

VOLUME LXXXVII

NUMBER SIX

THE NATIONAL GEOGRAPHIC

To the American People

Your sons, husbands and brothers who are standing today upon the battlefronts are fighting for more than victory in war. They are fighting for a new world of freedom and peace.

We, upon whom has been placed the responsibility of leading the American forces, appeal to you with all possible earnestness to invest in War Bonds to the fullest extent of your capacity.

Give us not only the needed implements of war, but the assurance and backing of a united people so necessary to hasten the victory and speed the return of your fighting men.

G. C. Marshall

William D. Leahy

E. J. King

C. W. Nimitz



Dwight D. Eisenhower

H. H. Arnold

Douglas MacArthur

JUNE, 1945

China Fights Erosion with U. S. Aid
With 10 Illustrations
26 Natural Color Photographs

WALTER C. LOWDERMILK

Stilwell Road—Land Route to China
With 18 Illustrations

NELSON GRANT TAYMAN

Tai Shan, Sacred Mountain of the East
With 18 Illustrations and Map

MARY AUGUSTA MULLIKIN

Sights and Sounds of the Winged World
With 3 Illustrations
26 Natural Color Photographs

ARTHUR A. ALLEN

The Society's New Map of China

JAMES M. DARLEY

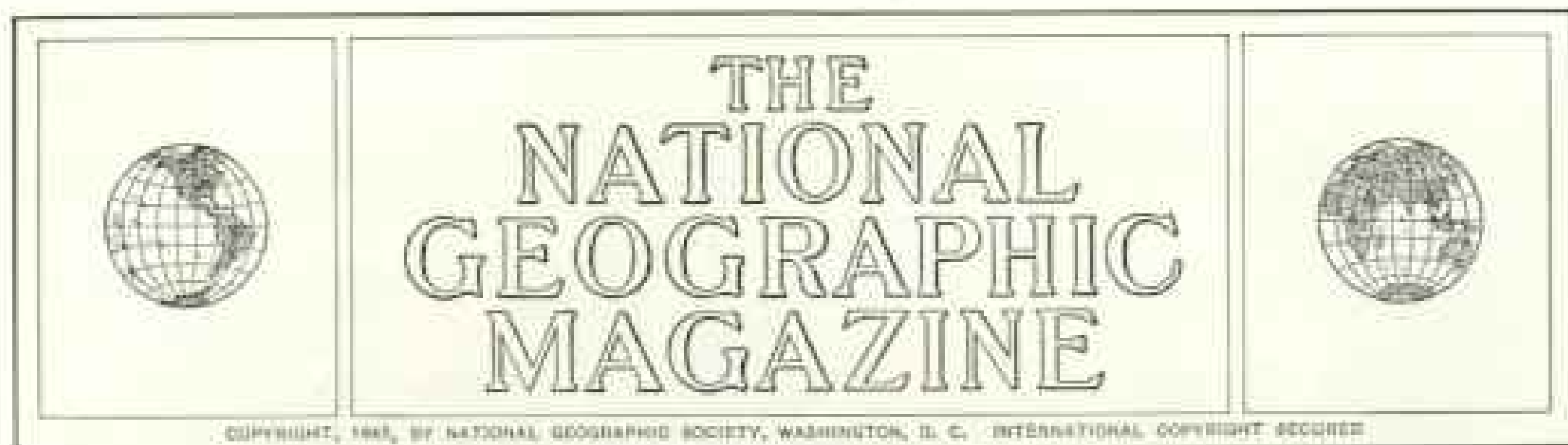
Americans Help Liberated Europe Live Again
With 17 Illustrations

FREDERICK SIMPICH, Jr.

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D.C.

\$4.00 A YEAR

50c THE COPY



China Fights Erosion with U. S. Aid

BY WALTER C. LOWDERMILK

Assistant Chief, Soil Conservation Service, U. S. Department of Agriculture

With Illustrations from Photographs by the Author

ON MY first mission to China, 23 years ago, the mighty Yangtze River met us 75 miles out at sea as a yellow pathway. Its waters were clogged with silt, the lifeblood of China's fertile fields.

My mission took me up the Yellow River, "China's sorrow," to find out where all the silt that is the chief cause of its floods came from. I concluded that famines in northwest China were due not to adverse change of climate, but to suicidal agriculture in cultivating steep slopes without adequate measures for protecting fields from soil erosion.

This expedition led me into my life work, the study of the interrelation of soil erosion and civilizations. By arrangement between the Governments of the United States and China, I went again to China in 1942-43 to collaborate with officials and farmers of that great ally in reclaiming eroded land and increasing food production. My work was part of the war effort against Japan.

On this trip, instead of meeting the Yangtze River at the coast, we bored through the clouds to find our landmark 1,000 miles inland, where the Kialing joins the Yangtze River at Chungking. As we descended, the gorge and its yellow-brown waters appeared to rise to meet us. We landed on a small island in close quarters in the gorge, where the water rises 90 feet in a season.*

Getting into our individual sedan chairs and tilting back precariously, we were carried up the 364 stone steps from the river level to the city of Chungking.

Millions of Chinese were killed when the Japanese invaded China, but China has not

surrendered. During these terrible eight years since China was invaded by the Japanese in 1937, the greatest drama of all her history has been enacted. Into this vast and little-known territory of Free China, only a little larger than the United States, has swept a tidal wave of refugees—50 to 70 million souls from coastal areas.

Going West in Many Vehicles

They came by every means imaginable—on foot, carrying bundles and babies; in wheelbarrows and sedan chairs; on Chinese junks, poled or pulled upstream with bamboo poles by sweating manpower. They came in carts, on donkeys or horses, or with the modern speed of steamers, automobiles, and trimotored planes.

Business men, industrialists, and farmers, old folk and infants, artisans and professors, and more than thirty colleges and universities were swept back into the estuaries of their native homeland. They have come back to where Chinese civilization had its birth: back to Siking (Sian), which, known as Changan, was the capital of China for several long periods (page 657); back to Chengtu, one of the capitals of the Three Kingdoms and ancient intellectual center where books were printed long before the time of Gutenberg (page 643).

Here, in Szechwan, against a literal wall of the snow mountains of old Tibet, China has established her base for resisting the invader

* See "Through the Great River Trenches of Asia," by Joseph F. Rock, NATIONAL GEOGRAPHIC MAGAZINE, August, 1926.



Refugee Farmers Express Their Gratitude for United States Aid

At a ceremony in appreciation of the soil-conservation project established at the Hwanglungshan colonization center of Shensi, one of the school children presents a flag to the author, Dr. Walter C. Lowdermilk.

and rebuilding her national life. What a human drama for future historians to write about!

Chungking, after eight years of war during which most of it lay almost defenseless under raid after raid by Japanese bombers, is today a bustling capital. All its people—men, women, and children—are working. They are scraping up the debris of bombings and putting up new buildings everywhere. Streets and shops are crowded. Folk laugh and joke and sing.

We wished to leave Chungking soon for Chengtu, the capital of Szechwan. After waiting days for a plane, we finally obtained reservations on a postal truck.

That truck was filled with mailbags and the maximum permitted number of passengers, who had paid for their tickets in advance. Afterward, as is customary, the driver took for himself all the "yellow fish" (extra fares) he could pick up en route.

We were packed in like sardines, each cling-

ing to some valuable parcels—mine cameras. The weather was cold, but heat of our huddled bodies kept us from freezing as we jolted along. Thanks to the wonderful Chinese sense of humor, laughter relieved our discomfort.

The Chengtu Plain was teeming with Chinese in bright-blue garments. On every road were endless lines of two-wheeled trucks and wheelbarrows, drawn or pushed by sturdy men and boys. They were taking loads of coke, coal, salt, lumber, or foodstuffs to Chengtu. An occasional automobile with its raucous horn sent pedestrians, donkeys, and carts scurrying to the roadside for safety.

Beginning of Good Roads in China

Twenty-five years ago there was not a wheeled vehicle, except wheelbarrows, in all this vast region. There was not a strip of road wide enough for an automobile.

To show millions of this interior province how in other lands things moved faster than water buffaloes, sedan chairs, and wheelbar-

rows, a missionary introduced a motorcycle—with electrifying results. Satin-robed officials vied with one another to take their first ride on the fender of this snorting machine. From this experience began the good-roads movement in western China.

An efficient highway commission today is building a network of roads throughout Free China and to Burma, India, and Russia. Wherever we went, we saw workers toiling on the highways.

Graves are everywhere. Outside populous centers the countryside seems to grow little else. The land of China must support a double population and supply not only food for the living but also space for a host of ancestors.

Chengtu a Center of Learning

Chengtu is a great center of learning for Free China. To Szechwan have fled some twenty of the thirty-odd universities and colleges that escaped westward from Japanese-occupied territory. They are carrying on with pitifully inadequate facilities but with the largest enrollment in history. A soils man apologized for the cramped surroundings but not for his work. Such is the spirit of the new China.

The West China Union University of Chengtu has acted as host to a number of these migrant institutions of higher learning. From early morning till late at night its playgrounds, classrooms, laboratories, and libraries are used by students seeking to learn and to prepare themselves for the new day in China.

Chengtu was the logical center for our preparatory work. There the University of Nanking had offered us office space.

I was invited to a reception by the Governor of Szechwan in celebration of the abrogation of treaties of extraterritoriality by China, Britain, and the United States. Fifty foreigners were among the crowd of guests. On the wall of the great hall were flags of the three countries and pictures of Generalsissimo Chiang Kai-shek, President Roosevelt, and Prime Minister Churchill. The Governor made a spirited talk, to which an American and a Britisher gave responses.

The Chinese Government was eager to cooperate with us. For our surveys and demonstrations it provided a staff of eight highly trained Chinese specialists in agriculture, irrigation, and hydraulic engineering.

Our station wagon, large enough to carry all nine of us and our driver, a trained mechanic, was specially equipped with truck wheels for bad roads. We had no breakdowns or accidents in the 6,000 miles of travel over all kinds of roads in seven months of field work.

At first gasoline cost us from \$12 to \$15 United States money a gallon, for it was hauled over "the Hump" at great expense. This scarcity stimulates use of substitutes. Alcohol is used by some, tung oil is cracked to make a foul-smelling motor fuel, and camphor is distilled as well. In North China we used Chinese gasoline refined from oil extracted near Yumen in the far northwest.

Inflation in China today is staggering. Formerly we could exchange our gold dollars for Chinese money and live far better than we could on the same amount in the United States. Now all that is reversed. The Chinese could now exchange their money, come to our country (if they could get transportation and passports), and live far better than they can under inflation in Free China.

There was little rationing in China. Anyone who had the cash could buy almost anything available. I paid 75 cents U. S. money for three small pieces of paper and a little string to wrap up a small gift package. A suit of clothes sold for \$500 U. S. A missionary sold a bicycle, used for ten years, for \$600. I paid \$3 for half a dozen oranges right where they were grown.

Our breakfasts usually consisted of noodles; pickled and salted vegetables, often including alfalfa greens; and boiled eggs. In the northwest no rice is grown, and the "staff of life" is wheat and millet. We did not suffer for body-building foods.

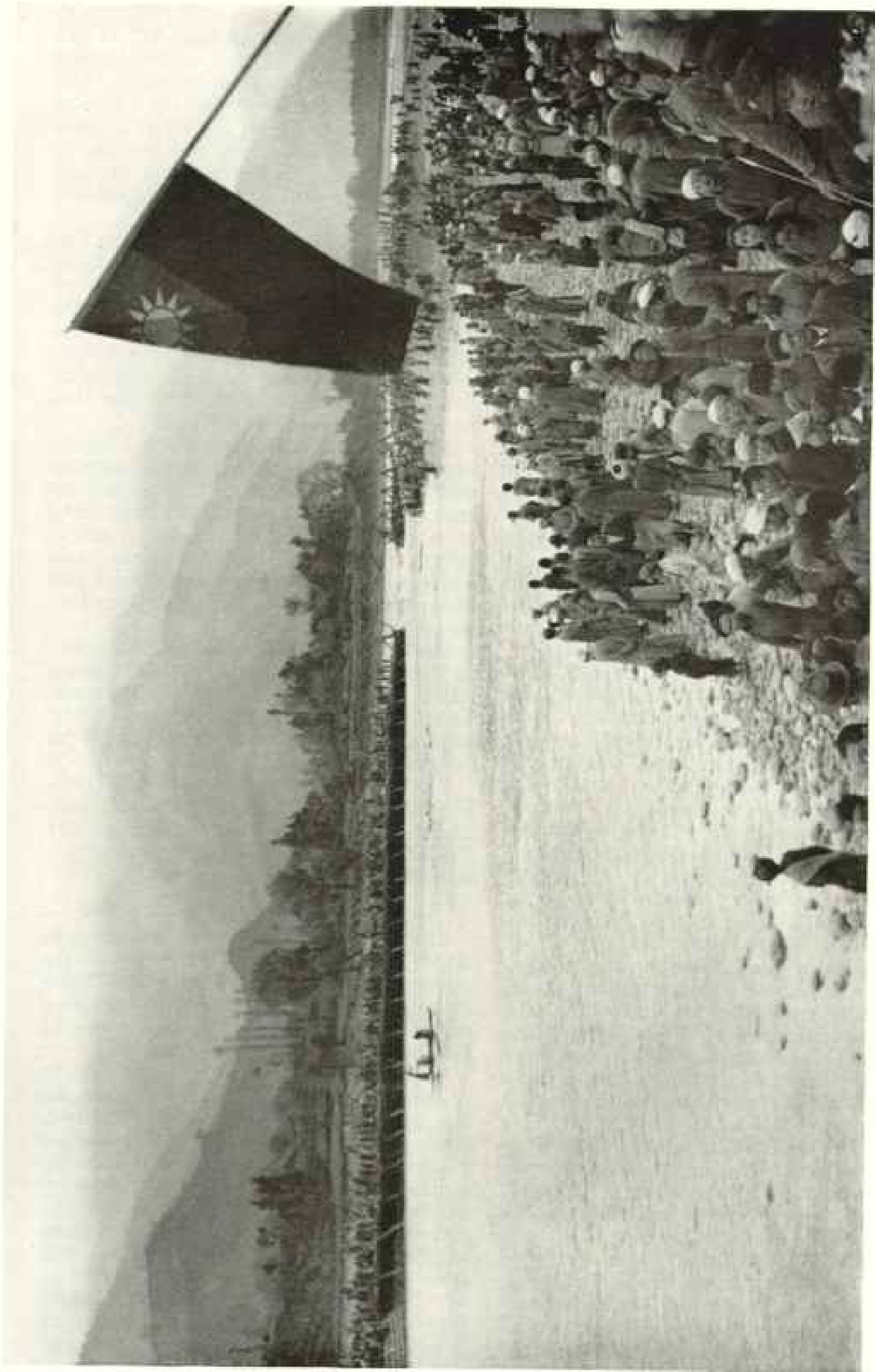
It is the white-collar class and students who are often emaciated from lack of proper nourishment. They cannot live on their salaries. I found missionaries selling their personal possessions for food.

Tu Kiang Irrigation 2,200 Years Old

The Honorable Chang Chen invited us to attend the official annual ceremony of the opening of the waters at Kwanhsien. These great irrigation works on the Min River were established by a Chinese engineer named Li Ping some 2,200 years ago (Plate XV).

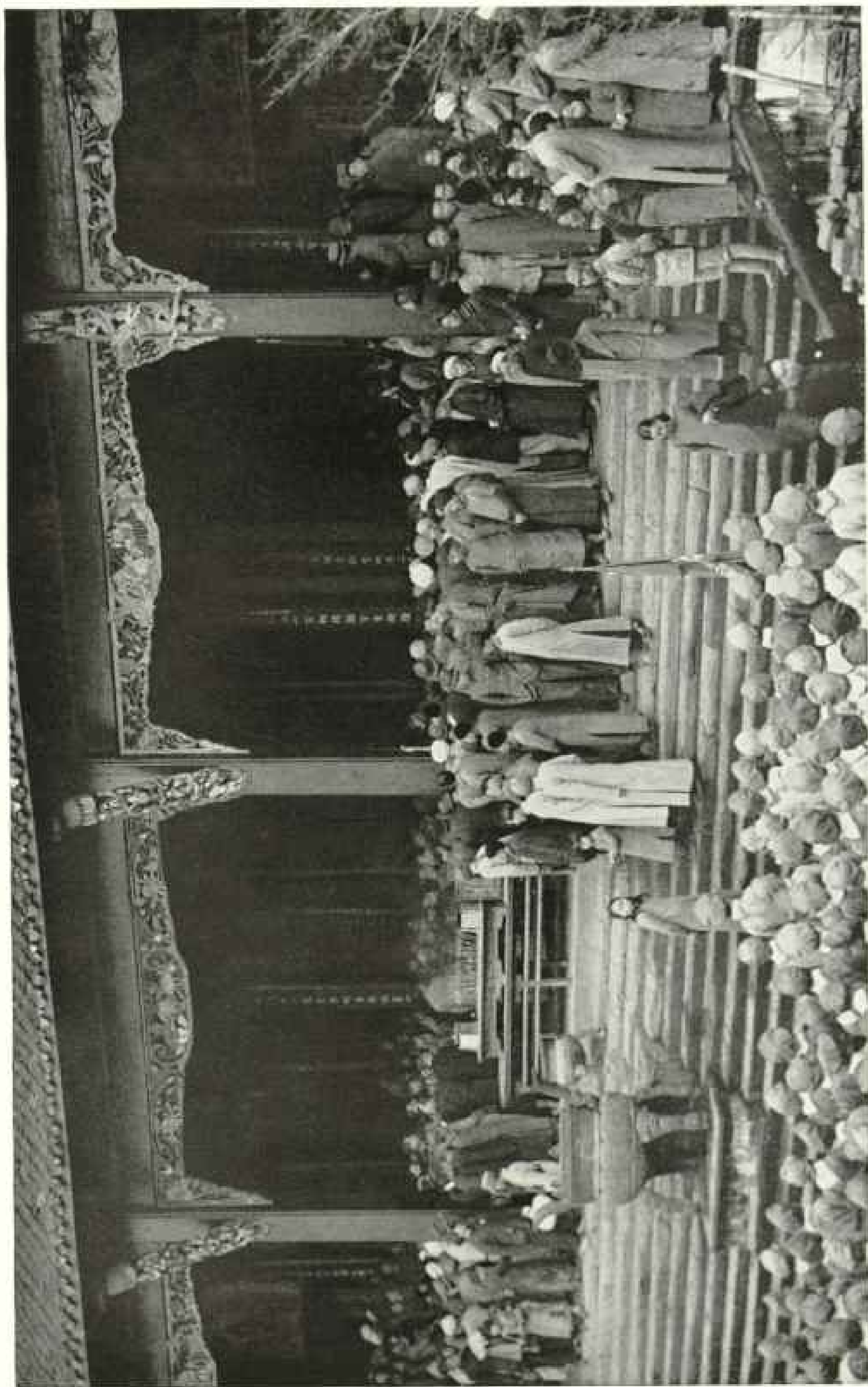
The road from Chengtu to Kwanhsien, in existence only a quarter of a century, was the first auto road in West China, I was told. As we rolled along it, we saw a lush landscape a full third of which was golden with blossoms of mustardlike rape, grown for oil yielded by its seeds.

Golden fields stood out amid the rich green of winter wheat just heading and the dull green of broad beans. No field is allowed to lie idle summer or winter in the Chengtu Plain. A few fields were dainty spots of "pink clover," a legume that is inserted now and then in the incessant crop rotation.



The Tu Kiang Cofferdam Is Broken for the Latest of Some 2,200 Summer Irrigation Seasons!

By means of heavy bamboo cables, the tripods of the temporary structure have been pulled down. Farmers on the rafts are collecting floating timbers for their own use, as traditional custom permits. The white turban worn by the people is peculiar to Szechwan. A crowd of some 40,000 have come from the ceremonies at the Temple of Er Wang (opposite page) to witness the division of the irrigation waters.



Before Division of Tu Kiang Waters, a Throng Honors Er Wang, Who Completed the Project 2,200 Years Ago

More than 40,000 people, including officials of both Szechwan Province and the National Government of China, as well as representatives of 14 *hsein* (counties) irrigated by the system, take part in the traditional ceremony (page 647). The stairs lead to the altar of the exquisitely adorned temple where incense is burned and homage paid before the image of Li Ping's son. Boy Scouts stand at attention. The crowd will proceed to the banks of the Min River as soon as the prescribed rites are ended and watch the breaking of the cofferdam to start a new spring season (opposite page).



When Excavations Expose the Iron Dragons, the Cofferdam May Be Broken

These three ancient bars, 7 inches in diameter and 10 feet long, and weighing about 1,400 pounds each, mark the level to which Li Ping decreed the canal should be cleared each spring before being flooded. Silt is not a problem on the Tu Kiang Project, for the Min River is fairly clear. Current-rolled boulders and gravel, however, pile up in the stream bed during high water, and these are removed by hand labor before the opening of every spring season.

Farmhouses with white stucco walls and dark wooden frames, topped with gray-tile roofs, stood partly hidden amid groves of waving bamboo. In Szechwan the bamboo grove is the multipurpose woodlot. It furnishes bamboo sprouts for food, and culms for fences, implements, tools, furniture, paper, house construction, and chopsticks.

We saw boys catching stranded fish by pumping water out of pools left in the canal. Like boys going fishing anywhere else, they were having the time of their lives.

The Min River comes forth as a clear stream

out of lost horizons in the mountains, which are drenched with heavy summer rains but get little precipitation during winter. Winter flow is low, but summer stages are high. The latter are diverted through a network of canals to thousands of fields in the Chengtu Plain.

A Mighty Dike Built without Concrete

Li Ping did not have silt to deal with in this project, but he did have the problem of boulders and gravel being moved along the stream bed. His plan called for dividing the river into two canals, the inner and outer, just where

it left its confining gorge and opened out into its broad flat outwash fan known as the Chengtu Plain.

Twenty-two centuries ago Li Ping had no reinforced concrete, but he used local materials and hand labor. His plan was simple. Wood, bamboo, and stones picked out of the stream bed were his materials. With these he built uncemented but well-designed structures to divert water as he chose. He cut a canal through the toe of a slope of hard conglomerate rock, which fixed the size of the intake for the inner canal. The main river was to serve as the outer canal and carry off flood waters.

"Fish's Snout" Divides the River

The "fish's snout," a strong point established in midstream by piling up year after year boulders and gravel excavated from the channels on each side, divides the current into two feeder canals, which lower down are divided into nine canals to distribute flood water to prevent floods (page 660).

These nine are further divided into 526 laterals and 2,200 sublaterals, providing irrigation water to an average depth of seven and a half feet for the entire Tu Kiang Project of 500,000 acres. The whole Chengtu Plain supports 2,000 persons to the square mile, one of the densest populations in the world.

Boulders and gravel rolled along the stream bottom by swift currents would shortly interfere with equal parting of the waters into the two canals. To safeguard against such failures, Li Ping prescribed simple regulations which are set forth in six characters plainly carved into a prominent wall of the Er Wang Temple. The translation is "Dig the channel deep and keep the spillway low" (page 663).

It was made a religious rite to carry out these measures each year before the ceremony of opening of the waters could be held. We were fortunate to be present at the opening.

The Governor of the Province led the official ceremony by paying homage to the images of Li Ping, who began the project, and Er Wang, his son, who completed the job (page 645). Actually, the temple to Er Wang is more pretentious, and homage to him is greater because of the son's filial piety in completing the work which his father began. Priests sacrificed two sheep and two pigs before the altars, and officials bowed before the images amid the noise of temple gongs.

After the ceremonies, to the deafening sounds of bursting firecrackers the temporary cofferdam, which had been built to divert the river flow, was breached (page 644). Twenty men pulling on a bamboo cable turned over the temporary wooden tripods, and life-giving

waters rushed through, to the acclaim of some 40,000 people. Then the river flowed down the inner and outer canals ready for another of the 2,200-year-old series of consecutive irrigations.

In forty centuries Chinese farmers have won the battle for food production in some places and lost it in others.* Sometimes erosion and floods have won and the people have failed despite centuries of effort. Nevertheless, I have yet to find a major problem of land use for which some ingenious farmer of the past has not worked out a solution in whole or in part, either by chance or by design. Generally, neither he nor his neighbors have fully appreciated his finding.

This trial-and-error method has been costly, yet its findings are valuable.

The Chinese farmers do not, as did our Puritan ancestors, "wrest a living from the soil," but work in conscious partnership with Nature. Love of the "good earth" is one of the most powerful social forces in China.

Chinese farmers are the world's greatest experts in the use of fertilizers. For this reason they have been able to cultivate year after year for thousands of years the flat fields in the vicinities of towns and cities without serious depletion of the soil.

Sewage Becomes Fertilizer in China

Our method of sewage disposal would be national suicide for the Chinese. We break the animal-plant nutrient cycle by discharging human waste into rivers and harbors and pollute these waters. We tax ourselves heavily thus to waste precious plant food; whereas the Chinese bid high prices for concessions to carry it back to their farm fields. Most Chinese farmers have pottery jars within an enclosure beside the road, offering invitations or inducements to the traveler to stop and contribute to this vital necessity for the next crop.

We passed three months in Chengtu in training for our survey of the use of land in northwest China and in acquainting our field staff with principles of soil and water conservation and with facts and measures that had been worked out in our national program in the United States.

Special emphasis was given to adaptation of findings in America to conditions in China. Our first objective throughout the course of our survey was to learn what the Chinese farmer had done, to observe farmer practice, and to find the places in his practice where our American experience would fit in to make best use of soil and water.

* See "Farmers Since the Days of Noah," NATIONAL GEOGRAPHIC MAGAZINE, April, 1927.

Preparations for our long trip into north-west China completed, we crossed the border mountains. From the Kunlun mountains of central Asia, which separate the sources of the Yellow and Yangtze Rivers, this natural wall extends eastward and gives out near the coast on the Yellow Sea.

South of this mountain wall annual rainfall is 40 inches and more. People there grow and eat rice. Originally the land was covered with dense forests.

North of the barrier rainfall is from 30 inches to almost none in the Gobi. There people grow and eat wheat and millet. Originally the land for the most part was a vast grassland, with forests in alluvial valleys and on higher mountains.

South of this natural wall no loess was deposited, but north of it lies the largest blanket of loess, or wind-blown soil material, on earth.

Leaving the teeming Chengtu Plain, we traveled northward over the old Marco Polo Road, now widened for automobiles. Seldom in any country have I found scenery to equal that I saw in these borderlands.

Valleys are narrow and sometimes 1,000 to 1,500 feet deep, so that the road must climb by switchbacks and hairpin turns, up one valley, across a sharp divide, then down again into another valley and up again to get through a maze of broken, deeply incised country. Sometimes the road has actually been niched out of the canyon walls, and the bluff above overhangs as a roof.

Astonishingly, the natural timber-growing areas in these rugged borderlands have been cleared and cultivated up to the very summits with Indian corn—a New World gift to the Old. Often the slopes appeared as if tipped up by some giant who had tried to spill out the soil, crop and all. Cultivation is sometimes on such steep slopes that farmers slide or fall off their fields into the canyon.

Loess Highly Subject to Erosion

Such farming is a gross misuse of land. With billions of kilowatts of hydroelectric power in rushing borderland streams going to waste, I look forward to a time when industry will draw off some of the subsistence farm peoples and let the hillsides be reforested. The mountains would be worth far more for production of timber, wood pulp, and other forest raw materials than for growing farm crops and would provide employment for a much larger population (page 658).

Throughout the border mountains fertility is declining, and in some places, as between Mienyang and Kienko, soils have been washed

off to bedrock as a result of clearing away the forest for farming.

The loess of North China is a remarkable and rich wind-blown deposit, probably contemporaneous with the ice sheets of North America and Europe during the Glacial period. Central Asia was too dry to produce an ice sheet, but high winds eroded a vast area of dry lands bordering the Gobi into clouds of dust that settled on the country to the south and east and left multitudes of dunes behind.

A mantle of loess accumulated over a vast dust bowl and smoothed out a formerly rough topography. Some of the material was carried away by streams to form the great delta plain of the Yellow River. This blanket of soil material of talcum-powder fineness is about 500 feet thick near its origin, but is thinned out to the south, west, and east until it disappears as a deposit.

Long cultivation has exposed sloping fields in the loess to sheet and gully erosion through centuries. Nowhere else on earth has a beautiful land been so deeply and widely gullied.

Modern American Methods to the Rescue

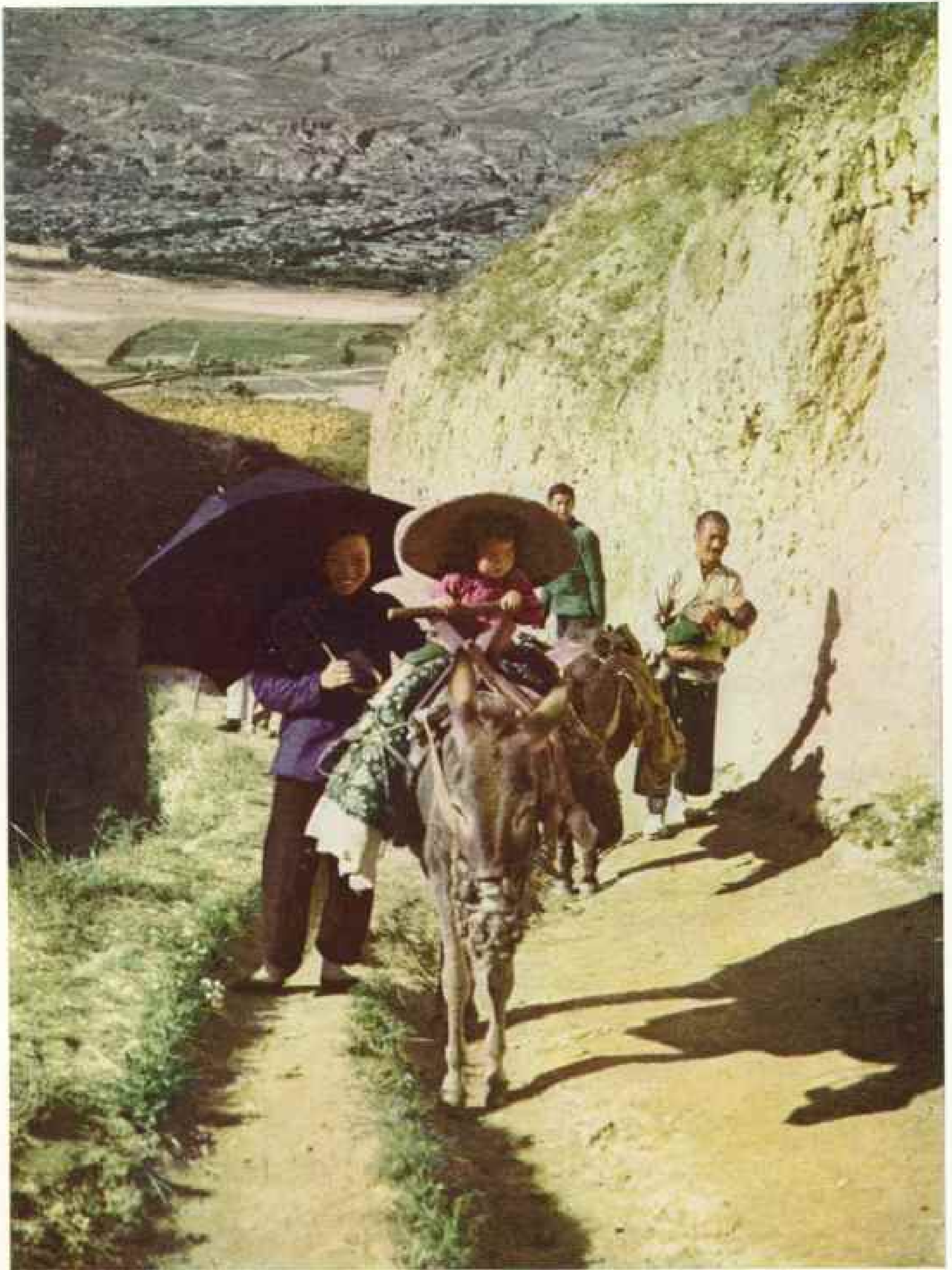
Our first work area was in the vicinity of Tienshui, southern Kansu, in the upper Wei River Valley (Plates I and III). Here we began a series of studies in detail of the condition of the land and measured up hundreds of fields after heavy rains. We put in experimental strip crops of alfalfa, rye grass, and sweet clover in mixture to discover how nearly we could get full absorption of rain by the soil on sloping land.

We discovered that there was no runoff on flat lands, for loessal soils in flat fields absorbed all the rain that fell. If all the rain could be absorbed as it falls on sloping land, there would be no soil erosion, no loss of fertilizers, no loss of beneficent rains, no silting of streams; and maximum yields in food crops would be harvested.

At the end of the 1943 rainy season, the heaviest since 1927, we found that our demonstration of narrow strip cropping on the contour with a contour channel had prevented any runoff on slopes up to 24 per cent!

The steep walls of gullies, large and small, that have cut back into the slopes through the years are a difficult and a different problem. These raw surfaces are both a loss and a menace. They yield little or no useful crop, but give rise to flashy runoff from rains that cuts and carries great quantities of earth, enlarging gullies and charging streams with enormous burdens of troublesome silt to damage other lands and interfere with flood-control works.

China Fights Erosion with U. S. Aid



© National Geographic Society

Illustrations by Walter C. Lowdermilk

Fleeing from the Japanese, a Chinese Farm Family Seeks a Home in Kansu

They have trudged for months to join relatives in the loess highlands of Free China, with all they have saved from the invader carried on one small donkey. Across the valley behind them lies Tientsin. Their oldest enemy, soil erosion, has gullied deeply the fertile slopes beyond the city.



© National Geographic Society

Many Generations of Chinese Farmers Have Benched These Highlands Southeast of Hwakiang

Though their toil has reduced erosion to some extent, gullies, mostly along field boundaries, are eating headward up slopes. Contour cultivation and bank channels would help. Concentrated by groupings of trees are five villages where the people live in caves cut into the loess. These homes are cool in summer and warm in winter.

Reproduction by Walter C. Lowdermilk

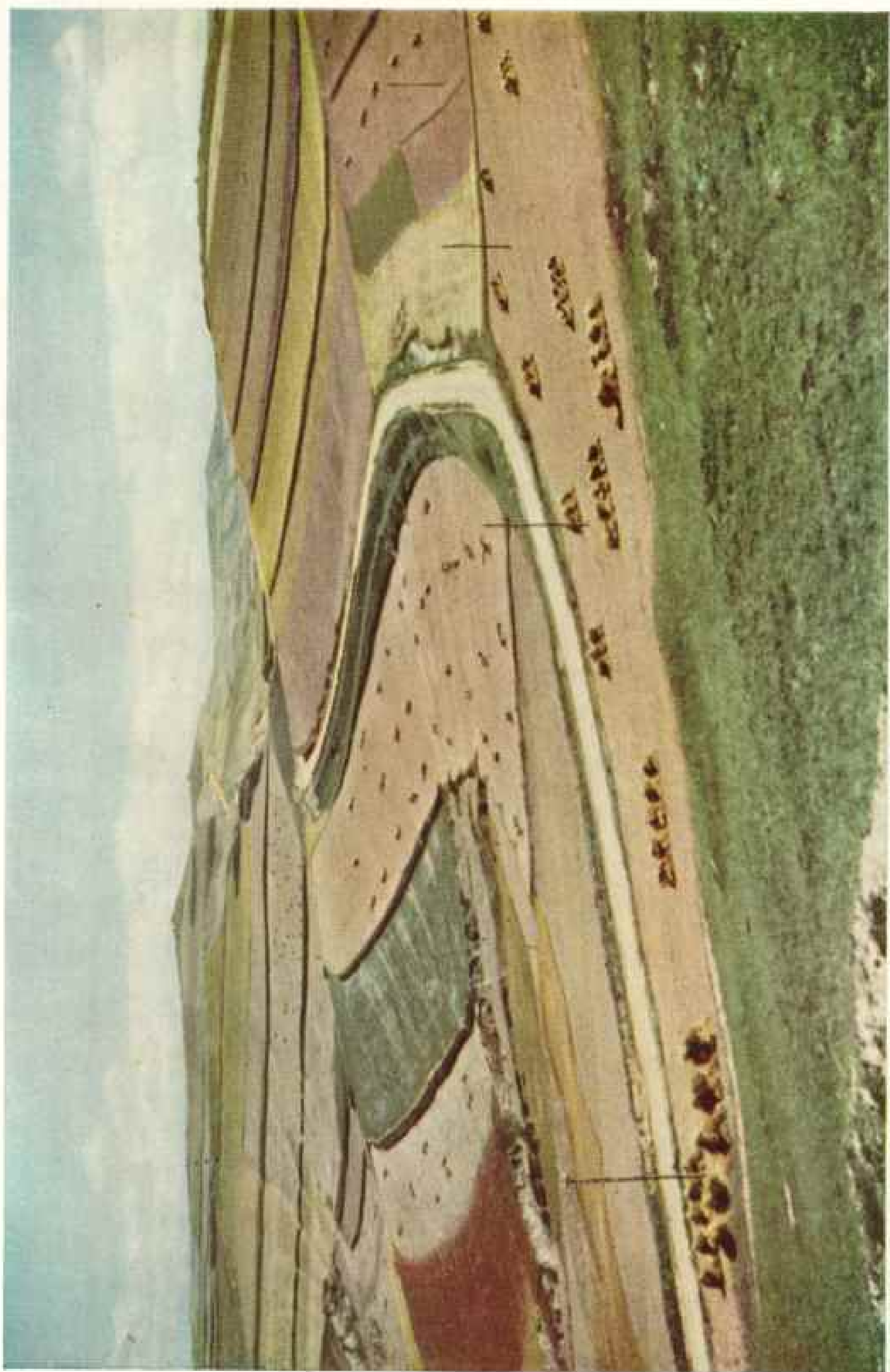


Photographs by Walter C. Lowenthal

After October Rains, Cornfields Are Plowed, Drugged, and Sowed Broadcast with Winter Wheat

This rich loessal soil near Tientsin yields two crops a year. Lacking labor-saving machinery, the farmers toil with crude implements to break up the large clods and smooth the land for hand seeding. Drills, which would give a more uniform stand of grain, are not yet available here.

© National Geographic Society

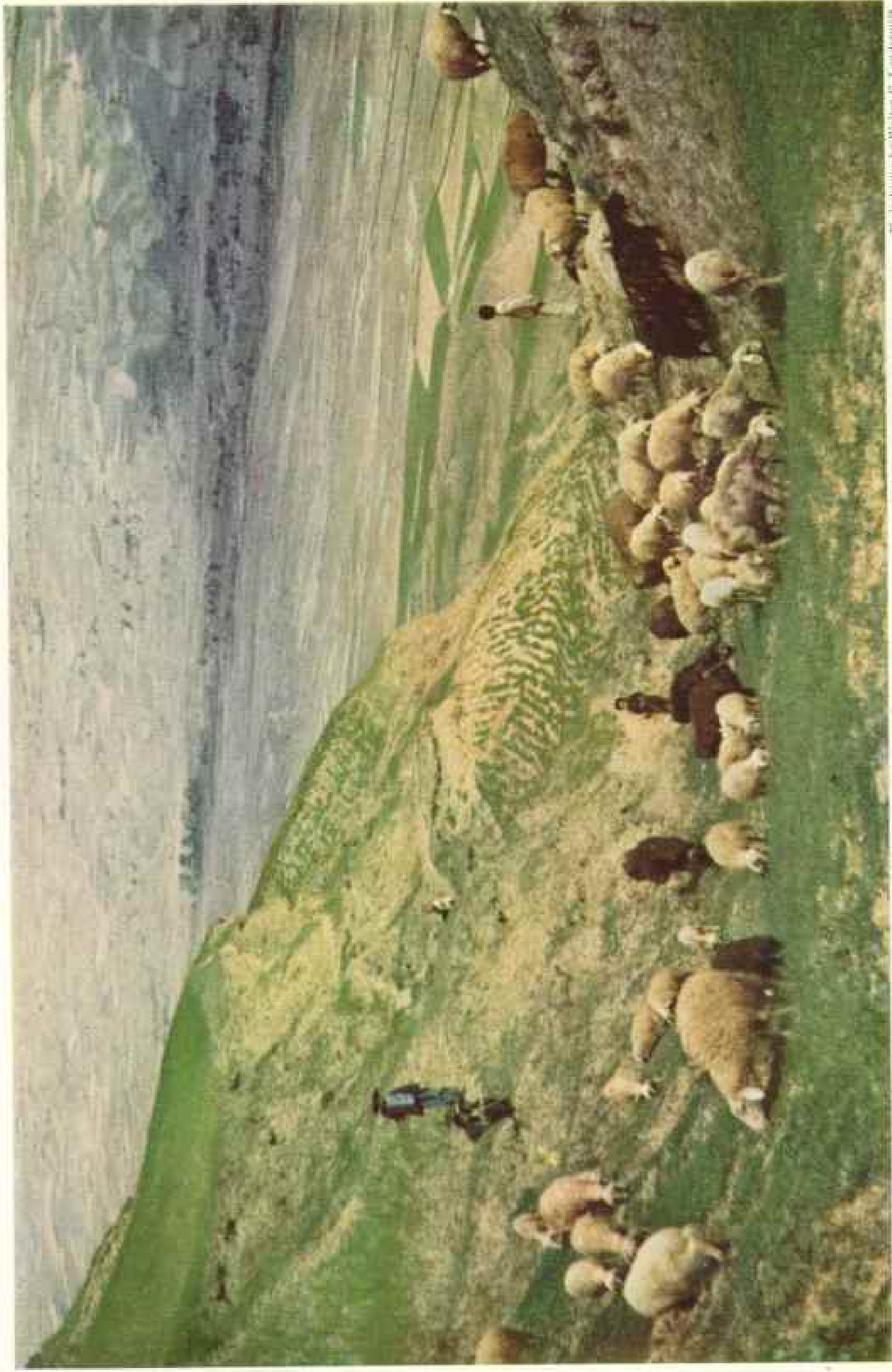


© National Geographic Society

Reproduced by Walter C. Haggard

Along the Hwakiang-Lanchow Highway Spring Wheat Has Just Been Harvested from Fields 7,000 Feet Up

Bench terracing has been started on some of these slopes, thus far not broken by gullies. On hillsides, however, corrugations show gully erosion beginning. This land has been cultivated for only a hundred years—a short time in China. Strip cropping and terrace channels on contours would control waste of soil and water.

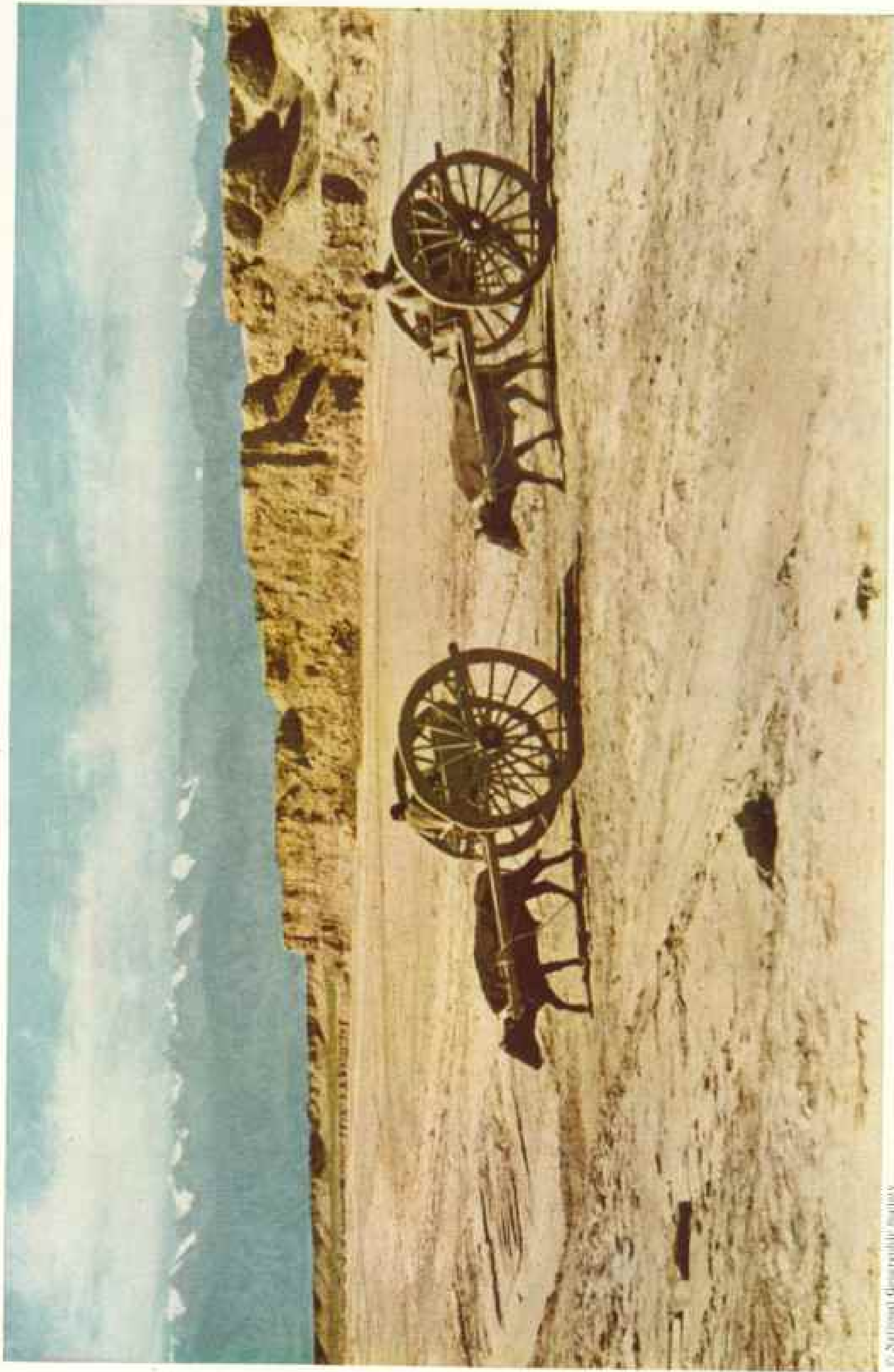


Reproduction by Walter C. Lowdermilk

Young Soldiers Away Fighting, Old Men and Boys Herd the Sheep in Southern Karsu

A flock composed of an animal or two from each household finds meager feeding on overgrazed gully slopes. Farmers strive to make the most of badly eroded hillsides along the valley of the Pi. When the river is in flood, it damages the city wall of Tiansbul in the distance.

© National Geographic Society

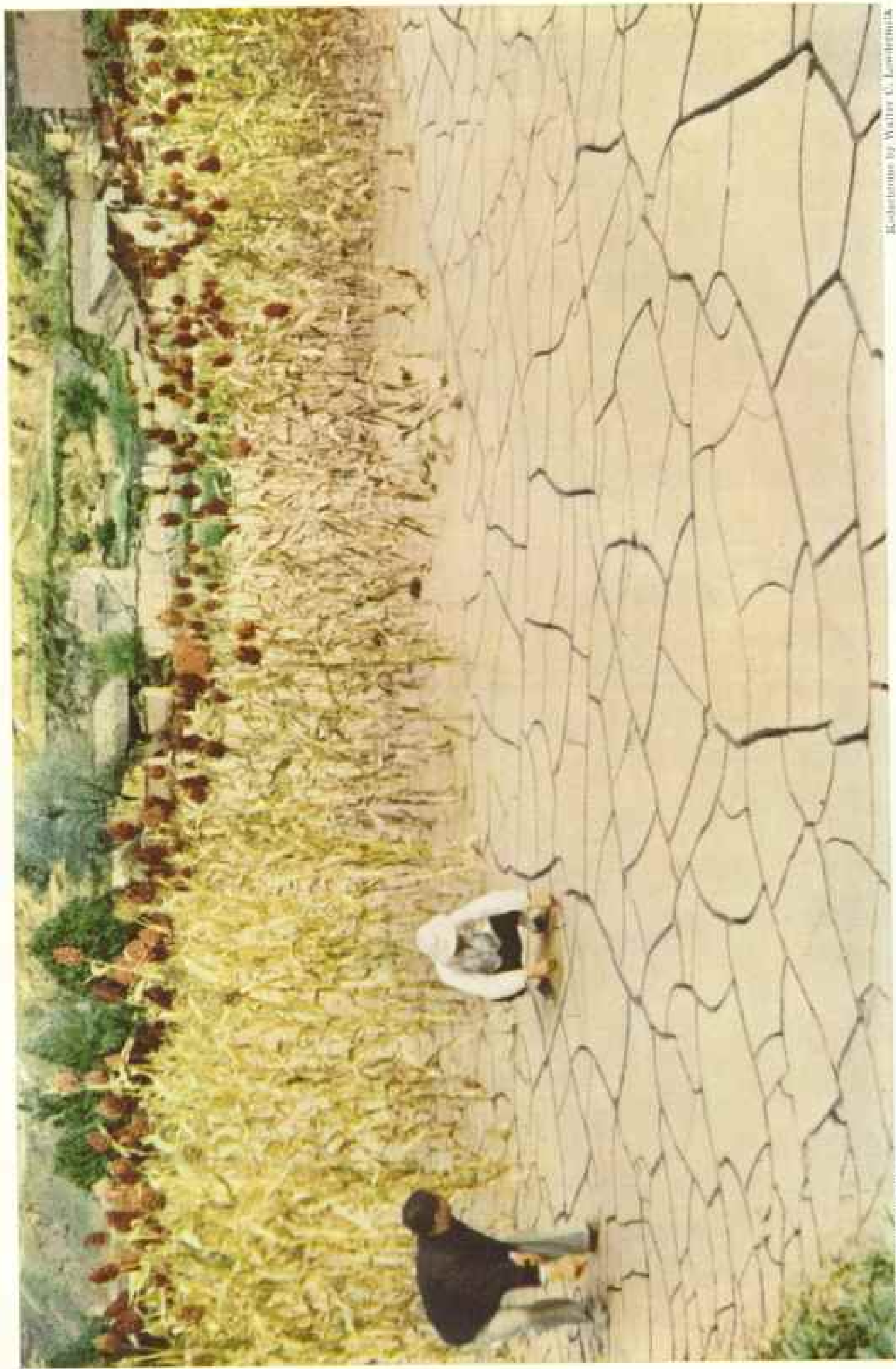


© National Geographic Society

Photographs by Walter R. Lindenberg

Farm Carts from Kuichuan Market Creek Homeward along a Dry Stream Bed on the Ancient Central Asia Silk Route

In the dust-flimed background the 19,000-foot Nan Shan rears 14,000 feet above the plains of the Corridor in northwest Kansu. Rivers roaring from the mountain wall have formed outwash fans of gravel, sands, and clays. To roll over and through chuckholes in the trail, high wheels are more practicable than those of smaller size.



Photograph by Walter C. Lentz

Mud Has Flowed Down from Storm-lashed Slopes and Dried in This Kaoliang Sorghum Field Near Tientshui

In the summer of 1943 the heaviest rains since 1927 accelerated erosion and caused severe damage. The unusual rainfall, coupled with failure of hillside soils to absorb water, caused floods which ruined many fertile farms. Here members of the author's party are measuring the extent and depth of the deposit.

© National Geographic Society



Modern Engineers Have Rejuvenated a King River Irrigation Project Begun 246 n. c. By this diversion dam Li Hsieh and an American, Oliver J. Todd, won the latest round in a 2,000-year battle with silt. The water, the consistency of tomato soup, carries from 25 to 54 per cent mud.



© National Geographic Society

Kodachromes by Walter C. Lentherin

From an Inflated Goatskin Raft Farmers from up the Yellow River Unload Melons at Lanchow. The author and his party found the fruit deliciously sweet and juicy. Markets here are filled with prize produce of all sorts. Going home, the vendors backpack their makeshift craft.

To heal the thousands of gullies where erosion is gnawing at the good earth, we worked out a novel plan for revegetation. Clay pellets containing seeds of grasses, shrubs, and trees together with fertilizer would be dropped from airplanes like incendiary bombs after soil-soaking rains. Such broad-scale seeding calls for nurseries to grow seed in quantities large enough to make up millions of pellets with marble-making machines. One nursery for this purpose was established.

Together with proposed revegetation of gully slopes, soil-saving dams are to be built by the thousands to collect silt in flat reaches of great gullies. This would build up alluvial areas suitable for farming and at the same time reduce the silt load of streams.

Stream bank protection from undercutting by floods, especially in smaller streams, is also proposed on a large scale. Needed timber for bank-protecting structures must be grown in poplar and willow plantations along streams.

South to Siking

After getting preliminary work under way at Tienshui, we traveled to Siking, the present capital of the Province of Shensi.

Siking stands in the wide alluvial plain of the Wei River on the site of ancient Chang-an, the capital of the earlier Han Dynasty some two thousand years ago. In the Tang Dynasty, A.D. 618-907, it was one of the great metropolises of the Orient. To the Tang court came embassies from the Far East and possibly from the Near East.

In the Wei River Plain are hundreds of great truncated earthen pyramids, or tombs, that date from the beginning of the Chou Dynasty. I was mystified at first as to how these memorials had been built, for nowhere did I find pits from which such vast amounts of earth could have come.

My good friend Li Hsieh, who was chief engineer of the King River Irrigation Project,* had died three years earlier. To do him honor, each farmer had brought a measure of soil from his own land to make up a memorial mound. The older mounds may well have been made in the same way. I placed a wreath on Li Hsieh's tomb.

Representatives of the Yellow River Commission at Siking led our field party to see the diversion dam built in 1935 just above the last intake of the former defunct project (Plate VIII).

Unlike the reliable Tu Kiang Irrigation Project, the King Irrigation Project has failed time after time and as often has been repaired and rebuilt. The total area of 100,000 acres now irrigated with modern works is only a

fourth of that watered under ancient works.

Silt is not mentioned as a problem in records of the King River Irrigation Project until A.D. 995, when the blocking of canals with silt was reported for prompt attention by officials. Prior to this time silt was regarded as an advantage. A Chinese song dating from A.D. 82 says, "In one *shih* [about 100 quarts] of King water there are several pecks of mud. Both irrigating and fertilizing, it makes long our growing millet, feeding and clothing the capital's vast multitudes."

After A.D. 995, reports of more and more difficulty with silt appear. The records indicate that increased cultivation of slopes caused the King River waters to carry a constantly increasing burden of silt. Nowadays the water carries up to 54 per cent mud of the time during summer rains, so that it cannot be used for irrigation.

Another problem frequently referred to in old records was a lowering of the river below the intake canal. We examined the site of the intake cut in 246 B.C. Now the river level is fully 40 feet below, showing that the river has scoured out its channel, doubtless because of higher flashy flood stages.

It was necessary from time to time to extend the intake upstream far enough for stream water to flow into the canal system. The modern diversion dam is built just above the last intake cut into the rock.

The Yellow River Commission has concluded that if floods are to be controlled in the delta plain and waters of the Yellow River and its tributaries used to the best advantage for irrigation, the enormous burden of silt must be reduced. This means a long-range program of control of soil erosion and conservation of soil and water on farmlands and revegetation of gullies throughout the vast loessal highlands.

Refugee Colonists at Hwanglungshan

We were invited to inspect Hwanglungshan (Yellow Dragon Mountain), where the largest colonization project of the Chinese Government is in operation. Many efforts have been made to locate refugees from Japanese-occupied China on farms. Colonization of empty areas of Free China has been a favorite scheme. We reached this project in central Shensi by traveling through Hancheng, where we were within rifle range of Japanese-controlled Shansi across the Yellow River.

* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Taming 'Flood Dragons' Along China's Hwang Ho," by Oliver J. Todd, February, 1942, and "Raft Life on the Hwang Ho (Yellow River)," by W. Robert Moore, June, 1937.



