How a group of enterprising Americans made diamonds more beautiful

AMERICAN CUT

THE FIRST 100 YEARS

Al Gilbertson, G.G.

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The Evolution of the American Cut Diamond, 1860–1960

by Al Gilbertson, G.G.

"Of the history of American diamond cutting, there is little available in written records. ... For such a chronology it is necessary either to rely almost entirely on the memory of individuals or upon the private business records of the older cutting firms."

Arthur Muller
J. R. Wood & Sons

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This book is dedicated to my father,
Chet Gilbertson (1913–1974), whose zeal to
share his knowledge and passion for gems and
minerals inspired my own enthusiasm and
desire to pass on what I have learned.

Contents

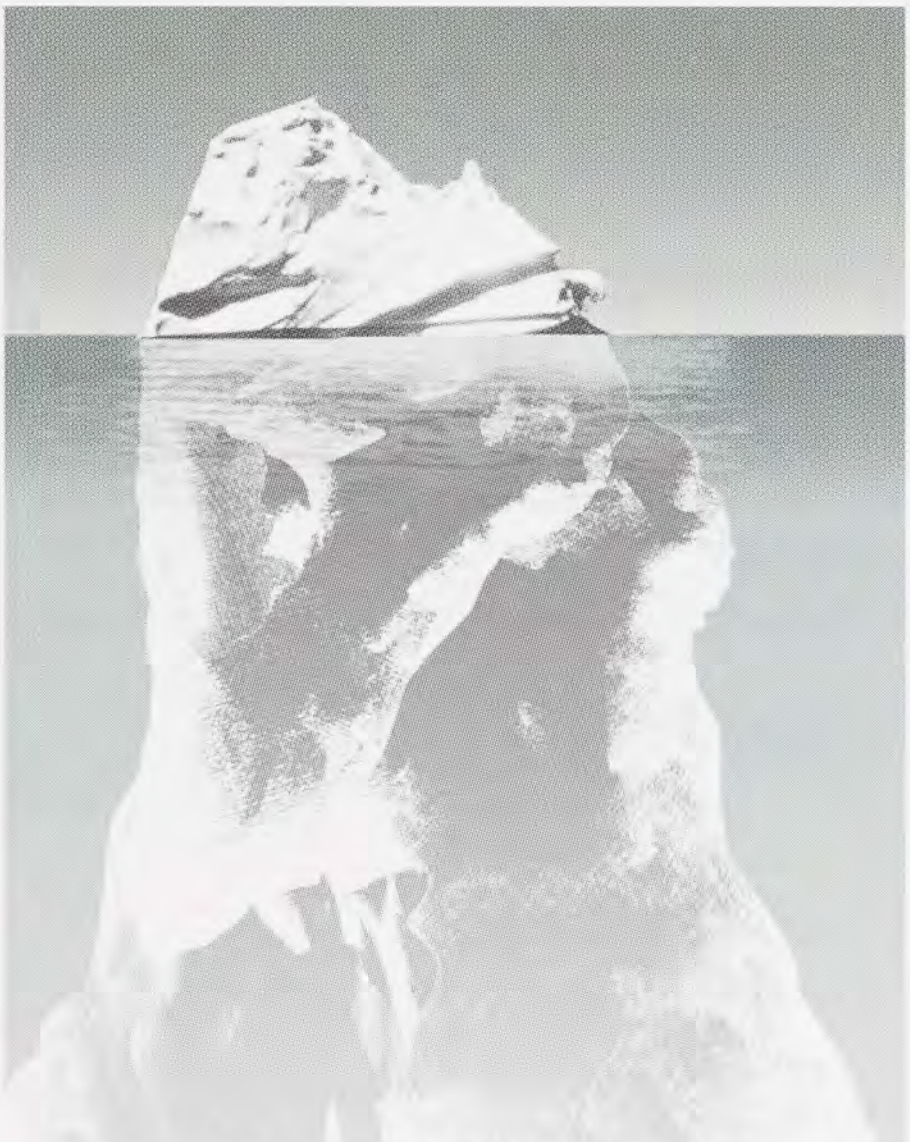


Illustration by Peter Johnston/GIA.

*"A living myth, like an iceberg,
is 10 percent visible and 90 percent
beneath the surface of consciousness.
While it involves a conscious celebration
of certain values … it also includes
the unspoken consensus,
the habitual way of seeing things,
the unquestioned assumptions."*

Sam Keen and Anne Valley-Fox, 1989
Your Mythic Journey

Foreword

Why are we consumed with the pursuit of the best? Why do we need a "first place," "number one" or "top dog"?

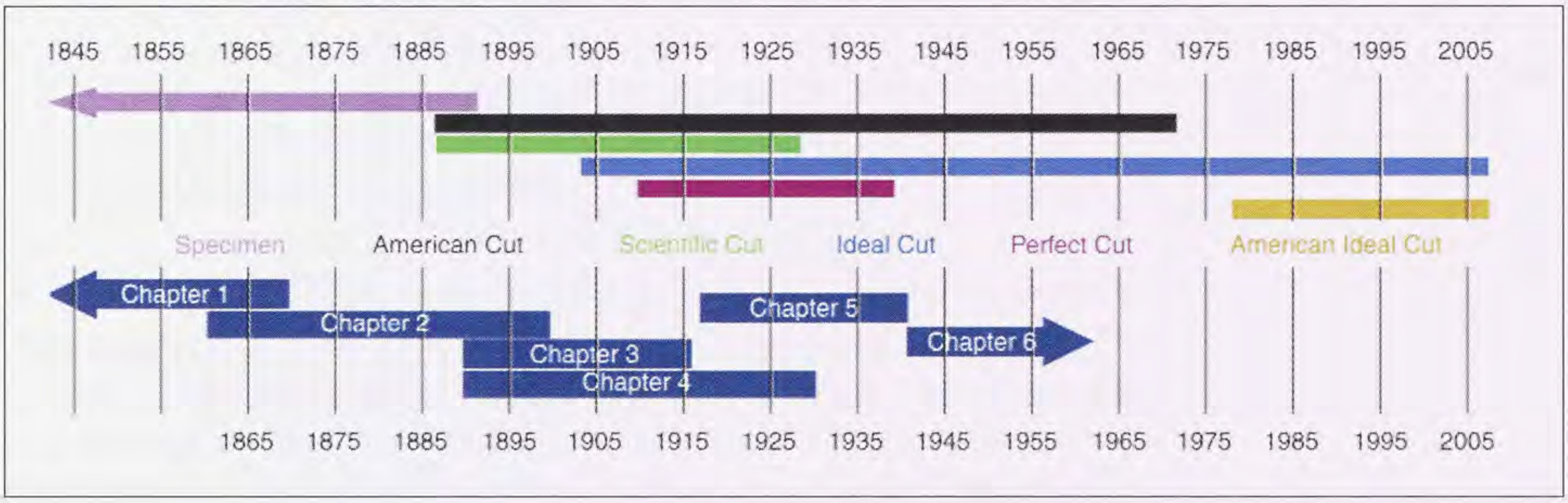
Given our passion for the nearly unattainable, it's not surprising that so much emotion is tied to having or being the best. Sports teams and their fans are shaken if they do anything less than win a championship. We want the best home, the best school for our children, the best marriage.

Controversy arises, however, when we try to characterize the best. How high is the standard? Whose standard is it? Who can really attain such a high goal? Somewhere, somehow, it has to be clearly defined. But who gets to do that? Whose authority determines what is best?

When no one authority sets the standard—when a "best" is established and ultimately embraced by a community—the origins and the reasons for how the standard came about sometimes become hazy, even lost, and lack of knowledge or understanding gives credence to myths.

That's exactly what happened to the American Cut diamond. Most of the modern jewelry trade has lost sight of its origins. Even its name has changed over the years; it is known as the "American Ideal Cut" or sometimes just the "Ideal Cut," but it has been known by other names as well (Fig. f-1). In a pursuit of excellence worthy of a sports fanatic, the jewelry industry sought out a "best" and elevated it to the highest level possible. Then came the myth.

Fig. f-1: This chart shows terms used over the decades by jewelers and diamond cutters to describe essentially the same range of diamond proportions (the exception is the term "specimen," which is explained in "Morse's 'Specimen Grade,'" page 40).



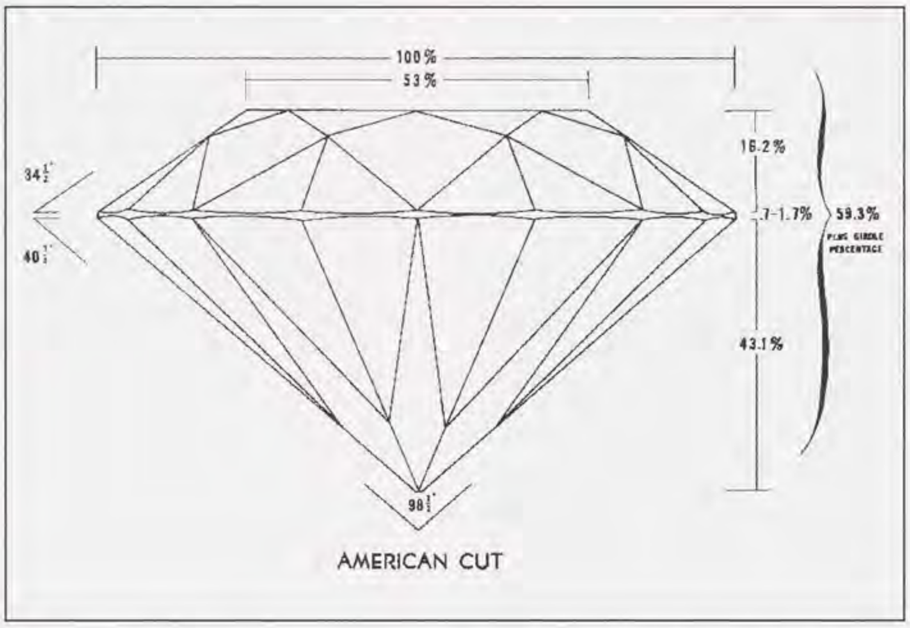


Fig. f-2: GIA and AGS taught the proportions for the American Cut through the 1970s. The following proportions were taught from the 1930s-70s:
Crown angle: 34.5°
Pavilion angle: 40.75°
Table size: 53%
From GIA and AGS course materials.

The American Cut Myth

My quest for the truth behind the American Cut began in 1976, on the first day of a job faceting colored stones for an American Gem Society (AGS) jeweler. I was raised in the lapidary (gem cutting) business, but had never worked in a fine jewelry store. Much about it was new to me.

As I sat at the faceting machine getting ready to cut a blue topaz on that first day, I noticed a framed drawing (Fig. f-2) on the wall that showed the profile and facet arrangement for a 58-facet round brilliant cut diamond. It was labeled "American Cut," something I had never heard of, but would come to be intrigued by.

Before long, I was on my way to completing the Gemological Institute of America (GIA) correspondence courses. The material talked about the round brilliant diamond and its proportions; I repeatedly saw the terms "Ideal Cut" and "American Cut."

The cut of a diamond, or any other gemstone, refers to the proportions (or how the facets are cut in relationship to one another) used to shape a piece of rough. I soon learned that "American Cut" is a name used to describe a specific set of proportions for a 58-facet round cut diamond that some feel create the best-looking diamonds.

To better my understanding of cut, I visited GIA's library to get a photocopy of Marcel Tolkowsky's *Diamond Design*, which people told me was the standard for diamond cutting and the origin of the Ideal Cut. Tolkowsky, a Belgian, wrote this book as an engineering student at the University of London in 1919. It is often incorrectly described as a thesis, but it was actually written for the diamond cutting industry. Much of the American jewelry industry, in particular, believes it is the source of the American Cut and Ideal Cut.

I can only explain my reaction to Tolkowsky's book as initial awe, then disappointment. Awe, because I held a copy of it in my hands and was able to pore over it many times in the weeks to come. But my frustration grew as I worked through the math, which was never a strong suit for me.

There was no solid discussion that explained why certain facets were placed where, and no real explanation of their angles. In fact, the facets that make up half the surface of the bottom of the diamond were virtually ignored. Rays that came in or exited through various facets were not addressed.

Tolkowsky only looked along a single flat plane—a slice through the stone—at a couple of specific facets. The diamond might as well have had two smooth-surfaced cones (one, as GIA calls it, "truncated").

I soon realized that, even though the jewelry industry relied heavily on Tolkowsky's theories, few jewelry professionals had ever actually read his book.

In 1980, I wrote a letter to Robert Limon, chairman of the Diamond Standards Committee for AGS, to discuss some of the math issues. I asked him to reexamine the calculations and either confirm or modify the standards for AGS's best, the AGS "0." He suggested that I ask GIA to do the research and that until there was other evidence, AGS would keep its standards in place.

This was the beginning of my personal quest to understand the "Ideal Cut." If most associate these cutting proportions with Tolkowsky, who was not American, I wondered, why is the cut referred to as "American"? Years later I was surprised to find that this cutting style was referred to as the "American Cut" long before Tolkowsky wrote his book.

I realize now that Tolkowsky created a wonderful work for his time, one that influenced the American Cut, but I wanted to get to the truth about the American Cut. My initial disappointment in his book set me on a journey through diamond cutting history to uncover the origins of this cutting style and its lofty claim of superiority. That's where my quest began. This book is about what I discovered as I traced this history of the American Cut.

The Term "American Cut"

The terms "American Round Brilliant" and "American Cut" have been used interchangeably in the trade with the terms "Ideal Cut" and "American Ideal." The term "American Ideal," which some in the trade are trying to popularize, is not accurate for this book, which is a historical record up until the late 1950s. The term "American Ideal Cut" did not come into use until the 1970s.

For more information on the use of "American Ideal," see "The 'American Ideal Cut' Has Been Demoted in Some Quarters to the 'American Brilliant Cut'"(Federman, 2003) and "The American Ideal Cut Diamond," from the American Gem Society (Cowing et al., 2002).

Numbing Numbers

Numbers and measurements play an important role in the story of the American Cut diamond, but here they are typically placed in figures and sidebars so they don't interrupt the story. Interestingly, this is similar to how you appreciate a diamond. Even though its measurements and proportions are essential to understanding why it is beautiful, the overall beauty you see with your eyes is ultimately most important.

Footnotes and Endnotes

Footnotes (Arabic numerals 1, 2, 3, ...) are primarily used to show the source of the material discussed and are referenced in the bibliography. Chapter endnotes (Roman numerals i, ii, iii, ...) are a further explanation of the discussion and frequently include a quote from the original source.

Errata

Note that on pages 57 and 121, minor errors have been corrected from the original printing.

Acknowledgments

My quest to collect as much information as possible about the evolution of the American Cut led me to many locations and many helpful people. I'd like to thank some of them here. Many added valuable insight into how diamond cutting in America changed over the years, and I am grateful to have had access to them.

My research took me to the Diamantmuseum Provincie Antwerpen, where Nico Weckx arranged for me to look at the museum's historic documents; the Tiffany & Co. Archives, where Louisa Bann and Katharine Collins pulled significant records pertinent to my research;

the Massachusetts Historical Society Library; the *Jewelers' Circular Keystone* archives, where editor-in-chief Hedda Schupack gave me full access. (Their archives included issues from *The Jewelers' Circular and Horological Review* [1873-1934], which was a consolidation of the *American Horological Journal* [1869-1873], *The Jeweler* [1872-1873], *Watchmakers, Jewelers and Silversmiths Journal* [starting in 1872], *The Jewelers' Weekly* [1885-1900], *The Keystone* [1881-1934] and *The Jeweler's Review* [1887-1902]. *The Jeweler's Circular-Weekly* dropped the name "Weekly" in 1917 and by the 1930s and became *The Jeweler's Circular-Keystone*, and today is known as *JCK*.) All proved to be invaluable sources of historical documents.

I also conducted extensive research at GIA's Richard T. Liddicoat Gemological Library and Information Center, where I found many sources, including a scrapbook of news clippings collected by Charles Field, the manager of Henry Morse's Boston cutting shop in the late 1800s. The superior staff at the library provided comprehensive assistance in locating documents and books not only in its collection, but from sources around the world. Library staff who provided such critical assistance included: Neil Barron, Sharon Bohannon, Judy Colbert, Kathleen Dillon Dailey, Michael Daligdig, Dona Dirlam, Sheryl Elen, Cathy Jonathon, Lynn Lewis, Caroline Nelms, Ruth Patrick, Gus Pritchett, Paula Rucinski, Kevin Schumacher, Rose Tozer, Peggy Tsiamis and Robert Weldon.

Through this research, I discovered two very rare bound volumes of business letters from Henry Morse that were eventually donated to the GIA Richard T. Liddicoat Gemological Library and Information Center by J. & S. S. DeYoung, Inc. in June 2005. This donation was from Joseph Samuel, and Alan and Janet Levy of J. & S. S. DeYoung, Inc. The volumes contain more than 2,500 business letters from the Morse diamond cutting business.

I want to express my thanks to Donna Baker, Bill Boyajian, Dona Dirlam, Duncan Pay, Tom Moses and Tom Yonelunas for supporting this project and the research that went into it.

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The design and layout are the hard work and artful expression of creative director Faizah Bhatti, assisted by Richard Canedo. Merilee Chapin helped with early edits. Images and illustrations were finalized or processed for production by Sharon Doar-Toth, Peter Johnston, Valerie Power and Eric Welch.

I am grateful for the assistance in the final editing provided by Alice Keller and Stuart Overlin, whose meticulous attention to detail are incomparable and indispensable.

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I am indebted to the work of my tireless editor, Amanda Luke, who shared my vision and passion for this book. Her guidance through this process has been invaluable.

My most deeply felt thanks must go to my wife, Laura. Her love, along with her faith in my ability, was absolutely indispensable over the last six years. I am deeply indebted to her.

Al Gilbertson, G.G.

"FOR THE PERFECTION OF THE RAINBOW-PLAY OF HUES, IT IS ESSENTIAL THAT THE FACETS OF THE SUPERIOR AND INFERIOR PARTS OF THE STONE SHOULD CORRESPOND IN EXACT PROPORTIONS, AND STAND AT FIXED DISTANCES, SO AS TO MULTIPLY THE REFLECTIONS AND REFRACTIONS, AND PRODUCE THE COLORS OF THE PRISMATIC SPECTRUM. ALL LIMPID AND WHITE GEMS MUST BE CUT ACCORDING TO THIS RULE."[1]

Dr. A. C. Hamlin
American author of several books on gems in the mid-1800s

Chapter 1

Old World Roots of the American Cut

How can we dispel a myth without understanding its entire context? A myth is often built on misunderstanding and inaccuracies; uncovering its origins will get to the heart of the matter. The process may even involve tearing down what some may hold as sacred to reveal the fundamentals of what is true. The evolution of the round brilliant cut diamond into the American Cut, known by many as the Ideal Cut, began hundreds of years ago, and in some ways it was brought on by competition from glass imitations.

The Renaissance and Baroque periods were an explosive rebirth of the arts and sciences. Jewelry, already a predominant symbol of power and wealth, evolved from plain and simple pieces to a profusion of richly colored gems and enamels. Women began to wear more jewelry than men in the 1500s, and lighter colors slowly came into vogue. Diamonds became more plentiful in the 1600s when the Golconda mines of India opened to more trade with the West (Figs. 1-1, 1-2, 1-3 and 1-4 are examples of cutting styles for these periods).

[1] Hamlin, 1876

Fig. 1-1: By the late 1300s, natural crystals were being modified in Europe by simply polishing their faces so no natural irregularities of the original crystal remained. Within 100 years, the point cut was modified by cutting a portion of the top off to create a table-like surface, which became known as the "table cut." These cut styles reflected light off their outer surfaces, but light did not enter and exit them with the same force of brilliance and fire seen in cut diamonds today. They appeared dark and the metal backing was visible through them, except when light reflected off their tops. The ring (left) is Northern European in origin, from about the 14th century. It's set with a diamond crystal reminiscent of the point cut. The 11.90-ct. diamond octahedron (right) illustrates the natural shape of the crystal. *Photo of ring (left) by Harold & Erica Van Pelt. Diamond photo (right) by Elizabeth Schrader. Both photos/GIA.*

Fig. 1-3: The gold and enamel hat ornament (left) is accented by table cut diamonds. Known as an aigrette, the piece is designed to imitate egret feather plumes worn by Indian potentates (rulers), and is attributed to Joseph Mores the Elder of Hamburg, Germany, around 1600. Aigrettes were worn on men's hats or in women's hair. Table and rose cut diamonds (right) are set into a silver, gold and enameled floral-design English pendant from the 1600s. *Both photos by Harold & Erica Van Pelt/GIA.*

Fig. 1-2: A rose cut diamond is typically flat on one side, with a number of facets forming a dome shape on the top of the diamond. *Photos by Don Mengason (top) and Anne Brett (bottom)/GIA.*

Fig. 1-4: These English gold and silver rings from the 1700s are set with rose cut (both) and table cut diamonds (right). The insect design (left) probably symbolized persistence for its owner. The crowned heart pierced with arrows (right) is an allegory for the "triumph of love." *Photo by Harold & Erica Van Pelt/GIA.*

Fig. 1-5: The extravagant fashion designs of the late 1700s were heavily accented with large jewels. Anything that was ostentatious and glittered to draw attention to the wearer was not only acceptable, but expected. This created demand for extremes that would dominate jewelry fashion for years afterwards. *Black-and-white plate: Moreau, 1920. Color plate: Cornu, 1912. Both Special Collections and Archives, the UC Irvine Libraries*

"Outward appearances in the 18th century were everything; a certain fashionable falseness was everywhere. Both men and women worked seriously toward an unrivalled magnificence in their dress, their ornaments and movements. Ladies wore false hair piled wondrously high, powdered and laden with feathers, bows, jewels and the occasional stuffed bird or ship in full sail or flowers (kept fresh in vases of water hidden in the depths of the coiffure),"[2] writes jewelry historian Vivianne Becker (Fig. 1-5).

Fashion reached upward—sometimes adding three to five feet to the wearer's height—and petticoats and panniers (whale-bone or cane hoops) pushed dresses outward. Faces were heavily painted and strips of mouse skin sometimes covered fully plucked eyebrows.

[2] Becker, 1988

Fig. 1-6: This Russian diamond necklace, woven with silver and gold ribbons and flowers, was worn at the court of Catherine the Great in the 1700s. *Photo by Harold & Erica Van Pelt/GIA.*

Fig. 1-7: This 1700s bowknot brooch of diamonds, silver and gold is from Northern Europe. The bowknot, which signifies a "true lover's knot," was a favorite subject for jewelry. This example is set with pear shaped and round old mine cut and rose cut diamonds. *Photo by Harold & Erica Van Pelt/GIA.*

The woman's bosom remained the intended center of attention: It was decorated after pushing the partially covered breasts upward by "bows, lace or ribbons, jewels or nosegays of real or artificial 'made' flowers that protruded eccentrically," Becker writes. "Eventually this fashion was interpreted in jewels, and sprays of twinkling gem-set blossoms were pinned to the neckline. There was nothing like diamonds, or brilliant paste, worn at the ears, breast or throat to light up the face and bosom, to add vital glistening glamour"[3] (Figs. 1-6 and 1-7).

The opulent Baroque period fueled demand for diamonds. New and better candles burned more brightly, adding a spectacular glamour to evening social life as the jewels glistened and shimmered.

George Frederic Stras, a Parisian jeweler, found a way to apply metal to the back of glass in the early 1700s, which caused gem imitations to sparkle, in some cases more than diamonds. The metal behind the glass acted as a mirror and returned all the light coming into the gem. Diamonds, on the other hand, were not cut in a way that consistently returned all the light. Fake gems were used because they were cheaper, plentiful and looked bright and colorful in the candlelight.[4]

Rose cut and the primitive table cut diamonds were the dominant styles of cutting through the 1700s; the rose would continue to dominate until the late 1800s. Both styles contained only a few facets and didn't sparkle as much as the fake gems, but diamonds were still seen wherever fashion was important (Figs. 1-8 and 1-9).

Diamonds now faced competition. If glamour was enhanced by lots of sparkle, diamonds needed to be more consistent in appearance, and maybe even better than the fakes. They retained their status

[3] Becker, 1988
[4] Ibid.

Fig. 1-8: Rose cut diamonds were often used to accent clothing worn for formal occasions. The English silver and gold buckles (top) were worn to fasten a man's britches just blow the knee. The buckles and vest buttons (bottom) are from the 1700s. *Photo by Harold & Erica Van Pelt/ GIA.*

Fig. 1-9: A "coulant," or slide, like this crowned bowknot and cross pendant, would be worn on a ribbon tied around the neck in the 1700s. The silver and gold Northern European slide is set with rose cut diamonds. *Photo by Harold & Erica Van Pelt/GIA.*

Fig. 1-10: London goldsmith SamTaylor's mid-1700s business card, with ornate, gem-encrusted design, shows how he catered to the heavily embellished fashion of the day. *The London Goldsmiths, 1935.*

because of their rarity and value; the bigger the diamond, the better, regardless of how much it sparkled. Jewelers emphasized this new fashion trend, banking on the desire for glitter (Fig. 1-10).

Jewelers continued to sell the fake gems because their customers wanted the biggest, most sparkling pieces of jewelry that they could get their hands on.

Early Ideas About Diamond Angles and Proportions

The first use of the term "brilliant" in association with diamonds is believed to have been in France in 1564, as an adjective to describe the appearance of certain polished diamonds.[5] The 1614 inventories of Daniel de Hase, a German jeweler, contain another early reference.[6] By 1668, the term was being applied to the jewels of the future Queen Mary II of England.

The 1691 French Crown jewelry inventories, however, use "brilliant" as a noun; evidently, the term was already in circulation at the time,

[5] Tillander, 1995
[6] Legrand, 1980

and would have been understood by anyone reviewing the inventory.[7] "Brilliant" describes the difference between rose cut, table cut and other faceting styles.

The best or correct proportions for non-round shapes were a concern nearly four and a half centuries ago, in 1572, when Juan de Arfe y Villafane,[i] an assayer for the royal mints in Madrid and Segovia, wrote about the importance of "perfect cutting" and how deviating from it diminished the value of the diamond.[ii] He was not alone in his concern.

A more detailed explanation analyzing various types of cutting styles is found in a 1721 Dionisio de Mosquera text, which noted mineralogist John Sinkankas[8] described as explaining "how to correctly judge cutting proportions and thus aid in arriving at more accurate estimates of value."[iii]

De Mosquera, a Madrid goldsmith-jeweler who had the favor of the Spanish court, wrote about the theoretical and practical details of weighing and valuing precious stones in the 1700s. He described how to evaluate cutting proportions to help estimate value and provided several geometric diagrams based on the diamond's natural octahedral shape (Fig. 1-11). Harry Emanuel, an 1860s gemstone expert, later illustrated de Mosquera's idea about how an octahedral crystal is cut (Fig. 1-12).

Fig. 1-11: The octahedron is the most common shape for rough (uncut) diamonds found in nature. This octahedral diamond crystal has natural faces that are transparent and clear, almost as if they were polished. Cutting styles for diamonds followed this shape until the late 1800s. *Courtesy GIA.*

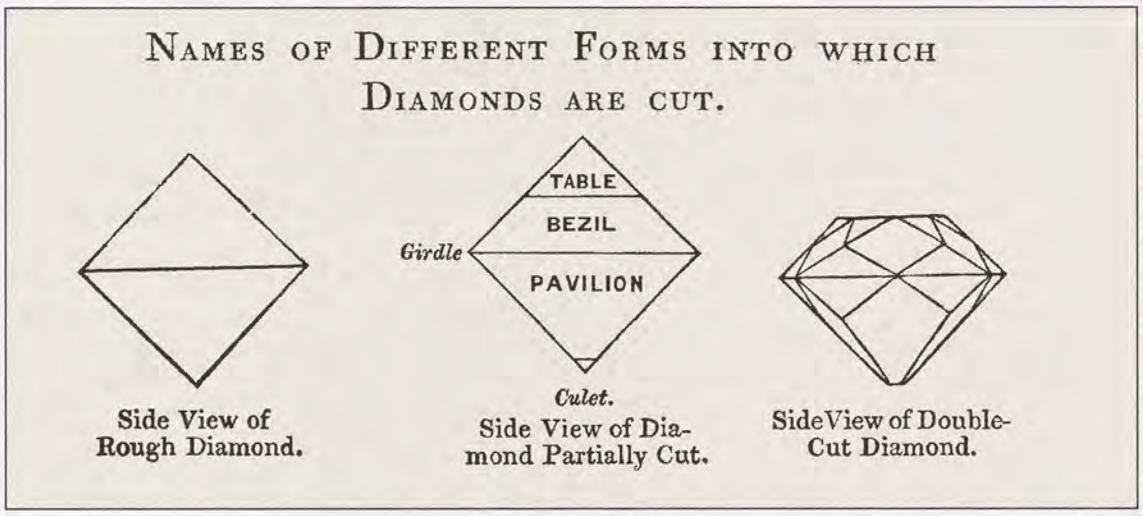
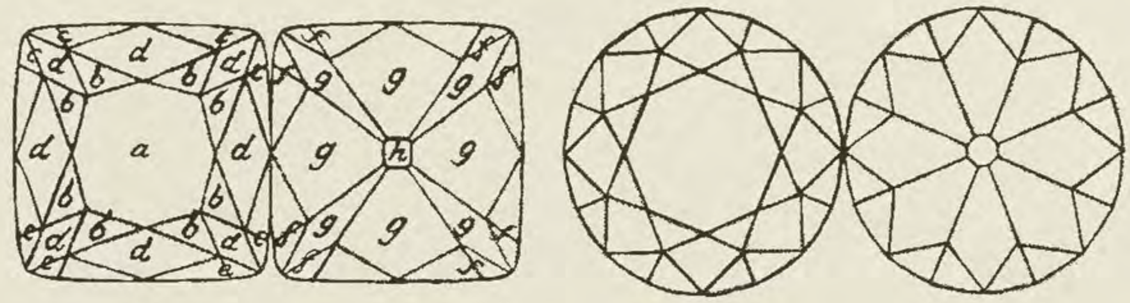


Fig. 1-12: Harry Emanuel, an 1860s London gem expert, illustrated de Mosquera's ideas about how a fashioned diamond retains most of the shape of the original octahedral crystal. *Emanuel, 1865.*

[7] Tillander, 1995
[8] Sinkankas, 1993

Fig. 1-13: (a) David Jeffries used simple line drawings to illustrate popular cutting styles in the mid-18th century. Note the short lower half facet length (*f*) and the large culet with the fairly normal (modern) sized table. Round shapes (58 facets) were a distinct but fairly uncommon cutting style during Jeffries' time. He labeled the facets of the square brilliant, not the round shape because that's what most people were cutting. Jeffries also wrote at some length about the various proportional relationships of the square brilliant's facets, but not the round's facets. (b) A comparison of facet names during Jeffries' time to modern times. *Jeffries, 1751 (2nd edition), table 1.*



a

Jeffries' name	Label	Modern name
Table	a	Table
Star facets	b	Star facets
Skill facets	c	Upper girdle or upper half facets
Upper sides or bisils	d	Bezel facets
Girdle or outline	e	Girdle
Under skill facets	f	Lower girdle or lower half facets
Lower side facets	g	Pavilion main facets
Collet	h	Culet

b

Thirty years later, brilliants were still referenced as nouns by de Mosquera and David Jeffries, who wrote *A Treatise on Diamonds and Pearls* in 1750, one of the earliest guidelines for evaluating and pricing diamonds and pearls based on size (weight) and styles of cut, color and clarity. Jeffries used simple line drawings to illustrate various cutting styles popular at the time, and is believed to be the first to show a round brilliant with 58 facets[iv] (Fig. 1-13). He carefully described the proper cutting of diamonds and discussed those that departed from the ideal proportions of his time.

The 58-facet round brilliant was recognized as a distinct cutting style by 1750. The square brilliant also had 58 facets, indicating that the brilliant form– whether square or round– had 58 facets. De Mosquera used somewhat complicated geometries to compare the relationships of facet sizes, but Jeffries[9] used what he called a "prover" (Fig. 1-14) to measure the distances and relationships of facet lengths and proportions.[v] Jeffries, like Arfe y Villafane in the 1570s, was irritated by diamonds cut with poor proportions and went to some length to articulate what proportions he thought worked best.

[9] Jeffries, 1751

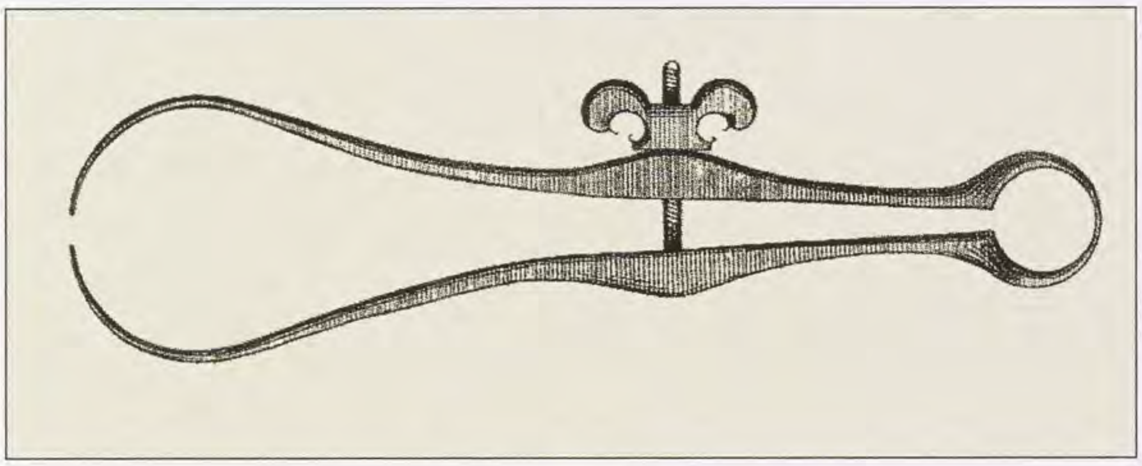


Fig. 1-14: Jeffries used a prover to measure facet lengths and check the relative proportions of a diamond to determine if they were correct. *Jeffries, 1751, plate 6.*

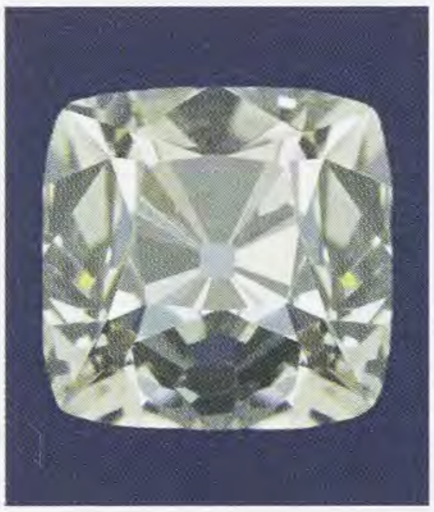


Fig. 1-15: The square brilliant is usually referred to as a triple cut brilliant, sometimes called a Peruzzi brilliant. Antoine Caire, an 1826 Parisian jeweler, one of the first who seemed to care about historical aspects of the diamond industry, studied Jeffries' work on the sequence of diamond cutting and wrote about the origins of certain styles. He gave Cardinal Mazarin— the first minister of France in the mid-17th century— credit for the double cut, a precursor to the 58-facet brilliant, and Vincenzio Peruzzi, from Venice, credit for the triple cut brilliant. Historians have since discovered, however, that the double cut was in use long before Mazarin (*Bruton, 1978*), and it is doubtful that Peruzzi ever existed, much less cut diamonds, even though many have believed Caire's story for more than a century (*Tillander, 1995*). The Peruzzi cut is associated with the facet arrangement of the cushion or squarish brilliant of Jeffries' time. *Simulated photograph based on the diagram from Jeffries' book. Al Gilbertson/GIA.*

Jeffries' best proportions are radically different from what is considered acceptable today because they were based less on attaining brightness and fire, and more on retaining the maximum weight to present a reasonable appearance (mostly based on proper symmetry). Cutting diamonds was a slow process; the less material cut away from the original crystal shape, the more quickly the cutter could complete his work. The ideal cut in Jeffries' time is a very squarish cushion brilliant, what some in the jewelry industry now call an old mine cut or Peruzzi cut (Figs. 1-15 and 1-16); the diamond's crown (top) and pavilion (bottom) are both much deeper than today's standards.

Fig. 1-16: The top and side views of this squarish brilliant diamond show lumpy styles that were typically cut in the mid- to late-1800s. The cutting style simply saved weight from the original crystals. *Photos by Eric Welch (top) and Don Mengason (bottom)/GIA.*

Jeffries encountered skepticism over his claims about diamond proportions after he published his book in 1750.

He responded:

> AND AS THE retaining a right knowledge of the true make of Diamonds ... the reader is informed in what manner defects of ill made Brilliant Diamonds will appear. To that end, an instance is given of a stone of six carats weight, which is but of the expansion [i.e., diameter] of one of five carats. ... Either it will be deeper than a Stone of five carats; or, if not deeper, its table and collet [culet] will be larger, and that will render it blocky ... or, it will be left too thick at the girdle ... and, if such thickness be sufficiently reduced ... the skill facets will be executed in an obtuse, or blunt manner, and that will cause an undue swelling in the Stone. ... A Stone thus made will unavoidably be of an ill form, and be rendered lifeless, and dull; which cannot be rectified without the loss of its superabounding weight, which will reduce it to five carats; and therefore it is to be valued only as one of five carats.

