, is very uneven, it being built on the declivity of a ſteep hill, and the houſes very cloſe. The caſtle overlooks the whole town. That part built by Robert was of great ſtrength, and ſquare, and ſurrounded by two walls; the ſquare was 62 feet by 54, and the walls 13 feet thick, within which was a chapel. The outward fortifications are now defaced, and their ſite crowded with buildings. The tower remains entire, and ſituated on a lofty eminence, and its principal entrance is to the ſouth. This caſtle belongs to the county, and makes no part of the liberties.—It is now the county priſon, and in the great hall the judges hold the aſſizes. Here Baliol king of Scotland did homage to King Edward I. in 1292: as did Edward Baliol in 1334 to King Edward III. Here is a magnificent exchange and a cuſtomhouſe; and a very fine quay. There is a handſome manſion houſe for the mayor, who is allowed 1000l. a-year, for his table, beſides a coach and barge. The old bridge was carried away in a flood, and the preſent was erected about 1775, of nine noble elliptic arches. With the old bridge 22 houſes were thrown down, and ſix lives loſt. It was originally built of wood; but having been deſtroyed by fire in 1248, was rebuilt of ſtone, and conſiſted of 12 arches, three of which on the north ſide were cloſed up, and ſerved for cellars: this was again rebuilt about 1450, and was crowded with wooden buildings; but near the middle was a tower with an iron gate, uſed as a town priſon. A ſtrong building croſſed the bridge, which was uſed as a magazine. On the ſouth front was a ſtatue of King Charles II. The water which deſtroyed this bridge, on November 11. 1771, was upwards of 12 feet above high water mark in ſpring tides.—On removing the foundations of the piers of the old bridge to erect the preſent, by obſervations made, and medals found, part of it is ſuppoſed to have exiſted from the time of the Romans. It is computed that above 6000 keelmen are employed here, who have formed themſelves into a friendly ſociety; and, by their own contributions, built a noble hoſpital containing 50 chambers, for ſuch of their fraternity as are poor, diſabled, or paſt their labour; and it is ſupported by the contribution of thoſe that are in health. The town is extremely populous; and, notwithſtanding the multitude of thoſe employed in and about the coal pits, with which the town is in a manner ſurrounded, has abundance of poor; but it has alſo many wealthy inhabitants, and it is ſaid they pay above 4000l. a-year to their relief. It is obſerved, that this town has the greateſt public revenue in its own right as a corporation, of any town in England, it being computed at no leſs than 8000l. a-year. In 1774, the receipts of the corporation were 20,360l. 9s. 8d.; and their diſburſements about 19,445l. The number of inhabitants is about 36,891, excluſive of a number of ſeamen who cannot be accurately eſtimated. Here are four churches or chapels. That of St Nicholas is the mother church, a curious fabric, built cathedral-wiſe by David king of Scots, 240 feet long, 75 broad, and proportionably high, with a tower ſteeple 194 feet in height, of Gothic architecture; alſo St Andrew's, St John's, and All Saints, lately rebuilt on the ſite of the old ſtructure, of a circular form. Here are alſo ſeveral meeting houſes, and four charity ſchools for 300 children; a fine hall for the ſurgeons, and a large priſon called *Newgate;* alſo an hoſpital for lunatics, another for the lying-in of married women, as well as a fund raiſed for the relief of thoſe who are delivered at their own houſes. Here is a well endowed and large infirmary, and an aſſembly room that attracts attention, containing every uſeful apartment, and a ball-room 93 feet by 40: The front is ornamented with ſix Ionic pillars, &c. In another part of the town is a new theatre. Here is a very neat ſet of baths. A free grammar ſchool was granted by James I. from an old foundation of

Newcaſtle on Tyne.

of St Mary's hoſpital, in the veſtry room of whoſe chapel is the election of the officers of the corporation. There were formerly ſeveral palaces in this city, viz. Pampedon hall, Lumley place, Earl's place, Northumberland houſe, Weſtmoreland place, &c. The free maſons have lately erected an elegant hall, richly ornamented, to hold their lodge in, near High friar chair, capable of holding above 4000 of that ancient fraternity. Here is an hoſpital for 39 decayed freemen and their widows; and another for three clergymen's widows and three merchants widows. The Maidens hoſpital, built in 1753, is endowed with 240l. for ſix maiden women and ſix poor men. Dr Thomlin, a prebendary of St Paul's, and rector of Whicham in the biſhopric of Durham, gave a library of above 6000 valuable books to the corporation, and ſettled a rent charge of 5l. a-year for ever for buying new ones; and Sir Walter Blacket, formerly one of its repreſentatives in parliament, built a neat repoſitory for them, and ſettled 25l. a-year for ever on a librarian. The upper or north part of the town, inhabited by the politer ſort of people, is much pleaſanter than that part next the river, and has three level, well built, and ſpacious ſtreets. The river all the way up from Shields to Newcaſtle is broad, the channel ſafe, and the tide flows with a ſtrong current to the town, and far beyond it. In the beginning of the late civil wars, this town was taken and plundered by the *Scotch fanatics*, who here ſold their king, Charles I. for 200,000l. in hand, and ſecurity for as much more. The glaſs works are very curious, and have more buſineſs of the fine ſort than moſt other places, the duty on this article drawn by government is ſaid to amount to 200,000l. annually. Beſides, it has a conſiderable manufacture of broad and narrow cloths, and ſeveral ſoap boileries; and this place is famous for grindſtones, for which there is ſuch a demand, that ſcarce a ſhip ſtirs without them; from whence came the proverb, "That a Scotſman and a Newcaſtle grindſtone travel all the world over." Ships fit for the coal trade are built here to perfection, with great ſtrength. Here is a conſiderable manufactory of hardware and wrought iron, after the manner of that at Sheffield.—Its markets are on Tueſdays and Saturdays. Its fairs in Auguſt, which laſt nine days, and October 29th, which laſt nine days. By an act of Queen Mary, the price of the carriage of goods hither from London by waggons was ſettled at 2d. per lb. London alone is ſaid to conſume at leaſt 766,887 chaldrons of its coal every year; but as for the fiſh vended in that city by the name of *Newcaſtle ſalmon*, it is more properly called *Berwick ſalmon*, the freſh ſalmon being taken near 50 miles farther, as far as the Tweed, and brought on the backs of horſes to Shields, where it is cured, pickled, and ſent on board for London. It is worth remembering, that at the aſſizes here in 1743, two old men were ſubpœna'd hither as witneſſes from a neighbouring village, viz. one 135 years of age, and his ſon 95, both hearty, and having their ſight and hearing; and that in 1744, one Adam Turnbull died in this town aged 112, who had had four wives, the laſt of whom he had married when he was near 100 years old.

The annual amount of the revenue of cuſtoms at this port, which Mr Brand in his Hiſtory of Newcaſtle ſtates at 41,000l. is now very conſiderably upwards of 70,000l.

Newcaſtle on Tyne, Newcaſtle.

The coals carried out of it annually (on an average from 1785 to 1791) were nearly 448,000 Newcaſtle chaldrons; the weight of which is 1,187,200 tons. The following are the exports of coals from the Tyne for the years annexed.

Years.	Coaſtways.	Over ſea.	Plantations.
1802	494,488	41,157	2844
1803	505,137	42,808	1516
1804	579,929	48,737	3852
1805	552,827	47,213	2360

The number of perſons employed in the coal trade of the rivers Tyne and Wear in 1792 exceeded 64,000.

The manufacture of earthen ware is greatly increaſed, and carried on to great perfection in its neighbourhood, in ſeven potteries; and their produce exported hence to foreign parts, as well as to the different ports of this kingdom; ſome of which potteries conſtantly employ upwards of 100 perſons, men, women, and children.

New works of conſiderable extent for the manufacture of iron have been eſtabliſhed; as alſo a very capital manufactory for white lead, milled lead, &c. Independent of red and white lead, the quantity of lead exported from the river Tyne during four years was as follows.

Years.	Tons.	Cwt.
1802	8609	18
1803	6364	6
1804	10352	2
1805	9163	3

The trade with the Weſt India iſlands is increaſing, and may in time become very conſiderable; as the port has great advantages, in being able to ſupply on the cheapeſt terms many articles wanted in thoſe iſlands; ſuch as coals, grindſtones, lime, bricks, tiles, iron wares, &c.; and is moſt advantageouſly ſituated for the re-exportation of the Weſt India produce to the ports on the Baltic, to Germany, the United Provinces, Flanders, and part of France; and moreover, the riſk of navigation, and the rate of inſurance, not being greater than between thoſe iſlands and Liverpool, and ſome other ports on the weſtern coaſt of this kingdom.

The town of Newcaſtle is daily increaſing in its population and opulence. It has been long noted for hoſpitality and good living. Great improvements have been made in the town, by opening new ſtreets, and paving the principal ones, in the ſame manner as in London.

To the liſt of public edifices of modern erection, and mentioned above, viz. the grand aſſembly rooms, and the elegant theatre, which were built by ſubſcription, and the ſuperb pariſh church of All Saints, built at a very great expence by the pariſhioners, may be added a commodious riding houſe, built alſo by ſubſcription.

Newcastle, a borough town of Ireland, in the county of Dublin, and province of Leinſter, which returns two members to parliament, and holds two fairs, 9th of May and 8th of October.

Newcastle is alſo the name of a handſome town in-

in the county of Limerick and province of Munster, on the high road to Kerry, 114 miles from Dublin. Here was a religious house possessed by the knights templars. It is said, they used some barbarous customs which greatly disgusted the Irish, who, watching a favourable opportunity, attacked a number of the knights riding out together and put them to death; the place is still remembered where their remains were interred. This order was suppressed in the famous council of Vienna, 22d of March 1312. Newcastle consists of a large square where markets and fairs are held; on the northern side stands a market house, with an assembly room; on the south side is the church, which is the neatest in the county; it was finished in 1777 at the sole expence of Lord Courtenay. It stands close to the walls and fortifications of the knights templars, of which one of the castles is fitted up for Lord Courtenay's agent.

NEWCASTLE, a small town in America, 35 miles below Philadelphia, on the west bank of Delaware river. It was first settled by the Swedes about the year 1627, and called *Stockholm*. It was afterwards taken by the Dutch, and called *New Amsterdam*. When it fell into the hands of the English, it was called by its present name. It contains about 60 houses, which have the aspect of decay, and was formerly the seat of government. This is the first town that was settled on Delaware river.

NEWCASTLE, *Duke of*. See CAVENDISH.

NEW England. See *ENGLAND, New*.

NEW Forest of Hampshire in England, is a tract of at least 40 miles in compass, which had many populous towns and villages, and 36 mother churches, till it was destroyed and turned into a forest by William the Conqueror. There are nine walks in it; and to every one a keeper, under a lord warden, besides two rangers, and a bow-bearer. As this large tract lay many ages open and exposed to invasions from foreigners, King Henry VIII. built some castles in it; and it has now several pretty towns and villages. It is situated in that part of Hampshire which is bounded on the east by Southampton river, and on the south by the British Channel. It possesses advantages of situation, with respect to the convenience of water carriage and nearness to the dock yards, superior to every other forest, having in its neighbourhood several ports and places of shelter for shipping timber, among which Lymington is at the distance of only two miles, Bewley about half a mile, and Redbridge three or four miles from the forest; and the navigation to Portsmouth, the most considerable dock yard in this kingdom, is only about 30 miles from the nearest of those places. This is the only forest belonging to the crown of which the origin is known. Doomsday-book contains the most distinct account of its afforestation by William the Conqueror: the contents of every field, farm, or estate afforested, in hides, carucates, or virgates, by which the extent of land was then computed, together with the names of the hundreds and villages, and of the former proprietors (which are for the most part Saxon), the rent or yearly value of each possession, and the tax which had been paid for it to the crown during the reign of Edward the Confessor, before the inhabitants were expelled, and that part of the country laid waste, are all to be found in that most curious and venerable record. Wishing to discover the original extent of the forest, we extracted, for our own information, all that relates to it in that ancient survey. The extract is far too voluminous for insertion. The names of many of the places having been changed since that time, it is difficult to ascertain with precision what were then the limits of the forest. The oldest perambulation we have met with is among the Pleas of the Forest, in the eighth year of King Edward I. preserved in the Chapter-house at Westminster. The boundaries there described include all the country from Southampton river on the east to the Avon on the west, following the sea coast as far as the southern boundary between those rivers, and extending northwards as far as North Chadeford, or North Charford, on the west, and to Wade and Orebrugg, or Owerbridge, on the east; and the greatest part, if not the whole, of that extensive district, is mentioned in Doomsday book to be the forest belonging to the crown. Another perambulation was however made in the 29th of the same king, which leaves out a great part of the country contained within the former. This perambulation, which is preserved in the tower of London, confines the forest to limits which, as far as we can trace them, appear to have been followed in the 22d year of Charles II. when the forest was again perambulated. By the *Charta de Foresta*, all lands not belonging to the crown which had been afforested by Henry II. Richard I. or King John, were to be disafforested; but as no provision was made for the reduction of the more ancient afforestations, it is easy to account for the great diminution of this forest in the reign of Edward I. who was not a prince likely to submit to any encroachment on his rights. The perambulation of the 22d of Charles II. is the last which we find on record: it contains the present legal bounds of the forest, and was given to the surveyors as their guide, in taking the plan which they have made lately by direction. From that plan, with the approbation of the lords commissioners of his majesty's treasury, an engraving was made. According to the last-mentioned perambulation and the plan, the forest extends from Godshill on the north-west to the sea on the south-east, about 20 miles; and from Hardley on the east to Ringwood on the west, about 15 miles; and contains within those limits about 92,365 acres statute measure. The whole of that quantity, however, is not forest land, or now the property of the crown: there are several manors and other considerable freehold estates within the perambulation, belonging to individuals, to the amount of about 24,797 acres; about 625 acres are copyhold or customary lands belonging to his majesty's manor of Lyndhurst; about 1004 acres are lease-hold under the crown, granted for certain terms of years, and forming part of the demised land revenue, under the management of the surveyor-general of crown lands; about 901 acres are purprestures or encroachments on the forest; about 1193 acres more are enclosed lands held by the master-keepers and groom-keepers, with their respective lodges; and the remainder, being about 63,845 acres, are woods and waste lands of the forest. To perpetuate the spot where William Rufus was killed by the glance of an arrow shot at a stag, a triangular stone was erected in 1745. George III. visited fited this ſpot in 1789. In Auguſt 1782, a curious ancient golden croſs was found here by a labouring man digging turf. It weighed above an ounce of gold, and had on one ſide an engraving of our Saviour, and on the other, the ladder, ſpear, nails, and other emblems of his ſufferings.

New Holland. See Holland, *New.*

New York. See *York*, *New.*

New Zealand. See Zealand, *New.*

New Years Gifts, preſents made on the firſt day of the new year. Nonius Marcellus refers the origin of this cuſtom among the Romans to Tatius king of the Sabines, who reigned at Rome conjointly with Romulus, and who having conſidered as a good omen a preſent of ſome branches cut in a wood conſecrated to *Strenia*, the goddeſs of ſtrength, which he received on the firſt day of the new year, authorized this cuſtom afterwards, and gave to theſe preſents the name of *ſtrenæ*. However this may be, the Romans on that day celebrated a feſtival in honour of Janus, and paid their reſpects at the ſame time to Juno; but they did not paſs it in idleneſs, leſt they ſhould become indolent during the reſt of the year. They ſent preſents to one another of figs, dates, honey, &c. to ſhow their friends that they wiſhed for a happy and agreeable life. Clients, that is to ſay, thoſe who were under the protection of the great, carried preſents of this kind to their patrons, adding to them a ſmall piece of ſilver. Under Auguſtus, the ſenate, the knights, and the people, preſented ſuch gifts to him, and in his abſence depoſited them in the capitol. Of the ſucceeding princes ſome adopted this cuſtom and others aboliſhed it; but it always continued among the people. The early Chriſtians condemned it, becauſe it appeared to be a relick of Paganiſm and a ſpecies of ſuperſtition; but when it began to have no other object than that of being a mark of veneration and eſteem, the church ceaſed to diſapprove of it.

NEWEL, in architecture, is the upright poſt which a pair of winding ſtairs turn about; this is properly a cylinder of ſtone, which bears on the ground, and is formed by the end of the ſteps of the winding ſtairs.

NEWFIDLER-sea, a lake in Hungary, 17 miles in length and 6 in breadth.

NEWFOUNDLAND, a large iſland of North America, belonging to Great Britain, lying between 46. 50. and 51. 30. N. Lat. and between 53. 30. and 58. 20. W. Long. from London. The form is that of an irregular triangle, the baſe or ſouth ſide being 80 leagues in extent; the eaſt ſide is the longeſt; and the whole circumference about 150 leagues. It is bounded on the north by the ſtraits of Belleiſle, which ſeparate it from Labrador; on the eaſt and ſouth it hath the Atlantic ocean, and on the weſt the gulf of St Lawrence. The climate is rather ſevere; and the ſoil, at leaſt on the ſea coaſt, which is all that we know of it, is poor and barren. A few kitchen vegetables, with ſtrawberries and raſpberries, are all its produce. The country within land is mountainous, and abounds with timber; there are ſeveral rivers which are plentifully ſtored with various ſorts of fiſh, abundance of deep bays, and many good ports. St John's and Placentia are the two principal ſettlements, and at each of theſe there is a fort; the number of people who remain here in the winter hath been computed at 4000. The French, by the treaty of Utrecht, were permitted to fiſh from Cape Bonaviſta on the eaſt ſide round the north of the iſland to Point Rich on the weſt; and by the treaty of Paris, they are allowed the iſles of St Pierre and Miquelon, upon which they are to dry their fiſh, but not to erect fortifications of any kind.

The great importance of this place ariſes from its fiſhery, which is in part carried on by the inhabitants at the ſeveral harbours, which are about 20 in number, who take vaſt quantities of cod near the coaſt, which they bring in and cure at their leiſure, in order to have it ready for the ſhips when they arrive. But the great and extenſive fiſhery is on the banks at ſome diſtance from the iſland. The great bank lies 20 leagues from the neareſt point of land from the latitude 41° to 49°, ſtretching 300 miles in length and 75 in breadth.—To the eaſt of this lies the Falſe Bank; the next is ſtyled *Vert*, or *the Green Bank*, about 240 miles long, and 120 over; then Banquero, about the ſame ſize; the ſhoals of Sand Iſland, Whale Bank, and the Bank of St Peter's, with ſeveral others of leſs note, all abounding with fiſh.