French Missionaries at Pui Lu Chang Have Reforested a Mountainside

Twenty years ago they planted quick-growing trees to restore the grove of an old temple they had occupied near Penghsien. Their success has demonstrated how slopes too steep for agriculture can produce badly needed timber and furnish jobs for subsistence farmers.

In a ten-day survey we talked to refugees, some on the trek, others who had settled on new farms. One family, Mah by name, had fled the flat land of Honan because the Yellow River, whose dikes were breached as a war measure, now flows over their farm. Never before had Farmer Mah cultivated sloping land; its problems were new to him.

Another refugee family by the name of Li had stopped for lunch in the shade of trees beside a clear flowing stream and were making wheat and corn bread dough for their noon-day meal as we passed. This family, including an aged grandmother, had fled Hupeh and the cruelties of the Japs.

The spirit of these people moved me. I wished the refugees *hou fu chih*, good luck. The Wang family invited us to have lunch with them, for which, of course, we paid them well, despite their protestations. They gave us millet, wild celery, fresh green leaves of trees as cooked vegetables, onion tops, and boiled eggs. We had a nourishing meal. Chopsticks were cut from slender stems of bushes near by. The hospitality of these proud people was very real and dignified.

We put in a demonstration for these refugee farmers, and more than 300 came to see their first surveyed contour furrow and to learn how to make A frames and V drags, to build broad-base terraces, and to sow strip crops. Many farmers asked help to do this work (Plates XIV, XX, and page 661).

Where the King River Gets Its Silt

After Siking our next objective was the loessal highlands out of which the King River draws its water and heavy loads of silt. We crossed the Wei River in our station wagon on the railway bridge that now serves both carts and automobile traffic. Guards close off highway vehicles when a train is coming.

We drove across the loess plateau where it is a vast undulating country lying beautifully for large-scale farming and the application of soil- and water-conservation measures. Passing the divide, we dropped by steep grades into the King Valley to Pinhsien, where dates grow large and persimmons good; thence up to Pingliang, which we made the center of a number of field studies.

After a breath-taking climb up Liu Pan Shan and down again, we reached Hwakialing, 7,500 feet altitude, a small village at the junction of the highways that connect Tienshui, Siking, and Lanchow. The China Travel Service keeps an inn there that offers simple but ample accommodations to the many passengers who must make an overnight stop.

The country about Hwakialing had special

meaning for us. The line of cultivation, which began more than 30 centuries ago in the alluvial plain about Siking, reached this high elevation only about 100 years ago, and the lands have suffered little from soil erosion (Plate II). This area lies in the spring wheat belt, where only summer crops, such as spring wheat, millet, buckwheat, and rape seed, can be grown.

About Hwakialing we found remnants of the original grassland. Forests never blanketed this part of China. The rolling stretches of this remarkably fertile wind-blown soil probably once looked much like the Palouse grasslands on the loess of eastern Washington State and Oregon. But the loessal lands of America have been cleared of grass and cultivated for only about a half century.

Farmers Fight Erosion by Benching

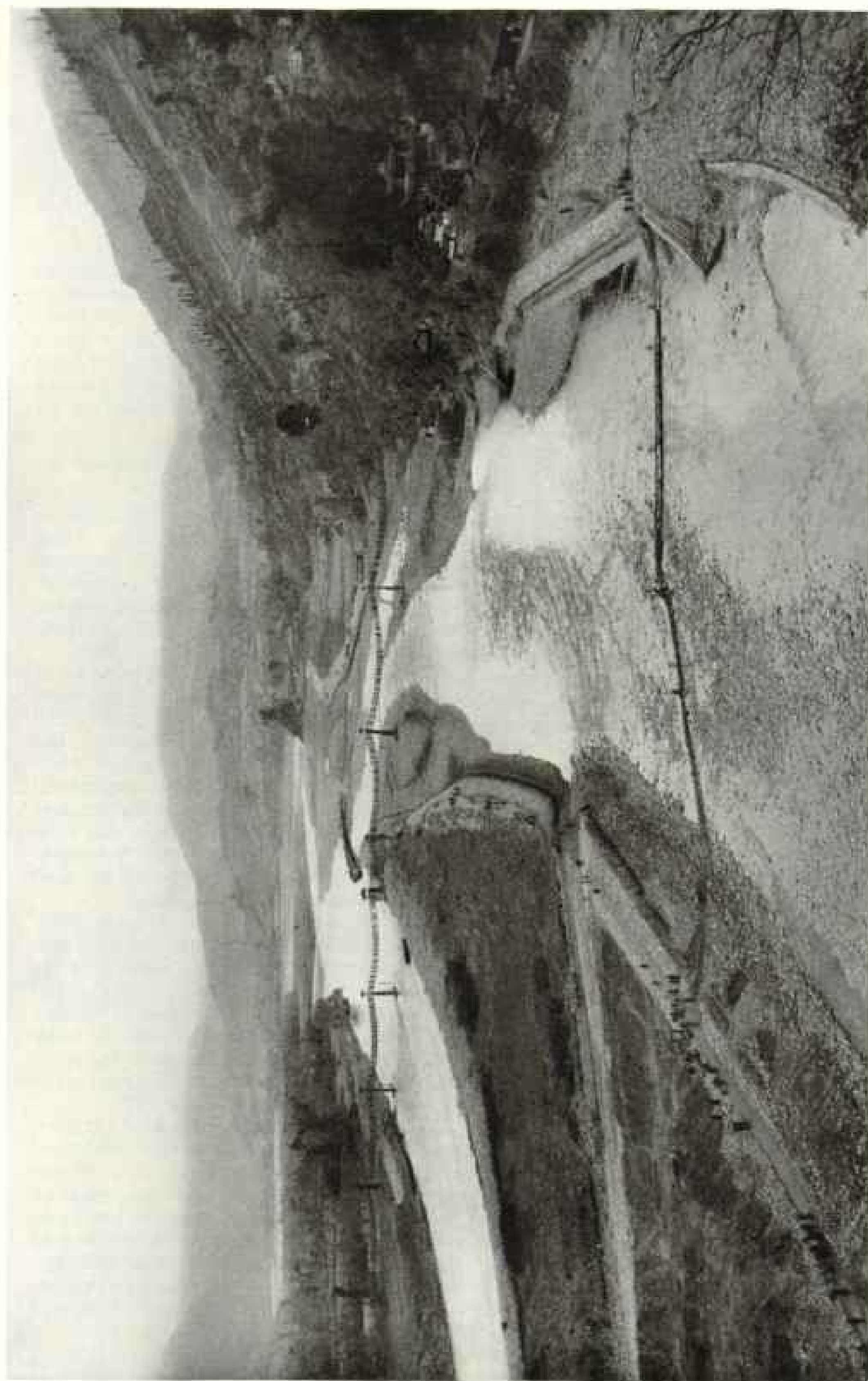
The Chinese farmer long ago developed the remarkable practice of benching his land to safeguard it from erosion (Plate XII). These bench terraces give landscapes of the loessal highlands a fantastic and unreal appearance. This measure as it has been applied has not been sufficient to prevent serious erosion damage in places, yet it has sufficed in others.

We found benching across slopes to be in accord with sound principles of soil and water conservation. In fact, we have made use of the principles in our American program. But this excellent principle, to be applied effectively, calls for exact layout with engineering instruments and for other supporting measures of contour channels and strip crops. We combined these features in the three demonstration projects set up in the course of our field work at Tienshui and out of Siking.

From the studies of land use about Hwakialing we continued our way through fantastic country as we dropped down into the Yellow River Valley at Lanchow, the capital of Kansu Province. This center of China's new frontier, the Northwest, became our headquarters for a number of surveys in the vicinity, to the Corridor and to the Tibetan grasslands about Koko Nor (Tsing Hai).

Lanchow is a center of Industrial Cooperatives. When the Japanese invaded the coastal areas, they seized or destroyed about 90 per cent of China's factories. Chinese workmen loaded tools and machine parts on their backs and transported enough to Free China to keep up a supply of small arms and other necessary war materials sufficient to hold off the enemy. These small enterprises gave rise to Industrial Cooperatives.*

* See "China Opens Her Wild West," by Owen Lattimore, NATIONAL GEOGRAPHIC, Sept., 1942.



King Kong Dike with "Fish's Snout" and Cofferdam at Its Point Separates the Channels in the Tu Kiang Project

Across the Min River at the tip of the headworks stretches the "Husband and Wife" bridge. A temporary walk at the right spans the nearly dry canal, filled with water when the cofferdam is broken (pages 646-7). A spillway cuts the dike in the left foreground. The temple to Er Wang is at the foot of the slope on right.



At Hwanglungshan Colonization Project the Author Has Contour Farming Demonstrated in a Rain-eroded Field

The plowman is throwing up a ridge on a staked line. Later a V drag will open out a terrace channel to hold excess water and carry it off slowly, preventing soil waste.



Lumberjacks Five Miles above Kwanhsien Haul Logs up a Slidway from a Boom Laid across the Min River

Overcutting has destroyed former heavy forests until the only timber for the millions of people of the Chemtu Plain comes from border mountains 200 miles upstream.



Erosion Has Not Spared Even the Great Wall of China

On the divide between the Yellow River Basin and the Gobi a monument remaining from a ruined temple bears inscriptions telling of happenings along the man-made barrier. Weather has cut away most of the earthwork and masonry, but a portion of a guard station still stands in the background.

Thousands of young men are being trained to organize and supervise these cooperative units. They are working out machinery simple enough to be made locally and yet efficient enough to give adequate output.

In the far Northwest I was much interested to find that under General Mah soldier camps were also set up as complete cooperatives. Along with military training, soldiers grow their own food, shear their sheep, card the wool, twist the thread, and knit their own sweaters, as well as pad and make their winter garments, blankets, and tents (Plate XXI).

About Lanchow we were introduced to "pebble mulching" as a means of conserving moisture in farmlands. The practice is old. It consists of the heavy task of digging out river gravels and spreading them over fields to a depth of three to four inches.

A local saying has it that the father works hard, the son lives in ease, but the grandson must work hard again. The meaning is that the farmer must work to cover his land with this mulch of pebbles. His son profits by the father's work in good crops with little work, for it is scarcely necessary to cultivate the land. But by the third generation the pebbles have become mixed with soil. They

must be removed and replaced with new ones.

The effect of this remarkable farming practice is now being studied at the Kansu Agricultural Experiment Station. The layer of pebbles causes all the rain to soak into the soil and reduces evaporation loss, thus increasing effectiveness of a scanty rainfall of about 12 inches. The favorite crops for pebble mulch are melons, watermelons, cantaloupes, and cotton (Plates VIII and XVIII).

From Lanchow we began our long-planned survey of the Corridor, which extends to the northwest to Sinkiang. Summer rains had made the road muddy out of Lanchow as we traveled along the ancient caravan route that leads across central Asia.

The Great Wall of China

Along our highway we had glimpses of remnants of the Great Wall of China, stretching like a monster serpent from horizon to horizon.* The big loop of the Yellow River separates the eastern section of the wall, made largely of stones and burned brick, from the western section, built of tamped earth. This

* See "Thousand Miles Along the Great Wall of China," NATIONAL GEOGRAPHIC MAGAZINE, February, 1923.



"Dig the Channel Deep; Keep the Spillway Low"

In these six characters Li Ping set forth the regulations for the maintenance of the Tu Kiang Irrigation Project which for more than 2,000 years has watered the fabulously productive Chengtu Plain in Szechwan. The plaque bearing his instructions occupies a ceremonial position on the great stairway leading to the altar of the temple dedicated to his son Er Wang, who completed the plans he formulated (pages 646-7).

section is more rapidly melting away with the storms of the centuries which have beaten upon it.

End to end, the wall in a straight line would be about 1,250 miles long, but in its windings it stretches 2,000 miles. It contains enough material to form a wall 3 feet thick and 8 feet high around the earth at the Equator.

We followed this western wall of tamped earth and saw that storm floods rushing out of the mountains had, in places, swept away sections of it. The Peita River is undermining the last huge tower at the westernmost end, and I jumped back quickly from where I was taking pictures when I discovered I was on a 300-foot precipice protruding far out over the gorge.

Although the Great Wall is one of the world's wonders as an engineering achievement, it is also a monument to an equally great failure of governments in times past to harmonize the economies of grazing and farming.

The elements in this age-old conflict that has cursed northwest China for two thousand years are still present. I did not see a stack of hay for winter feed of herds of nomads that must come in off the cold steppe in winter.

Improved welfare of the region calls for hay to feed and fatten the herds coming off summer ranges in the interests of farmer and nomad and of the towns.

Now this old-new part of China is having a boom. Building is going on apace in the cities of Wuwei, Changyeh, and Kiuchuan of the Corridor. Commerce is lively. Government banks are being established to give credit to new enterprises. Reconstruction in China's new frontier in this Northwest is the talk of marts and hostels as people of many affairs come and go (Plates VI and XVI).

The Tibetan Borderlands

From Lanchow again we set off for Sining, capital of the Province of Tsinghai, and to find the Yellow River where its waters are generally clear. Tsinghai Province was created in recent years by combining a portion of Kansu and northeastern Tibet.

For twenty-five years I had wanted to see Tibet's Koko Nor (Tsing Hai—Blue Lake). At last my ambition was realized. Koko Nor is a gem of sapphire set in an emerald basin bordered by green-clad mountains capped with snow.

The surface stands at about 10,000 feet and covers about 1,600 square miles. The waters are too salty to drink. It is the highest salt lake in the world.

To the nomads who graze their herds on the grassy shores and into mountain valleys, Koko Nor is a mysterious body of water, whose origin is explained in fabulous myths. They hold a superstition that boats will not float on its waters. Violent storms sometimes sweep over its otherwise placid surface.

In winter it is frozen over, and only then can hermit priests who live on its only inhabited island leave their hermitage for supplies. Koko Nor, with white sand dunes along its northern shore and set in a valley carpeted with wild flowers in vivid colors, reflected in its azure depths the lofty brooding mountains in green and crowned with everlasting snows.

Grazing Grounds for Tibetan Nomads

Here are the summer grazing grounds of many Tibetan nomads and the land of the hardy and active yak. Commerce is carried out of Tibet into bordering towns on these domesticated pack animals. Herds of yak, with packsaddles, were seen grazing along the road south of Koko Nor.

Here is the best dude-ranch country I have ever seen. All outdoors seems air-conditioned. Here is an ideal summer resort to escape the steaming heat of Chinese cities of the coastal plains when plane and automobile travel is available after the war. It will also be a scenic region for tourists from other nations.

There is no erosion of the soil in these Tibetan grasslands except for sand dunes north of the lake. Surface control is complete. We must credit the Tibetans for good management of their grasslands; so ideal for summer grazing.*

But winters are too severe in this high region for winter grazing. The nomads must find winter feed for their herds at lower elevations in sheltered river valleys. This they have done from time immemorial.

We visited a Tibetan encampment with its black yak-hair tents like black blisters on the green landscape. Proper etiquette in approaching a Tibetan tent is important, for around all tents man-killing dogs are staked in a circle. When the dogs begin to bark, the courteous thing to do is to stop.

On our visit, a woman came down to see us, for the menfolks were out with the flocks of sheep and yak. Through our interpreter, the Governor's representative made known our wishes to visit their tent. We were invited to go along and were escorted through the line of barking dogs.

Trouble threatens in this region; another Cain and Abel tragedy is beginning. The Chinese farmers are encroaching on the winter feeding grounds of the nomads down in the warmer valleys at lower elevation.

During the Mohammedan rebellion of the last century, most of the farmers were driven out of these river valleys of the upper Yellow River. Now, however, they are beginning to come back again.

They are plowing up the grass. When the nomads come out of their mountain summer grazing lands, they have no suitable places to graze their herds during the long winters.

I was told that 50 per cent of the herds died the winter before because of starvation and disease. Yet in all this region I did not see a single stack of hay.

The Yellow River Valley about Kungho is wonderfully adapted to growing irrigated alfalfa in great fields for winter pasture and hay. Stacks of alfalfa grown here would feed and fatten herds for the market in Lanchow and, in time, central China. Problems of the grazing lands are thus far given little attention in China.

We in the United States solved this problem in our West by making the two economies supplement each other, rather than allow them to continue antagonistic. A coordinated plan for this vast Tibetan grassland region would provide the farmers with quantities of cheap meat in exchange for stacks of hay for winter fodder.

Back in Chungking

Our survey, involving more than 6,000 miles of travel in northwest China and detailed studies in many localities, as well as practical demonstrations for farmers to see, was completed. We returned to Chungking to show officials colored slides of the country we had seen and explained land-use problems of these regions and presented our preliminary report.

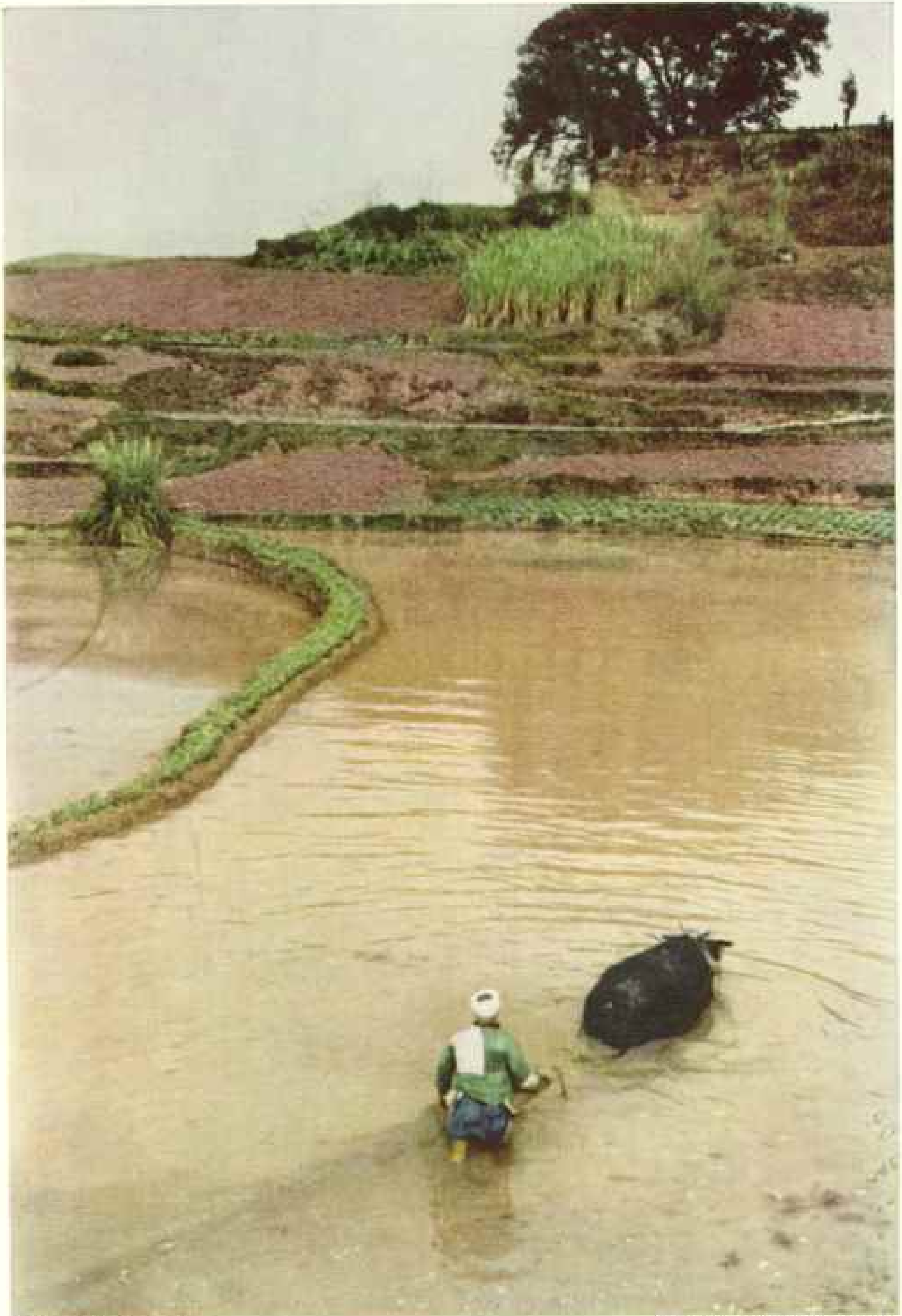
The task of working out a lasting adjustment of our respective peoples to their land resources is vital, but complex. We may well collaborate with the farmers of forty centuries and they with us in this all-important task.

Our common enemy, accelerated erosion of our land heritage, asks no quarter and we can give him none. Victory in this unending war calls for application of the best in experience and science and interest and collaboration of conservationists the world around.†

* See "Exploring a Grass Wonderland of Wild West China," by Ray G. Johnson, NATIONAL GEOGRAPHIC MAGAZINE, June, 1944.

† For additional articles on China, see *Cumulative Index to the NATIONAL GEOGRAPHIC MAGAZINE*.

China Fights Erosion with U. S. Aid

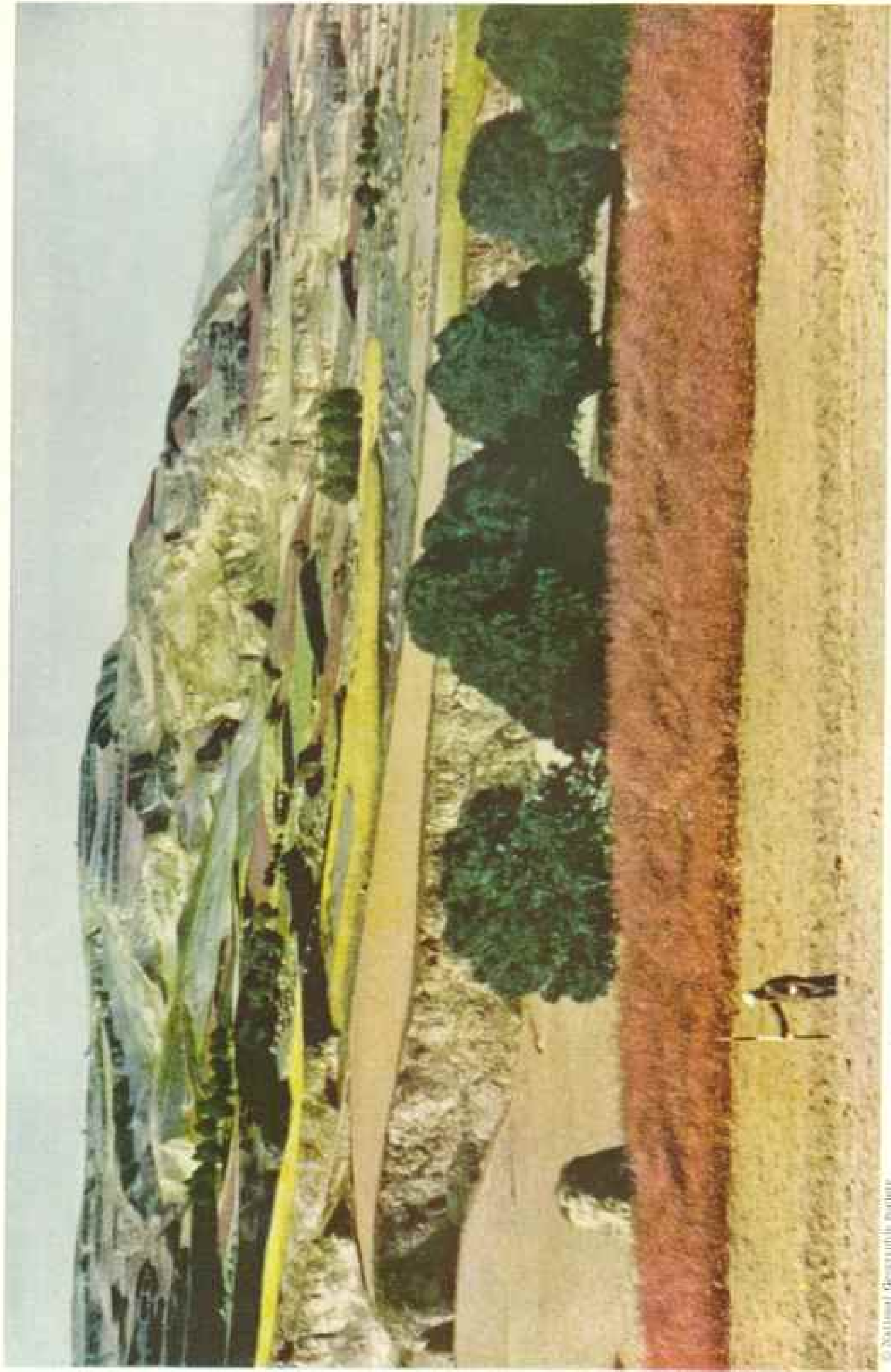


© National Geographic Society

Kodachrome by Walter C. Lowdermilk

Man and Ox Are Not Fording a Stream but Plowing a Paddy Field!

For spring rice planting they are preparing ground still in winter water fallow. A clump of sugar cane is growing in the purplish soil beyond the pond, and some plume grass on the dam.



© National Geographic Society

Reproduction by Walter C. Lowdermilk

Modern American Contour Farming and Revegetation of Gullies Come to the Rescue of Ruined Land

On this demonstration project the Chinese Ministry of Agriculture and Forestry is trying out American methods. Tsiang Teh Chi, a member of the author's expedition, is standing in a broad-base terrace channel just completed by way of example. Trees are to be planted on lower slopes, grasses on upper.

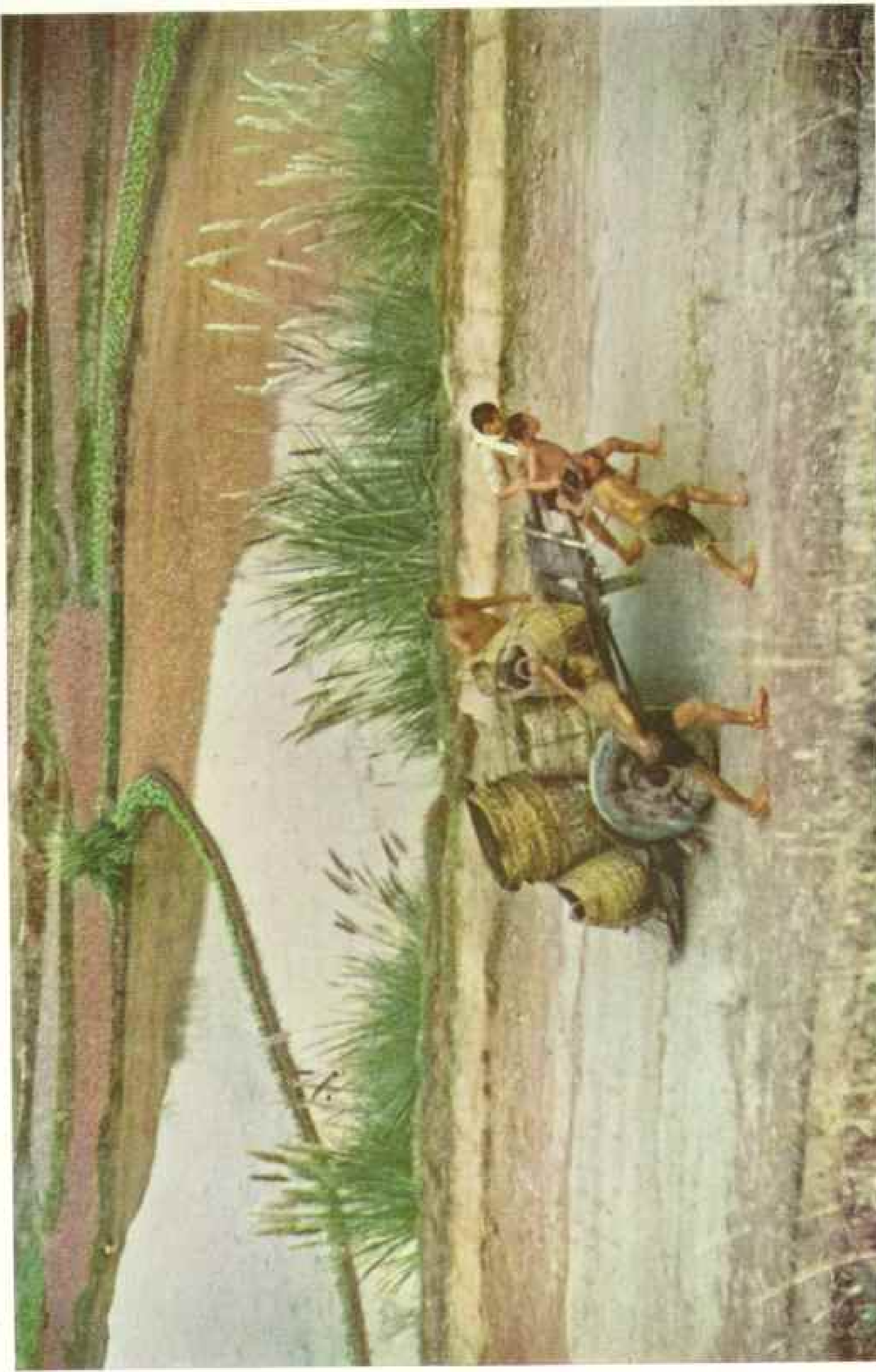
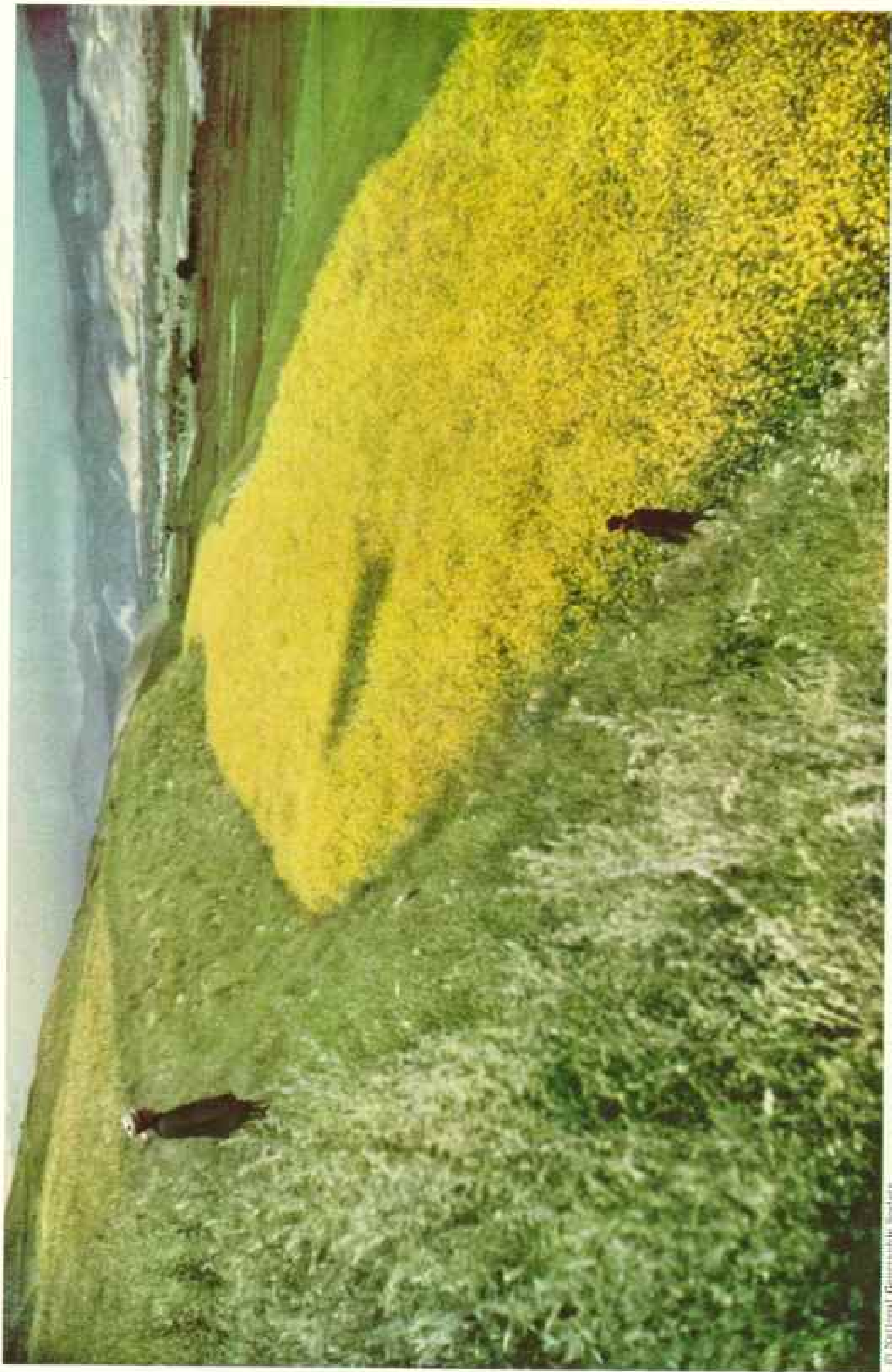


Illustration by Walter C. Lambornick

Because Draft Animals Are Scarce in Szechwan, Brawny Men Do the Hauling on the Chengtu-Chungking Highway

Drawing a rubber-tired cart laboriously up slopes and running recklessly down, they are moving a cartload of coal. Ponds at the roadside are rice fields lying in the winter water fallow. To utilize every foot of growing space, broad beans are planted along the terraces. Fringing the bank are tufts of plume grass.

© National Geographic Society



© National Geographic Society

Some of the Finest Bench Terracing Reduces Erosion in Tsinghai, North of the Provincial Capital Sining

Year by year the farmers build the dividing bank higher and make the benches flatter by plowing toward the terrace on the upper side and away from it at its base. The lower field here is planted with rape, from the seed of which a cooking oil is pressed. The Chinese use little animal fat in their kitchens.

Reprinted by Walter C. Lowenthal



Conditions of Walter C. Lowenthal

At a Roadside in the Border Mountains of Szechwan Province a Herd of Camels Get a Breathing Spell

These Bactrians, the two-humped breed, are being brought in from summer pasture for work as beasts of burden in the winter packing season. When motor trucks become available, the work will be done less romantically but more efficiently. Autumn paints this back country of northwest China with a sunburst of colors.

© National Geographic Society



© National Geographic Society

Draft Animals of the Favorite "Yellow Cow" Breed Find Ready Sale at Hwangfungsban, Shensi

Breaking the hard soil, overgrown with shrubs and trees, calls for power, which these patient beasts furnish to the plow. For more than half a century the land being reclaimed by this colonization project in North China has lain abandoned. Now refugees from Japanese-occupied country are pioneering it again.

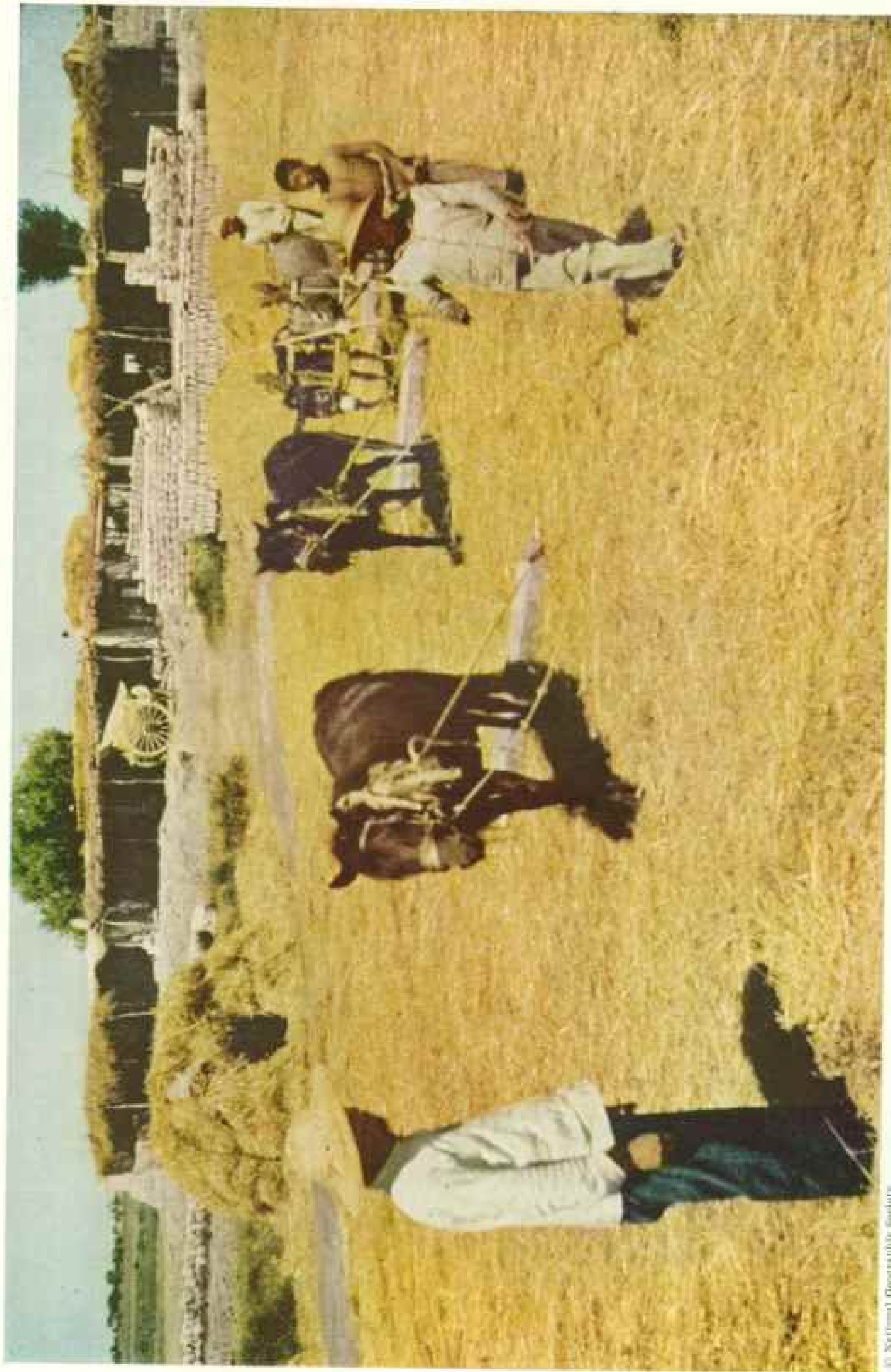
Reclutimus by Walter C. Lowndes



© National Geographic Society

Illustrations by Walter C. Lamplugh

For More Than 2,000 Years These Handmade Headworks of the Tu Kiang Project at Kwanhsien Have Prevented Floods and Famine
The men are loading a bamboo "sausage" with stones for use like riprap to bind the stream bank. The heavy timber tripods, bound together with bamboo rope, support a dam filled with stones. To open the floodgates, laborers carry off these rocks and break the contraption apart in the middle by pulling on huge cables.



© National Geographic Society

In the Kichuan Oasis All Hands Turn Out to Trample Wheat on the Threshing Floor

The method is as old as Chinese civilization. When the grain has been broken, the chaff will be winnowed by hand. Soil deposited by rivers from the Nan Shan range (Plate VI) makes this area in northwest Kansu highly productive. By American methods erosion may be controlled here and dust storms lessened.

Koching, by Walter C. Lowenthal

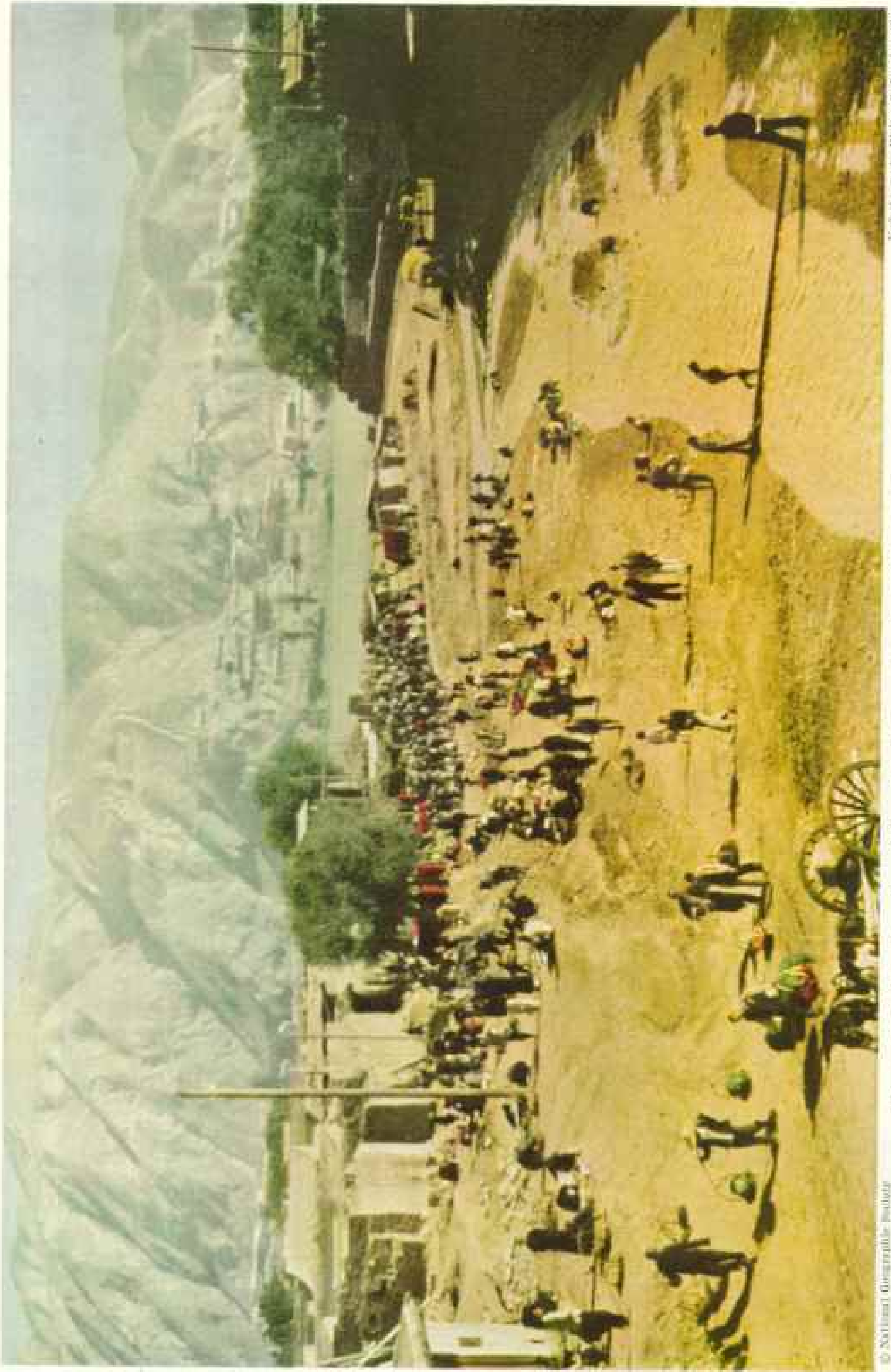


© National Geographic Society

Illustration by Walter G. Lowenthal

Man-powered Boats and Junks Carry Most of the Shipping on the Min River in Szechwan

When winds are favorable, larger craft are carried downstream by sail and current, but most of the traffic moves by oars. Upstream hauls are made by muscular "trackers," who chant rhythmically as they toil along the banks pulling on heavy towropes. This water carries less silt than is usual in China.



Photograph by Walter C. Fairbank.

Buyers Flock to Lanchow When Fruit from Up the Valley Is Brought to the Market

On rafts of inflated goat and sheep skins, the farmers float their produce down the Yellow River (Plate VIII) and offer it for sale in the town. Apricots larger than ordinary peaches, watermelons, red peppers, and other produce are displayed in the stalls.



© National Geographic Society

Because Timber for Bridges Is Lacking in China, Carters Have to Ford Streams Often Flooded

They are wading the little Pi River, carrying their vehicles as much as possible out of the swift current which heavy rains have made treacherous. Though shallow, it is strong enough to sweep a load away. Most of the hauling in this part of southern Kansu near Tientsin is by manpower, for draft animals are scarce.

Illustration by Walter C. Landers



© National Geographic Society

Soldiers and Farmers of Hwanglungshan Bid Farewell to the Author and His Party

Waving flags bearing promises to carry out soil- and water-conservation measures on the newly opened farms of the colonization area in Shensi Province, they express their gratitude to the engineers who directed the project. These intelligent people are eager to try new methods of agriculture (Plate XIV).

Illustration by Walter C. Lowmyer, Ill.

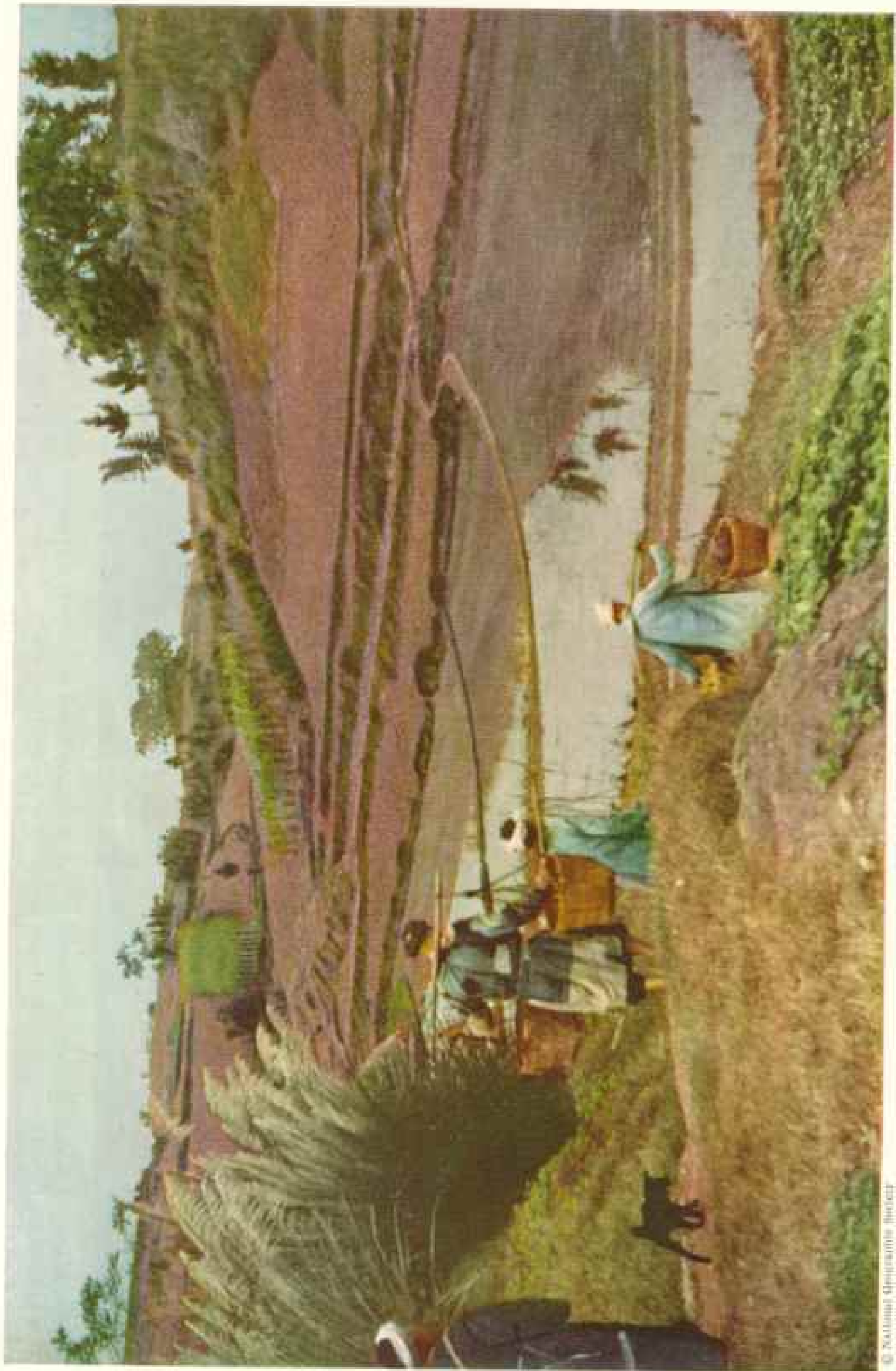


© National Geographic Society

Illustration by Walter C. Benbow

In Remote Tsinghai Soldiers of Governor Mah Bu Fang Stand in Military Formation to Spin Wool for Their Own Uniforms!

Their station at San Chow Chen, northwest of Hwangyuan, is far from manufacturing centers. To keep themselves fit for the defense of China, they have learned not only spinning, but carding, weaving, knitting, and sewing. The work is not "kitchen police," but a regular part of the daily routine.

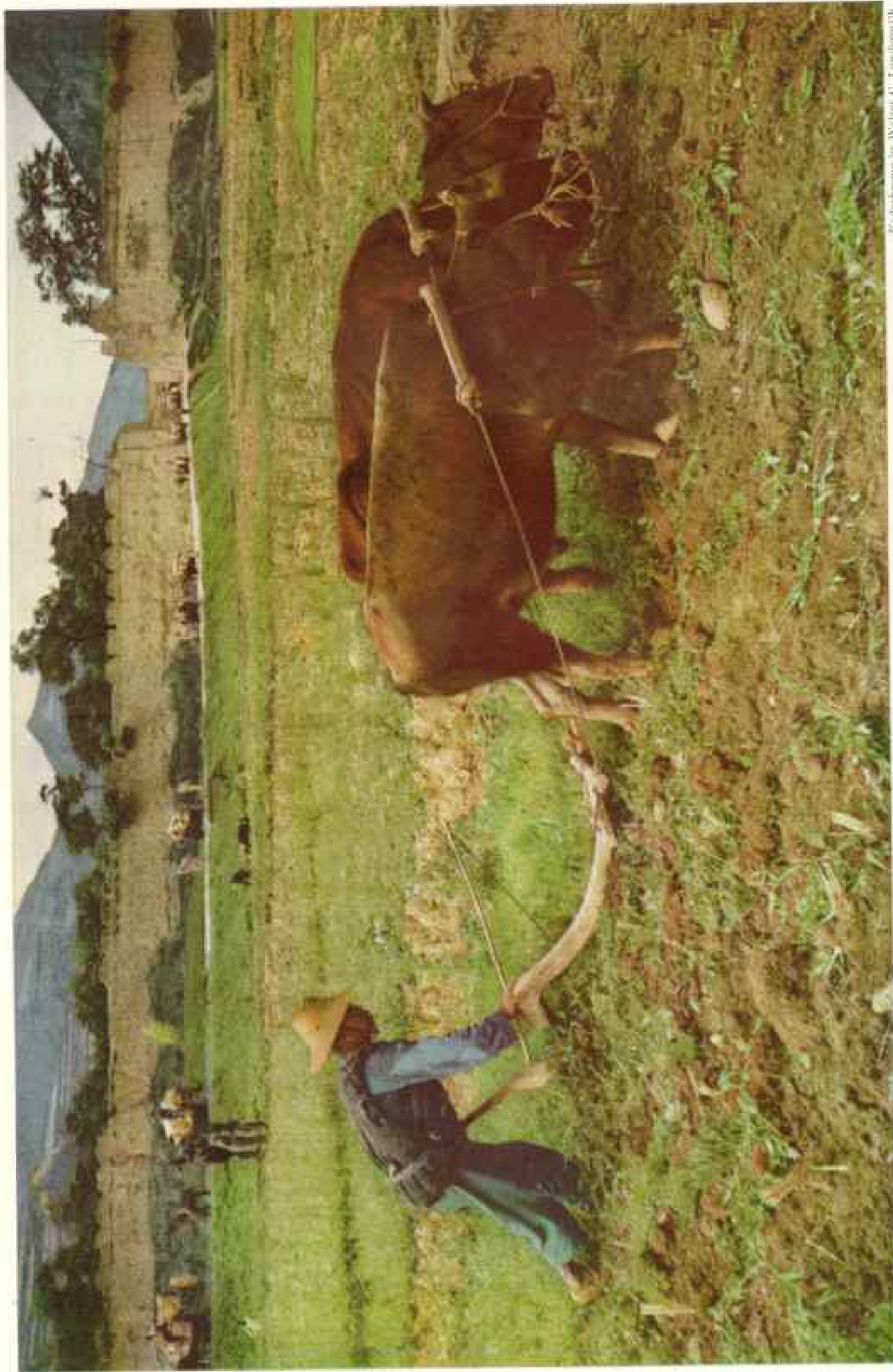


© National Geographic Society

Near Tzechum, Szechwan, Winter Finds the Paddy Fields Flooded in Water Fallow

Surrounding slopes of the famous "purple-brown" soil of the Red Basin support in cold months sugar cane, broad beans, and rice. As soon as spring opens, the inundated plots will be plowed (Plate IX) and planted to the cereal which feeds more people than any other crop in the Orient.

Photograms by Walter G. Judd and Mack



Goosehead to Walnut C. Letcher's

Near the Main Highway to Sinking Tough Alluvial Soil Is Still Broken with Crude Equipment

The wooden plow has to be held down to keep its depth. For such toll oxen of the "yellow cow" breed are the best draft animals (Plate XIV). Though this field is almost under the shadow of the walls of ancient Fenghsien, Shensi Province, the farmer can obtain no modern implements.

© National Geographic Society



Stone Rollers, Round or Square, Are Threshing Aids in the Wei Valley

Around Siking, Shensi Province, wheat is the principal cereal crop, for rainfall here is insufficient for rice. This farmer's draft ox is of the "yellow cow" breed (Plate XIV).



© National Geographic Society

Koshirumun by Walter C. Lowdermilk

At Kunglio Village Red-robed Lamas Meet with Farmers and Merchants

Chinese are beginning to migrate into this sheltered valley of the Tibetan grasslands in Tsinghai Province. Monks of the Red Sect, unlike those of the Yellow Order, are permitted to marry.

Stilwell Road—Land Route to China

BY NELSON GRANT TAYMAN *

TODAY hundreds of trucks in steady procession are carrying the sinews of war over the Stilwell Road, the Ledo-Burma Road which was renamed by Generalissimo Chiang Kai-shek in recognition of General Joseph W. Stilwell.

These heavily laden trucks are dramatic proof of U. S. Army Engineers' resourcefulness. The town of Wanting, on the China-Burma border, recaptured from the Japanese in January, 1944, may be likened to a beach-head. It is China's "back door," opening wide the land route of invasion.

The Stilwell Road, China's new lifeline, is a combination of the new Ledo Road, built by the U. S. Army Engineer Corps, and the Chinese-held portion of the old Burma Road. The Ledo Road links northern India and Yunnan Province with an all-weather highway for the first time in history.

I had a part in its building, for I spent three months in Burma and China, determining the type and location of major bridges on both the Ledo and Burma Roads.

Roads are indispensable to the network of communications and supply which is essential for a sustained offensive against the Japanese in China.

Flying "the Hump"

Before the Stilwell Road was opened, every ounce of fuel for the B-29's, equipment and supplies for our Army, and critical materials for Free China's 200 million fighting men and civilians had to be flown to their Chinese destinations over one of the world's loftiest mountain ranges. "The Hump" our aviators call this hazardous section of the route between India and China.

Peaks towering 15,000 feet are common; many rise more than 17,000. To negotiate the crossing, planes frequently climb well over 16,000 feet.

This air lift means costly transportation. A Liberator bomber, serving as an aerial "oil tanker," starts from an Indian base with four tons of gasoline. By the time it climbs skyward, crosses the Hump, and descends to its destination, it has only one ton of fuel available for delivery. Its motors eat up the other three making the round trip.