In 1753, Jeffries further elaborated on the importance of proper cutting, as well as color, clarity and weight (the same four factors we use today to determine a diamond's value, also known as the Four Cs). He felt jewelers were probably ignorant of the facts,[vi]

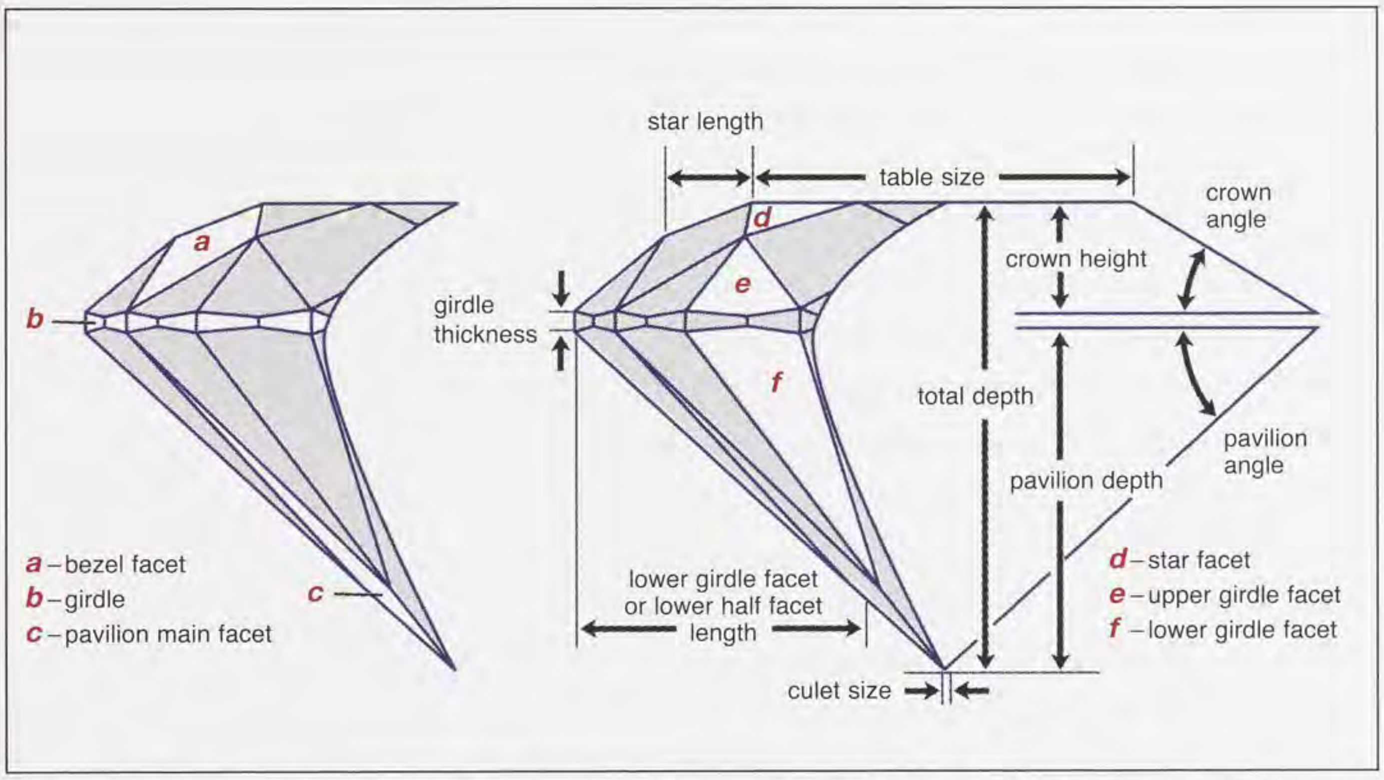


Fig. 1-17: Most descriptions of the facets or proportions of a standard round brilliant diamond mention pavilion angle, crown angle, table size, crown height, pavilion depth and total depth, but fail to mention some or all of the following: lower and upper girdle facets (also called lower and upper halves), star facets, culet size and girdle thickness. This diagram shows the terms GIA uses for the different components of the round brilliant. *Courtesy GIA.*

or didn't want the knowledge to be widely shared because it gave them an advantage in buying and selling.

Jeffries' proportions for a round brilliant were 45 degree crown and pavilion angles, 56 percent table, 66 to 67 percent total depth, and a crown that is half as thick as the pavilion.[10] De Mosquera's plates show the same proportions. (Fig. 1-17 shows the modern components of a round brilliant diamond.)

Jeffries' proportions still weren't fully embraced by the diamond-cutting industry, however. By the early 1800s, many diamonds were cut to give the largest appearance, regardless of actual weight, from less perfect or damaged crystals. Instead of spending time fashioning a piece of rough to the preferred shape, cutters would just get the most weight they could from the irregular rough. They spent less on cutting rough, but sold the finished stone at a higher price because of its larger face-up diameter. Diamond cutters of this era thought more weight was better.

"When the work is finished the large stones are weighed singly, the small stones in the lots, to see what the loss has been, and, according to the extent of this, the payment is greater or less. If a stone is found to be wanting in any of the lots, the workman has to pay a fine much greater than the value of the stone," Louis Dieulafait wrote in 1874 to describe the process in Coster's diamond cutting factory, the largest in the world at that time[11] (see "Coster's Diamond Cutting Works in Amsterdam," page 13).

Some yearned for Jeffries' standards, however. John Mawe, an early 1800s geological historian and mineralogist, bemoaned the lack of regard for proper proportions:

> SO MUCH STRESS is laid by modern fashion on the superficial extent [i.e., physical spread or size] of a brilliant, that the old rules for proportioning its dimensions are now nearly obsolete: the diamond-cutters have almost discarded the use of measures, and, in forming the facets, trust wholly to the eye. If however, the brilliant were formed according to the rules, it would be in the best proportion, and exhibit the greatest possible refulgence [brightness].[12]

Public demand, however, gradually began to dictate change. The face-up appearance of a diamond was becoming more important. The public

[10] Ross, 1981
[11] Dieulafait, 1874
[12] Mawe, 1823

Fig. 1-18: This opulent diamond corsage ornament (left, circa 1850) is set with a variety of early brilliant cut diamonds. It was made for Princess Mathilde, cousin of Napoleon III. Cartier purchased it at auction after her death and later sold it to Mrs. Cornelius Vanderbilt. The diamonds are from Brazil and set in silver on gold. Such opulent jewelry was typical for those of stature. *Photo by Harold & Erica Van Pelt/GIA.*

Fig. 1-19: The 41-ct. Dresden Green diamond (right), one of the few green diamonds known to be of natural color, was set in a hat ornament made by Prague jeweler Diessbach in 1768 with early brilliant style diamonds. The flowery bottom portion was originally fashioned by Geneva jeweler Andre Jacques Pallard in 1746 as a section of a badge of the Order of the Golden Fleece, a chivalry order founded in 1430 by Duke Phillip III of Burgundy. *Photo by Shane F. McClure/GIA.*

preferred brilliants to other cuts (rose cut, table cut, etc.) and cutters began to respond. The proliferation of rhinestone (named for the sand from the Rhine River that was used to create it) made it possible for people to see lots of sparkle in a cheap imitation. The rose cut diamond and other early styles of cutting did not dazzle or glitter when compared to rhinestone.

The brilliant cut diamond did sparkle, however, and its fire could not be duplicated in the rhinestone. It was the preferred choice, for those who could afford it, to enhance the fashion of the day (Figs. 1-18 and 1-19).

"Brilliant cut Diamonds are so infinitely superior to the others, that of late many rose-cut stones from Holland have been recut into brilliants," Mawe wrote in 1813.[13] It was the brilliant style that American cutters would focus on.

[13] Mawe, 1813

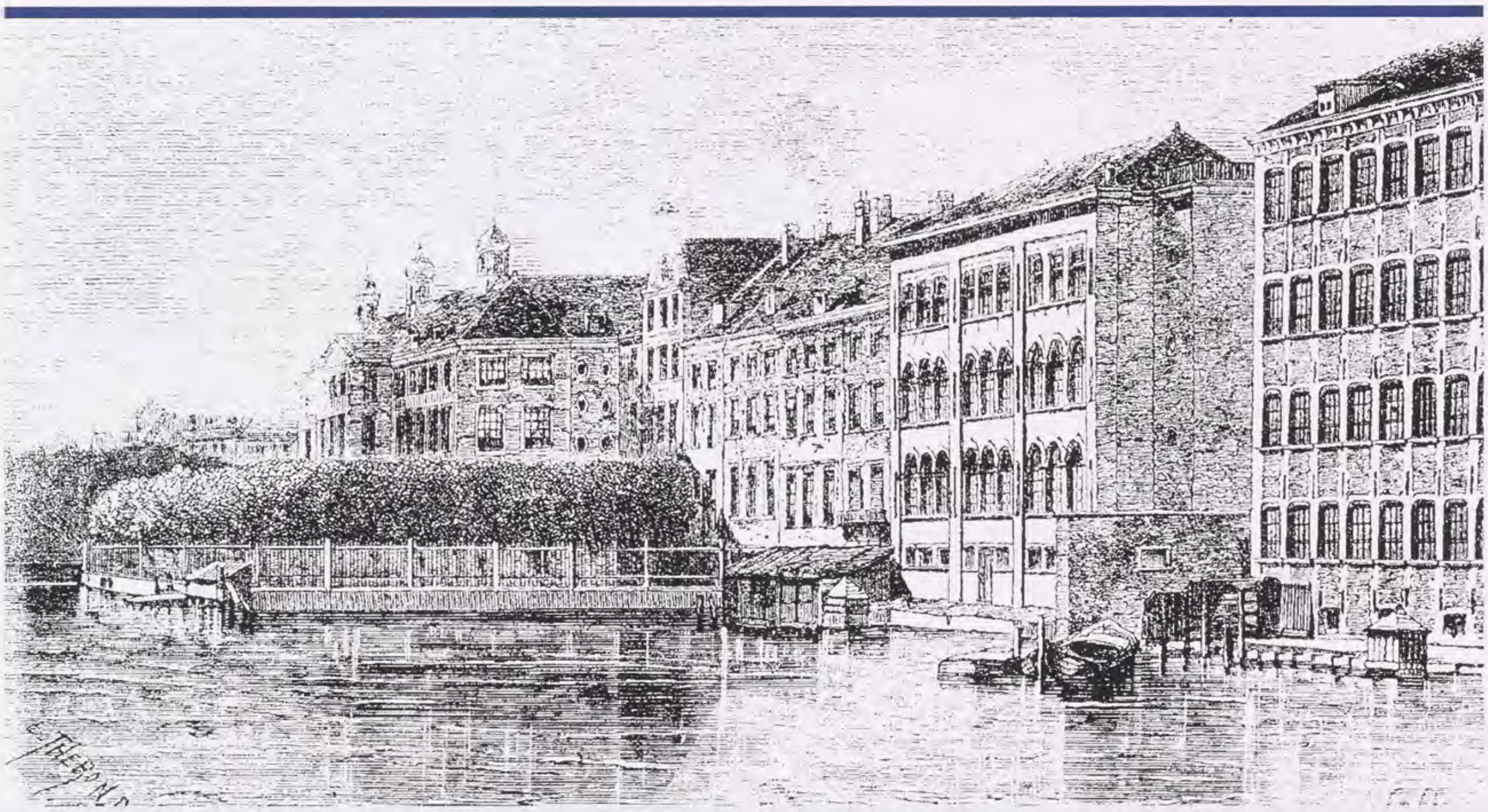


Fig. 1-20: Coster's diamond cutting works was located along one of Amsterdam's many canals in the 1860s.

Coster's Diamond Cutting Works in Amsterdam

American influence in diamond cutting began with Henry Dutton Morse in the late 1860s in Boston, but factories in Amsterdam best illustrate how diamonds were cut in Europe and throughout the world between 1860 and 1875.

Moses Elias Coster opened Coster Diamonds in 1840. His pioneering spirit drove him to be the first to use steam-powered cutting machinery.

Prince Albert and Queen Victoria of England invited Coster to reshape the Koh-i-noor, a legendary diamond whose recorded history dates back to 1304. He recut the gem to its present oval weight of 105.60 carats in 1852.

Coster's Amsterdam cutting house (Fig. 1-20) was the largest diamond cutting establishment in the world by 1874. Louis Dieulafait, professor of physics at the Faculty of Science in Marseilles, wrote a detailed description of the process for cutting diamonds in his book *Diamonds and Precious Stones*, based on Coster's cutting works. His descriptions and accompanying line drawings (used as figures here) are some of the best representations of the diamond manufacturing process from that time. The following is from Dieulafait's 1874 book:

THE CUTTING of the diamond includes three series of operations: the splitting or cleaving; the cutting, properly so called; and the polishing. Special workmen are required for each one of these branches.

It is to the splitter that the rough diamond is given; his quick penetration and ready action are to determine the future of the stone. First of all, he examines very carefully the little morsel in his hand; he decides how it should be shaped to retain the utmost weight with the most brilliant effect; he detects every flaw and streak, and he knows whether the imperfections are at the stone's surface or at its heart.

Very quickly then he sets to work. He takes a longish wooden implement or baton, shaped so as to be conveniently held in the hand, and having at one end a ferule extending a little beyond the wood and filled with a mastic or cement of resin and brick-dust. This cement he softens by heating it at a lamp, then embeds the diamond in it and lets the cement cool, by which means the diamond is firmly fixed in its place.

With another diamond, sharply edged and secured in the same way, he cuts a notch in the diamond he is about to split. This notch is of a V shape, and must lie exactly in the direction of the cleavage-plane of the stone — a result which, though apparently so difficult, is easily attained by the practised [*sic*] eye and dexterous hand of the workman. A box beneath his work catches the dust, and a little sieve sifts at once the diamond-powder from the particles of resin dropped.

When the notch is cut deep enough the workman places the wooden baton upright in a hole in a block of lead before him; then introducing with one hand the blunt edge of a small steel ruler into the notch of the diamond, with the other he strikes the ruler a smart blow with a steel rod, and the stone is split. It is not without emotion that ones sees this blow given, for the slightest error may prove fatal to the diamond's value for ever [*sic*]; but it is given without hesitation and with perfect composure.

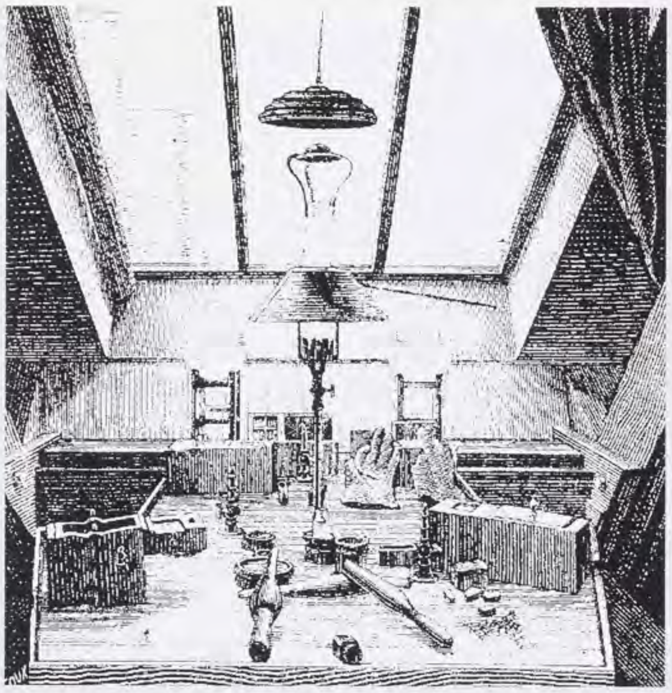


Fig. 1-21

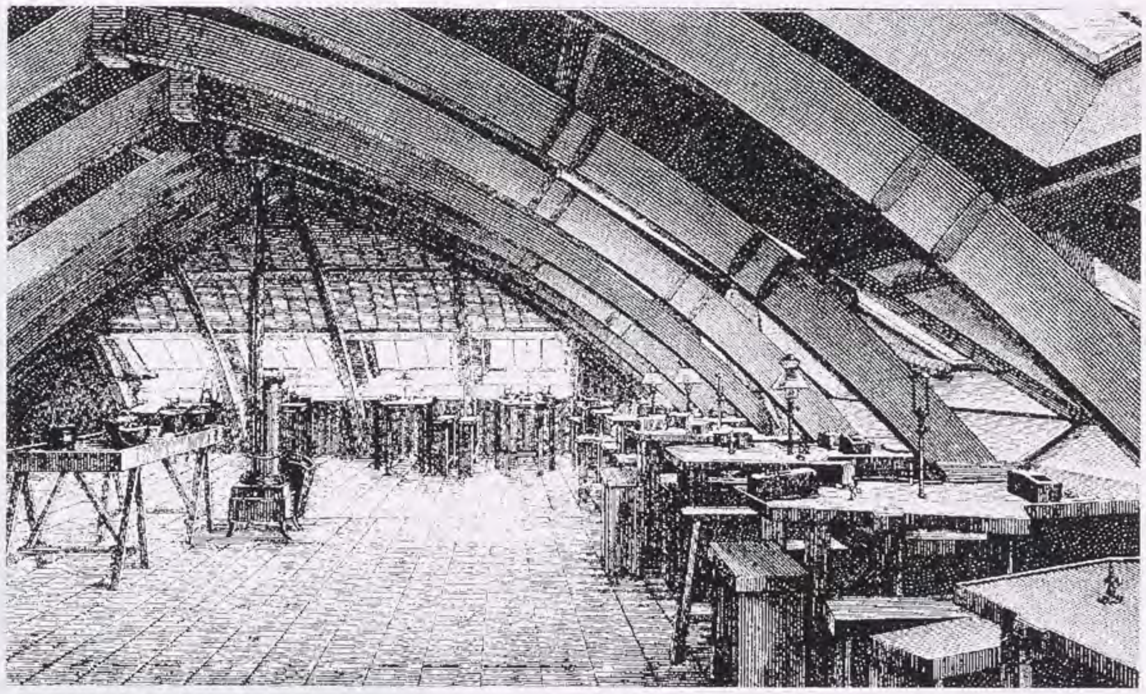


Fig. 1-22

The stone, which is now divided into two parts, is removed from the cement; the main part undergoes a repetition of the operation until it has received its proper form and all flaws are removed; and the fragments are carefully preserved to be cut into little roses, which, however small, have a value.

In Fig. 112 [1-21] a general view is given of the room in which splitters work in Coster's establishment at Amsterdam. Fig. 113 [1-22] shows on a larger scale the complete arrangement of every division in this vast workroom.

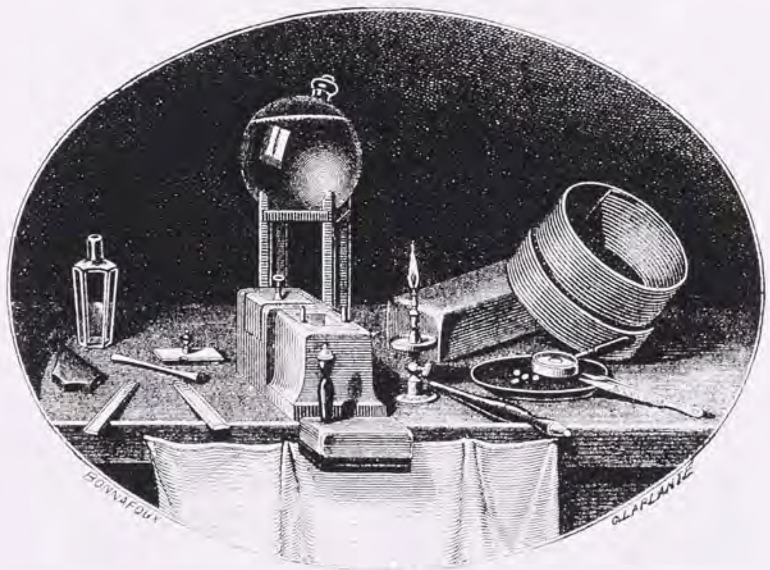


Fig. 1-23

Fig. 115 [1-23] is an illustration of the diamond-splitter's table. The reader will see on the left the blunt-edged steel rulers and the iron rod, somewhat in the shape of a double cone, which serves as a hammer; on the right, a saucer containing diamonds, and supporting a pair of pincers, and a lamp; in front, a handle having the sharp-edged cutting diamond attached, and, standing upright the wooden implement which supports the diamond intended to be split; in the background is a globe of water for concentrating the light at such points as more particularly require it.

Fig. 1-24

From the splitter [Fig. 1-24] the diamond passes to the cutter. At first sight the work appears to be exactly the same as at the table of the splitter. The cutter has two diamonds attached

Fig. 1-25

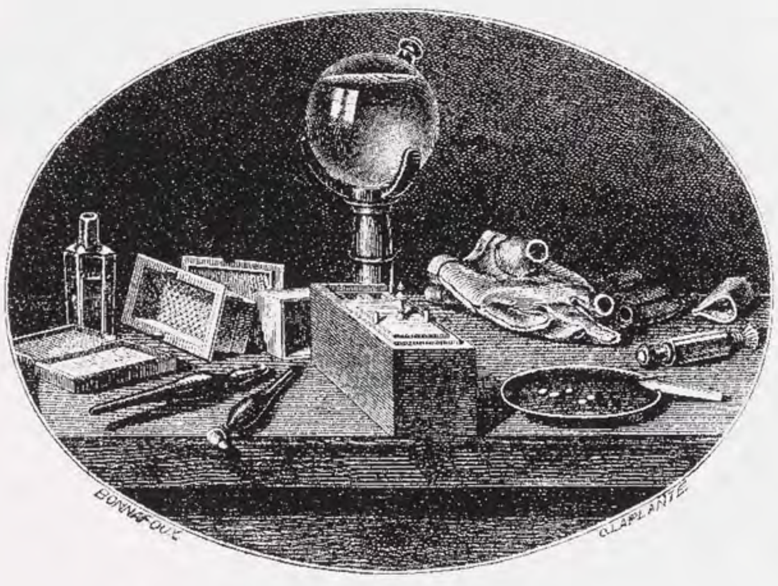


Fig. 1-26

by cement to wooden handles, and the same sort of a box as the splitter has, to receive the diamond-dust. But the process is essentially different. Instead of cutting a notch in one of the diamonds, the cutter is slowly and laboriously grinding the two together in that mutual manner which accomplishes the smoothing of both stones … from the primitive form received from the splitter, he is shaping the facets of the brilliant or the rose.

The work requires great muscular force, and the hands of the cutters [Fig. 1-25] have to be supported by gloves — we might almost call them cases — of stiff leather. These gloves are seen in Fig. 117 [1-26], which represents the tools necessary to the work-table of the cutter.

The work of the cutter is not confined to the removal of the outer crust of the stones — he gives them the definite form which they are to preserve. If the stone is thick enough to produce a brilliant, he forms first the table, then the collet, and successively all the facets of the pavilion and the crown.

It is easily seen that in all this labour a great deal of latitude is left to the cutter; but, as the final weight, and consequently the value of the stone, depends in a great measure on his skill, it is only tried workmen that are intrusted [*sic*] with valuable diamonds, such as those of larger size than four hundred to the carat. Smaller stones are made up in lots and delivered to the workmen after having been weighed.

So long as the diamond-cutter is engaged on a piece of work he shuts up the stones every evening in a little iron coffer provided with a padlock, of which he keeps the key. All these coffers, each with its number, are shut up after working hours in a large strong safe, and distributed to the workmen every morning. When the work is finished the large stones are weighed singly, the small stones in the lots, to see what the loss has been, and, according to the extent of this, the payment is greater or less.

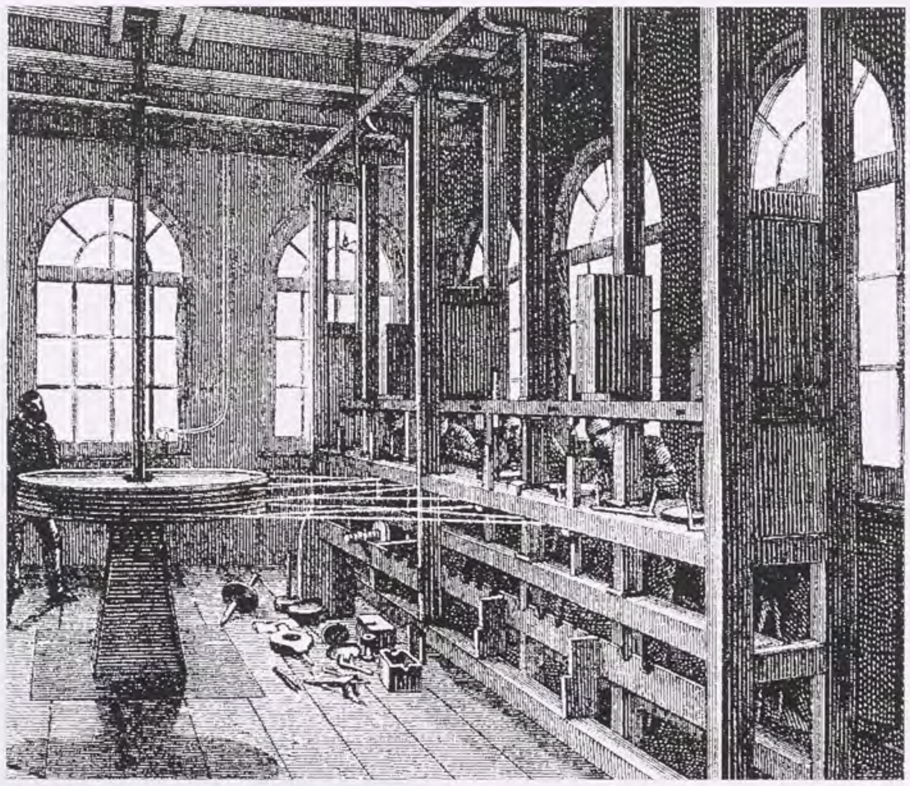


Fig. 1-27

If a stone is found to be wanting in any of the lots, the workman has to pay a fine much greater than the value of the stone. As a brilliant of five hundred to the carat, or still more, a rose of a thousand to the carat, are very small objects, it often happens that they are lost in the course of the manipulations they have to pass through. The floor, and the dust upon it, are then subjected to a most minute examination, in which a long silken broom is used.

The polishing comprehends two distinct operations — the setting, and the polishing properly so called.

The setter has at his command a furnace filled with burning charcoal. His work is to solder the diamond into a quantity of alloy resting in a brass or copper cup, which has attached to it a rod for holding it by. The alloy consists of a mixture of tin and lead, which, when pressed into the cup gives to the whole the form of an acorn, with the diamond at its apex.

This soldering is no easy task. There are sixty four distinct surfaces to be smoothed in the brilliant, and each of these must be properly adjusted in the burning mould. It would seem that the fingers of the setters are fireproof, for it is with their fingers that they adjust the setting of the metal around the diamond; and when, after its manipulation, the alloy is plunged into water to be cooled, the cloud of steam that arises attests the painful temperature to which the hand of the workman has been subjected.

The diamond, set as the apex of the acorn shaped lump of metal, which again rests in a brazen cup with unyielding stem, is given to the polisher.

The polishing rooms [Fig. 1-27] are the most interesting apartments of the great establishments for diamond-cutting, such as that of Mr. Coster at Amsterdam. Before revolving steel disks, that are running scrupulously parallel with the floor, and turning noiselessly with a speed of two thousand revolutions to the minute, are numerous workmen intent upon their task.

The eyes of these polishers seem of little use compared with their sense of touch, which has been exquisitely educated. It is by the instinct of their finger-ends that the point of the diamond — kept constantly wet with

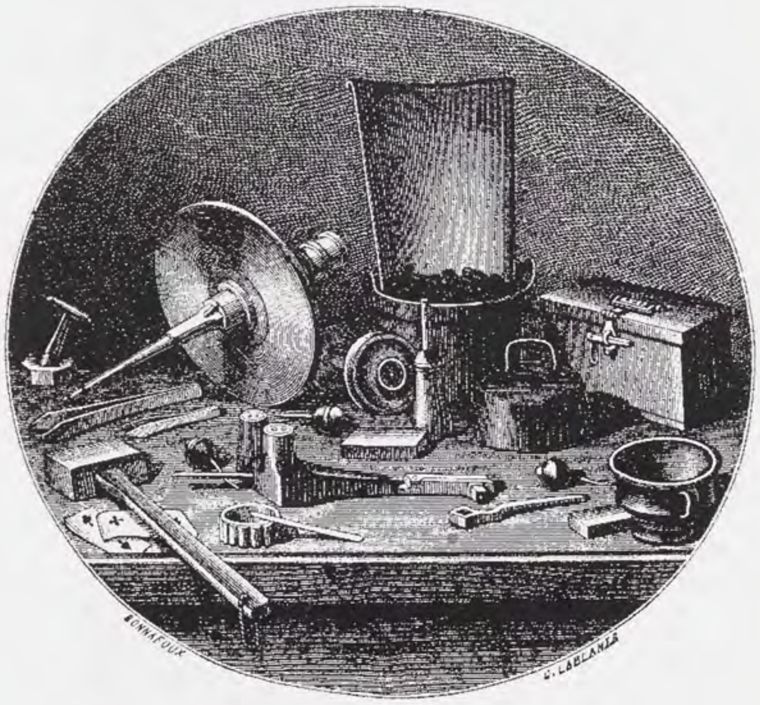


Fig. 1-28

Fig. 1-29

mingled diamond-dust and olive-oil — is adjusted with determinate exactness of position, to the face of the revolving disk. It is clamped in a wooden rest, and the pressure is regulated by leaden weights, so that the diamond just touches the flying wheel. To the casual observer the polishing art seems to be one requiring little skill or intelligence, but to acquire proficiency in the work requires years of assiduous toil.

From generation to generation the trade has been carried on, and the patient and monotonous toil and technical skill inherited and acquired by the finished workman is sure to be rewarded at last by a glittering surface from the hardest stone.

In Fig. 120 [1-28] are shown some of the objects connected with the polishing of diamonds. In the background towards the left the polishing wheel of steel is seen, and scattered over the table three of the copper cups, filled with alloy. The implement near the centre of the table, with the two upright pieces or feet at the left end of it, is for holding the diamond on the wheel during the operation of polishing. For this purpose it has a kind of vice at the end, in which the tail or stem of the copper cup is tightly screwed, and the whole then forms a sort of tripod, the cup which carries the diamond forming the third foot. The nut of the screw, and the key for turning it, are seen at the head of the implement. Its use will be understood from the cut showing the polisher at work (Fig. 119 [1-29]).

Dieulafait abruptly ends the discussion about diamond cutting and begins to discuss colored stone cutting.

Notes

[i] Also spelled Ioan Arphe de Villaphane and Joan Arpice de Villafan.

[ii] "The perfect diamond is one that is cut in such a manner that its entire area is square, with four equal sides and straight angles. And each side is split into four sections, the bezel must have one fourth of A in B and the middle facet should be two fourths, which is half its entire width. From the side, its height must be five sixths of the height of the bezel of C in D, and the remaining four, diminishing to form the depth, E, which is another facet, small and square with each side one eighth of the entire width of the diamond. Thus remaining the four sides of E in C, as large as the facet on top. And polished in this manner, having all the angles whole, and very sharp corners, with the color of iron, polished like a mirror and very clean, and transparent, will be perfect; and its value, depending upon its weight is assessed in this manner."

There follows a discussion of a price table for diamonds, after which the following comments are made: "It is understood that this value is for perfect diamonds, but when they are not perfect, there is great variation and when in spite of being perfect in color, but not in cut, or if perfect in cut, but not in color— although the cut is more easily disguised ... and when there are other defects, such as a broken angle, or if flawed, or it is yellow or blue, then they are worth less, and this is determined as follows: When a diamond of 4 or 6 carats is missing an angle, or it is sullied, or with poor color, it is considered that such a diamond is equivalent to only one carat" (Arfe y Villafane, 1572; translation by Sonia Brodkin, GIA).

[iii] According to Sinkankas (1993), De Mosquera's text explains, "how to correctly judge cutting proportions and thus aid in arriving at more accurate estimates of value, here referring the reader to the folded engraving plate which shows geometric diagrams based on the octahedral crystal of natural diamond, its cross section, various geometrical forms, diagrams of several gem cuts, a balance with weights, scales for measurement, etc., all aimed at facilitating weight estimation, correct cutting proportions, and values."

[iv] The square brilliant was the dominant style of cutting in use at the time; Jeffries only briefly mentioned the round and provided a diagram showing its facet arrangement.

[v] Jeffries wrote the following to show what the "prover" measured: "The next thing to be done, is to produce the Table and Collet [culet]. In order to which, divide the block into eighteen parts from top to bottom; and then take away from the upper part 5/18 and from the lower part 1/18. This gives the upper part, or table side, 4/18 above the girdle, which is 1/3 of the remaining substance; and the lower, or collet side, 8/18 or 2/3; only 12 of the original parts being left in depth. And thus the table and collet are formed; which will be found to bear this proportion to each other, viz. The collet will be one fifth of the breadth

of the table. In this state it is a complete square table Diamond" (Jeffries, 1751).

[vi] "In order to show, that it is calculated to advance the real interest of the trade, and of all who are, or may be possessed of those Jewels, and also that the secrets therein laid upon are those of my own discovering, the effect of many years study, and the perfecting of which for public service has been attended with a considerable expense, and which the trade were not acquainted with before the publication of the Treatise" (Jeffries, 1753).

"THE SUPERIORITY OF THE AMERICAN CUTTING MAY BE SEEN FROM THIS—ALL THE MORSE CUT DIAMONDS ARE SO CUT THAT ALL THE LIGHT ENTERING ABOVE THE GIRDLES IS REFRACTED IN SUCH A WAY THAT IT COMES OUT AGAIN ABOVE THE GIRDLE."[14]

***Boston Traveler*, 1887**

Chapter 2

Mechanization, Ingenuity and Henry Dutton Morse

Industrialization and mechanization affected many trades in the late 19th century, so it was only a matter of time before new technologies were applied to diamond cutting. Many European cutters, steeped in the tradition of keeping trade secrets within the family, adopted some changes, but stronger breaks with tradition were slow in coming. As geological historian John Mawe pointed out half a century before, diamond cutters mainly trusted their own eyes. Mechanization that took away from hand-crafting was resisted by traditionalists.

Of all the methods introduced between 1860 and 1900, mechanical bruting—the critical step in making a diamond truly round—was most fundamental to the development of the round brilliant. Other new methods included analysis of what angles optimized appearance and a way to saw the rough crystal so it could be cut into two diamonds to retain more weight from the original crystal.

[14] "Diamond Cut Diamond," 1887

As appearance became more important, the diamond cutting and jewelry industries slowly, often reluctantly, adopted new ways of thinking. Henry Morse, of Boston, was an integral figure in many of these developments.

Henry Dutton Morse

Henry Morse (Fig. 2-1) was born in Boston on April 20, 1826, the seventh of 11 children. A seventh-generation New Englander, he was the son of Hazen Morse,[15] a well-known bank-note engraver and silversmith, a representative to the Massachusetts State Legislature and later a bank president.[16]

Young Henry started to develop his artistic talents after school in his father's workshop[17] and soon became an engraver known for his workmanship. He wasn't satisfied with engraving, however, and went on to learn gold and silversmithing. The lure of entrepreneurship spurred him to open his own shop at age 18.

Fig. 2-1: A photo of Henry Morse from the scrapbook of his foreman, Charles Field, who held the patents used in Morse's diamond cutting shop. Field kept a scrapbook of notes, news clippings and photos that is held in GIA's John and Marjorie Sinkankas Gemological and Mineralogical Collection. *Field, undated.*

Restless and perhaps not as successful at age 20 as he wanted to be, he paid Clark & Currier, an old Boston jewelry firm, $300 (close to $5,000 today) to learn the jewelry manufacturing business. Morse spent six months as an apprentice with the firm, and then set off on his own as a diamond dealer and jeweler, manufacturing jewelry on Exchange Street, where he stayed until 1858, when he was 32.[18]

That year, Morse became a partner in Crosby, Hunnewell & Morse, a retail jewelry store in Boston that would later be known as Crosby, Morse & Foss.[19] By 1860, Morse (again, never satisfied) was "devoting

[15] *Dictionary of American Biography*, 1936
[16] "American Silversmiths, List of Included Makers," 2004
[17] Foss, 1888
[18] Smith, post-1891; Foss, 1888
[19] Foss, 1888; *Dictionary of American Biography*, 1936

himself to the scientific study of gemmology and developing new revolutionary techniques for cutting gems."[20]

Crosby noted that he had formed a "co-partnership" with Morse, "the diamond jeweler who had been supplying the finest stones in Boston for the last twelve years," in a May 8, 1860, *Boston Evening Transcript* announcement.

Morse was already known for his expertise in diamonds. He not only was in charge of the store's large stock of rare gems, but also directed new jewelry designs in the workshop. He gained even more attention when he displayed his equipment and the results of his diamond cutting work at the prestigious Boston Mechanics' Fair in 1865.

"Crosby & Morse exhibited a case of jewelry at the Mechanics' Fair. ... Many of the diamonds they sold they cut themselves, thanks to Morse's achievements in this area. 'Being the only Diamond Cutters in the country,' they said they had 'superior facilities for obtaining Diamonds of the finest quality, and for reforming and making more brilliant those, that by being badly cut lack force and brilliancy.'"[21]

Morse also started to keep a sketchbook of jewelry designs. Given his engraving training and keen artistic ability, it is likely that many of the sketches are his own (Figs. 2-2 and 2-3), but some have initials that are clearly not his and could have been drawn by Charles Foss or others.

The details of Morse's efforts during this time can only be discerned through his later accomplishments. Exactly when or how he derived various methods to improve diamond cutting are lost, other than by patent records and brief mentions in newspaper articles.

It is clear, however, that Morse decided that rough diamonds should be imported and cut in America.[22] He went to Amsterdam to observe cutting,[23] and decided to make improvements to the equipment he saw there. Records indicate that he was cutting diamonds or overseeing the cutting of diamonds as early as 1860.