The cod are caught only by a hook; an expert fiſher will take from 150 to 300 and upwards in a day; for the fiſh never bite in the night: the labour is very great. The ſeaſon is from May to October, in the height of which there are from 500 to 700 ſail upon the banks at a time. The fiſh caught in the ſpring months are beſt; they are cured in very different ways. Some are ſtyled *white fiſh*, others *mud fiſh*, which are ſtowed and ſalted in the hold, and will not keep long; but the beſt and moſt valuable are the dried cod. The quantity taken is prodigious: yet in ſome ſeaſons and in different places varies conſiderably, as the fiſh frequently change their ſtations. The *fiſhing ſhips*, as they are called, lie upon the banks, with the help of their boats take and cure their own fiſh, and as ſoon as they are full ſail for a market. The ſack ſhips proceed directly to the iſland, where they purchaſe fiſh from the inhabitants either by barter or bills of exchange. The principal markets for cod are Spain, Portugal, Italy, and the Weſt Indies. The value of this fiſhery is computed at ſome hundred thouſand pounds annually; employing, beſides ſeveral hundred ſhips, ſome thouſands of ſeamen, and affording a maintenance to a number of tradeſmen of different occupations, by which many large towns on the weſt ſide of England accumulate much wealth, and at the ſame time contribute in many reſpects to the benefit of the public.

The great utility of this fiſhery was very early ſeen, and very vigorouſly purſued; for in the beginning of the reign of King James I. we had two hundred and fifty ſail employed therein. It is computed, that three quintals of wet fiſh make one quintal of dried cod. Beſides, the livers of every hundred quintals make a hogſhead of oil; and excluſive of theſe there are many leſſer advantages that go in diminution of the expence. The fiſhery, as we have ſaid above, produces differently in different ſeaſons; but it is judged to be a very good one when it produces 300,000 quintals of fiſh and 3000 barrels of oil, both equally ſaleable and valuable commodities. As every ſhip carries twelve, and each of their boats eight men, and as theſe return home in ſix months, there cannot be a more noble nurſery for ſeamen.

Newfoundland. seamen. The artificers and traders employed in building, victualling, and repairing these vessels, are very numerous in the respective ports from which they sail. These circumstances justify the particular attention paid by government to this branch of the public service; in respect to which that they may be well informed, an annual and very distinct account, by which the whole is seen at one view, is delivered by the proper officer to the governor of Newfoundland, that is, to the commodore of his majesty's squadron. Mr Pennant, in the appendix to his Arctic Zoology, gives us, from what appears to be very good authority, the following account of this island.

"Within the circuit of 60 miles of the southern part, the country is hilly, but not mountainous. The hills increase in height as they recede from the sea; their course is irregular, not forming a chain of hills, but rising and falling abruptly. The coasts are high, and the shores most remarkably bold. The same may be said of almost every part of this vast island. The country is much wooded, and the hills (such as have not flat tops to admit the rain to stagnate on them) are clothed with birch, with hazel, spruce, fir, and pine, all small; which is chiefly owing to the inhabitants taking off the bark to cover the fish stages. This peninsula is so indented by the fine and deep bays of Placentia, St Mary, Conception, and Trinity, that it may be penetrated in all parts, which is done for the sake of fowling, or the procuring of spars for masts, oars, &c. The island is on all sides pierced with deep bays, which peninsulate it in many places by isthmuses most remarkably narrow.—The mountains on the south-west side, near the sea, are very high, and terminate in lofty headlands; such are Chapeau Rouge, a most remarkably high promontory, Cape St Mary's, and Cape le Hune. Such in general is the formation of the island; on the north-east, most of the hills in the interior part of the country terminate pyramidically, but form no chain. The interior parts of the country consist chiefly of morasses, or dry barren hammocks, or level land, with frequent lakes or ponds, and in some places covered with stunted black spruce. The rivers of Newfoundland are unfit for navigation, but they are of use in floating down the wood with the summer floods. Still the rivers and the brooks are excellent guides for the hunters of beavers and other animals, to penetrate up the country, which as yet has never been done deeper than 30 miles. Near the brooks it is that timber is commonly met with, but seldom above three or four miles inland, and in valleys; the hills in the northern district being naked and barren.

"In some parts of Newfoundland there is timber sufficiently large for the building of merchant ships: the hulk is made of juniper, and the pine furnishes masts and yards; but as yet none has been found large enough for a mast for a large cutter. The fishery is divided into two seasons; that on the shore, or the shore season, commences about the 20th of April, and ends about the 10th of October; the boats fish in from four to 20 fathoms of water. The most important, the bank fishing season, begins the 10th of May, and continues till the last of September, and is carried on in 30 to 45 fathoms depth of water. Banking vessels have sailed from St John's to the bank as early as the 12th of April. At first they use pork or birds for a bait; but as they catch fish, they supply themselves with a shell fish called clams, which is found in the belly of the cod. The next bait is the lobster; after that the herring and the launce, which last till June, when the capelan comes on the coast, and is another bait. In August the squid comes into use, and finally the herring again. The greatest number of cod fish taken by a single fisherman in the season has been 12,000, but the average is 7000. The largest fish which has been taken was four feet three inches long, and weighed 46 pounds. A banking vessel of 10,000 fish ought to be filled in three weeks, and so in proportion; and 80 quintals (112 lb. each) for a boat in the same time.

"In 1785, 541 English vessels fished on the bank, a number exceeding that of the French. A heap of dried fish, 20 feet long and ten wide, and four deep, contains 300 quintals. Such a heap settles, in the course of 48 hours after it is made, about $\frac{1}{12}$. An extraordinary splitter will split five quintals of fish in an hour. The average in that time is two. There is no fishing during winter, on account of the inclemency of the season. It is supposed that the fish in a great measure quit the banks before that time, as in general they are very scarce when the fishing vessels go upon the banks early in the spring.

"There are a few small towns on the coasts, which have gardens sown with English pulse; but many of the inhabitants quit the country in winter.

"An admiral or some sea officer is generally governor of Newfoundland."

Newmarket, Newross.

NEWMARKET, in Cambridgeshire, 13 miles from Cambridge, 13 from St Edmundsbury, and 60 from London, is a town with one long street, the north side in Suffolk, the south side in Cambridgeshire. It is a healthy place, and a great thoroughfare in the road from London to Norfolk; but stands mostly by the horse races every year in April and October, here being the finest course in England; on which there is a house for the king when he comes to the races, which was built by Charles II. The king gives a plate or two every year, besides those given by the nobility; and wagers are laid upon the horses, which are seldom under 500l. and often above 1000l. Here are two coffeehouses, at which, every night and morning during the races, there is gaming, as there is also at the houses of the nobility and gentry. Here are also cock matches. Here is a little chapel, which is a chapel of ease to the mother church at Ditton; and another in the Suffolk side, which is parochial. The town was burnt in 1683, but soon rebuilt.

NEWROSS, a borough town in the county of Wexford, and province of Leinster, in Ireland, 67 miles from Dublin. This town was formerly walled, and some of the gates still remain. It lies on the river Barrow, which is here very deep, and ships of burden can come up to the quay even when the tide is out. The church is large, but the customhouse and quay are both small, and sometimes overflooded many feet. It is one of the staple ports for exporting wool, yet its trade is but inconsiderable; beef and butter are the principal articles exported. Here is a barrack for a troop of horse, and a good ferry into the county of Kilkenny. Near this town is a charter school. It is also a post town, and gives title of earl to the family of Gore. It was formerly fortified, and adorned with

with many religious houses, among which was a crouched friary, built on the summit of a hill in the town; but one of the friars having killed a principal inhabitant, the whole body of the people arose, put the friars to death, and totally destroyed the friary; on the site of which the monastery of St Saviour, for conventual Franciscans, was afterwards erected by Sir John Devereux; and the east end of this last building is now the parish church. A friary for Eremites, following the rule of St Augustine, was also founded here in the reign of Edward III.

NEWSPAPERS, periodical publications, daily, weekly, &c. for the purpose of communicating to the world every thing of importance, whether political or literary, &c. which is going on. They have tended much to the dissemination of learning, and have served many other valuable purposes; and while they are carried on with candour, impartiality, and ability, they are unquestionably a great national benefit. When this, however, is not the case, and it often happens, they disgrace their authors, and are highly injurious to the public. They were first published in England, August 22. 1642. *Journal de Sçavans*, a French paper, was first published in 1665, though one was printed in England, under the title of the *Public Intelligencer*, by Sir Roger L'Estrange, 1663, which he dropped, on the publication of the first London Gazette. Newspapers and pamphlets were prohibited by royal proclamation 1680. Though at the Revolution prohibitions of this kind were done away, and the press set at liberty, yet newspapers were afterwards made objects of taxation, and for this purpose were first stamped in 1713. The number of them, however, gradually increased; and there were printed in the whole kingdom during the years 1775, 12,680,000; 1776, 12,830,000; 1777, 13,150,642; 1778, 13,240,059; 1779, 14,106,842; 1780, 14,217,371; 1781, 14,397,620; 1782, 15,272,519. They are now still more numerous. The average number of newspapers printed in England at the close of the reign of George II, was 9,464,790. The number in 1790, was 14,035,639; in 1792, it was 15,005,760. *Chalmers' Life of Ruddiman*, p. 442.

NEW STYLE, first used in England in 1753, was introduced into the western world by Pope Gregory XIII. See CHRONOLOGY, N° 24.

NEWT, or EFT, the common lizard. See LACERTA, ERPETOLOGY *Index*.

NEWTON, SIR ISAAC, one of the greatest philosophers and mathematicians the world has ever produced, was the only child of Mr John Newton of Colesworth, not far from Grantham in Lincolnshire, who had an estate of about 120l. *per annum*, which he kept in his own hands. He was born at that place on Christmas day 1642. His father dying when he was young, his mother's brother, a clergyman of the name of *Aufcough*, or *Askew*, who lived near her, and directed all her affairs after the death of Mr Newton, put her son to school at Grantham. When he had finished his school learning, his mother took him home, intending, as she had no other child, to have the pleasure of his company; and that he, as his father had done, should occupy his own estate. But his uncle happening to find him in a hay loft at Grantham working a mathematical problem, and having otherwise observed the boy's mind to be uncommonly bent upon learning, he prevailed upon her to part with him; and she sent him to Trinity College in Cambridge, where her brother, having himself been a member of it, had still many friends. Isaac was soon taken notice of by Dr Isaac Barrow; who, observing his bright genius, contracted a great friendship for him. M. de Fontenelle tells us, "That in learning mathematics he did not study Euclid, who seemed to him too plain and simple, and unworthy of taking up his time. He understood him almost before he read him; and a cast of his eye upon the contents of his theorems was sufficient to make him master of them. He advanced at once to the geometry of Des Cartes, Kepler's Optics, &c. It is certain that he had made his great discoveries in geometry, and laid the foundation of his two famous works, the *Principia* and *Optics*, by the time he was 24 years of age."

In 1664, he took the degree of bachelor of arts; and in 1668 that of master, being elected the year before, fellow of his college. He had before this time discovered the method of fluxions; and in 1669 he was chosen professor of mathematics in the university of Cambridge, upon the resignation of Mr Barrow. The same year, and the two following, he read a course of optical lectures in Latin, in the public schools of the university; an English translation of which was printed at London in 1728, in 8vo, as was the Latin original the next year in 4to. From the year 1671 to 1679, he held a correspondence by letters with Mr Henry Oldenburg secretary of the Royal Society, and Mr John Collins fellow of that society; which letters contain a variety of curious observations.

Concerning the origin of his discoveries, we are told, that as he sat alone in a garden, the falling of some apples from a tree led him into a speculation on the power of gravity; that as this power is not diminished at the remotest distance from the centre of the earth to which we can rise, it appeared to him reasonable to conclude, that it must extend much farther than was usually thought; and pursuing this speculation, by comparing the periods of the several planets with their distances from the sun, he found, that if any power like gravity held them in their courses, its strength must decrease in the duplicate proportion of the increase of distance. This inquiry was dropped; but resumed again, and gave rise to his writing the treatise which he published in 1687, under the name of *Mathematical Principles of Natural Philosophy*; a work looked upon as the production of a celestial intelligence rather than of a man. The very same year in which this great work was published, the university of Cambridge was attacked by King James II. when Mr Newton was one of its most zealous defenders, and was accordingly nominated one of the delegates of that university to the high-commission court; and the next year he was chosen one of their members for the convention parliament, in which he sat till it was dissolved. In 1696, Mr Montague, then chancellor of the exchequer, and afterwards earl of Halifax, obtained for him of the king the office of warden of the mint; in which employment he was of signal service, when the money was called in to be recoined. Three years after, he was appointed master of the mint; a place of very considerable profit, which he held till his death. In 1699, he was elected one of the members of the Royal Academy of Sciences at Paris. In 1701, he was a second

Newton.

time chosen member of parliament for the university of Cambridge. In 1704, he published his *Optics;* which is a piece of philosophy so new, that the science may be considered as entirely indebted to our author. In 1705, he was knighted by Queen Anne. In 1707, he published his *Arithmetica Universalis.* In 1711, his *Analysis per Quantitatum Series, Fluxiones et Differentias,* &c. was published by William Jones, Esq. In 1712, several letters of his were published in the *Commercium Epistolicum.* In the reign of George I. he was better known at court than before. The princess of Wales, afterwards queen consort of England, used frequently to propose questions to him, and to declare that she thought herself happy to live at the same time with him, and have the pleasure and advantages of his conversation. He had written a treatise of ancient chronology, which he did not think of publishing; but the princess desired an abstract, which she would never part with. However, a copy of it stole abroad, and was carried into France; where it was translated and printed, with some observations, which were afterwards answered by Sir Isaac. But, in 1728, the Chronology itself was published at London in quarto; and was attacked by several persons, and as zealously defended by Sir Isaac's friends. The main design of it was to find out, from some tracts of the most ancient Greek astronomy, what was the position of the colures with respect to the fixed stars, in the time of Chiron the centaur. As it is now known that these stars have a motion in longitude of one degree in 72 years, if it be once known through what fixed stars the colure passed in Chiron's time, by taking the distance of these stars from those through which it now passes, we might determine what number of years has elapsed since Chiron's time. As Chiron was one of the Argonauts, this would fix the time of that famous expedition, and consequently that of the Trojan war; the two great events upon which all ancient chronology depends. Sir Isaac places them 500 years nearer the birth of Christ than other chronologers have done.

This great man had all along enjoyed a settled and equal state of health to the age of 80, when he began to be afflicted with an incontinence of urine. However, for the five following years, he had great intervals of ease, which he procured by the observance of a strict regimen. It was then believed that he certainly had the stone; and when the paroxysms were so violent, that large drops of sweat ran down his face, he never uttered the least complaint, or expressed the smallest degree of impatience; but, as soon as he had a moment's ease, would smile and talk with his usual cheerfulness. Till then he always read and wrote several hours in a day. He had the perfect use of all his senses and understanding till the day before he died, which was on the 20th of March 1726-7 in the 85th year of his age. He lay in state in the Jerusalem chamber at Westminster, and on the 28th of March his body was conveyed into Westminster abbey; the pall being supported by the lord chancellor, the dukes of Montrose and Roxburgh, and the earls of Pembroke, Sussex, and Macclesfield. The bishop of Rochester read the funeral service, being attended by all the clergy of the church. The corpse was interred just at the entrance into the choir, where a noble monument is erected to his memory.

Sir Isaac was of a middling stature, and in the latter part of his life somewhat inclined to be fat. His countenance was pleasing and at the same time venerable. He never made use of spectacles, and lost but one tooth during his whole life.

His temper is said to have been so equal and mild, that no accident could disturb it. Of this the following remarkable instance is related. Sir Isaac had a favourite little dog, which he called *Diamond;* and being one day called out of his study into the next room, Diamond was left behind. When Sir Isaac returned, having been absent but a few minutes, he had the mortification to find, that Diamond having thrown down a lighted candle among some papers, the nearly finished labour of many years was in flames, and almost consumed to ashes. This loss, as Sir Isaac was then very far advanced in years, was irretrievable; yet without once striking the dog, he only rebuked him with this exclamation, "Oh! Diamond! Diamond! thou little knowest the mischief thou hast done!

He was a great lover of peace, and would rather have chosen to remain in obscurity than to have the calm of life ruffled by those storms and disputes which genius and learning always draw upon those that are peculiarly eminent for them. In contemplating his genius it presently becomes a doubt, which of these endowments had the greatest share, sagacity, penetration, strength or diligence: and after all, the mark that seems most to distinguish it is, that he himself made the justest estimation of it, declaring, that, if he had done the world any service, it was due to nothing but industry and patient thought; that he kept the subject under consideration constantly before him, and waited till the first dawning opened gradually, by little and little, into a full and clear light. It is said, that when he had any mathematical problems or solutions in his mind, he would never quit the subject on any account. Dinner has been often three hours ready for him before he could be brought to table: and his man often said, when he has been getting up in a morning, he has sometimes begun to dress, and with one leg in his breeches sat down again on the bed, where he has remained for hours before he got his clothes on. From his love of peace, no doubt, arose that unusual kind of horror which he had for all disputes; a steady unbroken attention, free from those frequent recoilings inseparably incident to others, was his peculiar felicity; he knew it, and he knew the value of it. No wonder then that controversy was looked on as his bane. When some objections, hastily made to his discoveries concerning light and colours, induced him to lay aside the design he had of publishing his optic lectures, we find him reflecting on that dispute, into which he was unavoidably drawn thereby, in these terms: "I blamed my own imprudence for parting with so real a blessing as my quiet, to run after a shadow." It is true this shadow (as Mr Fontenelle observes) did not escape him afterwards, nor did it cost him that quiet which he so much valued, but proved as much a real happiness to him as his quiet itself; yet this was a happiness of his own making: he took a resolution, from these disputes, not to publish any more about that theory till he had put it above the reach of controversy, by the exactest experiments and the strictest demonstrations; and accordingly it has never been called in question since. In the same temper, after

Newton. ter he had ſent the manuſcript of his *Principia* to the Royal Society, with his conſent to the printing of it by them, upon Mr Hook's injuriouſly inſiſting that himſelf had demonſtrated Kepler's problem before our author, he determined, rather than be involved again in a controverſy, to ſuppreſs the third book, and was very hardly prevailed upon to alter that reſolution. In is true, the public was thereby a gainer; that book, which is indeed no more than a corollary of ſome propoſitions in the firſt, being originally drawn up in the popular way, with the deſign to publiſh it in that form; whereas he was now convinced that it would be beſt not to let it go abroad without a ſtrict demonſtration.