Today a pipeline reaches far into Burma and soon will extend across that country into China. This pipeline now carries aviation gasoline from Indian ports directly to airbases near the China border. The story of its construction through the jungle rivals in romance

that of the Ledo Road (pages 692-694).

When I was in Burma I saw the pipeline being built. C-47's flew the pipe into the jungle. I saw pumping stations going up along the line. U. S. Army Engineers conceived this idea more than two years ago.

Pipeline, pumping equipment, and engineer building methods have all been battle-tested in Africa, Italy, France, and the Pacific.

Before the Japanese occupied Burma, supplies for China from overseas were unloaded at Rangoon, sent northward by rail to Lashio, and then were transported to Kunming, Yunnan Province, over the Burma Road, China's lifeline.†

With Burmese ports and the railhead at Lashio in Japanese hands and the Burma Road cut, a new route had to be mapped. So American supplies were unloaded at Calcutta, sent by rail up the valley of the Brahmaputra to numerous airfields, and then flown across the Hump.

New Road Starts at Ledo

The rail line from Calcutta ends seven miles east of Ledo, Assam, where the new Ledo Road begins. Crossing the Patkai Range into Burma, the highway pushes southward toward Mogaung, Myitkyina, and Bhamo (page 682).

As fast as the jungle was cleared of Japs, U. S. Engineers extended the road, until it hooked up with the old Burma Road east of the Irrawaddy River.

Together with the string of airfields which make possible the air supply route across the Hump, the Ledo and Burma Roads (now jointly called Stilwell Road) form the skeleton around which we are building the structure for large-scale operations.‡

I traveled with Lt. Col. George H. Taylor, of the War Plans Division, Office of the Chief of Engineers. We left the United States in January, 1944, flying by way of Brazil, Ascension Island, Africa, Arabia, the Arabian Sea, Karachi, New Delhi, Agra, Calcutta, and Chabua, one of the airports from which our flyers take off to cross the Hump.

I could have continued on to Ledo by rail.

* Mr. Tayman, bridge engineer, is attached to the Theater Branch, War Plans Division, Office of Chief of Engineers, U. S. Army.

† See Map Supplement, "China," with this issue of the NATIONAL GEOGRAPHIC MAGAZINE.

‡ See "Burma Road, Back Door to China," by Frank Outram and G. E. Fane, NATIONAL GEOGRAPHIC MAGAZINE, November, 1940; and "Burma: Where India and China Meet," by John LeRoy Christian, October, 1943.



U. S. Army Signal Corps, Official

The Stilwell Road's First Truck Convoy Makes Up at Ledo Railhead

Ambulances, jeeps, and mobile artillery also take part in the first full-scale overland trek into China for 2½ years. Destination of the convoy is Kunming, about 24 days and 1,000 miles away. The tracks are in the Likhapani yards of the Bengal and Assam Railway, 7 miles east of Ledo.

but I chose the lesser of two transportation evils and went by jeep. The railroad, of meter gauge, is equipped with little 5-ton-capacity wagons and third-class coaches. Every train that pulled out of Chabua was jammed with natives. An American soldier with whom I watched one of these trains chug away remarked, "They ride everything but the whistle!"

Incidentally, there is a sign in the Army recreation hut at Chabua telling GI's they may take away any magazine except the NATIONAL GEOGRAPHIC.

The highway from Chabua to Ledo is a one-way affair, surfaced partly with asphalt. The road winds through rolling countryside past hundreds of tea gardens, each fenced and planted in orderly rows. Laborers among the green, hedge-like plants worked with one hand while the other gripped an American-made sun umbrella.

Most of the tea-plantation laborers were natives of the Darjeeling area. Except for small crews maintaining the gardens, the bulk of the Darjeeling workers—some 12,000 to 15,000—were under contract to the American forces building the Ledo Road.

They toiled through the blazing heat of the dry season and the flooding rains of the monsoon with admirable stoicism. The work was tough, but they never complained. They were housed along the side of the road in village camps of bamboo huts which once quartered General Stilwell's Chinese troops.

Elephants Help Road Builders

At intervals along the Chabua-Ledo highway, I saw elephants hauling timber to the roadside for American trucks to carry off for use on the Ledo Road. The elephants are owned by native lumbermen under contract to furnish teak and other hardwoods to the U. S. Army Engineers.*

Ledo is a bustling little frontier town. Its relation to Burma today is somewhat that of Pittsburgh in colonial America. It is a frontier town, a jumping-off place into uncharted wilderness for the most part. And it has the atmosphere of a frontier town.

In peacetime Ledo was the tea center of Assam. It had a normal population

* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Working Teak in the Burma Forests," by A. W. Smith, August, 1930.



U. S. Army Air Forces, Official

GIs Find a Snack Bar, Games, and Reading Matter in Chabua's Recreation Hut

U. S. Army Air Forces ground crews relax in this enlisted men's dayroom in Assam after working on their planes, destined for "over the Hump." Here Mr. Tayman noted a sign advising the men that they could take away any magazine except the *NATIONAL GEOGRAPHIC*.

of 2,000, small but surprisingly cosmopolitan. There were British tea growers and other commercial representatives, natives of Assam and other Provinces of India, and a scattering of Mongols, Tibetans, Burmese, and Chinese.

The main street, lined with native bamboo huts and tin-roofed godowns, the tea-storage houses, parallels the railroad from Chabua, about 40 miles away. Ledo is the end of the long rail supply line from Calcutta up the Brahmaputra River Valley.

The tea business is at a standstill now because the needs of war must be served first. The real business activity of Ledo has shifted to the native bazaar, covering three blocks of one of the side streets. The natives, thanks to the Ledo Road, now have more money than they've ever seen before; trading is brisk.

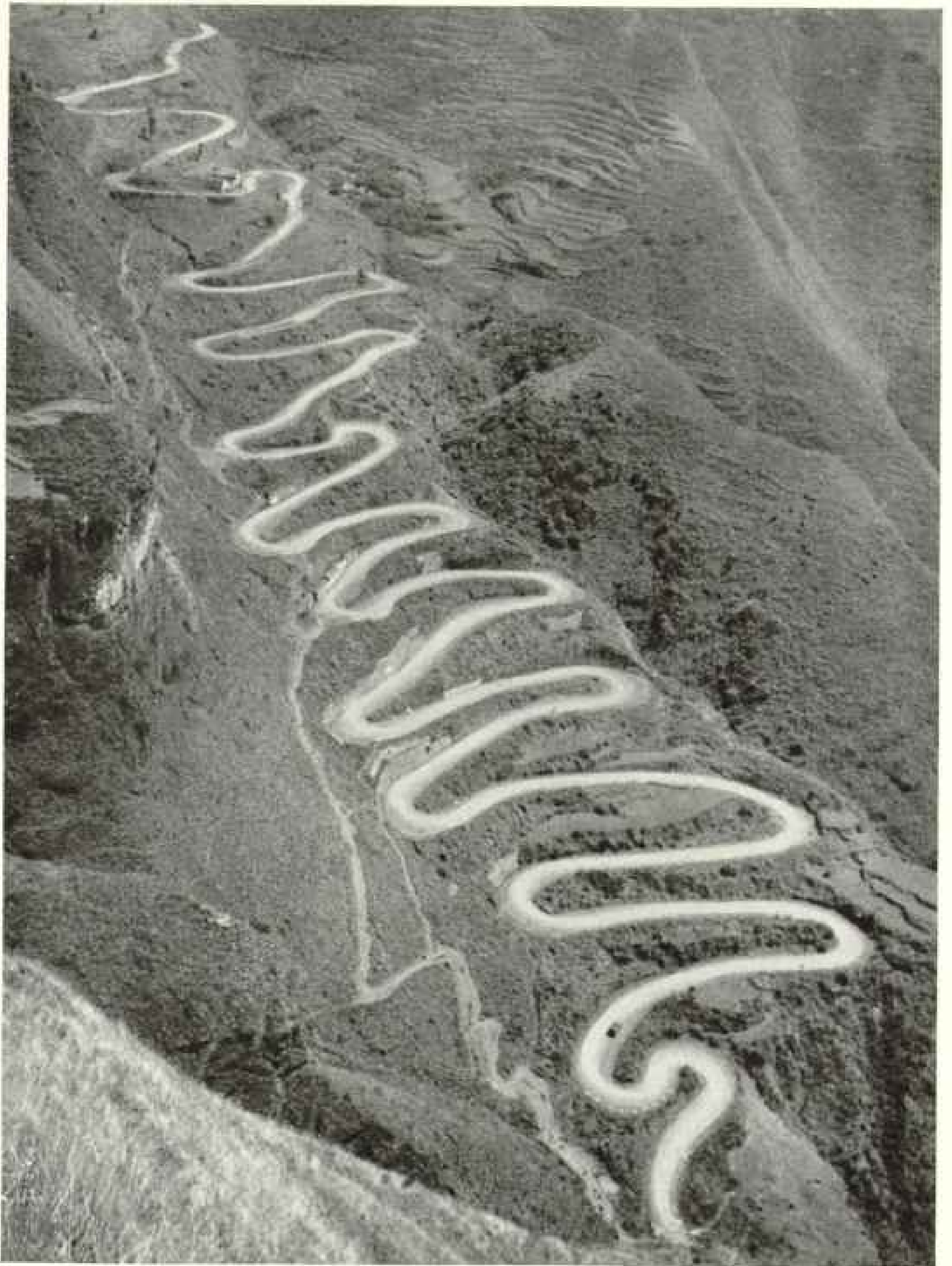
I bought some shoe polish, paying 95 cents for a can which would have cost 10 cents in the United States. Even then I had to dicker a little. The seller asked \$1.25.

The variety of goods for sale is amazing. Traders come from Tibet with hides. Large quantities of manufactured goods from India are on display.

Good customers are the American Negro Engineer troops and Chinese troops who came out of Burma with General Stilwell on his epic retreat in 1942.

These Chinese soldiers, under American command and fed and clothed by the United States, showed an average gain in weight of 25 pounds soon after they arrived at Ledo.

Trading was in British, United States, Chinese, and Indian money, but none of this currency was so sought after as Japanese invasion money once the Negro troops discovered it was for sale. So eager were these lads to buy up the worthless Japanese currency, brought into Ledo by enterprising Chinese merchants, that they were willing to pay up to \$3 for a single bill. They wanted to send the money home as souvenirs.



U. S. Army Signal Corps, Official

With Snake-like Turns the Chinese Section of Stilwell Road Climbs a Mountain

Up the steep hillside in 24 tight switchbacks the pass corkscrews, avoiding as many life-giving rice terraces as possible. Stilwell Road, new name given by Generalissimo Chiang Kai-shek to the combined Lodo-Burma Roads between India and China, was opened in January, 1945, after the Japs had been driven southward in Burma.



C. R. Army Signal Corps, Official

Lead Jeep of Stilwell Road's First Convoy Crosses the Burma-China Border

Brig. Gen. Lewis A. Pick, builder of the Ledo section of the road, which his troops dubbed "Pick's Pike," sits beside the driver. When the convoy reached the border town of Wanting on January 28, 1945, T. V. Soong, brother of Mme. Chiang Kai-shek, cut a tape across the road and the trucks passed onto Chinese soil.

I brought back with me several Chinese \$100 bills—worth about fifty cents each when I arrived in the United States.

The Ledo Road starts with the main street of the village of Ledo, a stretch of ten miles which the British improved with some asphalt covering.

Before the Americans arrived, the highway beyond this section was little more than a foot trail snaking off into the Naga Hills. Now there is a wide graveled highway to take the heavy loads of military convoys.

The colorful Naga head-hunters who live in the hills around Ledo bear a striking resemblance to our own American Indian. They have the same copper coloring, high cheekbones, and hooked noses, and they walk with a natural grace.

Whether in the wilderness of the hill country or in town, they habitually move in single file. The men wear loincloths; the women, varicolored sarongs and shawls.

It is almost a breach of etiquette for a Naga to be caught without his knife, a murderous-looking weapon with a 20-inch blade that curves toward the end and is even more formidable in appearance than the storied Gurkha knives which have slit many an Axis throat in this war.

Some Nagas also carry quivers of blow darts. Although intended for hunting animals, Naga darts have been found in dead Japanese in the jungles of eastern Assam.

Nagas Rescue American Airmen

The Nagas like Americans. One reason may be the offer of one hundred rupees for every Allied flyer rescued from the jungle. With nice impartiality, the Nagas also are willing to supply Japanese for the same fee.

While I was at Ledo I saw a group of Nagas bring in seven American airmen who were forced to parachute when their transport ran into difficulties over the high mountains.



F. S. Army Signal Corps, Official

Indian Boys and Girls Scramble for a Handout of C Ration Biscuits

Palms uplifted, they greet a carload of U. S. Army Engineers whose train has halted on the Bengal and Assam Railway. The men go by train to Ledo, thence by truck and bus to the scene of road-building operations just behind the front lines in Burma (page 682).



U. S. Army Engineers

U. S. Negro Troops Inflate a Rubber Float for a Pontoon Bridge

This supply depot is temporary headquarters for their Army Engineers' unit. Negro soldiers, who made up 65 percent of the 15,000 American troops in Burma, did yeoman service building the Ledo Road. At night they filled the air with plantation songs and "boogie-woogie."

These Nagas were feted and paid their seven hundred rupees of silver.

Then, instead of beginning their hike back up to the hills, the group lingered so long that someone asked why they didn't go home.

Their spokesman said they wanted to see the nesting place of the "roaring giant birds" that flew over their country. The Naga delegation was taken by motor to an American airfield. The loin-clothed visitors stood with folded arms in complete silence for fully half an hour as they watched the big planes land and take off (page 689).

Only visible sign of excitement was the increased tempo of their jaw movements as they chewed betel nut. Then, their curiosity satisfied, they fell again into single file and returned to the jungle.

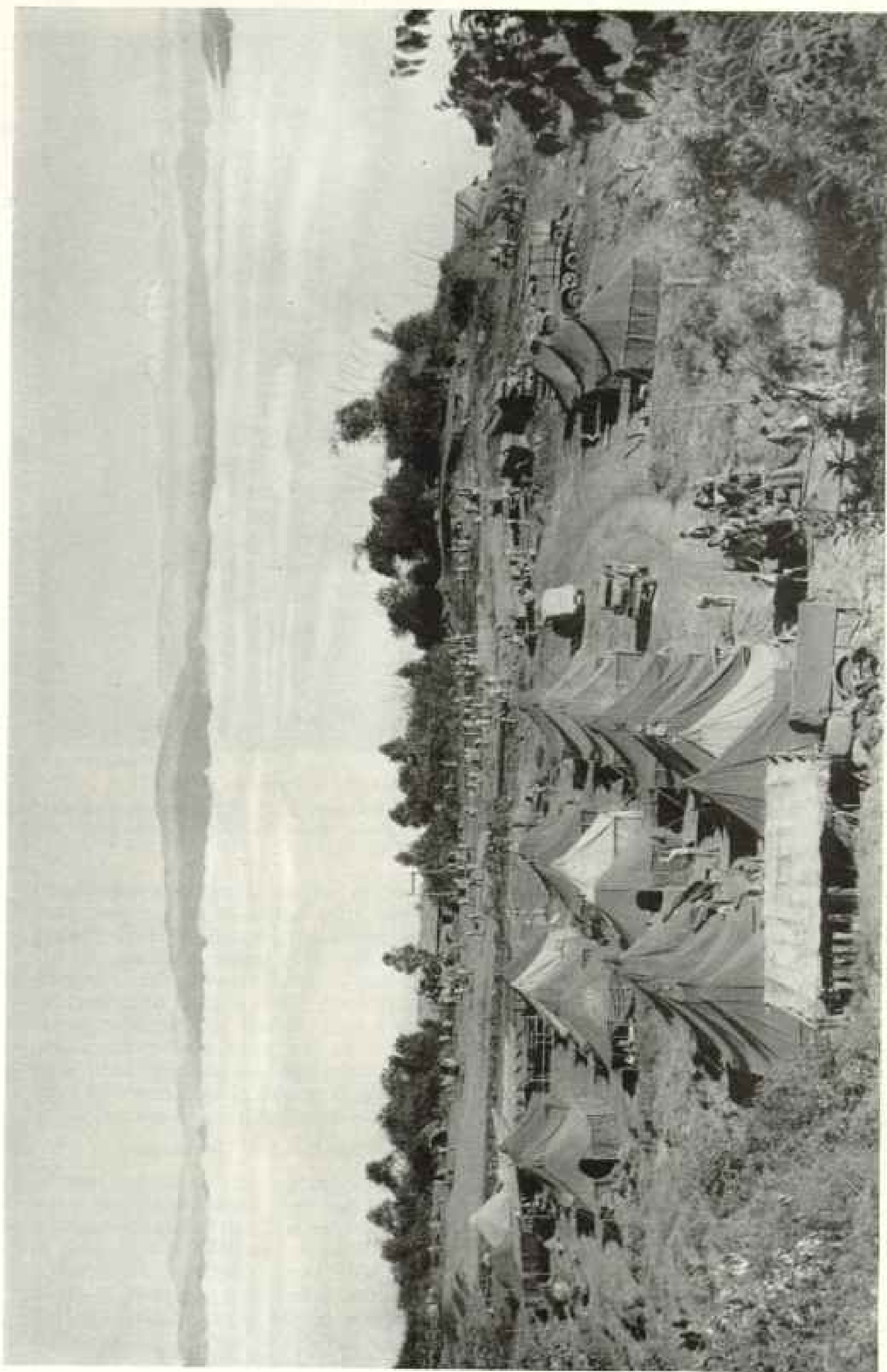
Isolation is ended in Upper Burma, too. Naga tribesmen got a close-up of a B-29 Superfortress while it was still a mystery plane to Americans.

Never in all my engineering experience, including Army service in the last war, have I seen anything to match the Ledo project for plain and fancy terrain problems.

The road is carved out of earth; its foundations are earth; there is little or no rock to provide a solid roadbed. At numerous points it had to be contoured around mountains, where it resembles an earthen bench with sheer drops thousands of feet below and overburdens towering hundreds of feet above.

The Road of 700 Bridges

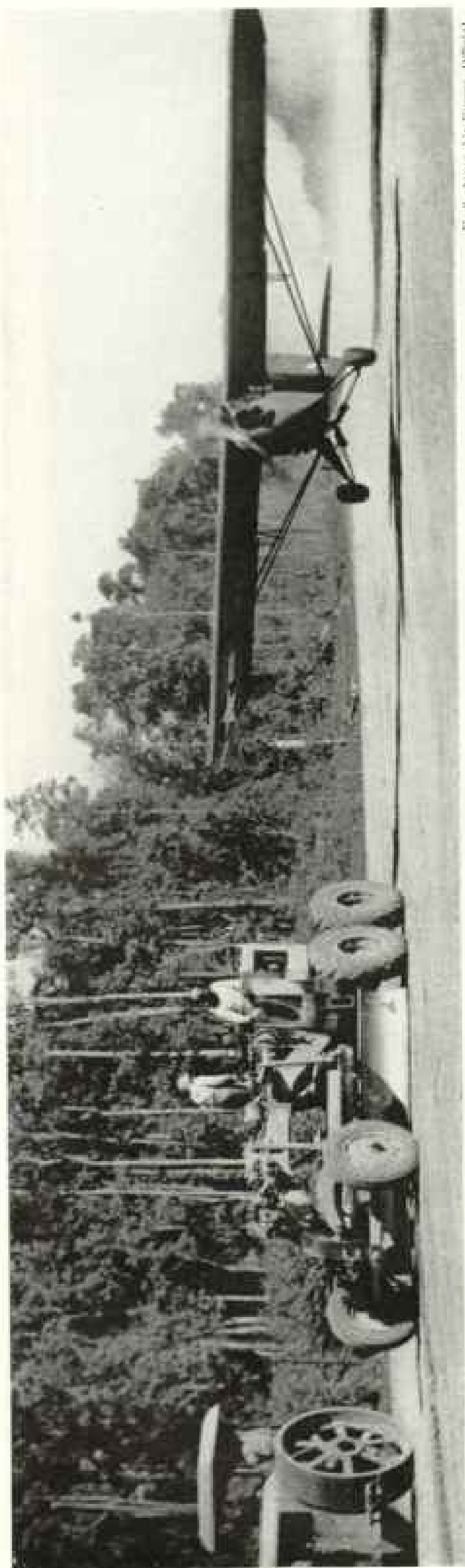
The mountains, devoid in all but rare instances of any rock formation, present pressing maintenance problems during the monsoon period. However, earthslides are easier to contend with than rockslides. Whenever a slide occurs, a bulldozer moves in to cut a new section of the road. Fortunately the slopes are heavily forested, a condition which to some extent retards slides.



Chinese Coolies Transform Burmese Wilderness into a Hand-built Airstrip above the Clouds

They carry baskets of earth from the hillock at right to fill in the strip at extreme left. U. S. Army Engineers make themselves at home in the tent village. One, center, chaps wood for the cookstove. Today, transport planes stop at this field to refuel as they wing between China and India.

U. S. Army Air Forces, official



U. S. Army Air Forces, Official

Out to Spot Japs, This Cub Liaison Plane Takes Off from a Roadside Landing Strip in Burma

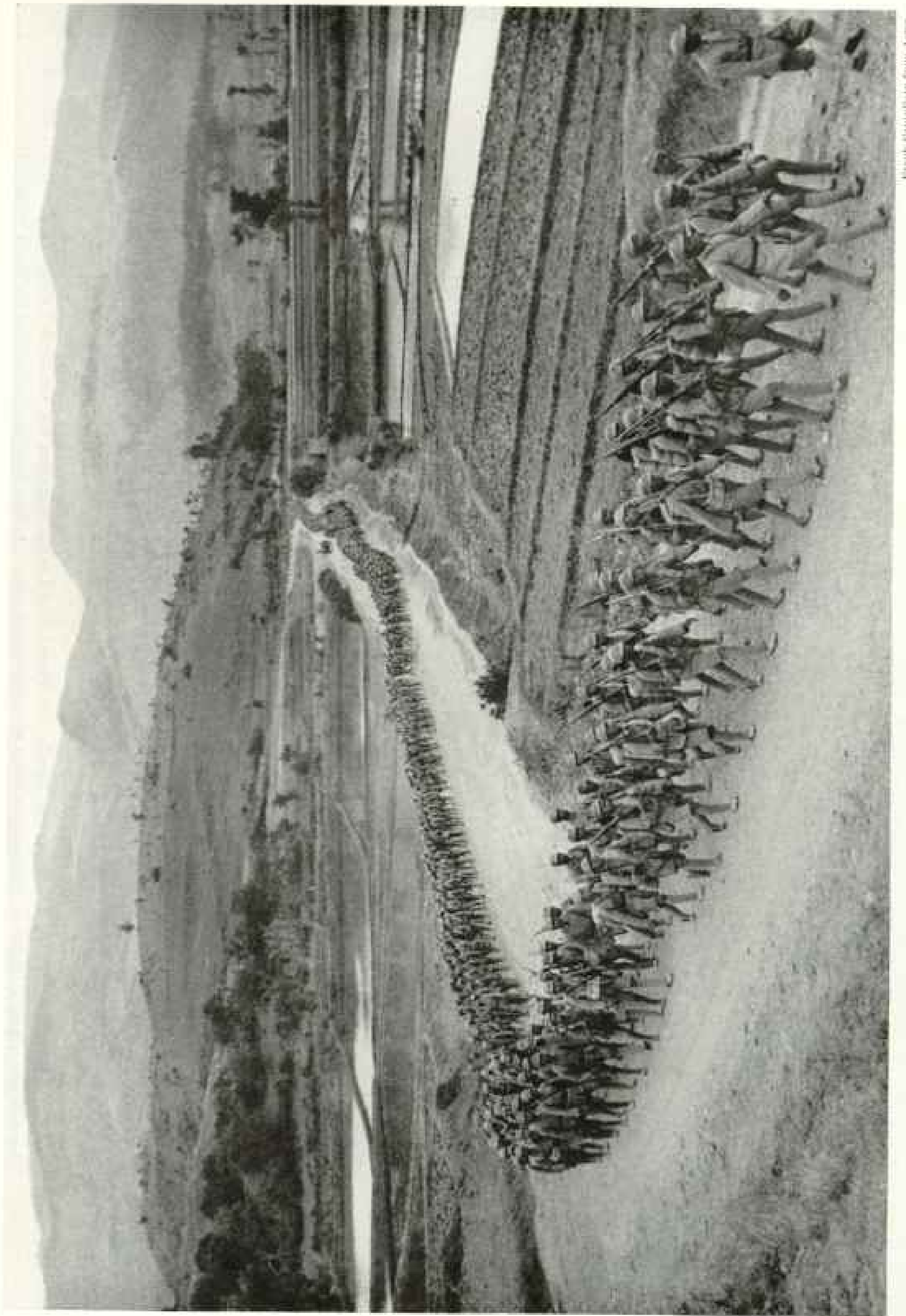
Wing tip of the L-4 almost brushes the American patrol grader and roller working on Stilwell Road at Shingbwiyang, 108 miles out of Laddo.



U. S. Army Signal Corps, Official

Awed Tribesmen Watch C-47's of U. S. Army Tenth Air Force Land with Supplies for Ground Troops in Northern Burma

Naga hillmen receive a reward of 100 rupees in silver for every forced-down American flyer they rescue from the jungle (page 685).



Chinese Troops Move Up Stilwell Road in China to Relieve Comrades Fighting Off Jap Attempts to Cross the Salween River

Photo copyright from Army

The Ledo Road passes over 700 bridges. Each bridge had to be built to withstand the annual monsoon (page 696).

I met a score of splendid Chinese engineers in Burma, including graduates of all the principal engineering schools in the United States. The preceding year's monsoon had washed out many of their bridges, but it was little wonder. Even Chinese engineers had never before built bridges in monsoon country.

One reason I was sent to Burma was that I had had experience in building some 20 bridges in the Mississippi Valley—in Arkansas, Louisiana, Texas.

To withstand Mississippi floods, bridge abutments and approaches must have sturdy footing. The same is true of Ledo Road bridges, for otherwise the monsoon cuts the earth from under the foundations.

The Ledo Road crosses numerous small mountain streams to cut through the Hukawng Valley of northern Burma. There are major crossings of the upper Chindwin River which must be bridged, in addition to numerous lesser streams crossing the Hukawng Valley.

The designs for these bridges were worked out in the field, using local material, largely timber, supplemented by United States Army equipment.

Convoys were already rolling along that section of the road which had been completed, bringing up supplies both for the fighting forces at the front and for the road builders. The convoys moved on schedules that would be the envy of transportation experts in this country. This was due largely to a block system controlling the movement and maintenance of trucks.

Prime nuisances in building the Ledo Road were the flash rains which break without warning during the dry season. Such a storm occurred while I was at a road camp near Shingbwiyang in Burma (page 689).

A group of truck drivers from an American Negro Engineer outfit was there, seeking shelter from the sudden rain. One of the soldiers popped his head out of a hut, pulled it back, and, grinning, summed up his opinion:

"Captain, this is the first time I've seen somethin' up here of what there was enough of."

Nighttime provides a pleasant interlude along the Ledo. Chinese laborers, sitting on the hillsides around the camps, sing their weird Oriental tunes to the accompaniment of twanging strings and the liquid minor tones of wind instruments.

They are also avid movie fans. Whenever a U. S. Army Special Service truck comes up the highway to put on a film show for the

Americans, the Chinese and Burmese come down to watch. Many films shown along the Ledo Road have not yet been released in this country.

The Chinese laborers have their own cooks. They wear their own clothing, nondescript and in all the colors of the rainbow. They eat twice a day, in the morning and at night, in keeping with native custom. At work they are divided into groups of 30 to 70, supervised by American noncoms.

American Plantation Songs in Burma

The Negro Engineer troops, who have done a marvelous job as tractor and truck drivers, also lend enchantment to the night with their singing of the old familiar plantation songs, with an occasional excursion into the field of "boogie-woogie" (page 687).

When I was there, a musical program by these American Negroes in remote Burma was broadcast in the United States.

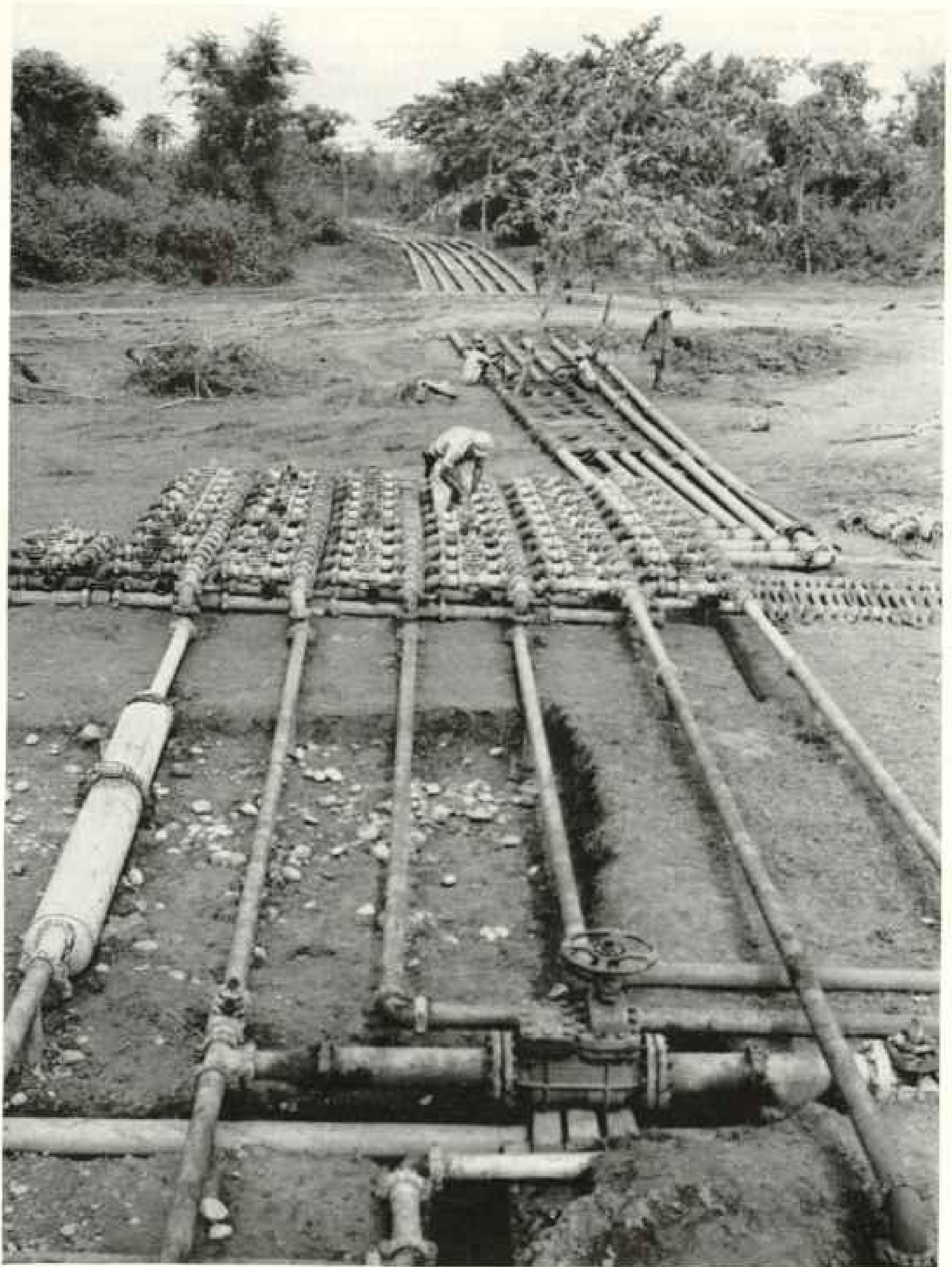
I went as far as I could along the Ledo Road, right up to the jungle foxholes at its forward end. Then I returned to the Assam airfields to fly over the Hump and visit the Burma Road. The Hump is considered by pilots the toughest air route in the world, and they're willing to wager their flight pay on that. I wouldn't bet with them because I would have lost.

We had twenty-eight passengers on the plane which was to take me to China. Thirty minutes out, when we had climbed to a height of more than 15,000 feet and were sucking oxygen, one of the engines conked out. The pilot banked his plane around carefully and, nursing his one good engine, sent us into an oblique dive back to the airfield.

At Kunming, Chinese terminus of the air transport over the Hump, I was stationed at the old Flying Tigers headquarters in the ancient agricultural college. The walls are still adorned with the trophies of air victories over the hated Japs.

Here I began to note the contrasts between the two roads. The Burma Road west from Kunming isn't a Lincoln Highway, and it wasn't built that way. In many places it is nothing more than a refinement of the ancient Marco Polo trail. The improvements and maintenance on this highway were accomplished with the blood, sweat, and tears of the humble Chinese who live along its tortuous route.

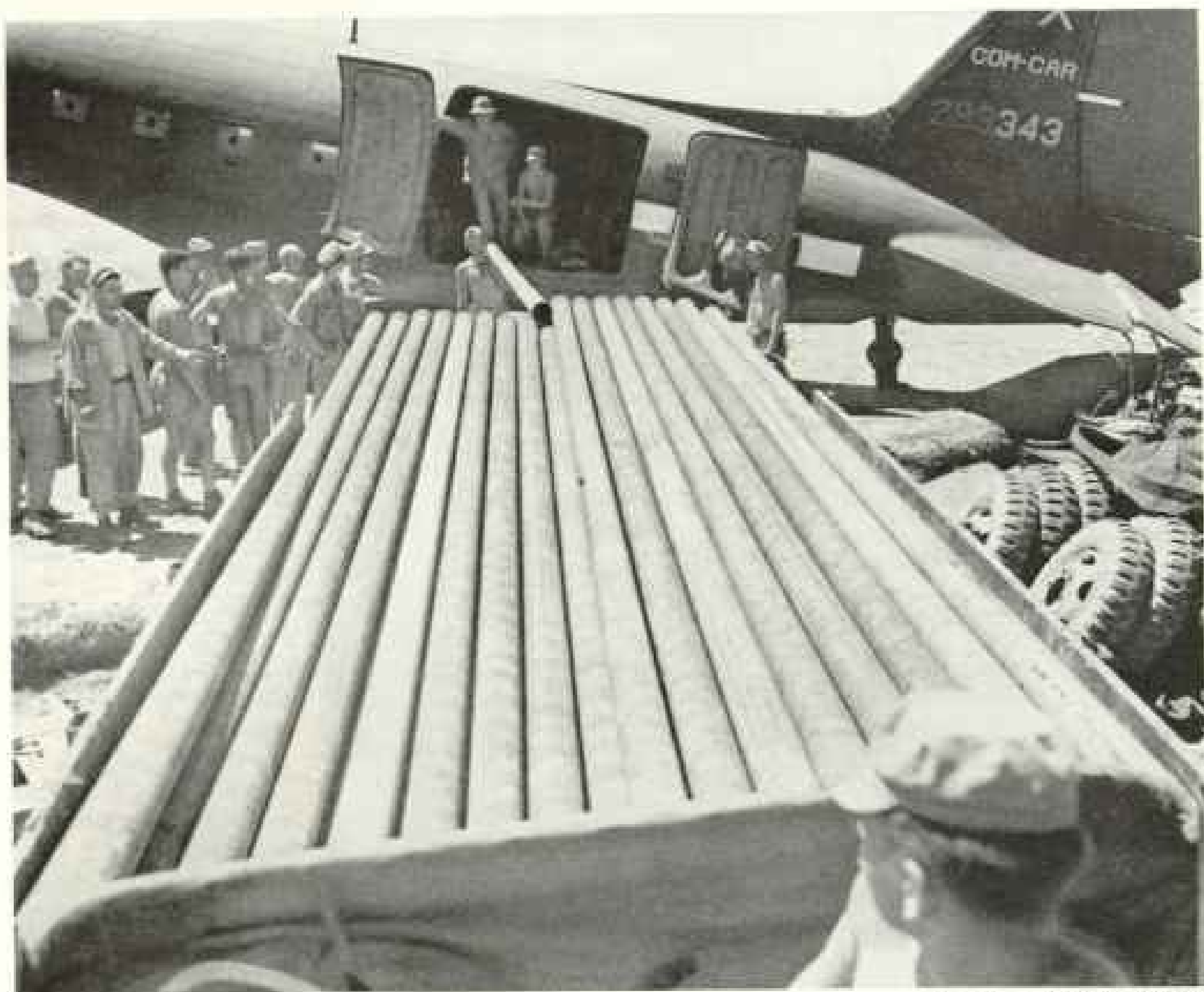
When the Chungking Government realized the urgent need for a highway to keep the Chinese back door open to the outside world, it called on the Governor of Yunnan Province, Gen. Lung Yun, to complete the Burma Road.



U. S. Army Signal Corps, Official

Through This Pipeline, Aviation Gasoline Will Flow from India to China

U. S. Army Engineers install a manifold-valve system along the new line "somewhere in Burma." When completed, it will extend more than 1,500 miles, from Calcutta, in India, to Kunming, Yunnan. Indian battalions cut the way for the line through the jungle. One foot out of every 250 crosses rivers, gullies, or other obstacles.



U. S. Army Signal Corps, Official

In the Wilds of Burma a C-47 Delivers a Cargo of 4-inch Pipe from India

The heavy lengths will be used in the India-Burma-China pipeline for aviation gasoline. U. S. Army Engineers have completed the line beyond Myitkyina, Burma, as well as pumping stations en route (page 681).

Thousands of Chinese worked right through the monsoon periods. Many died of malaria; but the job was finished in 1938, in record time of a little more than a year. The Burma Road was really a hand-built highway.

The Chinese Central Government directed the recruiting of this huge working force. Provincial governors received orders to produce squads of workers. They in turn communicated with village magistrates, who rounded up their quotas.

I learned that nearly every community was in reality a family group. In the ancient walled town of Yungping, for example, I found that all the 4,000 residents belong to the communal family. Authority is vested in the family elder, who is the magistrate.

When the governor of Yunnan Province wants a levy from Yungping for his provincial army, or for the National Army, or for road building, coal mining, rice-field work, or similar large-scale enterprises, he simply advises

Yungping's magistrate to supply the town's quota. That's the way labor in China has been drafted for thousands of years.

Coolies Take Place of Bulldozers

To build military roads the U. S. Army allots so many bulldozers to one area, so many more to another. In China, when generals build roads, they have no bulldozers to allot; so they draft men to take their place.

I visited the coolies at lunch and at dinner and usually found them eating rice seasoned with pepper. Groups working near rivers were fortunate, for they could set fish traps.

At night they slept on the ground in caves or beneath rude bamboo shelters.

Working methods were primitive. First, the coolies would pry loose from fissures and stream banks, or dig out of the ground, big rocks weighing from 60 to 75 pounds. These "one-man" boulders they would lug to the proposed roadway, sometimes 500 yards away,



U. S. Army Signal Corps, Official

GPs Plod Through Jungle Grass with a Pipeline Section

They are members of the U. S. 776th Engineer Petroleum Distribution Company, building the India-Burma-China pipeline. The stretch on which they are working is in wilderness south of Warrizup, Burma.

and lay as a rough foundation pavement. Then, in baskets, wheelbarrows, and slings, they would bring smaller rocks to wedge into the spaces between the big ones. Gradually they built up this rock base, using smaller and smaller stones as it grew higher. Roadbeds were graded by hand with an ordinary builder's water level.

The final layer was of mud-moistened earth of western China, which has a bonding quality similar to Texas adobe. This earth was carefully worked down into all crevices and then smoothed on top. The finished product was closely akin to what United States road builders call a telford base.

Rock excavation took a high toll of Chinese lives. Black powder was used for blasting.

Instead of detonators, the Chinese made fuses of paper, soaked in oil and black powder and of uncertain timing. They jammed powder into the drilled holes with the back end of a steel hand drill. There were many explosions that brought sudden death to scores of coolies.

Burma Road Carved from Mountains

Western China is developing a common dialect as a result of the mingling of people from widely separated districts. Prior to these huge building operations, inhabitants of one part of Yunnan Province could not converse with people from other sections.

Now thousands can talk among themselves, no matter how far apart their homelands are.

Carved entirely out of rock-studded mountains, the Burma Road reaches elevations as high as 8,500 feet. That section of it in Chinese hands is still in process of improvement.

My trip down the Chinese portion of the Burma Road convinced me, however, that before it can carry heavy two-way traffic considerable realignment and reduction of grades will be necessary. The road has many curves, an average of four to the mile (page 684). Chinese officials seem reluctant to cut through paddy fields. Perhaps they feel that the rice produced is more important than a few miles of travel saved.

Since my sole concern was with bridges, I examined with great interest the crossings built by Chinese engineers. They were, generally speaking, of good construction but designed to carry lighter loads than the American type. Bridges ranged from primitive types to elaborate stonework structures more attractive than utilitarian.



"Ding Hao, Mei-kuos"—Chinese Children Greet a Jeep with Thumbs Up

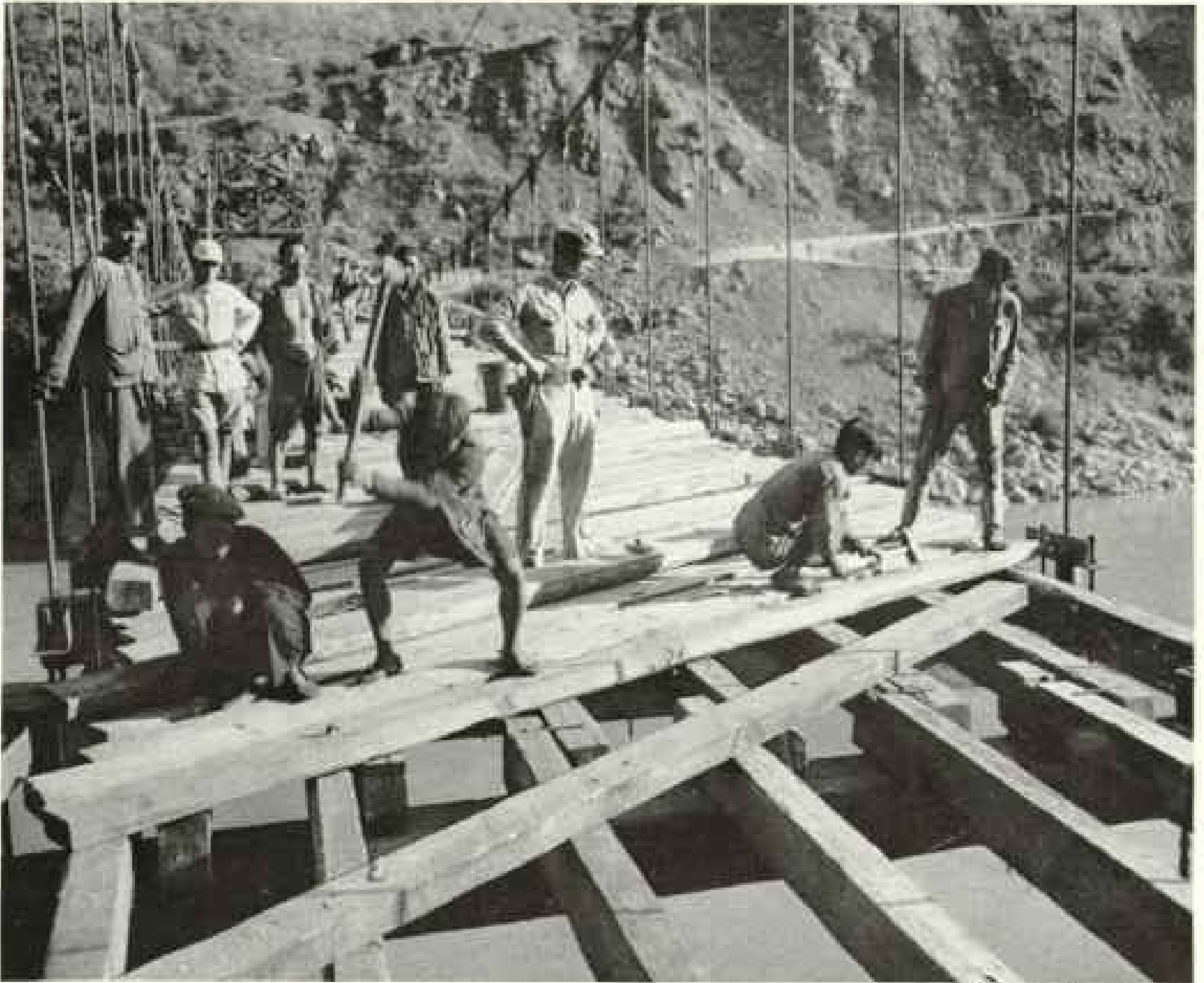
The GI's, returning the salute, know enough Chinese to understand that "Mei-kuos" means "Americans" and "ding hao," "very, very good." This operations staff moves along a military road in unconquered China.



U. S. Army Signal Corps, Official

Kachin Tribesmen Take Their First Auto Ride in a U.S. Aviation Engineers' Truck

War has brought cars, airplanes, and strange faces into their remote hill country; Now the Kachins have learned to thumb rides. They saw B-29's long before Superfortresses were publicly shown in the United States.



U. S. Army Signal Corps, Official

Chinese Builders Plank the Hwei Tung Suspension Bridge on Stilwell Road in China

The author was sent to Burma to design and supervise such bridge construction (pages 681, 691). More than 700 bridges span the upper Chindwin River and numerous smaller streams on the new section of the highway from Ledo to its junction with the old road.

It was spring along the Burma Road. My jeep would be rolling along a drab mountain-side. Suddenly, around a turn, would come into view a lush green valley with the flooded terraced paddies sparkling in the sun.

In the midst of such a setting would be nestled a Chinese village. I visited some of these Chinese communities. One night was spent in Yunnanyi, about 135 miles from Kunming. The village was crowded with evacuees from occupied China.

Surrounded by a thick mud-brick wall with four gates surmounted by stone dragons, Yunnanyi has narrow, cobbled streets lined with little open shops.

But the inhabitants are a cheerful lot. They are grateful for the help the United States has given China; and whenever an American appears the natives give forth with the Chinese equivalent of "O. K."—"ding hao"—and an upraised thumb (page 695).

Even little children carried on their moth-

ers' backs raised their thumbs in salute to passing Americans.

Salt Sold by the Chunk

Often I encountered salt salesmen. These itinerant merchants set out from Kunming along the Burma Road with two large blocks of salt slung over their shoulders and held in place by thongs passed through holes bored in the blocks. The salesmen cut off chunks of desired size for customers and trudge along until the blocks have been completely sold. To sustain them on their journeys, they carry pocketfuls of rice.

The salt comes from the huge wells at Tzeliutsing, 110 miles west of Chungking. These centuries-old wells produce about 250,000 metric tons a year, or about one-fourth of all the salt mined in Free China.*

* See "Salt for China's Daily Rice," 11 Illustrations in the NATIONAL GEOGRAPHIC MAGAZINE, September, 1944.



U. S. Army Signal Corps Official

Loyal Burmese Assure Their Countrymen the Japs Won't Be Back

Tribesmen read the sign in the village of Namti, near Myitkyina, in northern Burma. It was posted a few weeks after the Japs were driven out.

By the time my jeep returned to Kunming I had completed a thousand miles of travel on the Chinese-held portion of the Burma Road.

Kunming, one of the largest cities of Free China, is as much a contrast to the Naga Hills wilderness as is the Burma Road to the Ledo. Its shops would seem incredible to ration-restricted Americans.

How they got there is one of the mysteries of the war; but I saw and touched the latest-type American electric refrigerators, fountain pens, flashlights, thermos bottles, and watches. Housewives in America would buy them up in a hurry, but not at Chinese prices!

Here are some typical inflation prices when I was there: fountain pen, \$80 in American currency, or 16,000 Chinese dollars; refrigerators, \$400, U. S. currency, or 80,000 Chinese dollars. A Big Ben alarm clock was selling for \$20 American, or 4,000 Chinese dollars.

A building boom has smitten Kunming. Modern homes were going up fast while I was

there. They resembled American types, but each was surrounded by the traditional Chinese wall.

In Kunming I saw mercenary troops recruited from many races—Malayans, Kachins, Karens, Tibetans, and a few Burmese among others—who fight on the side of the Chinese. One division was commanded by an Australian, another by a Hollander. Some of their officers were South Americans. All were soldiers of fortune fighting for adventure and gold.

American Engineers Blast Ledo Trail

I flew back to Ledo and then we started our homeward journey to the States. Reflecting on my trip, I recalled the juxtaposition of old and new, of mountain jungle with centuries-old wagon road, of superbombers and blow darts, of Ledo and Burma and America. To me they all seemed symbolized in the career of one U. S. Engineer General Service Regiment at work on the Ledo Road.



Frank Castellani from Anne

Luxury in the Jungle! Spoon-fed by a Burmese Nurse

She is a member of the famous unit recruited by Dr. Gordon Seagrave, author of *Burma Surgeon*, which tended the wounded during General Stilwell's epic retreat from Burma in May, 1942.

Composed largely of middle-aged men recruited directly from civilian road-building jobs on State highways in the middle and northwest United States, this regiment had been in the China-Burma-India theater for nearly two years, under the command of Col. Charles S. Gleim. They handled the lead "cats," as engineers call their bulldozers, blasting the trail for the Ledo Road from the project's beginning.

Most of them are veterans of the last war who fought in France. They fight this war

on the other side of the world. Many are members of the American Legion. At an impromptu Legion Post meeting held while I was there, a former State commander and six former post commanders were present.

These men all agreed that the Ledo job was 100 percent tougher than their Alaska assignment. Despite rain, mud, and malaria, they completed many precious miles of road.

Not only did they operate the lead bulldozers in clearing the trail for the Negro troops to follow; they also laid down fighter strips for the use of tactical forces. At one airstrip site in the Chindwin area, Japanese mortar fire started falling on them. Unperturbed, they simply moved to the other end of the airstrip and continued their construction work. Two hours after the Japanese mortar fire had been knocked out, fighter planes were landing.

Some day the saga may be told of the few pieces of American highway construction equipment which were left on the Chinese portion of the Burma Road when the Japs cut across the Burmese sector. The three bulldozers, the patrol grader, and the air compressor were out of order more often than they were in use. Many of the parts to keep them in running condition were hand-forged in homemade Chinese machine shops.

The Chinese kept accurate records of the exact hours each piece of equipment was in operation and the amount of work done. With this dilapidated machinery, 30 American soldiers and 200 coolies did as much work in a trial period as 30,000 coolies with hand labor alone.

Chinese engineers were delighted. Gradually additional pieces were flown to them over the Hump. Today the Chinese operators of compressed air tools are the aristocrats of the road-building army. Chinese engineers request road-building equipment by American model and trade names.

What American and Chinese road builders have done together is an augury for the future.

Tai Shan, Sacred Mountain of the East

BY MARY AUGUSTA MULLIKIN *

A THOUSAND years before Tutankhamen was laid in his tomb on the Nile, centuries before Moses sought Jehovah on Sinai, religious pilgrims were toiling up the steep slopes of Tai Shan,† most revered of the five sacred mountains of China. Tradition is that the Emperor Shun climbed to the peak some 2,200 years before Christ to proclaim himself the "Son of Heaven." Confucius made the pilgrimage, a venerable custom even in his day, and, standing on the summit, remarked that the Celestial Kingdom was small indeed.

In the course of four millenniums, untold millions—men and women, young and old, rich and poor, hale and feeble—have struggled up these heights that they might worship "nearest Heaven." Here they have raised their holiest temples, offered their most precious sacrifices.

The Greatest Stairway in the World

Those who came in the earlier periods climbed as best they could over rough terrain. Later, stone steps were built from the base to the top—some 6,700 of them—the most stupendous stairway in the world (pages 705, 711, 715). Visitors today make the ascent comfortably in chairs carried on the shoulders of bearers, but throngs of worshipers still go on foot.

I had been only three days in China when I undertook the first of my nine ascents of Tai Shan. In the many years since, I have learned to know the mountain intimately.

Fresh from impressions of the jostling peoples of Shanghai,‡ the mingling and merging of East and West, my fellow artist and I stepped from the up-to-date Blue Express to the platform of Taian Station in Shantung. As if from a specially designed grandstand, we saw the rugged outline of China's foremost sacred mountain covering all the northern heavens and stretching in receding foothills to a far horizon.

At first I felt a little frightened and alone, but my spirits rose when, amid the babel of an unknown tongue, I recognized the one Chinese word of my vocabulary, *chi-tzu-r* (the son of a hen). Peddlers were selling hard-boiled eggs to hungry travelers.

In a moment, a rough Shantung giant disentangled himself from the noisy, roiling crowd and presented us, the only foreigners, with an identifying card from our prospective host. Soon we were being carried toward our destination in chairs. At that time rickshas,

good roads, and wars had not disturbed the Walled City of Taian (the great peace).

No later experience has dimmed memories of the sunrise awakening of a native town; of our chair bearers crying at the suburban gates, "*K'ai-k'ai-men*" (Open gates); of shopkeepers removing the boarded fronts of their shops, revealing well-stocked shelves of homemade products in metal, wood, and cloth; of apprentices dipping their sleepy heads in basins of water; of garden produce trundled to market on squeaking wheelbarrows.

The orthodox pilgrimage began at the Tai Temple, an enormous structure as strongly walled as Taian itself, the entire compound covering about an eighth of the area of the holy city. At least as early as the eleventh century a temple stood here, and the present structure is 500 years old. After worshipping in it the god Tai Shan, the devotee might proceed through the North Gate of the city with some hope of a successful pilgrimage.

The mountain rears up like a picture map, with dominant features clearly drawn on its severe surface. It seems to wear its skeleton outside its body. Up its side stretches the broad stone-paved *Pan Lu*, or Pilgrim Way, mentioned in history as early as the Han Dynasties (206 B.C.-A.D. 220) and unique among mountain roads. Twenty feet broad at the beginning, somewhat narrower farther up, it shows as a white, undulating line on the upper mountain, leading to the South Heavenly Gate. The pilgrim must surmount the 6,000-odd stone steps to reach the celestial portal.