Morse eventually enlisted the financial help of Benjamin Pray, a well-known importer and businessman from the Boston area, to set up a new diamond cutting company. Morse likely knew a number of wealthy entrepreneurs because his father was a bank president. Pray was already involved in the import of various African goods[i] when he heard about the discovery of diamond fields there; he checked with his sources and determined it was a worthwhile venture.[24]

[20] Fales, 1995
[21] Ibid.
[22] Smith, post-1891
[23] "Early History," 2000; Fales, 1995
[24] "A Dazzling Story," 1883

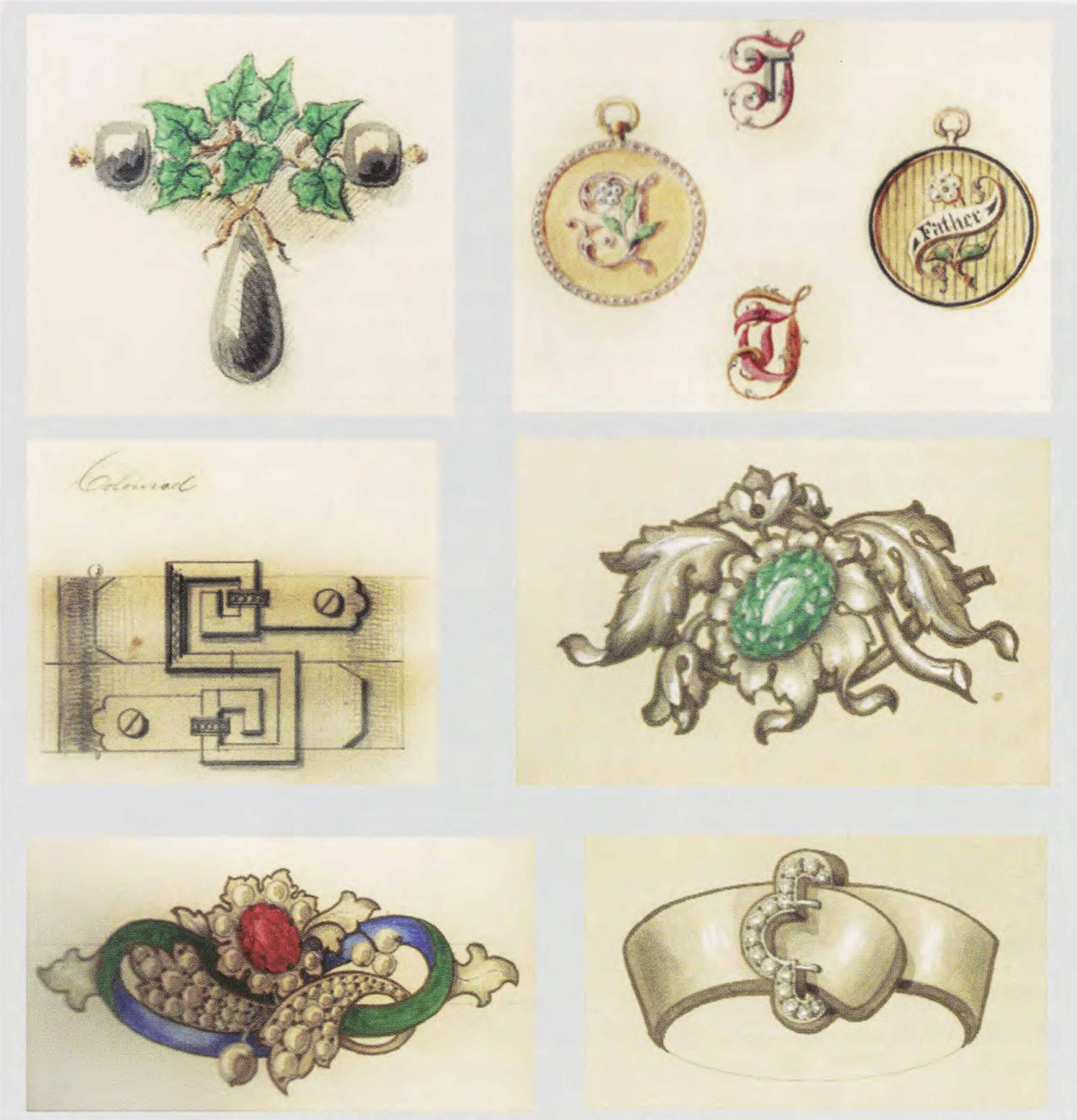


Fig. 2-2: Drawings from Henry Morse's sketchbook. Some are signed with initials that seem to be Charles Foss' (examples not shown). It is unclear if any of the sketches were drawn by Morse, although given his artistic talents, it is likely he drew at least some of them. The dates inside the cover indicate that Henry Morse used this sketchbook until 1885 or 1886; his former partners used it after that. *Courtesy J. & S. S. DeYoung, Inc.*

Fig. 2-3: Note that most of the diamonds from Morse's sketchbook are of a squarish shape. Morse wrote that he cut mostly that shape (see endnote xv, page 60). *Courtesy J. & S. S. DeYoung, Inc.*

The firm of Crosby, Morse & Foss, Jewelers and Diamond Cutters, was formed in 1868 and lasted until 1875. Some accounts state that Pray and Morse started the Morse Diamond Cutting Company in about 1870, and claim that it was the first diamond cutting shop in America. Morse did not, in fact, start the Morse Diamond Cutting Company until about 1875.[25]

Boston's First Cutting Shop

How Morse acquired his staff of cutters is subject to debate, but two different stories have been suggested. In one version, Simon DeYoung, along with several other diamond cutters who immigrated to Boston from Holland as early as 1835, set up a small diamond cutting shop that Morse visited. In the other, Morse had already set up his shop when an itinerant peddler and former diamond cutter (perhaps Simon DeYoung) stopped by to sell fruits and vegetables.[ii]

Whichever story is true, Morse's diamond cutting shop (when Morse was part of the firm Crosby, Hunnewell & Morse, but the name changed several times over the years) was the first formalized diamond cutting business in America. It was located in Central Place, a lane off Washington Street near the Jordan March building (now Macy's department store). Morse later moved the shop to 436 Washington Street, at the corner of Summer Street.

The fruit and vegetable peddler version of the story is the one most reported in newspapers from that time: The peddler went to Morse's shop, saw the rough gems and the apparatus Morse was trying to work with and offered to work for him as a diamond cutter. He said he knew the early steps of cutting a diamond, but didn't understand the art of polishing. Morse, who would never have been satisfied to learn just one part of the process, was surprised that someone who knew how to start the process—how to take advantage of the cleavage planes—could not polish the facets after he shaped the diamond.

The peddler told him of a fellow immigrant in Boston who could be his polisher.[26] Morse agreed and soon found more experienced Dutchmen to do the first diamond cutting in America, including Simon DeYoung, Van Volen, Henry Cohenno and Aron Keiser[iii] (Figs. 2-4 and 2-5).

[25] Smith, post-1891; Foss, 1888; "American Diamond Cutting," 1894

[26] Samuel, 2004, personal comments, great grandson of Simon DeYoung; Hamlin, 1876; "American Diamond Cutting," 1894

Morse wanted to hire more cutters as the business grew, and he thought apprenticeships in his shop would help him train young men. He had been an apprentice for a jewelry manufacturing firm, so he understood how the system worked. But Dutchman Aron Keiser, the first foreman in Morse's shop, refused to teach Americans. Morse thought the expert cutters were too secretive about their work and didn't like that they only allowed Dutch boys to work with them. In their world, apprentices were traditionally bound to their teacher, not their employer, and Morse found these old-world attitudes difficult to tolerate.[27]

The more Morse learned about diamond cutting, the more impatient he grew with the Dutch cutters. Morse thought diamonds should be cut for beauty. He was frustrated with cutters who focused only on weight retention; he couldn't understand why they wouldn't want to cut the most beautiful diamonds, those that were lively, glittering objects of excellence and elegance.

Fig. 2-4: Morse left the retail jewelry firm Crosby, Morse & Foss to open his own Boston diamond cutting firm in about 1875. Some of the "Morse Boys" are pictured, including Jacob DeYoung (later of J. & S. S. DeYoung, Inc.) at the top left. Charles Field is in the middle of the top row. *Field, undated.*

Fig. 2-5: These are some of Morse's cutters in 1882. George Hampton, from left, who became foreman of Tiffany's cutting shop, William Clark, James H. Parks, David Lindsay and Jacob DeYoung, one of the founders of J. & S. S. DeYoung, Inc., of Boston, where the photograph remains on display. *Courtesy J. & S. S. DeYoung, Inc.*

[27] "A Dazzling Story," 1883; Smith, post-1891; Federman, 1985

Henry Morse enjoyed a rich and interesting life in addition to his diamond business. He married Ann Eliza Hayden on May 22, 1849, when he was 23. They had four daughters. He cherished his family, and involved them in many of his pursuits.

An artist at heart, he was a frequent exhibitor at art shows and placed his paintings of landscapes and animals on view (Fig. 2-6); his paintings were well known and commanded high prices for the times. He supported his family for a short time painting animal portraits when business was down. He was also an ornithologist and skilled taxidermist, and known as the "best billiard player in Boston."[28]

Morse, the Man and Artist

Morse's home was his sanctuary. He set aside business concerns and enjoyed lifelong interests such as painting and reading. Although he sold some of his paintings, his art was more about self-expression, a chance to unwind and enjoy his own talents. He decorated his home with stuffed animals, carvings, sketches and paintings, many of which hung on six panels in the dining room. The family often retired to the sitting room after dinner, where Morse would rest in his large leather chair, smoke a cigar and read from his treasured books.

Morse kept his book collection in two walnut bookcases with glass doors and he would spend hours with them. He pored over Audubon's eight volumes, or studied the animal engravings of Sir Edwin Henry Landseer or those in illustrated British volumes. An animated bronze, "Castor and Pollux" (the mythical offspring of Leda and the Swan) topped one case, and several of his portraits of various family pets or animals in heavy gold frames decorated the walls.

His personal favorite, which held the place of honor over the mantel, was a brace of handsome English setters named Speed and Dan. (The latter was named for Daniel Webster, a Morse acquaintance who lived in Marshfield, Massachusetts.) This favorite, displayed at the Boston Art Club in 1868, was purchased by a famous shoe merchant. Morse always had more orders for dog portraits than he could fill.

Fig. 2-6: Morse, in addition to his famed work with diamonds, is also recognized as an American artist. This painting, titled "After the Hunt," sold at Shannon's Fine Art Auctioneers in Connecticut on April 28, 2005, for $14,100. It was painted by Henry Dutton Morse, dated 1857. *Courtesy Shannon's Fine Art Auctioneers, Milford, Connecticut, 2005.*

[28]Foss, 1888; Smith, post-1891

Landseer engravings, painted landscapes by a number of artists, a carving of a hare by Morse, and a copy of a painting by Morse depicting a red setter were also displayed in his home.

Morse's home was near Jamaica Pond and he spent many hours outside, not only boating on the pond, but walking and studying nature, his first love. His fascination with wildlife extended beyond the frequent hunting trips and the many paintings and sketches he drew over the years.

"My mother and grandmother told me more than once how they watched Morse [as an adult] and Abbot Thayer [who came to live with the Morse family until he was 18] busy at painting blocks in different colors and patterns, and setting them in the grass near the house, in order to find out why gamebirds were often so difficult to locate on the ground,"[29] a grandson recounted.

They were exploring "ways in which nature obliterates contrast," better known as camouflage. Thayer, a well-known artist of the period, is also known as the "father of camouflage." World War I soldiers wore the first camouflage uniforms because of his work, and the first British vessel painted according to Thayer's suggestions, the *HMS Broke*, was rammed by two different Royal Navy ships that were unable to spot it before colliding.[30]

By the time young Thayer left the Morse home, Thayer's animal paintings were already being sold.

Morse's influence reaches far beyond diamond cutting. He was never satisfied in his quest to do more and understand more, and most of all, he was enthralled by beauty and yearned to capture or imitate it. This need drove him just as relentlessly in business as it did in his private life.

[29] Channing, 1952
[30] Meryman, 1999; Smith, 2003

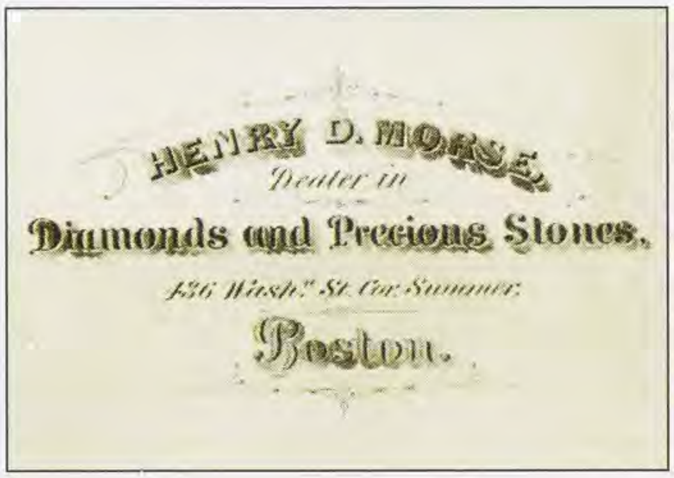


Fig. 2-7: Morse's business card. *Field, undated.*

Morse made a name for himself by speaking out against the Dutch style of cutting. A perfectionist, he was quoted as a gemstone expert (Fig. 2-7) in the *Boston Herald* as saying, "Shopping for diamonds by the carat is like buying a race horse by the pound." This infuriated his Dutch cutters.

Morse went on to say, referring to the Dutch, "They invariably work by the piece; the more they finish within a given time, the more money they make. Consequently the work is slighted; the stones thick, clumsy and ill-shaped with beauty being sacrificed for weight. Their goal is profit for themselves. Such is the character of nine-tenths of the diamonds imported into this country."[31]

Tensions ran high in Morse's shop, but the demand for diamond cutting ran higher. Morse's obsession with capturing beauty drove him to make changes. He carefully watched the workmen as they cut and polished diamonds, then secretly started a shop in nearby Roxbury in about 1864, and hired 23 young women and men to cut diamonds.[iv] The foreman of the Roxbury shop was Charles M. Field.[v][32]

Increasingly agitated with Morse's policies, the Dutchmen decided to strike. Morse responded by immediately replacing them with his Roxbury apprentices. Some of the Dutch cutters were livid. According to one account, "Mr. Pray received a letter at his house one evening, in which his life was threatened if the terms of the foreign workmen were not forthwith agreed to. When they found that intimidation and threats would not work, they resorted to the more sensible plan of competition, and several of them set up business for themselves both in Boston and New York."[33]

Aron Keiser, Morse's one-time foreman, set up his own shop by 1869. When that failed, he joined Henry Cohenno, another former Morse cutter, in a different shop in 1875.[34] Most of the Dutch workers had left by 1871; only Simon DeYoung stayed with Morse. Jacob DeYoung, Simon's 19-year-old son, joined the Morse company in 1877 and both remained there until Morse's death in 1888.

[31] "Early History," 2000
[32] Smith, post-1891
[33] "A Dazzling Story," 1883
[34] "A Directory of Jewelry Concerns in Boston in 1869," 1919; "A New Factory Set Up in Boston," 1877; *The Diamond: Its Source, Properties and Uses,* 1877

Morse, unhindered by the Dutchmen's traditions, could now pursue beauty in diamond cutting. His cutting style evolved to what the trade called the American cut round brilliant, but the DeYoung family (of J. & S. S. DeYoung, Inc.) refers to the cutting style as "Boston Cut" to this day.[35]

Morse and Field Develop Mechanical Bruting

At the time Morse turned his eye to diamond cutting, bruting—often called "cutting" in Europe[vi]—involved attaching two diamonds to sticks and striking or rubbing them against each other to shape the diamond crystal's outline (Fig. 2-8).

This was a difficult process that could take days or even weeks, and the very round shapes necessary for the round brilliant were not a guarantee:

> ONE DIAMOND is rubbed against the other over a small receptacle or wooden trough, cleaver's box, into which splinters and fragments fall directly. In these operations great pressure must be exerted by the hands. The two vertical pins of the cleaver's box are used as an abutment for the sticks when performing this operation. For protection, but without hindering himself, the bruter wears leather gloves over the fingers, with which he exerts pressure. That the fingers suffer under this continual work is inevitable. It cannot be expected, however, that with this hand operation more or less round bodies can be produced.[36]

The bruter would work on a diamond for weeks to shape it into a round. One would think this might mean more wages for the bruter, but in Europe bruters or cutters were paid by the carat; leaving more weight on a diamond was to their advantage.

Fig. 2-8: A bruter rubs two diamonds against each other in order to form the shape or outer circumference of the diamond. The heading on this picture in Mawe's book is "Diamond Cutter," consistent with the British term for the act of bruting. *Mawe, 1823, plate 1.*

By the late 1700s, some diamond cutters (primarily British) were focusing more on rounds, but they were very poorly formed compared to the

[35] "Early History," 2000
[36] Grodzinski, 1953

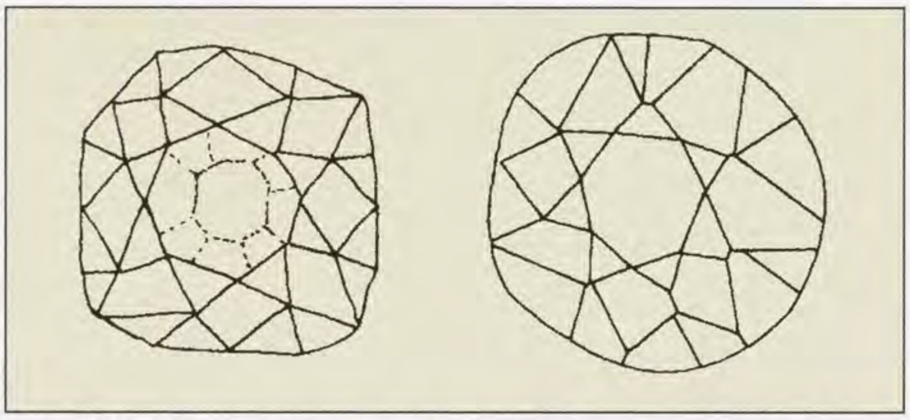


Fig. 2-9: These drawings of round cuts appeared in Dutch pamphlets published in the second half of the 18th century. *Tillander ©Art Books International, 1995.*

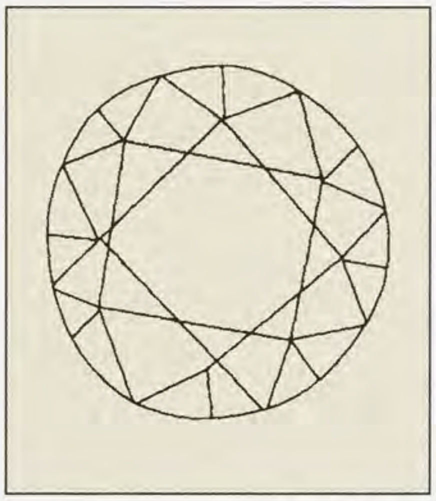


Fig. 2-10: A circular brilliant from John Carton's *Englischer Juwelier* (1818). Some diamond cutters (primarily British) were focusing more on round shapes by 1818. *Tillander ©Art Books International, 1995.*

round shapes of today, as pamphlets of the period show.

Herbert Tillander,[37] one of the 20th century's leading authorities on diamond cuts through history, has illustrations of early cutting (Fig. 2-9) in his book *Diamond Cuts in Historic Jewellery, 1381-1910*. He noted that John Carton illustrated the facets of a circular brilliant in 1818 (Fig. 2-10): "The only possible reason for reproducing such a disgraceful gem in a serious publication must have been that very few people were aware at the time of what a truly beautiful diamond should look like," Tillander speculated.

Despite the relatively poor appearance of these diamonds, there were members of the European jewelry trade in the 1800s who were willing to pay more for round shapes and some took the time to make them. The public seemed to like them and the British were willing to cut some, but they were rare and outside of England, few saw them.

Morse, an independent thinker on diamond cutting, was anxious to improve traditional bruting methods, but relied on the engineering skills of Charles Field, his shop foreman, to invent the mechanical means to do so.

Field applied for patents in Great Britain and the United States in 1873 for a machine (Fig. 2-11) he devised for cutting (bruting and shaping) diamonds.[vii] [38] He then filed another patent for improvements to this machine in 1874. The improvement patent was granted immediately,[39] although the first U.S. patent application was not approved until 1876 because of a competing application by Isaac Hermann,[viii] who learned about cutting from Morse and opened a competing factory in New York.

In the introduction to his first U.S. patent application, Field stated: "Heretofore the reducing or cutting of diamonds has been effected by hand-labor to a great extent, if not entirely, and the purpose

[37] Tillander, 1995
[38] Field, 1873a, 1873b
[39] Field, 1874

of this machine is to perform this labor more perfectly and at much less expense than has been before accomplished."[ix]

Near the end, he added:

AS THE TOOL borne by its carrier moves in a reciprocating path past a diamond held in or upon the arbor of the tail-stock, it sets upon the diamond with abrasive effect, similar to the same operation by hand-labor, but much more rapidly, and I am enabled to reduce a diamond or other stone to its finished form with the mathematical exactness and finish always resulting from mechanical means as distinguished from the results of hand-labor.

There are no records of machine bruting of diamonds in the trade prior to Field's patent, although there was some experimentation in Europe with shaping (also known as "turning") a diamond on a lathe so it could be used to shape softer materials, such as metal.[x] [40]

Although Field was granted his patent in England, it is unclear who originated the idea of using machines for bruting there. It took more than 10 years for some of the large European cutting houses to use machines for bruting.[41]

George Frederick Kunz credits Morse (and thereby Field)[xi] [42] for the original idea of machine bruting. Belgians, however, feel they

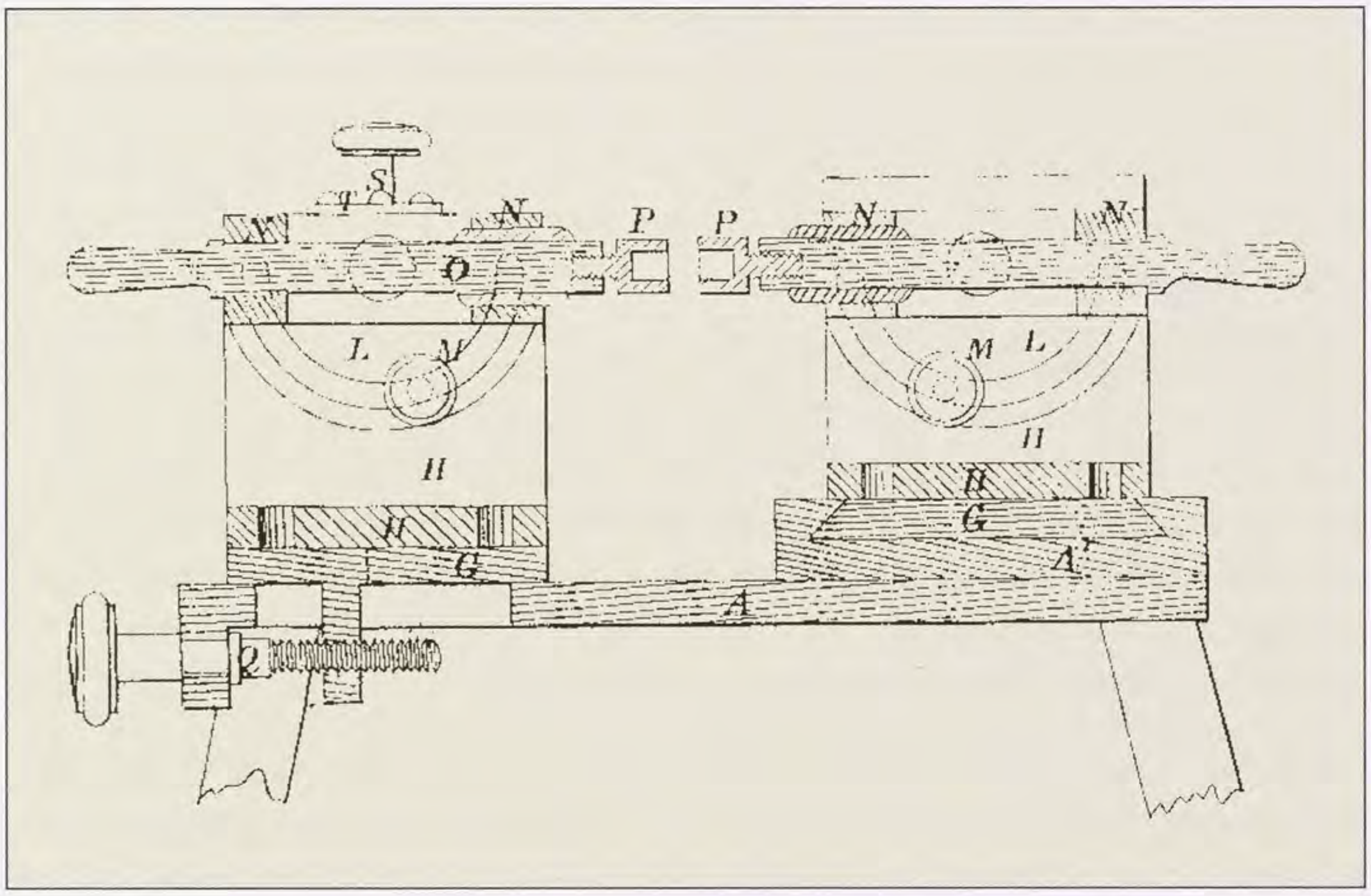


Fig. 2-11: This drawing is from the patent for the Field Diamond Cutting Machine (British Patent 2389/73). It shows two opposing holders that grasp diamonds that rub against each other (see also Fig. 2-18, page 45). By rubbing these diamonds together at high speed in a controlled arc around each other, one diamond is rounded. This is the initial bruting process. Field's patent is believed to be the first record of mechanized bruting. *Field, 1873b.*

[40] "The Early Use of Diamond Tools," 1943
[41] Stern Bros. & Co., 1893
[42] Kunz, 1888a; 1911

were the first to introduce it: "The bruting machine, at first foot-operated but soon motorized, was invented in Antwerp around 1890 by Gerard Leyten, who ran the café 'Au Petit Duc' on the corner of Kievitstraat and Simonsstraat, a meeting-place for diamond dealers before diamond bourses were founded."[43]

Leyten's machine came 17 years after Field's patent. Most Europeans were unaware that it had been used in America since the 1870s.[xii] The earliest non-American patents in Europe for any type of bruting machine were issued in 1891 to Rodrigues in Britain.[xiii] [44] Joseph Asscher (the designer of the famous Asscher cut and cutter of the historic Cullinan diamond) later wrote that "diamond cutting by machine was done in Amsterdam for the first time about the year 1892."[45]

An 1894 article, "The Equipment of a Diamond Cutting Shop," which appeared in *The Jewelers' Circular and Horological Review*, compared the old and new methods: "The old method, still in use in many European shops, is to rub together two rough diamonds, each embedded in cement at the end of a suitably shaped handle. In this country diamond cutters generally use a machine or lathe."[46]

Keiser and Cohenno, the Dutchmen from Morse's original shop,[47] discussed the hand bruting they used in the 1877 booklet *The Diamond: Its Source, Properties and Uses*, and disparaged Morse's method of mechanical bruting: "Lately a certain firm in Boston received a patent for a diamond cutting machine, but it will not be a success, [as] it makes twice as much loss as stones cut by hand, and will produce flaws in clear diamond."[xiv]

Cohenno probably saw Morse working with early mechanical bruting, when he was likely to have damaged a number of diamonds. The stones must be brought together gently at first, or the diamond will be fractured when bruting is done mechanically. Keiser and Cohenno thought Europeans were not mechanically bruting for these reasons. Machine bruting, however, would become the standard within 30 years.

"Old-cut brilliants … were at first modified by making the size and the angle of the facets more uniform, this bringing about a somewhat rounder stone. With the introduction of mechanical bruting …

[43] Kockelbergh et al., 1992
[44] Bruton, 1978
[45] Asscher, 1928
[46] "The Equipment of a Diamond Cutting Shop," 1894
[47] "A New Factory Set Up in Boston," 1877

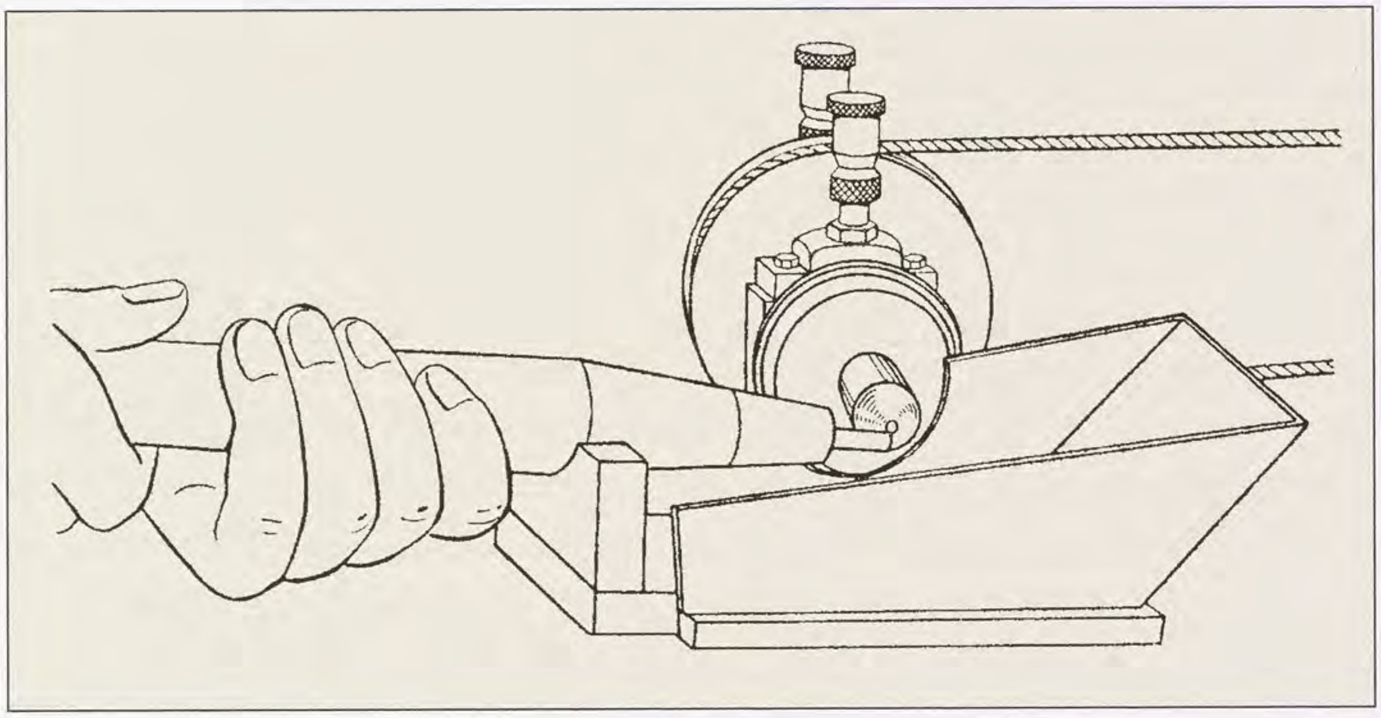
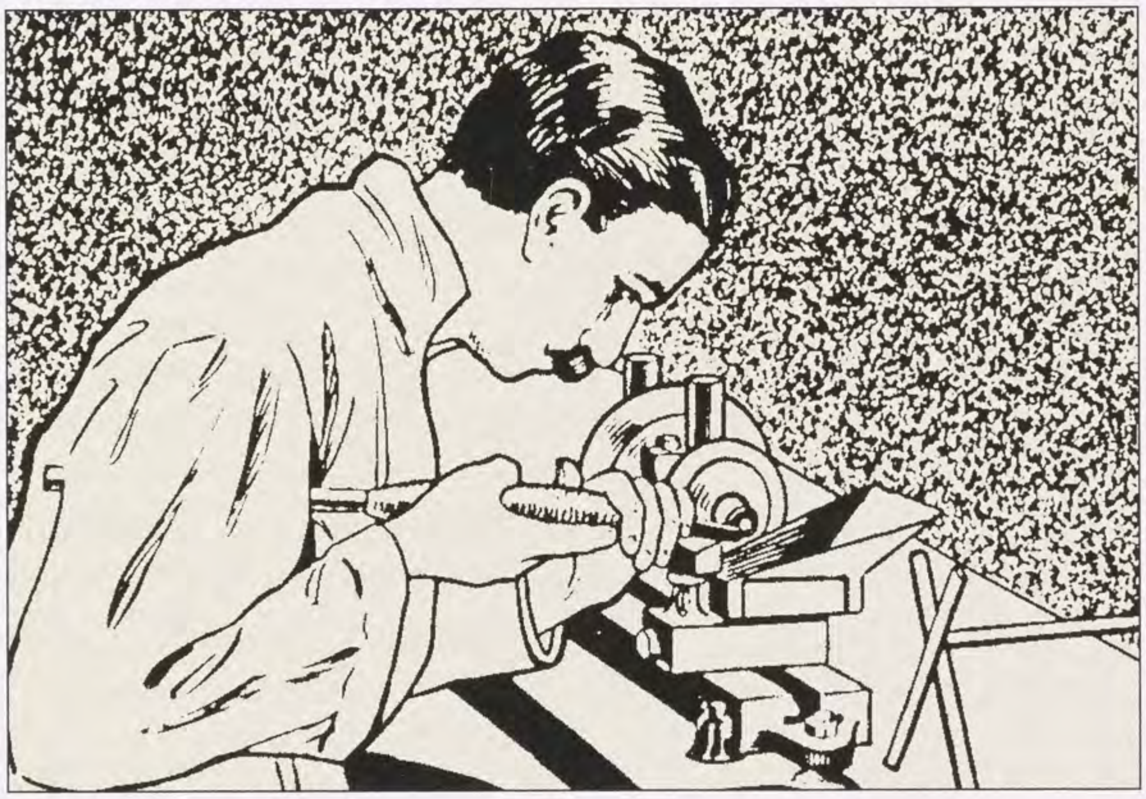


Fig. 2-12: Alternative methods of mechanized bruting were in use by 1902. J. R. Wood & Sons provided the sketch (bottom) of a diamond being shaped (bruted). The drawing (left) shows how the diamond being cut was attached to the spinning lathe while the diamond cutter held a second diamond attached to the shaft. The diamond cutter would then slowly shape the first diamond by grinding it away. *J. R. Wood & Sons, 1902* (bottom); *Grodzinski, 1953* (left).



diamonds were made absolutely circular in plan," wrote Marcel Tolkowsky, whom many credit with determining the proportions that produce the most beautifully cut diamonds, in his 1919 book *Diamond Design*. "The gradual shrinking-in of the corners of an old-cut brilliant necessitated a less thickly cut stone with a consequent increasing fire and life, until a point of maximum brilliancy was reached. This is the present-day brilliant."[48]

J. R. Wood & Sons, Stern Bros. & Co. and several other New York diamond cutting companies[49] were using a simpler form of mechanized bruting by 1902. In this method, a bruter held a shaft with a rough diamond attached to it against a diamond that was being spun by machine. As the diamond on the rotating shaft ground down, the round shape was formed (Fig. 2-12). It is likely this became the preferred method, since the bruter acted as a sort of shock absorber, and the diamond being shaped had some give and fractured less in the process.

[48]Tolkowsky, 1919
[49]Stern Bros. & Co., 1914

The American view of Morse's influence on the diamond cutting trade through mechanized bruting is best summed up in the 1894 Silver Anniversary issue of *The Jewelers' Circular and Horological Review*:

> PRIOR TO THE DAYS of the Morse Diamond Cutting Co., the usual shape of the cut diamond was what is termed in the trade cushion cut. Mr. Morse was the first to introduce the circular shaped stone of to-day which he did soon after he opened his cutting shop. … How popular the circular shape, in which nearly all diamonds are now polished, eventually became, may be imagined when one considers how rarely a cushion or square cut stone is seen to-day.[50]

Morse and Field used their bruting machine for years; there is no evidence they ever used the simplified version that became popular with other cutters in the U.S. by the turn of the century.

Although his revolutionary methods for bruting led to rounder brilliants, Morse mostly cut cushion shaped or squarish diamonds in his shop.[xv] The round shape was too new to be in high demand.

Steam

Other mechanical innovations besides bruting were being introduced in the diamond industry to improve the cutting process. Hand-operated flywheels, capable of only 200 revolutions per minute, were very time consuming. That changed at the 1862 London Exposition when Hunt and Roskell, highly respected London jewelers and silversmiths, demonstrated a steam-driven scaife (polishing wheel) that turned at 2,000 to 3,000 revolutions per minute.[51]

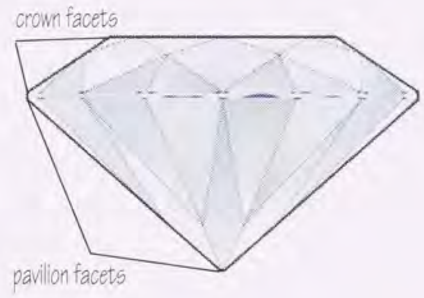
Amsterdam diamond cutter Moses Elias Coster introduced another steam-driven scaife at the 1867 Paris Exposition. Coster used machines powered by horses when he founded Coster's Diamond Cutting Works in 1840. His became the first cutting shop in the Netherlands to introduce steam as the source of power (see "Coster's Diamond Cutting Works in Amsterdam," page 13).

Morse's shop, at its peak, used 24 steam-driven polishing wheels,[52] revolving at 1,500 revolutions a minute.[53] Together, machine bruting and steam-powered polishing wheels made it possible to cut diamonds faster and with much less labor.

[50] "The Diamond Cutting Industry in America," 1894
[51] Bury, 1991
[52] Fales, 1995
[53] Nichols, 1872

Since steam-driven machines appeared as early as the 1860s, it is reasonable to think that some European cutters may have been using machine bruting even earlier, but there is no record of mechanical bruting before Morse's use.[xvi]

Measurement of Angles Gives Way to a New Cutting Style



The face-up appearance of a diamond is critically dependent upon the angles used to fashion it. If the pavilion (bottom) facets are cut at the correct angle, light bounces off them and returns to the top of the diamond, rather than just continuing through the bottom; the pavilion facets become a collection of mirrors that reflect light back. If the crown (top) facets are then cut in a way that help direct light reflections, the diamond can be quite bright and interesting to the observer.

Until the late 1800s, some cutters used the compass (Fig. 2-13), which John Mawe described as a plain brass plate with an attached hinged bar extended at a 45 degree angle, to measure the pavilion and crown angles.[54] These are the same angles advocated by de Mosquera and Jeffries.

Most cutters, however, just cut whatever shape the rough diamond would yield, with little regard to the angles they used, especially if the rough was damaged or irregularly shaped. This variation in angles meant that each diamond looked radically different and none were cut to their potential. Even if the cutters followed the angles that de Mosquera and Jeffries recommended, the diamonds would be considered lackluster and dull by today's standards; the only thing pleasing about them might be their symmetry (if carefully cut).

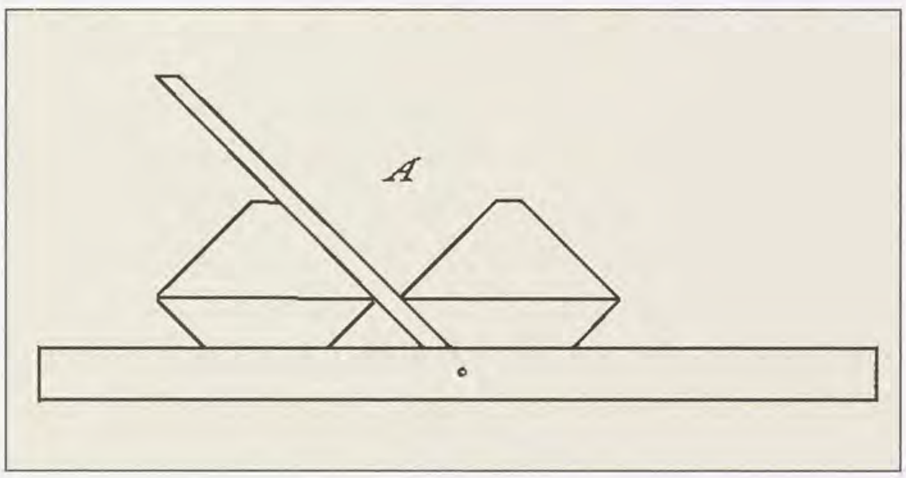


Fig. 2-13: Diamond cutters used the compass to make sure both crown angles and pavilion angles were at 45 degrees, the angle some cutters used up until Morse's time. *Mawe, 1823, plate 1.*

[54] Mawe, 1823

Giving a diamond a smooth, round outline is crucial to placing its facets symmetrically. It is not known when Morse decided to see if certain faceting angles would produce a more attractive appearance, but he couldn't do so efficiently until he perfected rounding the diamond through mechanized bruting. Morse felt he had perfected the process by 1870.