After all, notwithſtanding his anxious care to avoid every occaſion of breaking his intenſe application to ſtudy, he was at a great diſtance from being ſteeped in philoſophy: on the contrary, he could lay aſide his thoughts, though engaged in the moſt intricate reſearches, when his other affairs required his attendance; and as ſoon as he had leiſure, reſume the ſubject at the point where he had left off. This he ſeems to have done not ſo much by any extraordinary ſtrength of memory, as by the force of his inventive faculty, to which every thing opened itſelf again with eaſe, if nothing intervened to ruffle him. The readineſs of his invention made him not think of putting his memory much to the trial: but this was the offspring of a vigorous intenſeneſs of thought, out of which he was but a common man. He ſpent therefore, the prime of his age in thoſe abſtruſe reſearches, when his ſituation in a college gave him leiſure, and even while ſtudy was his proper profeſſion. But as ſoon as he was removed to the mint, he applied himſelf chiefly to the buſineſs of that office; and ſo far quitted mathematics and philoſophy, as not to engage in any purſuits of either kind afterwards.

The amiable quality of modeſty is repreſented as ſtanding foremoſt in the character of this great man's mind and manners. It was in reality greater than can be eaſily imagined, or will be readily believed; yet it always continued ſo without any alteration, though the whole world, ſays Fontenelle, conſpired againſt it; and let us add, though he was thereby robbed of his inventions of fluxions. Nicholas Mercator publiſhing his *Logarithmotechnia* in 1668, where he gave the quadrature of the hyperbola by an infinite ſeries, which was the firſt appearance in the learned world of a ſeries of this ſort drawn from the particular nature of the curve, and that in a manner very new and abſtracted; Dr Barrow, then at Cambridge, where Mr Newton, at that time about 26 years of age, reſided, recollected that he had met with the ſame thing in the writings of that young gentleman; and there not confined to the hyperbola only, but extended, by general forms, to all ſorts of curves, even ſuch as are mechanical; to their quadratures, their rectifications, and their centres of gravity; to the ſolids formed by their rotations, and to the ſuperficies of thoſe ſolids; ſo that, when their determinations were poſſible, the ſeries ſtopped at a certain point, or at leaſt their ſums were given by ſtated rules: and, if the abſolute determinations were impoſſible, they could yet be infinitely approximated; which is the happieſt and moſt refined method, ſays Mr Fontenelle, of ſupplying the defects of human knowledge that man's imagination could poſſibly invent. To be maſter of ſo fruitful and general a theory was a mine of gold to a geometrician; but it was a greater glory to have been the diſcoverer of ſo ſurpriſing and ingenious a ſyſtem. So that Mr Newton finding, by Mercator's book, that he was in the way to it, and that others might follow in his track, ſhould naturally have been forward to open his treaſures, and ſecure the property, which conſiſted in making the diſcovery; but he contented himſelf with his treaſure which he had found, without regarding the glory. What an idea does it give us of his unparalleled modeſty, when we ſee him declaring, that he thought Mercator had entirely diſcovered his ſecret, or that others would, before he was of a proper age for writing? His MS. upon infinite ſeries was communicated to none but Mr John Collins and the lord Brounker; and even that had not been complied with, but for Dr Barrow, who would not ſuffer him to indulge his modeſty ſo much as he deſired. Newton.

It is further obſerved, concerning this part of his character, that he never talked either of himſelf or others, nor ever behaved, in ſuch a manner as to give the moſt malicious cenſurers the leaſt occaſion even to ſuſpect him of vanity. He was candid and affable, and always put himſelf upon a level with his company. He never thought either his merit or his reputation ſufficient to excuſe him from any of the common offices of ſocial life; no ſingularities, either natural or affected, diſtinguiſhed him from other men. Though he was firmly attached to the church of England, he was averſe to the perſecution of the non-conformiſts. He judged of men by their manners; and the true ſchiſmatics, in his opinion, were the vicious and the wicked. Not that he confined his principles to natural religion, for he was thoroughly perſuaded of the truth of revelation; and amidſt the great variety of books which he had conſtantly before him, that which he ſtudied with the greateſt application was the Bible: and he underſtood the nature and force of moral certainty as well as he did that of a ſtrict demonſtration.

Sir Iſaac did not neglect the opportunities of doing good, when the revenues of his patrimony, and a profitable employment, improved by a prudent economy, put it in his power. We have two remarkable inſtances of his bounty and generoſity; one to Mr M'Laurin, profeſſor of mathematics at Edinburgh, to whom he offered 20l. per annum, and the other to his niece Barton, on whom he ſettled an annuity of 100l. When decency upon any occaſion required expence and ſhow, he was magnificent without grudging it, and with a very good grace; at all other times, that pomp which ſeems great to low minds only, was utterly retrenched, and the expence reſerved for better uſes. He never married, and perhaps he never had leiſure to think of it. Being immerſed in profound ſtudies during the prime of his age, and afterwards engaged in an employment of great importance, and even quite taken up with the company which his merit drew to him, he was not ſenſible of any vacancy in life, or of the want of a companion at home. He left 32,000l. at his death; but made no will, which Mr Fontenelle tells us was becauſe he thought a legacy was no gift. As to his works, beſides what were publiſhed in his lifetime, there were found after his death, among his papers, ſeveral diſcourſes upon ſubjects of antiquity, hiſtory, divinity, chemiſtry,

ſtry,

Newtonian Philosophy.

ftry, and mathematics, feveral of which were publifhed at different times.

Newtonian Philofophy, the doctrine of the univerfe, and particularly of the heavenly bodies, their laws, affections, &c. as delivered by Sir Ifaac Newton.

1 Different opinions concerning this philofophy.

The term *Newtonian Philofophy* is applied very differently; whence divers confufed notions relating thereto. Some authors under this philofophy include all the corpufcular philofophy, confidered as it now ftands corrected and reformed by the difcoveries and improvements made in feveral parts thereof by Sir Ifaac Newton. In which fenfe it is that Gravefande calls his elements of phyfics, *Introductio ad Philofophiam Newtonianam*. And in this fenfe the Newtonian is the fame with the new philofophy; and ftands contradiftinguifhed from the Cartefian, the Peripatetic, and the ancient Corpufcular.

Others, by *Newtonian philofophy*, mean the method or order which Sir Ifaac Newton obferves in philofophizing; viz. the reafoning and drawing of conclufions directly from phenomena, exclufive of all previous hypothefes; the beginning from fimple principles; deducing the firft powers and laws of nature from a few felect phenomena, and then applying thofe laws, &c. to account for other things. And in this fenfe the *Newtonian philofophy* is the fame with the *experimental philofophy*, and ftands oppofed to the ancient *corpufcular*.

Others, by *Newtonian philofophy*, mean that wherein phyfical bodies are confidered mathematically, and where geometry and mechanics are applied to the folution of the appearances of nature. In which fenfe the Newtonian is the fame with the *mechanical* and *mathematical philofophy*.

Others again, by *Newtonian philofophy*, underftand that part of phyfical knowledge which Sir Ifaac Newton has handled, improved, and demonftrated, in his *Principia*.

Others, laftly, by *Newtonian philofophy*, mean the new principles which Sir Ifaac Newton has brought into philofophy; the new fyftem founded thereon; and the new folutions of phenomena thence deduced; or that which characterizes and diftinguifhes his philofophy from all others.—Which is the fenfe wherein we fhall chiefly confider it.

As to the hiftory of this philofophy, we have nothing to add to what has been given in the preceding article. It was firft made public in the year 1687, by the author, then a fellow of Trinity College, Cambridge, and in the year 1713, republifhed with confiderable improvements.—Several authors have fince attempted to make it plainer; by fetting afide many of the more fublime mathematical refearches, and fubftituting either more obvious reafonings or experiments in lieu thereof; particularly Whifton in his *Prælect. Phyf. Mathemat.* Gravefande in *Element. et Inftit.* and Dr Pemberton in his *View*.

2 Definitions on which the philofophy is founded.

The whole of the *Newtonian philofophy*, as delivered by the author, is contained in his *Principia* or *Mathematical Principles of Natural Philofophy*. He founds his fyftem on the following definitions:

1. The quantity of matter is the meafure of the fame, arifing from its denfity and bulk conjunctly.—Thus air of a double denfity, in a double fpace, is quadruple in quantity; in a triple fpace, fextuple in quantity, &c.

2. The quantity of motion is the meafure of the fame, arifing from the velocity and quantity of matter conjunctly. This is evident, becaufe the motion of the whole is the motion of all its parts; and therefore in a body double in quantity, with equal velocity, the motion is double, &c.

3 *Vis infita* defined and objected to.

3. The *vis infita*, or innate force of matter, is a power of refifting, by which every body, as much as in it lies, endeavours to perfevere in its prefent ftate, whether it be of reft, or moving uniformly forward in a right line.—This definition is proved to be juft, only by the difficulty we find in moving any thing out of its place; and this difficulty is by fome reckoned to proceed only from gravity. They contend, that in thofe cafes where we can prevent the force of gravity from acting upon bodies, this power of refiftance becomes infenfible, and the greateft quantities of matter may be put in motion by the very leaft force. Thus there have been balances formed fo exact, that when loaded with 200 weight in each fcale, they would turn by the addition of a fingle drachm. In this cafe 400lb. of matter was put in motion by a fingle drachm, i. e. by $\frac{1}{51200}$ part of its own quantity: and even this fmall weight, they fay, is only neceffary on account of the inaccuracy of the machine: fo that we have no reafon to fuppofe, that, if the friction could be entirely removed, it would take more force to move a tun weight than a grain of fand. This objection, however, is not taken notice of by Sir Ifaac: and he beftows on the refifting power above mentioned the name of *vis inertiæ*; a phrafe which is perhaps not well chofen, and with which inferior writers have endeavoured to make their readers merry at the expence of Newton. A *force of inactivity*, it has been faid, is a *forcelefs* force; and analogous to a *black white*, a *cold heat*, and a *tempeftuous calm*.

But objections of more importance have been made to the whole of this doctrine than thofe which merely refpect the term *vis inertiæ*. "An endeavour to remain at reft (we are told *) is unneceffary, whilft nothing attempts to difturb the reft. It is likewife impoffible to be conceived, as it implies a contradiction. A man, by oppofing force to force, may endeavour not to be moved; but this oppofition is an endeavour to *move*, not with a defign to *move*, but by counteracting another force to *prevent* being moved. An endeavour not to move therefore cannot exift in bodies, becaufe it is abfurd; and if we appeal to fact, we fhall find every body in an actual and conftant endeavour to move." It has been likewife obferved, and we think juftly, that "if bodies could *continue* to move by any innate force, they might alfo *begin* to move by that force. For the fame caufe which can move a body with a given velocity at one time, could do it, if prefent, at any other time; and therefore if the force by which bodies continue in motion were innate and effential to them, they would begin to move of themfelves, which is not true." Newton indeed fays that this innate force is the caufe of motion under certain circumftances only, or when the body is acted upon by a force impreffed *ab extra*. But if this impreffed force do not continue as well as

* *Young's Examination of the third and fourth Definitions of the firft Book of the Principia, &c.*

Newtonian Philoſophy.

as begin the motion, if it ceaſe the inſtant that the impreſſion is over, and the body continue to move by its *vis inertiæ*, why is the body ever ſtopped? "If in the beginning of the motion the body, by its innate force, overcomes a certain reſiſtance of friction and air, in any following times, the force being undiminiſhed, it will overcome the ſame reſiſtance for ever. Theſe reſiſtances, therefore, could never change the ſtate of a moving body, becauſe they cannot change the quantity of its motive force. But this is contrary to univerſal experience." For theſe reaſons we are inclined to think that bodies are wholly paſſive; that they endeavour nothing; and that they continue in motion not by any innate force or *vis inſita*, but by that force, whatever it be, which begins the motion, and which, whilſt it remains with the moving body, is gradually diminiſhed, and at laſt overcome by oppoſite forces, when the body of courſe ceaſes to move.

4. An impreſſed force is an action exerted upon a body, in order to change its ſtate, either of reſt or of moving uniformly forward in a right line.—This force conſiſts in the action only; and remains no longer in the body when the action is over. For a body maintains every new ſtate it acquires by its *vis inertiæ* only.

It is here implied, and indeed fully expreſſed, that motion is not continued by the ſame power that produced it. Now there are two grounds on which the truth of this doctrine may be ſuppoſed to reſt.

"*Firſt*, On a direct proof that the impreſſed force does not remain in the body, either by ſhowing the nature of the force to be tranſitory and incapable of more than its firſt action; or that it acts only on the ſurface, and that the body eſcapes from it; or that the force is ſomewhere elſe, and not remaining in the body. But none of theſe direct proofs are offered.

"*Secondly*, It may reſt on an indirect proof, that there is in the nature of body a ſufficient cauſe for the continuance of every new ſtate acquired; and that therefore any adventitious force to continue motion, though neceſſary for its production, is ſuperfluous and inadmiſſible. As this is the very ground on which the ſuppoſition ſtands, it ought to have been indubitably certain that the innate force of the body is ſufficient to perpetuate the motion it has once acquired, before the other agent, by which the motion was communicated, had been diſmiſſed from the office. But the innate force of body has been ſhown not to be that which continues its motion; and therefore the proof, that the impreſſed force does not remain in the body, fails. Nor indeed is it in this caſe deſirable to ſupport the proof, becauſe we ſhould then be left without any reaſon for the continuance of motion *." When we mention an impreſſed force, we mean ſuch a force as is communicated either at the ſurface of the body or by being diffuſed through the maſs.

* Young's Examination, &c.

5. A centripetal force is that by which bodies are drawn, impelled, or any way tend towards a point, as to a centre.—The quantity of any centripetal force may be conſidered as of three kinds, abſolute, accelerative, and motive.

6. The abſolute quantity of a centrifugal force is the meaſure of the ſame, proportional to the efficacy of the cauſe that propagates it from the centre, through the ſpaces round it.

7. The accelerative quantity of a centripetal force is the meaſure of the ſame, proportional to the velocity which it generates in a given time.

8. The motive quantity of a centripetal force is a meaſure of the ſame, proportional to the motion which it generates in a given time. This is always known by the quantity of a force equal and contrary to it, that is juſt ſufficient to hinder the deſcent of the body.

Scholia.

I. Abſolute, true, and mathematical time, of itſelf, 4 Of Time.
and from its own nature, flows equably, without regard to any thing external, and, by another name, is called *duration*. Relative, apparent, and common time, is ſome ſenſible and external meaſure of duration, whether accurate or not, which is commonly uſed inſtead of true time; ſuch as an hour, a day, a month, a year, &c.

II. Abſolute ſpace, in its own nature, without re- 5 Space.
gard to any thing external, remains always ſimilar and immoveable. Relative ſpace is ſome moveable dimenſion or meaſure of the abſolute ſpaces; and which is vulgarly taken for immoveable ſpace. Such is the dimenſion of a ſubterraneous, an aerial, or celeſtial ſpace, determined by its poſition to bodies, and which is vulgarly taken for immoveable ſpace; as the diſtance of a ſubterraneous, an aerial, or celeſtial ſpace, determined by its poſition in reſpect of the earth. Abſolute and relative ſpace are the ſame in figure and magnitude; but they do not remain always numerically the ſame. For if the earth, for inſtance, moves, a ſpace of our air which, relatively and in reſpect of the earth, remains always the ſame, will at one time be one part of the abſolute ſpace into which the earth paſſes; at another time it will be another part of the ſame; and ſo, abſolutely underſtood, it will be perpetually mutable.

III. Place is a part of ſpace which a body takes 6 Place de-
up; and is, according to the ſpace, either abſolute or fined.
relative. Our author ſays it is *part* of ſpace; not the ſituation, nor the external ſurface of the body. For the places of equal ſolids are always equal; but their ſuperficies, by reaſon of their diſſimilar figures, are often unequal. Poſitions properly have no quantity, nor are they ſo much the places themſelves as the properties of places. The motion of the whole is the ſame thing with the ſum of the motions of the parts; that is, the tranſlation of the whole out of its place is the ſame thing with the ſum of the tranſlations of the parts out of their places: and therefore the place of the whole is the ſame thing with the ſum of the places of the parts; and for that reaſon it is internal, and in the whole body.

IV. Abſolute motion is the tranſlation of a body 7 Of Motion.
from one abſolute place into another, and relative motion the tranſlation from one relative place into another. Thus, in a ſhip under ſail, the relative place of a body is that part of the ſhip which the body poſſeſſes, or that part of its cavity which the body fills, and which therefore moves together with the ſhip; and relative reſt is the continuance of the body in the ſame part of the ſhip, or of its cavity. But real abſolute

Newtonian Philosophy.

absolute rest is the continuance of the body in the same part of that immoveable space in which the ship itself, its cavity, and all that it contains, is moved. Wherefore, if the earth is really at rest, the body which relatively rests in the ship will really and absolutely move with the same velocity which the ship has on the earth. But if the earth also moves, the true and absolute motion of the body will arise, partly from the true motion of the earth in immoveable space; partly from the relative motion of the ship on the earth: and if the body moves also relatively in the ship, its true motion will arise partly from the true motion of the earth in immoveable space, and partly from the relative motions as well of the ship on the earth as of the body in the ship; and from these relative motions will arise the relative motion of the body on the earth. As if that part of the earth where the ship is, was truly moved towards the east, with a velocity of 10010 parts; while the ship itself with a fresh gale is carried towards the west, with a velocity expressed by 10 of these parts; but a sailor walks in the ship towards the east with one part of the said velocity: then the sailor will be moved truly and absolutely in immoveable space towards the east with a velocity of 1001 parts; and relatively on the earth towards the west, with a velocity of 9 of those parts.

Absolute time, in astronomy, is distinguished from relative, by the equation or correction of the vulgar time. For the natural days are truly unequal, though they are commonly considered as equal, and used for a measure of time: astronomers correct this inequality for their more accurate deducing of the celestial motions. It may be that there is no such thing as an equable motion whereby time may be accurately measured. All motions may be accelerated or retarded; but the true or equable progress of absolute time is liable to no change. The duration or perseverance of the existence of things remains the same, whether the motions are swift or slow, or none at all; and therefore ought to be distinguished from what are only sensible measures thereof, and out of which we collect it by means of the astronomical equation. The necessity of which equation for determining the times of a phenomenon is evinced, as well from the experiments of the pendulum clock as by eclipses of the satellites of Jupiter.

8
Immutability of time and space.

As the order of the parts of time is immutable, so also is the order of the parts of space. Suppose those parts to be moved out of their places, and they will be moved (if we may be allowed the expression) out of themselves. For times and spaces are, as it were, the places of themselves as of all other things. All things are placed in time as to order of succession; and in space as to order of situation. It is from their essence or nature that they are places; and that the primary places of things should be moveable, is absurd. These are therefore the absolute places; and translations out of those places are the only absolute motions.

But because the parts of space cannot be seen, or distinguished from one another by the senses, therefore in their stead we use sensible measures of them. For, from the positions and distances of things from any body, considered as immoveable, we define all places; and then with respect to such places, we estimate all motions, considering bodies as transferred from some of those places into others. And so, instead of absolute places and motions, we use relative ones; and that without any inconvenience in common affairs: but in philosophical disquisitions we ought to abstract from our senses, and consider things themselves distinct from what are only sensible measures of them. For it may be, that there is no body really at rest, to which the places and motions of others may be referred.