Worshipers Swarm Like Insects

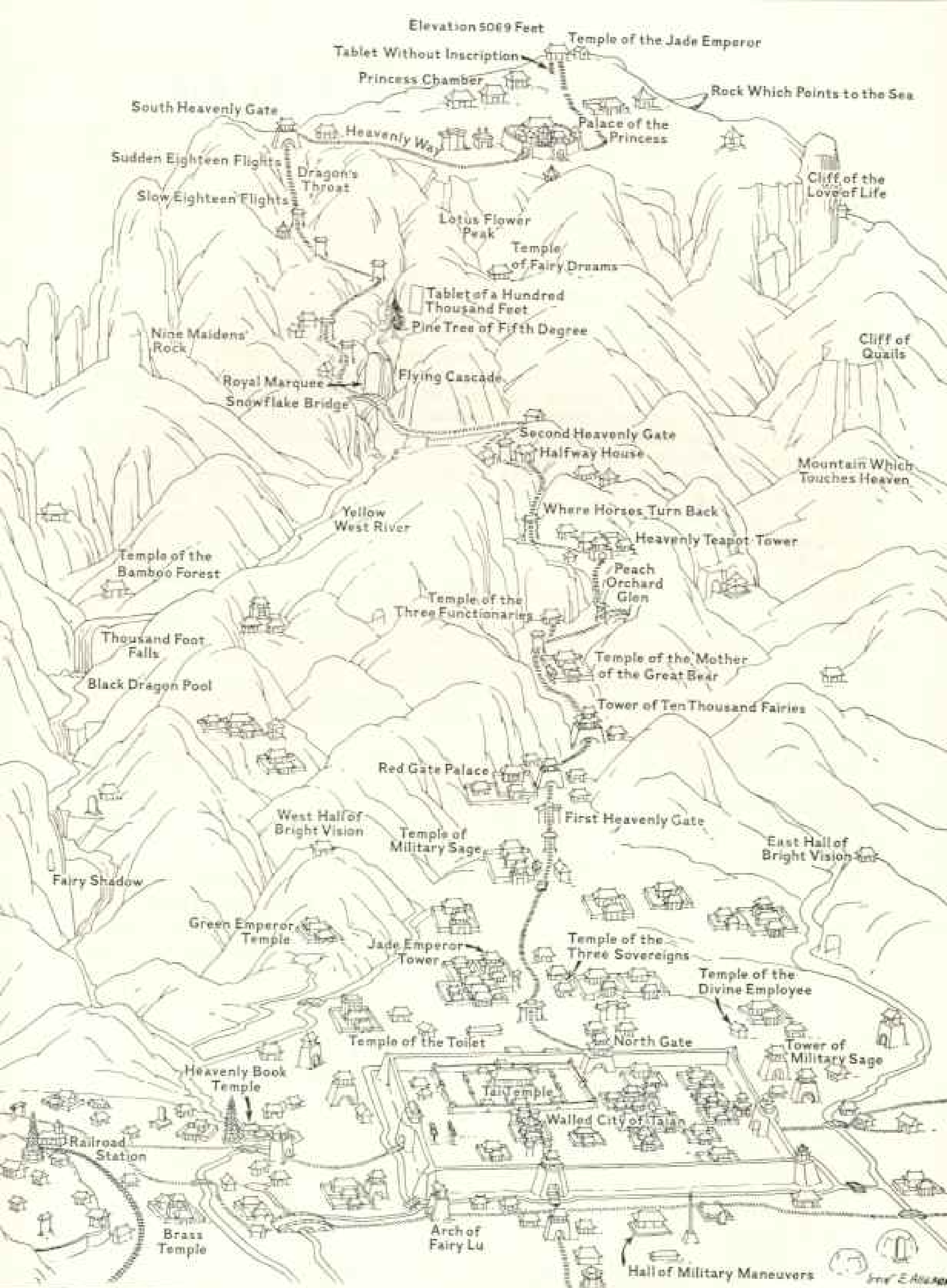
Passing under the first monument, a stone *pailou*, or straight-lined ornamental arch (page 713), the road approaches Peach Orchard Glen. Here I was carried from the view of distant grandeurs to immediate and lively details.

The Chinese almanac notes a day in spring as "the awakening of excited insects," and

* For more than a year Miss Mullikin, an artist, has been interned at Tientsin by the Japanese. In 1920 she went to China and, loving the country, remained to paint its people and scenery. For the March, 1938, NATIONAL GEOGRAPHIC MAGAZINE she wrote "China's Great Wall of Sculpture" and contributed paintings to illustrate it.

† See Tai, E-14, "China" Map Supplement, with this issue of the NATIONAL GEOGRAPHIC MAGAZINE, and page 700.

‡ See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Changing Shanghai," by Amanda Boyden, October 1937; and "Cosmopolitan Shanghai, Key Seaport of China," by W. Robert Moore, September, 1932.



From Walled Tai'an, China's Devout Climb the 15-mile Pilgrim Way to the Tip of Tai Shan Temple of Fairy Dreams! East Hall of Bright Vision! Heavenly Teapot Tower! What other people can match these exquisite place names? Tai'an Station lies on the main railway between Nanking and Peiping.



Howard M. Vandenberg

With Fruits and Sales Cries, Peddlers Besiege a Pilgrim Train to Taian

Several carry white offerings resembling sticks of rock candy. These are crab apples, spitted on chopsticks and dipped in sweet syrup. When they all press the same line on a customer, a small riot ensues.

when, in February and March, the pilgrimage is in full swing—as many as ten thousand pilgrims a day—such an eruption of new life seems to have taken place. Human insects in swarms spread up the mountain. There is a shuffle of feet in soft shoes and a chatter of amiable and excited voices, with the sputter of fire-crackers at every important stage of the Way.

There are not only pilgrims, on foot or in chairs, but also beggars, peddlers, carriers with poles on their shoulders; the permanent residents—farmers, teahouse keepers, hermits, priests and nuns, sellers of incense, charms, and paper money, and all others who hope to reap reward by or from pilgrimage. One seems to be carried up on a tide of enthusiasm.

Despite their ancient lineage, the Chinese are the least blasé of people, and their religious festivals rival in verve the fish fry in *The Green Pastures*. They are businesslike, however, and expect a substantial return from the gods at whose shrines they make offerings. Among the visitors are many modern Chinese, come not as worshipers but as sight-seers, with knowledge of the historic and national importance of what they see.

More or less permanent residents live in huts or houses of rough stone, built for safety and convenience close to the Pilgrim Way.

Farmers in the lower regions herd goats and sheep and tend farms and orchards. Blooming apricot and peach trees in the spring, and ripening persimmons in the fall, add beauty to the Way.

One charm of the Pilgrim Way is the tea-houses, shaded by matting awnings and trellises of wistaria or gourd. Very popular in season are fried cakes made from wistaria blossoms; and the gourd, useful as cricket cage or dipper or traveler's flask, is a recognized symbol of pilgrimage. There are always gay potted flowers on the steps and parapets and caged larks singing.

Climbers Need Not Go Hungry

There are piles of incense gaily wrapped in red-and-yellow paper and stacks of gilded paper money to pay the gods, made in the boat-shaped form of the old tael "shoe." Big cakes of a sort of hardtack and white *mo-mo*, steamed bread rolls, are displayed temptingly. In season, cucumbers, radishes, apricots, melons, and persimmons are favorite additions to the climber's food supplies.

Huge caldrons, built into brick stoves, keep water always steaming for the tea guest. A smaller device is a long tin tube which, plunged into a bed of coals, produces boiling water



GILBERT GROSSNER

Tower of Ten Thousand Fairies, a Taoist Shrine, Sits Astride Tai Shan's Pilgrim Way

A passageway, called Cave of the True Hermit, leads visitors into the presence of three large religious statues. Life-size birds, made of bronze, perch on each corner of the twin roofs. Plaster keeps falling; beggars now occupy the cells once given to priests.

with surprising speed. There are also alluring antiques, huge, graceful copper and brass urns with curving spouts. It is easy to linger too long by the wayside among people who have brought friendly manner to a fine art.

Noticing a broken teapot which had been skillfully pieced together with brass rivets, my companion asked the host why he did not get a new pot.

"But, lady," he answered, "don't you know that the flavor of the tea is much better from an old pot?"

Beggars sit in the middle of the road, so that chair riders must be carried over them and their shallow wicker coin baskets. Their heart-rending whine is generally "*Cash-a, cash-a, chih-pa*" (Give cash, must eat). "Cash" is the one foreign word at their command, although the copper alloy coin with a square hole in the middle no longer circulates.

Another familiar call is "*Lao-yeh, l'ai-l'ai, k'e lien, k'e lien*" (Old lord, lady, have pity,

have pity). I have sometimes thought that the wail of Malvolio in the dark chamber must have been studied from a Chinese beggar.

To give is an act of piety, a way of gaining merit; therefore the beggar is giving his benefactor an opportunity to advance in spiritual status. His is an honorable calling, for Buddha begged, and the begging bowl is a sign of priesthood. The modern priest, however, is often content to farm out the right to beg to humbler people.

Crippled beggars, carried here for the pilgrim season, are often financial assets to their families. All children living on the Way are potential beggars. They play heartily in groups until they receive a signal that a pilgrim is coming; then they scamper, each to his appointed spot, and their gay voices change instantly to a moving wail.

Many of them became my friends as they watched me paint, and I have had tea in their homes, which are congested with comfortable



Gilbert Grosvenor

Temple of the Mother of the Great Bear: the Author's Strange Address for Two Weeks

Inside the teahouse-nunnery the goddess is represented by a Hindu-type image whose powers are symbolized by 48 arms. Scholars facing examinations in Empire days prayed for her intercession with her son, their patron, residing in the Constellation of the Great Bear (page 717). "Miraculously responding (to prayer) without fail," the door announces. Left: a commemorative tablet (page 704).

belongings. No thought of beggary in our sense attaches to their begging.

Almost halfway up the mountain an arthritic cripple lived in a bed built right on the road, where no one could fail to see the pathos of his condition. His wife was busy in and about their tiny house, while he, in moments between begging, herded a brood of small chickens with a long whip.

One Beggar a Stuffed Dummy

A little farther along there was a dummy beggar, realistically stuffed, clothed, and posed, with a wig of gray hair, a sure mark of venerability, which should wring coppers from the stonyhearted. The dummy sat by its begging basket while its owner went about better business.

The chair bearers, who belong to a well-organized guild, are virtually all Mohammedans. The newcomer to China may feel shy

at using brother man as a beast of burden, but the independence and good humor of the men soon eases the feeling.

Stopping for lunch by the way, I offered sandwiches to my men, but met a decided "*Wo pu chih*" (I don't eat). Doubtless these sons of the Prophet feared the foreign food might be "pig meat." They indulged in gay mockery of beggars and priests, imitating their wails and calls realistically.

The Tai Shan chair, lightly built of bent wood and rope, differs from the bamboo sedan of the South and is ideally suited to its purpose. The breadth of the stairs permits the men to go up side by side, so that the chair is kept level and not tilted as in the tandem carrying usual in mountains. The weight is cleverly divided, being carried partly by a shoulder yoke and partly by shafts in the hand. It is, like many other Chinese devices, crude and practical (pages 706, 708, 710).



The Great Stone Road of 6,700 Steps Begins Here

Gilbert S. Murray

Temples, shrines, pailou, tablets, and inscribed rocks exist in hundreds along the Pilgrim Way. The sentiments of great men are cut in rock, but the humble visitor adds his scrawl in chalk. One often sees students copying in their notebooks the choicest inscriptions, many of which are of historic importance, while others are poetic sentiments aptly phrased.

The Red Gate Palace, named from a natural gate of ruddy rock, is the first regular resting place. There is a pailou and a group of teahouses besides the Raiment Changing Pavilion, where pilgrims prepare for stiffer climbing ahead. From this point one has a view of the upper mountain, soaring above intervening ridges.

A Temple Teahouse Profitable

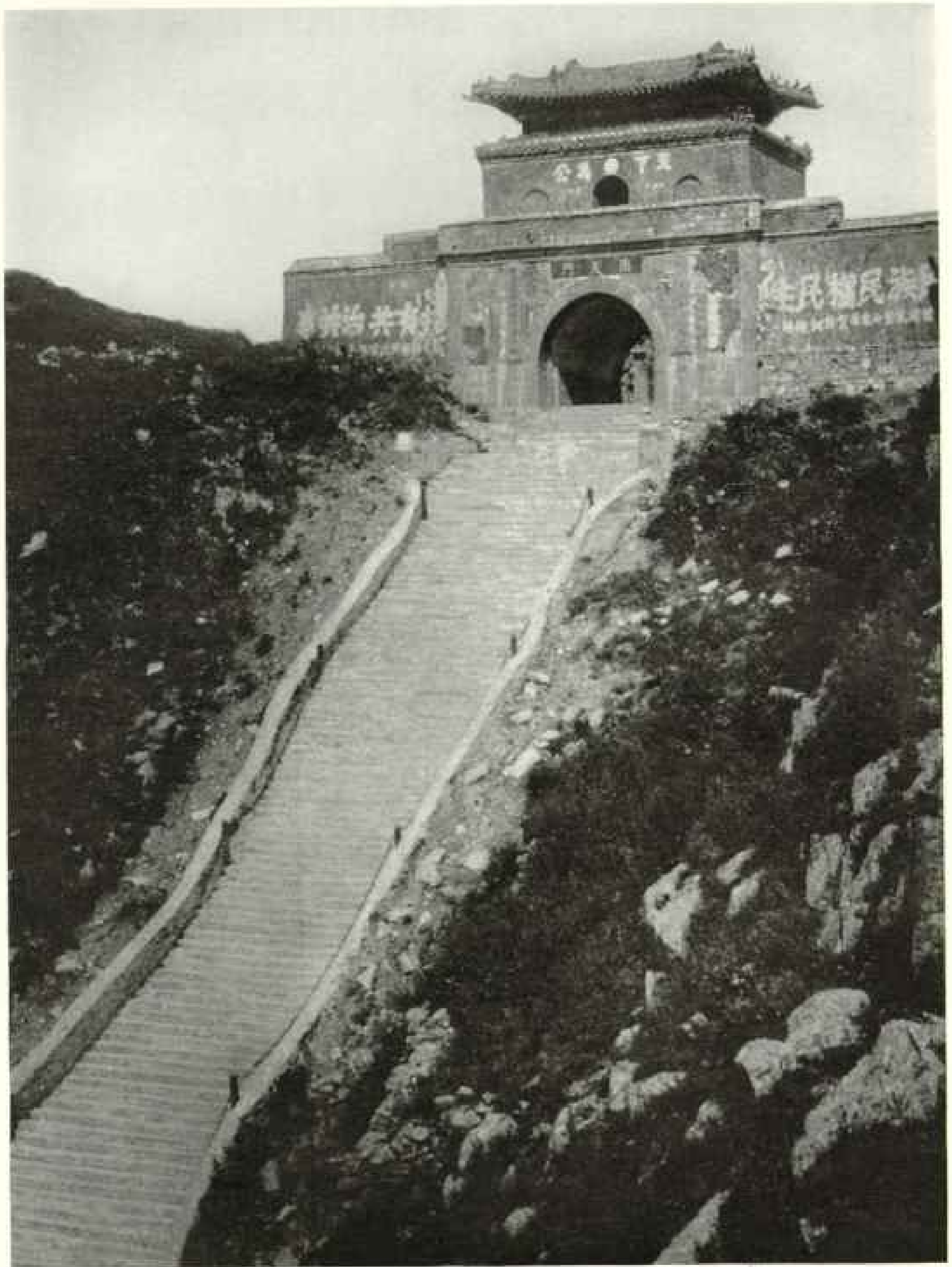
The second resting place, where chair bearers set their patrons down unceremoniously, is the Tou Mu Kung (Temple of the Mother of the Peck Measure), or Temple of the Mother of the Great Bear (page 703). This temple is in the charge of nuns, short-haired, fresh-

faced young women, who see to it that their temple is successful as a teahouse.

Since the temple and neighborhood were particularly paintable, we felt the place was worth a prolonged visit. To get permission, we paid a ceremonious call on the abbess, who lived at headquarters near the Tai Temple. Our servant saw that we performed the proper courtesies; and the shriveled old woman, seated cross-legged on her *kang* (brick bed), proved gracious, agreeing to a nominal rental for a two weeks' stay.

We were soon installed and keeping house in the temple teahouse, which was built on high foundations above a quaint garden. Ours was an airy view of Peach Orchard Glen and the foursquare walls of Taian, set in checkered fields.

Our first necessity was paper to cover the windows, for all our neighbors gathered on the veranda to watch us set up housekeeping. We provided everything but tables, chairs, and kitchen stove. The nuns took no responsibility for our privacy, but our tactful servant used laughing persuasion on our visitors.



Steep Is the Road to Heaven up the Sudden Eighteen Flights

Here, in season, the footsore drag themselves up the 1,000 steps hand over hand, by means of the chains on either side. South Heavenly Gate, shown in a view earlier than that on page 709, is painted with political propaganda slogans. "The public owns, the public rules, and the public enjoys," says one on the left (page 717).



Gilbert Grosvenor

Weary Chair Bearers Rest on Narrow "Sawhorse" Benches and Eat Off a Stone Table

Near the Temple of the Three Sovereigns, on Tai Shan's pilgrim road, they have laid down their light but strong bamboo chairs. Chickens belong to the innkeeper. As republican China refuses subsidies, many of the temples exist only by catering to pilgrims. Right: a bronze urn similar to many kept in temples.

Even Confucius is said to have protested against a circumstance "when twenty eyes watch you and ten fingers point at you," but he failed to influence his people in this particular. Surely "The Mother of the Great Bear" is the strangest address I have ever given on my letterhead, but whatever animal progeny she is accused of having, our days in her shrine were happy.

A Death Message Relayed by Shouts

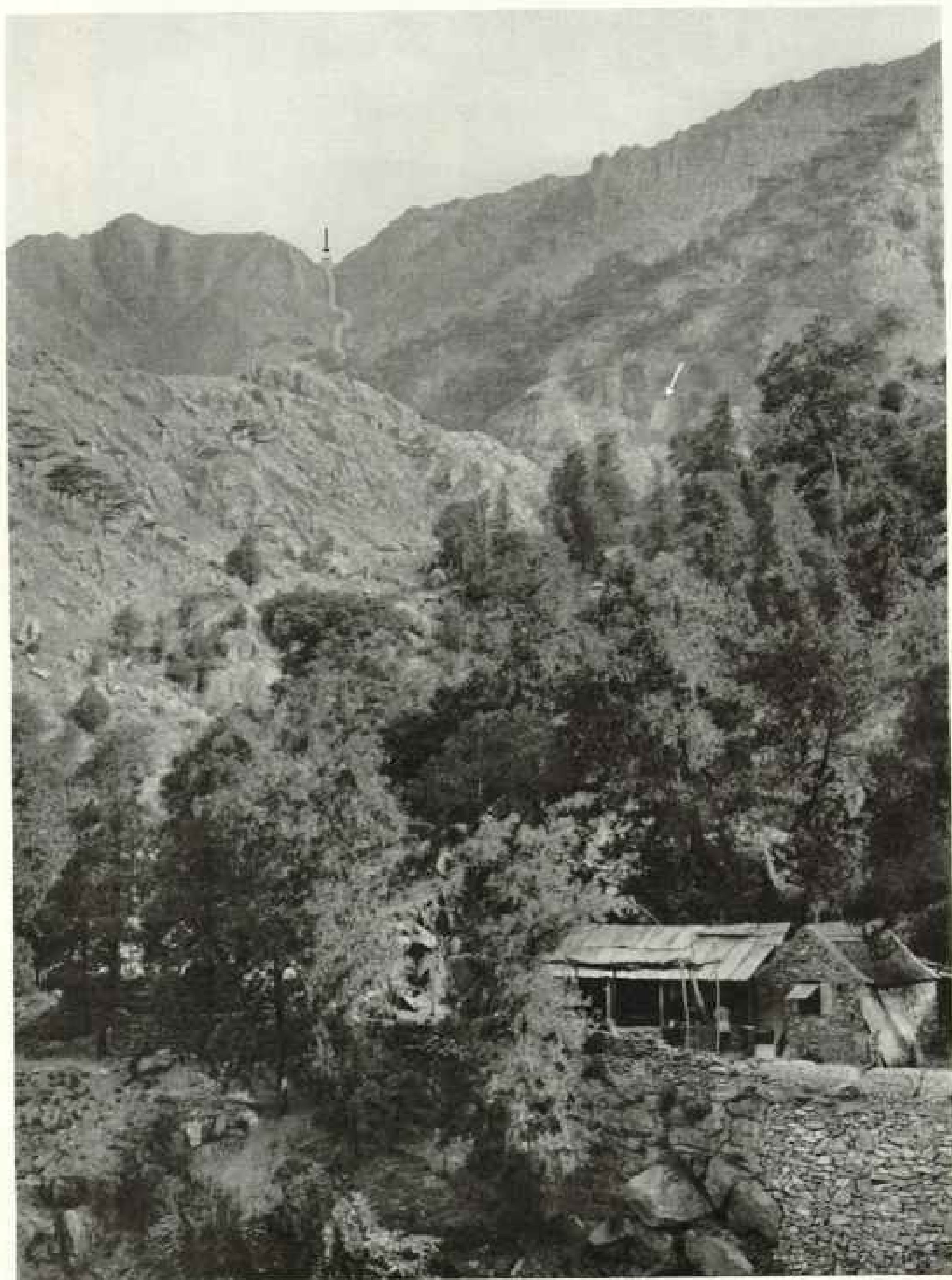
No degree of tact and persuasion could protect us from the invasion of sight-seers on the national holiday, Chinese Republican Day, the Double Tenth, or Tenth Day of the Tenth Moon (October). Every school child, every Boy Scout and Girl Guide, and every soldier for miles around climbed Tai Shan that day, and among thousands few missed a parade around our veranda and a use of every peephole in our paper windows.

One night footsteps pattered over our ve-

randa, and a woman's voice shouted, to be answered from some lower temple. It was a message being relayed to the abbess of Taian, a message of sad purport, for one of the little sisters had died that night. For several days and nights her body lay in state in a room near ours, with lighted candles and incense about her, and a nun always in attendance, rhythmically beating a "Buddha's ear" wooden drum.

Like a small village were the houses clustered near our temple, and as we came and went on our painting errands, we were soon on speaking terms with our neighbors and their many children, especially with a Moham-medan family living amiably in this Taoist center.

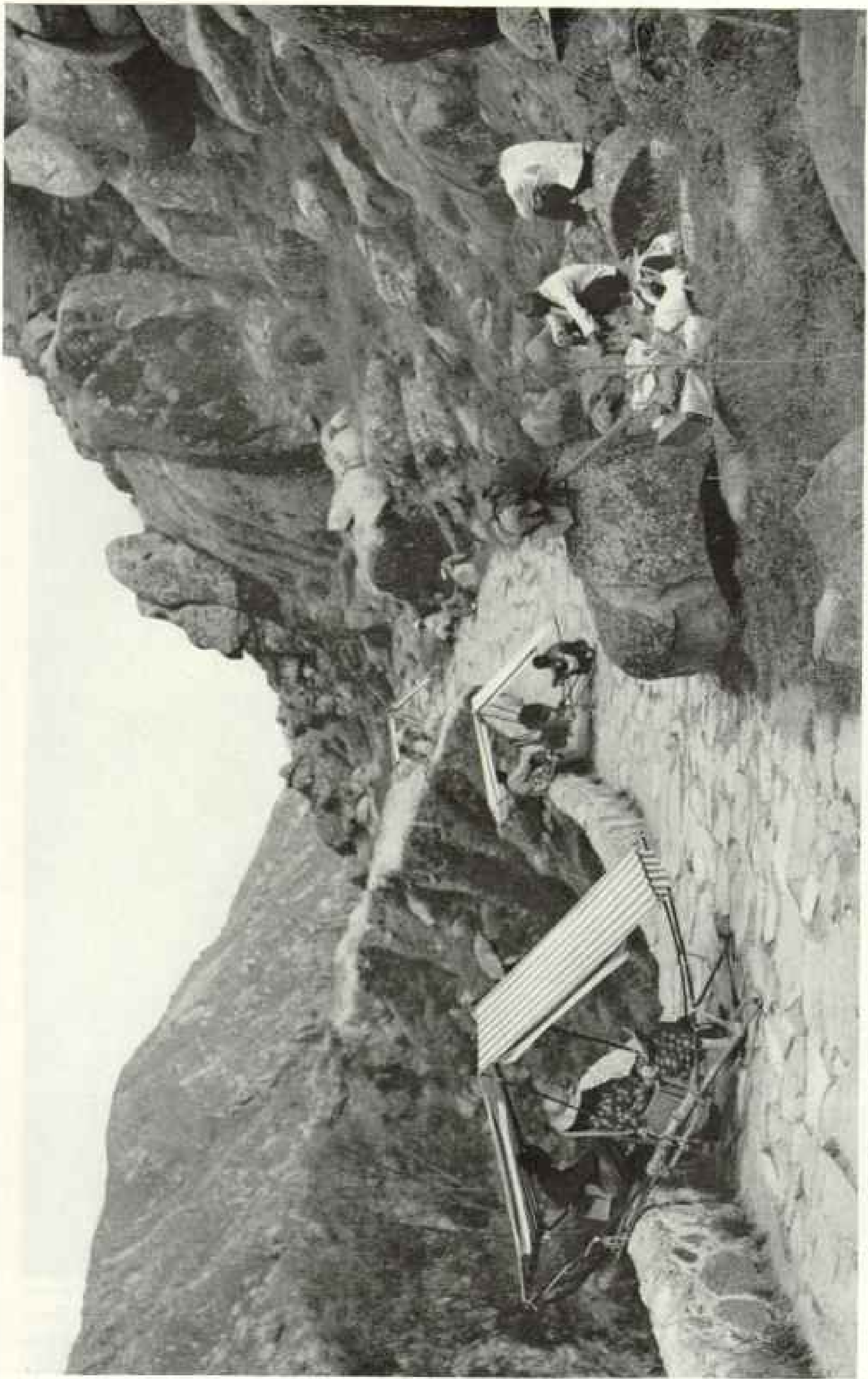
On the lower section of the Pan Lu, where long, gently rising ramps are broken by flights of steps, there is frequent shade of acacia and thuja trees, and poplars and fruit trees fill the ravines. A thuja, said to be one planted



Gilbert Grosvenor

From Halfway House So Staggering a Prospect Confronts Pilgrims That the Weak Turn Back

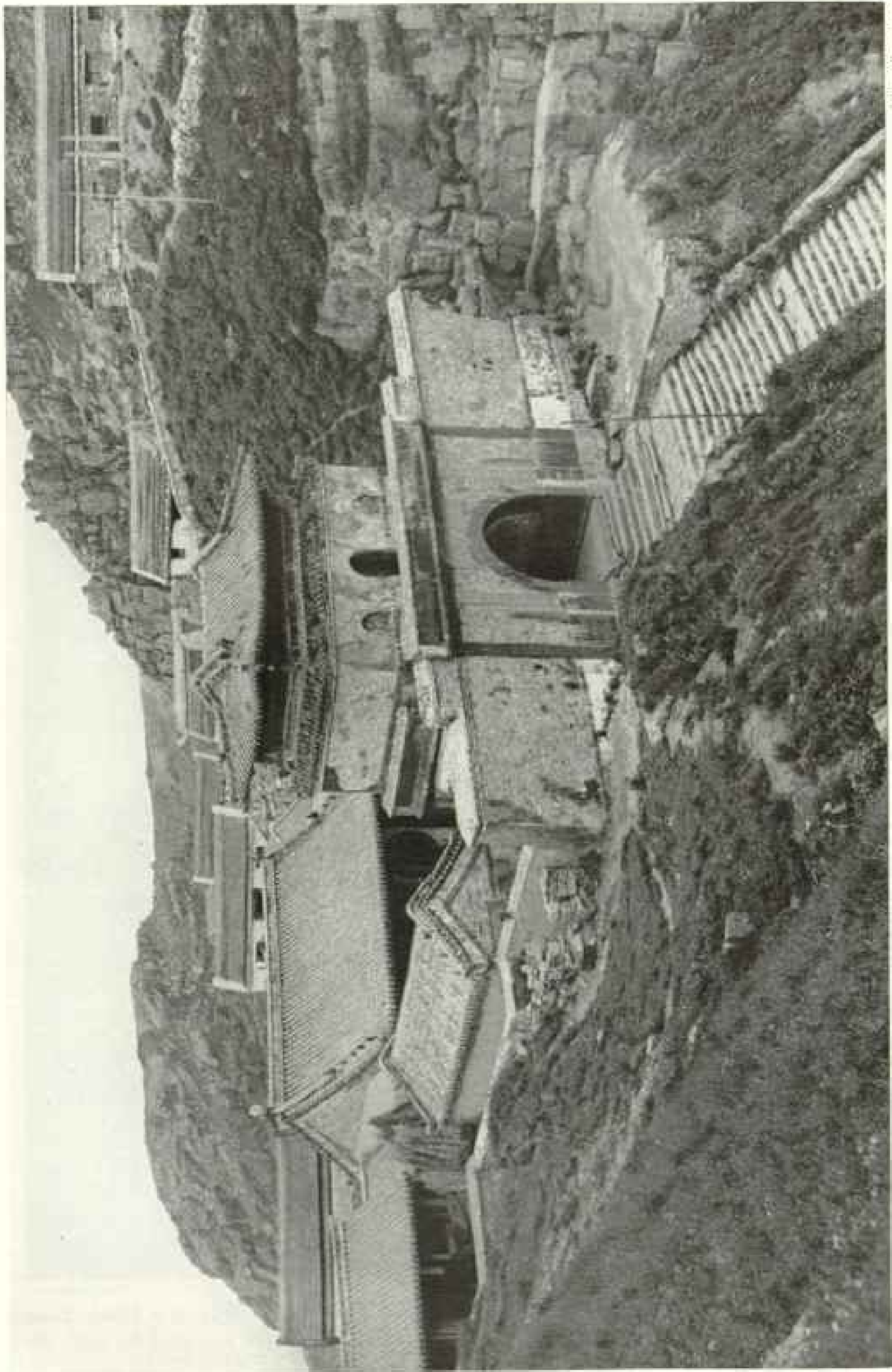
Near the summit the lofty staircase looms below South Heavenly Gate (pages 705, 709). In the middle distance (center, right) stands the gigantic Tablet of a Hundred Thousand Feet, inscription of an emperor. Characters on its smooth face are a yard high. The "100,000 feet" may represent an exaggerated idea of altitude.



Hilbert Demoyant

Struggling Toward Tai Shan's Summit, Weary Bearers Drop Chairs for a Rest Beside the Pan Lu, or Pilgrim Way

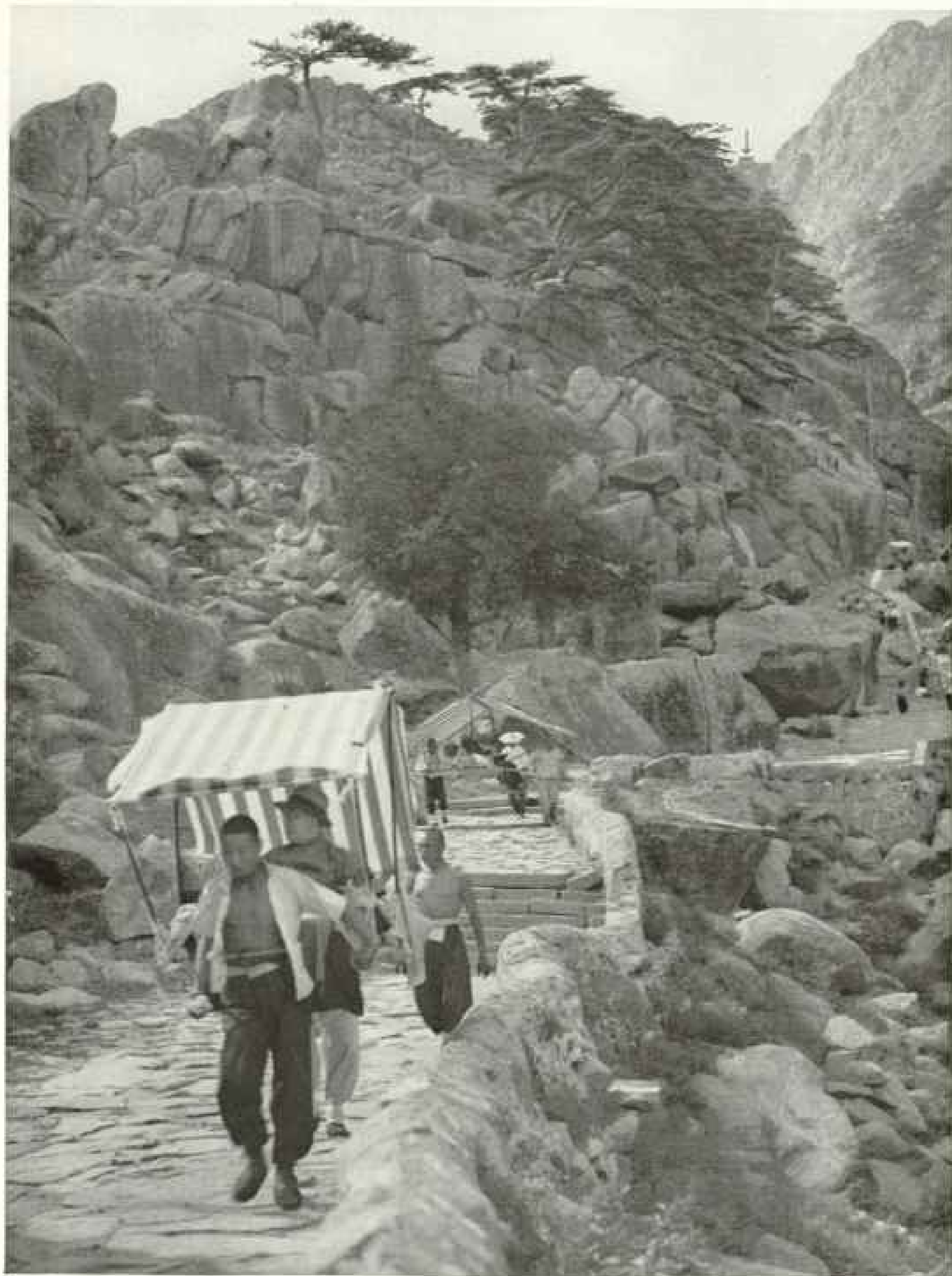
Twice traversing the 6,700 steps, they make the round trip in a day. Most are brawny six-footers. Here an extra man rests his shoulder pole, suitcase at one end, blankets and lunch basket at the other. Awnings above the chairs are impossible on a windy day. With a heavy rain, the gorge on the left becomes a torrent. In spring the sweet melody of the Chinese thrush (blackbird), blue-tailed robin, bulbul, Chinese nightingale, larks, and finches and the profuse wild flowers soften the stern face of the mountain. The area is of very old geologic age.



Hubert Grauert

At the Top of Thousands of Back-breaking Steps Sits South Heavenly Gate, Where Millions Have Heaved Sighs of Relief

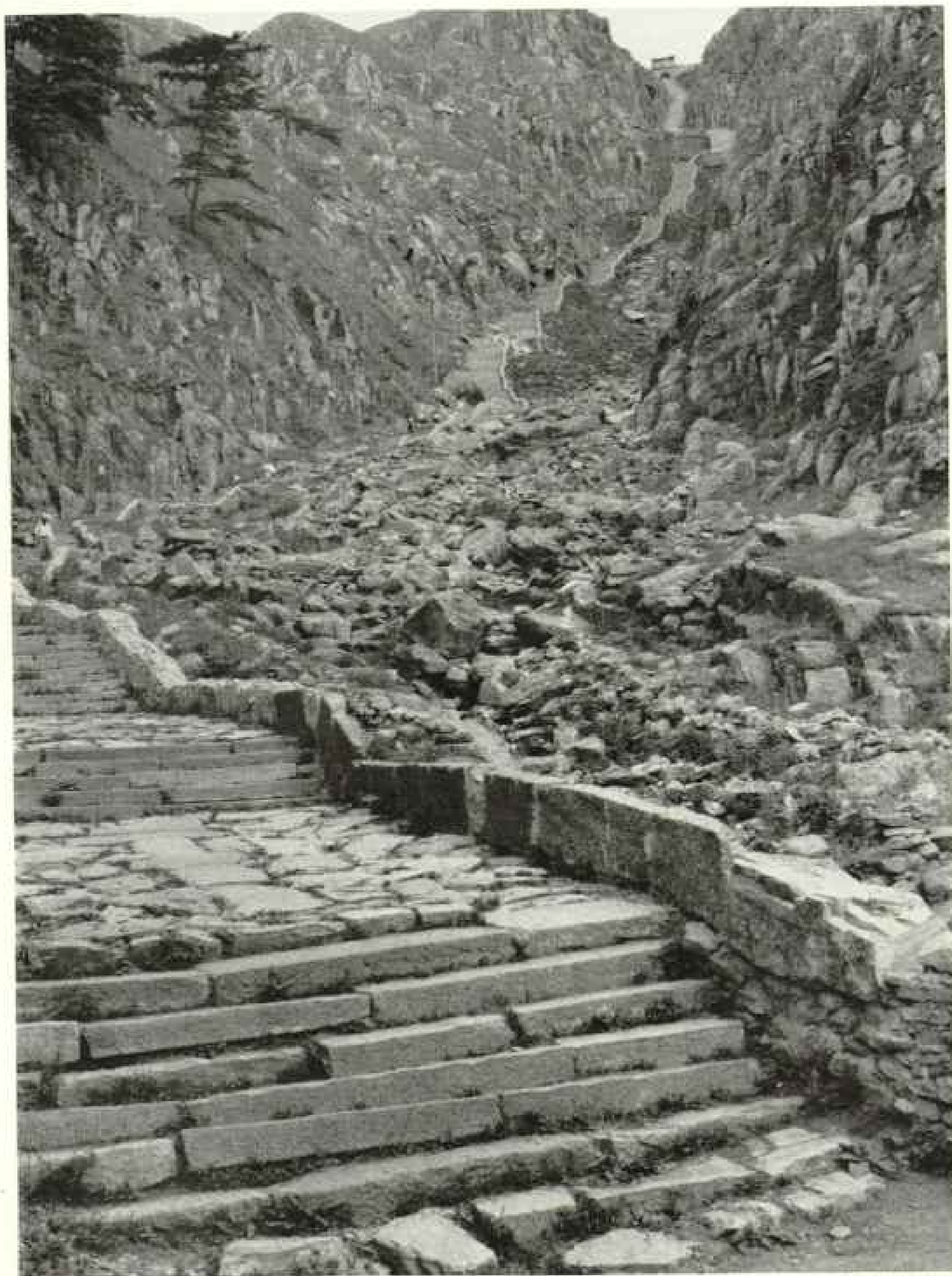
In a peacetime February or March 10,000 pilgrims a day pass through this portal, sometimes known as the Summit Where One Touches the Empty Space. Then they take a road (the Heavenly Way), winding to the right, up to the Temple of the Jade Emperor, which crowns the top of China's most famous mountain (page 715).



OSBERT GRANTHUR

To Their Passengers' Frequent Alarm, Bearers Trot down the Pilgrim Way at a Dizzy Pace

Straps to the shafts enable shoulders and hands to share the weight. Here two men carry the load. As one tires, he tosses his burden to the relief man (waist bared). If a bearer slips, he drops to his knees, protecting his fare. The poor have no fear; they walk. Arrow points to the South Heavenly Gate (pages 705, 709).



Gilbert Grosvenor

On the Dragon's Throat Stairs, Hearts Palpitate, Lungs Gasp, and Knees Weaken

Anyone who has climbed a skyscraper will know how pedestrians feel mounting the 1,000 steps to the South Heavenly Gate. To some, descent is even more terrifying, as the feet involuntarily fly faster and faster. Some make the pilgrimage kowtowing every few steps.



Gilbert Grosvenor

Above the Larger Inscription, Fading Characters a Yard High Announce "Cloud Peak"

Facing a crumbling shrine, a Chinese guide examines text carved in granite. Tradition says the Emperor Shun performed sacrifices on Tai Shan 22 centuries before Christ. Many of his successors and thousands of pilgrims have commemorated their devotions by ordering inscriptions carved on cliffs and walls. In 1748 Emperor Chien Lung had this one copied from his own handwriting. The smaller inscription is dated 1907.

by the Han imperial pilgrim Wu Ti, in 110 B.C., still leans over a temple wall to shade the road, its proud pedigree lettered on a stone tablet.

Farther up, stairs are more nearly continuous, temples are scattered, the Way is steeper and more barren, and occasional glimpses of the South Heavenly Gate are clearer (page 707). Beggars' thatch-roofed huts, built of boulders, are sometimes so low that it would be impossible to stand in them. In one we found a charming, wistful, consumptive woman. Her hope and joy was a ten-year-

old son, who attended a school in the Temple of the Three Functionaries, where a Government school had been installed.

With the new political regime in 1928 came the blue paintpot, the aggressive blue of the Government party, putting its mark on doorways and pailou to the very summit.

One day I met some dyed-in-the-wool conservatives; one could not say they were true-blue, for that was the very color they detested. They had just come from the annual meeting of the Confucian Society in Chufu (Kufow), and in a mixture of languages they spluttered

their resentment at the defacing of monuments. On esthetic grounds I quite agreed with them. However, if the Chinese Government is as lasting as the blue, its long existence is assured.

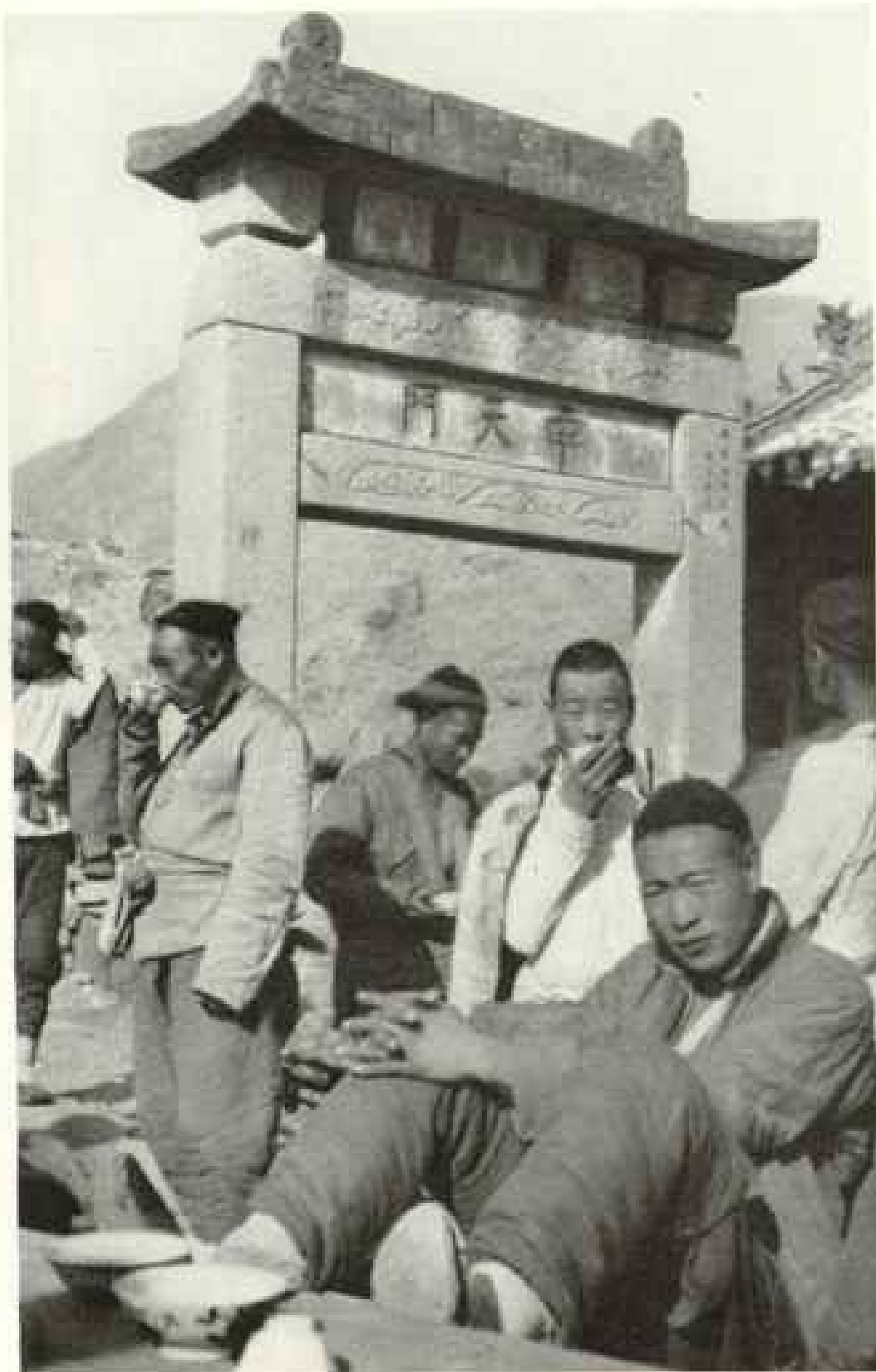
At the head of a watercourse stands the Heavenly Teapot Tower, named from the thought that the heavens arch above it like the bulging form of a teapot. Near it is the pailou with the speaking title, "Where Horses Turn Back." Since the Pan Lu was laid with steps, centuries ago, horses have been of no use, but one pictures early pilgrims leaving their mounts at this point and facing the steep gorge ahead.

A Grand View from Halfway House

The steps now advance continuously, turning and twisting to master the contours of the rocky valley, until at the Halfway House one comes to a steep ridge dividing watercourses. To the west is the long valley of the Hwang Hsi Ho, the Yellow West River, which far below plunges into the Black Dragon Pool. To the east are the streams which flow into the Peach Orchard Glen. From a bench on the open platform of a teahouse, one revels in the wide sweep of view below and the abrupt heights above. A stone pailou called the Second Heavenly Gate marks this important stage in the ascent.

Imperial memories attend the Snowflake Bridge, where a strong span swings across the Flying Cascade beside the great stone of the Royal Marquee. HOLLOWED in the rock are holes which, according to tradition, held the tent poles of the Sung Emperor Chen Tsung, who A.D. 1008 rested a night at this thrilling spot, listening to the thunder of the torrent.

On the night of his descent, flares were set burning at intervals from summit to base. What a trail of light it must have been! Small wonder if the Chinese imagine that angels ascended and descended the ladder of light. That night was the climax of Tai Shan's his-



CHARLES A. JONES

Chair Bearers Pause for Tea at Second Heavenly Gate

They measure Tai Shan by the energy required to climb it. This pailou, or memorial arch, they consider the halfway point up the Pilgrim Way, though it is actually almost the three-fifths mark. These men, drinking from handleless cups, are Mohammedans. They gladly carry Buddhists, Taoists, Confucianists, and Christians. To them Tai Shan is not holy; they mimic the cries of its priests (page 703).

tory, for the taxpayers groaned under the expense of the imperial progress.

The Pine Tree of Fifth Degree

An earlier emperor has left a legend at the Pine Tree of Fifth Degree. It was no imperial silken tent, but a simple tree which sheltered from storm the great Chin Shih Huang Ti, uniter of China in one broad empire, builder of the Great Wall, and—unforgivable sin—burner of the Classic Books. Our word "China" comes from the name of his dynasty.

Confucian historians have heaped obloquy



Gilbert Grosvenor

A Robed Attendant Stands Watch in the Jade Emperor's Court

Taoism recognizes many gods. One of these was a 12th-century physician, Chang Yu Huang, who cured his sovereign. After Chang's death the grateful ruler deified him. As the Jade Emperor, he became supreme in the Taoist pantheon. One of the mountain's scrawny mongrels is fed by the helmeted guide.

on him and have stated that the storm was Nature's punishment of a usurping autocrat. Yet there is a gentle touch in the emperor's "thank you" to the sheltering tree, which he honored with the fifth degree of mandarin rank. A broken stone kept in the Tai Temple bears an inscription believed to be his, the oldest on Tai Shan.

For sheer conspicuousness, no other memorial equals that of the Manchu Emperor Chien Lung, the Wan Chang Pei, or Tablet of a Hundred Thousand Feet (page 707). The title speaks in decidedly round numbers, whether it refers to the size of the tablet or its height on the mountain. A large upright surface on a high cliff has been covered by a

poem of the emperor's composition, cut in characters each one meter square. The emperor wished the world to remember that he had climbed Tai Shan. The poem has weathered considerably, but the smooth background shines out as a panel of light, easily visible from the plain.

A better and more modest memorial is that of Chien Lung's son, Chia Ching, who caused to be planted along the Pan Lu 22,000 pine trees. I passed a memorable day in their shade, painting a view of the many hundred remaining stairs abruptly rising through the last chasm to the South Heavenly Gate.

Pilgrims ceased to chatter as they put forth full strength for the last climb of several hundred steep steps without a break. We heard only the shriek of hawks circling above and the tom-tom of a hermit in some high cleft. The red walls and yellow-tiled roofs of the south-facing Heavenly Gate, to which we had looked up during four hours of

travel, were a reality now.

Sinking on a bench in the shady portal, I discovered a huge figure of Kuan Ti, god of war, sword in hand, glaring down the stairs at the struggling pilgrims. Perhaps he is a sort of St. Peter guarding the Gate of Heaven, but at least he let me pass with other sinners. He is a popular hero, for there are in all seventeen shrines to him on the Way or in Taian.

The Profile of Tai Shan

But the journey is not over. There is the long ridge, gently rising to the east precipice, which marks the strong profile of Tai Shan as seen from the plain. There are weather-beaten stone huts and strongly built temples



Tai Shan's Last Steps Lead to the Temple of the Jade Emperor, Taoism's Supreme Divinity. To the left of the gate stands a four-sided monolith, 15 feet high. More than 2,000 years old, it is the famous Tablet Without Inscription. Only the word "Ti" (God) is engraved.

along the road, which is presently joined by narrow stone paths from the west and north.

A complete pilgrimage requires the giving of at least one *cash* at each of the many shrines along the Pan Lu. The descent is accented by firing strings of tiny spluttering firecrackers.

Pilgrimages are often made in groups representing and financed by a village. The leader carries a gay pennant, lettered with the name of a society or a village. Orange-yellow is the typical pilgrim's color, and often each member carries a bag of this hue. Pilgrim canes are painted scarlet and have carved dragon heads.

One group I met were dressed in silk robes, each of a different color, brilliant red, strong blue, mauve, and orange, so that they made a gay showing against the sober rock tones of stairs and cliffs. Their servant carried on his back a prayer mat woven of a dark fiber, perhaps coconut, with a fringed edge which

stood out in bristles behind his head like a devil's halo. They were, I believe, conscious reincarnations of a distant past, meaning to save China—and themselves—by a return to the "good old days."

A Tribute to Filial Piety

Individual pilgrims, too, show the persistence of old ways. One morning I saw a man carrying his mother on his back, and in the evening I saw them returning down the mountain in the same way. This also was an effort to relive the old stories, such as those given in the *Classic of Filial Piety*.

I saw another extreme case, which was probably the carrying out of a vow, a man kowtowing full length every two steps of the way.

Most of the pilgrims are Shantung* peas-

* See "Shantung—China's Holy Land," by Charles K. Edmunds, and "Descendants of Confucius," by Maynard Owen Williams, both in the NATIONAL GEOGRAPHIC MAGAZINE, September, 1919.



Gilbert Grosvenor

Tablet Without Inscription Looms Through the Arch of the Temple of the Jade Emperor. Four center characters say: "Tai Shan's Highest Peak," referring to the walled-in stone in the foreground. Left of the gate, three others say: "Foremost (pillar) on Heaven's left."

ants, especially in recent years when travel has been interrupted by wars. The women wear satin headbands, often with colored glass ornaments attached, useless and coquettish substitutes for a bonnet, especially if a shining bald pate projects above this gaiety.

Their feet, many still bound—for these are peasants—also make a bid for attention, being wrapped with magenta and bright-green ankle bands extending well up the leg. Men with queues are still seen.

Here one may study the hard-bitten features of a people to whom self-indulgence is unknown. Ignorant and superstitious they may be, but with a simplicity and a power of endurance which shames the world.

The Tablet Without Inscription

The highest temple, that of Yu Huang, the Jade Emperor, chief of Taoist divinity, is approached by long flights of steps. At the base of the last of these stands the Tablet Without Inscription, which, like the Athenian

Altar to the Unknown God, has intrigued by its mystery (page 715).

Geologists prove that the stone was not quarried on Tai Shan.

This enormous mass, measuring more than 15 feet in height and 3 x 4 feet in thickness, and weighing more than one dares to guess, was somehow transported by manpower to the heights.

Stupendous labor! For what? Perhaps beneath it is buried the jade tablet of the secretive emperor Wu Ti of the Han Dynasty. In 110 n.c., he sacrificed on the summit in the presence of one attendant, who soon after mysteriously died. There is irony in the story that Wu Ti himself finally "died of eating immortality pills."

A strange modern touch is seen in the blue sun of the Nationalist Government, painted on the pear-shaped finial at the top of the monument. It is about as important as dotting one letter *i* in the long page of history.

In the central court of the Temple of the



Gilbert Grosvenor

Gift of an Emperor in 1572; a Stone Wall Encloses Tai Shan's Holy Granite Pinnacle

This jagged outcropping is the Jade Emperor's Summit, once known as Father-in-Law Peak. Chinese say the rocks "fell from Heaven." Visitors in 1937 were Dr. Gilbert Grosvenor, Editor of the NATIONAL GEOGRAPHIC MAGAZINE, and Mrs. Grosvenor. Though it was late spring, they had heavy coats, and a Chinese wore a quilt, for at Tai Shan's top they stand at 5,060 feet.

Jade Emperor are the rocks of the true crest of the mountain, carefully herded within an octagonal railing (opposite). People call them "the rocks which fell from Heaven," but they are not meteoric. Pilgrims climb them and stand with triumphant "see me" grins.

From the parapet of the temple there are sweeping views in all directions. To lodge for a night in the cool, often cold, clean guest room, with windows overlooking the world, to commune with brilliant stars, almost to enter the palace of Wen Chang, god of literature, in Ursa Major—that indeed is to be so divorced from all ordinary life as to enter for the time a true oriental heaven.

The Isles of the Blest

To the east, beyond range after range of mountains, lie the Isles of the Blest, where the sun rises. Who shall say I have not seen

them, there in the dazzle of the first rays of light, where gold-edged cloud and mountain meet?

Old and kindly priests are the spiritual offspring of long-haired anchorites, "who on honeydew have fed," winning the secrets of immortality by nearness to Nature. For one night at least, Tai Shan has written my name on the good side of the ledger.

The late afternoon sun floods the southern plain with a glow of yellow, reminding one that the imperial color was the emblem of Earth.

On the verge of a precipice which is now called Cliff of the Love of Life, but once was "Suicide Cliff," I was all atingle with the beauty spread out before me. Yet here, as the earlier name suggests, fatal decisions were carried out, until the law took its stand on the value of human life and put up a high wall along the brink, lettering it with an "It

is forbidden" sign. Many suicides were acts of filial piety, a son seeking to substitute his life for that of an ailing parent and thus reverse the judgment written in Tai Shan's *Domesday Book*.

If you trust your life to fleet-footed chair bearers, the return trip may be made in two hours, but the sensation is terrifying as you swing through the South Heavenly Gate and down the steepest stairs, which the bearers take at headlong speed with a twittering shuffle of feet (page 710).

They laugh at one's involuntary gasps and murmurs, for accidents are extremely rare, and they have their preventive technique in case of a misstep.

Especially if young, they are gay on the return trip, with innuendoes, intended for the patron's ear, about the size of the "wine money" which they, Allah forgive, hope to receive.

The western cliffs shade the Pan Lu, which opens before one in violet shadows. The beggars' calls have dwindled in number and volume; the quietness of approaching evening is on the mountainside. Then, if one is not a traveler but a resident of some wayside temple, one seems to participate in an ownership of its vastness.

While spirits of legend and history rise with the shadows, one settles back into the peace of tiny nests of life. Fires for the evening meal send their smoke comfortably from little red pottery chimneys, and voices join in friendly talk. It is the familiar, insistent life of China which dominates the mountain.

East and West Meet on the Way

War and changing politics have not spared Tai Shan. For a long time White Russian mercenaries, employed by a Shantung war lord, were quartered in the lower temples of the Pan Lu. As I stood painting in the porch of a closed teahouse, I realized that the voices from within were not Chinese, but belonged to Russians engaged in a gambling game. Further evidence was an empty vodka bottle at my feet.

Then the talk gave way to song, and a beautiful tenor voice led in a song of their own land, sad as that of the Israelites "by the rivers of Babylon."

It had a strange repercussion, for a beggar woman fired to rivalry came out from her stone hovel and filled the air with her shrill, unmelodious rhythm. The two civilizations were contrasted in their songs, but met on the sacred Way.

An innocent but nerve-racking encounter with the Russian troops took place before a

tiny temple which was the subject of my painting. The small level plot before it suddenly became the drill ground for a troop of soldiers.

Efforts to continue painting came to an end when, at an order which sounded like "*Itsch-la, R-rum-m-m!*" they all dropped to their knees, leveled their empty guns directly at me, and responded with a sharp click to the order, "*Hor-r-r!*"

I did not wait to inquire if their officer had a sense of humor. As a Chinese proverb says, "There are 36 ways of saving your life, but the best of all is to run away."