At first he was reluctant to share his results, probably because of the secrecy he encountered when he tried to learn the cutter's art from his Dutch workers. A few sources document that Morse "investigated" the angles at which diamonds should be cut.[55]

An 1883 article in the *Boston Herald* summarized his research:

> MR. MORSE PERSEVERED and, while prosecuting his researches and experiments, he also made a discovery which, in conjunction with the machine, has gone to form a most perfect combination. In determining the angle of light to be reflected, so as to bring out the greatest brilliancy of the stone, the eye of the workman was all that was to be relied upon in this manual system; the least deviation entailed a loss of brilliancy, and a consequent loss of value. By dint of repeated experiments, and after considerable study, Mr. Morse determined upon the exact angle of light which would be most universally applicable in the cutting of the stone. Having decided this, he next invented an instrument which should unerringly produce this ray of light without the deviation of a hair's breadth, so that the workmen need no longer trust to chance to obtain the greatest amount of brilliancy that the stone possessed.[xvii] [56]

All evidence suggests that Morse simply experimented with a number of different angles. Morse and Field also invented the first gauge to measure crown and pavilion angles.[xviii] A brief mention of this gauge appeared in the *Boston Traveler* in 1877:

> IN THIS CONNECTION another important invention—that of Mr. Henry D. Morse—should be mentioned; it is one used for testing the accuracy of the cuttings. It projects the angles of the smallest stone upon a dial which registers its size accurately, and anything not mathematically correct is rejected.[57]

Morse's cutters eventually began to work for others, so after a while he no longer tried to keep the angles and the gauge a secret. Morse didn't sell his gauges to other cutters, but he did let them know that

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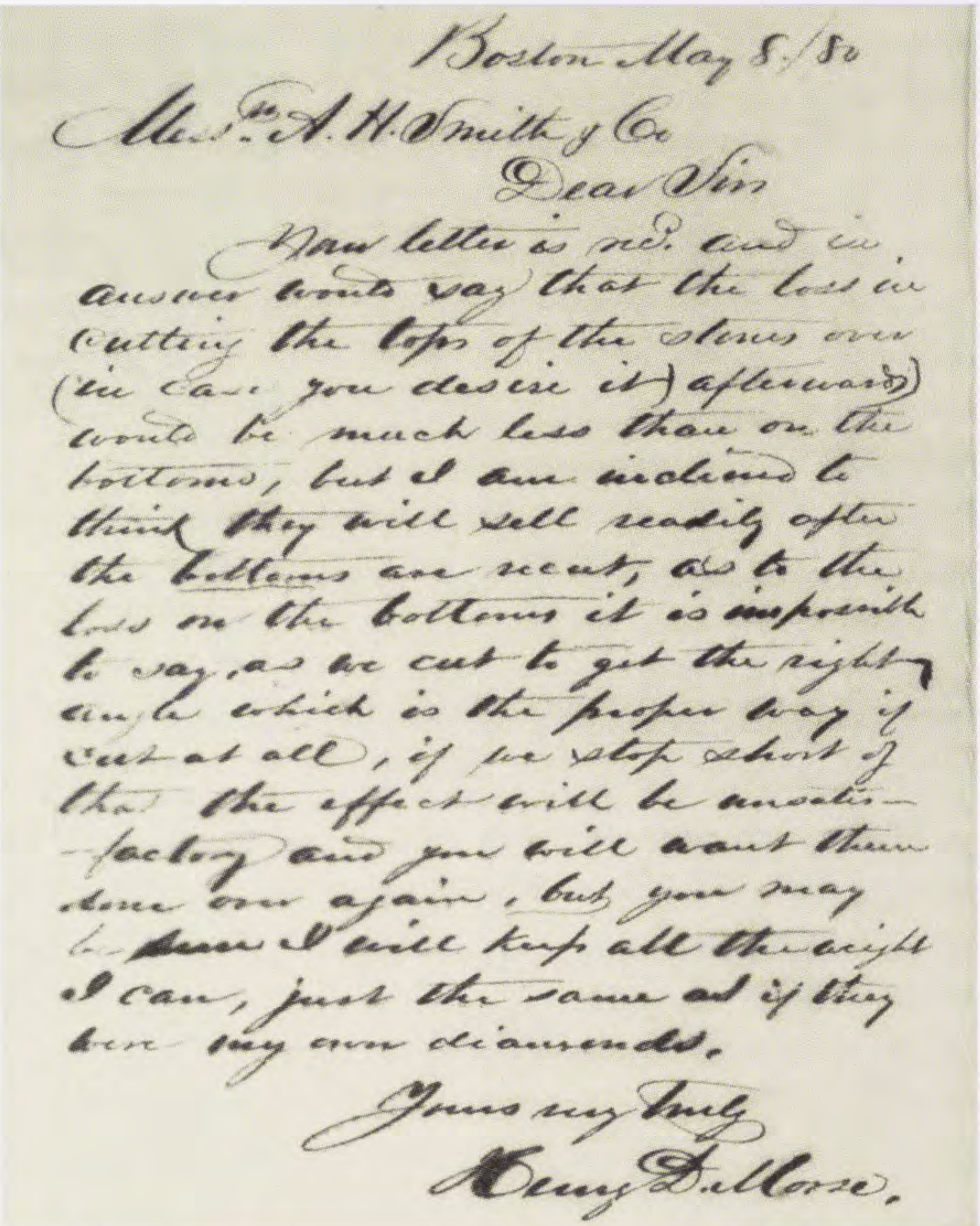
[55] "Diamond Cut Diamond," 1887
[56] "A Dazzling Story," 1883
[57] "Diamond Cut Diamond," 1887



Boston May 8/80

Mess^rs A. H. Smith & Co

Dear Sirs

Your letter is rec'd and in answer would say that the loss in cutting the tops of the stones over (in case you desire it) afterwards) would be much less than on the bottoms, but I am inclined to think they will sell readily after the bottoms are recut, as to the loss on the bottoms it is impossible to say, as we cut to get the right angle which is the proper way if cut at all, if we stop short of that the effect will be unsatisfactory and you will want them done over again, but you may be sure I will keep all the weight I can, just the same as if they were my own diamonds.

Yours very truly

Henry D. Morse.

Fig. 2-14: Henry Morse wrote many letters to explain why he was cutting diamonds the way he was:

"Your letter is rec'd and in answer would say that the loss in cutting the tops of the stones over (in case you desire it afterwards) would be much less than on the bottoms, but I am inclined to think they will sell readily after the bottoms are recut. As to the loss on the bottoms it is impossible to say, as we cut to get the right angle which is the proper way if cut at all. If you stop short of that the effect will be unsatisfactory and you will want them done again. But you may be sure I will keep all the weight I can, just the same as if they were my own diamonds." *From the copy book of Morse business letters, May 8, 1880.*

the Providence Tool Company made his[58] and could do the same for them.

Morse was trying to measure angles and make cutting more precise and efficient because in his mind, the appearance of the diamond was the final arbiter. Morse found that he could improve the face-up appearance by using certain sets of angles. When he saw the great difference it made, he immediately started to tout it to the press and anyone who would look at his diamonds. In one letter to a client, he explained, "[W]e cut to get the right angle"[59] (Fig. 2-14).

[58] Morse letter, August 15, 1883

[59] Morse letter, May 8, 1880

Morse's "Specimen Grade"[60]

Casting around for terms to express the highest quality is not unusual for those who describe commodities or products. Morse, throughout his letters, makes reference to the designation "specimen":

"In answer I would say that I can finish a fine 1 kt [carat] stone for $150, but occasionally get what we call a specimen for which we get about $200." (Aug. 30, 1880)

The term was widely used in Europe at that time to describe the best qualities: "A fine diamond of one carat will ordinarily be bought for £18, still if it be a specimen stone it may realize £20 or £21," London jeweler Harry Emanuel wrote in 1865.[61]

Morse used his best workmen when he needed the finest cutting, and mostly for his own stock. In a letter to his New York agent J. B. Yerrington, he wrote, "As for repairing stones, that pays well, but making stones all over into specimens does not pay and, it would be better to use our best workmen on our own work [rough material] and send it to you to sell. It would give us the profit, and reputation of having fine goods, as for that 2 kt [ct.] specimen, I don't believe such a price will ever be attained again." (April 14, 1880)

Morse did eventually cut specimens for others, as there was demand for it, but rather than charging his usual $8 per carat for recutting other people's poorly cut diamonds, he raised his price to $12 per carat. (May 17, 1882) He still charged $8 per carat for only slight improvement in the cut quality, usually recutting just the pavilions.

Morse used a special designation when the color and clarity were also of the highest quality: "In buying such a stone, I should expect to get it as cheap as we could buy a rough crystal of the same weight and quality, which would be about $400 to $500. As to value when cut, you are a better judge, as I do not think there is any price for an 'extra specimen' which this stone will make. It will depend upon the customer you find to buy it." (May 22, 1882)

Diamonds of the highest color and clarity were rare, and other jewelers would have expected this from specimens: "I hardly think I can suit Tiffany on a karat [carat] specimen—as they no doubt want blue white and we seldom have any of that material, but whenever I can I will see what I can do. Specimens 5/8 and [unreadable number] are very scarce. We only get one occasionally, and they must

[60] Dates in this sidebar indicate dates of letters from Morse
[61] Emanuel, 1865

bring good prices or else keep them to show as a case, as they are worth keeping." (Oct. 22, 1877)

Remember that Morse was bucking the tradition of poor cutting. His specimen grade for cutting seemed to include a range of proportions. Unfortunately, his papers only show the low end of the range for pavilion angle and a satisfactory point for the crown angle.

Another exchange shows that he resisted what others wanted him to do and objected to poor proportions. It also gives an idea of some of the angles that fall into the range of specimen: "Mr. Shutte advised cutting the bottoms only and to take 1/4 of a kt [ct.] off from the bottom of the smallest and then cut the other to match it. I will do as instructed if you say so, but I will give you my advice whether you decide to follow it or not. I have measured the angles on these stones, and the tops [crown angles] vary from 28 to 34 degrees. 28 is much too low, 34 would answer if they were all so. To be specimens we consider all the angles ought to be just exactly alike.

"Now the bottoms [pavilion angles] are from 45 to 48 degrees [more closely matching the shape of typical octahedral crystals], for these flat tops 38 is enough, which shows they ought to be changed from 7 to 10 degrees on the bottoms and to do that with a question of a carat would be impossible. Just what they would lose I can't say, but as stones of this weight I should think [unreadable number] to 1 kt [ct.] each on the bottoms alone, and to do the bottoms only the stones will be improved wonderfully if we can cut them to the proper angle to correspond with the tops and you will find them fair enough in brilliancy.

"But we cannot consider them specimens unless we make them mathematically correct all over [implying that 34 degrees on the crown would be adequate and at least 38 degrees on the pavilion]. I will await your reply before commencing them." (May 6, 1880)

This letter indicates that pavilion angles of nearly 38 degrees could be used for shallower crowns, but we don't have a preferred pavilion angle for his 34 degree crown. Nor do we know if 34 degrees is the only acceptable angle for the crown.

Morse used the term "specimen" well into the mid-1880s. An 1885 letter indicates that it was probably prevalent in the American trade at the time, but was replaced by "Scientific Cut" and "American Cut" by the early 1900s.

Morse used "brilliancy" as his criterion in judging diamond appearance when he talked to others. In an 1877 profile, a journalist in the *Boston Traveler* wrote:

> THE VALUE OF THE DIAMOND is dependent upon its color and brilliancy ... it is a ... canon of American cutting that everything shall be sacrificed to brilliancy. Since the investigations of Mr. Morse resulted in the discovery of the angle of refraction of the diamond which most contributed to brilliancy, all stones are cut upon this principle. ... The Morse system of cutting loses nothing from the apparent size of the stone, as the circumference remains the same as in the case of the European stone, the only difference being a greater brilliancy of the former and the absence in it of large planes reflecting no "fire."[xix] [62]

Loss of material from the rough was probably the biggest reason many cutters resisted Morse's angles and proportions or the new round brilliant.[xx] This was before the use of a circular saw for diamond cutting, so the entire top of the crystal had to be ground or bruted away to begin the faceting process.

Most of Morse's early work involved recutting diamonds, so the loss of weight from the rough was not an important issue for him. Once he started cutting from rough crystals, however, even his own cutters and polishers thought this excessive loss of material was reason enough not to use the new proportions.[63] Of course, this meant that the proportions used by other cutters were often deep, with steep crowns or pavilions that retained more weight from the rough. Morse recut these types of diamonds for various importers[xxi] and eventually replaced the workers who resisted his ideas.

Morse's beliefs about measuring angles eventually had an impact on European cutting. Leviticus and Polak, the Belgian authors of a 1908 Dutch encyclopedia on diamonds that was considered authoritative for the period, gave credit to Morse and Field for their work in this area[64] (Fig. 2-15). Aside from Leviticus and Polak's reference to gauges, it's unclear when European cutters might have first used gauges in diamond cutting, or whether they developed their own angles for round brilliants with the help of a gauge.

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[62] "Diamond Cut Diamond," 1887

[63] *The Diamond: Its Source, Properties and Uses*, 1877

[64] Leviticus and Polak, 1908

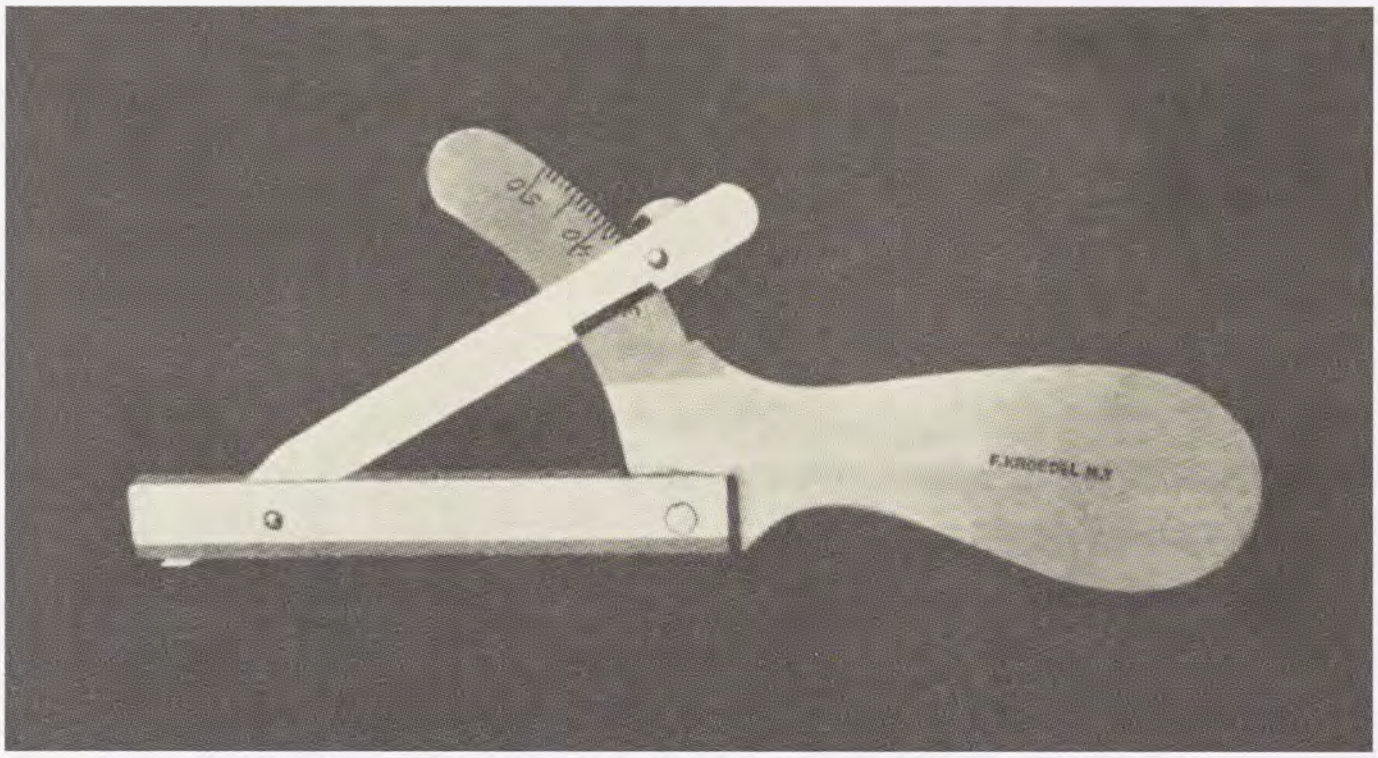


Fig. 2-15: Morse and Field are credited with inventing an adjustable gauge for measuring diamond cutting angles, similar to the one pictured here (see endnote xvii, page 60). By Leviticus' time, some cutters used fixed gauges for 39, 40, 41 and 42 degree angles. Some gauges could only be used on the crown or pavilion (due to their fixed angles). *Leviticus and Polak, 1908.*

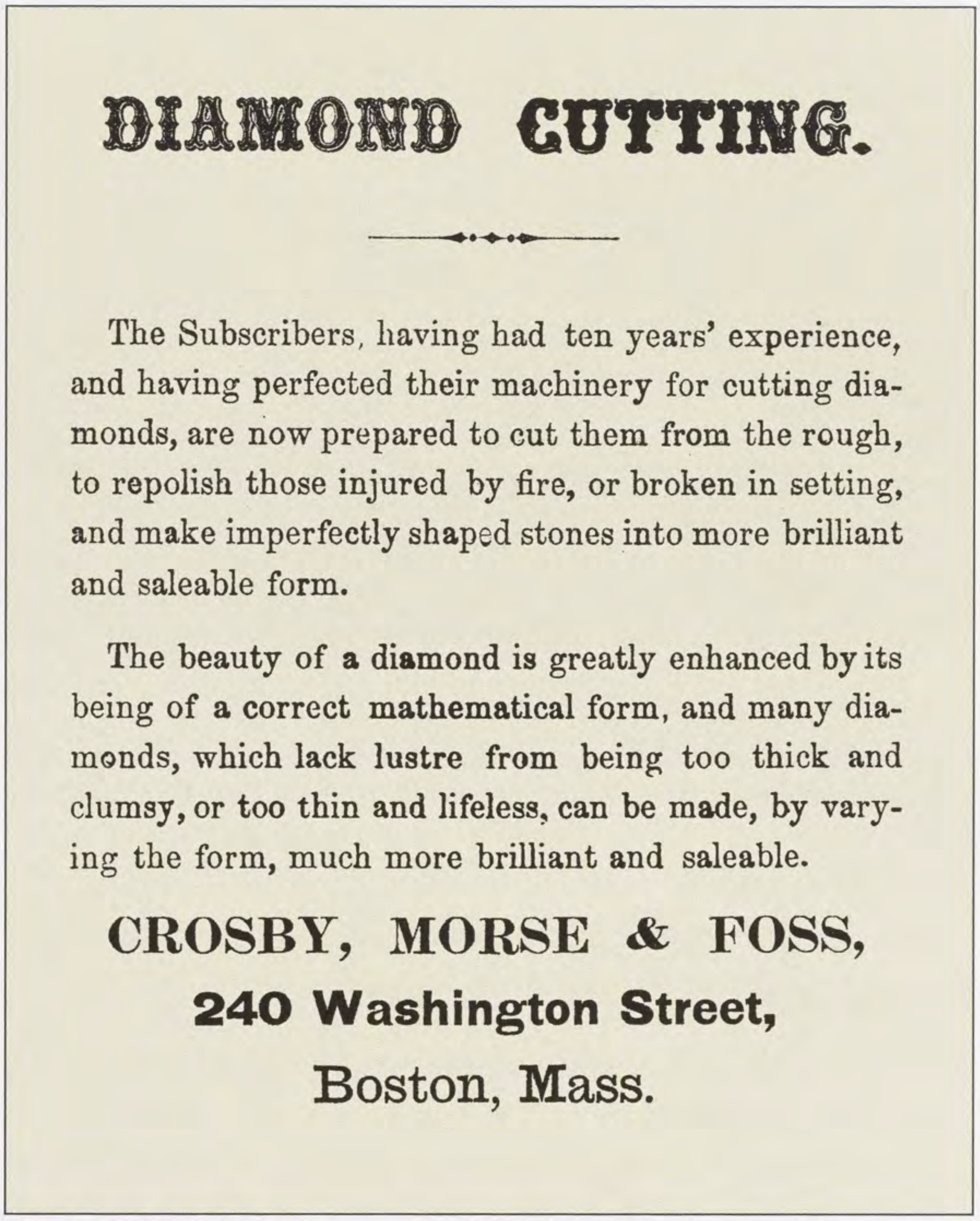
Morse's Reputation Spreads

Morse's shop reflected his character. His relentless, never-tiring search for improvements and beauty are what made him successful.

A rough diamond found by a laborer grading streets in Manchester, near Richmond, Virginia, was brought to Morse in 1869 and helped establish this success.[65] The Dewey or Morrissey diamond (also called the "Orinoor") originally weighed 23.75 carats. When Morse cut it into an 11.70-ct. cushion-shaped polished diamond, he "permanently established his reputation as a cutter and polisher."

The Dewey diamond was first owned by Senator John Morrissey, and later by Alvin Adams of the Adams Express Company.[66] An article about American diamond cutting and Morse appeared in *The Watchmaker and Jeweler* magazine in 1870 after the attention brought by his cutting of the Dewey diamond. It stated that Morse "has had charge of the diamond department of the firm above named for the past twelve years."[67]

[65] "American Diamonds," undated; *Dictionary of American Biography*, 1936
[66] "The Death of Henry D. Morse," 1888; Kunz, 1894b; "The Diamond Cutting Industry in America," 1894; "American Diamond Cutting," 1894
[67] "Diamonds," 1870



DIAMOND CUTTING.

The Subscribers, having had ten years' experience, and having perfected their machinery for cutting diamonds, are now prepared to cut them from the rough, to repolish those injured by fire, or broken in setting, and make imperfectly shaped stones into more brilliant and saleable form.

The beauty of a diamond is greatly enhanced by its being of a correct mathematical form, and many diamonds, which lack lustre from being too thick and clumsy, or too thin and lifeless, can be made, by varying the form, much more brilliant and saleable.

CROSBY, MORSE & FOSS,
240 Washington Street,
Boston, Mass.

Fig. 2-16: Morse's first known advertisement in a trade magazine appeared in an 1870 issue of *The Watchmaker and Jeweler. Crosby, Morse & Foss, 1870.*

Morse placed his first known advertisement for diamond cutting services in the same issue (Fig. 2-16). In it, he wrote of having perfected the "machinery [and tools] for cutting diamonds" (Figs. 2-17, 2-18 and 2-19) and how he could improve on the quality of cut diamonds.[68] Morse also took out ads in a local Boston paper after he started the Morse Diamond Cutting Company in 1875. The ad, with the tagline "Diamonds a Specialty," stated: "I am able to produce gems of superior beauty and brilliancy" (Fig. 2-20).

[68] Crosby, Morse & Foss, 1870

Fig. 2-17: Morse not only found a way to shape diamonds more efficiently and to measure the best angles for cutting, he also tried to make his equipment more practical. He didn't like "the rude and cumbersome apparatus" *(Hamlin, 1876)* used by Europeans and was "determined to discard the heavy wooden table used by the Dutch, and to substitute a smaller metal one, so fixing the diamond upon it that, even with the heavy powder used, it remained steadier in its position," unlike "the larger and more cumberous contrivance." *"A Dazzling Story," 1883; Fales, 1995.*

This series of drawings is signed by E. B. Morse, but it is not known if the artist was related to Henry Morse. The drawing on the upper right depicts women cutting diamonds; Morse is given credit for being one of the first to train women to cut diamonds. Isaac Hermann, who learned from Morse, continued this practice. Sketch 3 (above) is probably Simon DeYoung, whose job was to position the diamond in the lead dop so facets could be properly cut. This picture still hangs on the walls of J. & S. S. DeYoung, Inc., in their Boston office.

The small shop that started with a few men had grown to 30 employees (men and women). Morse, always trying to innovate, soon had 24 polishing wheels, powered by steam.

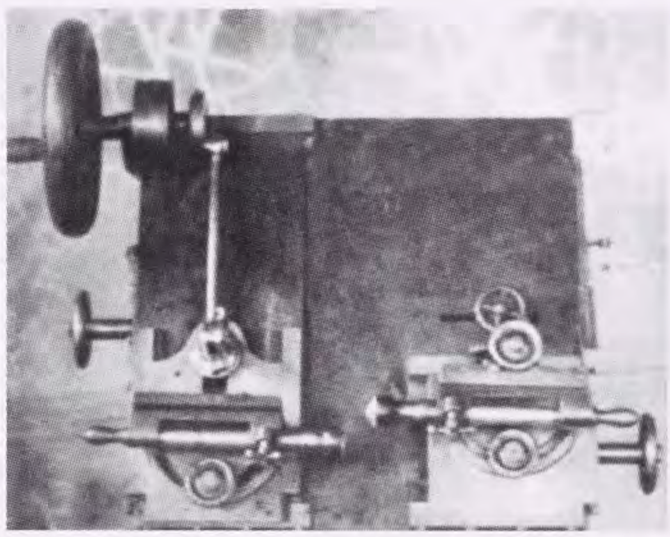
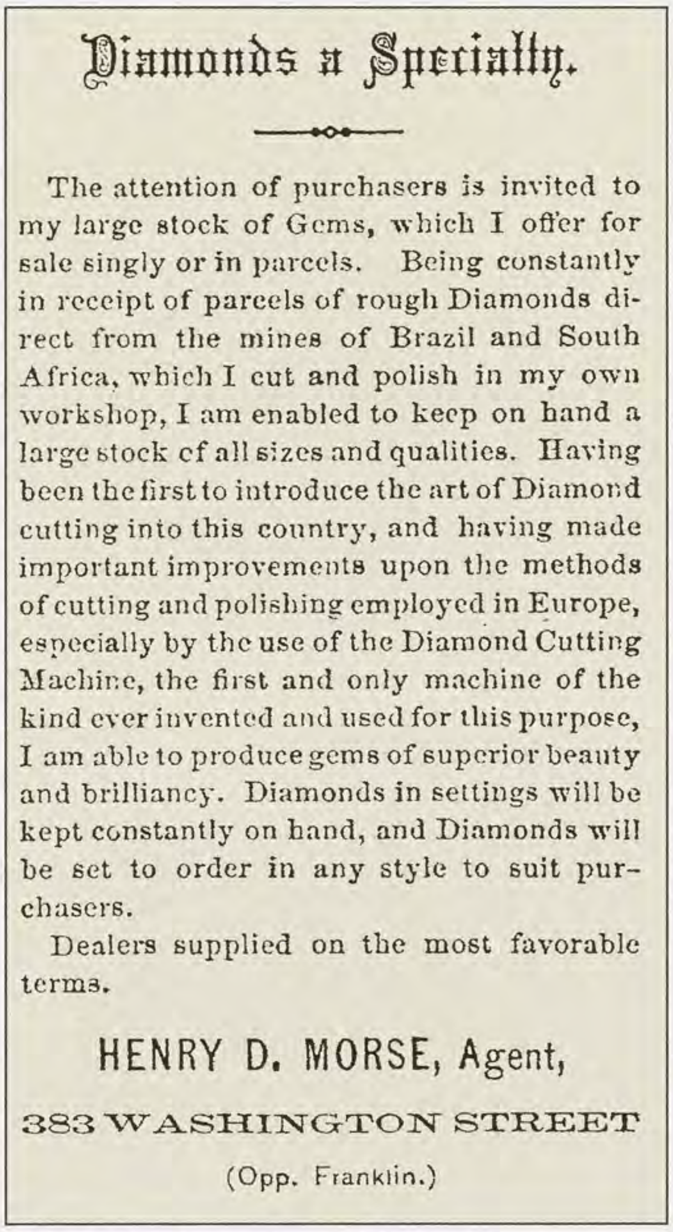


Fig. 2-18 Morse used the Field "cutting machine" for bruting. *Field, undated.*

Fig. 2-19: This custom case with Henry Morse's name on the box contains a goniometer for measuring angles. Morse was the first to empirically cut diamonds to different angles, observe the differences in appearance and determine a best set of angles. These were Morse's personal tools. *Photos by Al Gilbertson/GIA. Items in the GIA collection.*



Diamonds a Specialty.

The attention of purchasers is invited to my large stock of Gems, which I offer for sale singly or in parcels. Being constantly in receipt of parcels of rough Diamonds direct from the mines of Brazil and South Africa, which I cut and polish in my own workshop, I am enabled to keep on hand a large stock of all sizes and qualities. Having been the first to introduce the art of Diamond cutting into this country, and having made important improvements upon the methods of cutting and polishing employed in Europe, especially by the use of the Diamond Cutting Machine, the first and only machine of the kind ever invented and used for this purpose, I am able to produce gems of superior beauty and brilliancy. Diamonds in settings will be kept constantly on hand, and Diamonds will be set to order in any style to suit purchasers.

Dealers supplied on the most favorable terms.

HENRY D. MORSE, Agent,

383 WASHINGTON STREET

(Opp. Franklin.)

Fig. 2-20: An undated Morse advertisement emphasizes the "superior beauty and brilliancy" of his cutting. *Henry D. Morse, undated.*

As it turned out, people familiar with Morse's cutting did pay more for his diamonds.[xxii] Morse was not satisfied with the compensation for his work, however, because it was difficult for him to recover the cost of the time he needed to work carefully or the weight loss incurred. He certainly was paid more for his goods than those cut by most foreign sources. Morse and his agents spent considerable time negotiating terms and prices with clients (Fig. 2-21).

Hermann and Tiffany Follow Morse

Isaac Hermann, a successful New York jeweler, was probably the first diamond cutter in America to follow Morse's lead[xxiii] (Fig. 2-22). Hermann took two rough diamonds to Morse in 1870 and made notes as Morse cut them. The two stones are believed to be the first rough diamonds from South Africa to be cut and polished in America.[69]

Hermann became interested in diamond cutting after watching Morse, and he established a cutting shop in New York in 1871.[70] Thinking there must be immigrants from Belgium and Holland living in New York who had experience cutting diamonds, he walked the streets to search for them; he found 20.

Hermann had his machines built to mimic Morse's cutting style. He set up shop with the new equipment,

[69] "American Diamond Cutting," 1894
[70] Leviticus and Polak, 1908

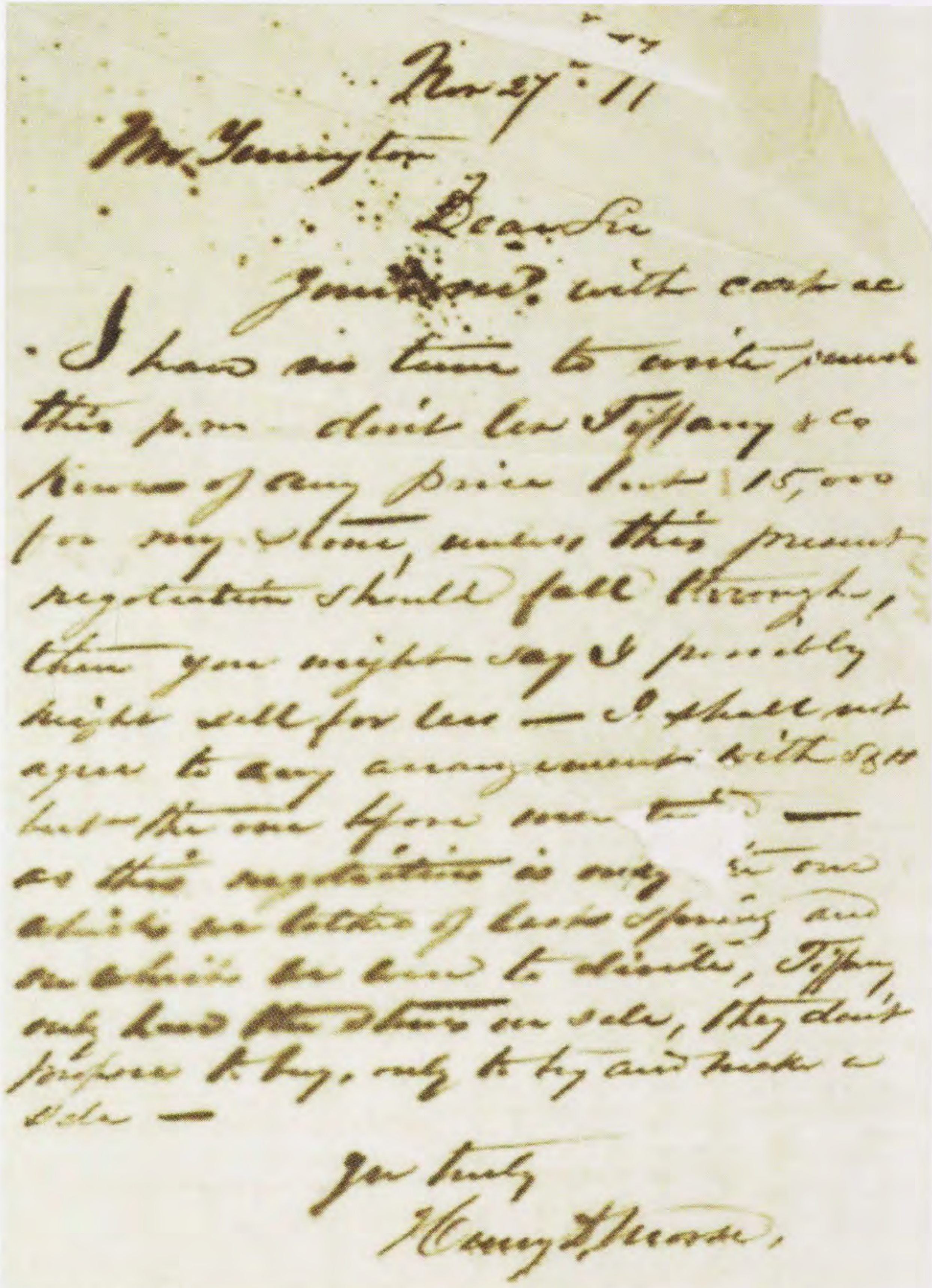

Nov 27 / 77
Mr. Yennington
Dear Sir
Yours recd with cont ac
I have no time to write much
this p.m. don't let Tiffany & Co
know of any price but 15,000
for my stone, unless this present
negotiation should fall through,
then you might say I possibly
might sell for less — I shall not
agree to any arrangement with S&H
but the one before mentioned —
as this negotiation is only in one
which we talked of last spring and
one which we were to decide, Tiffany
only have the stones on sale, they don't
propose to buy, only to try and make a
sale —
Yrs truly
Henry D. Morse

Fig. 2-21: This letter written by Henry Morse reads:

"I have no time to write much this p.m. Don't let Tiffany & Co know of any price other than 15,000 for my stone, unless this present negotiation should fall through, then you might say I possibly might sell for less–I shall not agree to any arrangement with S&H but the one before mentioned–as this negotiation is ... over which we talked of last spring and one which we were to decide. Tiffany only has the stones on sale, they don't propose to buy, only to try and make a sale." *From the copy book of Morse business letters, November 27, 1877.*

Fig. 2-22: A drawing by the Moss Engraving Co. (New York) shows Isaac Hermann inspecting the facets on a diamond around 1871. Hermann copied his machines from Morse and is considered one of the early diamond cutting pioneers in the United States. *"One Carat Perfect: $100,"* ©*JCK, 1969.*

purchased some rough and started cutting. "Then trouble began. Mr. Hermann's Holland workmen refused to use his newfangled machinery. They demanded that the regulation wheels and other appliances in use in Holland be imported for their purposes."[71]

Hermann, like Morse, tried to reason with the angry employees, but they felt they knew diamond cutting better and wanted to follow their traditional methods. He imported machines from Holland to appease them, but didn't stop trying to reason with them. Over time, "these contrary workmen were convinced of the superiority of the American machinery of Mr. Hermann, and it was again set up and used."[72]

Even though Hermann became well known, Morse was still recognized as the originator of the revolutionary cutting concepts.[xxiv] He was given credit for the innovation by *The Jewelers' Weekly* in 1894: "To his own ingenuity and foresight, however, are due many of the improvements in the art and favorable conditions for the industry enjoyed by those who follow it to-day."[73]

Hermann tried to patent a bruting machine similar to Field's, but there are no records to indicate why it failed or if it was considered an attempt at infringement. The dispute over whose patent came first was resolved in Morse's and Field's favor with no hard feelings. In fact, it seems that later on Morse and Hermann got along well; they formed a two-firm lobbying group to set up a uniform scale of wages for the diamond industry.[74]

The Jewelers' Weekly gave both men equal credit for the development of the new cutting style in 1894:

> NEITHER OF THESE PIONEERS in American diamond cutting ever served an apprenticeship to the trade, and yet the two have so impressed their genius upon the industry that their methods have revolutionized it. To their experiments are due the great brilliancy now regarded as indispensable to perfect gems ... according to the American methods established by Mr. Morse and Mr. Hermann. To them is due the high standard of brilliancy attained by modern diamond cutters, whether in this country or across the sea.[xxv] [75]

Morse also influenced a number of diamond cutting shops, including Tiffany & Co.[76] George Kunz, vice president of Tiffany,[xxvi]

[71] "American Diamond Cutting," 1894
[72] Ibid.
[73] Ibid.
[74] Ibid.
[75] Ibid.
[76] Fales, 1995

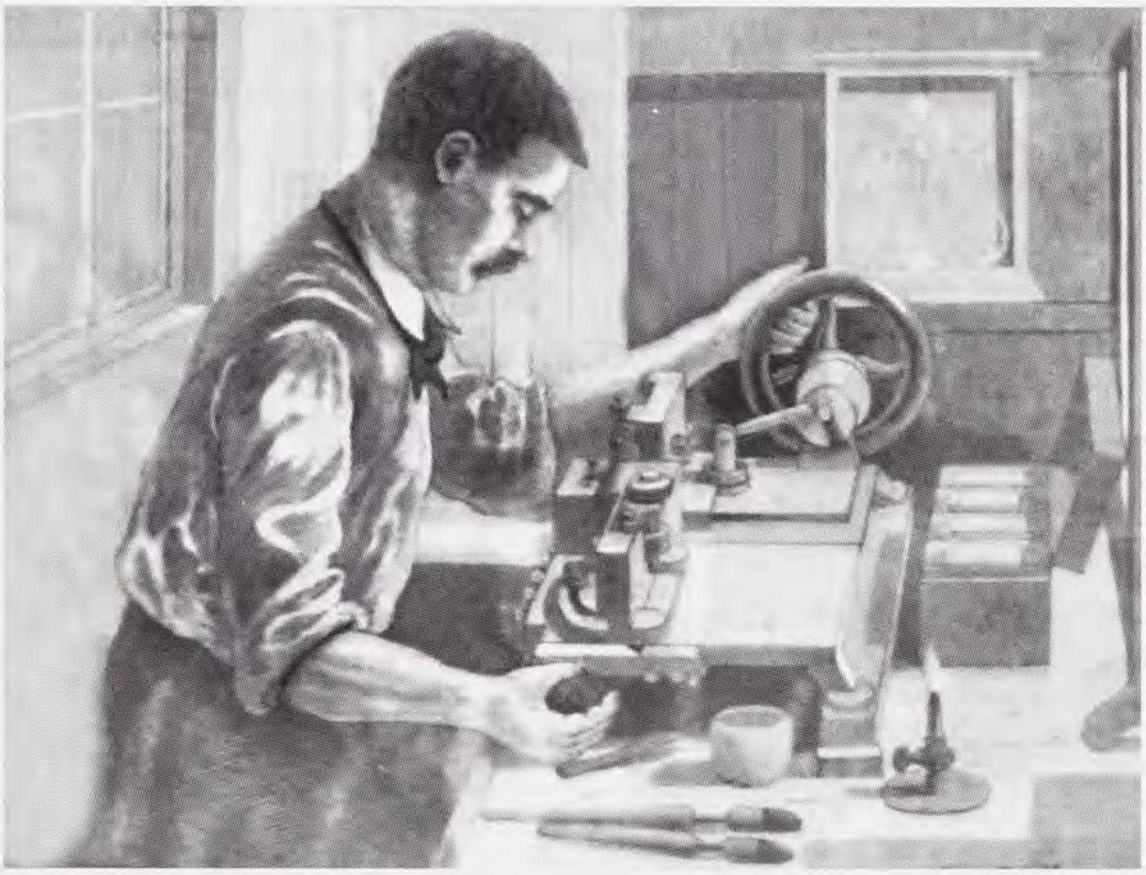


Fig. 2-23: The Field diamond cutting machine in use in Tiffany & Co.'s fifth-floor diamond cutting department was part of a July 18, 1891 article in *Scientific American*. The article, "Diamond Cutting by Hand and Machine," stated, "The jewelry firm of Tiffany & Co., of this city [New York], among others, have in operation a shop in which diamonds are cut and polished from the rough, and are recut when the original cutting as performed in Amsterdam or elsewhere has not left them of satisfactory brilliance." George Hampton, a former employee of Morse and the Tiffany & Co. shop foreman, supplied details about diamond cutting for the article. The photo caption gave credit to Field for the machine. *"Diamond Cutting by Hand and Machine," 1891.*

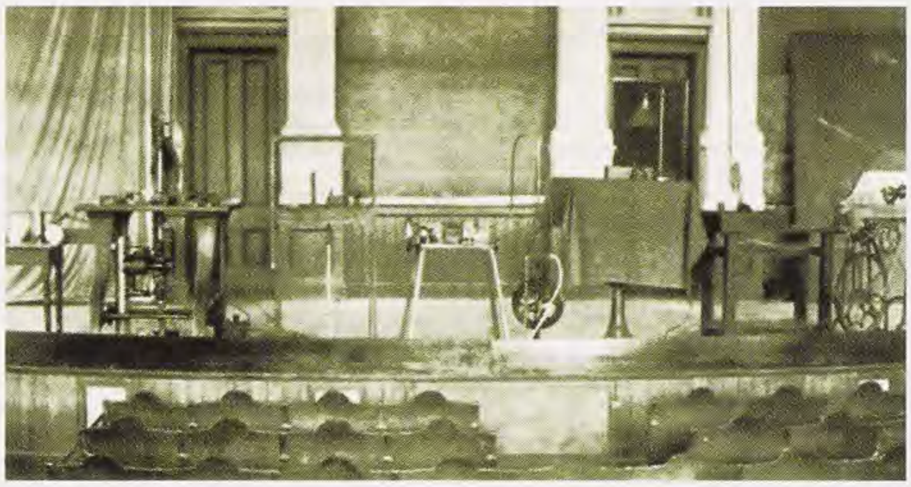


Fig. 2-24: George Kunz talked about diamond cutting at the Lowell Institute in Huntington Hall (Boston) in 1895. *Field, undated.*

was particularly excited by the changes in diamond cutting Morse initiated. Tiffany opened its own cutting shop[xxvii] sometime between 1880 and 1881,[xxviii] and by 1886 was advertising this service to the public.[xxix]

The company was using equipment designed by Field[xxx] by 1891. George Hampton, who had been a cutter for Morse, was the director of the Tiffany & Co. diamond cutting shop.[xxxi] [77] He supplied details about the diamond cutting process for a cover story of an 1891 issue of *Scientific American*, which also featured a sketch of the Field diamond cutting machine (Fig. 2-23).