But we may distinguish rest and motion, absolute and relative, one from the other by their properties, causes, and effects. It is a property of rest, that bodies really at rest do rest in respect of each other. And therefore, as it is possible, that in the remote regions of the fixed stars, or perhaps far beyond them, there may be some body absolutely at rest, though it be impossible to know from the position of bodies to one another in our regions, whether any of these do keep the same position to that remote body; it follows, that absolute rest cannot be determined from the position of bodies in our regions.

9
Of the motion of different bodies with respect to one another.

It is a property of motion, that the parts which retain given positions to their wholes do partake of the motion of their wholes. For all parts of revolving bodies endeavour to recede from the axis of motion; and the impetus of bodies moving forwards arises from the joint impetus of all the parts. Therefore if surrounding bodies are moved, those that are relatively at rest within them will partake of their motion. Upon which account the true and absolute motion of a body cannot be determined by the translation of it from those only which seem to rest; for the external bodies ought not only to appear at rest, but to be really at rest. For otherwise all included bodies, beside their translation from near the surrounding ones, partake likewise of their true motions; and though that translation was not made, they would not really be at rest, but only seem to be so. For the surrounding bodies stand in the like relation to the surrounded, as the exterior part of a whole does to the interior, or as the shell does to the kernel; but if the shell moves, the kernel will also move, as being part of the whole, without any removal from near the shell.

A property near akin to the preceding is, that if a place is moved, whatever is placed therein moves along with it; and therefore a body which is moved from a place in motion, partakes also of the motion of its place. Upon which account all motions from places in motion, are no other than parts of entire and absolute motions; and every entire motion is composed of the motion of the body out of its first place, and the motion of this place out of its place; and so on, until we come to some immoveable place, as in the above mentioned example of the sailor. Wherefore entire and absolute motions can be no otherwise determined than by immoveable places. Now, no other places are immoveable but those that from infinity to infinity do all retain the same given positions one to another; and upon this account must ever remain unmoved, and do thereby constitute what we call *immoveable space*.

The causes by which true and relative motions are distinguished one from the other, are the forces impressed

pressed upon bodies to generate motion. True motion is neither generated nor altered, but by some force impressed upon the body moved: but relative motion may be generated or altered without any force impressed upon the body. For it is sufficient only to impress some force on other bodies with which the former is compared, that by their giving way, that relation may be changed, in which the relative rest or motion of the other body did consist. Again, True motion suffers always some change from any force impressed upon the moving body; but relative motion does not necessarily undergo any changes by such force. For if the same forces are likewise impressed on those other bodies with which the comparison is made, that the relative position may be preserved; then that condition will be preserved, in which the relative motion consists. And therefore any relative motion may be changed when the true motion remains unaltered, and the relative may be preserved when the true motion suffers some change. Upon which account true motion does by no means consist in such relations.

10
Absolute and relative motion distinguished.

The effects which distinguish absolute from relative motion are, the forces of receding from the axis of circular motion. For there are no such forces in a circular motion purely relative: but, in a true and absolute circular motion, they are greater or less according to the quantity of the motion. If a vessel, hung by a long cord, is so often turned about that the cord is strongly twisted, then filled with water, and let go, it will be whirled about the contrary way; and while the cord is untwisting itself, the surface of the water will at first be plain, as before the vessel began to move; but the vessel, by gradually communicating its motion to the water, will make it begin sensibly to revolve, and recede by little and little from the middle, and ascend to the sides of the vessel, forming itself into a concave figure; and the swifter the motion becomes, the higher will the water rise, till at last, performing its revolutions in the same times with the vessel, it becomes relatively at rest in it. This ascent of the water shows its endeavour to recede from the axis of its motion; and the true and absolute circular motion of the water, which is here directly contrary to the relative, discovers itself, and may be measured by this endeavour. At first, when the relative motion in the water was greatest, it produced no endeavour to recede from the axis; the water showed no tendency to the circumference, nor any ascent towards the sides of the vessel, but remained of a plane surface; and therefore its true circular motion had not yet begun. But afterwards, when the relative motion of the water had decreased, the ascent thereof towards the sides of the vessel proved its endeavour to recede from the axis; and this endeavour showed the real circular motion of the water perpetually increasing, till it had acquired its greatest quantity, when the water rested relatively in the vessel. And therefore this endeavour does not depend upon any translation of the water in respect of the ambient bodies; nor can true circular motion be defined by such translations. There is only one real circular motion of any one revolving body, corresponding to only one power of endeavouring to recede from its axis of motion, as its proper and adequate effect: but relative motions in one and the same body are innumerable, according to the various relations it bears to external bodies; and, like other relations, are altogether destitute of any real effect, otherwise than they may perhaps participate of that only true motion. And therefore, in the system which supposes that our heavens, revolving below the sphere of the fixed stars, carry the planets along with them, the several parts of those heavens and the planets, which are indeed relatively at rest in their heavens, do yet really move. For they change their position one to another, which never happens to bodies truly at rest; and being carried together with the heavens, participate of their motions, and, as parts of revolving wholes, endeavour to recede from the axis of their motion.

Wherefore relative quantities are not the quantities themselves whose names they bear, but those sensible measures of them, either accurate or inaccurate, which are commonly used instead of the measured quantities themselves. And then, if the meaning of words be determined by their use, by the names *time*, *space*, *place*, and *motion*, their measures are properly to be understood; and the expression will be unusual and purely mathematical, if the measured quantities themselves are meant.

It is indeed a matter of great difficulty to discover, and effectually to distinguish, the true motions of particular bodies from those that are only apparent: because the parts of that immoveable space in which those motions are performed, do by no means come under the observation of our senses. Yet we have some things to direct us in this intricate affair; and these arise partly from the apparent motions which are the difference of the true motions, partly from the forces which are the causes and effects of the true motions. For instance, if two globes, kept at a given distance one from the other by means of a cord that connects them, were revolved about their common centre of gravity; we might, from the tension of the cord, discover the endeavour of the globes to recede from the axis of motion, and from thence we might compute the quantity of their circular motions. And then, if any equal forces should be impressed at once on the alternate faces of the globes to augment or diminish their circular motions, from the increase or decrease of the tension of the cord we might infer the increment or decrement of their motions; and thence would be found on what faces those forces ought to be impressed, that the motions of the globes might be most augmented; that is, we might discover their hindermost faces, or those which follow in the circular motion. But the faces which follow being known, and consequently the opposite ones that precede, we should likewise know the determination of their motions. And thus we might find both the quantity and determination of this circular motion, even in an immense vacuum, where there was nothing external or sensible, with which the globes might be compared. But now, if in that space some remote bodies were placed that kept always a given position one to another, as the fixed stars do in our regions; we could not indeed determine from the relative translation of the globes among those bodies, whether the motion did belong to the globes or to the bodies. But if we observed the cord, and found that its tension was that very tension which the motions of the globes required, we might conclude the motion to be in the globes, and the bodies to be

Newtonian Philosophy.

be at reſt; and then, laſtly, from the tranſlation of the globes among the bodies, we ſhould find the determination of their motions.

Having thus explained himſelf, Sir Iſaac propoſes to ſhow how we are to collect the true motions from their cauſes, effects, and apparent differences; and *vice verſa*, how, from the motion, either true or apparent, we may come to the knowledge of their cauſes and effects. In order to this, he lays down the following axioms or laws of motion.

11 Laws of motion.

1. EVERY BODY PERSEVERES IN ITS STATE OF REST, OR OF UNIFORM MOTION IN A RIGHT LINE, UNLESS IT IS COMPELLED TO CHANGE THAT STATE BY FORCES IMPRESSED UPON IT.—Sir Iſaac's proof of this axiom is as follows: "Projectiles perſevere in their motions, ſo far as they are not retarded by the reſiſtance of the air, or impelled downwards by the force of gravity. A top, whoſe parts, by their coheſion, are perpetually drawn aſide from rectilinear motions, does not ceaſe its rotation otherwiſe than as it is retarded by the air. The greater bodies of the planets and comets, meeting with leſs reſiſtance in more free ſpaces, preſerve their motions, both progreſſive and circular, for a much longer time."—Notwithſtanding this demonſtration, however, the axiom hath been violently diſputed. It hath been argued, that bodies continue in their ſtate of motion becauſe they are ſubjected to the continual impulſe of an inviſible and ſubtile fluid, which always pours in from behind, and of which all places are full. It hath been affirmed, that motion is as natural to this fluid as reſt is to all other matter. It is ſaid, moreover, that it is impoſſible we can know in what manner a body would be influenced by moving forces if it was entirely deſtitute of gravity. According to what we can obſerve, the momentum of a body, or its tendency to move, depends very much on its gravity. A heavy cannon-ball will fly to a much greater diſtance than a light one, though both are actuated by an equal force. It is by no means clear, therefore, that a body totally deſtitute of gravity would have any proper momentum of its own; and if it had no momentum, it could not continue its motion for the ſmalleſt ſpace of time after the moving power was withdrawn. Some have imagined that matter was capable of beginning motion of itſelf, and conſequently that the axiom was falſe; becauſe we ſee plainly that matter in ſome caſes hath a tendency to change from a ſtate of motion to a ſtate of reſt, and from a ſtate of reſt to a ſtate of motion. A paper appeared on this ſubject in the firſt volume of the Edinburgh Phyſical and Literary Eſſays; but the hypotheſis never gained any ground.

12 Objections to the firſt law.

2. THE ALTERATION OF MOTION IS EVER PROPORTIONAL TO THE MOTIVE FORCE IMPRESSED; AND IS MADE IN THE DIRECTION OF THE RIGHT LINE IN WHICH THAT FORCE IS IMPRESSED.—Thus, if any force generates a certain quantity of motion, a double force will generate a double quantity, whether that force be impreſſed all at once, or in ſucceſſive moments. To this law no objection of conſequence has ever been made. It is founded on this ſelf-evident truth, that every effect muſt be proportional to its cauſe. Mr Young, who ſeems to be very ambitious of detecting the errors of Newton, finds fault indeed with the expreſſions in which the law is ſtated; but he owns, that if thus expreſſed, *The alteration of motion is proportional to the actions or reſiſtances which produce it, and is in the direction in which the actions or reſiſtances are made*, it would be unexceptionable.

3. TO EVERY ACTION THERE ALWAYS IS OPPOSED AN EQUAL RE-ACTION: OR, THE MUTUAL ACTION OF TWO BODIES UPON EACH OTHER IS ALWAYS EQUAL, AND DIRECTED TO CONTRARY PARTS.—This axiom is alſo diſputed by many. In the above-mentioned paper in the Phyſical Eſſays, the author endeavours to make a diſtinction between re-action and reſiſtance; and the ſame attempt has been made by Mr Young. "When an action generates no motion (ſays he), it is certain that its effects have been deſtroyed by a contrary and equal action. When an action generates two contrary and equal motions, it is alſo evident that mutual actions were exerted, equal and contrary to each other. All caſes where one of theſe conditions is not found, are exceptions to the truth of the law. If a finger preſſes againſt a ſtone, the ſtone, if it does not yield to the preſſure, preſſes as much upon the finger; but if the ſtone yields, it re-acts leſs than the finger acts; and if it ſhould yield with all the momentum that the force of the preſſure ought to generate, which it would do if it were not impeded by friction, or a medium, it would not re-act at all. So if the ſtone drawn by a horſe, follows after the horſe, it does not re-act ſo much as the horſe acts; but only ſo much as the velocity of the ſtone is diminiſhed by friction, and it is the re-action of friction only, not of the ſtone. The ſtone does not re-act, becauſe it does not act; it reſiſts, but reſiſtance is not action.

13 Objections to the third law.

"In the loſs of motion from a ſtriking body, equal to the gain in the body ſtruck, there is a plain ſolution without requiring any re-action. The motion *loſt* is identically that which is *found* in the other body; this ſuppoſition accounts for the whole phenomenon in the moſt ſimple manner. If it be not admitted, but the ſolution by re-action is inſiſted upon, it will be incumbent on the party to account for the whole effect of communication of motion; otherwiſe he will lie under the imputation of rejecting a ſolution which is ſimple, obvious, and perfect; for one complex, unnatural, and incomplete. However this may be determined, it will be allowed, that the circumſtances mentioned, afford no ground for the inference, that action and re-action are equal, ſince appearances may be explained in another way" (A).

Others

(A) If there be a perfect reciprocity betwixt an impinging body and a body at reſt ſuſtaining its impulſe, may we not at our pleaſure conſider either body as the agent, and the other as the reſiſtant? Let a moving body, A, paſs from north to ſouth, an equal body B at reſt, which receives the ſtroke of A, act upon A from ſouth to north, and A reſiſt in a contrary direction, both inelaſtic: let the motion reciprocally communicated be called ſix. Then B at reſt communicates to A ſix degrees of motion towards the north, and receives ſix degrees towards the ſouth. B having no other motion than the ſix degrees it communicated, will, by its equal

Newtonian Philosophy.

Others grant that Sir Isaac's axiom is very true in respect to terrestrial substances; but they affirm, that, in these, both action and re-action are the effects of gravity. Substances void of gravity would have no momentum; and without this they could not act; they should be moved by the least force, and therefore could not resist or re-act. If therefore there is any fluid which is the cause of gravity, though such fluid could act upon terrestrial substances, yet these could not re-act upon it; because they have no force of their own, but depend entirely upon it for their momentum. In this manner, say they, we may conceive that the planets circulate, and all the operations of nature are carried on by means of a subtile fluid; which being perfectly active, and the rest of matter altogether passive, there is neither resistance nor loss of motion. See MOTION.

From the preceding axiom Sir Isaac draws the following corollaries.

1. A body by two forces conjoined will describe the diagonal of a parallelogram in the same time that it would describe the sides by those forces apart.

2. Hence we may explain the composition of any one direct force out of any two oblique ones, viz. by making the two oblique forces the sides of a parallelogram, and the direct one the diagonal.

3. The quantity of motion, which is collected by taking the sum of the motions directed towards the same parts, and the difference of those that are directed to contrary parts, suffers no change from the action of bodies among themselves; because the motion which one body loses is communicated to another: and if we suppose friction and the resistance of the air to be absent, the motion of a number of bodies which mutually impelled one another would be perpetual, and its quantity always equal.

4. The common centre of gravity of two or more bodies does not alter its state of motion or rest by the actions of the bodies among themselves; and therefore the common centre of gravity of all bodies acting upon each other (excluding outward actions and impediments) is either at rest, or moves uniformly in a right line.

5. The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forward in a right line without any circular motion. The truth of this is evidently shown by the experiment of a ship; where all motions happen after the same manner, whether the ship is at rest, or proceeds uniformly forward in a straight line.

6. If bodies, anyhow moved among themselves, are urged in the direction of parallel lines by equal accelerative forces, they will all continue to move among themselves, after the same manner as if they had been urged by no such forces.

The whole of the mathematical part of the Newtonian philosophy depends on the following lemmas; of which the first is the principal.

LEM. I. Quantities, and the ratios of quantities, which in any finite time converge continually to equality, and before that time approach nearer the one to the other than by any given difference, become ultimately equal. If you deny it; suppose them to be ultimately unequal, and let D be their ultimate difference. Therefore they cannot approach nearer to equality than by that given difference D; which is against the supposition.

14 Objections to the first lemma,

Concerning the meaning of this lemma philosophers are not agreed; and unhappily it is the very fundamental position on which the whole of the system rests. Many objections have been raised to it by people who supposed

equal and contrary loss and gain, remain in equilibro. Let the original motion of A have been twelve, then A having received a contrary action equal to six, six degrees of its motion will be destroyed or in equilibrio; consequently, a motive force as six will remain to A towards the south, and B will be in equilibrio, or at rest. A will then endeavour to move with six degrees, or half its original motion, and B will remain at rest as before. A and B being equal masses, by the laws of communication three degrees of motion will be communicated to B, or A with its six degrees will act with three, and B will re-act also with three. B then will act on A from south to north equal to three, while it is acted upon or resisted by A from north to south, equal also to three, and B will remain at rest as before; A will also have its six degrees of motion reduced to one half by the contrary action of B, and only three degrees of motion will remain to A, with which it will yet endeavour to move; and finding B still at rest, the same process will be repeated till the whole motion of A is reduced to an infinitely small quantity, B all the while remaining at rest, and there will be no communication of motion from A to B, which is contrary to experience.

Let a body, A, whose mass is twelve, at rest, be impinged upon first by B, having a mass as twelve, and a velocity as four, making a momentum of 48; and secondly by C, whose mass is six, and velocity eight, making a momentum of 48 equal to B, the three bodies being inelastic. In the first case, A will become possessed of a momentum of 24, and 24 will remain to B; and, in the second case, A will become possessed of a momentum of 32, and 16 will remain to C, both bodies moving with equal velocities after the shock, in both cases, by the laws of percussion. It is required to know, if in both cases A resists equally, and if B and C act equally? if the actions and resistances are equal, how does A in one case destroy 24 parts of B's motion, and in the other case 32 parts of C's motion, by an equal resistance? And how does B communicate in one case 24 degrees of motion, and C 32, by equal actions? If the actions and resistances are unequal, it is asked how the same mass can resist differently to bodies impinging upon it with equal momenta, and how bodies possessed of equal momenta can exert different actions, it being admitted that bodies resist proportional to their masses, and that their power of overcoming resistance is proportional to their momenta?

It is incumbent on those who maintain the doctrine of universal re-action, to free it from these difficulties and apparent contradictions.