Cigarettes and celluloid toys, matches and perfumes, find their way to Taian shops; but the people who plow the stony fields around Tai Shan and graze their flocks on its flanks are the Chinese of Confucius' day.

In the shadow of the city wall I took my stand to paint a temple gateway across a dry gully. The figures in blue on the temple steps made pleasing spots of color, about a half inch high each in my painting, but a diligent messenger sped across to tell them they were being painted.

Painting Smudged to Save a Soul

An angry mother, child in arms, stamped her way over and, with a flood of invective best not understood, thrust out her finger and smudged my painting. It seemed I had tried to steal the soul of her child by painting it, and she quite simply had wiped out the danger. To be sure, when she had gone, palette knife and brush restored the blue spots, and I have not since been pursued by Chinese ghosts.

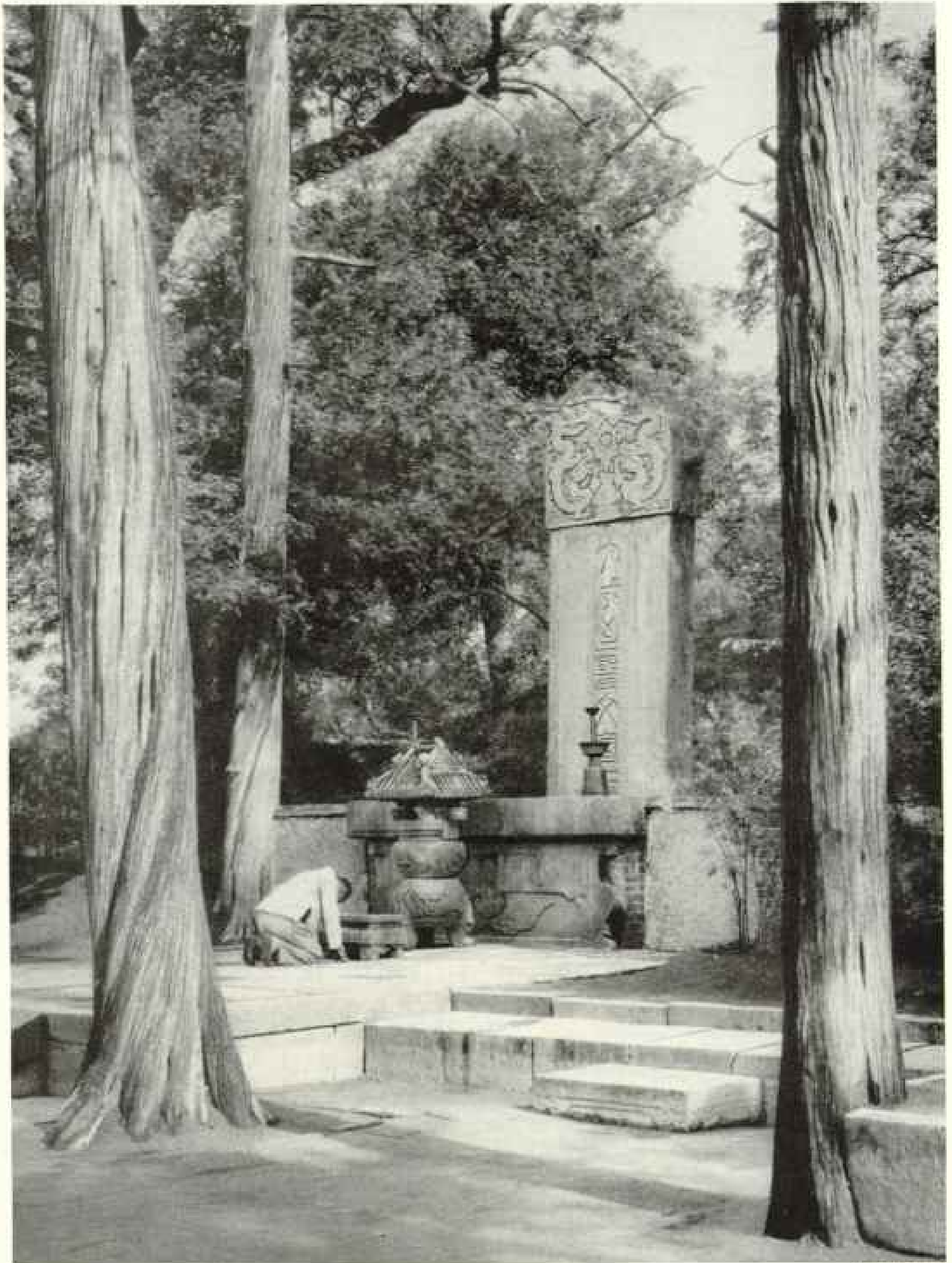
Chinese interest in artists is keen, though, according to their standards, the artist is but a "*hua-r Chiang*" (paint smith), working for no other than monetary reasons.

"How much does she get for a painting?" someone asks. And another answers with authority, "*I k'uai ch'ien*" (one dollar).

"How many does she paint in a day?" But the intended mental arithmetic is balked by lack of answer, and I am left, as it were, financially unrated.

Working one day among the ruins of the Brass Temple, near the railway, I was discovered by a troop of Chinese soldiers who had been practicing broad-sword drill. They jumped the wall and precipitated themselves on me, but in no warlike spirit. Theirs was but childlike curiosity.

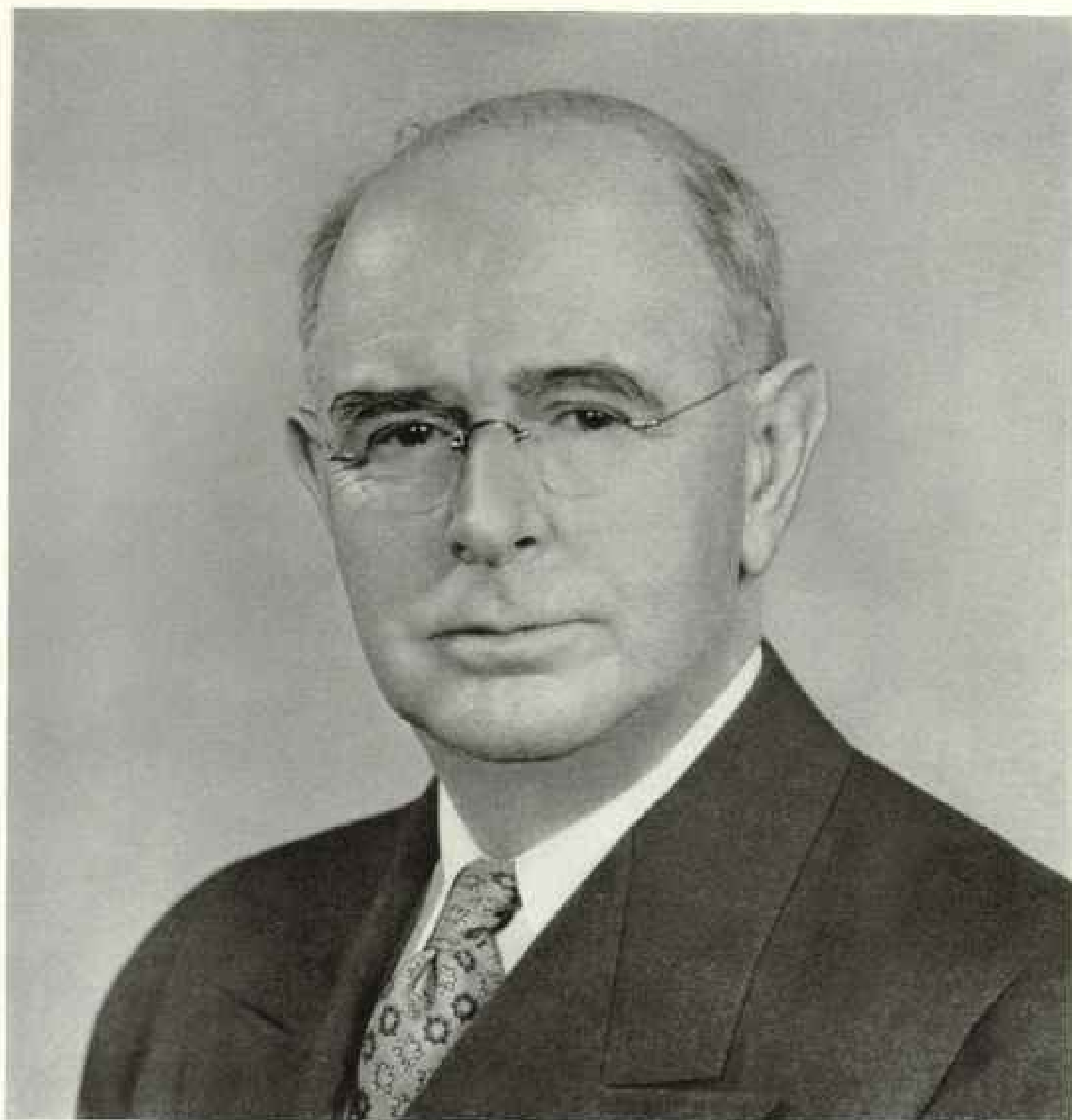
I tried to go on quietly with my work, surrounded by the bristling, shining blades of decapitating swords, until, presently, a bugle called them away.



© White Brothers

"The Most Wholly Perfect, the Most Sacred, the Prince of Literature"—Confucius' Epitaph

Buried in Chufu, China's Sage died in 478 B.C. This tombstone was erected 1,920 years later. An incense burner stands before it; ancient cypresses enclose it. Confucius is the Latinized form of Kung Fu-tzu. Thousands of Kungs, his descendants, are buried near him. His immediate family has clung together 2,500 years.



GEORGE W. HUTCHISON

1886—1945

THE Board of Trustees and Officers of the National Geographic Society, with deep regret, record the death of George Wayland Hutchison, Secretary of The Society. Dr. Hutchison was first employed by The Society in 1907, when he was 21 years old. Indefatigable, loyal, and intelligent, he gained promotion to Associate Secretary, Acting Secretary, Secretary, and to membership on the Board of Trustees. Ever vigilant and alert for any mechanical or human improvement that would

advance The Society's membership interests; always watchful for any trespass on The Society's rights; tenacious, straightforward, prudent, Dr. Hutchison continued always cheerful, genial, cordial, sympathetic and wise friend, whose counsel his fellow workers sought. His associates feel keenly the loss of an able colleague and a personal friend. The many expressions of sympathy received from The Society's membership are gratefully acknowledged.

Sights and Sounds of the Winged World

Study of Birds to Make NATIONAL GEOGRAPHIC Color Photographs
Yields Rich Scientific Knowledge of Their Habits and Behavior

BY ARTHUR A. ALLEN

Professor of Ornithology, Cornell University

With Illustrations from Kodachromes by the Author

MY PET crow, Jim, has given up the world of crows and prefers to live with me. Although he is free to fly off with his wild neighbors, they seem to hold no allure for him.

"Hello, Jim," I say to him. He bows very politely, spreads his wings, wags his tail rapidly from side to side, and makes a rattling noise in his throat, a greeting I have never seen a wild crow give another.

I did not teach Jim to do this; and since he was brought to me as a very young bird when his eyes were scarcely opened, I doubt that he learned it from his parents. I prefer to think of it as a spontaneous reaction developed through crow ages like a human smile.

At the approach of my pointer or a stray cat, Jim stands high on his legs and hurls invectives with wide-open mouth and vigorous shakes of his head. He sometimes scolds the wild crows that come into the trees near the house, though more often he pays no attention to them.

The Same World Different to Man and Crow

Jim's physical world and mine are fairly similar, but our reactions to parts of it are so different that I wonder whether he sees the same things I do, hears the same sounds, smells the same odors, and feels the same heat and cold. Surely, if things tasted the same to him he would not go after worms, grubs, and spiders with such avidity. He pays no attention when I talk to him in low tones, but if I whistle or squeak he shows instant alarm. Is he deaf to certain sounds and overresponsive to others?

How much of our world goes undetected by birds and how much of their world is beyond our ken? Some questions we may never answer, but others lend themselves readily to study and experimentation.

Today it is comparatively simple to record accurately on film all the sounds made by birds* and then to analyze the visible soundtrack record and compute the exact changes in pitch of a bird's song. Indeed, the late Albert R. Brand, who started the bird-song

recording project at Cornell, did exactly this for more than a hundred of our common birds.

From his studies we know that the highest note of the blackpoll warbler is about 10,225 vibrations a second and the lowest note of the harned owl only 150. The average for some sixty songbirds is 4,280, or a quarter note higher than the highest note on the piano.

An ingenious method of testing the hearing of birds, similar to that of the conditioned reflex developed by Ivan Petrovich Pavlov in his classical experiments on animals, was devised by Mr. Brand and Paul Kellogg of the Cornell Laboratory of Ornithology. Giving some unexpected results, it helps to show how the bird's world differs from ours in at least one particular.

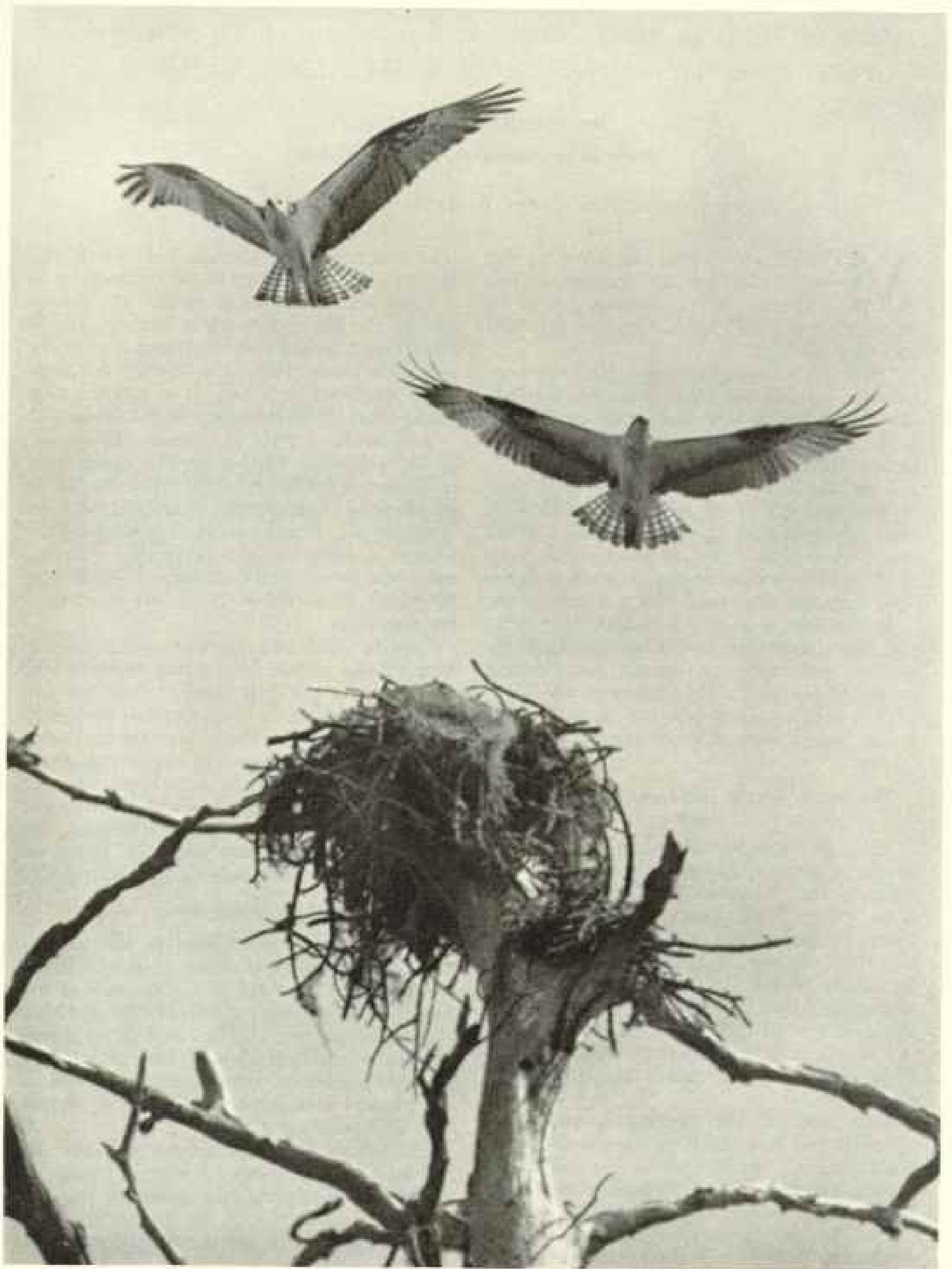
Captive starlings, sparrows, and pigeons were trained to feed from a tray so wired that a slight shock could be given to their feet and at the same instant a note of known frequency sounded from an oscillator directly overhead. After a few repetitions of the sound-shock stimulus the birds would jump from the tray when the sound was given without the shock. When the birds were thus conditioned, the note from the oscillator could be raised or lowered until no response was forthcoming.

What Birds Hear

Through many repetitions of this experiment it was learned that the range of hearing in starlings is from 700 to 15,000, that of the English sparrow from 675 to 11,500, and that of the pigeon from 200 to 7,500 cycles a second. Man can hear about four octaves lower than the pigeon, or down to about 20 cycles a second, and most of us can hear the highest note detected by a starling.

The sounds we hear extremely well, such as middle C on the piano, having a frequency of 259, would pass entirely unnoticed by sparrows and starlings, but are just within the hearing range of pigeons. When you talk

* See, by Arthur A. Allen, "Hunting with a Microphone the Voices of Vanishing Birds," NATIONAL GEOGRAPHIC MAGAZINE, June, 1937, and "Touring for Birds with Microphone and Color Cameras," June, 1944.



Ospreys Are Like Bombs with Built-in Sights

As they plunge at their prey, their hawk eyes enable them to correct their aim with every movement of the target (page 724). Here a pair are hovering over their nest—a mass of sticks on top of a dead tree. These huge nests are familiar sights along the Atlantic seaboard from Florida to New England.

to your canary, he may seem to be listening as he watches your lips move, but he does not hear a word you say.

When I talk to Jim Crow in a low voice, it is little wonder he turns a deaf ear to my crooning. If I speak loudly, even at the same pitch, I doubtless set up overtones that become audible to him, and he pays attention. What a lot of noise he is spared! His world is somewhat different from mine in this respect, although he doubtless hears more of the world's uproar than does the canary or the starling.

In our laboratory at Cornell, Ernest Edwards, a graduate student, made tests of the hearing of horned owls and determined that, in spite of the comparatively low frequency of the call (150), the owl's range of hearing extends downward only to about 70 cycles a second. This explains why the ruffed grouse can drum with impunity even at night in woods inhabited by horned owls, for the vibration frequency of the grouse drum is only 40 a second and therefore below the hearing range of the owl.

Most species of birds utter distinctive call notes—chips, chirps, or squeaks quite apart from their songs. Is it too farfetched to suppose that their ears are especially attuned to these notes, which sound much alike to man, and that they are thus able to exchange with their own kind a considerable range of feeling and experience? On the other hand, man's wide range of hearing enables him to detect many sounds inaudible to birds.

When I place some unfamiliar object before my crow, he usually scrutinizes it carefully, turning his head first on one side and then on the other, as if listening to see if it could make a noise. He is not listening any more than the robin cocking his head to one side as he seeks worms on the lawn. Birds, having their eyes on the sides of their heads, do not see near objects straight ahead so easily as those at the side. They turn their heads to center the vision of one eye on the object.

How Owls See at Night

On the retinas of such birds as the robin and the crow, there are two spots of keenest vision, one for monocular vision of things close up and one for binocular vision of more distant objects (pages 724, 725). Owls, whose eyes are directed forward, see more as we do and turn their heads in the direction they wish to see most clearly.

When the light fails and we begin to see poorly, the owl starts to waken, and the iris in its eye opens up to let in a maximum of light. In one of my photographs the dis-

tended iris proves that the picture was taken by flashlight in the dark. In bright sunlight the pupil might be the size of a pinhead.

In still another way, the owls have an advantage over man: Their retinas, like those of cats, are more sensitive to the blue end of the spectrum, which dominates at night. The retina contains two types of light-sensitive cells, the rods and the cones. The cone cells, which contain a drop of oil, are apparently more sensitive to the red end of the spectrum, while the rods are more sensitive to the blue. In the retina of the owl and other night-roaming creatures, the rods predominate.

Is it not possible that the periods of activity of the many kinds of birds are determined even more by the proportion of rods and cones in their retinas than by the size of their eyes or the activity of the pigment cells?

Cardinals Sing Early and Late

Certain species start their May morning concert much earlier than others. For example, a pair of cardinals are the first dawn visitors to the feeding station near my window and the last to leave at night. The chickadees, however (Plate IV), and the woodpeckers (Plates II, III) often do not show up for an hour after dawn, and they retire long before the cardinals.

When winter shadows lengthen on Cayuga Lake, the canvasbacks and bluebills cease diving near shore and swim farther out to sleep. While sleeping, they paddle occasionally with one foot to keep traveling in circles and not drift ashore. They obviously do not like the dark.

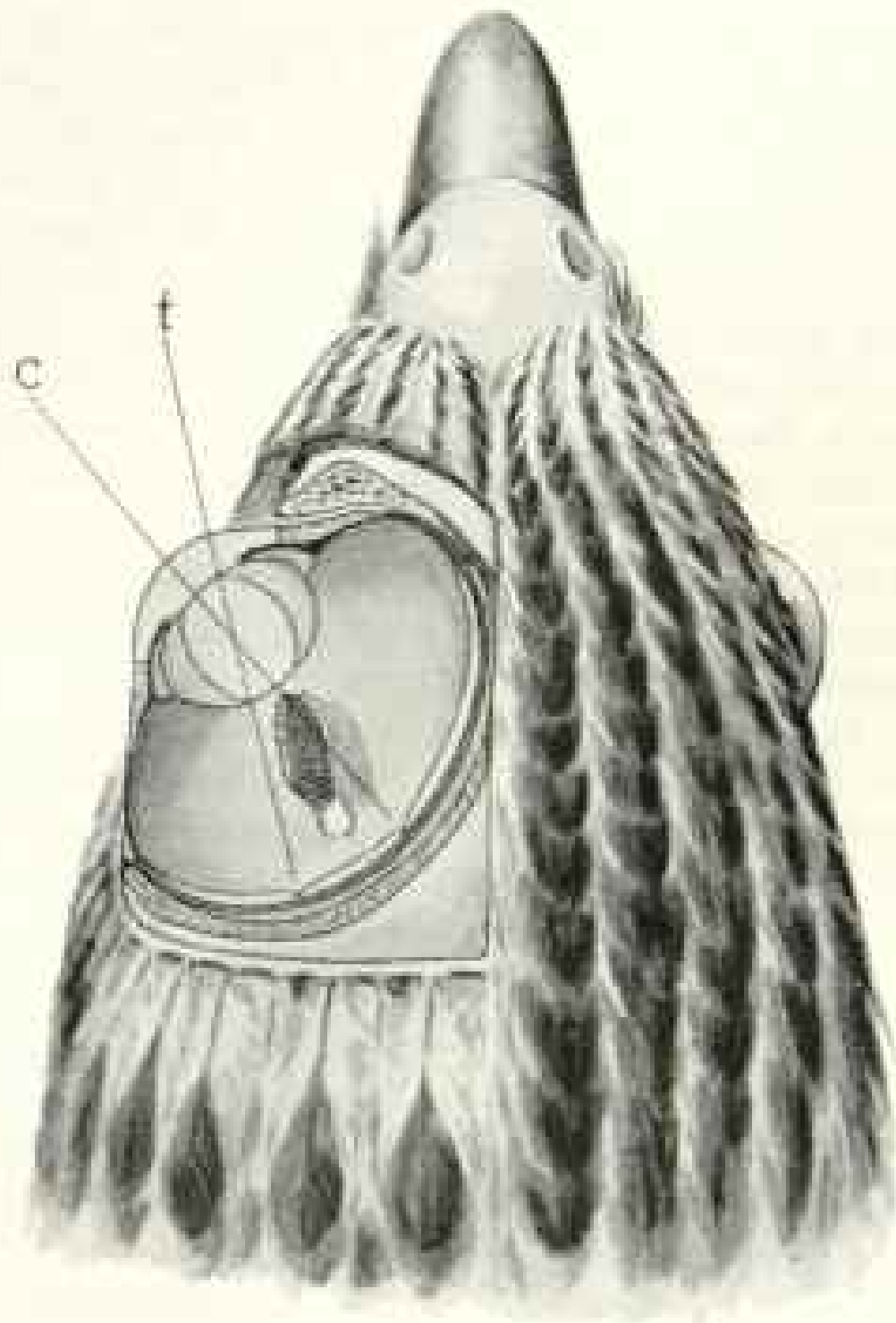
On the other hand, the black ducks that have been dozing out the day in the middle of the lake now become active. Like the woodcock (Plate IX), they go in search of food just when the diving ducks cease their activities.

Differences in responses to sunlight control all birds' selection of habitat and time their daily activities.

To a barn owl, the world viewed by the light of the moon and stars must be a cold, colorless place, but to the swallows (Plate X), which dart about in full sunlight, it takes on a riot of color.

The ovenbird and mourning warbler choose the dense shade of the woodlands for their abode: the orioles (Plate VI), cuckoos (Plate V), and kingbirds (Plate XV) like the light shade of gardens; the sandpiper (Plate XIII) and the terns (Plate I) prefer the bright sun of the open shores. And each species may be unhappy in the preferred habitat of the others.

The Arctic tern probably enjoys more day-



Drawn by Walter A. Weber

The Way a Bird Sees

The head of this Red-shouldered Hawk is dissected on the left side to show the extraordinary size of the eye. The retina has two depressions, or foveae, for sharpest sight. The line of binocular vision (t) is that for both eyes together; that of monocular vision (c) is that for each eye independently. These are adjusted by the large lens in front, while below lies the dark-colored pecten, behind which is the light-colored end of the optic nerve. The eye is not symmetrical (pages 723 and opposite).

light than any other bird, for it nests in the Arctic region during the period of almost perpetual daylight and winters in the Antarctic during a similar period. On the 22,000 miles of its migrations, it enjoys the periods of longest days and shortest nights. Is there a material difference in its eye structure that stimulates such a tremendous urge for migration? So far as I know, no scientist has yet worked this out.

Birds' Eyes Adjust Themselves Instantly

I have often watched an osprey or a kingfisher, hovering 50 to 75 feet over the lake, suddenly half close its wings and drop head-first toward a fish it has spied in the water.

Despite the rapidly increasing speed of its plunge, it apparently keeps its eyes focused on its prey, for it sometimes swerves when only three or four feet from the water to transfix a moving target! (Page 722.)

Human eyes require a fraction of a second to adjust from the distant road to the speedometer of a fast-moving automobile, but with birds adjustment seems to be instantaneous.

In the back of a bird's eye a little black vascular comb called the pecten projects from the region of the optic nerve into the vitreous humor behind the lens. One of the supposed functions of this pecten is to throw its shadow on the retina, so that the slightest motion of the object under scrutiny is perceived and telegraphed to the brain. Mammals do not have this structure.

The tiniest mite on the bird's nest is immediately picked up if it moves, but even large enemies escape detection if they are quiet.

A wounded grouse I once held in my hands at the edge of a wood was obviously frightened at being caught; yet, despite its predicament, it suddenly turned its head to watch the sky. After several moments I made out the tiniest black speck of a hawk flying so far above the earth that it was nearly out of range of human vision.

A hawk or an owl, however, that does not move often escapes detection even when close at hand. Bird-eating hawks like the Cooper's and sharp-shinned take advantage of small birds by perching motionless until their prey has become oblivious of their presence.

Once while banding canvasbacks on Cayuga Lake, I sat in a blind on a bag of grain from which I had baited the trap, a small enclosure of wire netting in the shallow water. I had spilled inadvertently a trail of corn along the shore. Before I realized what had happened, several black ducks had guzzled their way around and behind my little hideout and were nosing the grain from right under my coat-tails.

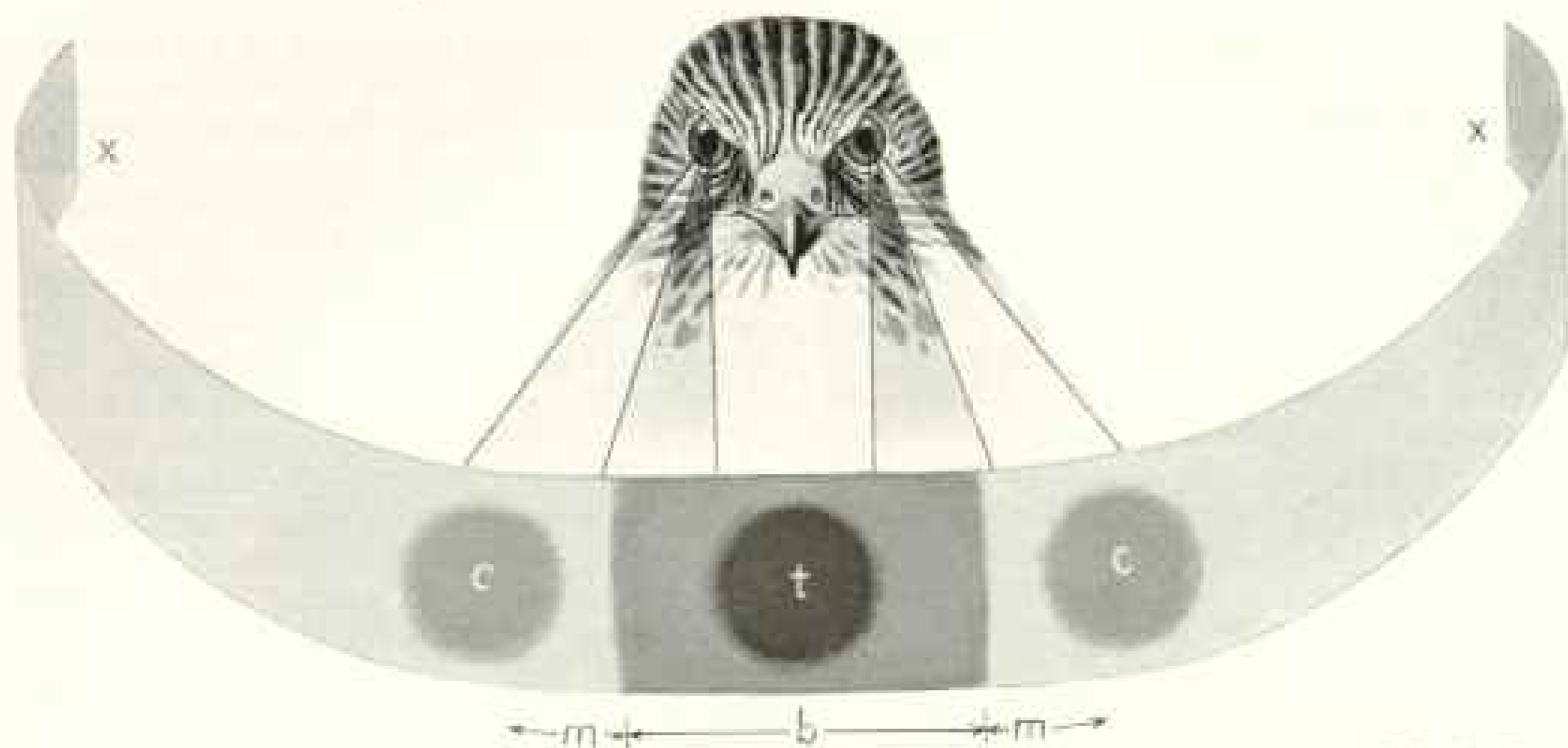
So long as I kept still, I was just a part of the landscape to them; but the instant I moved they sprang away in such alarm that one boxed my ear with his wing as he passed over my head.

Hunters consider the black duck the wariest and most sagacious of all our waterfowl. For this reason friends have remarked rudely that the ducks' failure to distinguish between me and the sack of corn was no compliment!

Do Birds Have a Sense of Smell?

Some duck hunters aver that the black duck is the only duck that has a sense of smell and that consequently it is as difficult to sneak up on as a deer. This opinion brings up the question of the importance of odors in the bird's world.

A few years ago one of our graduate stu-



Drawn by Walter A. Winer.

A Bird's-eye View of the World

This Red-shouldered Hawk looks straight ahead with both eyes together; this binocular vision (page 723) covers the dark central band with the central spot (t) of sharpest sight. Two circles (c) at either side designate the acute field of monocular vision for each eye alone; the gray band from x to x marks a segment of total arc of vision in this bird. This drawing was adapted from a sketch by Gordon Lynn Walls in *The Vertebrate Eye*, published by the Cranbrook Institute of Science.

dents, Victor Coles, attempted to settle the age-old question of whether turkey buzzards find their food by sight or smell.

John James Audubon thought he had settled it when buzzards were unaware of a carcass he had concealed under a canvas but were attracted by his painting of a dead sheep. Later observers, however, discovered that buzzards often found carcasses concealed in wood-chuck holes or under boxes.

After watching the buzzards of Barro Colorado Island, Canal Zone, discover the hiding place of some dead fish concealed under a thatched roof, Frank Chapman became convinced that they must have a keen sense of smell.*

For two years we housed Victor Coles' three buzzards while he carried on a series of experiments testing their olfactory sense. He has not yet published his thesis, but before he received his degree he had convinced even the most skeptical that his captive buzzards' sense of smell was so poor as to be of little more use to them than their sense of taste in locating food.

The olfactory lobe of the brain is very small in buzzards, as in all other birds, and the turbinal bones of the nose over which are spread the olfactory membrane and nerves are only partially covered with the sensory tissue.

The buzzard's vision, on the other hand, is exceedingly keen. Doubtless they have learned through experience to associate buzzing flies and crawling beetles with their type of repast,

even when the carrion itself is not visible from the air.

Their poor sense of smell spares them a discomfort that might become unbearable even to a scavenger.

One of the favorite foods of the horned owl is the common skunk. Probably the skunk's unique method of defense, so effective as far as man and dog are concerned, is scant protection against the night marauder with no sense of smell.

Psychologists tell us that there are only four tastes—sweet, sour, bitter, and salt—and that all the rest of those delectable sensations a good chef invokes are really smells. If that be so, the birds' poorly developed sense of smell may account for their strange choice of foods. If worms were only sweet or sour and all bugs tasted the same, we could close our eyes and never starve in the jungle.

Why Birds Eat Few Japanese Beetles

Some birds are guided by sight, touch, and experience in their selection of food. Only recently rodent exterminators have learned that poisoned grain stained blue or red will not be touched by birds but will be devoured, despite its coloring, by such creatures as rats and mice that find their food to a great extent by smell.

The Japanese beetle looks different from the

* See "Who Treads Our Trails?" by Frank M. Chapman, NATIONAL GEOGRAPHIC MAGAZINE, September, 1927.

beetles our birds have customarily fed upon. For that reason it has been virtually overlooked by them for several years.

William R. Van Dersal lists 16 species of birds as having been observed eating the persimmon in the South, where it is native; yet in 25 years I have never seen a bird touch one of the fruits of a persimmon tree in my garden. My tree is, so far as I know, the only fruiting persimmon in this part of New York State, and consequently, though many of the birds Van Dersal lists pass through my grounds every fall and spring, it stands inviolate.

Similarly the high-bush cranberry, relished by birds in New England, where it is native, is recommended by landscape gardeners elsewhere because "it holds its bright-red berries all winter and the birds don't bother it."

I once fed a lot of cabbage worms to a young cedar waxwing I had rescued when it fell out of its nest. Apparently these caterpillars taken in large quantity are toxic to birds. They made the waxwing sick. After that experience he would not eat any kind of green caterpillar, though he readily took brown ones.

Birds Use Touch in Choosing Food

When I swept a hayfield with an insect net and dumped the contents before him, he at first sailed into the squirming, buzzing, crawling, jumping mess of bugs and devoured them indiscriminately. He soon learned, however, to avoid the little bees and other stinging species, and to pass up all Hymenoptera and even the little tree hoppers with spines on their backs. Touch as well as taste and sight seems to enter into a bird's selection of food.

Both scientists and laymen are still debating the problem of bird migration and the guiding principle that carries the travelers safely to their appointed summer and winter homes through clouds and storms, fog and darkness, without chart or compass. Is it possible, as many have suggested, that birds have a mysterious sense of direction which enables them to utilize the magnetic lines of force on their long journeys?*

Are birds mere automatons which receive stimuli and react mechanically, or are some of these stimuli cogitated and some of their actions controlled by an inner force?

An albino rose-breasted grosbeak (Plate XVI) occupies a cage in my kitchen. Pursued by a hawk eight years ago, it flew into a window and stunned itself. It was at that time probably only a few months old, for conspicuous albinos usually do not last long in the wild.

Though it has lived in our kitchen for eight years, it is still a wild bird. It has learned

by long association not to fear us, yet it attacks my hand viciously when I clean the cage or offer it food. Through the window it watches the sky for hawks and the shrubbery for cats; and it is a veritable watchdog for notifying us in its own way when a predator is in sight.

It has learned to get along without insects and has become overfat on a vegetarian diet, but it still behaves as a normal grosbeak. The Allen family has become a part of its habitat, to be accepted guardedly, but it bears toward us no affection or gratitude for solicitous care. Why should its behavior be so different from that of Jim Crow?

A few years ago we were presented with a brown thrasher reared by Miss Edna Becker, one of my graduate students. A great pet, this bird had the run of the house. When we gave it entire freedom of the out-of-doors, it stayed in the shrubbery about the lawn and greeted all comers with friendliness, if a severe peck on the ankle or a tweak of the ear can be called friendly. Even our pointer received attention, a yank of the tail or the hair on his back. Quick as the dog was, he never quite caught Rufus.

There was never any question that we were as much an integral part of the thrasher's life as we now are of Jim Crow's; yet when fall came, Rufus started wandering farther afield and then suddenly disappeared. Perhaps his friendliness toward human beings or his lack of fear of dogs got him into trouble, but I prefer to believe that the instinct to migrate, inherent in thrashers, stimulated him to take off south without understanding what was happening.

Effects of Early Training

But why the difference in the behavior of the thrasher and the grosbeak—a difference that anyone who has ever kept wild birds in captivity has experienced? The grosbeak had passed at least the first month of its life in the wild, where the only part man played was that of an enemy. The thrasher, on the other hand, had been conditioned to man as a companion during this formative period.

Two barred owls were brought to us six and ten years ago, respectively. One was a tiny downy youngster when he was found and the other nearly grown, though still with down on his plumage. To this day, though they have lived together for six years, their responses to us are entirely different. The one we received very young flies to us; the other flies away. Throughout life birds re-

* See "Bird Banding, the Telltale of Migratory Flight," by E. W. Nelson, NATIONAL GEOGRAPHIC MAGAZINE, January, 1928.

tain the perceptive pattern of their early life.

In a recent report on her studies of the common song sparrow, Mrs. Margaret Nice, a painstaking observer, lists 59 activities which she was able to recognize and record as they first appeared or matured in some young birds she was rearing by hand. Such things as preening, yawning, standing on the tarsus, standing on the feet, scratching, fluttering, stretching, hopping, jumping, pecking, drinking, bathing, etc., were done for the first time at definite ages. Thus while the birds started preening when they were six days old, they did not scratch until they were seven and did not start bathing until they were thirteen.

These were all activities in which the young bird would engage for the rest of its life, and the order of their appearance is much the same, as she points out, in many of the common birds.

What Mrs. Nice was unable to record, but which likewise will be preserved for the rest of the bird's life, was the influence of the young birds' immediate environment and companions in imprinting a mental habitat picture that will affect all later behavior. That of the hand-reared bird is entirely different from that of the young bird reared by its parents, and one can expect that its later responses to man and to its environment will be somewhat different.

Our thrasher, one of the barred owls, and Jim Crow passed their early formative days in man's environment; the grosbeak and the other owl grew up in the wild, and after eight and ten years they still retain the picture of that habitat in which man was a disturbing element.

Effect of Captivity on Nesting Habits

When the nesting season rolls around, the song sparrow that was reared in the wild will search out a nesting site that conforms to the important features of the one in which it was raised. The hand-reared bird, on the other hand, while it may instinctively build a typical song sparrow nest, if it be given the right material, will be just as happy to build it in a box as in a bush.

For years I raised ruffed grouse in captivity under highly artificial conditions, on wire netting so that their feet never touched the ground. Their behavior was in most ways normal for grouse, except that they were absolutely devoid of fear of me or anyone else. At nesting time they were satisfied to lay their eggs in boxes prepared for them, although they still went through the gestures of tossing leaves upon their backs during the egg-laying period, even as do the wild birds. At

best they had only shavings or sawdust to toss.

For another decade I attempted to get wild-trapped canvasbacks and redheads to nest in captivity by keeping them on an enclosed spring-fed pond of several acres, with plenty of good nesting cover where they never had to be handled and where they could have seclusion if they wished it. They became quite tame; but though they went through all the behavior of courting and mating, females never built nests or laid eggs.

After four years an occasional black duck and a green-winged teal, captive on the same pond, laid eggs and reared young, but the canvasbacks and redheads maintained their egglessness.

Next I secured from Alberta some stock which had been hatched from wild eggs set under hens. When these birds were put on the pond, they nested and laid eggs the first year. So resistant to breeding in captivity are wild-trapped waterfowl that even artificial lighting and injections with gonadotropic hormones, which stimulate pheasants, grouse, and hand-reared ducks to lay two months early, did not cause them to lay an egg.

Why should there be such a difference between wild-trapped and captive-raised waterfowl? Is the mosaic of their juvenile habitat so deeply impressed upon the wild birds that they cannot form eggs until they duplicate the conditions of their youth?

The Eagle and the Little Black Hen

A few years ago I was given a live bald eagle which had been captured as it pounced on a rooster near a farmhouse. I kept this bird for 15 days in a building 50 feet long and 15 feet wide without its eating a morsel of food.

I tried everything from fresh fish to rabbit, mouse, and chicken to no avail. I went so far as to put a live bantam hen in with it, thinking that this might stimulate its predatory instinct.

When I peered through a crack in the door that evening, what was my surprise to see the little hen cuddled up on the perch by the side of the eagle!

For 30 days they lived together, the little black hen scratching out a living during the day and each night going to roost close beside the eagle. Meantime, the eagle gave up its hunger strike and soon was eating any kind of meat I supplied it, including little black hens exactly like its companion.

Friends who saw the miracle of the "lion and the lamb" suggested that the eagle had lost its predatory instinct in captivity.

To test this, I introduced into the room a

sister of the little black hen. I had scarcely closed the door before the eagle pounced on the newcomer and devoured her.

After a month of amiable companionship the eagle turned on the little hen that had roosted with it and gobbled her up!

During the 15 days of fasting the eagle was gradually adjusting itself to an entirely new environment. The mental picture of the habitat in which it had been accustomed to live and hunt its food had suddenly been obscured and was being replaced by another entirely different. Until the adjustment had been made, even physiological functions largely ceased. By the time the adjustment had been made, the mental picture included the little black hen, not as an item of food but as a companion.

The same holds for the little black hen. She had been summarily removed from her companions and placed in a new environment with another companion the like of which she had never seen before. Because of its size she immediately conceded its dominance, and it mattered little if it had a more curved bill and larger feet than the roosters of her acquaintance.

When it grew dark, her social instinct required that she roost with the flock, and she flew to the perch and moved along until she was as close as she had been the night before to a less lordly fowl.

The relationship between them might have endured indefinitely had not something suddenly stimulated the killing reaction in the eagle.

Falconers know that a bird in distress will lure hawks from a long distance, and a tethered pigeon that can be made to flop awkwardly is regularly used as a lure in catching wild hawks. Probably the little hen suddenly expressed alarm or helplessness and thus stimulated the killing instinct that put the touching end to the story.

When any new feature is introduced into the natural habitat of a bird, it is scrutinized with the greatest caution. If the change is at all fundamental to that species, the bird may move to another locality where there has been no change rather than try to adapt its life.

A pair of catbirds or thrashers nesting in the bushes in the garden will probably move to another yard if a garage replaces the shrubbery. Such a change may make little difference to the robins, but the catbirds and thrashers will seek new bushes which have grown to just the requisite density.

Birds Take Time to Get Used to Camera

When preparing to photograph a bird at its nest, I do not immediately place the camera or the blind where I want to use it. I have learned by experience to set it some distance away until the birds have grown used to it and accepted it as part of their mental picture. The longer I leave it, the more quickly will they accept it when I move it up to the required four or five feet from the nest.

The birds' parental instinct will overcome to some extent fear or objection to change, the reaction varying with the individual and with the particular stage of the nesting cycle. All birds, however, are resistant to change, and an understanding of their reactions is essential to a bird photographer.

In the world of his choice, the bird passes through a cycle of behavior which is repeated each year with the greatest precision. Migration in the spring, selection of territory, mating, nest building, egg laying, incubation, care of the young, fall flocking and wandering, fall migration, and choice of wintering grounds—these are major activities over which the bird as an individual has as little control as it has over growth and feather change.

The account of the bird's year, however, is another story.

Notice of change of address for your NATIONAL GEOGRAPHIC MAGAZINE should be received in the offices of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your August number, The Society should be notified of your new address not later than July first. Be sure to include your new postal zone number.

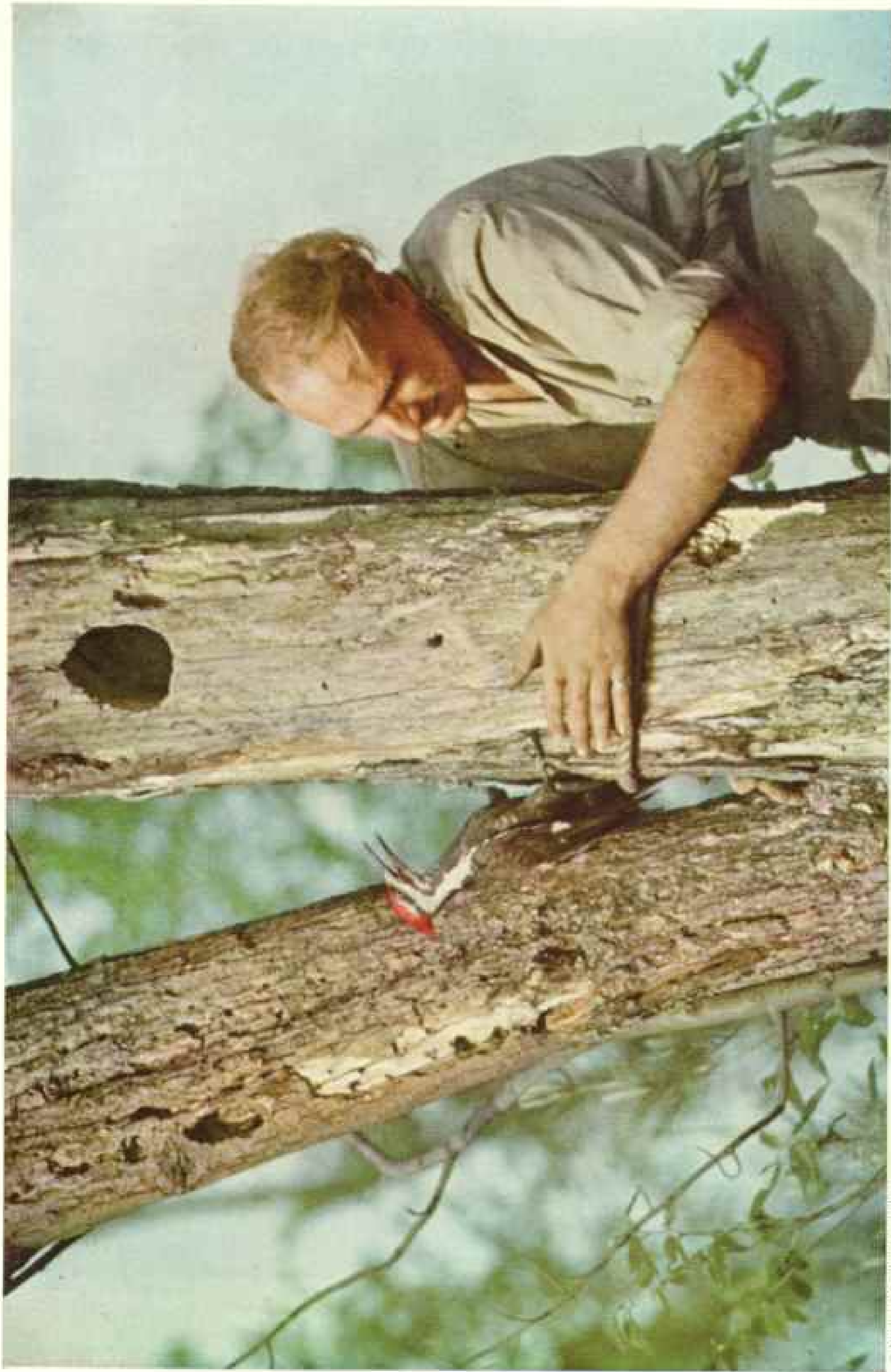


© National Geographic Society

Illustration by S. A. Gilmer

One Good Tern Was Once Mistaken for Another

Forster's Tern once was thought the same as the Common Tern, which it resembles, except that it has the outer web of the longest tail feather white. It breeds on coasts of Virginia, Louisiana, and Texas, and inland from Oregon to Manitoba. On migration it appears in other parts of the United States and south to Guatemala.



Woodpecker by Arthur A. Allen

Meddling Humans Beware a Courageous Fighter, the Pileated Woodpecker!

So strong was this male's parental instinct after the eggs hatched that it might have knocked Southgate Hoyt off the dead elm 30 feet above ground had he not been roped to the tree. This bird is found in broad woodlands throughout the United States and Canada. It ranges only three or four miles from its nest.

© National Geographic Society



Illustration by Arthur A. Allen

Larger Double of the Downy Is the Hairy Woodpecker.

Though the two species resemble each other almost feather for feather, the Hairy, less common and usually wilder, has a longer bill and no black bars on the white outer tail feathers. Except in the far north, neither strays far from the locality where it was raised.



© National Geographic Society

He Is an Avian Carpenter's Kit

With a head like a hammer and bill like a chisel, feet like pincers, and prop tail, the Woodpeckers lend a highly specialized existence. This is a male Downy Woodpecker, found throughout the United States and Canada. Its barred outer tail feathers are concealed. The female lacks the red cascade.



© Nylboud (Reynolds) Perle

Redpolls Are the "Linnets" of the Far North

Nesting in willows and dwarf spruces of timberline and tundra, they behave much like our more southern Goldfinches. In winter large flocks wander to northern United States and irregularly to northern California, Alabama, and South Carolina. Old males have rosier breasts than this yearling.



Photograph by Arthur A. Allen

Food Put Outside a Window Attracts This Little Fellow

The Black-capped Chickadee is a winter visitor at suburban feeding stations where it finds suet and sunflower seeds. It is a permanent resident except in the most northern parts of its range, which extends from Alaska to Newfoundland and southward into the United States.



© National Geographic Society

A "Currant" Event in the Garden Has Brought an Ugly Fellow out of a Lovely Blue Shell

Illustration by Arthur A. Allen

This Black-billed Cuckoo built her nest in a currant bush, and the first of the eggs has just hatched a youngster that only a mother could love. The species is a fairly common nesting bird in northern United States and southern Canada, less common southward except in mountains. It winters in Colombia and Peru.



For a Pair of Orchard Orioles Spanish Moss Makes a Home

The birds more often weave hanging nests of dried grasses in tree forks, but around Summerville, South Carolina, they use the epiphyte which festoons wild cherry. The male never sits on the eggs, but helps in feeding.



© National Geographic Society

Illustrations by Arthur J. Allen

Green Grasshoppers Make a Delicious Salad! This Is the Female; the Male Appears Above

When anything jars their nest, young Orchard Orioles stretch their necks and open their mouths for food. The species is familiar about shade trees and gardens from Florida and Texas to Nebraska and Massachusetts, but is less common in the northern States where the orange and black Baltimore Oriole ranges (Plate XV).

Sights and Sounds of the Winged World



On Pairing Grounds They Make Their Mating Calls in Spring

Male **Prairie Chickens** inflate their neck sacs as sounding boards and send their "oom-boom-boom" often two miles across the prairie. They range from Indiana to Colorado and into Canada, but are scarce.



© National Geographic Society

Kodachromes by Arthur A. Allen

"Hoot, Mon!" Says the Sharp-tailed Grouse, Like a Doughty Scot

With inflated air sacs like those of the Prairie Chicken, the cock of this species makes a call less musical and more abrupt. The male birds do a curious, stiff-legged dance for their ladyloves. Sharptails range from Wisconsin to eastern Colorado and northward into Alaska.



© National Geographic Society

Maternal Duties Keep the Female Marsh Hawk Quiet and Contented

Brooding her young in a nest of giant firweed, this dweller of the marshes is well concealed. The bird has an owl-like ruff of short feathers around the face, indicative of large external ears and keen hearing which are helpful in following rodent prey as it trots back and forth over hayfield, pasture, or plain.

Illustration by Arthur A. Allen



© National Geographic Society

Illustration by Arthur A. Allen

Natural Camouflage Takes Care of Danger from All Save the Keenest-eyed Searchers

The incubating Woodcock so relies on protective coloration, where line and pattern are similar to dead leaves, that it will sit without winking until nearly stepped on. It is found in summer from southern Canada to Florida and Louisiana east of the Rockies; in winter from New Jersey southward wherever it can get earthworms.



Something of a Hermit Is the Rough-winged Swallow

It does not nest in colonies like other Swallows, but uses the deserted burrow of a Kingfisher, a crevice in the cliff, a drainpipe, or a tunnel of its own. During summer it ranges throughout the United States as far north as southern New York and New England, and in winter goes down to Mexico and Central America.



© National Geographic Society

Reproduction by Arthur A. Allen

It Keeps Its Treasures in a Bank

The Bank Swallow is found in colonies during the summer throughout most of the Northern Hemisphere wherever it can find sandbanks in which to dig its burrows. It returns to the Southern Hemisphere for the winter. In England it is known as the Sand Martin.



A "Slim Meal" for a Northern Yellow-throat Family

The Yellow-throat, one of the Warbler family, is found in several forms throughout the United States and Canada. It usually frequents tangles of weeds and low bushes near swamps, though it sometimes nests farther from water. The male has a conspicuous black mask.



© National Geographic Society

Illustrations by Arthur A. Allen

Reflections on a Corn-fed Bronzed Grackle Gleam in Splendor

This is the male of the common Crow Blackbird, familiar about parks, lawns, and cornfields throughout the United States and Canada east of the Rockies and west of the Alleghenies. Along the central Atlantic coast is found its relative, the Purple Grackle; and in Florida, the Florida Grackle.



© National Geographic Society

Endorsement by Arthur A. Allen

Cattails and Sedges Are a Marsh Wren's World

Anywhere else the Long-billed Marsh Wren is unhappy and it has no use for bushes and trees or even for meadows. It is a familiar bird throughout the United States and Canada. The opening in the side of the spherical nest is sometimes quite concealed. Bumblebees often use the nests for rearing their young.

Sights and Sounds of the Winged World



"Chesty" Describes the Pectoral Sandpiper in Spring

During the breeding season in the far north this shore bird inflates air sacs on its breast until it swells out like a Pouter Pigeon. It nests on Arctic coasts from eastern Siberia to Alaska and on Southampton Island, and winters in South America from Peru to central Patagonia.



© National Geographic Society

Reproduction by Arthur A. Allen

A Traveled Bird Is This Wilson's Phalarope

Rare in eastern United States but common in the West, it winters from Chile and Argentina to the Falkland Islands. Here the bright plumage of the nesting season is replaced by the gray and white of winter.



Guess Which One Was Fed!