Kunz often lectured on many aspects of gemstones, including diamond cutting. He set up diamond cutting equipment to show the stages of cutting, including the Field bruting machine (Fig. 2-24), on March 21, 1895, at the Lowell Institute in Huntington Hall in Boston.[78] He sometimes brought a polishing wheel (scaife) to his talks, including one of the original wheels used by Henry D. Morse, whom he described as a diamond cutter "par excellence."[79]

[77] "A Miniature De Beers at the Fair," 1893
[78] Field, undated
[79] Kunz, 1898

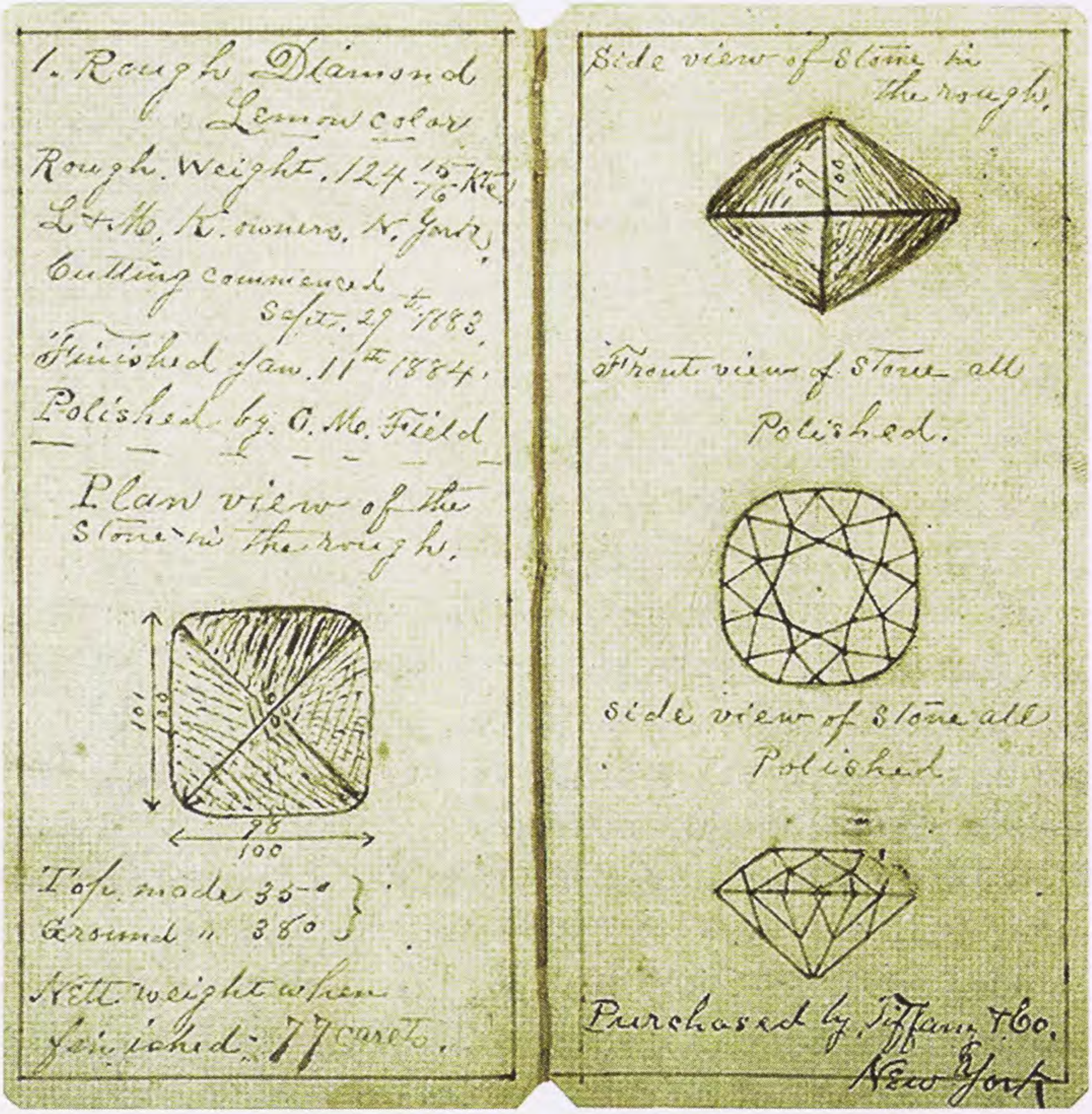


Fig. 2-25: The handwriting on this drawing of the Tiffany II is probably Field's. Note the angles mentioned for the crown ("top") and pavilion ("ground"). Using an optical, non-contact measuring device, the crown angle of the copper model (see Fig. 2-26) is 36.7 degrees and its average pavilion angle is 38.8 degrees. This shows how close Field's use of the gauge by eye was for the times. *Field, undated.*

Morse Cuts the Tiffany II

Morse was asked to cut what was then the largest diamond polished in the United States in 1883, which was owned by L. & M. Kahn & Co. of New York[80] (the finished stone was later purchased by Tiffany & Co. and called the Tiffany II). Morse cut the 125-ct. yellow crystal to a 77-ct. finished diamond (Fig. 2-25).[81]

[80] "American Diamond Cutting," 1894
[81] Fales, 1995; Federman, 1985

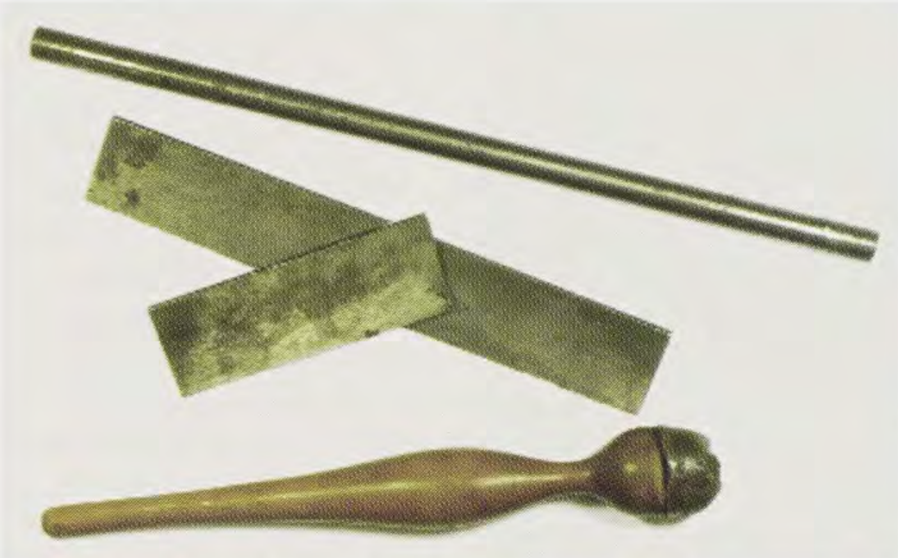
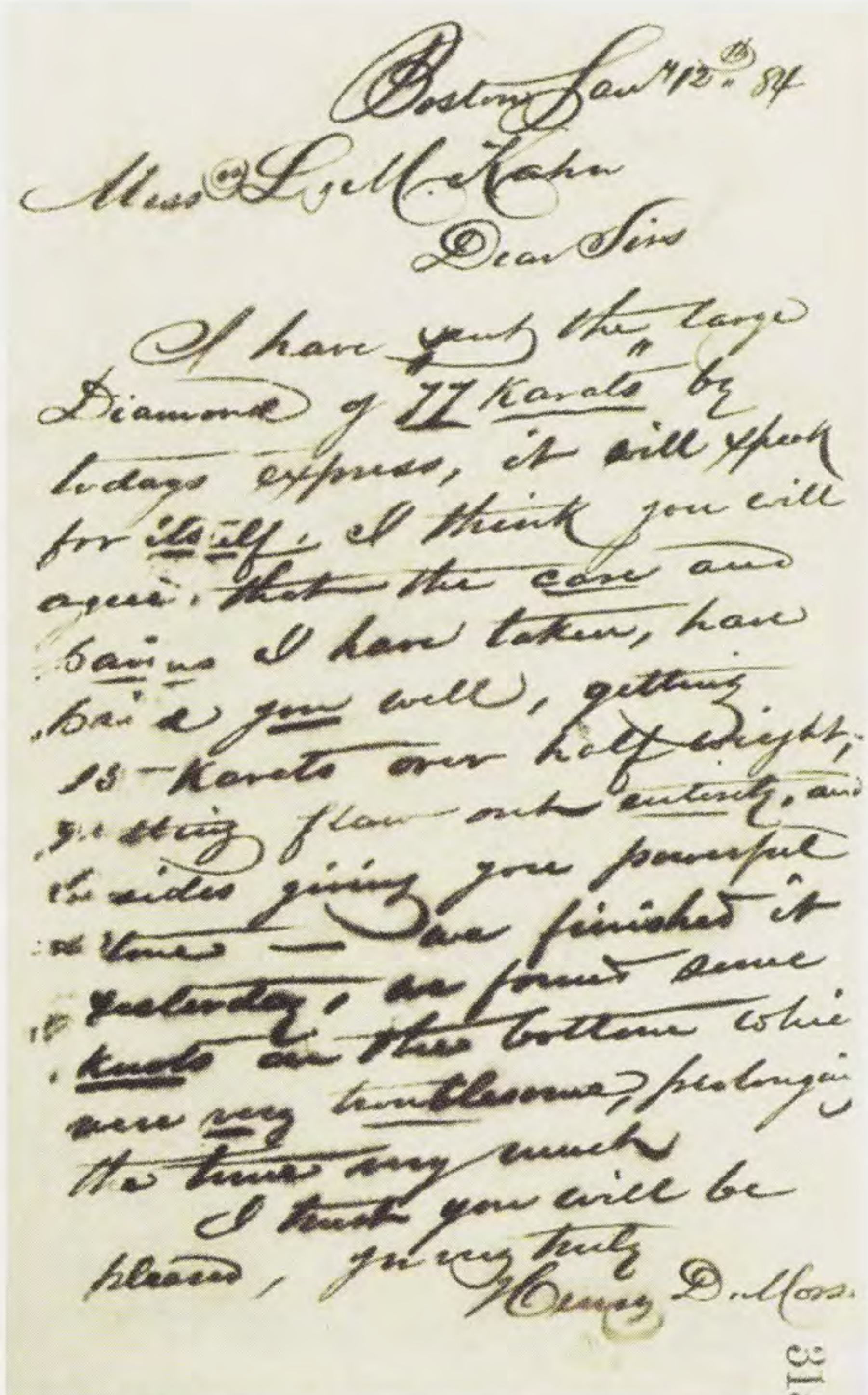


Fig. 2-26: This photo shows a cleaving stick (bottom) used to hold a diamond that's being notched for cleaving, a pair of cleavers (middle) and the rod used to tap the cleavers (top). These tools were used in Morse's diamond cutting shop. *Photo by Al Gilbertson/GIA. Items in the GIA collection.*

Fig. 2-27: These copper alloy models (top), a casting from the original Tiffany II, show the 77-ct. diamond and the original 125-ct. rough crystal (top right) Morse finished in 1884. The table size is 46 percent, the average crown angle is 36.7 degrees, and the average pavilion angle is 38.8 degrees. Morse used this tool (middle), shown with the copper model in place, to measure stones. The wood stick below it has a small diamond set into its end and was used to notch diamonds for cleaving. *Photos by Al Gilbertson/GIA. Items in the GIA collection, copper models donated by J. & S. S. DeYoung, Inc.*



Boston Jan 12th 84

Mess L & M Kahn

Dear Sirs

I have sent the large Diamond of 77 Karats by todays express, it will speak for itself. I think you will agree that the care and pains I have taken, have paid you well, getting 15 Karats over half weight, getting flaw out entirely, and besides giving you powerful stone — We finished it yesterday, we found some knots on the bottom which were very troublesome, prolonging the time very much

I trust you will be pleased, Yours very truly

Henry D. Morse

Fig. 2-28: This 1884 letter from Henry Morse to L. & M. Kahn & Co. reads:

"Dear Sirs
I have sent the large diamond of 77 karats [carats] by today's express. It will speak for itself. I think you will agree that the care and pains I have taken, have paid you well, getting 15 karats [carats] over half weight, getting flaw out entirely and besides giving you [a] powerful stone. We finished it yesterday. We found some knots on the bottom which were very troublesome, prolonging the time very much.

I think you will be pleased.
Yours very truly
Henry D. Morse"

From the copy book of Morse business letters, January 12, 1884.

Morse would typically ask his clients how they wanted their diamonds cut, so he exchanged a number of letters with the owners. L. & M. Kahn & Co.[82] wanted the diamond to look its best, but retain as much weight as possible. The stone also had a prominent flaw that Morse wanted to minimize.

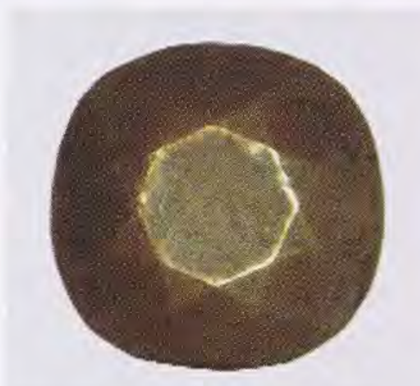


Fig. 2-29: This replica of the Tiffany II (top) was cut from a "pattern" made from the copper alloy model (bottom). The copper model was measured with a non-contact gemstone measuring system, a device with a rotating stage and camera, which takes digital photos of the side-view shadow of the gemstone (or other object) being measured. The measuring system's software processed these images to produce a three-dimensional mathematical representation of the measured copper model, which included the dimensions, proportions, angles and relative placement of all the facets. An electronic file of this 3D representation was provided to D. Swarovski & Co. in Austria who, with specialized cutting equipment, cut and polished the cubic zirconia replica in 2006. *Copper model photo by Al Gilbertson; replica photo by Robert Weldon. Both photos/GIA.*

After several letters back and forth, they arrived at a slight cushion shape with crown and pavilion angles compromised slightly from what Morse wanted. This appeased L. & M. Kahn & Co.'s need for weight retention and Morse's concern about the flaw.

Henry Morse Channing, one of Morse's great grandsons, recalled what Earle Barlow, who worked for Charles Foss after Morse's death, told him about the cleaving of the 125-carat piece of rough:

"Earle H. Barlow ... showed me Morse's [cleaving] kit (Fig. 2-26) and told with dramatic effect the delight with which Mr. Charles W. Foss said he had watched Morse sit, hammer in hand, at a little table in his shop, on which rested the largest rough diamond ever imported; the three perspiring New York owners, who had brought to Boston this diamond for the famous Mr. Morse to cut, sat watching him. The only calm person in the room, Morse, smashed [cleaved] the great stone, with no more sign of tension than if he had been cracking a walnut in his own dining-room—or so Mr. Foss remembered."[83]

Morse then turned the stone over to Field, who cut a slightly shallow pavilion angle to retain weight; the crystal itself was very symmetrical and only slightly squat (Fig. 2-27).

The L. & M. Kahn & Co. diamond would not be a spectacular diamond by today's standards, but compared to the angles prevalent at the time, Morse and Field removed the flaw and created a masterpiece (Figs. 2-28 and 2-29).

[82] Morse letters, September 29, 1883; November 9, 1883; November 14, 1883
[83] Channing, 1952

Fig. 2-30: The Tiffany II was the centerpiece of the Colonial necklace exhibited by Tiffany at the 1889 Exposition in Paris. "In the rough it weighed 124.94 carats. Charles M. Field, foreman of the Henry D. Morse factory in Boston and inventor of the first modern diamond cutting machine, began cutting the stone on September 29, 1883. When Field was finished on January 11, 1884, the stone weighed seventy-seven carats," wrote Tiffany historian John Loring. The necklace is shown here in plain and color-enhanced versions. *Loring, 1999; color enhancement (right) by Al Gilbertson.*

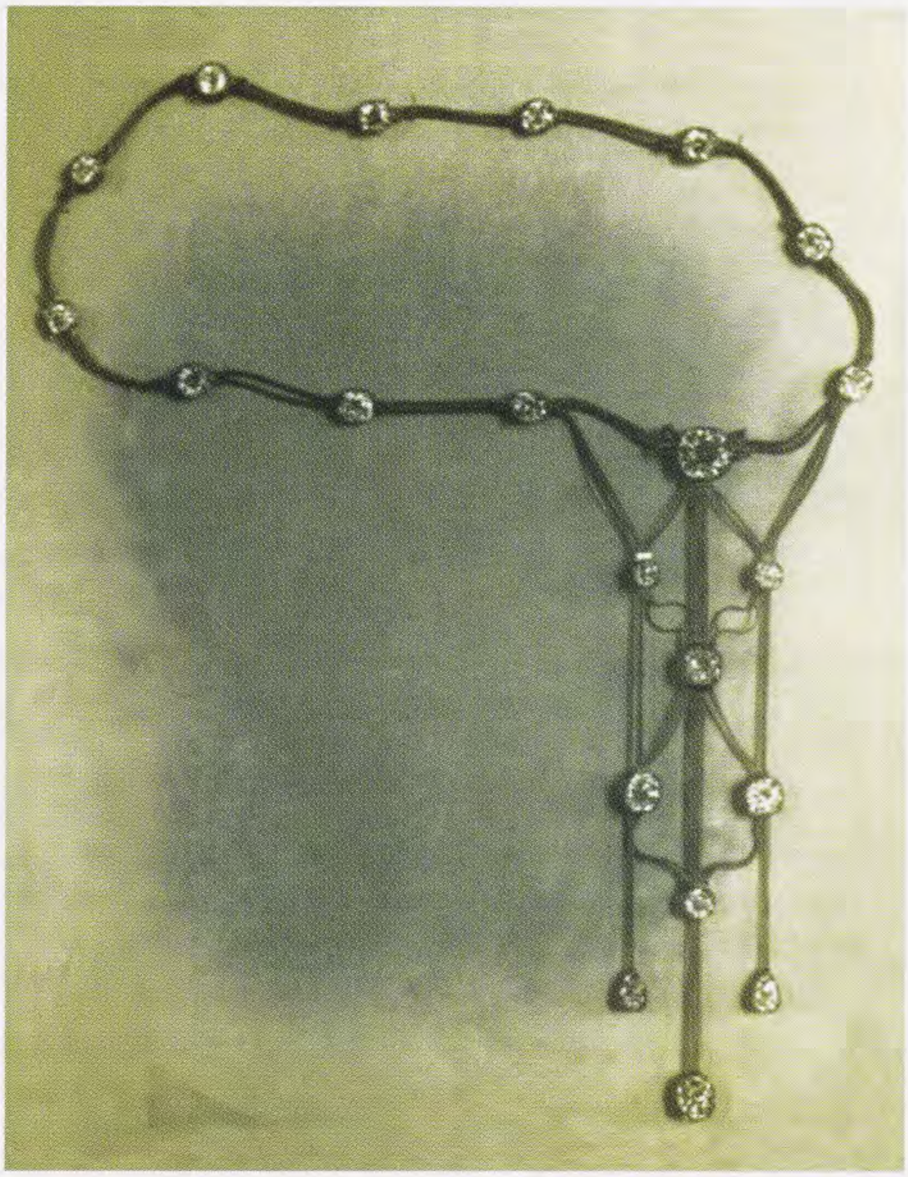


Fig. 2-31: A "girdle" or belt of yellow diamonds (totaling 450 carats) and gold chains was displayed at the 1893 Chicago World's Fair. The Tiffany II is the largest diamond in this piece *(Loring, 1999)*. The photo is from a short article in *The Jewelers' Review*, August 1893. *"The Tiffany Exhibit at the World's Fair," 1893.*

Cutting the Tiffany II brought Morse even more acclaim. The diamond became the centerpiece of the Colonial necklace, which was exhibited by the company at the 1889 Exposition in Paris[85] (Fig. 2-30). It was later removed from the necklace and set into a girdle or belt of yellow diamonds (totaling 450 carats) and gold chains and displayed by Tiffany & Co. at the 1893 Chicago World's Fair.[xxxii] [86] The new design of this "girdle" emphasized the neo-Renaissance theme of the fair[87] (Fig. 2-31).

Tiffany shared a booth with De Beers, the London diamond conglomerate that controlled the largest quantity of mined rough in the world, at the 1893 Chicago World's Fair. *The Jewelers' Circular and Horological Review* described the scene: "The capers of a crazy Zulu weighing 250 pounds and standing 6 feet 7 inches high, a hero of the Zulu war," drew visitors to the Cape of Good Hope exhibit in the Mines and Mining building. The article continued:

Henry Morse's clients:[84]

A. C. Titcomb

Bailey, Banks & Biddle

Black Starr and Frost

Carter Sloan & Co.

Durand & Co.

E. B. Horn

Elgin Watch Co.

E. Howard Watch Co.

J. E. Caldwell

Krementz

Merrick Welsh & Phelps Jewelry Co.

Shreve, Crump & Low

Simons Brothers

Tiffany & Co.

Tilden & Thurber

> STANDING NEAR AND SMILING at the Zulu's antics was George Hampton, in charge of Tiffany & Co.'s diamond cutting works. ... By buckets attached to an endless chain, the dirt [from a diamond mine] is elevated to the rotary pan, a huge pan capable of washing 300 loads of 16 cubic feet each in one day. It is here reduced to three loads and goes to a pulsator, where it is further reduced to one load. This is brought on hand-sieves and thrown on a sorting table, where the dirt is thrown into buckets and the diamonds sorted out. They then pass to Mr. Hampton's department.[88]

The Tiffany booth took the African diamonds through the steps of cutting—using a cutting and polishing machine to demonstrate. Hampton was on hand to answer questions and explain the process.[xxxiii] "The cutting [bruting] machine used by me is the invention of Chas. M. Field, and is the only one ever made of this pattern,"[89] a reporter wrote.

[84] Morse letters, 1877-1887
[85] Loring, 1999
[86] "The Tiffany Exhibit at the World's Fair," 1893; Loring, 1999
[87] Loring, 1999
[88] "A Miniature De Beers at the Fair," 1893
[89] Ibid.

Tiffany & Co. also published a small booklet titled *Diamond Cutting* to distribute at the Exposition. It reviewed the four stages of diamond cutting: cleaving, cutting (bruting), setting (the repositioning of a diamond in the lead dop to cut different facets) and polishing. Little detail is given in the polishing section, except some words of advice: "To insure the greatest brilliancy, it is necessary, in diamond cutting, that every angle be mathematically correct, so as to reflect as much as possible the light that enters the stone."[90]

Tiffany & Co. followed Morse's steps, carefully cutting their diamonds to specific proportions.

Morse's Passing

As Morse's health started to fail in the late 1880s, he slowly sold off some of his machines and trimmed his work crew down to just a few cutters and polishers. He retired from the Morse Diamond Cutting Company in June 1887, suffering from what the press referred to as "paralysis," but continued to engage in the wholesale diamond trade with his former partner under the firm name Henry D. Morse & Charles W. Foss.[91]

Morse suffered a "paralytic shock" and died on January 2, 1888.[92] Obituaries around the country credited him with revolutionizing diamond cutting and introducing the new techniques into a dozen or so shops in the United States, including Tiffany's cutting room in New York.[93]

"He started in the diamond cutting business with the idea that diamonds should be cut scientifically to bring out their beauties to the best advantage," *The Jewelers' Circular and Horological Review* obituary stated.[94]

The *Boston Transcript* reported on January 3, 1888:

MR. HENRY D. MORSE, whose death occurred at his residence at Jamaica Plain yesterday, after a short illness, of paralysis, was widely known and much respected by all who knew him. Mr. Morse was sixty-one years old. Although his life was passed in mercantile pursuits, he was an artist and genius by nature. In early life he followed the pursuit of ornamental engraving on the precious metals, and his work was equal to the finest English masters; after

[90] Tiffany & Co., 1893
[91] Foss, 1888; "American Diamond Cutting," 1894
[92] "American Diamond Cutting," 1894
[93] Fales, 1995
[94] "Henry D. Morse," 1888

which he conducted the manufacture of diamond mounting, using only fine gold at his factory. For a few years he was associated with others in the general jewelry business, which was distasteful to him, after which, and till the time of his death, he most successfully transacted the diamond business, and especially the cutting and polishing of rough crystals.

As a judge of gems he had no superior, and had been an authority to all the trade on all matters pertaining to precious stones. As an artist, in many ways, and especially in landscape and animal painting, Mr. Morse excelled. As a sportsman and expert shot on the wing he was widely known. As a lover of Nature, and familiar with her in her varied forms, was where Mr. Morse passed his happiest hours. He was genial, thoroughly honest and true; the father and centre of a happy family, who, with thousands of friends, mourn his loss.[95]

Kunz, vice president of Tiffany & Co. and noted world traveler and gem expert, summarized Morse's achievements in his book *Gems and Precious Stones of North America*: "He studied the diamond scientifically, and taught his pupils that mathematical precision in cutting greatly enhanced the beauty and consequently the value of the gem. … His treatment of the diamond gave a great impetus to the industry both here and abroad, shops being opened, both in this country and in London."[xxxiv] [96]

Kunz gave Morse credit for not only improving the beauty of the diamond, but also for finding a way to fashion a diamond quickly and more accurately. As a result, Morse's influence was far reaching:

IT WAS IN HIS SHOP that a machine for cutting diamonds was invented which did away in great measure with the tediousness and inaccuracy of the old manual process. ... The fact that so many fine stones were recut here after he started his wheel led to a great improvement abroad in cutting, especially in the French Jura and in Switzerland ... and, as a result, the diamonds sold to-day are decidedly better than those of twenty years ago, before Mr. Morse turned his attention to the work. He, above all others, has shown us that diamond-cutting is properly an art and not an industry.[97]

[95] "Mr. Henry D. Morse," 1888
[96] Kunz, 1968, reprint
[97] Kunz, 1888a

Notes

[i] Many newspaper accounts reported the dates incorrectly. Some accounts, for example, would have Mr. Pray starting to import diamonds from South Africa in 1860, prior to their discovery there in 1867. The author took the chronology into account in determining which dates were the most likely. For this reason, some of the sources cited may not agree with the dates used about Morse in this book.

[ii] An existing shop of Dutch diamond cutters might have been absorbed by Morse's operation. This would fit with the family history of the DeYoung family (Joseph Samuel, 2004, personal comments). However, there are more than 20 references to Morse's shop being the first diamond cutting establishment in America, including such authorities as Kunz (1911); many refer to a peddler coming through Morse's shop.

[iii] Some texts use the spelling "Keyzer."

[iv] Remember that this is during the Civil War and, in Boston, "Those who didn't go to war went to work. … Likewise, the women of Boston shared in the change that occurred when the city's men marched off to war. Their direct involvement in the Civil War was applied to subsequent feminist causes. … For the first time, Boston's women worked in retail stores, munitions plants, post offices, newspapers, and shoe and clothing factories" (Oslin, 1998).

[v] Charles Field again became foreman of Morse's diamond cutting shop when Morse and Pray set up a company after leaving the partnership with Foss and Crosby in 1875. When Morse scaled back his cutting shop in 1887, Field joined with William Sanborn to open Sanborn and Field, which specialized in diamonds, watches and jewelry ("We Would Call," 1887). When J. B. Humphrey took over Morse's shop after his death, Field became Humphrey's shop foreman (Field, undated).

[vi] "'Bruting' possibly comes from the Old Saxon 'brytan,' with the meaning of breaking. An alternative spelling is 'bruiting.' In England the operation is frequently called 'cutting,' but this gives rise to misunderstanding" (Grodzinski, 1953). In England and America in the 1800s and early 1900s, any reference to diamond cutting actually meant bruting. This explains why early bruting machines in America are called "cutting" machines. For example, "All Brilliants Must Have Proper Proportions, and that if the complementary faces or facets are unequal the refraction or light will be uneven and untrue, it will be seen that an undue pit or hole in any one face may be made to affect the whole. Therefore, though machine cutting is more rapid, it is claimed that it is far more costly in the end. For cutting the price paid is $1.25 a carat, and a smart cutter can make from $60 to $100 a week at his work.

He is expected to return in cut stones about 75 per cent of the weight he receives, and the balance in diamond powder. The amount lost in polishing is inconsiderable, so that, with the wastes already mentioned, it will be seen that rough diamonds usually return about 50 per cent of their weight in polished, marketable stones. After the cutter shapes the stone he passes it over to the polishers" ("Our Diamond Industry," 1877).

[vii] A reporter later described Field's bruting process as: "A sort of double lathe, which enables two diamonds to cut each other by attrition produced by rapidly revolving machinery … these are in general use today, the lathe superseding almost entirely the old practice of cementing the diamond to be cut into the end of a stick and rubbing it with another diamond of inferior quality, called bort, that is fastened into a stick in the same way" (Smith, post-1891, in Field Scrapbook).

[viii] "An important decision between rival claimants to the original invention of the first and only machine for cutting diamonds ever offered at the United States Patent Office has recently been rendered in favor of Mr. Charles M. Field, a skillful and experienced machinist residing in this city. … The result of the suit has been a victory of great importance, since it vests in the Field machine, which is owned jointly by Mr. Field and Messrs. Crosby, Morse & Foss, the sole and entire control of the art of cutting diamonds by machinery in this country and Europe" ("Diamond Cutting in America," 1875; Field, undated).

[ix] The significant point is that there seems to be no earlier patents or mechanical bruting methods, which indicates he was the first to invent one.

[x] Even this procedure was not generally known to be in use until the 1860s; it is unlikely to have crossed into the diamond cutting industry before that period ("The Early Use of Diamond Tools," 1943). "Of late years, the lapidaries [from India] have adopted a very injudicious method of cutting, leaving the stone, from the girdle to the culet, round, instead of angular, thus detracting from the play of the diamond," wrote Harry Emanuel of England (1865). He does not explain the technique used for the rounding in India, and it may be an early version of the method by Morse and Field.

[xi] "Well-shaped and flawless crystals, indeed may not require to be cleaved, and then the brutage is the first process. Here again, the old hand methods are beginning to give place to mechanism. … The old method was to do this by hand—an extremely tedious and laborious process. The machine method, invented … and first used by Field and Morse of Boston, is now used at Antwerp" (Kunz, 1911).

[xii] "It possesses a machine never before used in America and only recently adopted by a few of the largest establishments in Europe.

Instead of following the old method of rubbing two stones together by hand, the stone undergoing treatment is inserted in the chuck of a lathe revolving at a high rate of speed, and is placed in contact with another diamond that is likewise fastened in an adjustable chuck held in the hand of the operator. In the course of this operation, the stone receives its form and outline" (Stern Bros. & Co., 1893).

"Some American writers claim that this change from the thick cut to that of maximum brilliancy was made by an American cutter, Henry D. Morse. It was, however, as explained, necessitated by the absolute roundness of the new cut. Mr. Morse may have invented it independently in America. But it is highly probable that it originated where practically all the world's diamonds were polished, in Amsterdam or Antwerp, where also mechanical bruting was first introduced" (Tolkowsky, 1919).

[xiii] No record of this patent was found in the European Union online patent database.

[xiv] For complete context: "[In Cohenno's firm, the] stones are secured in precisely the same sticks (but a little heavier), and held over exactly the same kind of box, but something broader. The stone to be shaped is held in the left hand—though both stones are in process of cutting. The thumbs are closely braced, both hands being protected by heavy gloves. The process is a very slow one compared with the cleaving, and requires no end of patience and judgment. Lately a certain firm in Boston received a patent for a diamond cutting machine, but it will not be a success, it makes twice as much loss as stones cut by hand, and will produce flaws in clear diamond" (*The Diamond: Its Source, Properties and Uses*, 1877).

[xv] "… May be able to send a few from my stock … not many round ones, as we cut mostly cushion shapes" (Morse letter, March 8, 1886).

[xvi] It seems very likely that powered scaifes preceded powered bruting, since the former was a simple evolution of existing methods (i.e., replacing the foot pedal drive with a steam-driven shaft), while mechanical bruting was a much more revolutionary development that required developing a whole system from scratch. Steam scaifes appeared about 10 years before Field's mechanical bruting machine. It's hard to imagine anyone preceding Field by more than a handful of years.

[xvii] The text reads: "Beside being the pioneer of diamond cutting in the United States, Mr. Morse has invented a cutting and polishing machine which is acknowledged to surpass anything of its kind in the world. The labor, tediousness and inaccuracy of the old manual process just described struck Mr. Morse as matters to be remedied by the aid of machinery, and he immediately set to work, with the aid of his foreman, Mr. Charles M. Field, to invent a contrivance which would cut diamonds by a less laborious and cheaper process.

His efforts in this direction met with the ridicule from his old foreman. Still Mr. Morse persevered, and, while prosecuting his researches and experiments, he also made a discovery which, in conjunction with the machine, has gone to form a most perfect combination. In determining the angle of light to be reflected, so as to bring out the greatest brilliancy of the stone, the eye of the workman was all that was to be relied upon in this manual system; the least deviation entailed a loss of brilliancy, and a consequent loss of value. By dint of repeated experiments, and after considerable study, Mr. Morse determined upon the exact angle of light which would be almost universally applicable in the cutting of the stone. Having decided this, he next invented an instrument which should unerringly produce this ray of light without the deviation of a hair's breadth, so that the workmen need no longer trust to chance to obtain the greatest amount of brilliancy that the stone possessed" ("A Dazzling Story," 1883).

[xviii] A reporter later described the gauge in this way: "Mr. Morse invented the Morse gauge, an instrument for regulating all the angles to be cut on a stone. ... The Morse Gauge is what a navigator, or a draughtsman, would call a protractor. It is a semi-circle marked on its outer edge in degrees, to any of which a movable arm can be set with a thumb screw. The cutter and polisher no longer trusts his eye alone for angles. The little instrument tests everything until the stone is geometrically correct" (Smith, post-1891).

"Later on, the gauge was introduced, an invention by the instruments manufacturer Ch. Field, a business acquaintance of Morse. ... It appears that [the adjustable gauge] was invented by the American instruments manufacturer Ch. Field. An improved version of this gauge would have been invented by the diamond cutter W. van Lee." These authors also described how the gauge is to be used: "A gauge, used by the cutter, to verify that the stone meets all requirements, so that every facet has the right measurements. This gauge was invented by the American instruments manufacturer Ch. Field. An improved version of this compass was invented by the diamond cutter W. van Lee."

"Although different kinds of adjustable gauges exist, they all share the same basic principle: the angle line can be moved randomly to different degree positions that are mentioned next to each other on this instrument. As this gauge is adjustable, in the sense that the angle line can be chosen randomly, one always measures on the same side. By means of a small screw the instrument can be fixed, implying that the chosen angle line remains the same during use.