ſuppoſed themſelves capable of underſtanding it. They ſay, that it is impoſſible we can come to an end of any infinite ſeries, and therefore that the word *ultimate* can in this caſe have no meaning. In ſome caſes the lemma is evidently falſe. Thus, ſuppoſe there are two quantities of matter A and B, the one containing half a pound, and the other a third part of one. Let both be continually divided by 2; and though their ratio, or the proportion of the one to the other, doth not vary, yet the difference between them perpetually becomes leſs, as well as the quantities themſelves, until both the difference and quantities themſelves become leſs than any aſſignable quantity: yet the difference will never totally vaniſh, nor the quantities become equal, as is evident from the two following ſeries.

$$\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}\ \frac{1}{64}\ \frac{1}{128}\ \frac{1}{256}\ \frac{1}{512}\ \frac{1}{1024},\ \&c.$$
$$\frac{1}{3}\ \frac{1}{6}\ \frac{1}{12}\ \frac{1}{24}\ \frac{1}{48}\ \frac{1}{96}\ \frac{1}{192}\ \frac{1}{384}\ \frac{1}{768}\ \frac{1}{1536},\ \&c.$$
$$\text{Diff. } \frac{1}{6}\ \frac{1}{12}\ \frac{1}{24}\ \frac{1}{48}\ \frac{1}{96}\ \frac{1}{192}\ \frac{1}{384}\ \frac{1}{768}\ \frac{1}{1536}\ \frac{1}{3072},\ \&c.$$

Thus we ſee, that though the difference is continually diminiſhing, and that in a very large proportion, there is no hope of its vaniſhing, or the quantities becoming equal. In like manner, let us take the proportions or ratios of quantities, and we ſhall be equally unſucceſsful. Suppoſe two quantities of matter, one containing 8 and the other 10 pounds; theſe quantities already have to each other the ratio of 8 to 10, or of 4 to 5; but let us add 2 continually to each of them, and though the ratios continually come nearer to that of equality, it is in vain to hope for a perfect coincidence. Thus,

$$8\ 10\ 12\ 14\ 16\ 18\ 20\ 22\ 24,\ \&c.$$
$$10\ 12\ 14\ 16\ 18\ 20\ 22\ 24\ 26,\ \&c.$$
$$\text{Ratio } \frac{4}{5}\ \frac{5}{6}\ \frac{6}{7}\ \frac{7}{8}\ \frac{8}{9}\ \frac{9}{10}\ \frac{10}{11}\ \frac{11}{12}\ \frac{12}{13},\ \&c.$$

15 anſwered. For this and his other lemmas Sir Iſaac makes the following apology. "Theſe lemmas are premiſed, to avoid the tedioufneſs of deducing perplexed demonſtrations *ad abſurdum*, according to the method of ancient geometers. For demonſtrations are more contracted by the method of indiviſibles: but becauſe the hypotheſis of indiviſibles ſeems ſomewhat harſh, and therefore that method is reckoned leſs geometrical, I choſe rather to reduce the demonſtrations of the following propoſitions to the firſt and laſt ſums and ratios of naſcent and evaneſcent quantities, that is, to the limits of thoſe ſums and ratios; and ſo to premiſe, as ſhort as I could, the demonſtrations of thoſe limits. For hereby the ſame thing is performed as by the method of indiviſibles; and now thoſe principles being demonſtrated, we may uſe them with more ſafety.—Therefore, if hereafter I ſhould happen to conſider quantities as made of particles, or ſhould uſe little curve lines for right ones; I would not be underſtood to mean indiviſibles, but evaneſcent diviſible quantities; not the ſums and ratios of determinate parts, but always the limits of ſums and ratios; and that the force of ſuch demonſtrations always depends on the method laid down in the foregoing lemmas.

"Perhaps it may be objected, that there is no ultimate proportion of evaneſcent quantities, becauſe the proportion, before the quantities have vaniſhed, is not the ultimate, and, when they are vaniſhed, is none.—But by the ſame argument it may be alleged, that a body arriving at a certain place, and there ſtopping, has no ultimate velocity; becauſe the velocity before the body comes to the place is not its ultimate velocity; when it is arrived, it has none. But the anſwer is eaſy: for by the ultimate velocity is meant that with which the body is moved, neither before it arrives at its place and the motion ceaſes, nor after; but at the very inſtant it arrives, that is, that velocity with which the body arrives at its laſt place, and with which the motion ceaſes. And in like manner, by the ultimate ratio of evaneſcent quantities is to be underſtood the ratio of the quantities, not before they vaniſh, nor afterwards, but with which they vaniſh. In like manner, the firſt ratio of naſcent quantities is that with which they begin to be. And the firſt or laſt ſum is that with which they begin and ceaſe to be (or to be augmented and diminiſhed). There is a limit which the velocity at the end of the motion may attain, but not exceed; and this is the ultimate velocity. And there is the like limit in all quantities and proportions that begin and ceaſe to be. And, ſince ſuch limits are certain and definite, to determine the ſame is a problem ſtrictly geometrical. But whatever is geometrical we may be allowed to make uſe of in determining and demonſtrating any other thing that is likewiſe geometrical.

"It may alſo be objected, that if the ultimate ratios of evaneſcent quantities are given, their ultimate magnitudes will be alſo given; and ſo all quantities will conſiſt of indiviſibles, which is contrary to what Euclid has demonſtrated concerning incommenſurables, in the 10th book of his Elements. But this objection is founded on a falſe ſuppoſition. For thoſe ultimate ratios with which quantities vaniſh are not truly the ratios of ultimate quantities, but limits towards which the ratios of quantities decreaſing continually approach."

Lem. II. If in any figure A*ac*E terminated by the right line A*a*, AE, and the curve *ac*E, there be inſcribed any number of parallelograms A*b*, B*c*, C*d*, &c. comprehended under equal baſes AB, BC, CD, &c. and the ſides B*b*, C*c*, D*d*, &c. parallel to one ſide A*a* of the figure; and the parallelograms *a*K*bl*, *b*L*cm*, *c*M*dn*, &c. are completed.—Then if the breadth of thoſe parallelograms be ſuppoſed to be diminiſhed, and their number augmented *in infinitum;* the ultimate ratios which the inſcribed figure AK*b*L*c*M*d*D, the circumſcribed figure A*albmcndo*E, and curvilineal figure A*abcd*E, will have to one another, are ratios of equality.—For the difference of the inſcribed and circumſcribed figures is the ſum of the parallelograms K*l*, L*m*, M*n*, D*o;* that is (from the equality of all their baſes), the rectangle under one of their baſes K*b*, and the ſum of their altitudes A*a*, that is, the rectangle AB*la*. —But this rectangle, becauſe its breadth AB is ſuppoſed diminiſhed *in infinitum*, becomes leſs than any given ſpace. And therefore by Lem. I. the figures inſcribed and circumſcribed become ultimately equal the one to the other; and much more will the intermediate curvilinear figure be ultimately equal to either. Plate CCCLXIX. Fig. 1.

Lem. III. The ſame ultimate ratios are alſo ratios of equality, when the breadths AB, BC, CD, &c. of the parallelograms are unequal, and are all diminiſhed *in infinitum.*—The demonſtration of this differs but little from that of the former.

In his succeeding lemmas, Sir Isaac goes on to prove, in a manner similar to the above, that the ultimate ratios of the sine, chord, and tangent of arcs infinitely diminished, are ratios of equality, and therefore that in all our reasonings about these we may safely use the one for the other:—that the ultimate form of evanescent triangles made by the arc, chord, and tangent, is that of similitude, and their ultimate ratio is that of equality; and hence, in reasonings about ultimate ratios, we may safely use these triangles for each other, whether made with the sine, the arc, or the tangent.—He then shows some properties of the ordinates of curvilinear figures; and proves that the spaces which a body describes by any finite force urging it, whether that force is determinate and immutable, or is continually augmented or continually diminished, are, in the very beginning of the motion, one to the other in the duplicate ratio of the powers. And, lastly, Having added some demonstrations concerning the evanescence of angles of contact, he proceeds to lay down the mathematical part of his system, and which depends on the following theorems:

Theor. I. The areas which revolving bodies describe by radii drawn to an immoveable centre of force, lie in the same immoveable planes, and are proportional to the times in which they are described.—For, suppose the time to be divided into equal parts, and in the first part of that time, let the body by its innate force describe the right line AB (fig. 2.); in the second part of that time, the same would, by Law 1. if not hindered, proceed directly to *c* along the line B*c*=AB; so that by the radii AS, BS, *c*S, drawn to the centre, the equal areas ASB, BS*c*, would be described. But, when the body is arrived at B, suppose the centripetal force acts at once with a great impulse, and turning aside the body from the right line B*c*, compels it afterwards to continue its motion along the right line BC. Draw *c*C parallel to BS, meeting BC in C; and at the end of the second part of the time, the body, by Cor. 1. of the Laws, will be found in C, in the same plane with the triangle ASB. Join SC; and because SB and *c*C are parallel, the triangle SBC will be equal to the triangle SBC, and therefore also to the triangle SAB. By the like argument, if the centripetal force acts successively in C, D, E, &c. and makes the body in each single particle of time to describe the right lines CD, DE, EF, &c. they will all lie in the same plane; and the triangle SCD will be equal to the triangle SBC, and SDE to SCD, and SEF to SDE. And therefore, in equal times, equal areas are described in one immoveable plane; and, by composition, any sums SADS, SAFS, of those areas are, one to the other, as the times in which they are described. Now, let the number of those triangles be augmented, and their size diminished *in infinitum*; and then, by the preceding lemmas, their ultimate perimeter ADF will be a curve line: and therefore the centripetal force by which the body is perpetually drawn back from the tangent of this curve will act continually; and any described areas SADS, SAFS, which are always proportional to the times of description, will, in this case also, be proportional to those times. Q. E. D.

Fig. 2.

Cor. 1. The velocity of a body attracted towards an immoveable centre, in spaces void of resistance, is reciprocally as the perpendicular let fall from that centre on the right line which touches the orbit. For the velocities in these places, A, B, C, D, E, are as the bases AB, BC, DE, EF, of equal triangles; and these bases are reciprocally as the perpendiculars let fall upon them.

Cor. 2. If the chords AB, BC, of two arcs, successively described in equal times by the same body, in spaces void of resistance, are completed into a parallelogram ABCV, and the diagonal BV of this parallelogram, in the position which it ultimately acquires when those arcs are diminished *in infinitum*, is produced both ways, it will pass through the centre of force.

Cor. 3. If the chords AB, BC, and DE, EF, of arcs described in equal times, in spaces void of resistance, are completed into the parallelograms ABCV, DEFZ, the forces in B and E are one to the other in the ultimate ratio of the diagonals BV, EZ, when those arcs are diminished *in infinitum*. For the motions BC and EF of the body (by Cor. 1. of the laws), are compounded of the motions B*c*, BV and E*f*, EZ; but BV and EZ, which are equal to C*c*= and F*f*, in the demonstration of this proposition, were generated by the impulses of the centripetal force in B and E, and are therefore proportional to those impulses.

Cor. 4. The forces by which bodies, in spaces void of resistance, are drawn back from rectilinear motions, and turned into curvilinear orbits, are one to another as the versed sines of arcs described in equal times; which versed sines tend to the centre of force, and bisect the chords when these arcs are diminished to infinity. For such versed sines are the halfs of the diagonals mentioned in Cor. 3.

Cor. 5. And therefore those forces are to the force of gravity, as the said versed sines to the versed sines perpendicular to the horizon of those parabolic arcs which projectiles describe in the same time.

Cor. 6. And the same things do all hold good (by Cor. 5. of the laws) when the planes in which the bodies are moved, together with the centres of force, which are placed in those planes, are not at rest, but move uniformly forward in right lines.

Theor. II. Every body that moves in any curve line described in a plane, and, by a radius drawn to a point either immoveable or moving forward with an uniform rectilinear motion, describes about that point areas proportional to the times, is urged by a centripetal force directed to that point.

Case I. For every body that moves in a curve line is (by Law 1.) turned aside from its rectilinear course by the action of some force that impels it; and that force by which the body is turned off from its rectilinear course, and made to describe in equal times the least equal triangles SAB, SBC, SCD, &c. about the immoveable point S, (by Prop. 40. E. 1. and Law 2.) acts in the place B according to the direction of a line parallel to C; that is, in the direction of the line BS; and in the place C according to the direction of a line parallel to *d*D, that is, in the direction of the line CS, &c.; and therefore acts always in the direction of lines tending to the immoveable point S. Q. E. D.

Case II. And (by Cor. 5. of the laws) it is indifferent whether the superficies in which a body describes a curvilinear figure be quiescent, or moves together with the body, the figure described, and its point S, uniformly forward in right lines.

Cor.

Cor. 1. In non-reſiſting ſpaces or mediums, if the areas are not proportional to the times, the forces are not directed to the point in which the radii meet; but deviate therefrom *in conſequentia*, or towards the parts to which the motion is directed, if the deſcription of the areas is accelerated; but *in antecedentia* if retarded.

Cor. 2. And even in reſiſting mediums, if the deſcription of the areas is accelerated, the directions of the forces deviate from the point in which the radii meet, towards the parts to which the motion tends.

Scholium.

A body may be urged by a centripetal force compounded of ſeveral forces. In which caſe the meaning of the propoſition is, that the force which reſults out of all tends to the point S. But if any force acts perpetually in the direction of lines perpendicular to the deſcribed ſurface, this force will make the body to deviate from the plane of its motion, but will neither augment nor diminiſh the quantity of the deſcribed ſurface; and is therefore not to be neglected in the compoſition of forces.

Theor. III. Every body that, by a radius drawn to the centre of another body, howſoever moved, deſcribes areas about that centre proportional to the times, is urged by a force compounded of the centripetal forces tending to that other body, and of all the accelerative force by which that other body is impelled.—The demonſtration of this is a natural conſequence of the theorem immediately preceding.

Hence, if the one body L, by a radius drawn to the other body T, deſcribes areas proportional to the times, and from the whole force by which the firſt body L is urged, (whether that force is ſimple, or, according to Cor. 2. of the laws, compounded of ſeveral forces), we ſubduct that whole accelerative force by which the other body is urged; the whole remaining force by which the firſt body is urged will tend to the other body T, as its centre.

And *vice verſa*, if the remaining force tends nearly to the other body T, thoſe areas will be nearly proportional to the times.

If the body L, by a radius drawn to the other body T, deſcribes areas, which, compared with the times, are very unequal, and that other body T be either at reſt, or moves uniformly forward in a right line, the action of the centripetal force tending to that other body T is either none at all, or it is mixed and combined with very powerful actions of other forces: and the whole force compounded of them all, if they are many, is directed to another (immoveable or moveable) centre. The ſame thing obtains when the other body is actuated by any other motion whatever; provided that centripetal force is taken which remains after ſubducting that whole force acting upon that other body T.

Scholium.

Becauſe the equable deſcription of areas indicates that a centre is reſpected by that force with which the body is moſt affected, and by which it is drawn back from its rectilinear motion, and retained in its orbit, we may always be allowed to uſe the equable deſcription of areas as an indication of a centre about which all circular motion is performed in free ſpaces.

Theor. IV. The centripetal forces of bodies which by equable motions deſcribe different circles, tend to the centres of the ſame circles; and are one to the other as the ſquares of the arcs deſcribed in equal times applied to the radii of circles.—For theſe forces tend to the centres of the circles, (by Theor. 2. and Cor. 2. Theor. 1.) and are to one another as the verſed ſines of the leaſt arcs deſcribed in equal times, (by Cor. 4. Theor. 1.) that is, as the ſquares of the ſame arcs applied to the diameters of the circles, by one of the lemmas; and therefore, ſince thoſe arcs are as arcs deſcribed in any equal times, and the diameters are as the radii, the forces will be as the ſquares of any arcs deſcribed in the ſame time, applied to the radii of the circles. Q. E. D.

Cor. 1. Therefore, ſince thoſe arcs are as the velocities of the bodies, the centripetal forces are in a ratio compounded of the duplicate ratio of the velocities directly, and of the ſimple ratio of the radii inverſely.

Cor. 2. And ſince the periodic times are in a ratio compounded of the ratio of the radii directly, and the ratio of the velocities inverſely; the centripetal forces are in a ratio compounded of the ratio of the radii directly, and the duplicate ratio of the periodic times inverſely.

Cor. 3. Whence, if the periodic times are equal, and the velocities therefore as the radii, the centripetal forces will be equal among themſelves; and the contrary.

Cor. 4. If the periodic times and the velocities are both in the ſubduplicate ratio of the radii, the centripetal forces will be equal among themſelves; and the contrary.

Cor. 5. If the periodic times are as the radii, and therefore the velocities equal, the centripetal forces will be reciprocally as the radii; and the contrary.

Cor. 6. If the periodic times are in the ſeſquiplicate ratio of the radii, and therefore the velocities reciprocally in the ſubduplicate ratio of the radii, the centripetal forces will be in the duplicate ratio of the radii inverſely; and the contrary.

Cor. 7. And univerſally, if the periodic time is as any power R^n of the radius R, and therefore the velocity reciprocally as the power R^{n-1} of the radius, the centripetal force will be reciprocally as the power R^{2n-1} of the radius; and the contrary.

Cor. 8. The ſame things all hold concerning the times, the velocities, and forces, by which bodies deſcribe the ſimilar parts of any ſimilar figures, that have their centres in a ſimilar poſition within thoſe figures, as appears by applying the demonſtrations of the preceding caſes to thoſe. And the application is eaſy, by only ſubſtituting the equable deſcription of areas in the place of equable motion, and uſing the diſtances of the bodies from the centres inſtead of the radii.

Cor. 9. From the ſame demonſtration it likewiſe follows, that the arc which a body uniformly revolving in a circle by means of a given centripetal force deſcribes in any time, is a mean proportional between the diameter of the circle, and the ſpace which the ſame body, falling by the ſame given force, would deſcend through in the ſame given time.

"By

Newtonian Philosophy.

"By means of the preceding propofition and its corollaries (fays Sir Ifaac), we may difcover the proportion of a centripetal force to any other known force, fuch as that of gravity. For if a body by means of its gravity revolves in a circle concentric to the earth, this gravity is the centripetal force of that body. But from the defcent of heavy bodies, the time of one entire revolution, as well as the arc defcribed in any given time, is given (by Cor. 9. of this theorem). And by fuch propofitions Mr Huygens, in his excellent book *De Horologio Ofcillatorio*, has compared the force of gravity with the centrifugal forces of revolving bodies.

The preceding propofition may alfo be demonftrated in the following manner. In any circle fuppofe a polygon to be infcribed of any number of fides. And if a body, moved with a given velocity along the fides of the polygon, is reflected from the circle at the feveral angular points; the force with which, at every reflection it ftrikes the circle, will be as its velocity: and therefore the fum of the forces, in a given time, will be as that velocity and the number of reflections conjunctly; that is, (if the fpecies of the polygon be given), as the length defcribed in that given time, and increafed or diminifhed in the ratio of the fame length to the radius of the circle; that is, as the fquare of that length applied to the radius; and therefore, if the polygon, by having its fides diminifhed *in infinitum*, coincides with the circle, as the fquare of the arc defcribed in a given time applied to the radius. This is the centrifugal force, with which the body impels the circle; and to which the contrary force, wherewith the circle continually repels the body towards the centre, is equal.

On thefe principles hangs the whole of Sir Ifaac Newton's mathematical philofophy. He now fhows how to find the centre to which the forces impelling any body are directed, having the velocity of the body given: and finds the centrifugal force to be always as the verfed fine of the nafcent arc directly, and as the fquare of the time inverfely; or directly as the fquare of the velocity, and inverfely as the chord of the nafcent arc. From thefe premifes he deduces the method of finding the centripetal force directed to any given point when the body revolves in a circle; and this whether the central point is near or at an immenfe diftance; fo that all the lines drawn from it may be taken for parallels. The fame thing he fhows with regard to bodies revolving in fpirals, ellipfes, hyperbolas, or parabolas.—Having the figures of the orbits given, he fhows alfo how to find the velocities and moving powers; and, in fhort, folves all the moft difficult problems relating to the celeftial bodies with an aftonifhing degree of mathematical fkill. Thefe problems and demonftrations are all contained in the firft book of the *Principia*: but to give an account of them here would far exceed our limits; neither would many of them be intelligible, excepting to firft-rate mathematicians.