The Crested Flycatcher has just placed a large moth down the throat of the nearer baby, who immediately dozes. Hungry and alert, the other is ready at any disturbance to open its mouth and stretch its neck.



© National Geographic Society

Walden, Mass., by Arthur A. Allen

Maternal Solitude Keeps Her Close till the Baby Is Quiet

Chestnut-sided Warblers build rather flimsy nests in low bushes in clearings or near woods from southern Canada to northern United States east of the Rockies. The male has a brighter yellow crown and chestnut stripe.

Sights and Sounds of the Winged World



Lord Baltimore Turns His Back on the Camera

But this is fortunate, because the pose shows off his best colors. The Baltimore Oriole prefers open country east of the Rockies. The lady is dull of plumage.

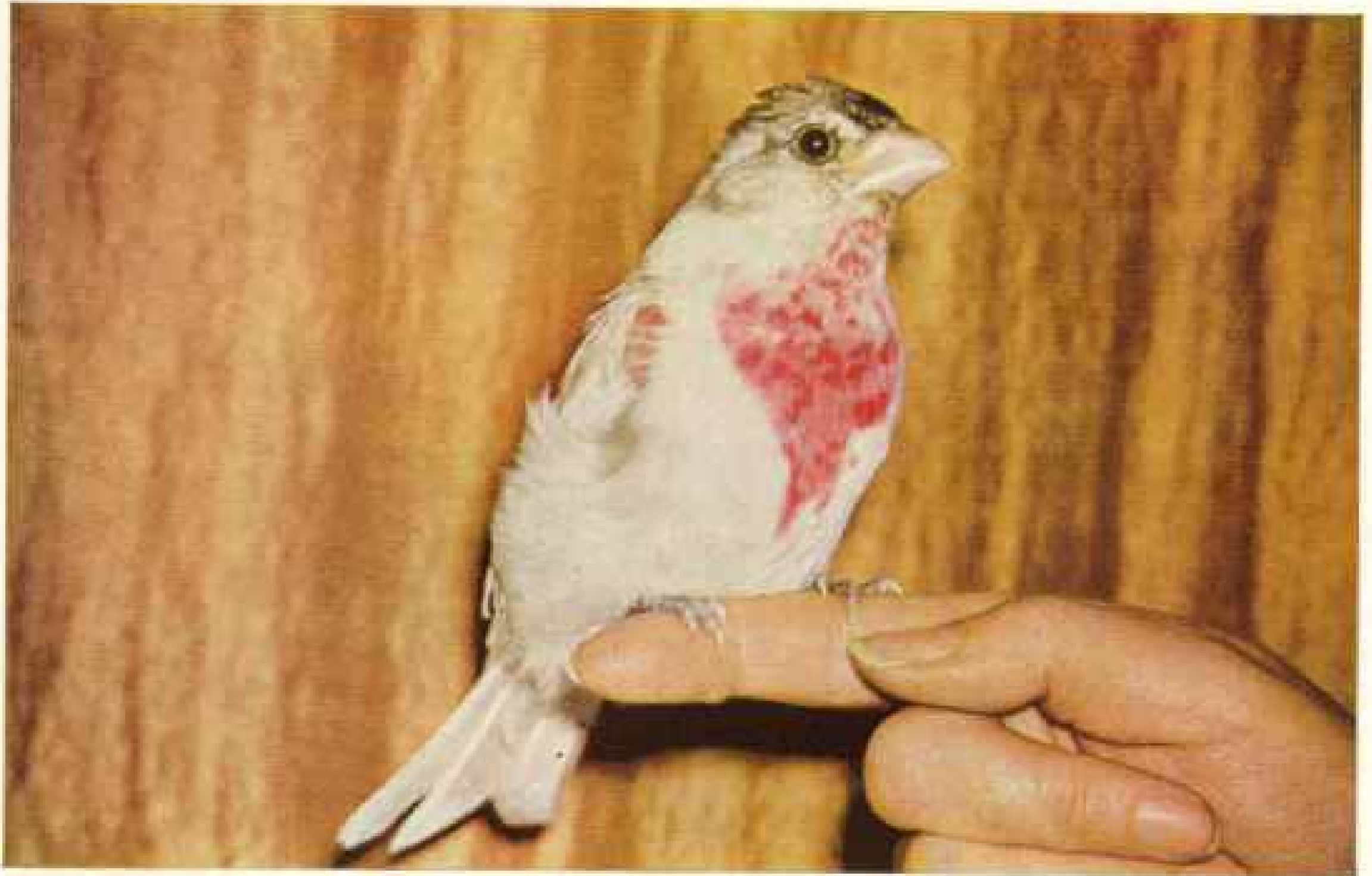


© National Geographic Society

Endochromes by Arthur A. Allen

The Kingbird Sits on a Regal Throne—Crows and Hawks Take Notice!

A larger member of the Flycatcher family, it derives its name from its habit of attacking big birds. Kingbirds are found in summer from British Columbia and Nova Scotia southward, and in winter south to Bolivia and Peru.



One in a Thousand Is an Albino Grosbeak

It is just a freak of the Rose-breasted Grosbeak family seen in normal plumage below. Pursued by a Hawk, it flew against a window and stunned itself. "Pinkie" has thrived as a family pet for eight years.



© National Geographic Society

Kodachromes by Arthur A. Allen

"Don't Forget Me, Daddy," Cries the Neglected One

So this young Rose-breasted Grosbeak seems to beseech his parent. The females, like the young, are brown and sparrowlike. The birds travel to Mexico and northern South America for the winter. During summer they frequent woodlands and gardens from Mackenzie and central Kansas eastward.

The Society's New Map of China

BY JAMES M. DARLEY

Chief Cartographer, National Geographic Society

OF ALL countries on earth, China presents the biggest challenge to the map maker.

Her borders enclose an area nearly twice as large as the United States, with three and one-half times the population. In China lie the world's most massive mountains, immense river systems and barren deserts, vast regions under intensive cultivation, swarming cities.

Superimposed on a map of North America, China would extend from the Atlantic to the Pacific, and from Mexico City to Lake Winnipeg, Canada. In China live more than three times as many people as in this comparable area in North America. Every fifth person in the world is Chinese.

Yet reliable map data about this huge segment of the earth's surface is extremely scarce.

With this issue of their NATIONAL GEOGRAPHIC MAGAZINE, the 1,250,000 member-families of the National Geographic Society receive a 10-color map supplement of China, printed on a sheet 37 by 26½ inches.* Months of careful research have gone into its preparation; all available basic data have been checked and compared.

Varied Source Material Consulted

On most maps of China only limited areas are reliable in detail; hence compilation of data for this over-all picture meant examination of a wide variety of source material.

Your Society's cartographers consulted the latest Russian military maps of Outer Mongolia and other northern areas. They drew upon American and Japanese charts of Manchuria, Chosen, and the China coast. They examined maps produced by the Survey of India for new data on the hinterlands of Burma, India, and Tibet. They studied new military maps of China proper.

Study of this material revealed striking contradictions. On two maps, for example, the same town may appear in locations 30 miles apart. One map may show a complex system of roads and towns virtually unrecognizable on another. To sift out accurate sources required painstaking research.

Nightmare for cartographers is the correct spelling of place names in this land of innumerable dialects. There is no official Government list. Where post offices exist, names on the new map are the Chinese Postal Guide's romanized spelling of Chinese designations.

Some 35 years ago the Conference on the

International Map of the World recognized these spellings. Since then the list has been standardized, supplemented, corrected, and kept up to date. Postal maps published in 1942 show new post offices and incorporated changes.

In a letter to the National Geographic Society, the Chinese Embassy observes: "The Chinese Government has tried its best to standardize pronunciation and spelling of the names of Chinese cities, but so far we do not have official spelling. However, the spelling used by the Chinese Post Office on its maps has the approval of the Chinese Government."

Without recourse to a recognized list, spelling of Chinese place names becomes hopelessly confused. A city as large and well known as Waiyeung is spelled Hweiyang, Huiyang, or Kweishan.

Spelling of place names on the new map coincides with the spelling used in nearly all Chinese communiques and news dispatches.

In April, 1944, the three major press associations serving American newspapers adopted National Geographic Society spellings. This map will make for further conformity and readier recognition of Far East war news. Society members will experience no difficulty in following the progress of military operations with the map as a guide.

New Addition to Wartime Series

Your Society's new over-all picture of China rounds out a NATIONAL GEOGRAPHIC map series which affords members complete coverage for present and future military operations against Japan. Notable predecessors are the Map of the Philippines (March, 1945), Map of the Union of Soviet Socialist Republics (December, 1944), Map of Southeast Asia and Pacific Islands (October, 1944), Map of Japan and Adjacent Regions of Asia and the Pacific Ocean (April, 1944), and Map of Pacific Ocean and Bay of Bengal (Sept. 1943).

On the north, the new cartographic mosaic embraces southeastern Kazakhstan and south-

* Members may obtain additional copies of the new "Map of China" (and of all other maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices, in United States and Possessions, 30¢ each, on paper; \$1 on linen; Index, 25¢. Outside of United States and Possessions, 75¢ on paper; \$1.25 on linen (postal regulations generally prohibit mailing linen maps outside of Western Hemisphere); Index, 50¢. All remittances payable in U. S. funds. Postage prepaid.

ern Siberia. The Russian Bear faces Japanese-held Manchuria beyond the Amur. On the east lie the islands of Japan, including bloody Iwo Jima; on the south, part of liberated Luzon, Indochina, Thailand, and Burma. On the west, the map extends from India's Madras coast to the eastern tip of Afghanistan.

In recent centuries, China traditionally consisted of 18 provinces lying south of the Great Wall, and the outer territories of Manchuria, Mongolia, Chinese Turkistan, and Tibet.

The map shows today's alignment. China now comprises 28 provinces (chiefly the result of changes since the Revolution of 1911), the territories of Outer Mongolia and Tannu Tuva on the north, and Tibet on the west.

The three outlying territories and Sinkiang Province, which includes Chinese Turkistan, are parts of China, but they possess varying degrees of self-rule. Outer Mongolia and Tannu Tuva pattern their governments on the Soviet model.

Slices Carved from China by Japs

Since 1932, Japan has controlled Manchuria. The three provinces which made up that area, together with neighboring Jehol Province, were incorporated by the Japs into the State of Manchukuo. A puppet government was installed and Japanese appointed to administrative posts.

Japan started her undeclared war against China in July, 1937. In the succeeding eight years she has occupied 10 additional Chinese provinces and gained footholds in three others. April 1, 1945, she ruled about 11 per cent of the area of the whole country and its dependencies, including China's four biggest cities—Shanghai, Tientsin, Nanking, and Peiping—and the richest, most densely populated, and most highly developed portion of the country.*

Since the fall of Nanking, China's provisional government has resided in Chungking, in hinterland Szechwan Province.

Along with the Government, many million refugees have fled into western China, in one of the biggest migrations of history.

The new map provides detailed coverage of roads, showing virtually all highways which might be used for military purposes. Since the occupation, the Chinese have built a remarkable network of roads in the free areas, substituting for our familiar bulldozers, rock crushers, and other heavy road machinery, the strength of millions of human hands and bodies. Of some 70,000 miles of road, about one-fifth has been paved.

The long road from Chungking to Chengtu, Fengsiang, Lanchow, Hami, and Urumchi to

Ayaguz (Sergiopol) in Russia is the famous Red Route. Some supplies have trickled in from Russia constantly over this road.

The new Stilwell Road, from the Assam border across Burma, to Kunming in Yunnan Province, dwarfs the Red Route in importance. The romance of its building is described in this issue of the NATIONAL GEOGRAPHIC MAGAZINE, beginning on page 681.

An official report makes an interesting comparison between the building of the Alaska Highway and Stilwell Road. The Alaska Highway was built with 1,500 pieces of machinery; the old Burma Road section of Stilwell Road with eight pieces. Highest elevation on the Alaska Highway is 4,212 feet. Much of the old Burma Road is hewn out of a cliff at that elevation, and in addition a part of the road passes over a mountain pass 9,200 feet above sea level.

The Alaska Highway bridges 200 streams. The Burma Road, in its first 510 miles southwest from Kunming, crosses 412 streams, including the formidable Mekong and Salween Rivers. The new Ledo section of Stilwell Road has 700 bridges.

On the new map members may follow the famous aerial "Hump" route over the Himalayas from India to Chungking.

The Burma-Assam-Yunnan Province section of the new map shows in detail an area in which American, Chinese, British, and Indian forces have cooperated to win one of the war's most spectacular battles against a combination of enemy forces and hostile natural surroundings.

Careful attention has been paid to mapping the east China coast. Admiral Chester W. Nimitz, commander-in-chief of the United States Pacific Fleet, has frequently mentioned the possibility of invading this stretch to obtain land bases for operations against the Japanese homeland. The map shows how the southern end of the Japanese islands, the Ryukyu Archipelago and Formosa—targets of American operations for many months—guard the approaches to China's east coast.

Within the area of the new map the final stages of this global war likely will take place. Within its borders appear names, today unknown to most of us, which in the near future may become the English Channel, Cherbourg, St. Lô, and Remagen of the China coast.†

* For Japanese penetration in China, see black-and-white map accompanying "Today on the China Coast," by John B. Powell, NATIONAL GEOGRAPHIC MAGAZINE, February, 1945—page 223.

† For additional articles and photographs of China, consult the *Cumulative Index to the National Geographic Magazine*.

Americans Help Liberated Europe Live Again

By LT. COL. FREDERICK SIMPICH, JR., GSC, USA

"I'D RATHER fight in Africa," said the veteran of Tunisia as he surveyed a ruined French village. "There weren't so many civilians around to get in your hair."

Much of the Allies' time and resources since liberation has been spent in keeping the civilians of Europe "out of their hair."

For liberation and conquest, though glowing words, carry with them grave responsibilities in densely populated, highly civilized areas.

Today, everybody in Europe wants something.

Belgians want to go to France, and Frenchmen demand to get to Belgium. Paris wants wheat, Rennes wants transport for its wheat. Patriots want to shoot collaborationists, collaborationists want to prove they were patriots. Thirsty Cherbourg wants pumps to get water. Flooded Walcheren wants pumps to get rid of it.

Our Armies, too, have their demands—supplies and services from the liberated people to support the military operations, and law and order to ensure security for our troops.

From War to Peace

To reconcile these conflicting needs, to bring order out of the chaos they generate is as much a part of the task of liberation and conquest as the battle proper. Thus the Allied Armies find themselves performing such diverse jobs as these:

Dropping serum behind enemy lines, so that anthrax may be treated and cattle preserved against our coming.

Giving hundreds of sorely needed trucks to Allied authorities so that they may haul food to hungry cities.

Building jails with military labor and materials so that liberated governments can hold criminals for trial.

Clearing filter plants and water systems of battle debris ranging from shell fragments to 30-ton tanks, so that civilians may have pure water.

Running soup kitchens at Belgian mine shafts, so that undernourished labor can muster strength to dig coal for the European winter.

These are only fragments of the job that is being done, but they suggest the pattern and the character of the work that is going on.

In the liberated countries, which must be considered apart from Germany, the great problem is civilian supply. Shortages range from food and fuel in the cities to pit props

in mining districts and bait for commercial fishermen along the coast.

Primary cause of all these shortages rests in another fundamental shortage—transport. To illustrate:

In 1939 France had 1,885,000 passenger automobiles; today she has about 65,000. Her prewar merchant fleet of 3,000,000 tons has shrunk to less than 1,000,000 tons, which is now pooled for Allied use. German requisitions, Allied purchases, almost six years of depreciation, and extensive war damage account for the loss.

Crippled thus, she cannot even move the fuel to run her few remaining trains, barges, and trucks. So the hopeless cycle begins—no transport for fuel, no fuel for transport. That is why food backs up in provincial warehouses, and then for lack of warehouse space lies unharvested in the fields. And that is why hunger is an ever-present threat in the midst of plenty.*

Tire factories whose production is an urgent Allied requirement are idle because there isn't transport to bring them fuel. Textile mills and sugar-beet processors have raw materials at hand, but are equally idle because there isn't transport to carry their products to centers of distribution.

Well, what are we doing about it?

There are two approaches to the problem. One is on a national basis, the beginning of long-range rehabilitation. The other is in day-to-day, "on the ground" emergency measures.

To do much on a continent-wide, long-term basis has been out of the question so long as German resistance continued up front. Every ton of ship space devoted to civilian supplies is that much less ammunition for the rationed guns on the battle line. Every truck turned over to the liberated governments means equivalent reduction in the supply of a combat division in Germany.

U. S. Army Runs Railroad Trains

Notwithstanding, at this writing we have given the French over a thousand trucks, have many more backed up in England waiting an opportunity for shipment, and have given the Belgian, Netherlands, and Luxembourg Governments numbers proportionate to their populations. Special trains pulled by Army railroad engines run regular services

* See "Paris Freed," by Frederick Simpich, Jr., in the NATIONAL GEOGRAPHIC MAGAZINE, April, 1945.



U. S. Army Signal Corps, Official

In Mannheim, German Chemical Center, Milk Is Doled Out to Children and Mothers

Americans found Alsace peasants milking 36 cows hidden 1,200 feet deep in a mine to avert seizure by Hitler's escaping Army. In Hannover, looters clawed one another for food abandoned in warehouses. General Eisenhower warned Germans they could not count on the Allies to supply food, fuel, or clothing.

from Channel ports to inland centers with civilian supplies.

Along the length of the winding Seine, Army equipment and personnel labor with the French to clear away bombed bridges so that barges may move freely in the transport of civilian supplies.

Goods for Civilians

In the coal mines of Belgium and northern France, Allied officers using Army trucks and tools work with civilian managers and labor to restore full-scale production so that there may be fuel to run the trains to carry the fuel to the waiting factories and furnaces.

Over the beaches, in through the battered ports moves a constant flow of goods for civilian use. Ordered months before the invasion in anticipation of these wants, they were "phased in," as the Army says, in accordance with tactical plans. The Army has grown accustomed now to the added respon-

sibilities of liberation; so such supplies are forwarded as if they were ammunition or combat rations. Only the hieroglyphics with which the War Department marks its shipments distinguish cartons of "energized" chocolates for the infants of Belgium from the Army's famed emergency D ration.

Other items in the import list include clothing, soap, medical supplies, police and civil-defense equipment, and gasoline. By the first of March more than 600,000 tons of such commodities had been moved into the liberated countries to meet emergency requirements. That is 100 shiploads, or enough to sustain a combat division in action for nearly two years.

When critical needs arise, as when floods and combat wiped out food reserves in the Netherlands, supplies are flown across the Channel from depots in the United Kingdom.

No one argues that these measures of direct relief provide a solution to the wants of



U. S. Army Channel Camp, Official

Happy Orphans Near the Italian Front Exchange Their Rags for Red Cross Gift Clothes

To freezing refugees, clothes are as important as food. Warmth, not style, is essential. Contributors are asked to mend old garments, as bombed-out areas may lack scissors and buttons. Men's, but not women's, hats are needed. Shoes should be tied together to avoid separation; no high heels. In liberated Europe millions of children are in need. China prefers materials to make its own padded garments.

Europe. But they are like plasma to the wounded economy; administered judiciously, they keep it going.

Like so many of their worries, the supply problem of the liberated countries is but the sum of a multitude of local troubles. It is on the ground, in the towns and cities and among the cantons and prefectures, that much of our most effective help is being given.

Every day since we landed, Allied resources and talents have been devoted to helping the little people in the wake of the battle solve their immediate supply problems. These incidents are representative:

In one town power was cut off by bombing. Some 4,000 pounds of fine beef held in freezers by the Wehrmacht began to melt and threatened to spoil. Engineer field generators hooked up to the freezing plant saved the city's meat until the mayor was able to distribute it.

Civilians of beleaguered St. Nazaire were hungry. The surrounding agriculturally rich Brittany district needed salt. Army negotiators arranged with the besieged German commander to exchange, under a special truce, a trainload of St. Nazaire's salt for a trainload of Brittany food.

River towns with bridges blown up are cut off from their hinterlands. Therefore, amphibious trucks intended by the Army to discharge cargoes in landing operations and to ferry troops in river crossings are diverted to carrying potatoes and grain for civilians.

Power plants in many Channel ports have been reduced to shambles; so naval escort craft are tied up to the piers and their engines operated to generate electricity for essential civilian needs. In other cases, floating generators, specially built for this purpose in advance of the landings, have been floated into place and keep ports running.



U. S. Army Signal Corps, Official

In France Drivers Rest on 2½-ton Trucks; These Workhorses Are a U. S. "Secret Weapon"

Last summer the famed Red Ball Line's trucks sped across France on the heels of the tanks. From Normandy to the Siegfried Line, many made 400 miles in a day and a half. On reaching Hitler's superhighways, the Army used huge tractor-trucks hauling trailers with a 10-ton capacity. All Europe cries for American trucks.

One commander solved a shortage of milk containers which threatened to dry up the cows in a large dairying area by lending thousands of Army water cans to dairymen to carry milk to market.

Mine fields interfere with plowing; so skilled Army personnel help local authorities train farmers to locate and neutralize the buried explosives.

A Herring Run Helps Feed Belgium

A herring run in the North Sea promised a big supply of food, but Belgian fishing smacks were taken by the Germans. The Army borrowed 50 boats from the French and moved them up the coast under armed escort.

No one can tabulate the aid given in these thousand and one little ways—give it value in terms of dollars. But as you read on, you may come to feel that these little things done for the little people every day combine to make an immense contribution to the recovery and stability of Europe.

There is substantial direct relief provided as well in the form of regular Army rations. It is a rare family in the liberated countries that doesn't know and by now have its preference between the ham and egg or cheese spread provided in K rations.

Such rations have come to them not only as direct gifts from sympathetic GI's but also on the formal orders of commanders, who often distribute food from regular Army stocks when they find the civilian supply is disrupted.

Clothes as well as food are a civilian supply problem (page 749).

Skeptics say, "Clothes don't wear out overnight. If they had clothes when we got there, why shouldn't they have them still?" Such questioners forget that we moved into Europe as it went into bankruptcy as a result of the German occupation.

In Europe today if an elevator breaks down, tenants walk thereafter. There are no parts to fix it. So it is with clothes. Most people have an outfit and a change left, but that is all. Before we could get labor to help us wrestle cargo on the Normandy beaches we had to provide the men with shoes and work clothes. Money is no use to a man who has to stay in bed for modesty's sake.

They tell a story of an RAF Christmas party given for children in the Netherlands. One lucky little boy arrived through the snow in a handsome overcoat, but his chilled playmates had only shawls and sweaters. Despite urging by the flyers, the boy kept his coat on throughout the party. The urging stopped when a tactful little friend whispered, "He doesn't have much on underneath."

Clothing shortages were anticipated well in advance of the invasion, and the Army imported for distribution to emergency cases special garments made to a standard design along the lines of British utility clothing. There is one pattern for women and another for little girls, as well as uniform outfits for men and boys.

As rapidly as shipping space can be made available, the American Red Cross is moving dresses, shoes, suits, and coats into the liberated countries from stocks they have accumulated in the United States. Largely second-hand but refurbished, these garments can't come too fast or in too great quantity.

Civilian supply shortages do not end with food and clothes, coal and transport. Machine tools, fertilizer, and spark plugs are in equal demand.

The Army, finding itself for the time being in control of the resources and, as a result, the major influence on the economy of Europe, must do all it can to help.

The Black Market is rampant. The official price of an egg in Luxembourg is one franc. They sell in the Luxembourg Black Market for five francs. But it is still good business for a Belgian to slip across the border and buy up all he can get. A Black Market egg in Belgium is 18 francs!

Prices of processed goods progress geometrically in the Black Market. A pair of shoes, cut from a Black Market hide, processed by Black Market labor (shortage of skilled tradesmen is such that employers exceed legal wage rates), and sold through a Black Market wholesaler to a Black Market retailer, understandably winds up costing \$100.

Thus the purchasing power and, consequently, the morale of Allied troops are affected by inflation. It is the lure of Black Market prices which leads to pilferage and consequent shortages at the front.

The Army has done much to curb this inflation. Exchange rates were set low to reduce soldier spending. Army gasoline is specially colored so that if pilfered and sold in the Black Market it can be identified. Trials of Army pilferers are widely publicized, as a caution to troops seeking to capitalize on the inflation.

25 Million Away from Homes

Army procurement in liberated countries is kept to a minimum to spare further demands on the economy. Where local goods and services are purchased, the prices paid are agreed on beforehand with the Allied Governments.



U. S. Army Signal Corps, 100-161

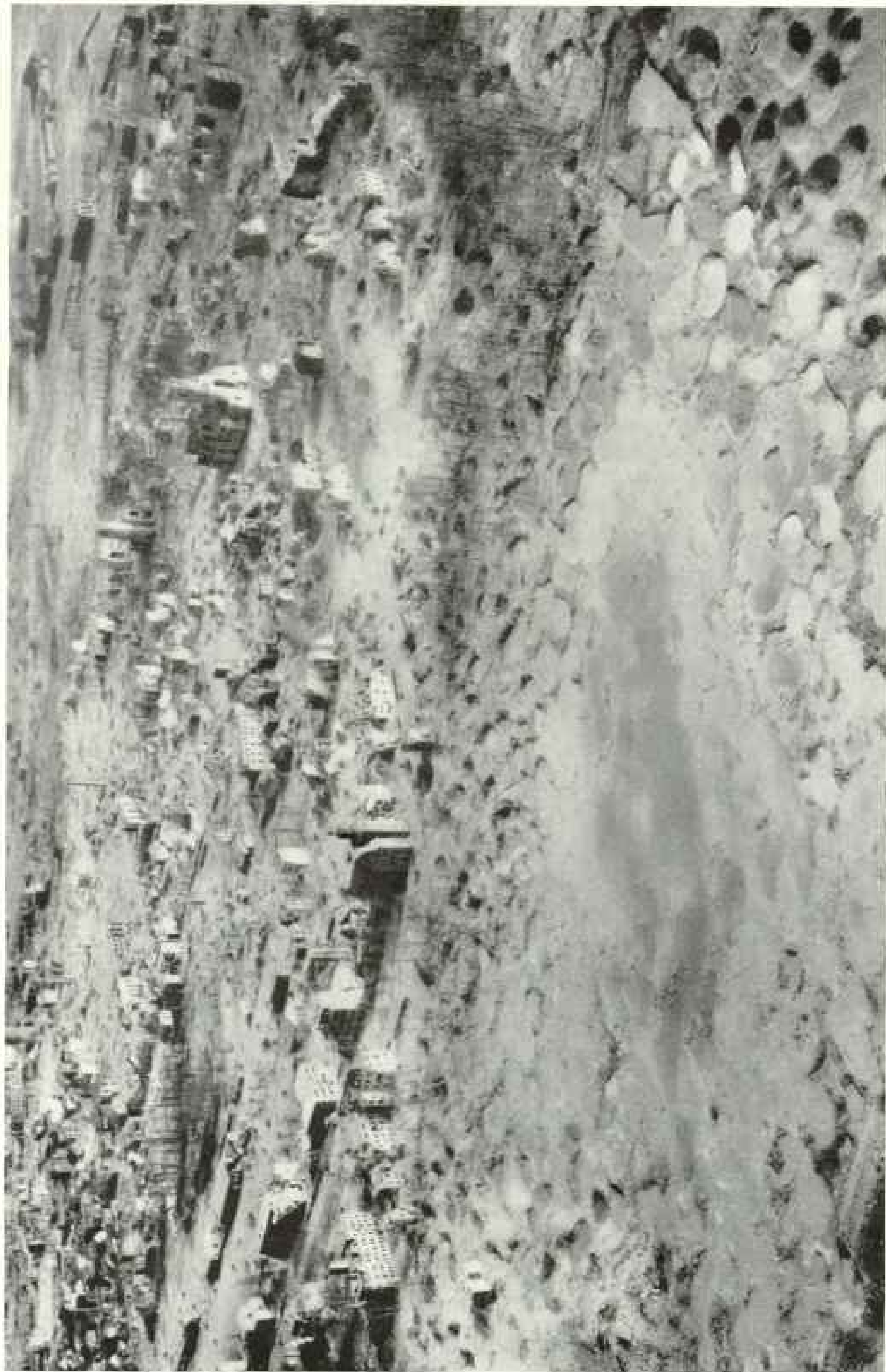
Invasion's Panic of 1940 Is Repeated as Refugees Clog Ardennes Forest Roads in Flight from Von Rundstedt's Break-through in 1944

"Leave your homes and flee," a Nazi radio told them. "German armies are using horrifying new weapons. Not a single human being will be left alive. Commandeur American trucks or take them by force." Rumor spread, "The Boche will be in Paris in a few days." Civil affairs detachments quickly restored confidence (page 768).



U. S. Army Signal Corps Official

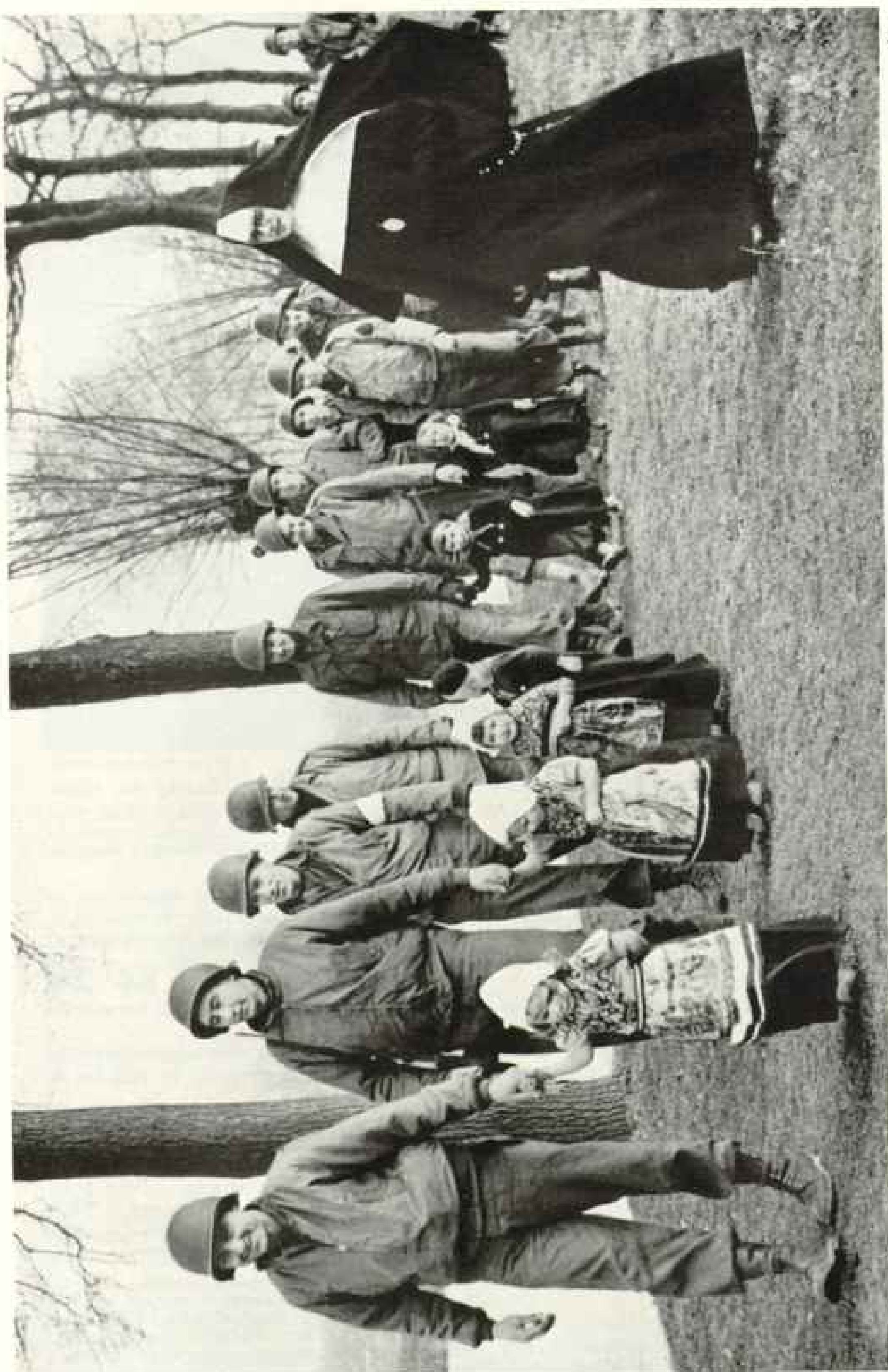
With Dump Cars and Portable Tracks, Frenchmen Tunnel Like Miners into Mantes sur Seine, a City of 15,000 Wrecked by Air Power Here a few days before the freeing of Paris, 50 miles to the southeast, the Yanks crossed the Seine and flanked Germans in flight from Normandy. They found a third of the city in ruins like these. In 1087 Mantes was captured and burned by William the Conqueror, but the victory cost him his life when his horse fell.



U. S. Army Air Forces, official

Bomb-cratered Wesel Paid This Fearsome Price for Its Defense by Hitler's Fanatic Parachute Troops

From this Rhine-side town, two bridges supported Germany's last pocket of resistance opposite the Ruhr Valley. Leaping the river, the Allies found this wreckage, photographed from a P-38. Churches, still standing, show how our airmen tried to spare cultural monuments. Twisted rails reveal what they did to transport (lower left).



AP/WIDE

To Show Their Gratitude to Their Yankee "Uncles," Dutch Children Parade in Their National Costume

In retaliation for a railway strike, Hitler cut the Netherlands ration to one-third. Recently England, which sent children to America during the blitz, has given succor to starving Dutch waifs. These youngsters live in Limbourg, a neighbor to the Belgian province of Limburg (Limbourg) that gave its name to the cheese.



U. S. Army Signal Corps, Official

In Krefeld, Post Office and Telephone Signs Represent Services Suspended by the Allies

This west-of-the-Rhine steel town was a favorite RAF target (damage, left). America's Ninth Army found 120,000 survivors living in 21 huge shelters. Horst Wessel street sign comes down; it commemorates the author of a Nazi song. Up goes Francis Scott Key sign in honor of the Star-Spangled Banner's composer.

So much for supply. The other big problem of the liberated countries has been hinted. It arises from the fact that there are in all Europe perhaps 25,000,000 persons who by reason of bomb damage, forced labor, or the tides of battle are out of their homes. Already the Allied Armies have encountered and contended with several million of them.

From the time Todt* workers first came into our lines out of the hills of the Cherbourg peninsula until the last of the fighting in Alsace, questions of feeding, transporting, and housing the hundreds of thousands of homeless have plagued the Armies.

Whenever we advanced, more were "uncovered," living in basements, straggling through woods in parties of five and ten, or bunched in barracks behind wire where the Germans had left them.

It will be difficult for those in America to realize how civilians act in combat. They don't run; they stroll down the road to talk

it over with their cousin, or wander out to forage for food (page 752). Women carry milk through small-arms fire, farmers stick at their plows amid artillery shelling. I have seen French women even wheel their babies in perambulators down roads that were under fire.

All these are commonplace manifestations of the peculiar civilian tenacity in sticking to home.

A technical distinction is made at SHAEF (Supreme Headquarters Allied Expeditionary Forces) between refugees and displaced persons. Refugees are nationals of the country in which they are uncovered. They usually present a relatively simple problem. Displaced persons are the foreigners hundreds,

* Fritz Todt, German military engineer, was responsible for building Germany's network of high-speed highways and the Siegfried defense line. Before his death in 1942, he is credited with having constructed a series of submarine bases along the French coast.

even thousands, of miles from home. The roster of their nationalities reads like a history of German conquest: Poles, Czechs, Austrians, Danes, Dutch, Belgians, Frenchmen, Hungarians, Romanians, Serbs, Croats, Bulgars, Greeks, and of course Russians—Russians by the hundreds of thousands.

One statistician figures that it would take one train each hour, every hour for a year and a half, to get them all home.

You will hear a lot about displaced persons before the last one is repatriated.

Refugees and "Displaced Persons"

The degree of care which the Armies have been able to give refugees and displaced persons has ranged from the provision of a hot ration or a truck ride to a rear area (where refugees can usually fend for themselves) to the extreme in which displaced persons found at work on Hitler's West Wall in June last year have been fed and housed ever since.

Not all the care of these people has been an Army function. By a series of agreements with the governments concerned, SHAEF has arranged for each to undertake the care of the displaced persons of the others and to speed their repatriation when transportation is available.

Camps for displaced persons are generally run by the Allied Governments, which try to provide jobs for those of working age. In some, schools have been set up, courses of domestic science arranged, and there is a general effort to make of each camp a self-administered unit. But the fundamental responsibility for all these people and the direction of their care continue with the Army as long as it controls transportation, food, and medical supplies.

It is to assist with displaced persons that UNRRA (United Nations Relief and Rehabilitation Administration) has first been called to action by the Army. This organization, which may ultimately have the full responsibility for relief and rehabilitation in Europe, is providing hundreds of its officers to serve under military command in the administration of the growing displaced-persons problem.

As with the supply of civilians, the whole matter of refugees and displaced persons is approached not only on a national basis and in terms of a long-range repatriation program, but every day in more or less rough-and-tumble fashion by Army units on the ground.

Military men learned in France in 1940 that uncontrolled movements of civilians could immobilize an army. Controlled evacuation,

standfast orders, and the use of specified roads for civilian traffic are some of the measures employed to regulate refugee movements in combat areas.

From one unconventional report of an officer commanding a civil affairs detachment with the Third Army (page 768) come these graphic paragraphs, illustrating the treatment of these people "on the ground":

"Five hundred and one were evacuated. We had them screened (for security) and inscribed (tagged for identification) and loaded, arguing, pleading, and commanding them to get rid of some of their omnipresent baggage. We straightened out the families, returned children to their mothers, found a place for that last bicycle, and evacuated the 501 . . .

"In a suburb there was a gigantic quarry. Approximately 3,500 people had taken shelter in this quarry. They had cows, chickens, lamps, and other household items with them. There were two doctors in the group and, although there were several wounded, the health situation was not dangerous. Seven German soldiers were also in the cave.

"The organization was individual. Each family had brought its own supplies. The poorer people had begun to run out of food. The tactical commander could permit neither the entrance of a relief mission nor the evacuation of any sizable number. The forest covering the entrance was mined.

"Finally a relief mission was completed. The mines along one path through the woods were cleared. Food and medicine were carried on litters through the woods for one and one-half kilometers (about a mile) beyond American outposts and under enemy fire. On arrival we ordered a reorganization of the quarry dwellers so that those who had food would share with those whose supplies were exhausted."

Such incidents are commonplace, being repeated in one form or another every day along the whole battle line.

By an orderly process based on existing Army procedures for the evacuation of prisoners of war, refugees and displaced persons are transported to assembly centers and ultimately to camps where they live until they can return to their homes.

Curfews, Travel Passes, and Questions

Army activity in the course of liberation extends into many other fields, largely concerned with the protection of the troops.

In border regions it is particularly difficult to distinguish between an ally and an enemy civilian. The most harmless-looking French type, complete with beret and dangling



British Official

Advancing on the Siegfried Line, Canadians in Ducks Undertake a "Naval Operation"

In February, 1944, Nazis flooded the Nijmegen-to-Kleve road with Rhine water. Soil repair in this section of the Netherlands will be easy compared with the task of Walcheren Island, where sea water lapped at second-story windows. Washing salt off Walcheren's soil will take several years. American pumps have been ordered.

cigarette, may well be a German from just across the line. Anyone, regardless of nationality, may be a collaborationist still at large; so there must be positive restrictions on movement and communication.

Curfews, passes for travel, interrogation of suspects—all are measures in which Allied commanders combine with local authorities to preserve the security of the troops. Reliance is placed on the local governments to pass the laws, run the courts, and provide the general legal basis to meet security requirements, for the Allied Armies exercise no military government in liberated countries.

Aside from more conventional measures intended to stop the flow of information to the enemy, Allied Governments in military areas, at the request of our Armies, prohibit telephone calls from public booths, restrict correspondence to post cards, and maintain a system of road blocks along highways where travelers are halted for identification.

Such cooperation greatly simplifies this part of the job of liberation. In one country the statement of an American soldier to a gendarme is sufficient evidence to try a civilian for a security violation. In return for such cooperation the civilian authorities have had the moral support of the Army in controlling the hurly-burly that follows in the wake of the battle. There have been instances of civil disorders, but these are rare.

Once patriots stormed a jail and lynched two collaborationists. In Belgium, members of the Resistance demonstrated over an order of their Government requiring them to surrender their arms. For a time in France the FFI (French Forces of the Interior) were disposed to shoot off their guns in the night. But disorders and violence have been the exception behind our lines.

So, with most of Europe physically liberated, a start has been made even during the battle on the problem of rehabilitation. Rough-and-ready it has been, but displaced persons have been deloused, Diesel oil has been gotten to flour mills that had to have it, municipalities suffering from V-bomb attacks against our lines of communications have been helped to get their civil-defense systems going, and, through it all, much has been done to solve the basic shortages of transportation and fuel.

The measure of the job is that there is no starvation in these liberated areas. SHAEF public-health experts say that, though undernourished and underweight, the average liberated European is in good health.

All this has been done within the framework of a policy which has left responsibility

for civil administration and supply with the recognized governments of the Allied nations. We thus are freed of direct concern in many vexing problems.

Questions arising from the great volume of currency in circulation in each of the countries as a consequence of the occupation are theirs to solve. It is up to Luxembourg,* which was absorbed into the Reich, to re-educate its children to use Latin script, for the Germans had insisted on Gothic. Shifts in population of the Netherlands, forced by combat and flooding, so transferred power loads on transmission lines that they had to be re-engineered and transformers moved appropriately. Another matter of no direct concern to the Army. But it helps where it can.

Such is the pattern of liberation.

In Germany the picture is one of conquest, keyed by the Supreme Commander's dramatic statement in his proclamation to the German people, "We come as conquerors but not as oppressors."

Immediate Allied objectives after the defeat of the Wehrmacht have been made clear in broadcasts to the Germans and in the course of the months in which military government has functioned to the west of the Rhine.

Gen. Eisenhower as Military Governor

Initially, at least, General Eisenhower as military governor in areas occupied by his troops is concerned only with the security and maintenance of his forces, the protection and care of Allied prisoners of war, displaced persons, and property, and the elimination of Nazis from positions of power and influence.

These short-range objectives keep the Army busy. To accomplish them there must be the skeleton, at least, of local German government. But, up to the time this is written, there has rarely been a government where we entered. The Nazis have deliberately wrecked it, or, as in Cologne, the normal government broke down months before our occupation, rule in the interval being exercised by martial law through Nazi Party agencies.

Records are gone or destroyed, key administrative personnel evacuated, and the physical tools of government—offices, teletypes, law libraries, and mimeographs—are a maze of junk.

So, to the degree required to fulfill the objectives, the Allies have assumed some of the traditional responsibilities of conquest.

On occupation two major jobs go hand in hand. One consists of direct controls of the

* See "Grand Duchy of Luxemburg," by Maynard Owen Williams, in the NATIONAL GEOGRAPHIC MAGAZINE, November, 1934.



U. S. Army Signal Corps, Official

As Power Fails, a GI Tractor Turns a French Locomotive Built in Wartime 1917

To speed the drive to Berlin, the United States shipped some 1,500 locomotives and 20,000 freight cars to the Continent. Patriots salvaged about 450 French locomotives from the retreating Germans. Weak from hunger, liberated railway gangs emerged from hiding. Working beside Allied crews, they draw K rations.

civilians to ensure security. The other is the business of setting up a minimum government structure and selecting Germans to run it. The latter task is especially essential if we are not to spend all our manpower as governors, rather than in winning the war and proceeding with the disarmament of the German Armies.

Security, in an enemy country pledged to continue the fight underground, is a broad word. It means security from guerrilla assault on our troops, security for our supplies and information, and requires the immediate arrest of all individuals known to be or suspected of being potentially dangerous.

Stringent Methods for Security

The measures taken are stringent. Curfews are imposed which belie the word, civilians being allowed on the streets as little as an hour a day by some wary tactical commanders. Soldiers search out "bad actors"

and put them "behind wire" as civilian internees or, as is often the case where jails are blown down, place them under house arrest.

Ordinances posted on entry by military government detachments call for the immediate surrender of weapons in civilian hands. In response we collect barrels of arms, ranging from sporting Mausers, capable of killing a deer or a man, and sabers carried against the French in the days of Bismarck to World War I Lugers and fancy Nazi daggers.

Review the legislation adopted by the military government on occupation and you learn the details of the initial Allied policy toward Germany.

The Nazi Party is dissolved, German laws carrying Nazi principles are suspended, "cruel and excessive punishments" are prohibited, German courts are closed or, where they are of Nazi origin, dissolved, Allied military currency is made legal tender, foreign exchange transactions by Germans are blocked,



U. S. Army Signal Corps Official

In France an Army Crew Heaves In a Flexible Hose for Transfer of Fuel from Ship to Shore

Two pipelines follow the Armies, one for trucks and tanks, the other for planes. By October, 1944, 800 miles of six-inch pipe had been laid toward the front from the Channel and the Mediterranean. When the Yanks crossed the Rhine in 1945, a pipeline went with them. It pumped fuel from Cherbourg.

their property abroad is frozen, and all German Government and Nazi property at home and abroad is controlled. Mail is impounded, telephone, telegraph, and postal services are suspended, a system of censorship is established, radio broadcasting by Germans is terminated, travel across frontiers is prohibited, and movement out of towns and villages sharply curtailed.

Among the Allied laws is one which sets up a series of crimes and offenses by individuals. The death penalty is provided under this law for Germans guilty of espionage, communication with the enemy, armed attack on our forces, wearing our uniform, harboring members of the German armed forces, rioting, or looting our supplies.

Other acts which have been common through the ages among populations under military occupation are also proscribed. They range from disobedience of orders of the military authorities and counterfeiting

our currency to "dissemination of rumors calculated to alarm or excite the people" and "conduct hostile or disrespectful to the Allied Forces."

Legislation like this requires courts to enforce it. So, within hours after a city is occupied, military government courts are established for trial of civilians (page 762).

These courts, following simple procedures, are firm, fast, and just. Trial by jury, habeas corpus, and certain other Anglo-Saxon privileges are dispensed with, but in general an enemy who comes before these courts has the same right to be furnished a copy of the charges, to be represented by an attorney, and to call witnesses on his own behalf as does a GI brought before a court-martial. One docket I saw showed that some 15 percent of the Germans tried were acquitted as "not guilty."

The vast majority of the offenses so far committed by Germans concern circulation:



F. R. Arner (Right), Official

Was This German Civilian Astounded! He Got a Fair Trial from the American Army

At Aachen he was found not guilty of harboring Nazi soldiers. Elsewhere two civilians who sheltered German troops were acquitted on the plea that they had only carried out General Eisenhower's instructions to aid deserters. Accused Germans have more rights under the Allies than under the Gestapo (page 761).

violation of curfew, unauthorized travel, or displaying improper credentials. The rare instances in which civilians have been detected sniping, passing information to the enemy, or harboring a German soldier indicate that there is no organized Underground in the areas we occupy—or possibly that the "resistance" is so well organized that it is able to restrain guerrilla activity until a later time.

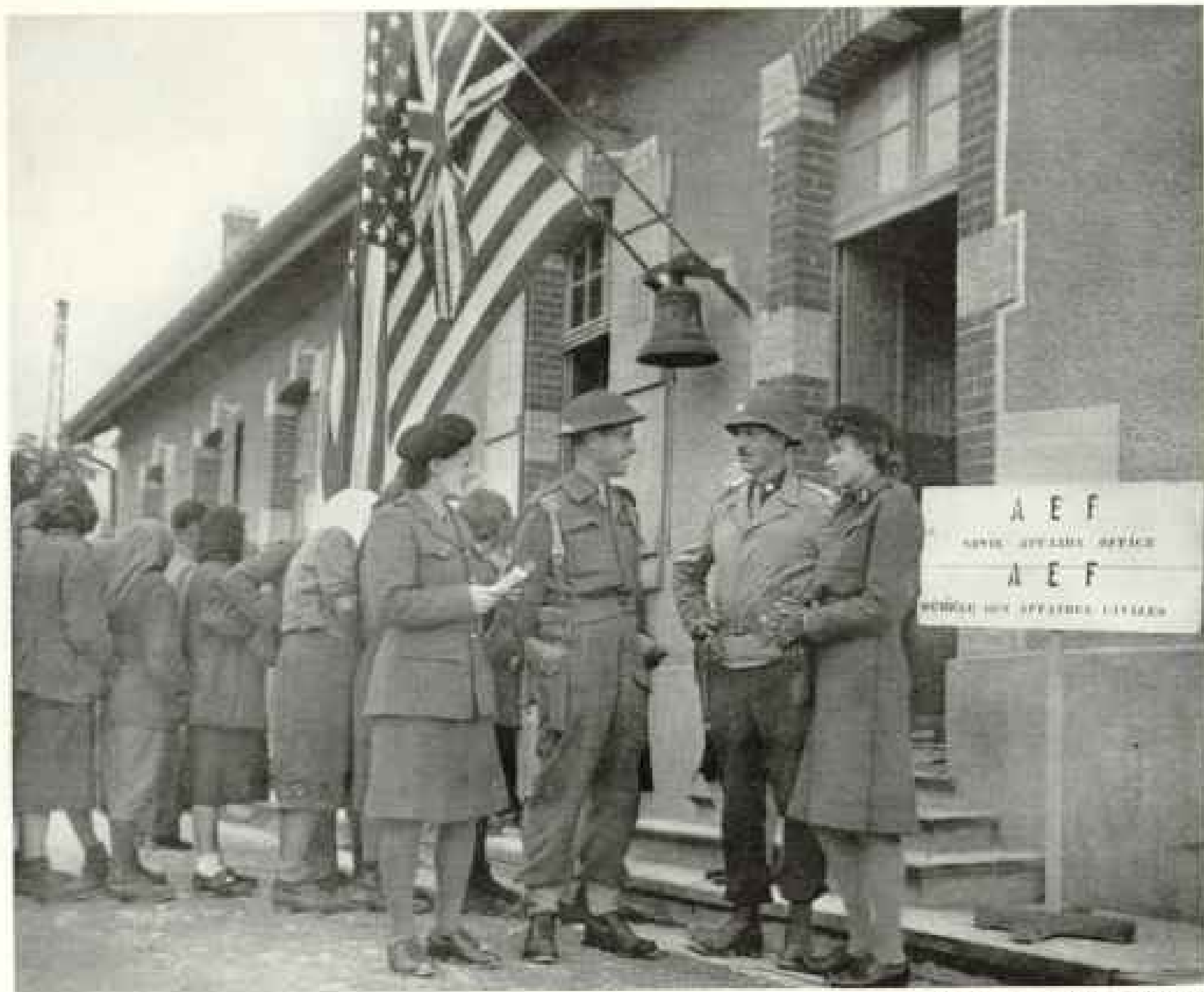
How Military Government Works

In its early stages military government is a rough-and-tumble affair. Courts sit in barns or garages, or wherever they can find shelter. With regular city officials gone, government is conducted through the civilians who seem most suitable at the moment. Thus air-raid wardens, postmen, large employers, and schoolteachers—anyone who is known to and who knows the public—are pressed into service, after a hurried investigation of their past associations, as a preliminary in the long pro-

gram to avoid using Nazis in positions of responsibility.

As an almost universal rule, these selected civilians are first ordered to clear streets of debris, bury civilian dead, set up emergency feeding provisions, and ensure that banks comply with our foreign-exchange requirements, that factories discontinue armament production, and that utilities provide the light and power we require. In short, we use the officials we name to set the life of the community to the pattern of our occupation.

It follows that they also assume leadership in matters which are of no direct military concern, such as the distribution of food among the population. Informed that we do not propose to import relief supplies for the benefit of Germans if we can help it, these German officials first distribute the stocks left behind by those who evacuated. Resources of remaining civilians are often pooled against the day when food will run short.



U. S. Army Signal Corps, Official

In Verdun, American and British Flags Fly as One Over a Civil Affairs Office

Created by SHAEF, civil affairs detachments reorganize civilian life. In liberated countries British and American members act as a team; in Germany they serve in different zones. Here a Briton (shallow helmet), an American, and two French girls see that the line of refugees gets food and shelter.

Because Germans must live off German production, communities with a surplus, such as we found at Remagen and Aachen, are ordered to limit consumption by rationing or other measures so that their surpluses can be shipped to deficient industrial areas.

As conditions stabilize and the battle moves on past these German towns, Allied problems multiply. The skeleton municipal government is ordered to see that coal is mined for the benefit of liberated areas and cattle buried, and to relieve our manpower commitments by taking over such tasks as civilian traffic control, registration of civilians, and the issuance of circulation permits—all matters which a responsible local government can perform under the supervision of the occupation forces.

Non-Nazis Hard to Find

The identification and selection of reliable German officials is a problem which will plague the Allies for months. We are, as a primary

objective, out to rid the German Government of Nazis. Yet virtually everyone with administrative experience is a Nazi. Among the whole population, somewhat less than 10 percent were active members of the party when the war started. But added millions were members of affiliated organizations, like the Hitler Youth.

Exclude the aged, the women, and the children, and it becomes apparent that to find men of administrative experience who are actually anti-Nazi is likely to be almost impossible. They were long ago convinced or silenced by the Gestapo. And the few non-Nazis not serving in the German armed forces who might be used are usually found to have benefited from war contracts, to have a brother who is a Party official, or to be associated in one way or another with the Party.

There is practically no one in Germany today who can be looked to for unprejudiced advice on this question. In Italy the Church



U. S. Army Signal Corps, Official

Life Must Go On . . . a Frenchman Plows Even as Yanks Splice Wire for Battle

Though his fields were mined and the skies were a path for shells, the farmer and his strangely matched team kept on working. Recently bazookas have shot wire to advance patrols, and planes have laid lines over mountains and woods.

was often a source of good counsel on personalities and other problems of military government, but in Germany there are disadvantages in placing too much reliance on the advice of churchmen, no matter how well intentioned.

Find a business man who passes Army investigations and he will be immediately denounced by the Socialists as a Nazi. Find a Socialist whose record seems clear and the business men complain loudly that he is a Nazi. The truth seems to be that Nazi association can be proved against virtually everyone in Germany.

This is the great dilemma of the military government. To accomplish certain of its objectives, a functioning government at regional levels is essential, but persons associated with the Nazi movement cannot be employed in making that government function.

To use Allied Army officers in German administrative posts is impossible. As a pure matter of arithmetic, there are far more positions to be filled than there are officers to spare. And should we use our own officers on food distribution or price control, it would

appear that the Allies assume some responsibility for the prompt solution of these problems in chaotic Germany. We do not. They are properly questions for the Germans themselves to work out.

These local governments, once established, have their problems. They must contend with all the questions which plague the liberated countries, from refugees to fuel and transportation shortages. There are, in addition, a number of circumstances peculiar to a defeated and devastated country.

Germans Don't Want to Work

To clear up rubble, bury the dead, get essential services running calls first for common labor in great numbers. But people in most cities of Germany today don't want to work. Their instinct is toward self-preservation. That means patching up their own homes, foraging for food, and locating scattered belongings and relatives. No German wants to go far from what is left of his home, fearing that while he is away his neighbors will loot his remaining effects.



C. S. Army (Front) Corps, Official

Worried Germans at Rittersdorf Learn What Our Conquest Holds for "Supermen"

Similar American proclamations, in German and English, have imposed curfew and blackout, restricted travel, and prohibited public gatherings except for church. They demanded surrender of firearms, barred newspapers and posters, outlawed Nazi anthem, flag, and uniforms, suspended public communications, and closed schools and courts (page 760).

The question of clothing arises. A German who wears out his "ersatz" suit doesn't know where he will get another. Money means nothing; there is nothing to spend it on. Even though the burgomasters we appoint have the authority to compel their community to labor, they have difficulty even in notifying citizens to report for work, with telephone lines down and no transport to round up gangs.