"In order to facilitate the measurement with the gauge, or more correctly, in order to better be able to check whether the angles match the used measure, it is recommended to hold the gauge, with the stone, in front of a white background. For this purpose one can use a clear white paper that is fixed to the mill beam, at the same height as the eye of the cutter. This way a tiny opening at the culet or at the girdle becomes much better visible. The eyes become less tired and one definitely has more certainty that the facets are OK.

"The use of such a white paper is also very efficient for the measurement of the crown angles. For the adjustment of the pavilion angles it is also possible to keep a regular loupe in front of the gauge, since the gauge and the stone are held with one and the same hand" (Leviticus and Polak, 1908; translation by Peter De Jong, GIA Antwerp).

"He [Morse] introduced cutting by gauge, making all facets and angles mathematically correct and really showing delighted buyers for the first time the brilliant possibilities of a properly cut diamond" ("The Diamond Cutting Industry in America," 1894). Cutting by gauge became more common. A 1935 *Popular Science Monthly* article reported that "gauges measure angle of faces as the stone is ground" ("Cutting the World's Biggest Diamond," 1935).

[xix] In "Diamond Cut Diamond" (1887), the importance of "fire" was mentioned. Fire had been rarely mentioned prior to this. I have only found it mentioned one other time in the 19th century: Bauer's *Edelsteinkunde* (1896). Bauer wrote, "This play of prismatic colours is sometimes, especially by English jewellers, referred to as the 'fire' of the stone. The same term, 'fire,' is, however, also used to denote the brilliancy of lustre of a stone."

[xx] "Saving weight prevailed on producing nice cuts, due to the high prices being asked for diamond rough. Later on, the gauge was introduced, an invention by the instruments manufacturer Ch. Field, a business acquaintance of Morse" (Leviticus and Polak, 1908).

[xxi] "Your letter is rec'd and in answer would say that the loss in cutting the tops of the stones over (in case you desire it afterwards) would be much less than on the bottoms, but I am inclined to think they will sell readily after the bottoms are recut. As to the loss on the bottoms it is impossible to say, as we cut to get the right angle which is the proper way if cut at all. If you stop short of that the effect will be unsatisfactory and you will want them done again. But you may be sure I will keep all the weight I can, just the same as if they were my own diamonds" (Morse letter, May 8, 1880).

[xxii] "If we left our stones with thick girdles, and carelessly cut we would get from 10 to 20 per cent more weight, then could afford to sell much cheaper. But as we cut these there is no profit in selling as [*sic*] the prices that the importers sell scratch cut stones" (Morse letter, May 14, 1880).

[xxiii] Some alternate spellings for Hermann in various articles are "Herimann" and "Heremann."

[xxiv] "Mr. Hermann is a modest man and is not disposed to take to himself credit for more than is his due. He is exceedingly conscientious in conceding to Mr. Morse the honor of being first to introduce the industry in the United States" ("American Diamond Cutting," 1894).

[xxv] "The industry as pursued in this country differs considerably from the methods that prevail in the Old World. In Europe, until the magnificent results obtained by Mr. Morse and Mr. Hermann revolutionized the methods of the cutters, every other consideration was sacrificed to that of weight. Seldom, indeed, did the loss of a rough stone of average form exceed 35 per cent of its weight, while Mr. Morse and Mr. Hermann freely sacrificed from 60 to 65 per cent of the weight of the original stone in cutting and polishing. While the girdles of stones cut in Amsterdam are irregular, some facets being carelessly cut through it while others do not reach it, American cutters religiously observe geometrical accuracy and obtain gems in which the refraction of light is the most perfect that form can give. In Europe, perfect cutting is not demanded by the people, hence it is not practiced by the artisans of Amsterdam and Antwerp, except for the supply of American buyers. Thousands of the cut diamonds imported are recut in this country" ("American Diamond Cutting," 1894).

[xxvi] Kunz was named vice president of Tiffany & Co. in 1879, at age 23 (*Dictionary of American Biography*, 1958; Purtell, 1971).

[xxvii] Tiffany opened the shop prior to 1882 (Leviticus and Polak, 1908). Fred Harkins was hired as the foreman of their diamond cutting shop sometime between 1880 and 1882. Tiffany's records show that George Hampton started on Harkin's last day and continued at Tiffany's shop through 1900. Records after 1900 are incomplete and do not show when Tiffany ceased diamond cutting (Engagement records, Tiffany & Co., 1880 to 1910).

[xxviii] Morse talks about Tiffany enticing workers away from his shop in the summer of 1881 (Morse letter, July 15, 1881).

[xxix] An advertisement for Tiffany & Co. states: "Importers and cutters of and dealers in Diamonds and other precious stones" (Tiffany & Co., advertisement, 1886).

[xxx] "The jewelry firm of Tiffany & Co., of this city, among others, have in operation a shop in which diamonds are cut and polished from the rough, and are recut when the original cutting as performed in Amsterdam or elsewhere has not left them of satisfactory brilliance." There is a detailed description of the cutting (bruting) process, at one point stating, "The machine is the invention of Charles M. Field, of Boston, Mass., and is only the third in use" ("Diamond Cutting by Hand and Machine," 1891).

[xxxi] According to Tiffany & Co. engagement records, Hampton was hired to start March 1, 1890, the last day of work for Harkins.

Harkins had been being paid $42 per week, and Hampton was hired at $30 per week. Compare these wages to the clock shop foreman, who made $2,200 per year (Engagement records, Tiffany & Co., 1880 to 1910).

Tiffany employed seven to eight "lapidaries [and] diamantaires" in 1894, according to the French Ministry of Industry, Post and Telecommunications (Krantz, 1894). This is consistent with Leviticus and Polak (1908), who reported that Tiffany had "6 to 8 mills."

Tiffany devised its own bruting machine prior to hiring Hampton, but was trying to be secretive about it. "The old Dutch style of cutting diamonds by two tools held in either hand has long been superseded by their ingenious foreman by a machine of his own invention which will rough cut a diamond in less time than is required by any other process. However, he looks very mysterious and rather sad when he finds out that one [visitor] is a newspaper man, and entreats us not to give any description of the rough cutting machine" ("Tiffany's, The World's Greatest Store," 1887).

[xxxii] An article from *The Jewelers' Review*, August 1893, reports: "Enthusiasts, watching the endless throngs crowding around the Tiffany diamonds at the Fair, have declared that were any single exhibit to be chosen for a special grand prize as the greatest attraction at the greatest international exposition the world has ever seen, the Tiffany diamonds would know no rival" (cited by Loring, 1999).

[xxxiii] Hampton was not the only former Morse employee to work for Tiffany & Co. Eddie Russell left Morse in 1882 and cut for Randel, Baremore & Billings until 1889, when he started at Tiffany & Co. ("Boston a Brilliant Solitaire in the Diamond World," 1924).

[xxxiv] "The recent death of Mr. Henry D. Morse, of Boston, known as the pioneer diamond cutter of the United States, brings to mind many interesting reminiscences. He has scarcely received the credit he deserved for his work. That he was the first in this country to cut diamonds is well known, and the best cutters in the United States today received their training under him" (Kunz, 1888).

"The death of Mr. Morse caused deep regret among the entire trade throughout the country. Among his personal friends he was highly esteemed, and to the trade he was a benefactor. He started in the diamond cutting business with the idea that diamonds should be cut scientifically to bring out their beauties to the best advantage. The result of his work is seen in the fact that the cutting of all fine stones is now subjected to the most rigid scrutiny, whereas formerly it was not considered of so much importance. The shapes of the facets and the table, the proportions of the several parts were so cut as to be mathematically correct" ("Henry D. Morse," 1888).

"THE LIGHT WHICH HAS ENTERED THE STONE IS NOW IN THE GRIP OF MORE EXACTING LAWS. IT HAS LOST THE FULL FREEDOM OF THE AIR. THE DENSER MEDIUM SETS BOUNDS, AND THE ARTISAN KNOWING THESE, SO CUTS THE DIAMOND AS TO LEAVE NO AVENUE OF ESCAPE FOR THE ENTRAPPED LIGHT BUT THE FRONT OF THE GEM WHERE IT ENTERED. JUMPING FROM WALL TO WALL OF THE TRANSPARENT ENCLOSURE, THE RAYS TRY THEM ALL WITH POINTS OF LIGHT IN VAIN, UNTIL THEY REACH AGAIN THE GATE OF ENTRY."[98]

Wallis Cattelle, 1911
English-born New York jeweler

Chapter 3

More Innovations and the Emergence of Optics

The mid- to late-1800s were a time of tremendous scientific advancement in most industries. Historian Peter Broks wrote in 2003:

> A SURFEIT OF WONDERS, "latest improvements," and "startling developments" had brought a nation to expect a new advance on an almost daily basis. The public were to be thrilled to the point of exhaustion. ... One magazine reported: the times in which we live may well be called the "age of invention." Never before, it would seem, have men so ardently studied the secrets of nature, and turned the knowledge thus acquired to practical account. We have become so accustomed to hearing of new inventions that nowadays they hardly surprise us.
>
> So commonplace had inventions become that in 1898 one correspondent to *Cassell's Saturday Journal* felt able to write, "We seem to be so up-to-date nowadays that I don't see that there is really much else to be invented."[99]

[98] Cattelle, 1911
[99] Broks, 2003

Despite the influence of Morse and other American innovators in the diamond industry from 1860 to 1910, a European newspaper reporter who toured the Amsterdam plant of Joseph Asscher (famous for the Asscher cut and Cullinan diamonds) in 1910 noted specific distinctions between American methods and those used by Asscher. After describing how a diamond is placed into position to polish a facet at a precise angle, the writer says, "It is noteworthy that this exceedingly delicate adjustment is made by the eye alone, and the Amsterdam cutters hold that in this way quite as good results are obtained as by the mechanical measuring instruments which American ingenuity has sought to introduce."[100]

Wallis Cattelle, a jeweler originally from England who migrated to New York, wrote several books and articles for industry journals at the time. He concluded that when the diamond-buying public saw the superiority of the American cut round brilliant diamond, "European cutters were gradually obliged to conform more and more to it." Cattelle wasn't subtle in proclaiming its virtues: "The finest and most exact cutting is still done in the United States."[101]

Still, the Europeans weren't so quick to credit Americans with the improved American diamond cutting quality. *The New York Herald*, reporting on the exhibit at the 1889 Paris Exposition that displayed diamonds cut by Tiffany & Co., quoted a company spokesperson who said, "Over there they are envious of the American work and said we employed Frenchmen to do it. Therefore we have had to put up a sign that everything has been executed by American workmen under American training."[102]

Mechanical Dops

Morse was not the only innovator in America during the period from 1870 to 1910. A New York firm, Stern Bros. & Co., announced in 1897 that it had patented a mechanical dop[i] in America, Germany, France, Belgium and England.[103]

Cutters had been using a lead dop to hold a diamond at specific positions for the wheel to grind away a facet as it turned against the stone. The dop was made by softening lead over a flame and embedding the diamond in it. There was always the risk of the diamond shifting

[100] "Rulers of Holland and Belgium Visit," 1910
[101] Cattelle, 1903
[102] "In Our Exhibit in Paris," 1889
[103] Stern, 1897

Old style dop for polishing.

Patented holding dop for polishing. American invention.

Fig. 3-1: Heat buildup during polishing sometimes softened the old-style lead dop (left), loosening its hold on the diamond. Stern Bros. & Co. developed a mechanical dop (right) in 1897 that held the diamond firmly no matter how much heat was generated during polishing. This allowed for greater polishing accuracy and consistency. *Both photos from J. R. Wood & Sons, 1914.*

position, however, because the lead could soften from the heat generated during polishing. The new machines were revolving at several thousand revolutions a minute, compared to several hundred per minute just a few decades earlier, and heat built up more easily. If the diamond slipped, the facet would be polished in the wrong position.

The new dop created by Stern Bros. & Co. used three metal fingers to hold the diamond in place as it was polished at various angles or positions. An 1898 company advertisement noted, "The great advantage ... is that it enables the polisher to make quick and accurate measurements, and gives him complete control of the stone during its entire manipulation"[104] (Fig. 3-1).

The mechanical dop helped maintain the accuracy achieved through mechanized bruting and angle measurement. Cutters spent less time cutting and enjoyed greater accuracy and consistency.

Sawing

Sawing rough crystals, rare until the late 1800s, was a slow process. A bow made of a fine iron or brass wire, coated with particles of diamond dust that acted as teeth, was manually drawn back and forth against the diamond.[105]

Although the new cutting style for round brilliants was in high demand, it required specific angles, which were hard to obtain without a significant loss of weight; a large portion of the top of the stone was

[104] Stern Bros. & Co., 1898
[105] Mawe, 1823

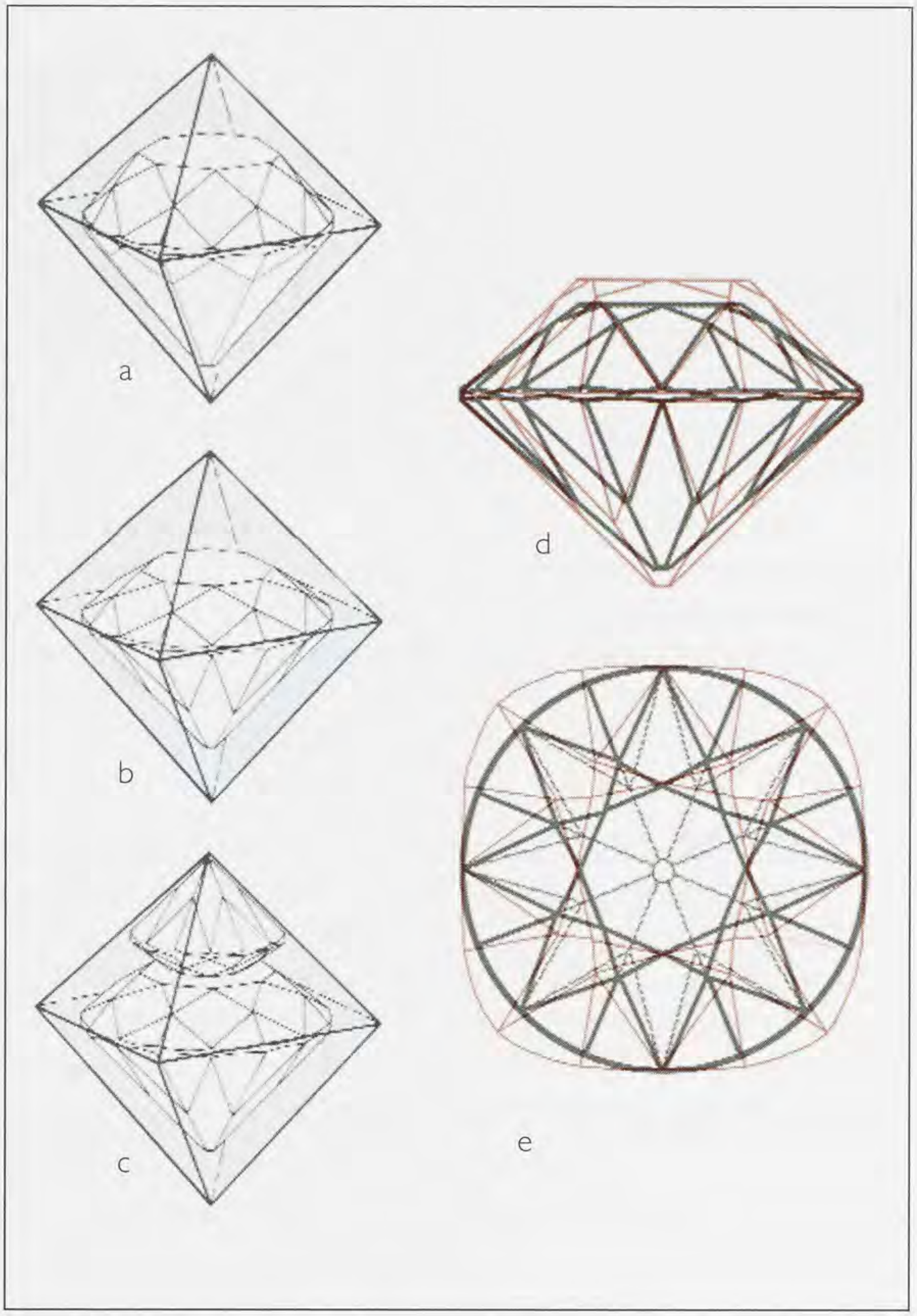


Fig. 3-2: Drawing (a) shows the preferred proportions of a round shape that existed before the advent of the circular saw. If a cutter wanted to make the diamond round rather than squarish, weight was lost at the corners as well as the top. Material around the diamond was simply ground away. Some cutters in Europe were sawing the top away with a bow saw, but this took considerable time.

Morse's recommended angles, shown at center left (b), meant the loss of even more weight from the rough diamond. He encouraged his clients to let him cut to these angles, regardless of the weight loss. (Ultimately, however, he followed the instructions of his client.)

Morse never witnessed the circular saw, which came into use around 1900. When it became available, cutters were able to easily cut two diamonds from a piece of rough (c). As shown, cutting a small and a large diamond from the same rough recovers more value than if the rough diamond is sawn through the middle.

The two drawings on the right (d, e) show a comparison of the shape of Morse's round diamond against the weightier cushion shape that was prevalent during the mid- to late-1800s. *Al Gilbertson/GIA.*

either bruted or ground away on the scaife, not cut away by the bow. Although the diamond dust, or bort, was caught in boxes during the grinding process and used to charge the scaifes that ground or cut the facets on a diamond, an intact octahedral top was obviously more valuable. Until a crystal could be economically cut with a saw, the loss of weight limited the large-scale adoption of the new cutting style (Figs. 3-2 and 3-3).

Fig. 3-3: The style of the diamond on the left (a, b) is similar to that developed by Morse. The diamond on the right (c, d) which is a typical European cut, does not have corners as square, but the general crown and pavilion depths and steep angles are characteristic of the period before the mechanical saw was widely used. *Photos by Eric Welch (a, c) and Don Mengason (b, d)/GIA. Diamonds courtesy Michael Goldstein.*

It was not until about 1900 that a circular saw came into use to make it easy to split an octahedron into two pieces. This made it possible to cut the smaller top piece into a finished diamond, rather than just grinding it away.

At the same time, European cutters were shifting their focus from weight recovery to beauty.[106] E. Loesser[107] in 1899, and G. Armeny in 1901,[108] each filed for a U.S. patent for a sawing machine. Despite the fact that Loesser was the first to patent the saw (Fig. 3-4), there is some uncertainty over its origin and initial use.

Asscher[109] claimed that the mechanical circular saw was first used in Amsterdam around 1902, and Leopold Claremont (one of the first gem cutters to write about the craft) chronicled its use there[110] in 1906. One Belgian source, however, stated (incorrectly attributing it to Armeny) that the origin of the mechanized circular saw was American:[ii] "The first patent for a diamond sawing machine, however, was granted only in 1901 to G. Armery [Armeny], an American. Gustav Garrel from Antwerp manufactured the first circular saw [in Belgium] according to the drawings that Hubert Oudens brought along from the U.S."[111]

Nevertheless, by 1902 the Syndicate (as De Beers was often called) realized that using the saw saved weight from the common octahedral diamond crystals. This meant the new proportions could be cut without expensive waste of rough; the small tops of the crystals

[106] "Rulers of Holland and Belgium Visit," 1910
[107] Loesser, 1901
[108] Armeny, 1902; Grodzinski, 1953
[109] Asscher, 1928
[110] Claremont, 1906
[111] Kockelbergh et al., 1992

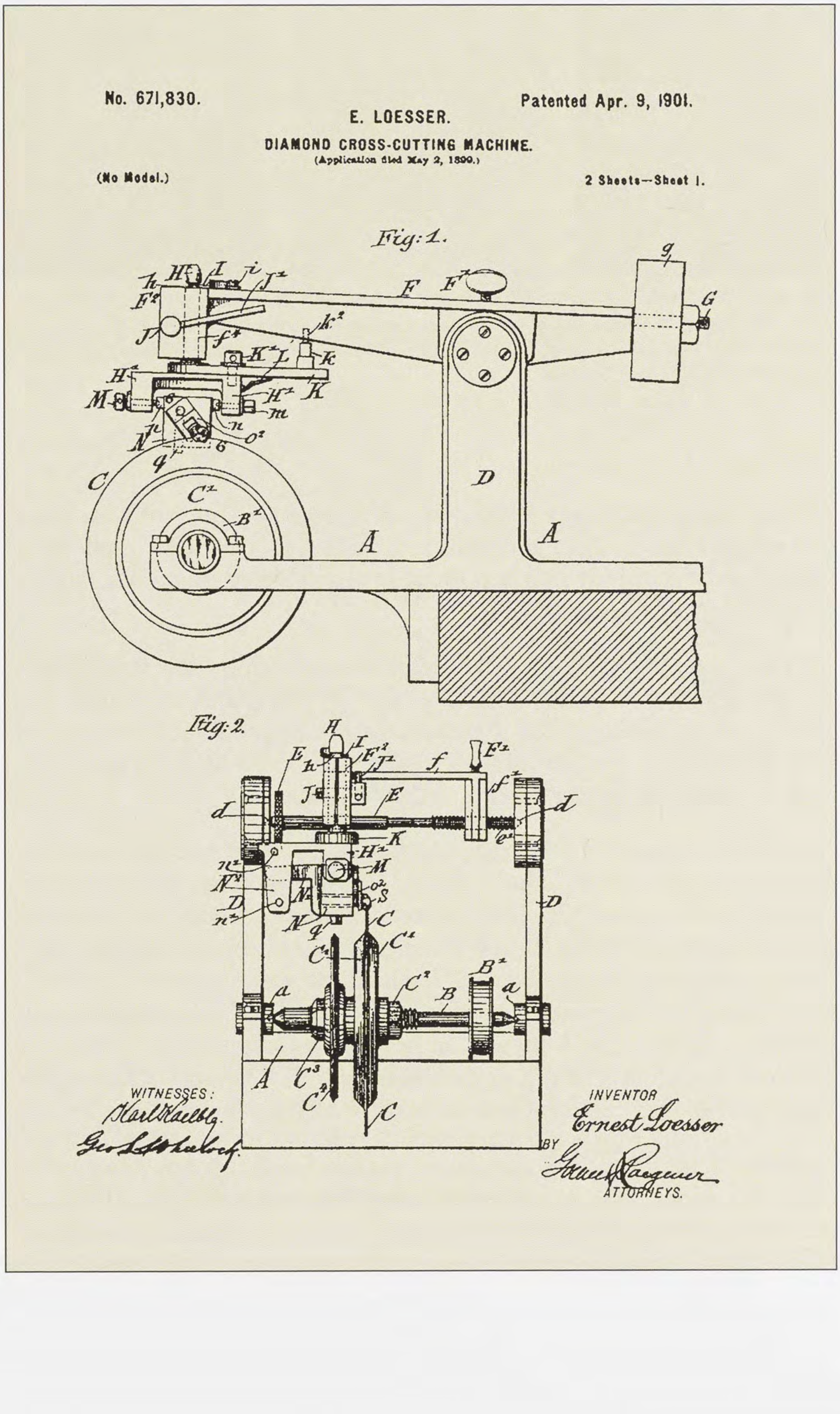


Fig. 3-4: E. Loesser submitted a patent in 1899 for a machine that used a circular saw to easily split a diamond into two pieces. *Loesser, 1901.*

could be cut into smaller stones. This also meant more profits, and the Syndicate saw the price of its rough diamonds jump 30 percent in response.[112]

The circular saw was also a dramatic improvement over cleaving, a method of splitting a gem into two or more pieces so several gems could be cut from one piece of rough. Cleaving can be done only along certain limited directions in the diamond. Much like splitting wood along a grain, it is done by making a notch in a specific direction in relation to the crystal growth, then placing a wedge inside the notch so the two sides of the wedge push apart along the grain of the crystal when tapped. The circular saw did allow more weight recovery with very large diamonds, but flawed diamonds still retained their flaws.[113]

The introduction of the mechanical saw made it much more practical to manufacture the American cutting style. Cutting shops in America set up banks of saws and were able to recover more weight. Interestingly, American shops are also credited with using both cleaving and the mechanical saw to remove inclusions and achieve better clarity for the diamonds they were cutting.[iii]

Optics, Ray-Tracing and Diamonds

Given the innovative spirit of the times, expectations of creating even more beautiful diamonds were not unusual. The public and jewelry trade were anxious for scientific proof that supported the specific proportions of polished diamonds that were being espoused as the "best."

Morse had already advanced the idea that diamonds should be cut for beauty. He cringed at the sight of diamonds cut to retain weight; he wanted dazzling brilliancy and fire—a sparkling diamond. To do that, he reengineered several steps in the cutting process that allowed him to control the stone's shape, the facet angles, and ultimately how light entered and exited the diamond. Eventually, the cutting industry started to adapt its thinking to his methods.

Even though Morse had developed a gauge for measuring angles and producing a well-cut diamond by the early 1870s, optic theories were not a significant part of the science of gemology until the 1890s.

[112] Kunz, 1903
[113] "American Cut Diamonds," 1900

A short article in an 1887 issue of *The Jewelers' Circular and Horological Review*, titled "Why Diamonds Sparkle," discussed why the optical properties of diamond allowed it to sparkle more than other materials.[114] Encyclopedias also started to document the "mean index of refraction" of diamonds at about this time.[115]

Gemological writers began to explore the influence of cutting angles on the appearance of diamonds and other gem materials at about the same time that scientists began to understand their interaction with light. The idea of how the critical angle influences light refraction and reflection in diamonds was known in the gemological world as early as 1881.[116]

Early ray-tracing—following the path of a single ray of light, in this case graphically, through the two-dimensional outline of a diamond's surface—was done by experts in mathematics and optics. This process offered the first support for "proper angles" in cutting.

Max Bauer, in his 1896 book *Precious Stones*, was the first to describe and demonstrate the light path through a diamond.[117] He did not address the subject of correct angles, but emphasized the correct proportions of the different parts of the gem.[iv] This is not surprising, since the use of a gauge for measuring angles to cut diamonds was still not widespread. Even if Bauer was aware of such a gauge, his European readers would not have been able to easily measure angles on their own.

The diamond cutting trade had also begun to change. Science was demonstrating the importance of angles and the gauge Morse introduced. This gave the jewelry trade more reason to accept these new ideas about optics and light.

The New York jeweler Wallis Cattelle synthesized these converging ideas in his 1903 book *Precious Stones: A Book of Reference for Jewellers*.[v] He provided what may be the first ray-tracing of what he called the American cut diamond (Fig. 3-5) and explained, "The public, seeing its superiority, began to insist upon having stones cut and proportioned after his [Morse's] method, and European cutters were gradually obliged to conform more and more to it. The result is that the proportions of the American brilliant have been generally adopted, though the finest and most exact cutting is still done in the United States."[118]

[114] "Why Diamonds Sparkle," 1887
[115] *Chamber's Encyclopedia*, 1891
[116] Jannettaz et al., 1881; Doelter, 1893
[117] Bauer, 1896
[118] Cattelle, 1903

Cattelle's book details the melding of optical science with practical cutting techniques, and uses the term "ideal"[vi] when referring to proportions and facet placement for diamonds for the first time, all in regard to the larger terms he used: "American brilliant" and "American-cut."

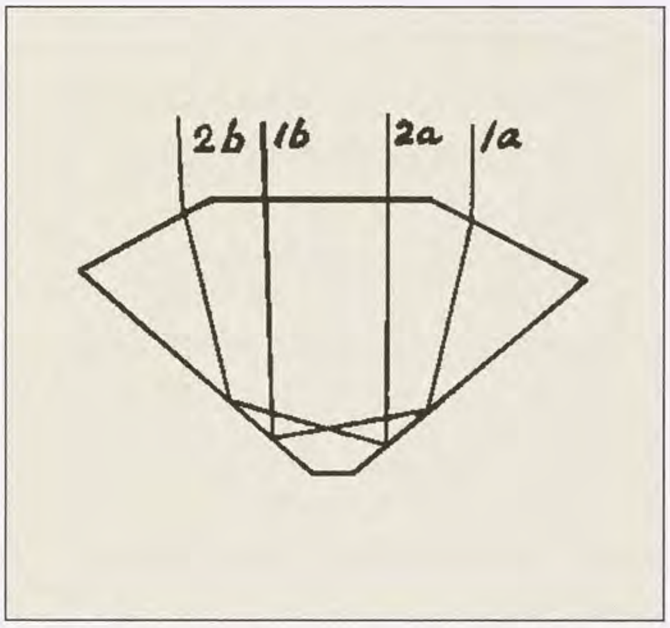


Fig. 3-5: Wallis Cattelle was one of the first to provide ray-tracing for the American cut diamond. *Cattelle, 1903.*

The general jewelry trade did not use the term "ideal" in describing the American cut diamond at this time, however. It associated "scientific cutting" with the American cutting style. Although the origin of the term is unknown, it implied that science was the basis for determining the best proportions for a polished diamond. "Scientific cutting" may have simply been the buzzword of the times (even Kunz used it).[119]

Angles, Gauges and Proportions

What were the original parameters for the diamonds Morse was cutting? Unfortunately, the cutting angles he considered to be the best for round diamonds are not known, and it's impossible to derive them from any of his papers or the articles written about him. Morse kept his proportions secret and wrote little about them in his thousands of letters available for review.

A retail jeweler's ability to measure the proportions of a diamond was severely limited in the early 1900s. The Moe gauge was the only instrument available to jewelers, and it was more commonly found in pawn shops than jewelry stores.[vii] The Charles Moe Company (manufacturer of the Moe gauge) provided an early glimpse of the new cutting style in its 1910 book, *The Science of Diamonds*, subtitled *Be Your Own Judge, The Only Self-Educational Book on Diamonds in the World*. Chandler Chester, the author, described the proportions as "three-fifths deep as it is broad [60 percent total depth]."

[119]Kunz, 1888a

Chester added:

THE FACETS ON ANY DIAMOND should be mathematically correct. The proportion and relative angles of the facets should be figured to a perfection, with the one object in view, development of the maximum light refraction, in order to obtain the greatest possible refraction from the gem.[120]

Probably the most important detail the book provides is that the table should be "two-fifths of its spread," or a table size of 40 percent, which is small by today's preferences. The book also points out that of two different-size diamonds, a smaller, better-cut one may have the same value as the larger, "due to the quality of its cutting and its brilliancy."

Most jewelers, despite Chester's book, really didn't know what the proportions of the American cut diamond should be. As late as 1915, angle gauges were only used by cutters but certainly not by retailers.[viii] Little was published about the exact proportions. With no means to validate the proportions, cutters continued to produce bigger, but less brilliant, diamonds.

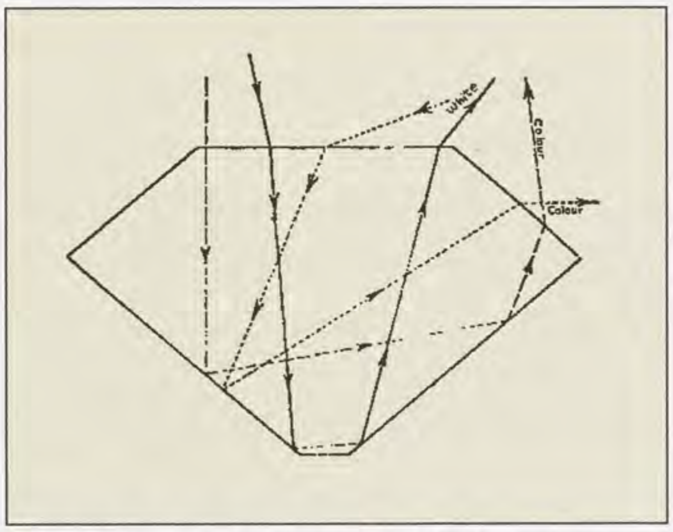


Fig. 3-6: G. F. Herbert Smith demonstrated how light passes through a diamond when he discussed the correct angles for cutting. This was one of the earliest ray-tracings published. *Smith, 1912.*

To add to the confusion, European experts gave contrary advice. The well-known London-based gemologist G. F. Herbert Smith[ix] wrote a book titled *Gem-Stones and their Distinctive Characters* in 1912. He used ray-tracing to demonstrate light passing through a diamond (Fig. 3-6), but his conclusions about optimal angles were more in line with older diamond cutting techniques than with optical design-based calculations.[x]

Smith's ideas of how diamonds were valued also stands in stark contrast to American values: He believed value was based on carat weight, color and clarity, with no reference to cut quality.[121]

It would be more than 40 years before jewelers had a tool they could use to measure proportions efficiently.

[120] Chester, 1910
[121] Smith, 1912

Notes

[i] The dop holds the diamond in a fixed position against the scaife, a revolving wheel charged with diamond powder. The scaife slowly grinds away material from the diamond being cut, leaving a flat facet.

[ii] In addition to the Belgian source quoted in the text, Kunz wrote, "The process of sawing diamonds, whereby it is possible to saw in two, at the central part or girdle, an octahedron (known as six-point) or a long stone, or to remove an imperfection that it was impossible to cleave at a given point, has now come largely into use in the United States, and also at Antwerp and Amsterdam. This is especially true of the United States and Antwerp, where the larger diamonds are cut, and to a less extent of Amsterdam, where the smaller stones, known as melee, are more used; although there is no patent law in Holland to prevent its introduction. The invention, or inventions, are by Americans, and call to mind the old method of sawing the larger gems by means of small, flat lead strips, or saws, such as were used when the Regent diamond was cut in 1750" (Kunz, 1903).

[iii] "This country has revolutionized the art of diamond cutting. Prior to the pioneer efforts of Henry D. Morse, of Boston, in the sixties, nearly all the diamonds sold were cut and polished in Amsterdam and Antwerp. The chief aim then was to get the largest gem possible out of a rough stone, regardless of its brilliancy. Mr. Morse's idea of a brilliant was a stone so cut as to receive, refract and finally to reflect all the light possible. He was soundly berated by the European cutters for his waste of material; but he produced gems that they were unable to match, except by conforming to his ideas. … Cleaving or splitting the diamond was not original with this pioneer American cutter. It has been practiced from the earliest times, but deliberately splitting a large stone along the plane of a small flaw was a treatment so courageous that the older cutters were astounded by it. They had been taught, that weight in a diamond was the first consideration, and a flaw that could be detected only by an expert was not regarded as sufficient to justify the division into two or three gems, however beautiful and perfect they might be. The American cutters completely overthrew that theory by adherence to the new school of perfection and securing the greatest possible brilliancy. The Americans did not hesitate to recut large stones that had been made ready for the market according to the European standard of form, thereby somewhat diminishing their weight, but unmistakably improving the appearance and increasing their value. The cleaving of diamonds became a higher art than ever, as a result of the studious endeavor to produce from a flawy [*sic*] stone the largest possible perfect brilliants" ("American Cut Diamonds," 1900).

[iv] "Gem cutters, by prolonged experience have arrived at certain empirical rules which are always applied, and which are modified to suit particular cases. In colourless stones, for example, there must be a fixed proportion between their breadth and their thickness" (Bauer, 1896).

[v] "Knowing the exact angle to which rays of light are bent on entering, and the angle at which light endeavoring to pass from a denser medium into the air, as from a diamond, is totally reflected, it has been found possible to so form it and arrange its back facets as to catch the fugitive rays in their effort to pass through, and, by driving them back and forth among the adamantine walls, round them up within the interior and finally return them in brilliant flash-lights through the face of the stone, to the delighted eye of the beholder" (Cattelle, 1903).

[vi] The term "ideal" was evidently used to describe the best mathematically derived proportions for various gems. A promotional pamphlet, written by W. Holcomb for San Diego County in 1905, titled "The Wealth of San Diego County: Precious Gems and Commercial Materials," includes a short section on the gem cutting trade. The pamphlet notes: "Ideal cutting not only requires exact proportions, but the placing of the facets mathematically true, and several of the Lapidists of San Diego have perfected very ingenious devices for securing mechanically right proportions and exact facetings" (Holcomb, 1905). The concept of using correct angles for various gems was crossing over into the colored stone world.

[vii] The more extensive use of the Moe gauge by pawnshop dealers is logical. A pawnshop dealer did not have the advantage of learning from a high volume of diamonds or suppliers. He had to teach himself how to make intelligent buying decisions, especially in purchasing diamonds or diamond jewelry. The Moe gauge helped in those decisions.

[viii] "Most dealers, however, are not provided with suitable gauges (goniometers) for the accurate measurement of the angles of small objects, like diamonds, nor have they skill to use them. The best and most careful American cutters who work only on fine goods are constantly testing the make of their brilliants as it develops on the lap, and they have gauges of various types for this purpose" (Wade, 1915a).

[ix] G. F. Herbert Smith was assistant secretary of the British Museum (Smith, 1930) and a member of GIA's Advisory Board (Gravender, 1933).

[x] "In order to secure the finest optical effect certain proportions have been found necessary. The depth of the crown must be one-half that of the base, and therefore one-third the total depth of the stone, and the width of the table must be slightly less than half that of the stone. ... If the table had actually half the width of the stone, the angle between it and a templet [*sic*] would be exactly half a right angle or 45°; it is, however, made somewhat smaller, namely, about 40°. A pavilion, being parallel to a templet [*sic*], makes a similar angle with the culet. The cross facets are more steeply inclined, and make the angle of about 45° with the table or the culet, as the case may be" (Smith, 1912).

"SCIENCE HAS COMPUTED THE EXACT PROPORTIONS IN WHICH THE DIAMOND MUST BE CUT TO ATTAIN THE MAXIMUM BRILLIANCY."[122]

J. R. Wood & Sons
Diamond Cutting Company, 1918

Chapter 4

Merchandising and the Early Years of the American Cut

To David Jeffries, writing in the 1750s, value was closely tied not only to color, clarity and carat weight, but also to the quality of the cutting. By Henry Morse's time, the relationship of cut to aspects of value and price was lost in many sectors of the cutting world. Morse, through his desire to create the most beautiful diamonds and his manufacturing innovations, brought the focus back to cut, but his ideas were slow to be adopted. This was due to resistance to his new methods, the sheer numbers of stones cut to older styles and a lack of clear information about the nature of the faceting style that would be referred to as the new American cut.

This diamond had a different appearance: It wasn't square or cushion shaped, but looked bright and sparkly and round. The new style's appearance was dramatic, noble and notable. Its proportions would soon be determined by mathematical calculations and ray-tracing.

[122] J. R. Wood & Sons, 1918

The public and the American retailer would come to believe that if a diamond was American cut, it had to be the best.

Until jewelers could easily represent value differences, with tools to show why diamonds were priced differently for different cut qualities, the proportions for the American cut were vulnerable to degradation.

American cut was also not a distinctive enough term, so "scientific cutting" became popular starting in the 1890s. This made it necessary to explain the advantages of specific proportions to the jewelry trade and public.[i] That's why Frank Wade, Herbert Whitlock, J. R. Wood & Sons, and a handful of retailers such as Tiffany & Co. and Marshall Field & Co., became so important. Without their education of the jewelry industry, the pioneering work of Morse, Field and Hermann would have been lost.