In the fecond book, Sir Ifaac treats of the properties of fluids, and their powers of refiftance: and here

16 Rules for philofophical reafoning.

he lays down fuch principles as entirely overthrow the doctrine of Des Cartes's vortices, which was the fafhionable fyftem in his time. In the third book, he begins particularly to treat of the natural phenomena, and apply them to the mathematical principles formerly demonftrated; and, as a neceffary preliminary to this part, he lays down the following rules for reafoning in natural philofophy.

1. We are to admit no more caufes of natural things than fuch as are both true and fufficient to explain their natural appearances.

2. Therefore to the fame natural effects we muft always affign, as far as poffible, the fame caufes.

3. The qualities of bodies which admit neither intenfion nor remiffion of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be efteemed the univerfal qualities of all bodies whatfoever.

4. In experimental philofophy, we are to look upon propofitions collected by general induction from phenomena as accurately or very nearly true, notwithftanding any contrary hypothefes that may be imagined, till fuch time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.

The phenomena firft confidered are, 1. That the fatellites of Jupiter by radii drawn to the centre of their primary, defcribe areas proportional to the times of their defcription; and that their periodic times, the fixed ftars being at reft, are in the fefquiplicate ratio of their diftances from its centre. 2. The fame thing is likewife obferved of the phenomena of Saturn. 3. The five primary planets, Mercury, Venus, Mars, Jupiter, and Saturn, with their feveral orbits encompafs the fun. 4. The fixed ftars being fuppofed at reft, the periodic times of the five primary planets, and of the earth, about the fun, are in the fefquiplicate proportion of their mean diftances from the fun. 5. The primary planets, by radii drawn to the earth, defcribe areas no ways proportionable to the times: but the areas which they defcribe by radii drawn to the fun are proportional to the times of defcription. 6. The moon, by a radius drawn to the centre of the earth, defcribes an area proportional to the time of defcription. All thefe phenomena are undeniable from aftronomical obfervations, and are explained at large under the article ASTRONOMY. The mathematical demonftrations are next applied by Sir Ifaac Newton in the following propofitions:

PROP. I. The forces by which the fatellites of Jupiter are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the centre of that planet; and are reciprocally as the fquares of the diftances of thofe fatellites from that centre. The former part of this propofition appears from Theor. 2. or 3. and the latter from Cor. 6. of Theor. 5.; and the fame thing we are to underftand of the fatellites of Saturn.

PROP. II. The forces by which the primary planets are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the fun; and are reciprocally as the fquares of the diftances from the fun's centre. The former part of this propofition is manifeft from Phenomenon 5. juft mentioned, and from Theor. 2.; the latter from Phenomenon 4. and Cor. 6. of Theor. 4. But this part of the propofition is with great accuracy deducible from the quiefcence of the aphelion points. For a very fmall aberration from the reciprocal duplicate proportion would produce a motion of the apfides, fenfible in every fingle revolution, and in many of them enormoufly great.

PROP. III. The force by which the moon is retained

in

Newtonian Philosophy.

in its orbit, tends towards the earth; and is reciprocally as the square of the distance of its place from the centre of the earth. The former part of this proposition is evident from Phenom. 5. and Theor. 2.; the latter from Phenom. 6. and Theor. 2. or 3. It is also evident from the very slow motion of the moon's apogee; which, in every single revolution, amounting but to $3^{\circ} 3'$ *in consequentia*, may be neglected: and this more fully appears from the next proposition.

Prop. IV. The moon gravitates towards the earth, and by the force of gravity is continually drawn off from a rectilinear motion, and retained in its orbit.—The mean distance of the moon from the earth in the syzigies in semidiameters of the latter, is about $60\frac{1}{2}$. Let us assume the mean distance of 60 semidiameters in the syzigies; and suppose one revolution of the moon in respect of the fixed stars to be completed in $27^{d}\ 7^{h}\ 43'$, as astronomers have determined; and the circumference of the earth to amount to 123,249,600 Paris feet. Now, if we imagine the moon, deprived of all motion, to be let go, so as to descend towards the earth with the impulse of all that force by which it is retained in its orbit, it will, in the space of one minute of time describe in its fall $15\frac{1}{4}$ Paris feet. For the versed sine of that arc which the moon, in the space of one minute of time, describes by its mean motion at the distance of 60 semidiameters of the earth, is nearly $15\frac{1}{12}$ Paris feet; or more accurately, 15 feet 1 inch and one line $\frac{4}{9}$. Wherefore since that force, in approaching to the earth, increases in the reciprocal duplicate proportion of the distance; and, upon that account, at the surface of the earth, is 60×60 times greater than that at the moon; a body in our regions, falling with that force ought, in the space of one minute of time, to describe $60 \times 60 \times 15\frac{1}{12}$ Paris feet; and in the space of one second of time to describe $15\frac{1}{12}$ of those feet; or, more accurately, 15 feet 1 inch, 1 line $\frac{4}{9}$. And with this very force we actually find that bodies here on earth do really descend.—For a pendulum oscillating seconds in the latitude of Paris, will be three Paris feet and $8\frac{1}{2}$ lines in length, as Mr Huygens has observed. And the space which a heavy body describes by falling one second of time is to half the length of the pendulum in the duplicate ratio of the circumference of the circle to its diameter; and is therefore 15 Paris feet, 1 inch 1 line $\frac{7}{9}$. And therefore the force by which the moon is retained in its orbit, becomes at the very surface of the earth, equal to the force of gravity which we observe in heavy bodies there. And therefore (by Rule 1. and 2.) the force by which the moon is retained in its orbit is that very same force which we commonly call *gravity*. For were gravity another force different from that, then bodies descending to the earth with the joint impulse of both forces would fall with a double velocity, and, in the space of one second of time, would describe $30\frac{1}{6}$ Paris feet; altogether against experience.

The demonstration of this proposition may be more diffusely explained after the following manner: Suppose several moons to revolve about the earth, as in the system of Jupiter or Saturn, the periodic times of those moons would (by the argument of induction) observe the same law which Kepler found to obtain among the planets; and therefore their centripetal forces would be reciprocally as the squares of the distances from the centre of the earth, by Prop. I. Now, if the lowest of these were very small, and were so near the earth as almost to touch the tops of the highest mountains, the centripetal force thereof, retaining it in its orbit, would be very nearly equal to the weights of any terrestrial bodies that should be found upon the tops of these mountains; as may be known from the foregoing calculation. Therefore, if the same little moon should be deserted by its centrifugal force that carries it through its orbit, it would descend to the earth; and that with the same velocity as heavy bodies do actually descend with upon the tops of those very mountains, because of the equality of forces that oblige them both to descend. And if the force by which that lowest moon would descend were different from that of gravity, and if that moon were to gravitate towards the earth, as we find terrestrial bodies do on the tops of mountains, it would then descend with twice the velocity, as being impelled by both these forces conspiring together. Therefore, since both these forces, that is, the gravity of heavy bodies, and the centripetal forces of the moons, respect the centre of the earth, and are similar and equal between themselves, they will (by Rule 1. and 2.) have the same cause. And therefore the force which retains the moon in its orbit, is that very force which we commonly call *gravity*; because otherwise, this little moon at the top of a mountain must either be without gravity, or fall twice as swiftly as heavy bodies use to do.

Newtonian Philosophy.

Having thus demonstrated that the moon is retained in its orbit by its gravitation towards the earth, it is easy to apply the same demonstration to the motions of the other secondary planets, and of the primary planets round the sun, and thus to show that gravitation prevails throughout the whole creation; after which, Sir Isaac proceeds to show from the same principles that the heavenly bodies gravitate towards each other, and contain different quantities of matter, or have different densities in proportion to their bulks.

Prop. V. All bodies gravitate towards every planet; and the weights of bodies towards the same planet, at equal distances from its centre, are proportional to the quantities of matter they contain.

It has been confirmed by many experiments, that all sorts of heavy bodies (allowance being made for the inequality of retardation by some small resistance of the air,) descend to the earth from equal heights in equal times; and that equality of times we may distinguish to a great accuracy by the help of pendulums. Sir Isaac Newton tried the thing in gold, silver, lead, glass, sand, common salt, wood, water, and wheat. He provided two wooden boxes, round and equal, filled the one with wood, and suspended an equal weight of gold in the centre of oscillation of the other. The boxes hanging by equal threads of 11 feet, made a couple of pendulums, perfectly equal in weight and figure, and equally receiving the resistance of the air. And placing the one by the other, he observed them to play together forwards and backward, for a long time, with equal vibrations. And therefore the quantity of matter in the gold was to the quantity of matter in the wood, as the action of the motive force (or *vis motrix*) upon all the gold, to the action of the same upon all the wood; that is, as the weight

MINERALOGY Plate CCCLI.

Fig. 1.

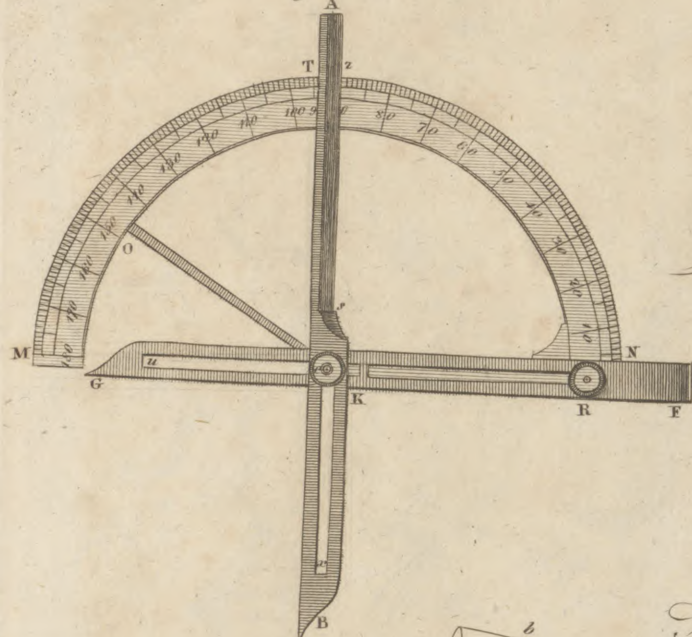


Fig. 3.

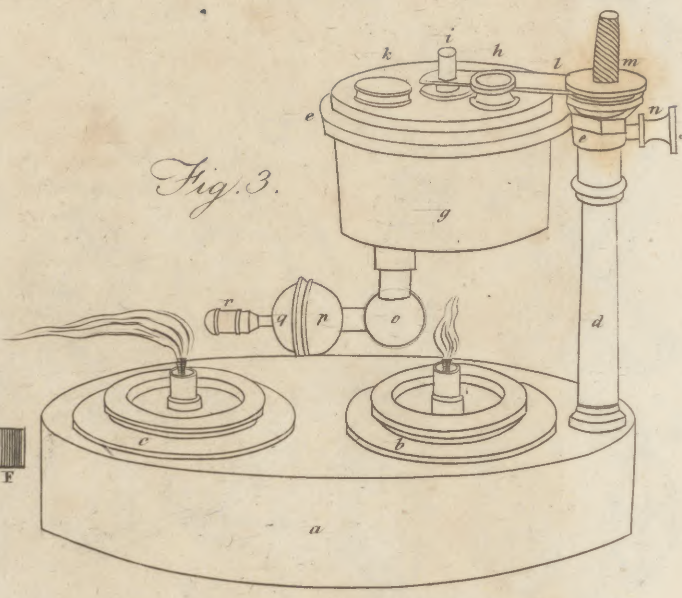


Fig. 4.

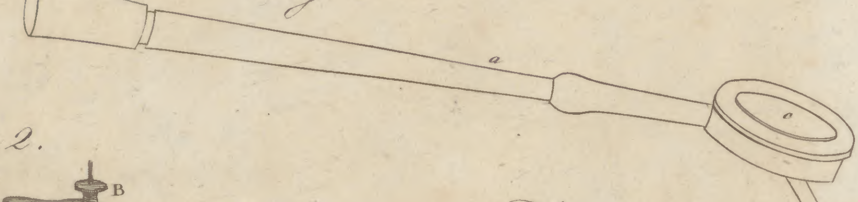


Fig. 2.

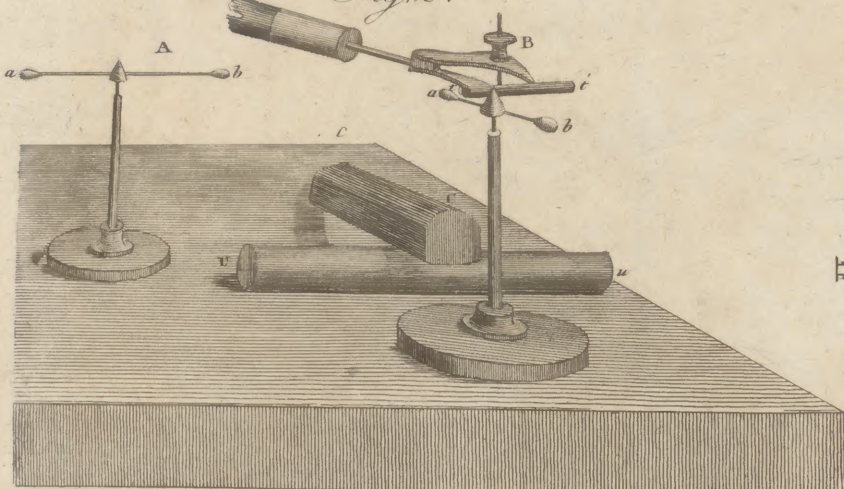


Fig. 5.

Fig. 6.

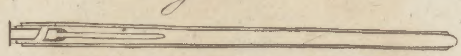
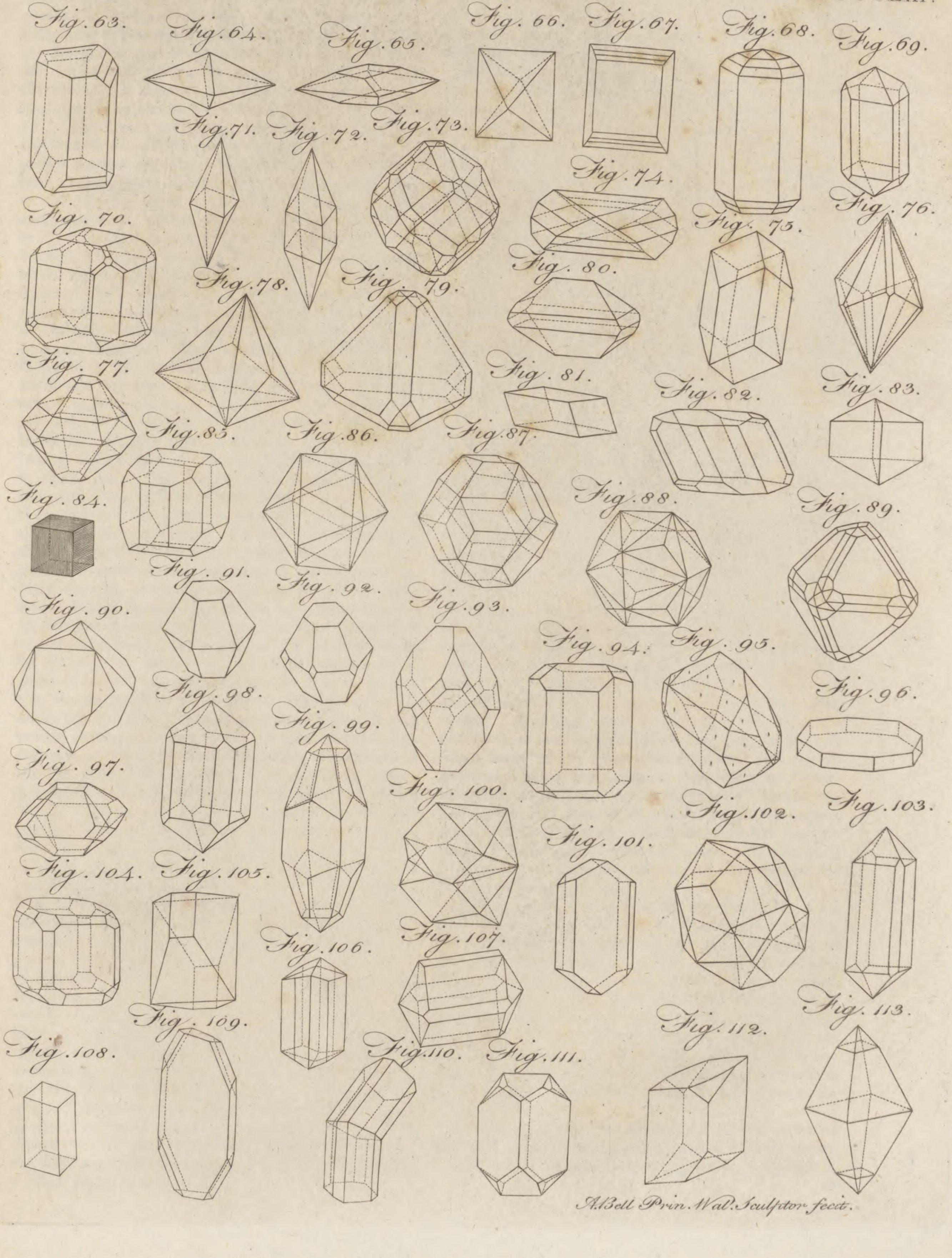


Fig. 7.