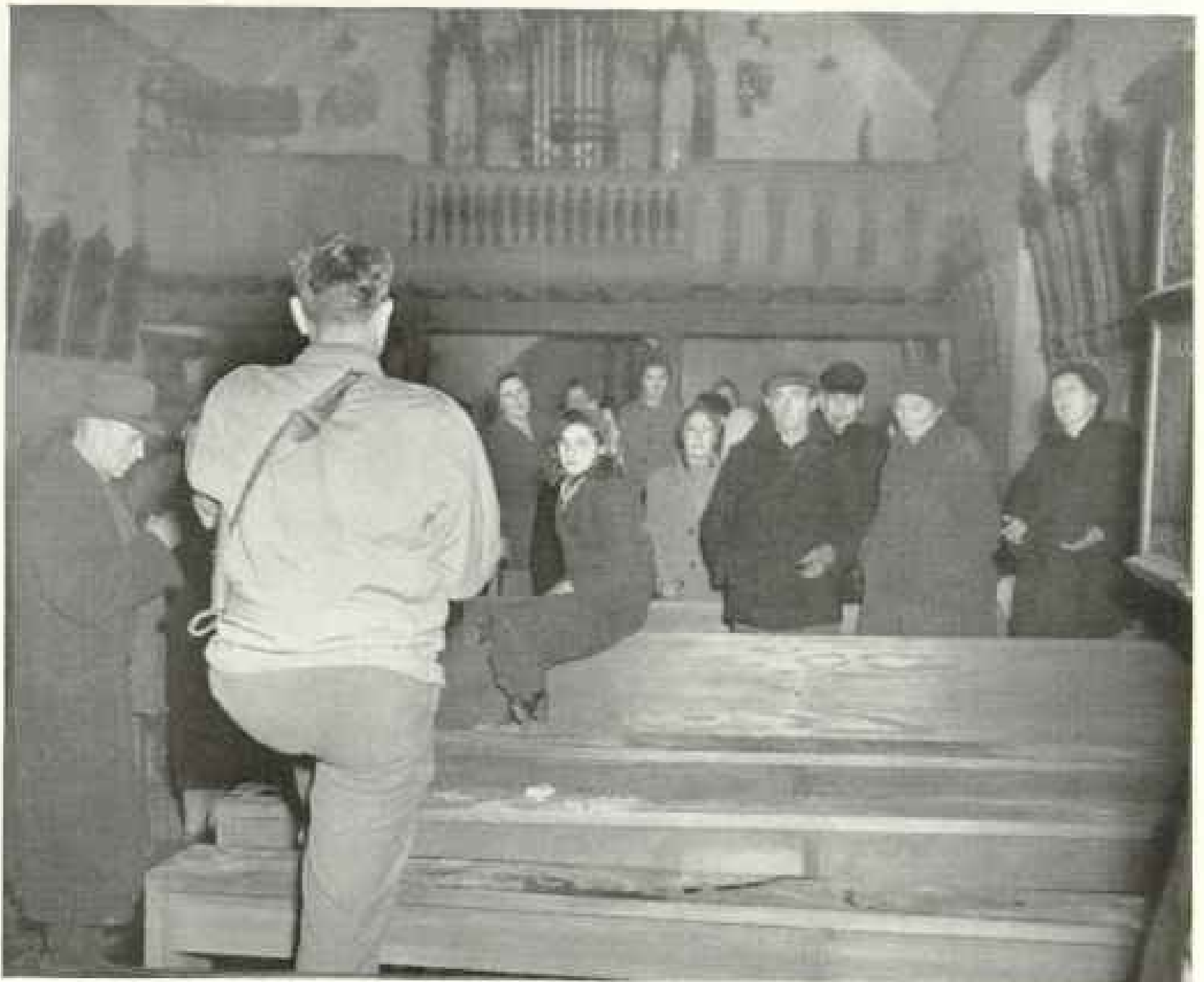
In addition, much of the common labor in Germany has been done in recent years by forced foreign laborers, who disappear "over the hill" headed for home when we occupy these German towns. Those of the foreign workers who remain are displaced persons and therefore an Allied responsibility comparable to Allied prisoners of war. Though they can be encouraged to continue working, the Allies won't press it. Many of them have been kept at a high productive level by slave tactics, such as feeding them a special liquor of vitamin C and sugar on an alcohol base. Allied Armies are disposed to treat such workers as welfare cases rather than to ask them to continue at the jobs to which they were enslaved.

The problems of the makeshift civilian governments set up by the Allies don't end with the procurement of labor. These governments are usually short of funds. Wholesale evacuations and the shutdown of industry mean an end to the bulk of tax collections; so local treasuries run dry.

Other taxes customarily paid to higher levels of government (as in our States) and then redistributed to municipalities are lost because the *Länder* governments (i.e., of former German States) may not be in Allied hands and the municipalities can't get at the funds they normally use to operate.

In these cases Allied military currency is given the municipal government to tide it over. The money so provided it will ultimately be up to the Germans to redeem. Such "loans" cost the Allies nothing.

The progress of an occupying army whose front cuts across conventional lines of civil authority and communication produces many an anomaly. Frequent instances have occurred in which towns held by the Allies have continued to receive power from generators



U. S. Army Signal Corps. Official

Equally Destitute, German Masters and Russian Slaves Meet in Church, Learn AMG Rules

To the Supreme Command, homeless Germans are "refugees"; their kidnaped serfs are "displaced persons," or "DP's" (page 757). General Eisenhower promised Germans freedom of worship, but not for undercover purposes. He abolished all "cruel, oppressive, and discriminatory" Nazi laws (page 760).

behind the German lines. In Africa a British brigadier once negotiated the surrender of an Italian garrison over a civilian telephone which ran through no-man's land!

The job of military government in Germany is just begun when a skeleton municipal administration is established. There are immediate problems also in terminating German armament production, regulating the relations of troops and civilians, and so laying the groundwork for the long-range occupation and control of Germany.

Nonfraternization Hard to Enforce

Military authorities find that factories have been scattered all over Germany to escape the bombing and, what is even more exasperating, have been given code names by the Germans to make their identification difficult. Thus Joseph Schmidt & Sons of Essen may now be located in Stuttgart and known only by a number.

Contacts between Allied troops and Germans are governed by the stern rule of "non-fraternization." But our GI's and the British Tommies are hard to curb when hungry-looking children pester them for food and sweets. Many adults make an impressive story out of their "real anti-Nazi feeling." Problem of the military is to see that all friendly advances by the Germans are repulsed. One platoon commander tells this story:

He and a group of his men knocked on the door of a brewery and demanded, "Open up!"

After some minutes a fat German face appeared, smiling. "Oh! You come to liberate us!"

"Like hell," the lieutenant replied. "We're here for a case of beer!"

If he paid for the beer, the lieutenant's attitude was in full accord with Allied policy.

So far, then, military government in Germany is a catch-as-catch-can affair at the



C. S. Army Signal Corps, Official

From the Near-by Reich, Yanks Escort German Civilians to Safety in Belgium

They help these enemies in line of duty, but fraternization is forbidden. Kissing a German girl may cost a 40-dollar fine. These refugees are in Malmédy, Germany's and Belgium's long-disputed prize. Two months after they arrived, the Battle of the Bulge struck Malmédy.

local levels of government. It is designed to keep the civilian population from molesting the security of the troops, to give relief to Allied prisoners of war and displaced persons, and to set up a structure of government employing non-Nazis to assist the occupation forces in meeting their minimum requirements.

All this serves as a framework for the later exercise of positive controls over Germany in accord with long-range policies arrived at by the Allied Control Commission.

Problems which will furrow the brows of statesmen for years, such as reparations, trial of war criminals, re-education of German youth, demilitarization of Germany, and its economic disarmament are treated for the time being by negative action.

Pending elaboration of the decisions reached at Yalta, the Army identifies and holds objects looted from the occupied countries, closes schools, and treats members of the armed

forces and Nazis who come under its control as prisoners of war and civilian internees.

As Allied policy is developed and as the mission of the Army in Germany changes from combat to occupation, the foundations now being laid will be used to build up a pattern of control designed, in the words of Yalta, "to ensure that Germany will never again be able to disturb the peace of the world."

The Functions of "G-5"

Though liberation and conquest are conventional military functions, many of the responsibilities being discharged by our Armies in Europe today are new—new, in part, because total war involves civilians as wars haven't done before. New also because this war was fought, more than most, to influence the ideals and political beliefs of civilians.

To discharge these added responsibilities effectively, the American Army modified its fundamental organization in one of the most

revolutionary moves since Elihu Root set up the General Staff in the War Department. Created in SHAEF, and in all subordinate American headquarters down through the Corps, is a fifth element of the General Staff, "G-5." It takes equal place with other General Staff divisions and is assigned primary responsibility for matters concerning civil affairs and military government.

To execute the policies developed by this new staff division and issued as orders by the commanders concerned, the Army has created new field teams, known in liberated countries as "civil affairs detachments" and in Germany as "military government detachments." It is these detachments who are the "doers," the men who are blamed if a Nazi stays in office or praised if French refugees are fed in the middle of battle.

One novel aspect of the detachments when they operate in liberated countries is that, like the tactical operations which they support, they function on a combined British-American basis. Detachments operating in Liège and Lyon, Nijmegen or Namur, all comprise equal numbers of British and United States officers, fly jointly the flags of the two countries, distribute supplies procured jointly by the two nations, and, in the words of the Combined Chiefs of Staff, "display all the characteristics of a combined undertaking."

In Germany, because Americans and British are ultimately to occupy different zones, the detachments are staffed on a national basis but follow a common policy, use standard forms and operating procedures, and freely interchange liaison officers and observers.

British and Americans Work Together

Nowhere is the combined nature of civil affairs and military government activity more apparent than at SHAEF. In the G-5 Division there, British and United States officers are sandwiched in with no apparent regard for nationality. Assignments are made on the basis of talent and capacity.

Under Canadian-born British Lt. Gen. A. E. Grasett, United States Brig. Gen. Frank J. McSherry is senior advisor on civil affairs and military government to General Eisenhower. General McSherry led Allied military government in Sicily and Italy. He was then moved to the European Theater to supervise the planning for the conduct of civil affairs in liberated Europe and military government in Germany.

Assigned throughout the military organization created to cope with the problems of liberation and conquest are thousands of officers selected and trained in the United States

and later in the United Kingdom for the job they are now doing. Names familiar in their home States for experience in civil administration and other fields of public life are common on this roster. No single branch or service in the Army boasts a greater collection of civilian talents.

"As Modern as Radar"

It is said that the test of a man or an organization comes in adversity. Civil affairs detachments proved themselves during Von Rundstedt's sudden break-through in the Ardennes last December (page 752).

With the first flush of liberation past, the small Belgian and French border towns in the path of the advance had settled down to rebuilding their governments, organizing their distribution, and relaxing in their new freedom.

Then the rumble of battle was heard again, from the direction of Germany. Officials fled, fearing German reprisals, refugees clogged the roads once more, and the rumors began. "The Allies have had a tremendous defeat!" "The Boche will be in Paris in a few days!" "It is 1940 all over again."

Civil affairs detachments were no longer liberators, but representatives of a defeated army. But by dint of their individual personality and exercise of their long training, the officers were able to assume authority among a strange people in a strange land.

Mayors were evacuated to safety, civilians who had nothing particular to fear were induced to stand fast, rumors of defeat were scotched, tall tales of parachutists in Allied uniform and of mysterious smoke signals were investigated, refugees from forward areas were fed, and civilian looting curbed.

These detachments were often the last Allied units to evacuate before the German push. They left with the reassuring words, "We'll be back in a few days." Elsewhere they stood fast, as did Lt. Sherman Hoyt, of New York, with his detachment during the siege of Bastogne.

For some time these teams will be the "doers" in Europe. When you read of decisions taken by statesmen to adopt a policy toward Germany, it will be the personnel of these detachments who execute it, for nowhere else is there available and organized a group in sufficient numbers capable of exercising the control over Germany required for years to come.

To an assembly of his military government detachments just prior to D Day, General Eisenhower said, with good cause, "You are as modern as radar and just as important to the command."

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDINGS
SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON 6, D. C.

GILBERT GROSVENOR, President
ROBERT V. FLEMING, Treasurer
HERBERT A. POOLE, Assistant Treasurer
LYMAN J. BRIGGS, Chairman, Research Committee
ALEXANDER WETMORE, Vice-Chairman, Research Committee

JOHN OLIVER LA GORCE, Vice-President
*GEORGE W. HUTCHISON, Secretary
THOMAS W. MCKNEW, Senior Assistant Secretary
VERNON H. BREWSTER, Assistant Secretary
MELVIN M. PAYNE, Assistant Secretary
*Died March 14, 1945

EXECUTIVE STAFF OF THE NATIONAL GEOGRAPHIC MAGAZINE

GILBERT GROSVENOR, EDITOR

JOHN OLIVER LA GORCE, Associate Editor

J. E. HILDEBRAND
Assistant Editor

MELVILLE BELL GROSVENOR
Assistant Editor

JAMES M. DARLEY
Chief Cartographer

NEWMAN BUMSTEAD
Research Cartographer

CHARLES E. RIDDIFORD
Cartographic Staff

WELLMAN CHAMBERLIN
Cartographic Staff

FREDERICK SIMPICH
Assistant Editor

McFALL KERBEY
Chief of School Service

LEO A. BORAH
Editorial Staff

LEONARD C. ROV
Editorial Staff

WILLIAM H. NICHOLAS
Editorial Staff

F. BARROWS COLTON
Editorial Staff

FRANKLIN L. FISHER
Chief Illustrations Division

MAYNARD OWEN WILLIAMS
Chief Foreign Editorial Staff

W. ROBERT MOORE
Foreign Editorial Staff

INEZ B. RYAN
Research Assistant

EDWIN L. WISHERD
Chief Photographic Laboratory

WALTER MEAVERS EDWARDS
Illustrations Division

RAYMOND W. WELCH
Director of Advertising

BOARD OF TRUSTEES

CHARLES EVANS HUGHES
Formerly Chief Justice of the
United States

WALTER S. GIFFORD
President American Telephone and
Telegraph Co.

WILLIAM V. PRATT
Admiral U. S. Navy, Retired

LYMAN J. BRIGGS
Director National Bureau of
Standards

GEORGE R. PUTNAM
Commissioner of Lighthouses,
Retired

THEODORE W. NOYES
Editor of The Evening Star

L. O. COLBERT
Rear Admiral, Director U. S. Coast
and Geodetic Survey

GEORGE W. HUTCHISON
Secretary National Geographic
Society

ROBERT V. FLEMING
President and Chairman of the
Board Riggs National Bank

H. H. ARNOLD
General of the Army
Commanding General,
U. S. Army Air Forces

LEROY A. LINCOLN
President Metropolitan Life
Insurance Company

EMORY S. LAND
Vice Admiral U. S. Navy, Retired;
Chairman U. S. Maritime Commission

DAVID FAIRCHILD
Special Agricultural Explorer, U. S.
Department of Agriculture

ALEXANDER WETMORE
Secretary Smithsonian Institution

GILBERT GROSVENOR
Editor of National Geographic
Magazine

JOHN J. PERSHING
General of the Armies of
the United States

CHARLES F. KETTERING
President General Motors
Research Corporation

CHARLES G. DAWES
Formerly Vice-President
of the United States

JUAN T. TRIPPE
President Pan American Airways

ELISHA HANSON
Lawyer and Neurologist

LLOYD B. WILSON
President Chesapeake and
Potomac Telephone Companies

ERNEST E. NORRIS
President Southern
Railway System

JOHN OLIVER LA GORCE
Associate Editor of the National
Geographic Magazine

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded fifty-seven years ago, the National Geographic Society publishes this Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researchers solved secrets that had puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1929, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,295 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society-U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

The Society granted \$25,000, and in addition \$75,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

UNITED STATES ARMY

May 25, 1945

Dear Folks:

I'm a big shot now! No kidding - the 3-stripe in the snapshot is me!

Thanks, Mom, for the candy. I managed to eat a few pieces before the rest of the boys found it.

And thanks for telling me about my birthday present. I sure would like a watch! The ones we use here are the most accurate I've ever seen - Hamiltons. But since they belong to the Army, they're only loaned to us. So I wish you'd sorta postpone my birthday present a little while - until Hamilton makes watches for sale again. (See enclosed ad.) Why not put the dough into some extra War Bonds?

Well, I've got to go now and put a couple of the boys to work. See you soon, I hope.

Hank



12 more bucks a month!

We're losing
no time

Though Hamilton is still building thousands of highly precise navigating instruments for war, every tank, aircraft and machine we can spare is working for the day when first, accurate Hamilton Watches will again be available for civilians. Wait for Hamilton.



This is it!

HAMILTON
The World of Central Time
A WATCH WORTH WAITING FOR

WAIT FOR
HAMILTON
you'll be glad you did



Leo McCarey
 PRODUCER AND DIRECTOR OF
 "BELLS OF ST. MARY'S"
 AN RKO RELEASE

"HOW TO MAKE

Finer Home Movies"

by **Leo McCarey**

Famous Hollywood Producer and Director

"WE'VE learned in the studios that it takes fine equipment to make fine movies. In personal movies as in professional movies, the pictures can be no better than the camera.

"Ever since the industry began we've looked to Bell & Howell for fine studio equipment. And we find the same perfection in B&H Filmo Cameras for personal movie making."

Filmos are so easy to use that even beginners get superior results, right from the first. Just sight, press a button, and *what you see, you get*—in full, natural color or in sparkling black-and-white.

Take This First Step Now

Send the coupon today for information on improved Filmos to be available when our war production permits. Bell & Howell Company, Chicago; New York; Hollywood; Washington, D. C.; London.



There's a Filmo Camera Exactly Suited to You

Shown here is the improved Filmo "Sportster," an 8mm. all-purpose home movie camera. Mr. McCarey's camera is a Filmo Auto Load, which uses pre-loaded 16mm. film magazines.

BELL & HOWELL COMPANY
 7194 McCormick Road, Chicago 45
 Please send information about improved Filmo
 Movie Cameras and Filmosound and Silent Pro-
 jectors.

Name.....

Address.....

City..... State.....

OPTI-ONICS—products combining the sciences of OPTics • electrONics • mechanICS

PRECISION-MADE BY



Bell & Howell

SINCE 1907 THE LARGEST MANUFACTURER OF PRECISION EQUIPMENT FOR MOTION PICTURE STUDIOS OF HOLLYWOOD AND THE WORLD

Most Wanted...

AND MORE PARKER 51'S CAN BE EXPECTED!



An owner proudly exhibits his Parker "51." You ask to try it—and it wins you completely!

The ever-moist, protected point starts on the split second. Eagerly it floats over the paper. That Osmiridium tip is smoother than satin!

Then look . . . your words dry as you write. For this pen uses magical Parker "51" Ink. It alone has the design and construction required for satisfactory use of this world's fastest drying ink. (It can also use any regular ink.)

Demand for the "51" cannot be completely filled. For it is a precision instrument, built to

the highest standards. It cannot be hastily mass produced. And our first obligation is equipment vital to victory.

More Parker "51" Pens, however, are coming. So place a reservation order now with your dealer. Perhaps sooner than you think, a Parker "51" will be yours!

Colors: Black, Blue Cedar, Dove Gray, Cordovan Brown. \$12.50; \$15.00. Pencils, \$5.00; \$7.50. Vacumatic pens, \$8.75. Pencils, \$4.00. The Parker Pen Company, Janesville, Wisconsin

MAKE YOUR DOLLARS FIGHT—BUY WAR BONDS NOW.

PARKER

“51”

The Next Best Thing to a Leave

... is a LETTER

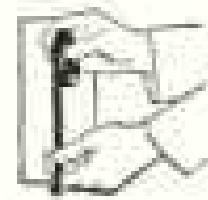
★ Home is heaven to men overseas. And a letter is a five-minute furlough at home. So however busy you are, find time to write that man in the service. When you write, remember these 3 rules: 1. Short, frequent letters are better than occasional long ones. 2. Write cheerful newsy letters about familiar places and faces. 3. Use V-Mail, because V-Mail gets there quicker, saves space for vital supplies that help speed Victory. Why not read this magazine later and write a V-Mail letter now?

HOW THE MARTIN MARS BOOSTS MORALE

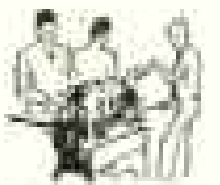
Mighty morale-booster is the Martin Mars. Each trip she carries thousands

of letters ... and if loaded only with V-Mail, she could carry the unbelievable total of 260,000,000 letters! Looking ahead, this great capacity of Mars-type planes will mean greater payloads, lowered costs, for over-ocean airlines. Already designed, commercial cargo and passenger versions of the Mars await only Victory to become reality. So tomorrow, for speed, safety, comfort and economy, plan to take trips or ship goods via Martin Mars!

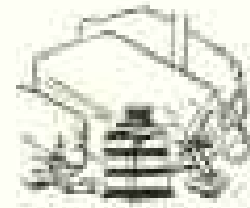
THE GLENN L. MARTIN CO.,
BALTIMORE 3, MARYLAND
THE GLENN L. MARTIN-NEBRASKA
COMPANY—OMAHA



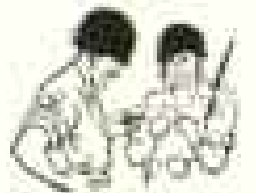
1. At Fleet or Army Post Offices, V-Mail letters are photographed on strips of film then reduced to postage-stamp size.



3. Arriving at overseas bases, micro-film is enlarged, cut into individual letters, sealed in envelopes by machine.



2. One V-Mail pouch carries as many letters as 57 regular pouches. One ton of ordinary mail reduces to 14 pounds of V-Mail film.



4. V-Mail reaches them quickly ... and saves cargo space for equipment they need. Get V-Mail paper at stationer's or post office.

Martin

AIRCRAFT

Builder of Dependable Aircraft Since 1918



V-MAIL VIA MARS! Making as many as 14 trips each month between California and Honolulu, the huge Martin Mars speeds mail, supplies and priority passengers to the Pacific. A number of 82-ton sisterships will soon join her to serve our lengthening battle lines.



UNION CARBIDE *AGAIN* REPORTS

on the production of **BUTADIENE**

for the Government's Synthetic Rubber Program



ONE OF THE MOST IMPORTANT factors in the Government's rubber program is the production of GR-S type synthetic rubber.

The basic chemical in this rubber is Butadiene, which can be made from alcohol or hydrocarbon materials.

The Government's original plan provided that about one third of the required Butadiene would be made by CARBIDE AND CARBON CHEMICALS CORPORATION'S alcohol process.

In 1943, their first year of operation, however, the plants using this process produced over 75 per cent of all Butadiene made for GR-S type synthetic rubber.

In 1944, the second year, these plants produced about 64 per cent of all Butadiene necessary for military and essential civilian rubber. This was true despite the fact that good progress had been made in the production of Butadiene by other processes.

THE RECORD

The first tank-car load of Butadiene was shipped from the Government's Carbide-built, Carbide-operated plant at Institute, West Virginia a little over two years ago.

This was just five months after the famous Baruch Committee Report pointed out this nation's desperate need for rubber—and approved Carbide's butadiene alcohol process, originally selected by Rubber Reserve Company, as one of the solutions.

In its first year the Institute plant, with a rated ca-

capacity of 80,000 tons per year, produced enough Butadiene for more than 90,000 long tons of synthetic rubber.

Two more great plants using Carbide's alcohol process—and built from the blueprints of the Institute plant—are in full production. One of these, with an annual rated capacity of 80,000 tons of Butadiene is located at Kobuta, Pennsylvania and is operated for the Government by another important chemical company.

The second, with a rated capacity of 60,000 tons a year, is operated for the Government by Carbide at Louisville, Kentucky—making the total rated capacity of the two huge plants now operated by Carbide 140,000 tons a year.

In 1944, the production of Butadiene from the three plants using the alcohol process totaled 361,000 tons—representing operation at over 164 per cent of rated capacity. An even higher rate is expected in 1945.

* * * * *

Before Pearl Harbor, the United States was a "have not" nation with respect to rubber. Now, thanks to American research, engineering and production skill, our country can take its place as a dominant factor among the great rubber producing nations of the world.



Business men, technicians, teachers, and others are invited to send for the book K-6 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.

SEPTEMBER 10, 1942

"Of all the critical and strategic materials, rubber is the one which presents the greatest threat to the safety of our nation, and to the Allied Cause . . . We find the situation to be so dangerous that unless corrective measures are taken immediately the country will face both a military and a civilian collapse."

—Report of the Rubber Survey Committee (Baruch Committee).

AUGUST 31, 1944

"Undoubtedly the outstanding achievement of your company has been the development of your process for the production of Butadiene from alcohol. With a rather meager background of experimental work, your engineers were able to design and construct commercial units for the production of Butadiene. In an exceedingly short time, the operation of this equipment at capacities up to 200 per cent of rating has been largely responsible for our present safe situation with respect to rubber supplies . . ."

—Letter from Rubber Director Bradley Dewey to CARBIDE AND CARBON CHEMICALS CORPORATION

The material herein has been reviewed and passed by the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street  New York 17, N. Y.

Principal Units in the United States and their Products

ALLOYS AND METALS—Electric Metallurgical Company, Haynes Stainless Company, Kemet Laboratories Company, Inc., United States Vanadium Corporation

CHEMICALS—Carbide and Carbon Chemicals Corporation PLASTICS—Bakelite Corporation ELECTRODES, CARBONS AND BATTERIES—National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE—The Linde Air Products Company, The Oxweld Railroad Service Company, The Prox-O-Lite Company, Inc.

U. S. F. & G. salutes the *Empire State!*

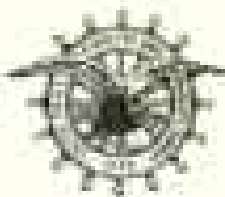


New York's State Capitol at Albany has witnessed the passage of much of America's progressive legislation. U. S. F. & G. is proud that it, too, has contributed to the unchecked progress of the Empire State.

New York Pioneers in Progress!

From the days when New York's turnpikes and canals were the wonder of the nation, to its present-day skyscrapers, super-highways and public works . . . New York has pioneered in progress. First in number of residents, one of the leaders in the value of farm products, home of great industrial and financial concerns, famed for scenic beauty and urban smartness, this is truly the Empire State! ☞ In New York, as in every state, U. S. F. & G. safeguards business and the individual, writing practically all forms of fidelity and surety bonds and casualty insurance policies.

Consult your insurance agent or broker



as you would your doctor or lawyer

U. S. F. & G.

UNITED STATES
FIDELITY & GUARANTY CO.

affiliate

FIDELITY AND GUARANTY FIRE CORPORATION
HOME OFFICES: BALTIMORE 3, MD.



SAVING BOTH SPACE AND WEIGHT

This is a pair of General Motors series 71 Diesel engines built side by side, delivering their power through a single shaft. It is Detroit Diesel engineers' answer to an urgent call for a lot of dependable Diesel power in a small space.

Some of the jobs assigned the basic series 71 power units in "Singles," "Twins," and "Quads" are among the toughest on the books today—powering landing craft and driving Army M-3, M-4 tanks and M-10 tank destroyers.

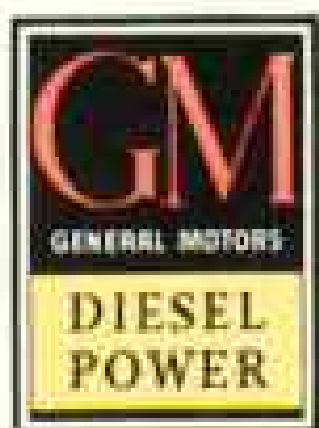
It takes "oomph"—plenty of it—to plow a tank through hip-deep mud, to lift it out of

shell craters, to keep it hot after the enemy—to beach and extricate a landing craft when the breakers are running high.

So it is easy to look ahead and see how these "multiple" Diesels will take hold of the countless jobs of industry and perform them equally well—particularly where the ratio of power to weight or space is of prime importance.

And remember, these "Twins" and "Quads," like the single sixes, share all the important developments which General Motors has contributed to Diesel science.

KEEP AMERICA STRONG
BUY MORE WAR BONDS



ENGINES . . . 11 to 210 H. P. DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.

ENGINES . . . 150 to 2000 H. P. CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio

LOCOMOTIVES ELECTRO-MOTIVE DIVISION, St. Louis, Mo.



Control Center

OF A GREAT CORPORATION

It is the microphone heart of Dictaphone *Electronic Dictation*, and it stands inconspicuously on the president's desk. It brings him new dictation freedom—provides him with complete and precise control over his entire organization.

Into it, he speaks his ideas, reports and decisions—all to be put into immediate action. He can even record over-the-desk conversations, and all the while his secretary is left free to protect him against interruptions and do other important work for him.

Why not learn more about this exciting new business expediter? Write for free descriptive literature. Dictaphone Corporation, 420 Lexington Ave., New York 17. In Canada: Dictaphone Corporation, Ltd. 86 Richmond St. West, Toronto 2, Ont.

DICTAPHONE *Electronic Dictation*

The word DICTAPHONE is the registered trade mark of Dictaphone Corporation, makers of Acoustic and Electronic dictating machines and other sound recording and reproducing equipment bearing said trade mark.





© 1945 The Studebaker Corporation

Studebaker Weasels help pace the drive to Tokyo

HERE'S a quotation from a Philippines dispatch to "Yank," the Army weekly:
 "The Weasel is getting to the front in this tough sector after every other type of vehicle has bogged down in the rice paddies and swamps."

Designed by Studebaker engineers and built in the Studebaker factories, the Weasel personnel and cargo carrier finds footing on all kinds of terrain—sand, snow, mud, swamp or solid ground. It clambors up and down steep, slippery banks and takes to deep water like a boat.

Power plant of the Weasel is the brilliantly responsive 6-cylinder engine of the remarkably economical Studebaker Champion motor car.

Studebaker is proud to add the versatile Weasel to its list of war equipment for our valiant fighting forces.

Awarded To All  Studebaker Plants

Studebaker

PEACETIME BUILDER OF
FINE CARS AND TRUCKS

Wartime builder of Wright Cyclone engines for the Boeing Flying Fortress—
heavy-duty Studebaker military trucks—Weasel personnel and cargo carriers



**YOUR BONDS HELP PAY FOR
EVERY FLYING FORTRESS FLIGHT**

Don't let up in buying War Bonds—they're your link with every man and woman in our country's uniform—your promise that America will stay strong.

GREAT DECISION...

A MAN THINKS deeply before he asks the one he loves to share his future for better or for worse. For no decision he can ever make will more completely affect his life and another's, than to become engaged and to marry.

A man wants everything in the world for his beloved wife, and means to have it. And yet he knows that many unexpected things may happen. So he makes another important decision — to protect her for always with insurance on his life. He knows that through a carefully planned Prudential life insurance program, her whole future can be made more secure. And, if there are children, their lives as well as hers will be more free from the possibility of hardship and want.

A Prudential representative will gladly show you how Prudential policies have been especially designed for family needs. He will help you decide which kind of protection you should have, and which payment plan is best suited to your circumstances. Call this Prudential representative today, and have a friendly talk with him.

Listen to the Prudential Family Hour, with Patrice Mautal... Every Sunday, 3:00 p. m., EWT—Columbia Broadcasting System



THE PRUDENTIAL
INSURANCE COMPANY OF AMERICA
A mutual life insurance company
HOME OFFICE: NEWARK, NEW JERSEY



THE FUTURE BELONGS TO THOSE WHO PREPARE FOR IT

Taking a Phone Call

AS HE ROLLS ALONG!



Buy United States War Bonds and Stamps

A railroad engineer in his locomotive cab answering a telephone call from the engineer of another train . . . or from the towerman in a railroad signal tower . . . or from the freight conductor in a distant caboose—*while his train rolls along.*

Not only has that become reality on the Pennsylvania Railroad—but installations are now being made on the main line on a big scale.

This train telephone system is a creation of Pennsylvania Railroad research, worked out in conjunction with the Union Switch and Signal Company. Tested and proved, it adds still further to established signaling, communicating and safety devices which make American railroads the safest transportation in the world!

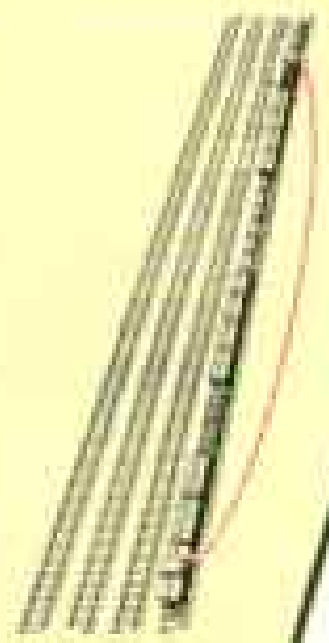
ALL LINKED TOGETHER
by Induction Telephone



TRAIN TO
TOWER



TRAIN TO
TRAIN



ENGINE TO
CABOOSE

PENNSYLVANIA RAILROAD

 *Serving the Nation* 

★ 21,000 entered the Armed Forces ● 600 have given their lives for their Country

"Goodness me," says Molly McGee,
 "it's wonderful how wax
 takes the wear!"



Hear Fibber McGee
 and Molly, Tuesday
 night, over NBC



It's so easy to protect your lovely floors — and preserve their good looks — with Johnson's Wax! The wax takes the wear and the surface underneath is safe. Regular care with Johnson's Wax actually makes floors more beautiful with each application!

Your furniture is precious! Give it protection with Johnson's Wax. Wax imparts a shining lustre . . . makes things easier to clean. They last longer, too . . . so important today when you can't buy all the new things you might wish! But you *can* buy all the War Bonds you want — buy an *extra* one today!



New!
JOHNSON'S DRAX

Trademark Reg. U. S. Pat. Off.

AVAILABLE LATER—DRAX is a protective rinse for washable clothes and fabrics—makes them resist dirt, shed water! DRAXed fabrics keep fresh, crisp, new-looking longer. Not available now—but later—in three ways: (1) look for the DRAX label on clothes you buy; (2) ask your laundry or dry cleaner for DRAX service; (3) DRAX your family washables at home.



"Johnson's Wax
 comes in 3 forms—
 paste, liquid and cream!"



© S. C. Johnson & Son, Inc.
 Racine, Wis., 1945



Official photo, U. S. A. A. F.

Finish the Fight—with War Bonds

. . . and more to come

With engines warmed up for the take-off, Boeing B-29 Superfortresses fill the long runway on Saipan . . . one behind another, as far as the eye can see. Across the field, as on other fields in the Marianas, still more wait to wheel into line. Tomorrow you will read in your paper: "Industrial targets in Tokyo have been hit again by 300 B-29 bombers."

It was less than a year ago that the first attack on Japan by the giant Superforts thrilled the nation. Today their valiant crews are regular commuters on the more than 3000-mile round trip. In waves of sky-filling formations, they carry destruction to the

enemy's workshops on a relentless schedule.

Back of this achievement is another story—an epic of production. To design, build, test and manufacture in quantity an airplane that so far exceeded all previous bombers in bomb-load, speed and range—and do it *in time*—was an unprecedented task. It called for pioneer work in engineering, tooling and planning. New facilities and processes had to be started from scratch. Methods had to be devised for putting the vast manufacturing program into effect, not only in Boeing's own plants but in those of other aircraft companies, chosen by the Air

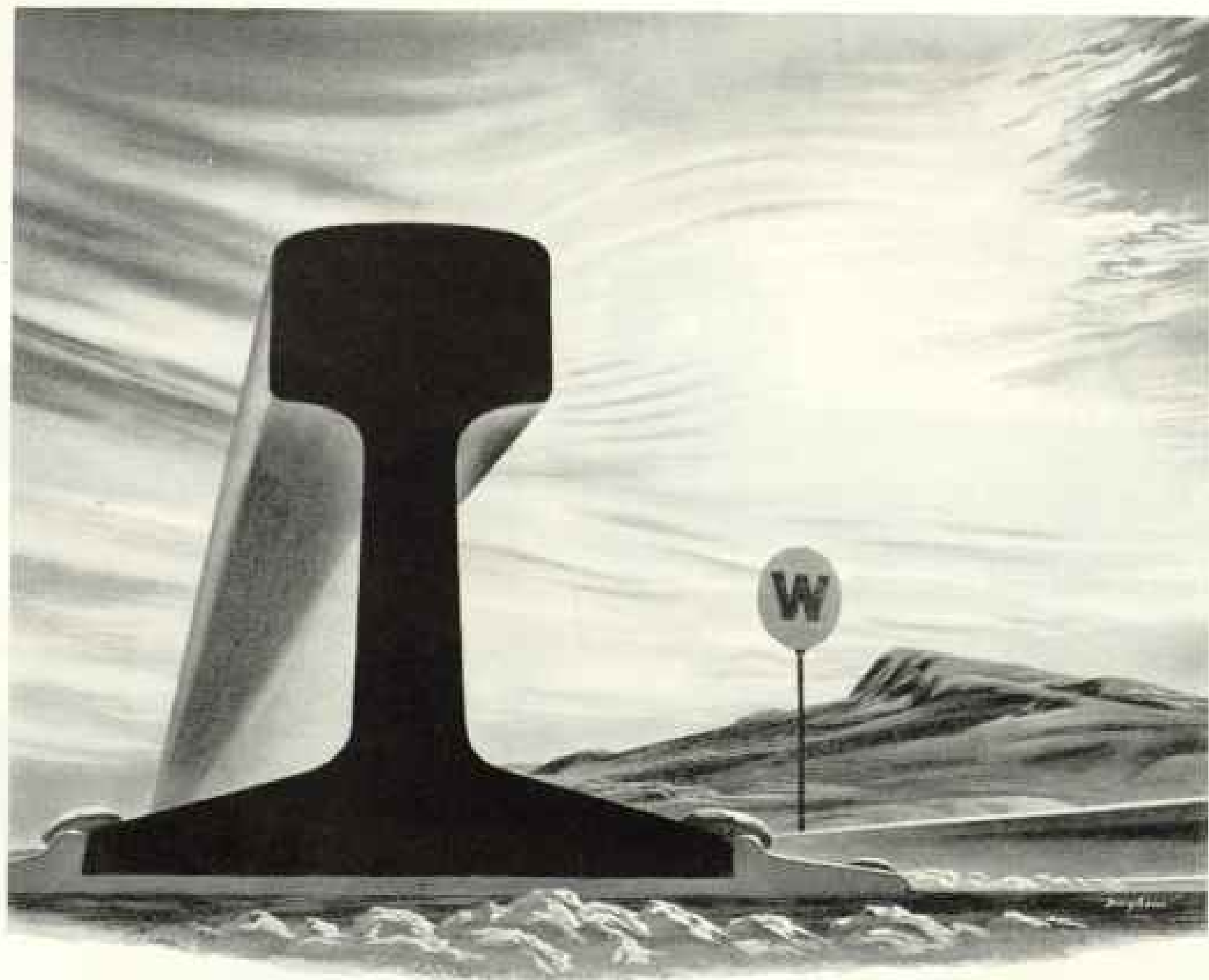
Technical Service Command of the Army Air Forces to help increase quantity production of the big planes.

Impossible as the job looked, Boeing men were equal to it. Superfortresses are rolling off the production lines in steadily mounting numbers. In the hands of hard-hitting American airmen, they are vital weapons in the war against Japan, and there are more . . . many more to come.

Tomorrow Boeing research, design, engineering and manufacture will be applied to peacetime aircraft for your use . . . your assurance that any such product "Built by Boeing" will be built to lead.

DESIGNERS OF THE B-29 SUPERFORTRESS • THE FLYING FORTRESS • THE NEW STRATOCRUISER
THE MAYDET TRAINER • THE STRATOLINER • PAN AMERICAN CLIPPERS

BOEING



“HIGH IRON”

“High Iron” is one of America’s not-so-secret weapons. It is a railroadman’s term for the 230,000 miles of mainline track — built, paid for and kept up by the railroads — which knit America together. ● Over these strong highways of steel moves America’s might — three quarters of all intercity transportation, 90% of all war freight. ● In this mass movement of freight — a movement that far exceeds anything moved before by any means of transport — lies a vital lesson. ● The lesson is this: America needs and must have — for success in war, for prosperity in peace — the low-priced, mass transportation which only railroads can deliver.

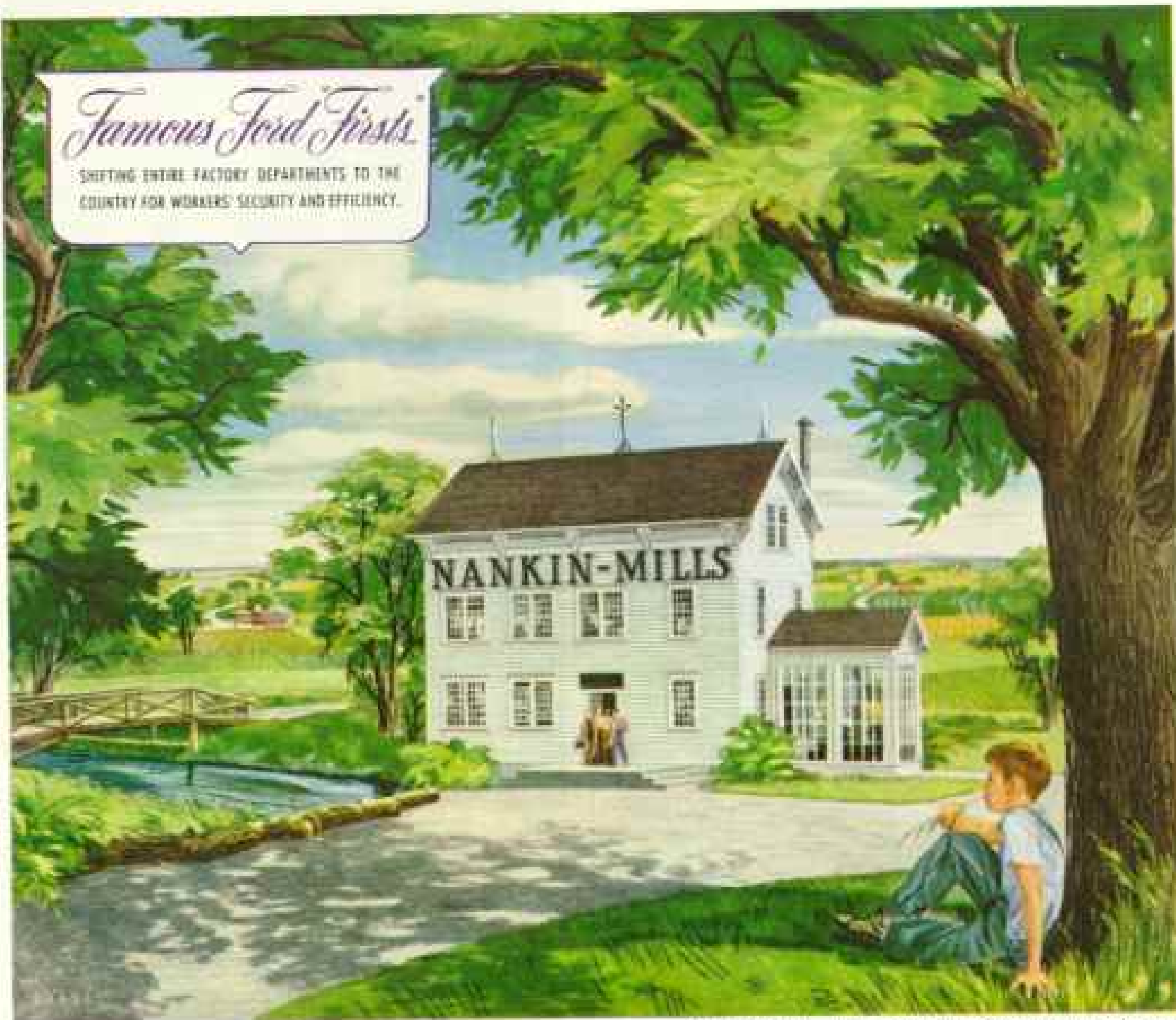


ASSOCIATION OF
AMERICAN RAILROADS

All United for Victory

Famous Ford Firsts

SHIFTING ENTIRE FACTORY DEPARTMENTS TO THE COUNTRY FOR WORKERS' SECURITY AND EFFICIENCY.



Nankin Mills—one of the first Ford Village Industries

1st

to demonstrate true
decentralization



At many different waterpower sites in Michigan you see them—18 "Village Industries" established by Ford.

Here work nearly 5000 men and women who know the peace and security that comes from having "one foot on the soil . . . and one in industry." Many live on their own farms nearby. They earn cash by their shopwork.

These little industries, since 1921, have been setting an example of true decentralization. They are not "branches." They do not duplicate the work of main plants. They are complete, self-contained production departments.

Such true decentralization distributes purchasing power. It assures finer precision on items like gages, lamps, carburetors. It eliminates power waste.

Mr. Ford visions industry becoming "a lot of little centers." By proving the economic possibilities of this plan he has established another Ford "first."

When car production is resumed at Ford, America will profit by such thinking and doing.

"THE FORD SHOW." Brilliant singing stars, orchestras and choruses. Every Sunday, over Coast-to-Coast NBC network. 2:00 P.M., E.W.T., 1:30 P.M., C.W.T., 12:00 M., M.W.T., 11:00 A.M. P.W.T.

EXPECT THE "FIRSTS" FROM FORD!

A MATTER OF
American Tradition



Give Dad Old Spice—and you give him modern shaving efficiency and a lot more—containers to fit a man's hand, packaging to please him, and the bracing Old Spice scent he prefers. *Shaving Soap in sturdy mug \$1.00, invigorating After-Shaving Lotion \$1.00, Talcum 75¢, Bath Soap, 2 cakes \$1.00. Not illustrated: Lather or Brushless Shaving Cream 50¢.*

Each a Shulton Original

Reg. U. S. Pat. Off.

17% Tax

SHULTON, INC. • ROCKEFELLER CENTER • N. Y. 20

Supreme in the arts of
public hospitality



The
WALDORF-ASTORIA

Park Avenue • 49th to 50th • New York



YOU'VE come to it. This vacation plan of yours. Don't put it off. You need health, vitality, resistance against fatigue more now than ever before. Vacation in accessible New Hampshire and get swimming, hiking and plain resting in superb natural surroundings, with completely congenial people. Write . . .

STATE PLANNING &
DEVELOPMENT COMM.
432 Capital St., Concord, N. H.

Send a copy of your
FREE illustrated Vacation Booklet.



The Milwaukee Road
822 Union Station, Chicago

Dear Sirs:

I'm looking around for my boy.
When he comes back out of the army
he'll want a place of his own. He's
thinking of a small ranch where
he could run some cattle—just a few
to start. I wouldn't want to close
anything till my boy gets back,
but I want to start looking around
now. Perhaps you know of some
elderly people who might
want to sell out.



"I'm looking around for my boy"

YOU bet we'll help. That's one of the jobs our Agricultural Development Department is organized for. The Milwaukee Road has no farm land to sell but our agricultural agents are familiar with opportunities in the twelve productive Midwest and Northwest States served by this railroad.

Last year, 10,361 home seekers requested our aid in directing them to localities where they

could practice the type of farming or ranching desired. We were in a position to give them impartial advice on where they could buy property to suit their needs and finances.

We can and will gladly help you too. Your requests for information will be promptly answered. Address *Agricultural and Mineral Development Department, 822 Union Station, Chicago 6, Ill.*

11,000-MILE SUPPLY LINE FOR WAR AND HOME FRONTS



★
**THE
MILWAUKEE
ROAD**
★

Precision optical instruments
made today for the Armed Forces
by Argus . . . foretell the good
pictures of Tomorrow . . . and we
are all looking forward to that.



argus

Cameras and Optical Instruments



Argus cameras
U.S.A.



ARGUS, INCORPORATED

ANN ARBOR, MICHIGAN

**SAN*DIEGO
IS IN THEIR MINDS**

Postwar potentialities for SAN DIEGO occupy the minds of keen observers who are thinking in terms of their own future activities in relation to new environments in which to live comfortably and thrive economically.

Plan ahead. Write for the free booklet "SAN DIEGO FACTS" or list any specific information you may desire. Expect to make your future home where climate and opportunity assure maximum comfort and success.

Address the San Diego-California Club, Room 328Y, Spreckels Building, San Diego 1, California.

**SAN*DIEGO
SOUTHERN CALIFORNIA**

432 THOUSAND GOOD TURNS A DAY



Yes, 432,000 turns a day! This is what the balance wheel—shown here in magnified size—does year after year without a pause. If you are interested in the fascinating story of watches, write for the brochure, "What's In a Fine Watch?"

GIRARD-PERREGAUX, Dept. G
ROCKEFELLER CENTER
NEW YORK, N. Y.

GIRARD-PERREGAUX

Time Watches since 1781

17 jewels
priced from \$35
featured by
leading jewelers.

"Buy U. S. War Bonds—They Identify You!"



Jet PROPULSION

Lockheed leads again. The sensational jet-propelled
Lockheed **SHOOTING STAR** is the fastest, highest-flying super-fighter in all
the world. Again proof that Lockheed is years ahead in the science of flight.

LOOK TO *Lockheed* FOR LEADERSHIP

LOCKHEED AIRCRAFT CORPORATION, BURBANK, CALIFORNIA



Five MC-227 full-size equipment of this painting was on board while ready for trial. With the latter great MC-227 Electric Boat Co., P.O. Box 10, New York 3, N. Y., enclosing 10¢ for postage and handling.



Trustworthy Craftsmanship

The sleek hull of an EBCo submarine is crammed with myriad parts and mechanisms on whose soundness and unfailing performance depend the lives of all on board. During long weeks of undersea patrols in hazardous enemy waters, EBCo's integrity, engineering skill and precision craftsmanship become vital realities to every member of a submarine's crew. Knowing this, Electric Boat has kept trustworthiness of product a firm tradition for 45 years in war and peace.

BUY WAR BONDS

CONNING THE **KILL**

A mighty U. S. submarine goes in for a better view of her victim. A moment ago she sent her torpedoes lashing into the flanks of another enemy warship, adding one more irreparable loss to the dwindling Jap fleet.

The Japs hate our submarines, and fear them; and no wonder! Submarine sinkings now total well over 1000! In the historic naval engagement during our invasion of the Philippines, U. S. submarines first made contact with the enemy fleet. Big Jap cruisers and a carrier were their part of the kill. After the battle, the communiqués paid special tribute to the work of the subs. In fact, a high naval official has recently said that "The submarines deserve the lion's share of the credit for knocking the props from under Japan's conquest."

With the help of the Navy, Electric Boat Company developed U.S. submarines from the crude early models of 1900 to the present



big, efficient, long-range ships. And Electric Boat Company now builds more submarines than any other shipbuilder in the United States.

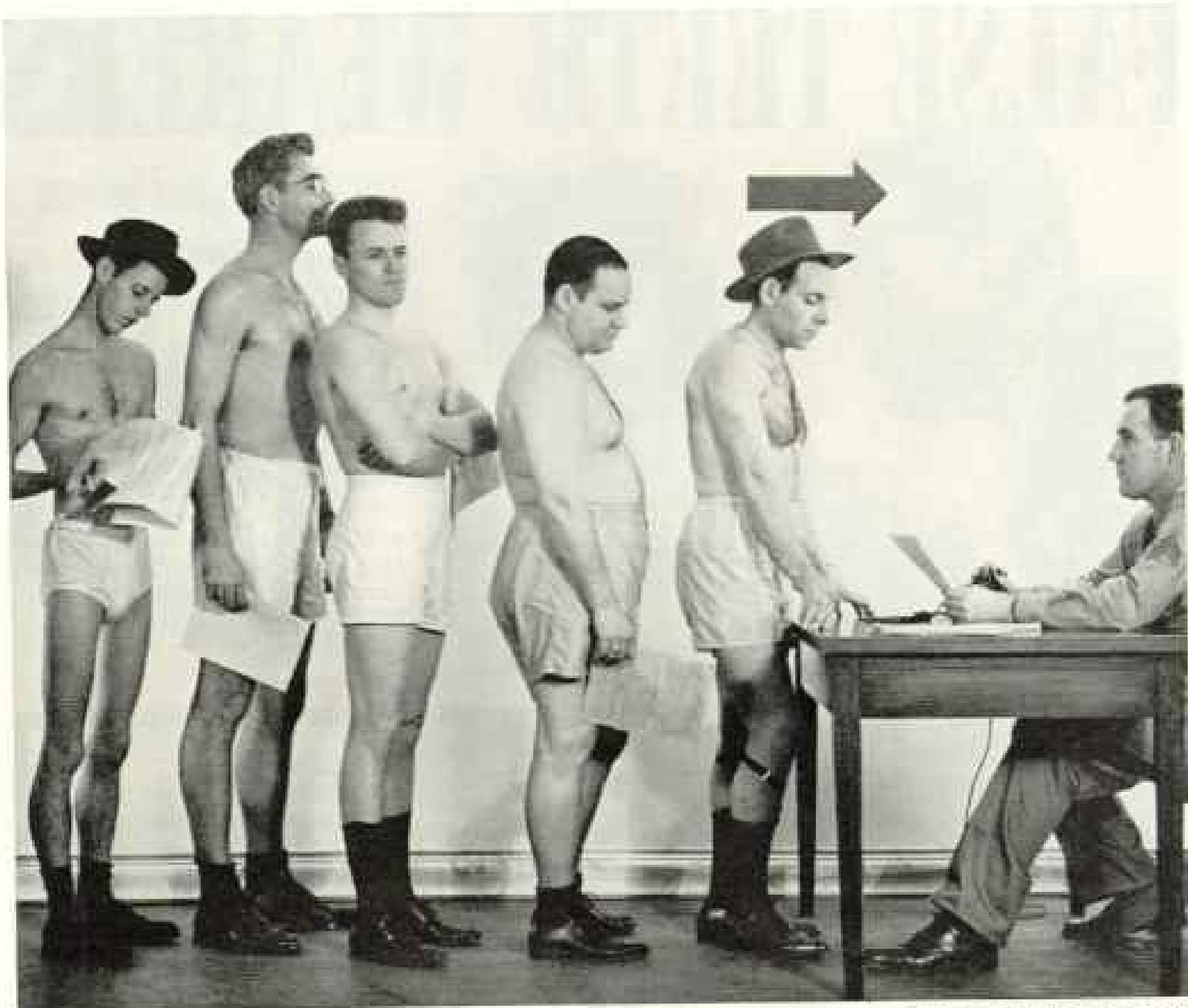
ELECTRIC BOAT COMPANY

22 Pine Street, New York 3, N. Y.

Electric Motors
ELECTRO DYNAMIC WORKS
Bayside, N. Y.

Submarines
NEW LONDON DEEP AND ENGINE WORKS
Green, Conn.

Main Torpedo Boats
ELCO NAVAL REVISION
Bayside, N. Y.



BUY WAR BONDS AND STAMPS

What's wrong with America's health?

Doctors, editors, congressmen and many a thoughtful citizen are deeply concerned by the same stark fact: *50% of America's young men are unfit for military service.**

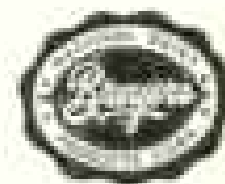
This doesn't make us a nation of weaklings. Ask our enemies! And it's no reflection on the men themselves. Most of them are serving in other ways. *But it does show America's health is far below what it should be.*

Three chief remedies have been suggested—preventive medicine, physical training, and diet. The last is often overlooked. But it has been officially estimated that *about 1/3 of all Selective Service rejections are caused directly or indirectly by nutritional deficiencies—lack of food or improper food.*

That's one big reason for the government's food education program. It's one reason why schools and factories regularly serve milk to their students and workers. For milk is nature's most nearly perfect food. Surgeon-General Parran recommends "a pint a day for adults, a quart for children."