Jewelers' Circular also created a campaign to teach jewelers about diamonds, and advocated the idea that the best-cut diamonds could be made, if only jewelers and cutters could distinguish them. If jewelers didn't take the time to get educated, they risked misrepresenting what a well-cut diamond looked like.

The confusion didn't stop Americans from being proud of their achievements; their bragging bordered on arrogance. George Kunz epitomized the pride held by Americans:

> THE INGENUITY AND ENTERPRISE of the American cutters have been material factors in their success. ... It has been left to the Americans to introduce a number of new mechanical labor-saving devices, which have unquestionably given them a great advantage over the European cutters.[123]

Branding the American cutting style was the next logical step as American cutting firms sought to distinguish their diamonds. Early on, they recognized the need to create demand for the cutting style before it could enjoy widespread acceptance.

A Small Part of a Large Market Grows

American and English cutters were trying to get a very small part of a very large market at the turn of the 19th century.

American Contract Labor[ii] laws restricted the importing of skilled laborers (in this case, experienced diamond cutters) under contract,

[123] Kunz, 1903

unless the skilled labor for that industry could not be found domestically. This set the stage for several legal battles over importing diamond cutters from Europe.[124] Dutch cutting houses wanted to set up shop in America[125] and move their workers there even though the pay was higher.

Diamond cutting in America amounted to only one percent of the finished diamonds sold in the U.S. in 1885, but Kunz noted in the 1902 Geological Report in *The Jewelers' Weekly* that "in the brief period ... during which the diamond cutting industry has been conducted on a commercial basis ... it has advanced with such rapid growth that this country now commands a foremost position among the diamond-cutting countries of the world."

Kunz went on to cite import figures of $7,000,000 worth of rough for the year ending June 30, 1903. When cut, it was valued at more than $10,000,000.[iii] Yet, during that same year, the United States imported $19,000,000 worth of finished diamonds. Domestic production accounted for more than one-third of American consumption[126] even though American workers numbered only 490 against more than 16,000 in Europe (Fig. 4-1).

Diamond Cutting in 1902

Location	Factories	Workers
Amsterdam	72	8,000
Antwerp	78	4,000
London	not reported	1,000
Jura region, France	not reported	1,000
Paris	not reported	500
Geneva and Berlin	not reported	500
Hesse, Germany	not reported	500
Idar & Oberstein	not reported	1,000
United States	**14**	**490**

Fig. 4-1: This chart shows the number of workers and factories cutting diamonds in Europe and America in 1902, as reported by Kunz (1903). The U.S. total represents an increase from 147 workers in 1885 to 490 in 1902, a more than 300 percent increase *(Kunz, 1894a)*. Some American cutting houses were extensions of European cutting factories and had only passing interest in the new American cutting style.

[124] "Foreign Diamond Cutters Have Trouble," 1895
[125] Kunz, 1896
[126] Kunz, 1903

Many American firms cut only a small amount of goods from rough at first; their primary work was recutting poorly cut European goods. The large parcels of finished diamonds and mixed goods they imported and cut or recut were put up for sale. The first large "parcels" of truly American-cut diamonds were successfully offered for sale in 1888, the year of Morse's death.[127] (Morse had tried to sell large parcels, but eventually gave up.[128])

The American diamond industry expanded dramatically in the few years after mechanization became widespread in the late 1800s, which created a temporary price advantage over imported cut diamonds. Cutting time for a 3-ct. diamond was reduced from 132 total hours—when bruted by hand—to 39 hours when shaped by machine; small stones were probably reduced from several days to one to three hours. Despite the improvements, "more than half the gain in time is lost in expense," Kunz reported at the time.[129]

A 10 percent duty on cut diamonds, imposed in the 1870s,[iv] [130] also added to the Americans' advantage.

The American Cut Is Born

American diamond cutting was setting itself apart from cutting done elsewhere in the world, and "cut by gauge" became a standard for those who followed Morse. J. B. Humphrey[v] purchased the Morse shop when Morse passed away in 1888. Humphrey was praised in an 1894 article in *The Jewelers' Circular and Horological Review* and the importance of the gauge was noted: "Every stone in Mr. Humphrey's shop is cut by gauge."[vi]

Thanks to the efforts of Morse and those who followed him, and reports in the public press about the quality of cutting he introduced, the American cut round brilliant was born. Because of the quality and quantity of cutting done in New York City, Morse's cutting style grew quickly once it reached the likes of Isaac Hermann, Tiffany & Co. and others.

The Jewelers' Weekly reported in 1882 that the perception was that the "work of cutting and polishing diamonds was often done carelessly in Europe and that American workmen could better satisfy the critical taste of American buyers. ... " The article credited a rising

[127] Traub, 1896
[128] Morse letters, June 19, 1885; June 20, 1885; July 16, 1885; May 9, 1887
[129] Kunz, 1898
[130] Kunz, 1899

Fig. 4-2: While the round shape was gaining importance in the American diamond trade, diamonds were still being cut in square cushion shapes. This is one of the last advertisements in the U.S. industry press to tout the square cut diamond (note the diamond's small table). *Smith, 1890.*

demand for American cut diamonds. "So marked was the difference between the imported diamonds and those cut and polished here, that a demand for stones of American finish was created."[131]

Even the British harbored a less than enthusiastic opinion of diamonds cut in Holland: "The Diamond-cutters of England are confessedly the best in Europe ... many stones ... sent to Holland; where ... the price of workmanship is considerably lower, but in at least an equal degree inferior to that of London."[132]

[131] "One Carat, Perfect: $100," 1969
[132] Mawe, 1813

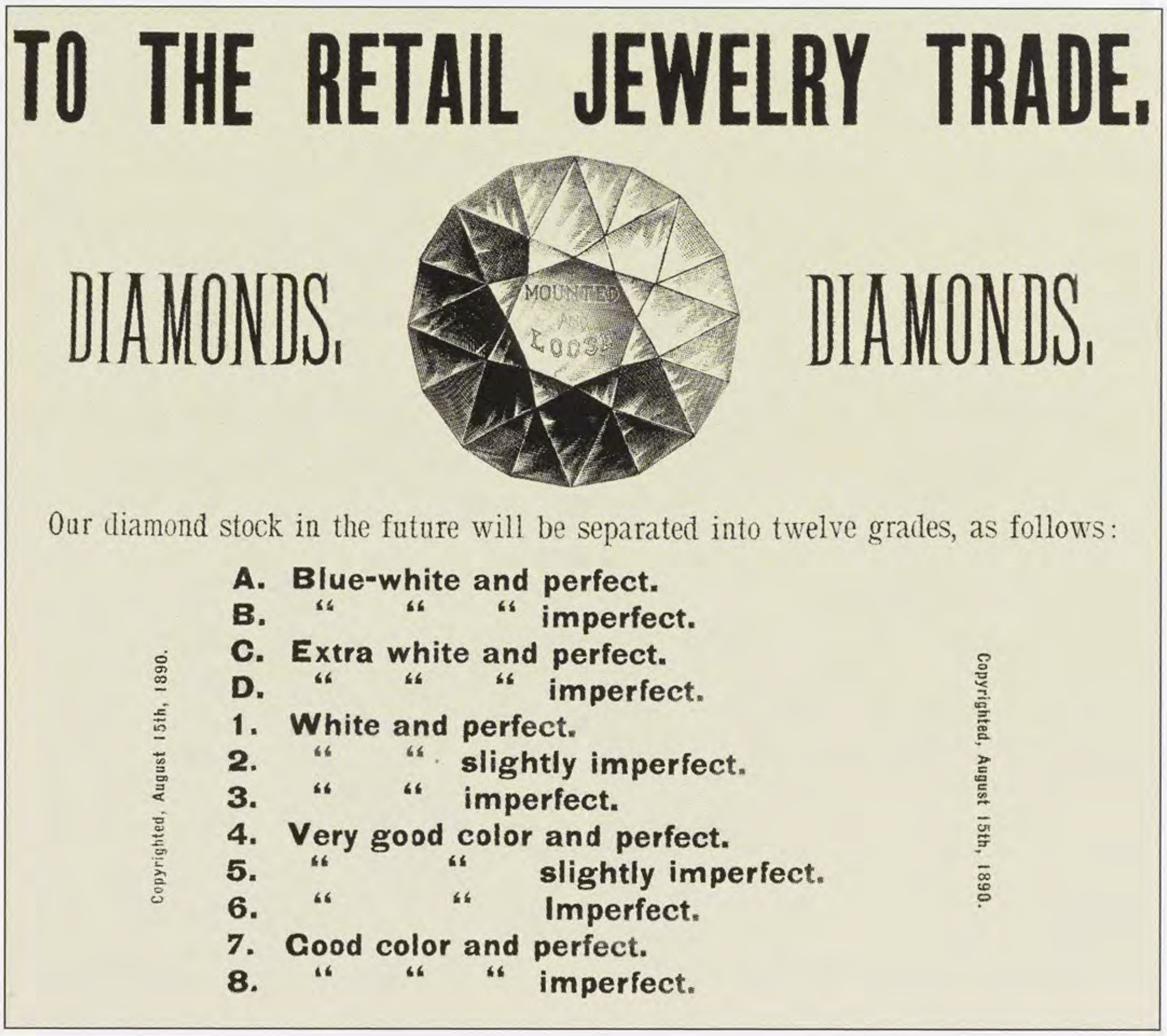


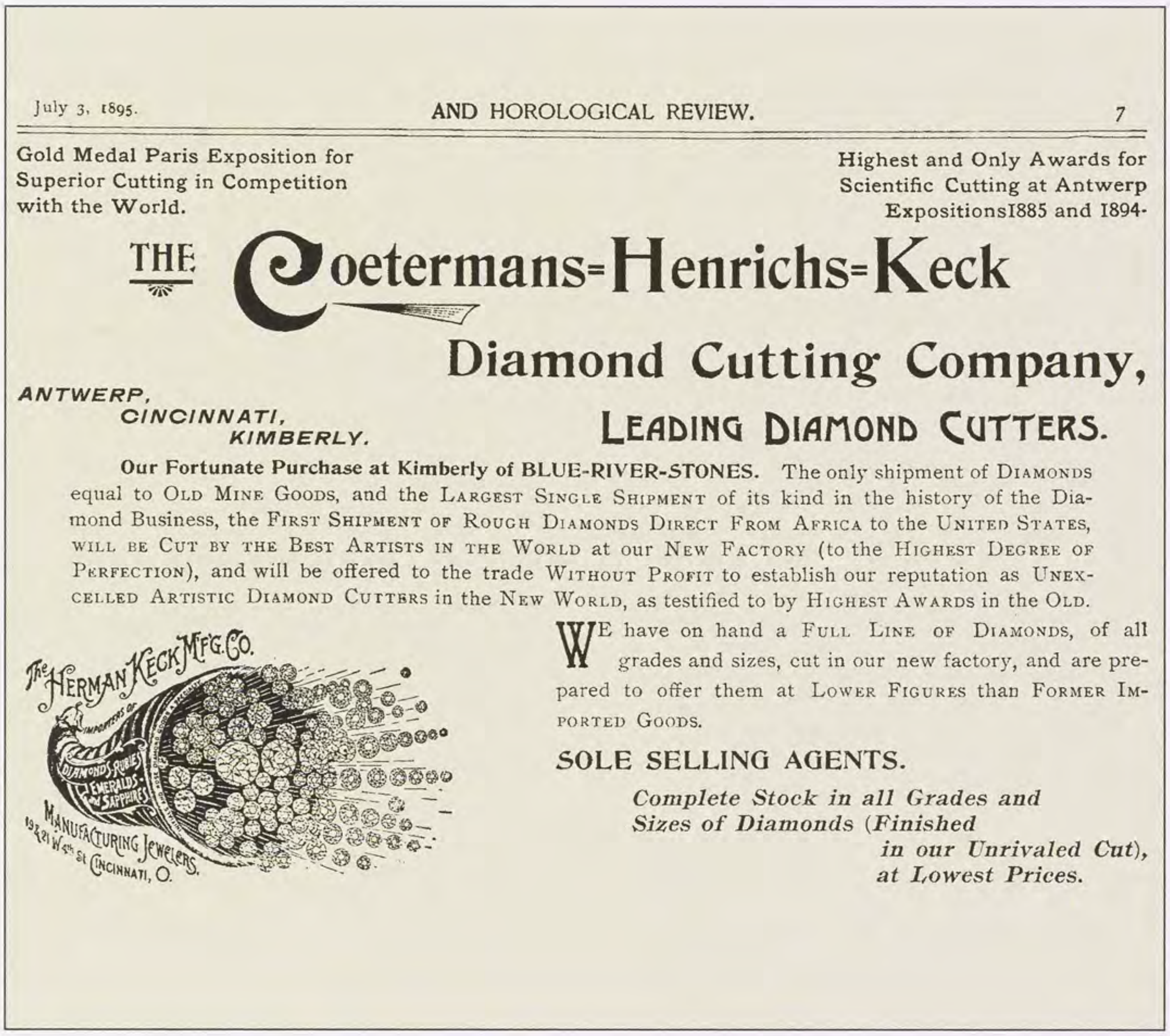
Fig. 4-3: The round shape was an important part of the American diamond trade by 1890 (note the small table and very round shape in this illustration). The 16-sided shape illustrates the preference for knife-edged girdles during this period. New York's Henry Ginnel & Co. was one of the first to advertise different quality grades. *Henry Ginnel & Co., 1890.*

Even though Boston newspapers referred to the local cutting by Morse as "American cutting,"[133] the American cutting style became best known through the efforts of the New York cutting firms. Author and jeweler Wallis Cattelle makes constant reference to the "American brilliant" and the "American cut brilliant" in his 1903 book on proper diamond cutting.[134]

Advertisements continued to tout the old square shape, but within a few years it was rarely seen in American trade journals (Fig. 4-2). The round brilliant was also being advertised by American cutters[135] (Fig. 4-3) by 1890.

Jewelers throughout America recognized the differences in cutting by the turn of the century. One advertisement for Julius C. Walk & Sons in an Indiana newspaper in 1903 proclaimed: "The finest diamonds come to America. The finest cutting of diamonds is done in America."[136]

[133] "Diamond Cut Diamond," 1887
[134] Cattelle, 1903
[135] Henry Ginnel & Co., 1890
[136] "Retail Jewelers' Advertising," 1903



July 3, 1895. AND HOROLOGICAL REVIEW. 7

Gold Medal Paris Exposition for Superior Cutting in Competition with the World.

Highest and Only Awards for Scientific Cutting at Antwerp Expositions1885 and 1894-

THE Coetermans-Henrichs-Keck

Diamond Cutting Company,

ANTWERP, CINCINNATI, KIMBERLY.

LEADING DIAMOND CUTTERS.

Our Fortunate Purchase at Kimberly of BLUE-RIVER-STONES. The only shipment of DIAMONDS equal to OLD MINE GOODS, and the LARGEST SINGLE SHIPMENT of its kind in the history of the Diamond Business, the FIRST SHIPMENT OF ROUGH DIAMONDS DIRECT FROM AFRICA to the UNITED STATES, WILL BE CUT BY THE BEST ARTISTS IN THE WORLD at our NEW FACTORY (to the HIGHEST DEGREE OF PERFECTION), and will be offered to the trade WITHOUT PROFIT to establish our reputation as UNEXCELLED ARTISTIC DIAMOND CUTTERS in the NEW WORLD, as testified to by HIGHEST AWARDS in the OLD.

WE have on hand a FULL LINE OF DIAMONDS, of all grades and sizes, cut in our new factory, and are prepared to offer them at LOWER FIGURES than FORMER IMPORTED GOODS.

SOLE SELLING AGENTS.

Complete Stock in all Grades and Sizes of Diamonds (Finished in our Unrivaled Cut), at Lowest Prices.

Fig. 4-4: The Coetermans-Henrichs-Keck Diamond Cutting Company was one of the first to advertise "scientifically cut" diamonds. *Coetermans-Henrichs-Keck Diamond Cutting Co., 1895a.*

Marketing the Scientifically Cut Diamond

There are numerous references to Morse's scientific approach to studying diamonds, but the earliest record of the term "scientific cutting" (aside from Kunz) is found in the 1895 advertising of a diamond cutting firm. The firm Coetermans-Henrichs-Keck Diamond Cutting Company, based in Antwerp, with an office in Cincinnati, advertised that it had received a "Gold Medal ... for Superior Cutting in Competition with the World," and also received the "Highest and Only Awards for Scientific Cutting. ... " in competitions in Antwerp.[vii] There is no evidence that an award for scientific cutting was given in Antwerp; it was probably an award for fine cutting[137] (Figs. 4-4 and 4-5).

Not to be outdone, the diamond cutting firm Oppenheimer Bros. & Veith in New York took out an advertisement in the *The Jewelers'*

[137] Coetermans-Henrichs-Keck, 1895

Fig. 4-5: Coetermans-Henrichs-Keck promoted its diamond goods with artistic advertisements, as well as ads about scientific cutting. *Coetermans-Henrichs-Keck Diamond Cutting Co., 1895b.*

Circular-Weekly claiming to be the "Leaders in Scientifically Cut Diamonds. We are daily receiving from our cutting works scientifically cut diamonds of all sizes."[138]

J. Heilbronn & S. Marchand diamond cutters, a company with offices in New York, Paris, Amsterdam and Antwerp, claimed, "By the end of this month we will have finished a beautiful series of diamonds, in sizes from 1/2 carat to 3 carats which will be cut and polished by us here in the most scientific manner."[139]

The concept of scientific diamond cutting was used freely in American publications, but seems to have been avoided in England. There, "scientific" alluded to manmade or synthetic gem materials.[140] Americans also called synthetic gems "scientific stones,"[141] but continued to refer to "scientific cut."

"Scientific cutting" became the buzzword of the American jewelry industry. It implied care and prudence in the cutting of diamonds, and most firms wanted to suggest that their diamonds were cut to such standards. Companies hoped the advertisements would capture the American public's attention.

Promoters of the Term "Scientific Cutting"

The firm that probably helped associate the term "scientific cutting" with the American cut round brilliant and gave it the clearest definition was J. R. Wood & Sons (the forerunner of ArtCarved) in New York. Established in 1850, the company began with a line of mountings and other merchandise for the jeweler, but by 1893 decided to start importing and selling diamonds, with an emphasis on high-quality cutting.

J. R. Wood & Sons began to run full-page ads that regularly appeared inside the front or back cover of major jewelry magazines in 1901.[viii] It also offered lifetime guarantees on their "seamless wedding rings," which it referred to as "America's Standard Wedding Rings."

J. R. Wood & Sons published a 1903 customer leaflet that gave "particulars regarding correct cutting and dimensions of diamonds." An advertisement referring to the leaflet shows three views: a top,

[138] Oppenheimer, 1897
[139] Heilbronn, 1902
[140] e.g., Smith, 1912
[141] e.g., Wade, 1918

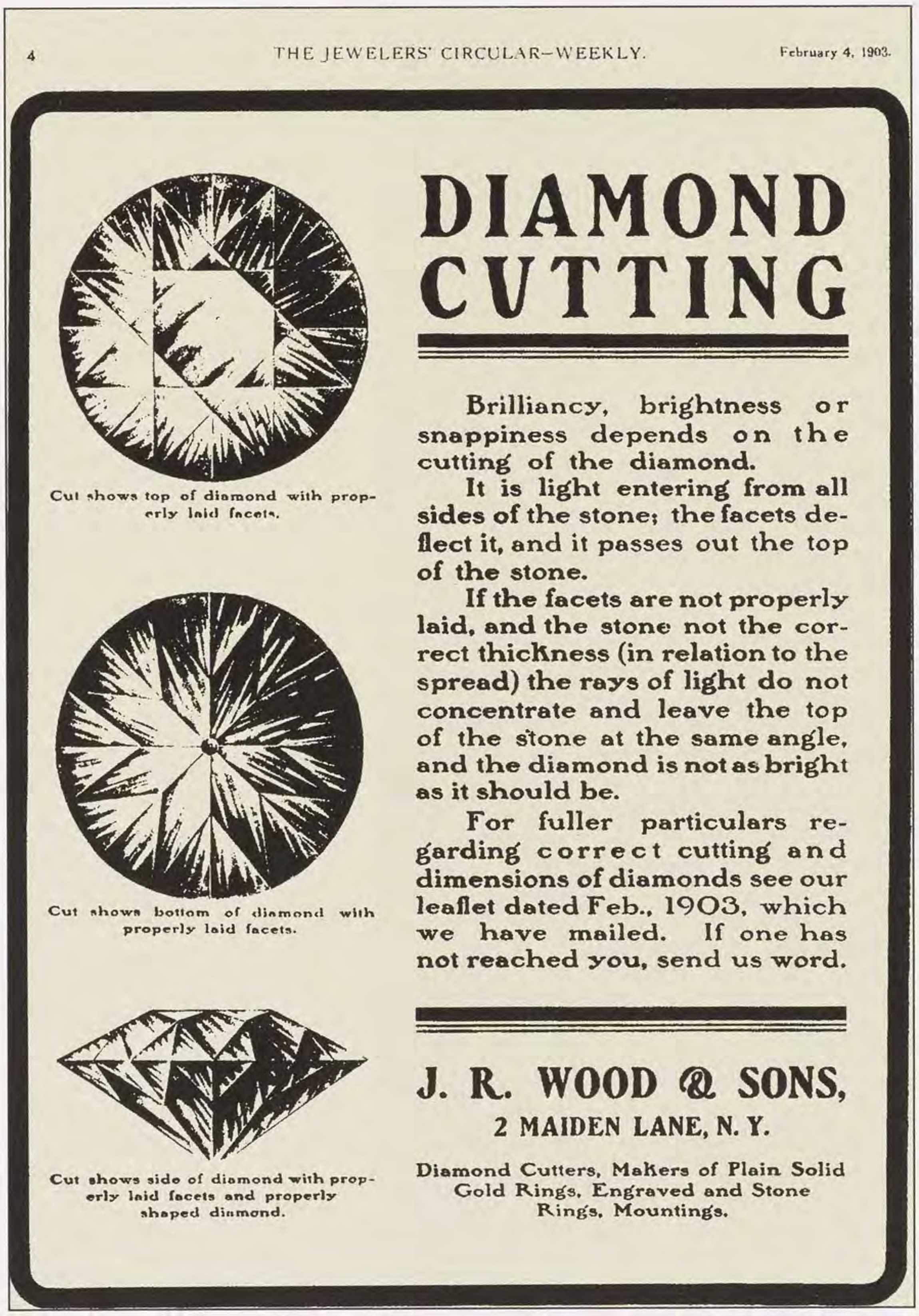


Fig. 4-6: J. R. Wood & Sons was careful to show retailers what they considered "correct cutting" in their advertising. Advertising that emphasized proportion information started around 1903. *J. R. Wood & Sons, 1903.*

bottom and side view of a round brilliant diamond, and states, "Brilliancy, brightness or snappiness depends on the cutting of the diamond."[ix][142] (Fig. 4-6)

The ad made a point to show jewelers that J. R. Wood & Sons was an American company and their policy (as stated inside the cover of their catalogs) was "to manufacture the highest grade article human skill coupled with absolute honesty can produce. ... The high regard together with the wide sale our products enjoy have led them to be known as—'America's Standard.'"[143]

By 1918, J. R. Wood & Sons claimed, "We are one of the largest diamond cutters in America. Finest American Cutting—Cut in our own Cutting Works."

In striving to import well-cut diamonds from overseas, the company reported in its 1918 catalog, "We experienced great difficulty in securing the high standard of cutting and perfection demanded. As a consequence arrangements were made to import rough diamonds only and cut them ourselves, thus controlling the make or brilliancy of our stones. ... It might be interesting to note that over ten thousand retail jewelers continuously buy their diamonds from us."[144]

J. R. Wood & Sons placed numerous advertisements at this time. Some played up the patriotic themes before and during World War I to evoke an American pride in their cutting style (Figs. 4-7, 4-8 and 4-9).

[142] J. R. Wood & Sons, 1903
[143] J. R. Wood & Sons, 1918
[144] Ibid.

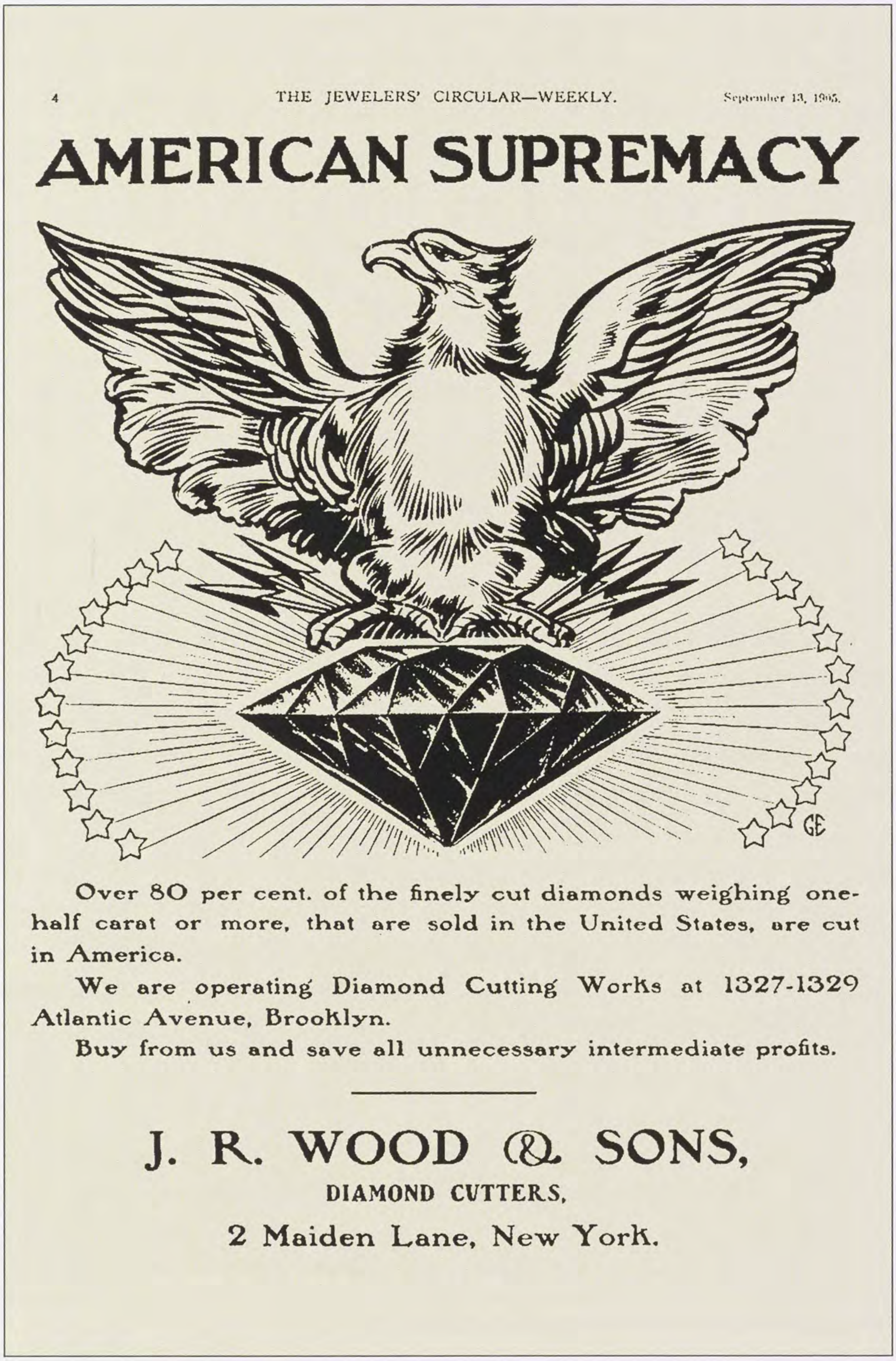


Fig. 4-7: This advertisement is one of J. R. Wood & Sons' more patriotic ads. *J. R. Wood & Sons, 1905.*

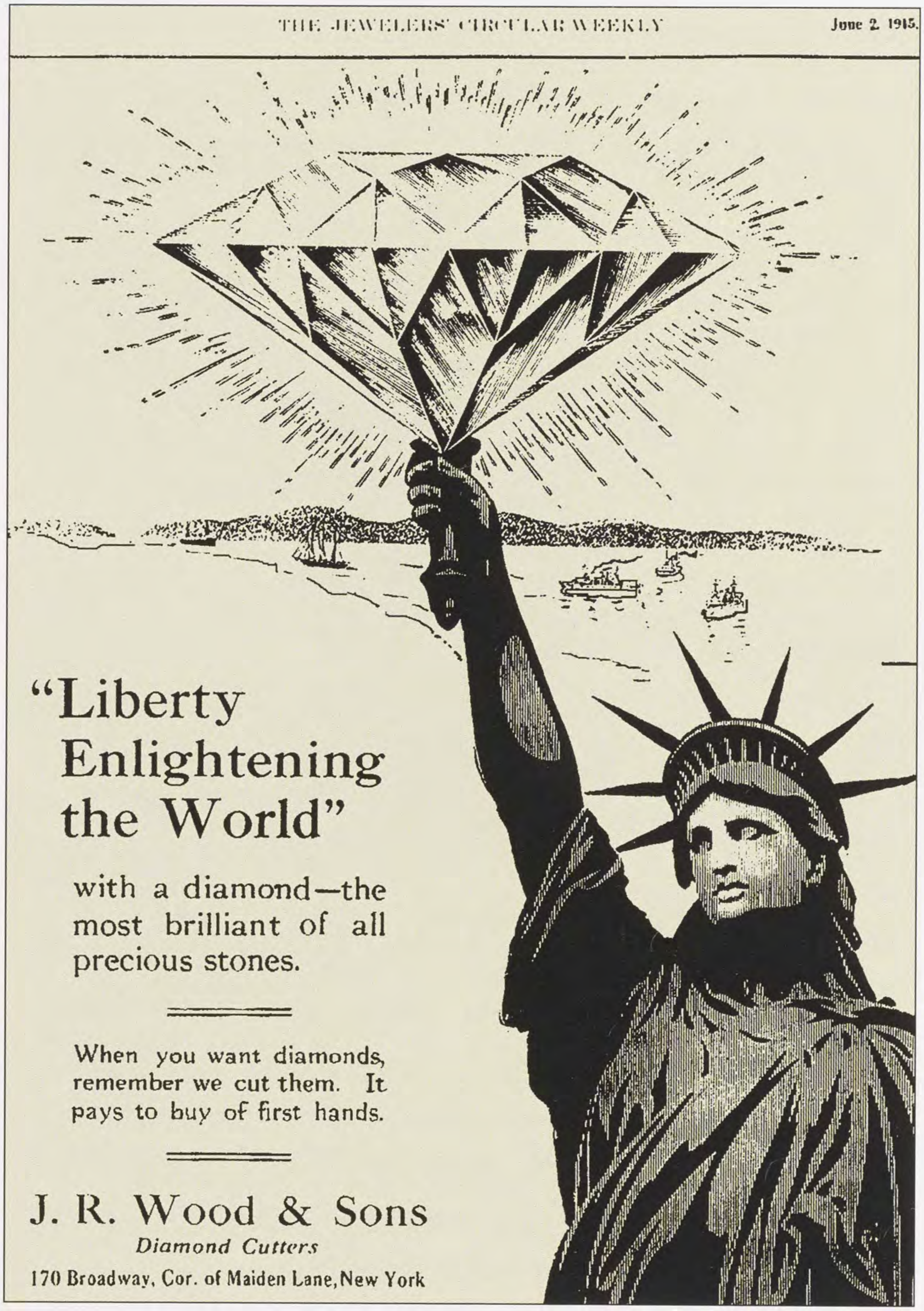


Fig. 4-8: Some J. R. Wood & Sons' ads emphasized "American cutting" by replacing Lady Liberty's torch with a radiant diamond. *J. R. Wood & Sons, 1915c.*

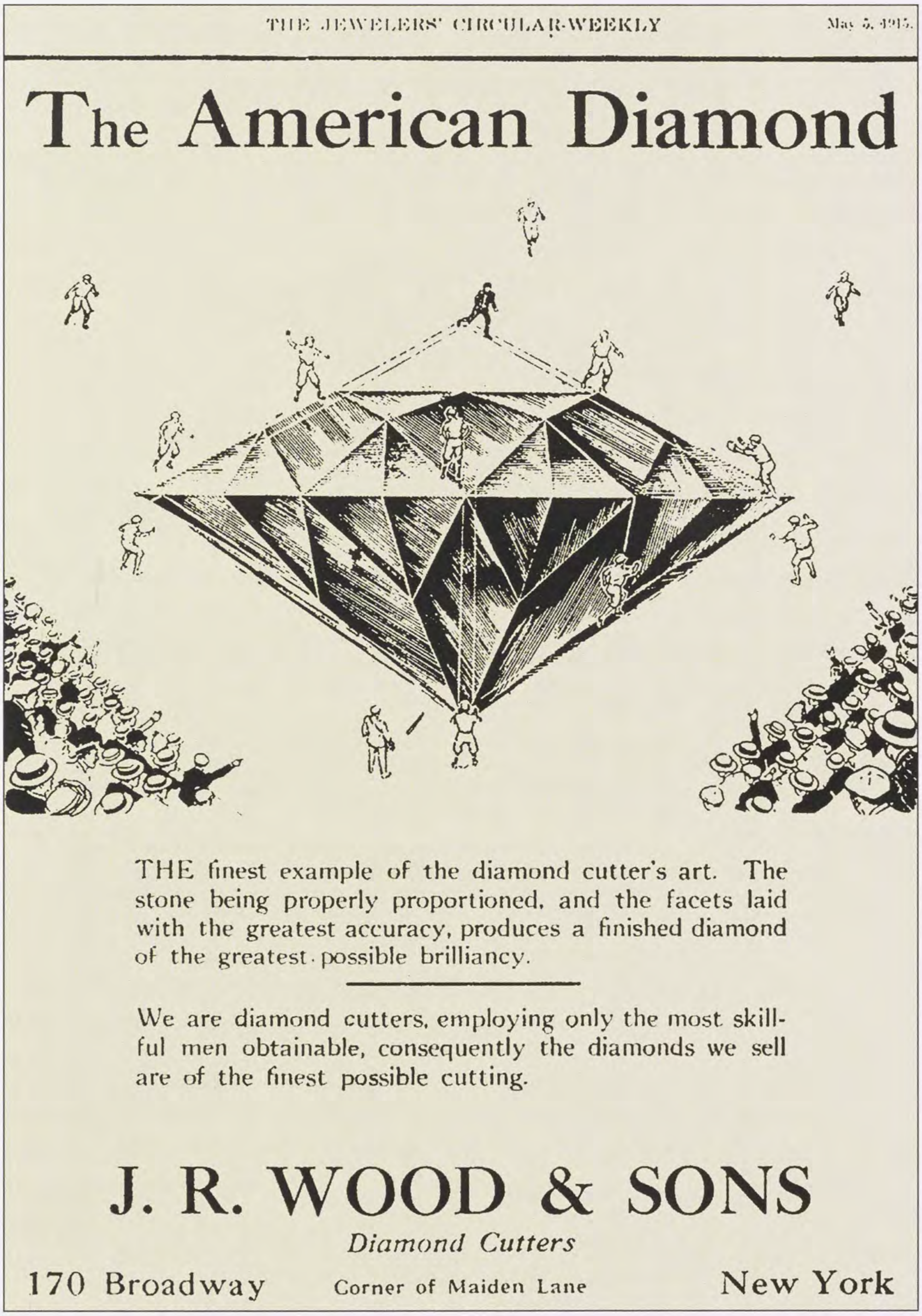


Fig. 4-9: J. R. Wood & Sons' advertising played heavily on the fact that their diamonds were American cut. This ad, which appeared frequently, shows a crowd around a baseball "diamond." *J. R. Wood & Sons, 1911b.*

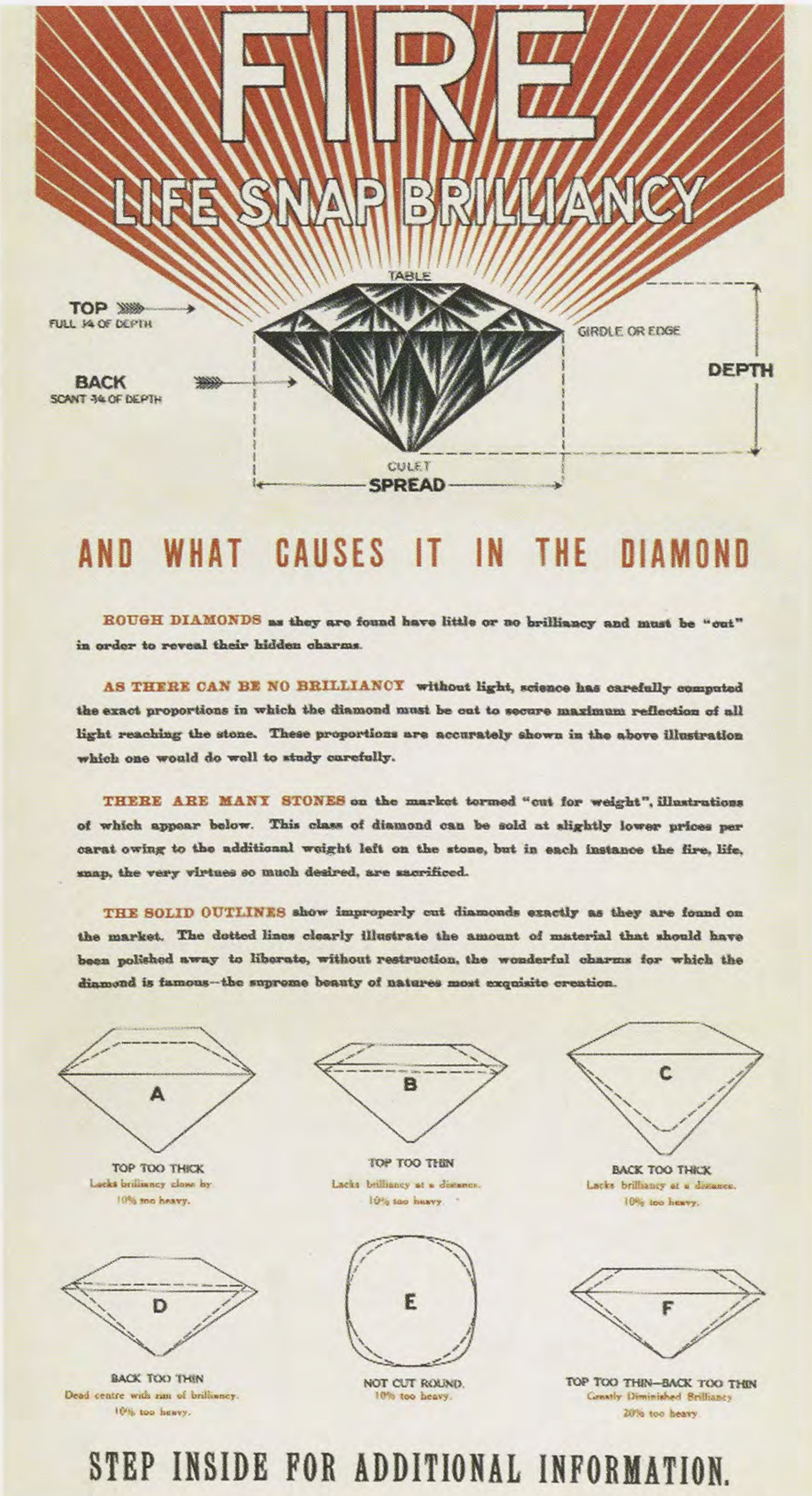


Fig. 4-10: J. R. Wood & Sons provided posters for retailers to display in their store windows that explained the importance of proper cutting proportions. Note the silhouettes at the bottom and the overlaying of the correct proportions. This made it easy for jewelers and the public to visually compare their diamonds with proportions that were considered correct. *J. R. Wood & Sons, 1915a.*