A. Bell Prin. Wal Sculptor fecit.

A. Bell Prin. Wal. Sculptor fecit.



A. Bell Prin. Wal. Sculptor fecit.

weight of the one to the weight of the other. And the like happened in the other bodies. By these experiments, in bodies of the same weight, he could manifestly have discovered a difference of matter less than the thousandth part of the whole, had any such been. But without all doubt, the nature of gravity towards the planets, is the same as towards the earth. For should we imagine our terrestrial bodies removed to the orb of the moon, and there, together with the moon, deprived of all motion, to be let go, so as to fall together towards the earth; it is certain, from what we have demonstrated before, that in equal times, they would describe equal spaces with the moon, and of consequence are to the moon in quantity of matter, as their weights to its weight. Moreover, since the satellites of Jupiter perform their revolutions in times which observe the sesquiplicate proportion of their distances from Jupiter's centre, their accelerative gravities towards Jupiter will be reciprocally as the squares of their distances from Jupiter's centre; that is, equal at equal distances. And therefore, these satellites, if supposed to fall towards Jupiter from equal heights, would describe equal spaces in equal times, in like manner as heavy bodies do on our earth. And by the same argument if the circumsolar planets were supposed to be let fall at equal distances from the sun, they would, in their descent towards the sun, describe equal spaces in equal times. But forces, which equally accelerate unequal bodies, must be as those bodies: that is to say, the weights of the planets towards the sun must be as their quantities of matter. Further, That the weights of Jupiter and his satellites towards the sun are proportional to the several quantities of their matter, appears from the exceeding regular motions of the satellites. For if some of the bodies were more strongly attracted to the sun in proportion to their quantity of matter than others, the motions of the satellites would be disturbed by that inequality of attraction. If, at equal distances from the sun, any satellite, in proportion to the quantity of its matter, did gravitate towards the sun, with a force greater than Jupiter in proportion to his, according to any given proportion, suppose *d* to *e*; then the distance between the centres of the sun and of the satellite's orbit would be always greater than the distance between the centres of the sun and of Jupiter nearly in the subduplicate of that proportion. And if the satellite gravitated towards the sun with a force less in the proportion of *e* to *d*, the distance of the centre of the satellite's orb from the sun would be less than the distance of the centre of Jupiter's from the sun in the subduplicate of the same proportion. Therefore, if, at equal distances from the sun, the accelerative gravity of any satellite towards the sun were greater or less than the accelerating gravity of Jupiter towards the sun but by $\frac{1}{1000}$ part of the whole gravity; the distance of the centre of the satellite's orbit from the sun would be greater or less than the distance of Jupiter from the sun by $\frac{1}{2000}$ part of the whole distance; that is, by a fifth part of the distance of the utmost satellite from the centre of Jupiter; an eccentricity of the orbit which would be very sensible. But the orbits of the satellites are concentric to Jupiter; therefore the accelerative gravities of Jupiter, and of all its satellites, towards the sun, are equal among themselves. And by the same argument, the weight of Saturn and of his satellites towards the sun, at equal distances from the sun, are as their several quantities of matter; and the weights of the moon and of the earth towards the sun, are either none, or accurately proportional to the masses of matter which they contain.

But further, the weights of all the parts of every planet towards any other planet are one to another as the matter in the several parts. For if some parts gravitated more, others less, than in proportion to the quantity of their matter; then the whole planet, according to the sort of parts with which it most abounds, would gravitate more or less than in proportion to the quantity of matter in the whole. Nor is it of any moment whether these parts are external or internal. For if, as an instance, we should imagine the terrestrial bodies with us to be raised up to the orb of the moon, to be there compared with its body; if the weights of such bodies were to the weights of the external parts of the moon as the quantities of matter in the one and in the other respectively, but to the weights of the internal parts in a greater or less proportion; then likewise the weights of those bodies would be to the weight of the whole moon in a greater or less proportion; against what we have showed above.

Cor. 1. Hence the weights of bodies do not depend upon their forms and textures. For if the weights could be altered with the forms, they would be greater or less, according to the variety of forms in equal matter; altogether against experience.

Cor. 2. Universally, all bodies about the earth gravitate towards the earth; and the weights of all, at equal distances from the earth's centre, are as the quantities of matter which they severally contain. This is the quality of all bodies within the reach of our experiments; and therefore (by Rule 3.) to be affirmed of all bodies whatsoever. If ether, or any other body, were either altogether void of gravity, or were to gravitate less in proportion to its quantity of matter; then, because (according to Aristotle, Des Cartes, and others) there is no difference betwixt that and other bodies, but in mere form of matter, by a successive change from form to form, it might be changed at last into a body of the same condition with those which gravitate most in proportion to their quantity of matter; and, on the other hand, the heaviest bodies, acquiring the first form of that body, might by degrees quite lose their gravity. And therefore the weights would depend upon the forms of bodies, and with those forms might be changed, contrary to what was proved in the preceding corollary.

Cor. 3. All spaces are not equally full. For if all spaces were equally full, then the specific gravity of the fluid which fills the region of the air, on account of the extreme density of the matter, would fall nothing short of the specific gravity of quicksilver or gold, or any other the most dense body; and therefore, neither gold, nor any other body, could descend in air. For bodies do not descend in fluids, unless they are specifically heavier than the fluids. And if the quantity of matter in a given space can by any rarefaction be diminished, what should hinder a diminution to infinity?

Cor. 4. If all the solid particles of all bodies are of the same density, nor can be rarefied without pores, a void space or vacuum must be granted. [By bodies of

Newtonian Philosophy.

of the same density, our author means those whose *vires inertiæ* are in the proportion of their bulks.]

PROB. VI. That there is a power of gravity tending to all bodies, proportional to the several quantities of matter which they contain.

That all the planets mutually gravitate one towards another, we have proved before; as well as that the force of gravity towards every one of them, considered apart, is reciprocally as the square of the distance of places from the centre of the planet. And thence it follows, that the gravity tending towards all the planets is proportional to the matter which they contain.

Moreover, since all the parts of any planet A gravitate towards any other planet B, and the gravity of every part is to the gravity of the whole as the matter of the part to the matter of the whole; and (by Law 3.) to every action corresponds an equal re-action: therefore the planet B will, on the other hand, gravitate towards all the parts of the planet A; and its gravity towards any one part will be to the gravity towards the whole, as the matter of the part to the matter of the whole. Q. E. D.

COR. 1. Therefore the force of gravity towards any whole planet, arises from, and is compounded of, the forces of gravity towards all its parts. Magnetic and electric attractions afford us examples of this. For all attraction towards the whole arises from the attractions towards the several parts. The thing may be easily understood in gravity, if we consider a greater planet as formed of a number of lesser planets, meeting together in one globe. For hence it would appear that the force of the whole must arise from the forces of the component parts. If it be objected, that, according to this law, all bodies with us must mutually gravitate one towards another, whereas no such gravitation anywhere appears; it is answered, that, since the gravitation towards these bodies is to the gravitation towards the whole earth, as these bodies are to the whole earth, the gravitation towards them must be far less than to fall under the observation of our senses. [The experiments with regard to the attraction of mountains, however, have now further elucidated this point.]

COR. 2. The force of gravity towards the several equal particles of any body, is reciprocally as the square of the distance of places from the particles.

PROP. VII. In two spheres mutually gravitating each towards the other, if the matter, in places on all sides round about and equidistant from the centres, is similar; the weight of either sphere towards the other will be reciprocally as the square of the distance between their centres.

For the demonstration of this, see the *Principia*, Book I. Prop. lxxv. and lxxvi.

COR. 1. Hence we may find and compare together the weights of bodies towards different planets. For the weights of bodies revolving in circles about planets are as the diameters of the circles directly, and the squares of their periodic times reciprocally; and their weights at the surfaces of the planets, or at any other distances from their centres, are (by this prop.) greater or less, in the reciprocal duplicate proportion of the distances. Thus from the periodic times of Venus, revolving about the sun, in 224d. $16\frac{3}{4}$h.; of the utmost circumjovial satellite revolving about Jupiter, in 16d. $16\frac{8}{15}$h.; of the Huygenian satellite about Saturn in 15d. $22\frac{2}{3}$h; and of the moon about the earth in 27d. 7h. 43′; compared with the mean distance of Venus from the sun, and with the greatest heliocentric elongations of the outmost circumjovial satellite from Jupiter's centre, 8′ 16″; of the Huygenian satellite from the centre of Saturn, 3′ 4″; and of the moon from the earth, 10′ 33″; by computation our author found, that the weight of equal bodies, at equal distances from the centres of the sun, of Jupiter, of Saturn, and of the earth, towards the sun, Jupiter, Saturn, and the earth, were one to another as $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$ respectively. Then, because as the distances are increased or diminished, the weights are diminished or increased in a duplicate ratio; the weights of equal bodies towards the sun, Jupiter, Saturn, and the earth, at the distances 10000, 997, 791, and 109, from their centres, that is, at their very superficies, will be as 10000, 943, 529, and 435 respectively.

COR. 2. Hence likewise we discover the quantity of matter in the several planets. For their quantities of matter are as the forces of gravity at equal distances from their centres, that is, in the sun, Jupiter, Saturn, and the earth, as 1, $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$, respectively. If the parallax of the sun be taken greater or less than 10″ 30‴, the quantity of matter in the earth must be augmented or diminished in the triplicate of that proportion.

COR. 3. Hence also we find the densities of the planets. For (by Prop. lxxii. Book I.) the weights of equal and similar bodies towards similar spheres, are, at the surfaces of those spheres, as the diameters of the spheres. And therefore the densities of dissimilar spheres are as those weights applied to the diameters of the spheres. But the true diameters of the sun, Jupiter, Saturn, and the earth, were one to another as 10000, 997, 791, and 109; and the weights towards the same, as 10000, 943, 529, and 435 respectively; and therefore their densities are as 120, $94\frac{1}{2}$, 67, and 400. The density of the earth, which comes out by this computation, does not depend upon the parallax of the sun, but it is determined by the parallax of the moon, and therefore is here truly defined. The sun therefore is a little denser than Jupiter, and Jupiter than Saturn, and the earth four times denser than the sun; for the sun, by its great heat, is kept in a sort of a rarefied state. The moon also is denser than the earth.

COR. 4. The smaller the planets are, they are, *cæteris paribus*, of so much the greater density. For so the powers of gravity on their several surfaces come nearer to equality. They are likewise, *cæteris paribus*, of the greater density as they are nearer to the sun. So Jupiter is more dense than Saturn, and the earth than Jupiter. For the planets were placed at different distances from the sun, that, according to their degrees of density, they might enjoy a greater or less proportion of the sun's heat. Our water, if it were removed as far as the orb of Saturn, would be converted into ice, and in the orb of Mercury would quickly fly away in vapour. For the light of the sun, to which its heat is proportional, is seven times denser in the orb of Mercury than with us: and by the thermometer Sir Isaac found, that a sevenfold heat of our summer sun will make water boil. Nor are we to doubt, that

Newton.

that the matter of Mercury is adapted to its heat, and is therefore more denſe than the matter of our earth; ſince, in a denſer matter, the operations of nature require a ſtronger heat.

It is ſhown in the ſcholium of Prop. xxii. Book II. of the *Principia*, that, at the height of 200 miles above the earth, the air is more rare than it is at the ſuperficies of the earth, in the ratio of 30 to 0,0000000000003998, or as 75,000000000000 to 1 nearly. And hence the planet Jupiter, revolving in a medium of the ſame denſity with that ſuperior air, would not loſe by the reſiſtance of the medium the 1000000th part of its motion in 1000000 years. In the ſpaces near the earth, the reſiſtance is produced only by the air, exhalations, and vapours. When theſe are carefully exhauſted by the air pump from under the receiver, heavy bodies fall within the receiver with perfect freedom, and without the leaſt ſenſible reſiſtance; gold itſelf, and the lighteſt down, let fall together, will deſcend with equal velocity; and though they fall through a ſpace of four, ſix, and eight feet, they will come to the bottom at the ſame time; as appears from experiments that have often been made. And therefore the celeſtial regions being perfectly void of air and exhalations, the planets and comets meeting no ſenſible reſiſtance in thoſe ſpaces, will continue their motions through them for an immenſe ſpace of time.

NEWTON, *Thomas*, lord biſhop of Briſtol and dean of St Paul's London, was born on the firſt of January 1704. His father, John Newton, was a conſiderable brandy and cyder merchant, who, by his induſtry and integrity, having acquired what he thought a competent fortune, left off trade ſeveral years before he died.

He received the firſt part of his education in the free ſchool of Litchfield; a ſchool which, the biſhop obſerves with ſome kind of exultation, had at all times ſent forth ſeveral perſons of note and eminence; from Biſhop Smaldridge and Mr Wollaſton, to Dr Johnſon and Mr Garrick.

From Litchfield he was removed to Weſtminſter ſchool, in 1717, under the care of Dr Freind and Dr Nicoll.

During the time he was at Weſtminſter, there were, he obſerves, more young men who made a diſtinguiſhed figure afterwards in the world, than perhaps at any other period, either before or ſince. He particularly mentions William Murray, the late earl of Mansfield, with whom he lived on terms of the higheſt friendſhip to the laſt.

He continued ſix years at Weſtminſter ſchool, five of which he paſſed in the college. He afterwards went to Cambridge, and entered at Trinity college. Here he conſtantly reſided eight months at leaſt in every year, till he had taken his Bachelor of Arts degree. Being choſen fellow of his college, he came afterwards to ſettle in London. As it had been his inclination from a child, and as he was alſo deſigned for holy orders, he had ſufficient time to prepare himſelf, and compoſed ſome ſermons, that he might have a ſtock in hand when he entered on the miniſtry. His title for orders was his fellowſhip; and he was ordained deacon in December 1729, and prieſt in the February following, by Biſhop Gibſon.

At his firſt ſetting out in his office, he was curate at St George's, Hanover-ſquare; and continued for ſeveral years aſſiſtant preacher to Dr Trebeck. His firſt preferment was that of reader and afternoon preacher at Groſvenor Chapel, in South Audley ſtreet.

Newton.

This introduced him to the family of Lord Tyrconnel, to whoſe ſon he became tutor. He continued in this ſituation for many years, very much at his eaſe, and on terms of great intimacy and friendſhip with Lord and Lady Tyrconnel, "without ſo much (ſays he) as an unkind word or a cool look intervening."

In the ſpring of 1744, he was, through the intereſt of the earl of Bath (who was his great friend and patron, and whoſe friendſhip and patronage were returned by grateful acknowledgements and the warmeſt encomiums), preſented to the rectory of St Mary le Bow; ſo that he was 40 years old before he obtained any living.

At the commencement of 1745, he took his doctor's degree. In the ſpring of 1747 he was choſen lecturer of St George's, Hanover-ſquare, by a moſt reſpectable veſtry of noblemen and gentlemen of high diſtinction. In Auguſt following he married his firſt wife, the eldeſt daughter of Dr Trebeck; an unaffected, modeſt, decent young woman, with whom he lived very happy in mutual love and harmony for near ſeven years.

In 1749 he publiſhed his edition of Milton's Paradiſe Loſt, (which (ſays he, very modeſtly) it is hoped hath not been ill received by the public, having, in 1775, gone through eight editions. After the Paradiſe Loſt, it was judged (ſays he) proper that Dr Newton ſhould alſo publiſh the Paradiſe Regained, and other poems of Milton; but theſe things he thought detained him from other more material ſtudies, though he had the good fortune to gain by them more than Milton did by all his works put together. But his greateſt gain (he ſays) was their firſt introducing him to the friendſhip and intimacy of two ſuch men as Biſhop Warburton and Dr Jortin, whoſe works will ſpeak for them better than any private commendation.

In 1754 he loſt his father at the age of 83; and within a few days his wife, at the age of 38. This was the ſevereſt trial he ever underwent, and almoſt overwhelmed him. At that time he was engaged in writing his Diſſertations on the Prophecies; and happy it was for him: for in any affliction he never found a better or more effectual remedy than plunging deep into ſtudy, and fixing his thoughts as intenſely as he poſſibly could upon other ſubjects. The firſt volume was publiſhed the following winter; but the other did not appear till three years afterwards; and as a reward for his paſt and an incitement to future labours, he was appointed, in the mean time, to preach Boyle's lecture. The biſhop informs us, that 1250 copies of the Diſſertations were taken at the firſt impreſſion, and 1000 at every other edition: and "though (ſays he) ſome things have been ſince publiſhed upon the ſame ſubjects, yet they ſtill hold up their head above water, and having gone through five editions, are again prepared for another. Abroad, too, their reception hath not been unfavourable, if accounts from thence may be depended upon." They were tranſlated into the German and Daniſh languages; and received the warmeſt encomiums from perſons of learning and rank.

In the ſpring of 1757, he was made prebendary of Weſtminſter, in the room of Dr Green, and promoted to the deanery of Salifbury. In October following, he was made fub-almoner to his majefty. This he owed to Bifhop Gilbert. He married a fecond wife in September 1761. She was the widow of the Rev. Mr Hand, and daughter of John Lord Vifcount Lifburn. In the fame month he kiffed his majefty's hand for his bifhopric.

In the winter of 1764, Dr Stone, the primate of Ireland, died. Mr Grenville fent for Bifhop Newton, and in the moft obliging manner defired his acceptance of the primacy. Having maturely weighed the matter in his mind, he declined the offer.

In 1768 he was made dean of St Paul's. His ambition was now fully fatisfied; and he firmly refolved never to afk for any thing more.

From this time to his death, ill health was almoft his conftant companion. It was wonderful that fuch a poor, weak, and flender thread as the bifhop's life, fhould be fpun out to fuch an amazing length as it really was. In the autumn of 1781 (ufually the moft favourable part of the year to him) he laboured under repeated illneffes: and on Saturday the 9th of February 1782, he began to find his breath much affected by the froft. His complaints grew worfe and worfe till the Thurfday following. He got up at five o'clock, and was placed in a chair by the fire; complained to his wife how much he had fuffered in bed, and repeated to himfelf that portion of the Pfalms, "O my God, I cry unto thee in the day time," &c. &c. About fix o'clock he was left by his apothecary in a quiet fleep. Between feven and eight he awoke, and appeared rather more eafy, and took a little refrefhment. He continued dozing till near nine, when he ordered his fervant to come and drefs him, and help him down ftairs. As foon as he was dreffed, he inquired the hour, and bid his fervant open the fhutter and look at the dial of St Paul's. The fervant anfwered, it was upon the ftroke of nine. The bifhop made an effort to take out his watch, with an intent to fet it; but funk down in his chair, and expired without a figh or the leaft vifible emotion, his countenance ftill retaining the fame placid appearance which was fo peculiar to him when alive. Of his numerous works, his Differtations on the Prophecies are by much the moft valuable. His learning was undoubtedly very confiderable; but he feldom exhibits evidence of a very vigorous mind. On one occafion, indeed, he appears to have thought with freedom; for we believe he was the firft dignitary of the church of England who avowed his belief of the final reftitution of all things to harmony and happinefs.

NEWTYA, a port little known, on the coaft between Goa the capital of the Portuguefe fettlements in India, and the Englifh fettlement of Bombay. Mr Rennel conjectures it to be the *Nitrias* of Pliny; near which the pirates cruized for the Roman fhip. The fame writer places it near to 15° 52′ 30″ North Latitude, and 73° 16′ 30″ Eaft Longitude.

NEXI, among the Romans, perfons free born, who for debt were reduced to a ftate of flavery. By the laws of the twelve tables it was ordained, that infolvent debtors fhould be given up to their creditors to be bound in fetters and cords, whence they were called *Nexi;* and though they did not entirely lofe the rights of freemen, yet they were often treated more harfhly than the flaves themfelves. If any one was indebted to feveral perfons, and could not within fixty days find a cautioner, his body according to fome, but according to others his effects, might be cut in pieces, and divided among his creditors. The latter opinion feems by much the moft probable, as Livy mentions a law by which creditors had a right to attach the goods but not the perfons of their debtors.