At National Dairy, we are doing our best to protect and improve the quality of milk and its many products—while our laboratories develop milk in other new forms that will benefit everybody.

Dedicated to the wider use and better understanding of dairy products as human food . . . as a base for the development of new products and materials . . . as a source of health and enduring progress on the farms and in the towns and cities of America.



**NATIONAL DAIRY
PRODUCTS CORPORATION**

AND AFFILIATED COMPANIES

*Report of Senate Subcommittee on Wartime Health and Education, January 2, 1943.

FALSE TEETH WEARERS



Why Risk **DOUBLE DANGER**
by Brushing with
MAKESHIFT CLEANERS?

No, it's not the candle smoke that's bothering her, Mister. It's probably your unpleasant breath due to unclean dentures. Avoid offending in this way. Don't brush your plates with ordinary cleansers that scratch plate material. Such scratches help food particles and film to collect faster, cling tighter, causing unpleasant breath.

PLAY SAFE—SOAK DENTURES IN POLIDENT DAILY

It's Easy! It's Quick!

Soak your plate or bridge in Polident fifteen minutes or overnight . . . rinse . . . and it's ready to use. A daily Polident bath gets into tiny crevices brushing never seems to reach—keeps your plate sparkling clean and odor-free.



NO BRUSHING



What's more . . . Your plate material is 60 times softer than natural teeth, and brushing with ordinary tooth pastes, tooth powders or soaps, often wears down the delicate fitting ridges on your plate. With worn-down ridges your plate loosens. But, since there is no need for brushing when using Polident—there's no danger.

Later—That's better! He doesn't worry now about unpleasant breath due to unclean dentures. He's one of the delighted millions who have found Polident the new, easy way to keep dental plates and bridges sparkling clean, odor-free.

If you wear a removable bridge or dental plate . . . play safe. Use Polident daily to help maintain the original natural appearance of your denture. Costs less than a penny a day. Get Polident at any drug counter, 30¢ and 60¢ sizes.



NEW!

Another
Polident Product

DENTU-GRIP

Pleasant Powder to
Hold Plates Tight

Use **POLIDENT** *Daily* TO KEEP PLATES AND BRIDGES
CLEAN . . . AND ODOR-FREE!

BOY or *Girl?*



There's not much use spending time pondering that. And who *really* cares? You'll be happy with your baby—boy or girl.

In the meantime, you young, first-time mothers and worried fathers—whether far away or near at hand—can do a lot to insure favorable answers to these and other important questions:

1. Will Mother have an easy time? Very likely. Pregnancy is a normal process, not a state of ill-health. But she should see her physician or go to a maternity clinic *early*—at least before the third month.



The doctor can foresee and avoid most difficulties by examination, blood tests, and the patient's co-operation—if he's consulted early, and as often as he wishes.

2. Will Baby be healthy? And why not! He'll benefit, of course, by mother's wise diet before he is born. To really nourish baby, it should include *extra* amounts of the foods he needs most, such as calcium. A baby's calcium needs are so great, he may draw from the mother's teeth and bones.



Mother needs eight hours sleep every night besides daytime rest periods. Strenuous exercise—especially

lifting heavy objects—should be avoided. Clothing should be comfortable and loose, shoes carefully fitted.

3. How can Father help best? Mothers and fathers have equal shares in parenthood.

If father is away, he will want to make sure that mother is at least near friends and family. He should write to her as often as possible, for his affectionate consideration and encouragement are specially important.

Should he be home, his first job is to see that his wife goes to the doctor early and carefully obeys instruc-



tions. He should also arrange for baby's delivery.

Send for Metropolitan's booklet, 65N, entitled, "Information for Expectant Mothers."

COPYRIGHT 1940—METROPOLITAN LIFE INSURANCE CO.

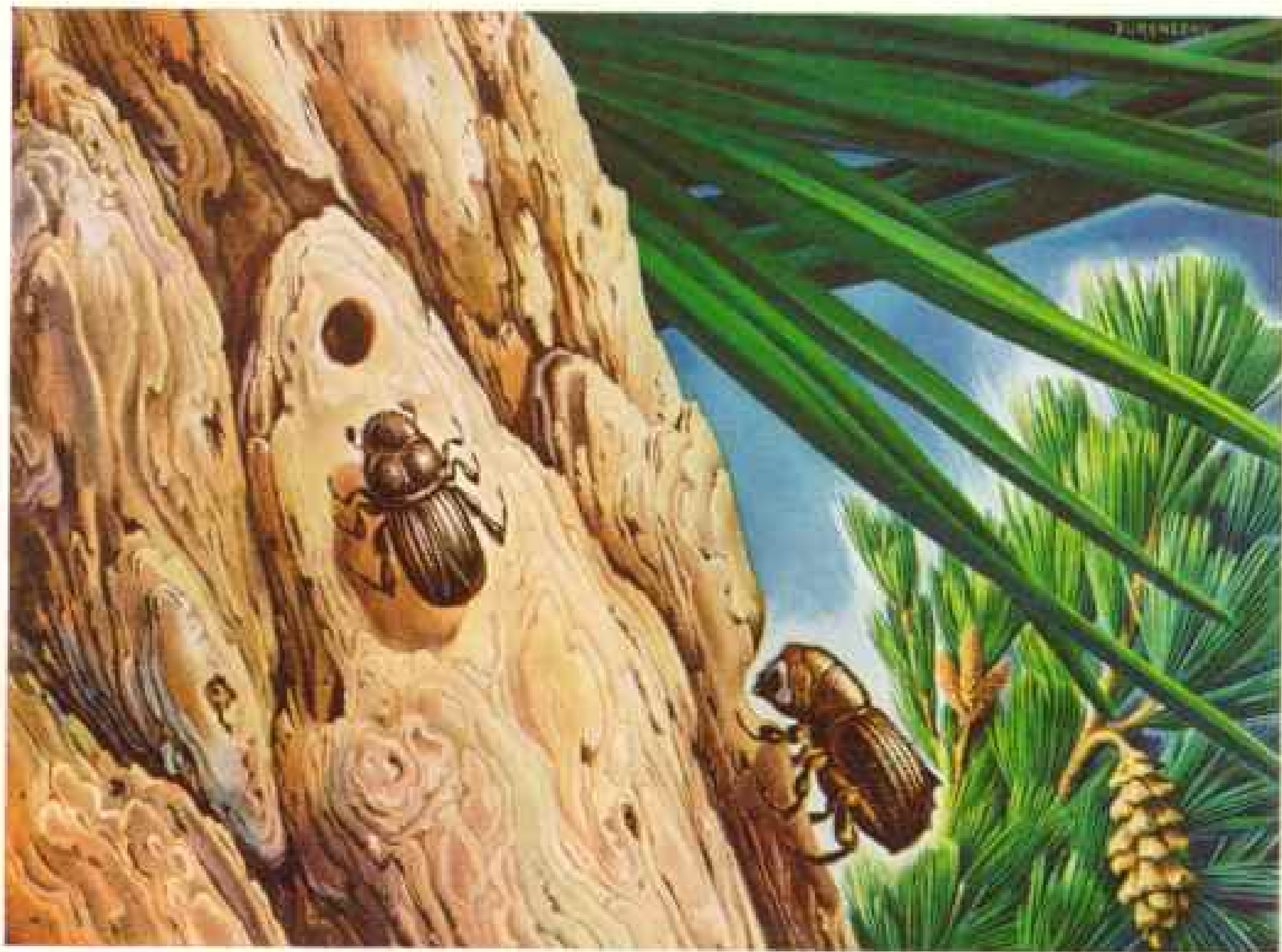
Metropolitan Life Insurance Company

(A MUTUAL COMPANY)

Frederick H. Ecker, CHAIRMAN OF THE BOARD
Leroy A. Lincoln, PRESIDENT

1 MADISON AVENUE, NEW YORK 10, N. Y.





His wings are his padlock

THE BARK BEETLE (*Pityogenes hopkinsi*) is a brown and black midget less than one twelfth of an inch long.

But for his size, he is amazingly strong.

His jaws are so powerful that he can eat the bark and wood of the white pine where he spends his life.

And, to make his home, he tunnels right through the bark and hollows out a tiny chamber in the wood beneath. From here the female beetles make egg galleries and raise their families.

But perhaps the most interesting thing about this little beetle is the way the male zealously protects his young.

After his home is built, he "locks" the door. Firmly wedging the back ends of his wings into the entrance of the tunnel, he maintains his position so tenaciously, that it is almost impossible for any enemy to dislodge him and push past.

As long as he is on hand to guard them, the bark beetle's young are safe from most dangers. But if something should happen to him before they have grown enough to take care of themselves, he leaves them unprotected.

Now, obviously, man is in somewhat the same

position when it comes to protecting his family. He can guard his children from most dangers by means of the income he earns to support them. But this protection is effective only as long as he is on hand to supply the income.

But man can also take steps to provide a kind of protection for his family on which he knows they will be able to rely, regardless of what happens to him. He invests in accident and life insurance.

This is the best, and usually the only way, he can make certain that his children will have adequate financial safety, whether or not he is on hand to earn for them.

It is not only important that he carry accident and life insurance, but also that he get sound advice on how much and what kinds he can reasonably afford to carry on his particular budget. Travelers representatives are well qualified to give that advice.

MORAL: Insure in the Travelers. All forms of insurance and surety bonds, The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, Hartford, Connecticut.

Da's na fijn, zunne! . . . Have a Coke

(SAY, THAT'S GREAT)



. . . a friendly American custom lands in Brussels

In Flemish, it's *vriendelijkheid*. In American, it's the plain, everyday word *friendliness*. And everywhere your Yankee doughboy goes, it comes spontaneously from his heart in a good old home-town phrase, *Have a Coke*. That's the way he's letting our democratic allies know why he does the friendly things he does. Friendliness is bred in his bone, and to kindred spirits it bubbles out—like the bubbling goodness of Coca-Cola itself and everything American that's behind it. Yes, the pause that refreshes with ice-cold Coke becomes an ambassador of good will . . . a bit of the old home spirit carried across the seas.

* * *

Our fighting men meet up with Coca-Cola many places overseas, where it's bottled on the spot. Coca-Cola has been a globe-trotter "since way back when".



Coca-Cola

-the global
high-sign

"Coke" = Coca-Cola

You naturally hear Coca-Cola called by its friendly abbreviation "Coke". Both mean the quality product of The Coca-Cola Company.



FROM A KODACHROME ORIGINAL

When film comes back . . .

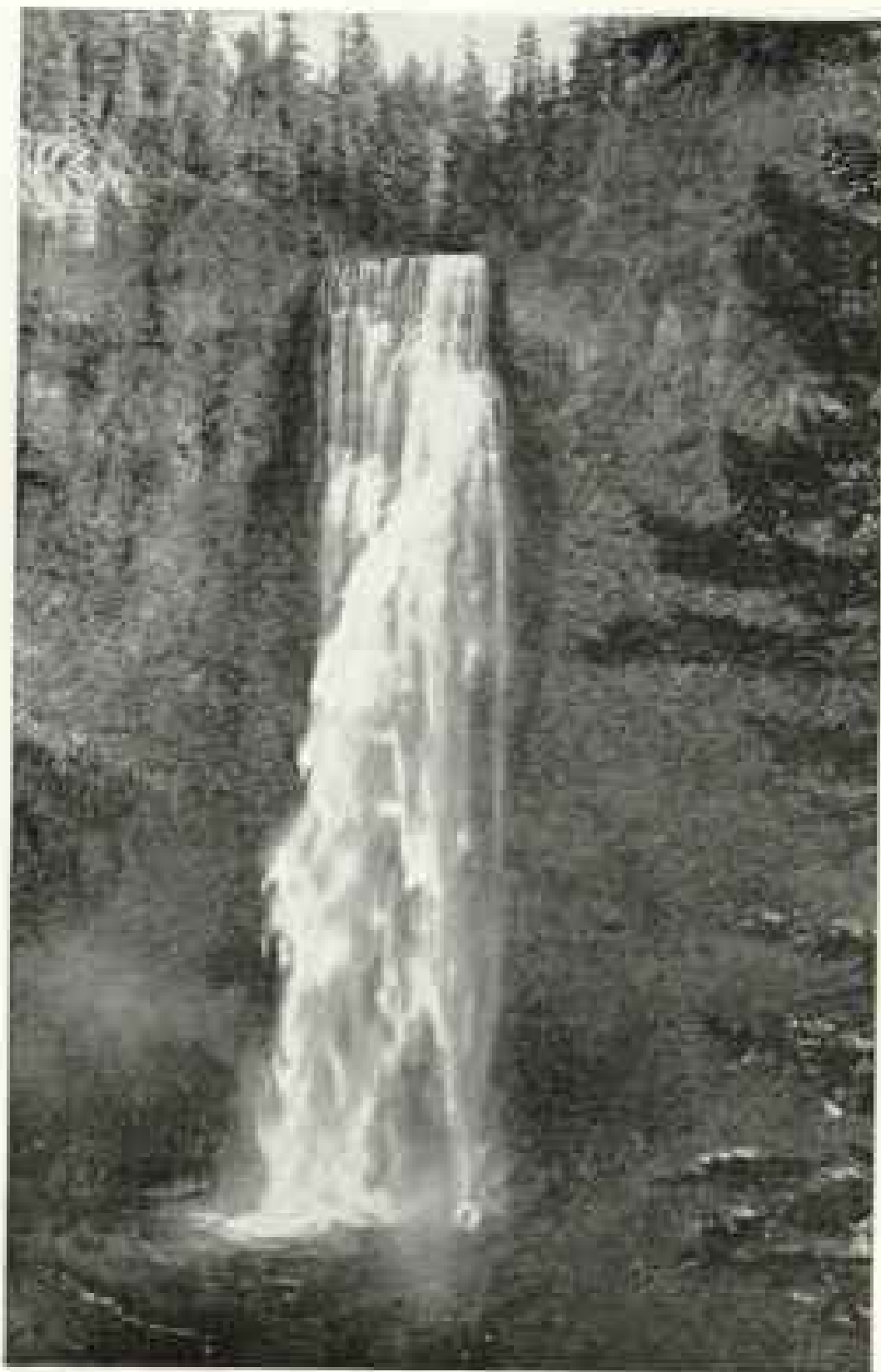
You can get color pictures as beautiful and precious as this one . . . with Kodachrome Film . . . to show as movies on your own home screen.

... And as soon as war conditions permit—Eastman, and Eastman only, as in former years, will again give you the complete equipment and service you need

for these wonderful home color movies: world-famed Ciné-Kodak, in a model exactly suited to your needs; Kodascope, the projector that shows your color movies in their full brilliancy and beauty; and, of course, full-color Kodachrome Film, including processing . . . Eastman all, and all designed to work together . . . Eastman Kodak Co., Rochester, N. Y.

Kodachrome Film

Kodak's full-color home movie film



SALT CREEK FALLS

*Victory first-
then that long-planned
trip to OREGON...*

Plan now on a Victory Vacation in Oregon! The recreation land of your dreams, a wonderland of mountains, forest and sea. All outdoors will be your playground, cool, green and inviting. Mail the coupon today.

Buy Bonds TODAY so that TOMORROW you may drive

OREGON
Highways

OREGON STATE HIGHWAY COMMISSION
Travel Dept. Room 401, Salem, Oregon

Please send me your free-illustrated booklet on Oregon.

Name _____

Address _____

City _____ State _____

NEW!
FUNDAMENTALLY DIFFERENT!

Originally developed by Mallory for the United States Army Signal Corps. Now, output is devoted to war needs. At war's end, these batteries will offer outstanding advantages for civilian use.

F. E. MALLORY & CO., Inc.
INDIANAPOLIS 6, INDIANA



A VACATION WITH REST

Even for the young and active, who will delight in the endless variety of uncrowded sports that abound in Vermont, the emphasis of a Green Mountain outing is truly on REST. Climate, hospitality, the relaxing freshness and beauty of the countryside all conspire to take one away from the scenes that disrupt composure and frazzle nerves.

For a serene and wholesome holiday, come to Vermont in 1945. FREE VERMONT BOOKS—Send for "Unspoiled Vermont," a pictorial feast of vacation information. If interested in a home of your own in Vermont's "summer colony," ask for Farm and Summer Home book.



Vermont Publicity Service
450 State House, Montpelier, Vt.

VERMONT
Beauty COOKER *of NEW ENGLAND*

GREAT NORTHERN RAILWAY

BETWEEN GREAT LAKES AND PACIFIC



PACIFIC NORTHWEST SEAPORTS FACE BRIGHT ORIENTAL TRADE FUTURE

Great Northern Links Nation With Principal Western Harbors

Peace in the Pacific will herald resumption of commerce between the United States and the Orient—an era of bright promise for the seaport cities of the Pacific Northwest.

Much of American-made merchandise destined for Asia will be transported to embarkation points served by Great Northern. This railway links the nation with Puget Sound ports of Seattle, Tacoma, Everett and Bellingham in Washington, and Vancouver in British Columbia. Great Northern stretches southward to Portland, Oregon; Vancouver, Washington, and connects with San Francisco, Los Angeles and other California ports.

Into these deep water ports also will come vast cargoes of the products of Russia, China, the Philippines, Australia, New

Zealand, India, Burma, and the East Indies. And, Great Northern's dependable service will be an important link in the nationwide distribution of these goods.

The railway's long commanding position in America's trade with the Orient through Pacific Northwest ports is one of the many things which will continue to make Great Northern great.



Ocean-going vessels reach Portland via the Columbia and Willamette Rivers.



Seattle's extensive dock facilities are served by Great Northern. Queen city of the Puget Sound region, Seattle is the railway's western terminus.



Famous lumber center, Tacoma also ranks as a major seaport.



Everett is one of the fast-growing ports on Puget Sound.



Great Northern serves Vancouver, Canada's gateway to the Orient.

Know Our Battle Fronts and Forces!

Keep posted with *Geographic Maps*—including two enlargements—
and *Full-color Book of 2,476 Insignia of U. S. Armed Forces*

National Geographic Society _____ 1945
Dept. C-R, Washington 5, D. C.

Please send me the items indicated below:

■ All Maps except the two Enlarged Maps come on either paper or linen. *Indexes are available for Maps marked with asterisk*. All items sent postage prepaid.	How Many Copies Desired		
	Paper Maps	Linen Maps	Indexes
	\$4c each in U. S. & Poss. Elsewhere 75c each	\$1 each in U. S. & Poss. Elsewhere \$1.25 each	25c each in U. S. & Poss. Elsewhere 50c each
China*			
The Philippines*			
U. S. S. R. (Russia)*			
Southeast Asia*			
Germany & Approaches*			
Japan & Adjacent Regions of Asia & Pacific Ocean*			
The World*			
E. & W. Hemispheres			1
No. & So. Hemispheres*			
Pacific Ocean* (20th 70th Meridians shown)			
Pacific Ocean and Bay of Bengal*			
Indian Ocean			1
Atlantic Ocean			1
United States*			
Europe and Near East* (Boundaries Sept. 1, 1939)			
Europe & Mediterranean* (Boundaries Jan. 1, 1939)			
Europe and Near East (Shows partition Poland 1945)			1
Central Europe & Medit.*			
British Isles			1
Asia and Adjacent Areas*			
Canada*			
Africa*			
Mex., Cen. Am., & W. I.*			
South America*			
North America*			
Bible Lands*			
Classical Lands of Medit.*			
The Arctic Regions			1
The Antarctic Regions			1

X in Index column indicates Map Index is NOT available. Paper maps are folded for convenient filing. Linen maps come rolled. Postal regulations usually prohibit mailing linen maps outside Western Hemisphere.

Also.....copies of MapFile @ \$2.50 in U. S. & Poss.; elsewhere, \$2.75.

Also.....copies of Enlarged World Map* and.....copies of Enlarged Map of Northern and Southern Hemispheres* @ \$2 each in U. S. & Poss.; elsewhere, \$2.25 each. Sent rolled to U. S. & Poss. except Hawaiian Islands. Postal regulations occasionally forbid these maps for mailing to Hawaiian Islands and places outside U. S. & Poss.

Also.....copies of "Insignia and Decorations of U. S. Armed Forces" @ \$1 per copy in U. S. & Poss.; elsewhere, \$1.25.

I enclose remittance of \$.....payable in U. S. funds.

Name.....

Address.....

Book of Insignia and Decorations of U. S. Armed Forces in Full Color

THIS new book, prepared with the cooperation of Army and Navy authorities, is so complete that distribution was delayed last January as a precaution against the enemy obtaining data hitherto unpublished. An official release has now been granted.

2,476 *full-color* reproductions and 159 monochrome photographs illustrate this revised and greatly enlarged presentation of the insignia, decorations, medals, service ribbons, and badges of the men and women in our fighting forces and other official organizations participating in the war effort.

Comprehensive notes accompany the color reproductions of insignia of the U. S. Army and State Guard, Navy, Marine Corps, and Coast Guard; aircraft and torpedo boat insignia; and insignia of the Maritime Service, Public Health Service, Coast and Geodetic Survey, Army Transportation Corps Vessels, American Red Cross, Ship Production Awards, Army-Navy "E," American Field Service, Service Lapel Buttons, Civil Air Patrol, Fourragère, United Service Organizations, U. S. O.—Camp Shows, Naval Air Transport Service, and Air Carrier Contract Personnel (ATC).

A new chapter pictures the romance of aviation badges. 208 pages; 7 x 10 in. \$1 in U. S. and Poss.

Ten-color Maps for War or Peace

To keep up with critical world-wide developments use the National Geographic Society's accurate wall maps. Particularly timely are the maps of "Germany," "Europe and Near East," "China," "Philippines," "Asia and Adjacent Areas," "Southeast Asia," and "Japan".... Map Indexes, available for maps marked with an asterisk * in adjoining order blank, describe areas covered and make easy the location of names on the related maps.

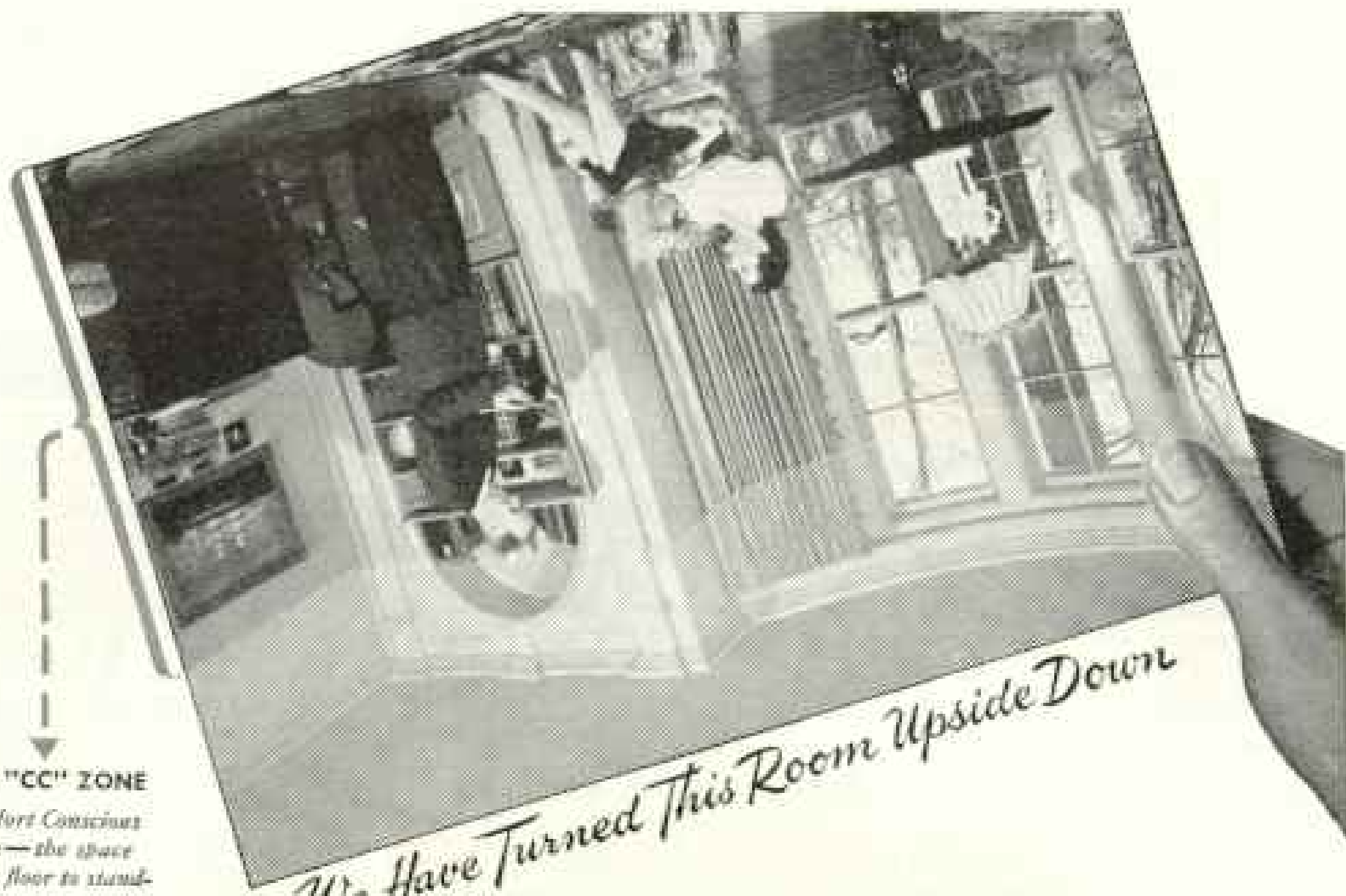
Map File: This handy 7¾ x 10½-inch file, bound like a book, preserves maps for instant use. Ten pockets can hold 20 *folded paper* maps of standard sizes or 10 *folded paper* maps with Indexes.

Enlarged World Map: A 67 x 45¼-inch enlargement of our standard World Map (41 x 26½ inches). Printed in *ten colors* on heavy paper, it is incomparable for large wall display. The standard World Map Index may be used with this enlargement.

Enlarged Map of No. and So. Hemispheres: This 67 x 35½-inch map is enlarged from the standard 41 x 22-inch edition and the same Index applies to it. *Ten colors*; 4,262 place names; highly legible.



PRICES: Please refer to coupon for separate prices in "U. S. & Poss." and "Elsewhere." Remittances should be payable in U. S. Funds. All items sent postage prepaid.



THE "CC" ZONE

Comfort Conscious Zone—the space from floor to standing height, approximately six feet.

We Have Turned This Room Upside Down

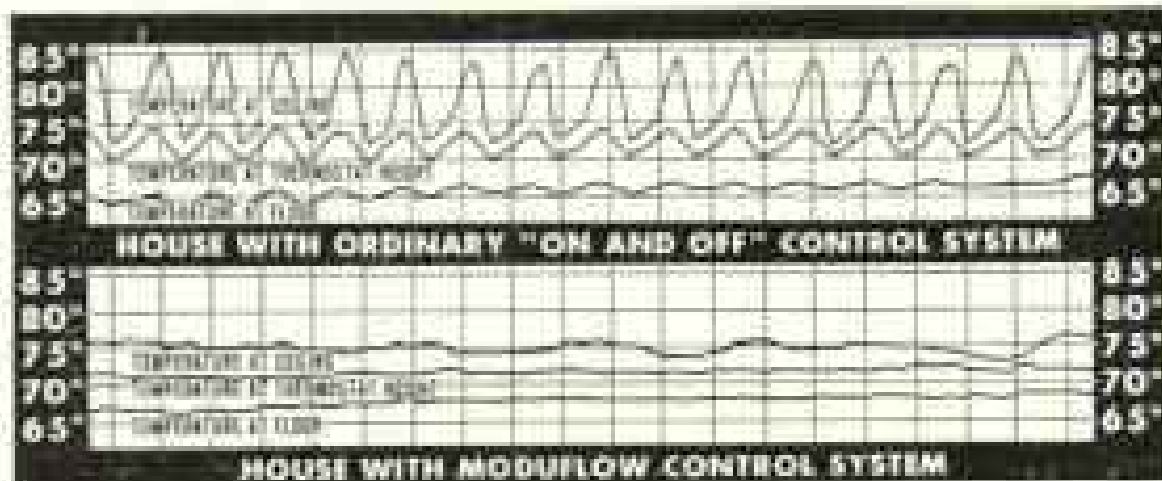
...To Show How MODUFLOW Turns Wasted Heat into Comfort!

Speaking of temperature, our rooms are really "upside down." They are hottest at the ceiling and coldest at the floor.

But Minneapolis-Honeywell engineers have invented a new and different system of heat

control that largely corrects this situation. It is called MODUFLOW. By an ingenious method of heat control and supply, Moduflow more nearly equalizes floor and ceiling temperatures. It uses much of the heat formerly wasted at the ceiling to heat the lower levels. Result—greater efficiency and blissful comfort from top to bottom of your Comfort Conscious Zone.

Learn how easily and inexpensively a Moduflow control system can be installed in your postwar home. Mail the coupon today for free booklet.



See the difference. Shows above are actual temperature recordings taken in two identical test houses—one with and one without Moduflow. Note how Moduflow smooths out the ups and downs of ordinary heating systems—reduces overheating at ceiling and increases floor temperature.

MODUFLOW

THE NEW HONEYWELL HEATING CONTROL SYSTEM



Free! SEND FOR THIS BOOKLET

Minneapolis-Honeywell Regulator Co.
 2908 Fourth Avenue South
 Minneapolis 8, Minnesota

Please send my free copy of "Heating and Air Conditioning the Postwar Home"

Name _____

Address _____

City _____ State _____

Girls' Camps

BROWN LEDGE MALLET'S Bay, Vermont. . . . one of New England's finest camps. Daily riding for all included in fee! Hiking, golf, dramatics. No "extra" Catalog, 1946 (ages 1) Also Camp Kithia Junior Division. Mr. and Mrs. Harry E. Brown, 319 E. 50 St., Apt. 4G, New York City.

OGONTZ WHITE MOUNTAIN Camp for Girls. 6-12 in separate groups. 100 acres on mountain lake. Rustic cabins. Swimming, sailing, canoeing, aquaplaning; farm and trail riding; tennis, hockey, golf; art, crafts, music, dramatics. Trips, Tutoring, Inductive Lab. Director, Abby A. Sutherland, Box 600, Ogontz School P. O., Pa.

SARGENT HAPPY, healthful summer for girls 6-12. Emphasis on individual interests. All sports, private lake, tennis, riding, crafts, dancing, dramatics, etc. Counselor training. Permanent cabins. Experienced staff. Near Peterborough, N. H. Catalog, Nelson S. Walke, Dir., 2 Everett St., Cambridge 28, Mass.

Boys' Camps

ADMIRAL BILLARD ACADEMY FULLY accred. Naval Prep School offers 5-week summer academic term. Intensive 4 weeks' naval training on famous schooner Yankee. Also summer naval camp for boys 9-13. Catalog, Rear Adm. W. T. Stromberg, USCG (Ret.), New London, Conn.

CULVER SUMMER SCHOOLS on Lake Maxinkuckee. Naval or Cavalry (Boys 11-15) Woodcraft (9-10). Educational facilities. Regular Academy sessions. Each camp \$100 for 1946. Arranging Applications now for 1946. Separate catalogs. 69 Lake Shore Lane, Culver, Indiana.

LEN-A-PE INDIAN, cowboy, magician, circus. On natural lake in Pogonip near N. Y. C. and Italia, Pa. Boys 7-17. Excellent food and care. Riding, sailing, aquaplaning, tennis, swimming, crafts, Indian lore, nature study. Booklet, David E. Neiser, 7733 MHI Road, Philadelphia 17, Penna. Call Melrose 102.

CAMP LUPTON In the Blue Ridge Mountains. For desirable boys 6-14. Unusually fine buildings, recreation, water sports, lectures, tutoring. 80 miles from Washington, D. C. Route 11, Greystone, Box direct. Directed by staff of Massachusetts Military Academy. Address: Camp Lupton, Box N-G, Woodstock, Va.

ST. JOHN'S MILITARY ACADEMY • SPENDING soldier training for boys 9-18. Special section for younger boys. Infantry drill, training in machine gun, rifle, trench mortar. Superb recreational facilities. Earn school credits if you wish. Catalog, N-136 DeKoven Hall, Delafield, Wis.

SUSQUEHANNA Boys 9-12. Mountain camp on private lake. New Milford, Pa. 27th year. 100 acres. Daily riding, complete course in horsemanship. Fine lake swimming. All other sports. Skilled leader for each 4 boys. Personal development our aim. Booklet, Rob't Smith, 252 W. 76th St., New York City.

Girls' Schools

ASHLEY HALL ACCREDITED college preparatory and general courses in atmosphere of historic Southern culture. Music, dramatics, home economics, art. Mild climate, year round outdoor sports, riding, pool. Lower school. Write for catalog. Mary Vordrime McGow, L. H. D., Prin., Box N, Charleston 13, S. C.

EDGEWOOD PARK ACCREDITED College prep. All-visioned courses in cultural and practical arts, fine arts, sci. soc., real estate, medical ass., home ec., dramatics, photography. Costume design, interior decorating, merchandising, kindergarten. Sports—riding. Box N, Briarcliff Manor, N. Y.

FAIRFAX HALL STANFORD accredited work, 2 years college, 4 years high school. Secretarial, Fine Arts. Healthful location in Shenandoah Valley. Spacious grounds. Happy social life. All sports. Private stable, indoor, outdoor pools. Wm. B. Gates, M.A., Pres., Box N-6, Park Station, Waynesboro, Va.

GREENBRIER COLLEGE For girls. Two years college preparatory and two years standard college work. Founded 1912. Art, Music, Dramatic Art, Secretarial. Exceptional social and recreational advantages. Modern fireproof dormitory. French W. Thompson, Pres., Dept. N-3, Lewisburg, W. Va.

GRIER SCHOOL IN THE Alleghenies. Accredited College Preparatory and General Courses. Home atmosphere for girls 12-18. Music, Art, Typing. Unlimited riding. Winter and team sports, golf, tennis, gym, pool. 6th year. Accessible New York, Washington. Catalog, Thos. C. Grier, Dir., Box 46, Birmingham, Pa.

HOUSE IN THE PINES SCHOOLS

COLLEGE School: college prep. and general courses, including art, music, secretarial. Excellent riding stable. Swimming. Jr. College: vocational and liberal arts courses. Write for other catalogue. Ruth F. Cleveland, Dir., 120 Pine St., Norton, Mass.

KINGSWOOD—CRANBROOK

GRADES 7-12, post-graduate. College preparatory and general courses. 10 acres on lake near Detroit. Unusual opportunities in arts, handicrafts, sciences, music, dramatics, sports, typing. Secretary, 156 Cranbrook Road, Bloomfield Hills, Mich.

THE KNOX SCHOOL COLLEGE preparatory. Postgraduate. Special training for secretaries, medical secretaries. Art, music, drama. Riding, golf, winter sports. On Utsego Lake. Catalog, Mrs. E. Russell Houghton, Box N, Coopers-town, N. Y.

LASELL JUNIOR COLLEGE

YOUTH women. Ten miles from Boston. Two years Junior College. Academic, Home Ec., Secretarial (gen. or med.), Merchandising, Fashion. Pre-occupying Art, Music. Catalog, Guy M. Winslow, Pres., 123 Woodland Rd., Auburnville, Mass.

LINDEN HALL JUNIOR College and School for Girls. Cultural and Vocational. Music, Home Economics, Secretarial Studies. Fine and Commercial Art, Dramatic Art. Preparatory and General Courses. Beautiful Campus. All sports. Riding, Swimming Pool. Moderate tuition. F. W. Stengel, O.D., Box 66, Lititz, Pa.

OAK GROVE & FRIENDS SCHOOL ENTHUSIASTIC Preparation for College and Graduate. Purposeful Living. Music, Art, Dramatics, Upper and Lower Schools. Joyous Outdoor Recreation. Riding Included. New Five-story Buildings. Mr. and Mrs. Robert Owen, Box 140, Vassalboro, Maine.

PENN HALL JR. COLLEGE

2-19. College with degree; 4-yr. Prep. Accredited. Music, Art, Drama. Home Ec., Merchandising, El. Journalism, Medical Ass't, Secretarial. Bath connects every room. Sports. Riding. Trips. Social life. Catalog—Box W, Chambersburg, Pa.

WARRENTON COUNTRY SCHOOL Washington. Girls ten to eighteen. Beautiful gardens, outdoor theatre. Thorough College Preparatory, well-planned General Course. Music, art. All sports, riding. Miss Lou M. Boudigny, Prin., Box N, Warrenton, Va.

Colleges for Women

CHRISTIAN COLLEGE ACCREDITED Junior College and Conservatory (A.A. degree). Terminal, transfer, pre-career courses. Music, Art, Drama, Secretarial, Nursing, Int. Dev., Costume Design, Home Mgmt. All sports, pool. 9th year. Catalog, James C. Miller, Ph.D., Pres., Box D, Columbia, Mo.

LINDENWOOD COLLEGE A. B., B. S., B.M. degrees. Also 4-yr. Junior College. Prepares for civic and social leadership. Modernized curriculum. Vocational emphasis. Secretarial. Special work in music, art. Near St. Louis. Sports. Catalog, President, Box 29, St. Charles, Mo.

Co-Ed Schools

GEORGE SCHOOL QUAKER. Established 1893. College preparatory. Known for its modern curriculum and excellent college preparatory results. Boys and girls in the same school under conditions that meet with approval of discriminating parents. G. A. Walton, A.M., Principal, Box 265, George School, Pa.

Vocational

BOSTON UNIVERSITY COLLEGE of Physical Education for Women: Sargent College. 4-yr. degree course in physical and health education and recreation. Physiotherapy major. 5 mos. sports instruction in N. H. camp. 4th yr. Catalog, N. S. Walke, Ph.D., Dean, 50 Everett St., Cambridge 28, Mass.

BRYANT COLLEGE Only professional college in New England offering B. S. in two years. Intensive Executive Secretarial Course prepares young women for important well-paid positions. Lifetime placement. Dorms added year. Co-ed. Catalog, Enrollment Secretary, Providence 6, R. I.

KANSAS CITY ART INSTITUTE and SCHOOL of DESIGN. Drawing, Painting, Sculpture, Ceramics, Industrial, Fashion, Commercial, Interior and Advertising Design. Low tuition. Scholarships. Campus. Girls' Dormitory. Catalog, Dept. 1305, K. C. Art Institute, K. C. 2, Mo.

KATHARINE GIBBS OUTSTANDING secretarial training for high school, private school graduates, college women. Resident facilities. Catalog, Assistant Dean, 90 Marlborough St., Boston 16; 720 N. Michigan Ave., Chicago 11; 230 Park Ave., New York 17; 155 Angell St., Providence 6.

NORTHWEST INSTITUTE

OF MEDICAL TECHNOLOGY offers intensive course in Clinical Laboratory technique and Blood Metabolism in 3 months. X-Ray and Electrocardiography 3 months. Catalog, Estab. 27 years. 3437 E. Lake St., Minneapolis 6, Minn.

Miscellaneous

JOHN BROWN SCHOOLS

JOHN BROWN UNIVERSITY (and Academy) — Co-Educational. Sham Springs, Ark. "America's first university of vocational specialization." Radio station, artfield, laboratory testing.

BROWN MILITARY ACADEMY San Diego, Calif. Junior School through Junior College. Highest official War-Dept. rating.

Address indicated school or JOHN E. BROWN, LL. D., Pres., SHAM SPRING, ARK.

Boys' Schools

ADMIRAL FARRAGUT New Florida unit in St. Petersburg. Naval, military training. Prepares for all colleges, gov't academies. Jr. School—grades 7-7. 28 acres. Sports. Aviation ground course. Adm. S. S. Robinson, U.S.N. (Ret.), Supt. Catalog, Box L, St. Petersburg, Florida.

AUGUSTA MILITARY ACADEMY

Country location in famous Shenandoah Valley of Virginia. Prepares for all Universities, West Point and Annapolis. Able faculty of experienced teachers. R. O. T. C. Beautiful gymnasium, indoor swimming pool. All sports. Fully accredited—80th session. Catalog, Col. T. J. Roller or Major C. S. Roller, Jr., Fort Defiance, Virginia.

Capacity enrollment last year.

BLAIR ACADEMY

ACCELERATED Summer Session begins June 22, permitting seniors to graduate by January; juniors by September, 1946. Country location, 26 miles from New York. Fast train service. Address Charles H. Breed, Headmaster, Box 17, Blairstown, N. J.

THE BOLLES SCHOOL

Beautifully situated on St. Johns River. Accredited. Prepares for college and Government Academies. 8th - 12th grades. Maritime-themed dormitory. Gymnasium. Military training. Honor Naval School. Fall term begins September 15. Summer term begins June 11. For catalog, address Col. Roger D. Painter, Pres., Jacksonville, Fla.

BORDENTOWN MILITARY FULLY ACCREDITED INSTITUTE

College Preparatory and general courses. R. O. T. C. Vigorous physical training. Boys taught how to study. Homelike atmosphere. Near Trenton, Jr. school. 10th year. Summer session. Catalog, Registrar, Box 656, Bordentown, N. J.

CASTLE HEIGHTS MILITARY ACADEMY

R. O. T. C. Preparatory. P. G. Separate Jr. School—special instructors, house mothers. 17 modern buildings. Endowed. Swimming pool, golf, tennis. For catalog and "50 Printer", write: Col. H. N. Armstrong, Pres., Lebanon (near Nashville), Tenn.

COLUMBIA

MILITARY ACADEMY

12 buildings, 9 built by U. S. Government. Fully accredited. R. O. T. C. Special department preparing for Gov't academies. Jr. School. Athletics: swimming, golf, membership. 50 plus land. Summer session. For catalog, address: Dept. N, Columbia, Tenn.

CULVER MILITARY ACADEMY

on Lake Maxinkuckee. Emphasis on physical, intellectual, moral stamina. High scholastic standards. Preparation for college. Senior R. O. T. C. units—Artillery, Cavalry, Infantry. Motorized equipment. Catalog, 69 Pershing Lane, Culver, Ind.

DARLINGTON SCHOOL FOR BOYS

FULLY accred. Individualistic instruction—highest standards. Christian character developed. In foothills. Lookout Mt. range. Sports. Military drill. Dairy Farm. For catalog, address: C. N. Wilson, Ph.D., Pres., Rome, Ga.

FISHBURNE MILITARY SCHOOL

60th yr. Individualized preparation of boys for college. West Point, Annapolis, business, R.O.T.C. High scholastic and military standards. War and postwar needs. Social advantages, sports. Catalog. Col. M. H. Hudgins, Box N-5, Waynesboro, Va.

FLORIDA MILITARY ACADEMY

One of the outstanding schools of the South. Fully accredited. R. O. T. C. Separate Junior School. Recreation center on Gulf of Mexico. All-inclusive rate. Limited enrollment. Col. Walter B. Mendels, President, Box 1, St. Petersburg, Florida.

FLORIDA NAVAL ACADEMY

"First Exclusively Naval School in South." Fully Accredited. On Matanzas Bay. Prepares for college. Gov't Academics, 3-yr. H. E. course. Aviation training. 18-21 training ship. Summer school. Catalog. Com'd'r Claude N. Brubeck, St. Augustine, Fla.

FORK UNION

FULLY ACCREDITED. Small classes. R.O.T.C. Supervised study. Prepares for college or business. Fireproof buildings. Junior school small boys. Home-teacher. Athletics, Swimming, 8th year. Catalog. Dr. J. J. Wicker, Fork Union Military Academy, Box N, Fork Union, Va.

GEORGIA MILITARY ACADEMY

8 miles from Atlanta—Accredited R. O. T. C. Most complete—Cultural advantages.

Courses—College and West Point-Annapolis Prep. Junior College—Literary arts and Bus. Admin. courses. Aviation—Pre flight training, physics and meteorology. Junior School—Separate department for 11th grade boys. Athletics—Expert coaches develop teams in major sports. Home Life—Cadets live with their teachers. Summer School makes unimpaired possible.

Write: Col. W. N. Brewster, College Park, Ga.

GREENBRIER MILITARY SCHOOL AND SUMMER CAMP

134th Year. Fully accredited Lower School, High School, Junior College.

Trains for leadership in War or in Peace. Remarkable success records at Government Academies and elsewhere. Elevated 2500 feet. Climate and health conditions ideal. Modern equipment connected building. Complete athletic program. R.O.T.C. For catalog, address: Colonel D. T. Moore, Registrar, Box N, Lewisburg, W. Va.

HARGRAVE MILITARY ACADEMY

"MAKING MEN—NOT MONEY." Accredited college preparatory and Junior school in beautiful Piedmont. Character-building stressed by Christian faculty. All sports. Moderate rates. Catalog. Col. A. H. Camden, Pres., Box N, Chatham, Va.

HILL MILITARY ACADEMY

R.O.T.C. SCHOOL, recognized by State and accredited Associations; exceptionally high Academic standards; ample facilities in the mid. Invigorating climate of the great Northwest. Grades and High School. Jos. A. Hill, Pres., Dept. NG, Rocky Butte, Portland 10, Ore.

HOWE MILITARY SCHOOL

TRAINING young Americans for leadership in war and peace. R.O.T.C. Accredited college prep., business courses. Jr. school. Sports. Episcopal. Est. 1884. Summer Camp. Catalog. Burnett B. Beuten, M.A., Supt., 965 Academy Pl., Howe, Ind.

THE HOWELL ACADEMY

Elementary, Junior high school courses. Grades 1-8. Music, art, and crafts, swimming. Carefully selected faculty, small classes. Individualized athletics. Riding. Gym. Howellike dorms. Limited enrollment. H. Lynn Womack, Box 5995-N, Bethesda, Wash. 14, D. C.

KEMPER



One of America's Most Distinguished Military Schools
HIGH SCHOOL and JUNIOR COLLEGE
* 101st YEAR *
Write for Catalog and View Book.

Col. A. M. Hitch, 65-B Third St., Boonville, Mo.

KENTUCKY MILITARY INSTITUTE

A SCHOOL with a winter home in Florida. Preparation for college under ideal climatic conditions all year. Oldest Private Military School in America. For illustrated catalog, address: Col. C. B. Richmond, Pres., Box N, Lyndon, Ky.

LAKE FOREST ACADEMY

ENGAGED in producing men versed in our common cultural heritage, trained in fundamentals, ready for any college. Grades 9-12. Small classes. Shop, art, glee club, sports. Founded 1857. Booklet. E. F. Bowditch, Headmaster, 15 Reid Hall, Lake Forest, Illinois.

LA SALLE MILITARY ACADEMY

ACCREDITED college preparation under Brothers of the Christian Schools, 7th grade through High School, meeting war and postwar demands. R. O. T. C. Two regulation rifle ranges. 6th year. Catalogue. Rev. Brother Brendatt, Headmaster, Box G, Oakdale, L. I., N. Y.

★ MANLIUS ★



MILITARY training develops initiative, character, fitness. R. O. T. C. 3rd troop. Aviation ground course. Excellent background for Gov't academies. Accredited college preparatory, 8th grade. All sports. Fine athletic fields. Golf. 125-acre campus. Register early. Catalog. Director of Admissions, Box 468, Manlius, N. Y.

MERCERSBURG ACADEMY

ACCELERATED program helps boys save a half year or more in preparing for college. Grades 9-12. Summer session. Beautiful campus of 300 acres. Sports. Founded 1835. Catalog. Charles S. Tippetts, Ph.D., Box N, Mercersburg, Penna.

MISSOURI MILITARY ACADEMY AND JUNIOR SCHOOL

36th yr. Fully accredited. R.O.T.C. Individualized instruction teaches boy how to study. Complete guidance program prepares for future. All sports. Athletic fields. 200 ac. campus. Riding. Catalog. Col. C. R. Strubling, 945 Main St., Mexico, Mo.

MORGAN PARK MILITARY ACADEMY

WAR has shown the value of military training for leadership. Accredited college preparation. Math, science stressed. Boys taught how to study. Sports. Gym. Near Chicago. 7th year. Lower School. Catalog. Col. H. D. Abells, Box 765, Morgan Park, Ill.

MOSES BROWN SCHOOL

HELP and inspiration for each boy, a century-old tradition. Known for successful college preparation. Arts and crafts hobbies. 20-acre campus. BELMONT, separate residence for younger boys. L. R. Thomson, Headmaster, 279 Hope St., Providence 8, R. I.

NEW MEXICO MILITARY INSTITUTE

BALANCED program of academic, military, physical training; High School, Junior College. Outdoor life year round; dry climate—7000 ft. alt. All sports. Cavalry R.O.T.C. Catalog. Col. D. C. Pearson, Supt., Box F, Roswell, N. M.

NEW YORK MILITARY ACADEMY

The School of Distinction

N.Y. M.A. graduates are destined for leadership. Capable Officers in the armed forces today... Entertaining Leaders in the Peace tomorrow... ready to "lead" again in future emergencies.

For Catalog, address 22 Academy Avenue
Cornwall-on-Hudson, New York

NORTHWESTERN MILITARY AND NAVAL ACADEMY

EMERGING military training—supplemented by naval courses. College prep. Grades 9 to 12. Sports, 5 naval cutters. 20th yr. 7th Mil. Chicago. Booklet. Col. J. H. Jacobson, 36 Lake Shore Road, Lake Geneva, Wis.

ONARGA MILITARY SCHOOL

STRENGTH College Preparation. Accredited without exams. Business Courses. Teaches How to Study. Character first! Friendly teachers. Ages 10-15. New gym and pool. 3 miles S. of Chicago. Endowed. Catalog. Col. L. W. Bittinger, Box W, Onarga, Ill.

RIVERSIDE

MILITARY TRAINING SUPERVISED BY U. S. WAR DEPT.

FULLY ACCREDITED preparation for all colleges. Highest rated R.O.T.C. rating. Junior College. Separate school for younger boys. SUPERIOR FACILITIES of two complete school plants and large faculty—who live in same buildings and eat at same tables with cadets—ensure development, individual attention, and guidance. Weekly reports. All athletics. Physical fitness program. HEALTH AND INTEREST assured by water at Hollywood-by-the-Sea, Florida, remainder of year in invigorating Blue Ridge Mountains of Georgia. \$194 total expense for regular school year. Optional extra-credits. If in writing for catalog, please be sure to indicate grade and interests. Address:

GENERAL LARRY BRAY, President
Riverside Military Academy, Box N
Cohasset, Georgia

3 WINTER MONTHS IN FLORIDA

PEDDIE

MAXIMUM personality development assured by 20 years' experience in preparing boys for college and for life. Accelerated program for older boys. Summer session. All sports for all. 200 acres. Junior School. Easily accessible. Catalog. Wilbur E. Saunders, Headmaster, Box 6-N, Hightstown, N. J.

RANDOLPH-MACON MILITARY ACADEMY

5th Year. At northern entrance to Skyline Drive. Prepares for college through intensive study methods. Fireproof buildings. Limited capacity. Write for catalog. Col. John C. Beggs, Prin., Box E, Front Royal, Va.

ST. JOHN'S MILITARY ACADEMY

7th Year. St. John's has been training boys to make wise choices in life. Thorough instruction, plenty of good times. Accredited college prep. All sports. Summer session. Catalog. 1365 DeKoven Hall, Delafield, Wis.

SHATTUCK SCHOOL

FOUNDED 1899. An accredited Episcopal Mil. School preparing boys for life, college or gov't academies. Offers a well-balanced education mentally, physically and spiritually. Catalog and Viewbook. Summer School Camp, ages 10-15. The Registrar, 455 Shumway Hall, Faribault, Minn.

STAUNTON MILITARY ACADEMY

- Distinguished for excellent academic, military and athletic training.
- In historic Shenandoah Valley of Virginia. High altitude.
- Unexcelled health record. War Dept. R.O.T.C. Unit. Separate Junior School. Highest War Dept. Rating. Early enrollment desirable. Catalog. Supt., Box D-6, Staunton, Va.



STONY BROOK

ACCREDITED program including: thorough grounding in mathematics, science, English, other fundamentals; physical fitness; distinctive Christian training. Grades five to college. 40-acre campus, accessible by train. Address: Frank E. Gabelstein, Litt.D., Box N, Stony Brook, L. I., N. Y.

TENNESSEE MILITARY INSTITUTE

High academic and military standards, developed through 71 years, encourage good scholarship, develop fine character traits. R. O. T. C. Superior prep work for gov't academies, technical schools, college. Grades 9-12. Athletics for all. 144 acres. Restricted to 200. Catalog.

Col. C. R. Endsley, Supt., Box 147, Sweetwater, Tenn.

TODD SCHOOL AND CAMP

Boys 6 to 20, 9th year. Accredited individual College Preparation. Study help. Shop. Radio. Navigation. Music. Business. Harmony environment. Swimming. Riding. Near Farm Chicago. Catalog. Roger Hill, Prin., Box G, Woodstock, Illinois.

VALLEY FORGE MILITARY ACADEMY

AT THE NATION'S BIRTH



PARENTS appreciate importance of young gentlemen under 18 being educated at distinguished Mil. Acad. for leadership in civil life as well as in the Army (over 1500 alumni now officers). Small classes. Sr. R.O.T.C. All sports. Motorized Fleet Artillery, Cav., Inf., Band. Highest Govt. rating. Catalog.

Box M, Wayne, Pa.

WENTWORTH MILITARY ACADEMY

4-YEAR HIGH SCHOOL—Separate 3-Year College R.O.T.C. All accredited. 65 years. Center of America. Large Gym. Indoor pool. All Sports. Stadium. C.A.A. Flying. Large campus. Summer School. Catalog. Col. J. M. Sellers, 845 Wash. Place, Lexington, Mo.

WESTERN MILITARY ACADEMY

DISSIMILATED military records of alumni in service prove value of training at Western. Fireproof barracks. Complete athletic and social program. 6th year. For catalog, give age, grade. Col. R. L. Jackson, Pres., Box N-6, Alton, Ill.

WILLISTON ACADEMY

THOROUGHNESS in basic subjects needed for college or armed services. Moderate cost, endowment. Separate Junior School. New recreation center, gymnasium, swimming pool. Summer School begins June 15. A. V. Galbraith, Box 21, Easthampton, Mass.

"Buy U. S. War Bonds—They Identify You"

"Going our Way?"



YOU can give them a lift in more ways than one if you will go easy on Long Distance between 7 and 10 each night.

That's the time many service men in the camps are calling home and they'll appreciate your help in leaving the lines for them.

BELL TELEPHONE SYSTEM





In Speeding Communications . . .

NOTHING SERVES LIKE COPPER

THE USE of electricity as a means of communication started with telegraphy. Then came the telephone, radio and television. Many of today's war pictures are radio-transmitted from distant battle fronts. From days to seconds has been the progress of communications since 1844.

Copper and its alloys have made important contributions to this dramatic chain of developments. From the beginning, advantage has been taken of the superior electrical conductivity of copper and the ready workability of brass for intricate and accurately machined parts. Phosphor bronze, another copper-base

alloy which combines excellent spring qualities with current-carrying capacity, also renders dependable service in equipment of all descriptions.

To realize the importance of copper, consider that every one of America's 26,000,000 telephones represents 80 pounds of the red metal at work in plants, equipment and transmission lines.

For more than a century, The American Brass Company has played a leading role in making these useful metals available. Research continues, and new and improved copper-base alloys will be ready to serve the expanding needs of American Industry.

THE AMERICAN BRASS COMPANY

Subsidiary of Anaconda Copper Mining Company
 General Offices: Waterbury 88, Connecticut
In Canada: ANACONDA AMERICAN BRASS, LTD.,
New Toronto, Ont.

SELENIUM COPPER, a new alloy developed by The American Brass Company, combines high electrical conductivity, free machining and hot working properties, and is much in demand for glass-to-copper seals in vacuum-tight electronic tubes.



Anaconda Copper & Brass

BUY WAR BONDS . . . Buy all you can, keep all you buy