NEYTRECHT, a town of Upper Hungary, capital of a county of the fame name, with a bifhop's fee; feated on the river *Neitra*, 40 miles north-eaft of Prefburg. E. Long. 17. 49. N. Lat. 48. 28.

NGAN-KING-FOU, a city of China, and capital of the weftern part of the province of Kiang nan. It is governed by a particular viceroy, who keeps a large garrifon in a fort built on the banks of the river Yang-tfe-kiang. Its fituation is delightful; its commerce and riches render it very confiderable; and every thing that goes from the fouthern part of China to Nan-king muft pafs through it. All the country belonging to it is level, pleafant, and fertile. It has under its jurifdiction only fix cities of the third clafs.

NGO-KIA, a Chinefe drug, of which the compofition will no doubt appear as fingular as the numerous properties afcribed to it. In the province Chang-tong, near Ngo-hien, a city of the third clafs, is a well formed by nature, which is reckoned to be feventy feet in depth, and which has a communication, as the Chinefe fay, with fome fubterranean lake, or other large refervoir. The water drawn from it is exceedingly clear, and much heavier then common; and if it be mixed with muddy water, it purifies it and renders it limpid, by precipitating all its impurities to the bottom of the veffel. This water is employed in making the ngo-kia, which is nothing elfe but a kind of glue procured from the fkin of a black afs.

The animal is killed and flayed, and the fkin is fteeped for five days in water drawn from this well. At the end of that time, it is taken out to be fcraped and cleaned; it is afterwards cut into fmall pieces, which are boiled over a flow fire, in the fame kind of water, until it is reduced to a jelly, which is ftrained, while warm, through a cloth, to free it from all the grofs matter which could not be melted. When this glue is cool, and has acquired a confiftence, it is formed into fquare cakes, upon which the Chinefe imprint characters and coats of arms, or the figns of their fhops.

This well is the only one of the kind in China; it is always fhut, and fealed by the governor of the place with his own feal, until the cuftomary day of making the emperor's glue. This operation generally lafts from the autumnal harveft till the month of March. During that time, the neighbouring people and merchants treat for the purchafe of the glue with thofe who guard the well, and with the people who make it. The latter manufacture as much of it as they can, on their own account, with this difference, that it is not fo pure, and that they are lefs fcrupulous in examining whether the afs be fat, or of a very black colour: however, all the glue made here is as much efteemed at Peking as that which the mandarins who are on the fpot tranfmit to court and to their friends.

As this drug is in the greateft requeft, and as the quantity of it made at Ngo-hien is not fufficient to ſupply the whole empire, there are not wanting people who counterfeit it elſewhere, and who manufacture a ſpurious kind from the ſkins of mules, horſes, and camels, and ſometimes even from old boots; it is, however, very eaſy to diſtinguiſh that which is genuine; it has neither a bad ſmell nor a diſagreeable taſte when applied to the mouth; it is brittle and friable, and always of a deep black colonr, ſometimes inclining to red. The qualities of the counterfeit kind are entirely different; both its taſte and ſmell are diſagreeable, and it is viſcous nnd flabby even when made of the ſkin of a hog, which is that which imitates the true kind the beſt.

The Chineſe attribute a great number of virtues to this drug. They aſſure us that it diſſolves phlegm, facilitates the play and elaſticity of the lungs, gives a free reſpiration to thoſe who breathe with difficulty; that it comforts the breaſt, increaſes the blood, ſtops dyſenteries, provokes urine, and ſtrengthens children in the womb. Without warranting the truth of all theſe properties, it appears, at leaſt, certain, by the teſtimony of the miſſionaries, that this drug is ſerviceable in all diſeaſes of the lungs. It is taken with a decoction of ſimples, and ſometimes in powder, but very ſeldom.

NIAGARA, a fort of North America, which was taken from the French in 1759. According to the treaty of 1794, it was delivered up by Britain to the United States in 1796. It is ſituated on a ſmall peninſula formed by the river Niagara as it flows into the lake Ontario. About ſix leagues from the fort is the greateſt cataract in the world, known by the name of the *Waterfall of Niagara*. The river at this fall runs from SSE to NNW; and the rock of the fall croſſes it not in a right line, but forms a kind of figure like a hollow ſemicircle or horſe ſhoe. Above the fall, in the middle of the river, is an iſland about 800 or 1000 feet long; the lower end of which is juſt at the perpendicular edge of the fall. On both ſides of this iſland runs all the water that comes from the lakes of Canada; viz. Lake Superior, Lake Michigan, Lake Huron, and Lake Erie, which have ſome large rivers that open themſelves into them. Before the water comes to this iſland, it runs but ſlowly compared with its motion afterwards, when it grows the moſt rapid in the world, running with a ſurpriſing ſwiftneſs before it comes to the fall. It is perfectly white, and in many places is thrown high up into the air. The water that runs down on the weſt ſide is more rapid, in greater abundance, and whiter, than that on the eaſt ſide; and ſeems almoſt to outfly an arrow in ſwiftneſs. When you are at the fall, and look up the river, you may ſee that the water is everywhere exceedingly ſteep, almoſt like the ſide of an hill; but when you come to look at the fall itſelf, it is impoſſible to expreſs the amazement it occaſions. The height of it, as meaſured by mathematical inſtruments, is found to be exactly 137 feet; and when the water is come to the bottom, it jumps back to a very great height in the air. The noiſe may be heard at the diſtance of 45 miles, but ſeldom further; nor can it be heard even at Fort Niagara, which is only ſix leagues diſtant, unleſs Lake Ontario is calm. At that fort it is obſerved, that when they hear the noiſe of the fall more loud than ordinary, they are ſure that a north-eaſt wind will follow; which is the more ſurpriſing, as the fort lies ſouth-weſt from the fall. At ſome times the fall makes a much greater noiſe than at others; and this is held for an infallible ſign of approaching rain or other bad weather.

From the place where the water falls there ariſes abundance of vapour like very thick ſmoke, inſomuch that when viewed at a diſtance you would think that the Indians had ſet the foreſts on fire. Theſe vapours riſe high in the air when it is calm, but are diſperſed by the wind when it blows hard. If you go into this vapour or fog, or if the wind blows it on you, it is ſo penetrating, that in a few moments you will be as wet as if you had been under water. Some are of opinion that when birds come flying into this fog or ſmoke of the fall, they drop down and periſh in the water; either becauſe their wings are become wet, or that the noiſe of the fall aſtoniſhes them, and they know not where to go in the darkneſs: but others think that ſeldom or never any bird periſhes there in that manner; becauſe among the abundance of birds found dead below the fall, there are no other ſorts than ſuch as live and ſwim frequently in the water; as ſwans, geeſe, ducks, water hens, teal, and the like. And very often great flocks of them are ſeen going to deſtruction in this manner: they ſwim in the river above the fall, and ſo are carried down lower and lower by the water; and as water fowl commonly take great delight in being carried with the ſtream, they indulge themſelves in enjoying this pleaſure ſo long, till the ſwiftneſs of the water becomes ſo great, that it is no longer poſſible for them to riſe, but they are driven down the precipice and periſh. They are obſerved, when they draw nigh the fall, to endeavour with all their might to take wing and leave the water; but they cannot. In the months of September and October ſuch abundant quantities of dead water fowl are found every morning below the fall, on the ſhore, that the garriſon of the fort for a long time live chiefly upon them. Beſides the fowl, they find alſo ſeveral ſorts of dead fiſh, alſo deer, bears, and other animals which have tried to croſs the water above the fall: the larger animals are generally found broken to pieces. Juſt below, a little way from the fall, the water is not rapid, but goes all in circles, and whirls like a boiling pot; which however does not hinder the Indians going upon it in ſmall canoes a-fiſhing; but a little further, and lower, the other ſmaller falls begin. When you are above the fall, and look down, your head begins to turn; even ſuch as have been here numberleſs times, will ſeldom venture to look down, without at the ſame time keeping faſt hold of ſome tree with one hand.

It was formerly thought impoſſible for anybody living to come at the iſland that is in the middle of the fall: but an accident that happened about 50 years ago made it appear otherwiſe. The hiſtory is this: Two Indians of the Six Nations went out from Niagara fort to hunt upon an iſland that is in the middle of the river, or ſtrait, above the great fall, on which there uſed to be abundance of deer. They took ſome French brandy with them from the fort, which they taſted ſeveral times as they were going over the carrying place; and when they were in their canoe, they took now and then a dram, and ſo went along up the ſtrait towards the iſland where they propoſed to

Niagara. to hunt; but growing ſleepy, they laid themſelves down in the canoe, which getting looſe drove back with the ſtream, farther and farther down, till it came nigh that iſland that is in the middle of the fall. Here one of them, awakened by the noiſe of the fall, cries out to the other that they were gone: Yet they tried if poſſible to ſave life. This iſland was nigheſt, and with much working they got on ſhore there. At firſt they were glad; but when they had conſidered every thing, they thought themſelves hardly in a better ſtate than if they had gone down the fall, ſince they had now no other choice, than either to throw themſelves down the ſame, or periſh with hunger. But hard neceſſity put them on invention. At the lower end of the iſland the rock is perpendicular, and no water is running there. The iſland has plenty of wood; they went to work then, and made a ladder or ſhrouds of the bark of the lind tree (which is very tough and ſtrong) ſo long till they could with it reach the water below; one end of this bark ladder they tied faſt to a great tree that grew at the ſide of the rock above the fall, and let the other end down to the water. So they went down along their new invented ſtairs, and when they came to the bottom in the middle of the fall they reſted a little; and as the water next below the fall is not rapid, as before mentioned, they threw themſelves out into it, thinking to ſwim on ſhore. We have ſaid before, that one part of the fall is on one ſide of the iſland, the other on the other ſide. Hence it is, that the waters of the two cataracts running againſt each other, turn back againſt the rock that is juſt under the iſland. Therefore, hardly had the Indians begun to ſwim, before the waves of the eddy threw them back with violence againſt the rock from whence they came. They tried it ſeveral times, but at laſt grew weary; and by being often thrown againſt the rock they were much bruiſed, and the ſkin torn off their bodies in many places. So they were obliged to climb up ſtairs again to the iſland not knowing what to do. After ſome time they perceived Indians on the ſhore, to whom they cried out. Theſe ſaw and pitied them, but gave them little hope or help: yet they made haſte down to the fort, and told the commandant where two of their brothers were. He perſuaded them to try all poſſible means of relieving the two poor Indians; and it was done in the following manner:

The water that runs on the eaſt ſide of this iſland is ſhallow, eſpecially a little above the iſland towards the eaſtern ſhore. The commandant cauſed poles to be made and pointed with iron; two Indians took upon them to walk to this iſland by the help of theſe poles, to ſave the other poor creatures, or periſh themſelves. They took leave of all their friends, as if they were going to death. Each had two ſuch poles in his hands, to ſet to the bottom of the ſtream, to keep them ſteady; and in this manner reached the iſland: and having given poles to the two poor Indians there, they all returned ſafely to the main land. Theſe two Indians (who in the above-mentioned manner were firſt brought to this iſland) were nine days on the iſland, and almoſt ready to ſtarve to death. Now ſince the road to this iſland has been found, the Indians go there often to kill deer, which have tried to croſs the river above the fall, and are driven upon it by the ſtream. On the weſt ſide of this iſland are ſome ſmall iſlands or rocks, of no conſequence. The eaſt ſide of the river is almoſt perpendicular, the weſt ſide more ſloping. In former times, a part of the rock at the fall which is on the weſt ſide of the iſland, hung over in ſuch a manner, that the water which fell perpendicularly from it left a vacancy below, ſo that people could go under between the rock and the water; but the prominent part ſome years ſince broke off and fell down. The breath of the fall, as it runs in a ſemicircle, is reckoned to be about 300 feet. The iſland is in the middle of the fall, and from it the water on each ſide is almoſt the ſame breadth; the breadth of the iſland at its lower end is about 100 feet. Below the fall, in the holes of the rocks, are great plenty of eels, which the Indians and French catch with their hands without any other means. Every day when the ſun ſhines, you ſee here from ten o'clock in the morning to two in the afternoon, below the fall, and under you, where you ſtand at the ſide of the fall, a glorious rainbow, and ſometimes two, one within the other. The more vapours, the brighter and clearer is the rainbow. When the wind carries the vapours from that place, the rainbow is gone, but appears again as ſoon as new vapours come. From the fall to the landing above it, where the canoes from Lake Erie put aſhore (or from the fall to the upper end of the carrying place), is half a mile. Lower the canoes dare not come, leſt they ſhould be obliged to try the fate of the two Indians, and perhaps with leſs ſucceſs. They have often found below the fall pieces of human bodies, perhaps drunken Indians, that have unhappily come down to the fall. The French ſay, that they have often thrown whole great trees into the water above, to ſee them tumble down the fall: they went down with ſurpriſing ſwiftneſs, but could never be ſeen afterwards; whence it was thought there was a bottomleſs deep or abyſs juſt under the fall. The rock of the fall conſiſts of a gray limeſtone. For an intereſting account of this celebrated fall, the reader is referred to Volney's Travels in America. Niagara.

Having mentioned the *Six Nations* which live on the banks of the Niagara, we ſhall here add a few particulars relative to thoſe nations which, as they ſeem not to be well underſtood even in America, are probably ſtill leſs known in Europe. The information which we have to give was communicated to the Royal Society of London by Mr Richard M'Cauſland ſurgeon to the 8th regiment of foot, who, writing from the beſt authority, informs us, that each nation is divided into three tribes, of which the principal are called the *turtle tribe*, the *wolf tribe*, and the *bear tribe*.

Each tribe has two, three, or more chiefs, called *ſachems;* and this diſtinction is always hereditary in the family, but deſcends along the female line: for inſtance, if a chief dies, one of his ſiſter's ſons, or one of his own brothers, will be appointed to ſucceed him. Among theſe no preference is given to proximity or primogeniture; but the ſachem, during his lifetime, pitches upon one whom he ſuppoſes to have more abilities than the reſt; and in this choice he frequently, though not always, conſults the principal men of the tribe. If the ſucceſſor happens to be a child, the offices of the poſt are performed by ſome

of

Niagara. of his friends until he is of ſufficient age to act himſelf.

Each of theſe poſts or ſachem has a name which is peculiar to it, and which never changes, as it is always adopted by the ſucceſſor: nor does the order of precedency of each of theſe names or titles ever vary. Nevertheleſs, any ſachem, by abilities and activity, may acquire greater power and influence in the nation than thoſe who rank before him in point of precedency; but this is merely temporary, and dies with him.

Each tribe has one or two chief warriors; which dignity is alſo hereditary, and has a peculiar name attached to it.

Theſe are the only titles of diſtinction which are fixed and permanent in the nation; for although any Indian may by ſuperior talents, either as a counſellor or as a warrior, acquire influence in the nation, yet it is not in his power to tranſmit this to his family.

The Indians have alſo their great women as well as their great men, to whoſe opinions they pay great deference; and this diſtinction is alſo hereditary in families. They do not ſit in council with the ſachems, but have ſeparate ones of their own.—When war is declared, the ſachems and great women generally give up the management of public affairs into the hands of the warriors. It may however ſo happen, that a ſachem may at the ſame be alſo a chief warrior.

Friendſhips ſeem to have been inſtituted with a view towards ſtrengthening the union between the ſeveral nations of the confederacy; and hence friends are called the *ſinews of the Six Nations*. An Indian has therefore generally one or more friends in each nation. Beſides the attachment which ſubſiſts during the lifetime of the two friends, whenever one of them happens to be killed, it is incumbent on the ſurvivor to replace him, by preſenting to his family either a ſcalp, a priſoner, or a belt conſiſting of ſome thouſands of wampum; and this ceremony is performed by every friend of the deceaſed.

The purpoſe and foundation of war parties, therefore, is in general to procure a priſoner or ſcalp to replace the friend or relation of the Indian who is the head of the party. An Indian who wiſhes to replace a friend or relation preſents a belt to his acquaintance; and as many as chooſe to follow him accept this belt, and become his party. After this, it is of no conſequence whether he goes on the expedition or remains at home (as it often happens that he is a child;) he is ſtill conſidered as the head of the party. The belt he preſented to his party is returned fixed to the ſcalp or priſoner, and paſſes along with them to the friends of the perſon he replaces. Hence it happens, that a war party, returning with more ſcalps or priſoners than the original intention of the party required, will often give one of theſe ſupernumerary ſcalps or priſoners to another war party whom they meet going out; upon which this party, having fulfilled the purpoſe of their expedition, will ſometimes return without going to war.

Nicæa. NICÆA, in *Ancient Geography*, the metropolis of Bithynia; ſituated on the lake Aſcanius, in a large and fertile plain; in compaſs 16 ſtadia: firſt built by Antigonus, the ſon of Philip, and thence called *Antigonea;* afterwards completed by Lyſimachus, who called it *Nicæa*, after his conſort the daughter of Antipater. According to Stephanus, it was originally a colony of the Bottiæi, a people of Thrace, and called *Ancore;* and afterwards called *Nicæa*. Now *Nice* in Aſia the Leſs *. Famous for the firſt general council.—A ſecond *Nicæa*, (Diodorus Siculus), of Corſica.—A third, of the Hither India, (Arrian); ſituated on the weſt ſide of the Hydaſpes, oppoſite to Bucephale, on the eaſt ſide.—A fourth *Nicæa*, a town of Liguria, at the Maritime Alps, on the eaſt ſide of the river Paulon, near its mouth, which runs between the Varus and Nicæa, (Mela). A colony of the Maſſilians, (Stephanus); the laſt town of Italy to the weſt. Now *Nizza* or *Nice*, capital of the county of that name, on the Mediterranean.—A fifth, of Locris, (Strabo); a town near Thermopylæ; one of the keys of that paſs. It ſtood on the Sinus Maliacus.

* See *Nice*.

END OF THE FOURTEENTH VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. XIV.

PART I.

Plate CCCXXXVII.—CCCXLV. to face - -	page 38
CCCXLVI.—CCCL. - - - -	76
CCCLI.—CCCLIII. - - - -	254

PART II.

CCCLIV.—CCCLXII. - - - -	552
CCCLXIII.—CCCLXVIII. - - -	702
CCCLXIX. - - - - -	734

ERRATA.

In the Explanation of the Plates of Midwifery on pp. 75 and 76, in ſome copies, *for* Plates CCC, CCCI, CCCII, CCCIII, and CCCIV. *read* Plates CCCXLVI, CCCXLVII, CCCXLVIII, CCCXLIX, and CCCL.

Page 511. col. 1. ſide note, *for* Plate CCCXXIII. *read* Plate CCCLIV.