The company's greatest contribution to the idea of scientific cutting, however, came in 1915, when it gave retailers a tool to explain to the public why cutting was important (Fig. 4-10):

"Science has carefully computed the exact proportions in which the diamond must be cut," the poster read. It also provided silhouettes of the recommended proportions along with those of "improperly cut" diamonds. The poster encouraged the passerby to "Step inside for additional information."[145]

The poster seems to have followed an earlier pamphlet (the same silhouettes and similar terms are used) that stated, "They are Scientifically Cut for Maximum Brilliancy, Fire, Snap and Animation—as Shown in This Illustration."[146] Other magazine ads echoed the theme, "Our diamonds scientifically cut by the most skillful workmen obtainable, for utmost brilliancy, are full of life and fire."[147]

J. R. Wood & Sons claimed that their diamonds were "standard" and took credit for making them so—one of their full-page ads declared, "Time Has Made Our Diamonds Standard."[148] They were quick to point out that "Brilliancy, the one feature which makes diamonds prized so much, is sacrificed when diamonds are 'cut for weight.' You are not giving your customers maximum diamond satisfaction, unless the diamond is proportioned as above which gives utmost snap and brilliancy."[149]

Many other jewelers and cutters also embraced the term "scientific cutting," adding credence to J. R. Wood & Sons' claim. Ads from jewelers around the country proclaimed, "Our stock is composed of unusually fine gems scientifically cut to produce a beautiful brilliancy,"[150] or "The cutting is of the most elaborate, scientific nature, rendering the utmost brilliancy."[151]

Another ad read, "Certainly ours are worthy of the best that can be said about diamonds. They are ... fiery, scientifically-cut, brilliant stones—diamonds that will never be criticized in any company."[152] Even the Hallmark Store recognized the popularity of the new American style of cut, claiming in a 1917 booklet that "nowhere else is the brilliancy [of diamonds] so pronounced as in the American-cut stones."[x]

Marshall Field & Co. of Chicago, one of the leading retail jewelers of the day, not only made scientific cutting and its proportions the standard for its diamonds, but also printed a booklet in 1914 titled

[145] J. R. Wood & Sons, 1915a
[146] J. R. Wood & Sons, 1911a
[147] J. R. Wood & Sons, 1915d
[148] J. R. Wood & Sons, 1917
[149] J. R. Wood & Sons, 1911a
[150] Kohn, 1917
[151] Mulford-Thompson, 1916
[152] Albert S. Samuels Jewelry Co., 1919

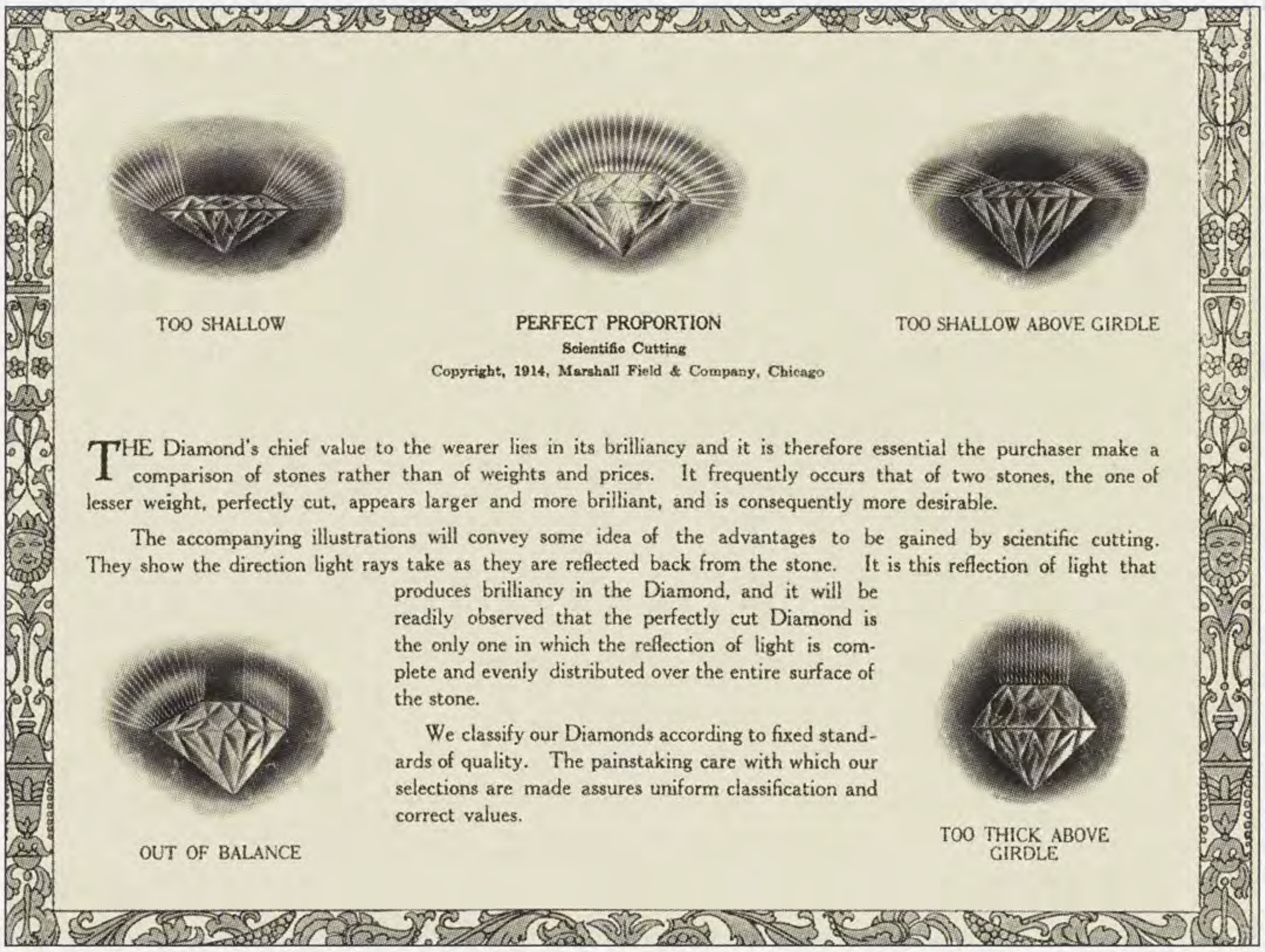


Fig. 4-11: Five diamond profiles used in the Marshall Field & Co. catalog demonstrate the advantages of scientific cutting. *Marshall Field & Co., 1918.*

"How to Buy Diamonds," which told customers about the impact of cut quality on a diamond's value.[xi]

Mimicking the advertising of J. R. Wood & Sons, it also provided profiles that compared diamonds with "perfect" and unacceptable proportions (Fig. 4-11).

Lack of Clear Measurements Leads to Misleading Advertising

The lack of a gauge to measure diamond angles meant that retail jewelry firms large or small could not recognize diamonds in the new American round style. The issue came to a head between 1915 and 1918 in the United States, as misleading advertising ran rampant. Sales ads proclaimed "perfect cut," "top Blue White" and "very fine quality" diamonds offered at prices well below wholesale (Fig. 4-12).[153]

As the jewelry industry became aware of the problem, *The Jewelers' Circular-Weekly* decided to run a series of articles on quality factors in

[153] Nattan, 1916a, 1916b

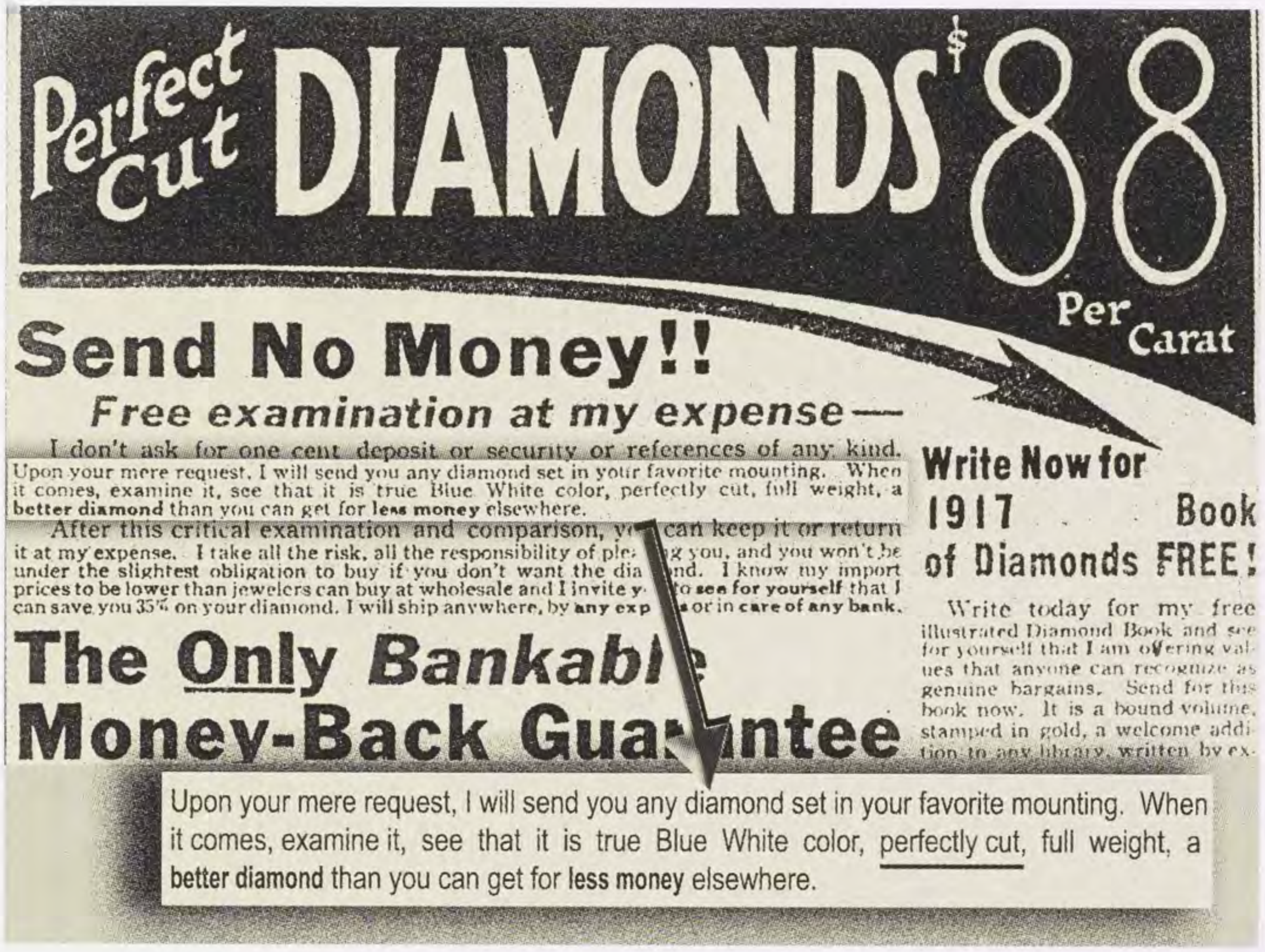
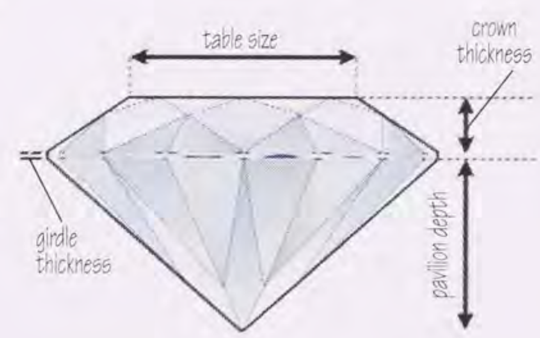


Fig. 4-12: Advertisements like this, declaring "Perfect Cut Diamonds," were becoming common in popular magazines in 1915. This ad was reproduced by *The Jewelers' Circular-Weekly* in 1916 to show the widespread misrepresentation that it felt was damaging the trade. *Nattan, 1916a.*

diamonds. One of the articles from 1915, "Cutting or 'Make' and Its Effect on the Value of Diamonds," was one of the first reports in the trade press on the proportions of the American cutting style. Frank Wade, head of the department of chemistry at Shortridge High School in Indianapolis, who became known as an expert in diamonds, wrote:

> A MEASUREMENT OF THE ANGLES being impossible to the dealer, the measurement of the spread and thickness, taken together with a measurement of the proportion of the stone above and below the girdle and that of the width of the table, will give nearly as good results, as these dimensions virtually measure the angles of the stone. In regard to these dimensions they should be about as follows in a finely-cut stone: First—The spread should be not quite twice the thickness. A ratio of 5 is [*sic*] to 3 gives very nearly the correct proportions.

Wade detailed several aspects of diamond proportions, namely: crown thickness, pavilion depth and table size ("four-tenths that of the stone"). He also explained how to use the Moe gauge to measure these relationships.[xii] [154]



[154] Wade, 1915a

Wade added a few other considerations for evaluating the "make" of the diamond. "The well-cut stone must be perfectly symmetrical. All the facets of a given set should be alike in size and shape. No additional facets should appear. ... The make of the girdle should be especially scrutinized. ... If too thick one has to pay for weight that is worse than useless ... if unpolished the dull gray edge may be reflected within the stone, hurting the color and brilliancy. The very best stones have either a knife-edge girdle or one that is polished." Wade also said that each facet must be well polished.

Wade's series of articles raised awareness that many diamonds were not being properly represented to retailers, and that the public was not getting what they thought they were buying (see "Frank Wade: America's Early Diamond Expert," facing page).

A 1916 conference sponsored by the *The Jewelers' Circular-Weekly*, the National Jewelers' Board of Trade, the American National Retail Jewelers' Association, the Retail Jewelers' Association of Greater New York and Vicinity, the New York State Retail Jewelers' Association and the New York Wholesale Jewelers' Association was held in New York.[155] The goal was to decide how to address the problems of misrepresentation of diamond cut, color and clarity.[xiii]

The Jewelers' Circular-Weekly, in connection with the conference, ran a series of editorials condemning the practice. It showed examples of misleading ads that hurt the image of the jewelry industry and mounted a letter-writing campaign to the magazines that carried them. In response to the fraudulent advertising, groups of local jewelers took out ads to define and explain what a "perfect" diamond was.[156]

Participating organizations collectively sent letters of protest to the magazines that had run the ads, such as *Literary Digest*, *McClure's Magazine*[xiv] and *Everybody's Magazine*.[xv] "One thing we notice particularly, that they use the words 'perfect cut,' which does not in any way indicate the quality of the stone," one letter pointed out.

The Jewelers' Circular-Weekly followed up by suggesting that jewelers create booklets to combat the false advertising. Some retail jewelers were against giving this information to the public. The magazine presented those dissenting views, but continued to endorse complete disclosure of all available information.

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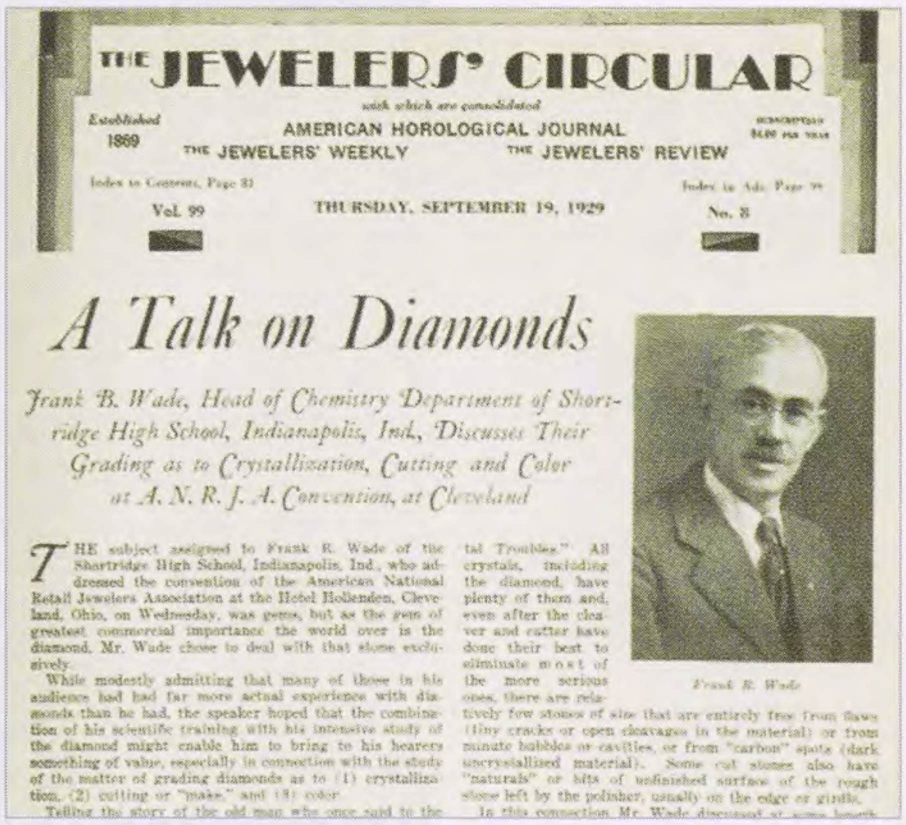
[155] "Misleading Advertising," 1916
[156] "Advertising That Works Injury to the Diamond Trade," 1916; Nattan, 1916a

Frank Wade: America's Early Diamond Expert

Frank Wade's eureka moment came from a vein of turquoise, not gold. Wade (Fig. 4-13), head of the chemistry department at Shortridge High School in Indianapolis, had an established national reputation as a chemist and international amateur gemologist when a Nevada turquoise miner wrote him in 1942.[157]



THE JEWELERS' CIRCULAR
with which are consolidated
AMERICAN HOROLOGICAL JOURNAL
THE JEWELERS' WEEKLY THE JEWELERS' REVIEW
Established 1869
Index to Contents, Page 83 Index to Ads. Page 99
Vol. 99 THURSDAY, SEPTEMBER 19, 1929 No. 8

A Talk on Diamonds

Frank B. Wade, Head of Chemistry Department of Shortridge High School, Indianapolis, Ind., Discusses Their Grading as to Crystallization, Cutting and Color at A. N. R. J. A. Convention, at Cleveland

THE subject assigned to Frank B. Wade of the Shortridge High School, Indianapolis, Ind., who addressed the convention of the American National Retail Jewelers Association at the Hotel Hollenden, Cleveland, Ohio, on Wednesday, was gems, but as the gem of greatest commercial importance the world over is the diamond, Mr. Wade chose to deal with that stone exclusively.

While modestly admitting that many of those in his audience had had far more actual experience with diamonds than he had, the speaker hoped that the combination of his scientific training with his intensive study of the diamond might enable him to bring to his hearers something of value, especially in connection with the study of the matter of grading diamonds as to (1) crystallization, (2) cutting or "make," and (3) color.

Telling the story of the old man who once said to the

...tal Troubles." All crystals, including the diamond, have plenty of them and, even after the cleaver and cutter have done their best to eliminate most of the more serious ones, there are relatively few stones of size that are entirely free from flaws (tiny cracks or open cleavages in the material) or from minute bubbles or cavities, or from "carbon" spots (dark uncrystallized material). Some cut stones also have "naturals" or bits of unfinished surface of the rough stone left by the polisher, usually on the edge or girdle.

In this connection Mr. Wade discussed at some length

Frank B. Wade

Fig. 4-13: The lead article in *The Jewelers' Circular* September 1929 edition reported on Frank Wade's talk about the American style of cutting. *"A Talk on Diamonds," 1929.*

The miner found an article written by Wade in the British journal *The Gemmologist* that described the reason for color in certain gems.[158] The miner explained that he had found a new deposit of turquoise in Nevada in the early 1930s, but that a partner double-crossed him and the resulting court fight put him deeply in debt. The judge in the case also closed and sealed the mine.

He had since found a second deposit of turquoise and was desperate to know why Nevada turquoise turned green with time and if there was a way to stabilize the original blue color. If Wade could help, the miner felt he could recover his losses and get back on his feet.

Wade, surprised by the flattery in the letter, was challenged to find an answer for him. The riddle of why some turquoise fades or changes color had mystified experts for centuries. Many attributed the color to copper phosphate. This didn't make sense to Wade the chemist. As he researched the chemical composition of turquoise, he found an obscure paragraph in the *Abstract Journal of the American Chemical Society* that mentioned a researcher spilling some copper ammonia compound in a jar of silica gel, causing the gel to turn blue. That was Wade's eureka moment.

[157] Johnson, 1947
[158] Wade, 1942

He ground a flat spot into a piece of turquoise provided by the miner and soaked it in silica gel. The porous turquoise absorbed the gel and Wade dipped it into some copper ammonia. He polished the vibrantly blue stone that resulted, and his wife wore it in a piece of jewelry for years. Whether this discovery helped the turquoise miner was never determined.

Wade was born in New Bedford, Massachusetts, on July 8, 1875. He received his bachelor's of science and master's degrees from Wesleyan University in Connecticut, with special honors in chemistry. He taught at the New Bedford High School in Massachusetts, then went to the Lewis Institute in Chicago to teach and do research. He started his long tenure at Shortridge High School in 1903, and eventually became the head of its chemistry department.[159]

Wade's popularity went beyond just teaching. He had a passion for his students and helped them obtain jobs, scholarships and financial aid for college. He kept in touch with many of them and helped in their job searches after they graduated.[160]

His fascination with gems began when he went on an all-day geology hike as a sophomore at Wesleyan. It was a Saturday, so he missed a school football game, but the class discovered a forgotten mine. Wade kept the small garnets and tourmalines he found, and admitted later in life that he was glad he missed the game. From that day on, he was a connoisseur of gems.[161]

Wade hiked through many areas of the United States—including Oregon, San Diego County (his favorite) and the Lake Superior area—to collect gems. His quests for gemstones led him to the shallow waters of the Atlantic and, once, to a snow bank 11,000 feet high in the Rockies, where he found a fine tourmaline specimen.[162]

Wade started to collect and polish his finds, and sold some of his crystals and polished stones. The money he made selling rough and finished gems put his two children through college.

[159] *Who Was Who in America*, 1966
[160] "Shortridge to Honor Teacher Frank Wade," 1949; "Frank B. Wade To Close 46-Year Career As Shortridge Instructor," 1949
[161] "Shortridge to Honor Teacher Frank Wade," 1949
[162] "Frank B. Wade To Close 46-Year Career As Shortridge Instructor," 1949

He recalled in an interview that he once bought a supposedly worthless chunk of opal from a mineral house for $1, cut it into a fine black opal, and sold it for $90.[163]

Wade wore a 1.33-ct. diamond tie pin; the diamond was one of eight that had been found in Upper Salt Creek, Indiana, by a gold panner. His collection contained two of the other eight diamonds from Indiana, including a 3.64-ct. crystal.[164]

Wade wrote about his hobby with the same passion he had for teaching. He published a series of articles in *The Jewelers' Circular and Horological Review* in 1914 and later *The Jewelers' Circular-Keystone*. An editorial in a 1916 issue of *The Jewelers' Circular* stated:

> THE EDITORIAL IN A RECENT ISSUE of *The Jewelers' Circular* in regard to "The Jeweler as a Gem Specialist" has not only brought forth favorable comment from a number of subscribers, but letters which have been received indicate that many jewelers are desirous of adding to their knowledge of gems, but are not in a position to get the instruction which they deem necessary. ... It was to evoke interest in this work that *The Jewelers' Circular* some time ago had Prof. Wade take up the various questions on gemology given at the last examination by the N. A. G. [the British National Association of Goldsmiths] and answer each one in detail, his articles being published in installments covering many issues of *The Jewelers' Circular* during the Summer and Fall of 1914.

"Unfortunately nothing has been done within our trade," the editorial went on, "but we again urge the American National Jewelers' Association or even some of the national associations among the jobbers and manufacturers to give consideration to the subject and if possible follow the example of the N. A. G. and arrange for a course on gems with examinations that will give the jeweler and his clerk a chance to take up the course of study and obtain certificates of efficiency."[165]

Wade went on to write many articles on diamonds for journals such as the Gemological Institute of America's *Gems & Gemology* and the British journal *The Gemmologist*. He also wrote two books:

[163] "Frank B. Wade To Close 46-Year Career As Shortridge Instructor," 1949
[164] Johnson, 1947
[165] "Information About Gems for the Jeweler," 1916

Fig. 4-14: Frank Wade (right foreground) was one of the academic leaders Robert Shipley recruited to advance the gemology movement. A 1947 GIA advisory board meeting in Chicago included (clockwise, from top) Elizabeth Brown; Dr. Cornelius Hurlbut Jr., Harvard University; Dr. Chester Slawson, University of Michigan; Richard Liddicoat; Wade; Dr. George Switzer; Dr. W. D. Shipton; Dr. Ralph Holmes, Columbia University; Dr. William Foshag; Shipley; and Edward Kraus, University of Michigan. *Courtesy GIA.*

Diamonds – A Study of the Factors that Govern their Value, published in 1916, and *A Text-Book of Precious Stones for Jewelers and the Gem-Loving Public*, published in 1918.

Wade's influence on the trade's understanding of diamond cutting quality was far reaching. An early advocate of the American cut round brilliant, he later equated it with Tolkowsky's calculations and was one of the first leaders in the trade to call it an "Ideal Cut."[166]

A member of GIA's Student Advisory Board (Fig. 4-14) and GIA founder Robert Shipley's "Committee of 100 World Gem Authorities," Wade was one of three to become the first "Honorary Members of the Institute" (GIA) in 1936[167] (see "Robert Shipley and GIA," page 128).

"Mr. Wade pioneered in America the first series of scientific articles on diamonds and gems written especially for the jeweler. His work hastened the introduction of organized gemological courses in America," a GIA *Guilds* article said about Wade.[168] Wade remained involved with GIA past his retirement from teaching at age 74, in March 1949.[169]

Friends, former students and colleagues in the world of science and gemology gathered at his retirement dinner, the culmination of Frank Wade Day at Shortridge High School. A talk by a noted gem expert underscored Wade's love of gems.[170]

A Quaker and a Mason, Wade married Ethel Alberta Nicholson in August 1908. They had two children, Lucille and Nicholson.[171] He and his wife planned to travel during retirement, but he passed away in October 1950, a little over a year and a half after he retired. He left behind many who had been influenced by his passion for gems.

[166] Wade, 1927
[167] "Institute Elects First Honorary Members," 1936
[168] Ibid.
[169] "Contributors in the Issue," 1950
[170] "Shortridge Friends Honor Wade With $1,220, Scrapbook," 1949
[171] *Who Was Who in America*, 1966

Diamond Articles by Frank Wade

- "Color and Its Effect on the Value of Diamonds," *The Jewelers' Circular (JC)*, 1915
- "Mounting and Its Influence on the Appearance of Diamonds," *JC*, 1915
- "Cutting or Make and Its Effect on the Value of Diamonds," *JC*, 1915
- "Flaws and Their Effect on the Value of Diamonds," *JC*, 1915
- "Repairing and Recutting and Their Effects on the Value of Diamonds," *JC*, 1915
- "Diamonds: How Cutting Affects Value," *JC*, 1917
- "Why the Diamond Is Cut With a Culet," *JC*, 1917
- "Selling Diamonds: A Realistic Drama In Several Acts," *JC*, 1917
- "A Tribute to the Diamond Cutter and a Few Words Upon His Work," *JC*, 1918
- "Diamond Brilliants—Why Not Make More of Them Than of Fancy Shapes?" *JC*, 1919
- "A Word About Blue Diamonds," *JC*, 1919
- "Why Knock the Diamond Containing a Little Flaw?" *JC*, 1919
- "How to Buy Diamonds Wisely," *JC*, 1920
- "Some Lessons on 'Diamond Design' from Marcel Tolkowsky's Little Book of That Title," *JC*, 1920
- "What Every Jeweler Should Know about Diamonds," *JC*, 1925
- "Diamonds of False Color," *JC*, 1925
- "Diamonds, a Study of the Factors that Govern their Value," *JC*, 1926
- "Better Make for Fine Diamonds," *JC*, 1927
- "Few Diamonds Perfect," *JC*, 1930
- "Colour Grading of Diamonds," *The Gemmologist*, 1948

Books by Frank Wade

- *Foundations of Chemistry* (with A. A. Blanchard), American Book Co., NY, 1914
- *Teacher's Hand Book* (with A. A. Blanchard), (publisher unknown), 1914
- *Laboratory Exercises in Chemistry*, (publisher unknown), 1917
- *Diamonds—A Study of the Factors that Govern their Value*, G. P. Putnam's Sons, NY, 1916
- *A Text-Book of Precious Stones for Jewelers and the Gem-Loving Public*, G. P. Putnam's Sons, NY, 1918
- *The Teaching of Science and the Science Teacher* (with Prof. Herbert Brownell), Century Co., NY, 1925

Memberships

- President of the School Science and Mathematics Association
- President and Fellow of the Indiana Academy of Sciences
- President of the Indiana Section of American Chemical Society (twice)
- President of the Central Association of Science and Mathematical Teachers

Proportion Information is Given to the Jewelry Trade and Public

Wade, realizing the lack of concise information available to jewelry retailers, compiled his *The Jewelers' Circular-Weekly* articles on diamond value into the 1916 book, *Diamonds—A Study of the Factors that Govern their Value*.[172]

His foreword referred to the jewelry industry's attitude toward understanding diamond quality evaluation, and the desire of some to keep it secret:

> WHILE MOST OF the technical information contained in the following chapters might be learned of men who are now in the business, many such have no time or taste for writing down what they have learned, and others, unfortunately, regard some of these matters as trade secrets to be kept from the buying public. The writer therefore feels that there is a place for such an essay, and hopes that many who are serving their apprenticeship in the jewelry business and perhaps a few who are already recognized as diamond merchants may profit by the close study of this handbook.

Wade included a drawing of the top, side and bottom views of the facet arrangement for the "finely cut diamond" (Fig. 4-15) just before the title page. To illustrate his concern about how diamond cutting styles had shifted, he wrote:

> WHEN ROUGH DIAMONDS are sawn or cleaved, the resulting brilliants usually have shallower tops and relatively deeper backs than shown in the cut, and the table is considerably broader. The full-fashioned brilliant is probably more desirable as it has considerable brilliancy as seen from the side as well as when viewed full in the face. The top angle should be very nearly 35° and the back angle slightly over 41° to produce the maximum brilliancy. Such are the angles represented in the drawing [which shows a 40 percent table].

The Jewelers' Circular-Weekly also continued its educational blitz. It called on Dr. Herbert Whitlock,[xvi] the curator of minerals and gems of the New York State Museum, to help. He wrote a series of articles on diamond cutting, including "Evolution of the Brilliant Cut Diamond," which concluded, "The final stage in the evolution of an ideal brilliant cut takes the form of the American Cut brilliant shown" (Fig. 4-16).[xvii] [173] Parts of the trade did refer to the new cutting style as "American Cut," but Whitlock was the first person

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[172] Wade, 1916
[173] Whitlock, 1917a

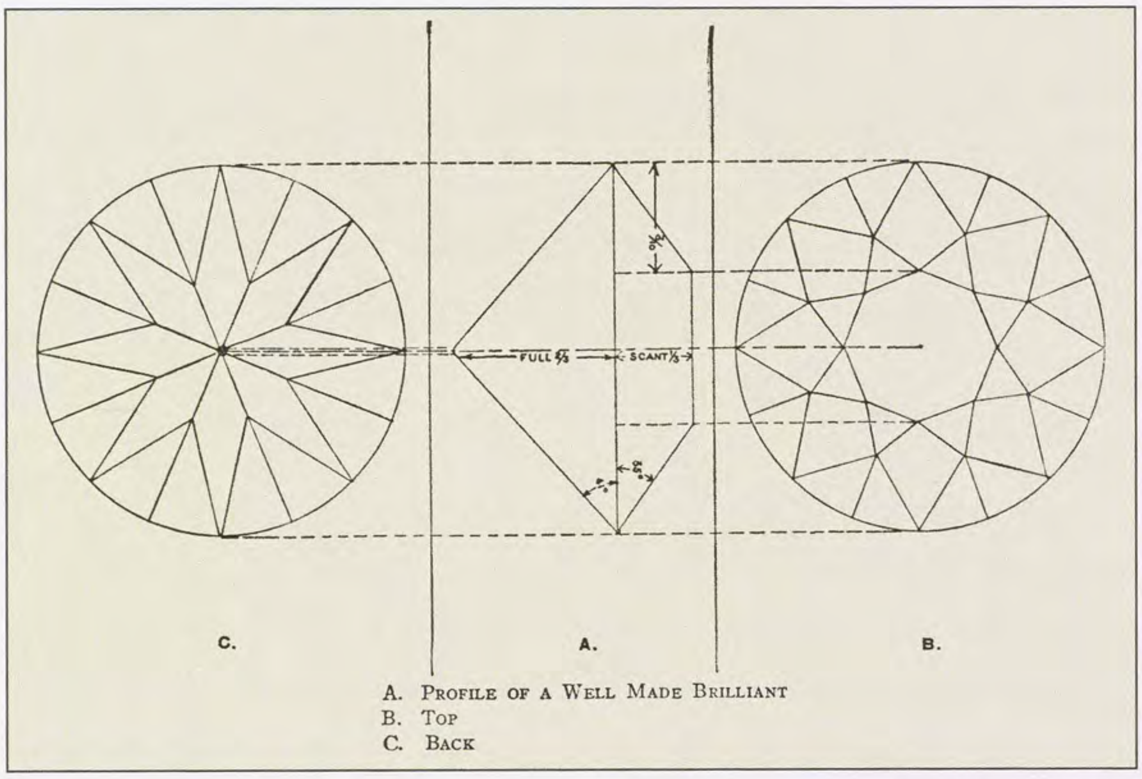


Fig. 4-15: This diagram is from the frontispiece of Frank Wade's 1916 book *Diamonds*. He called this diamond, with its very small table, the "Well Made" diamond and declared it "ideal" *(Wade, 1916)*. In *"A Talk on Diamonds,"* published in 1929, he refers to it as "American-cut." The early standard proportions for the American Cut were:
Crown angle: 35°
Pavilion angle: 41°
Table size: 40%

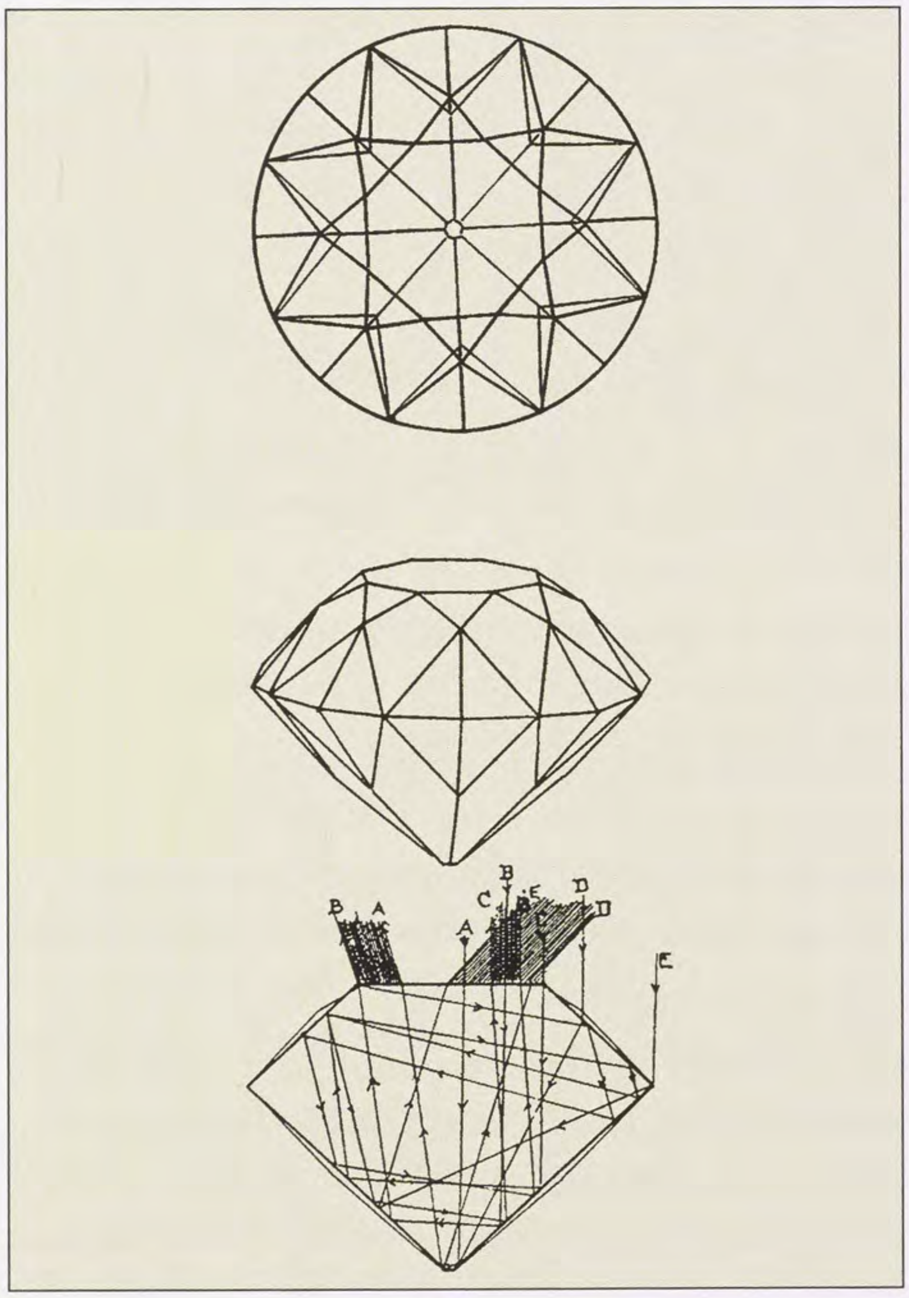
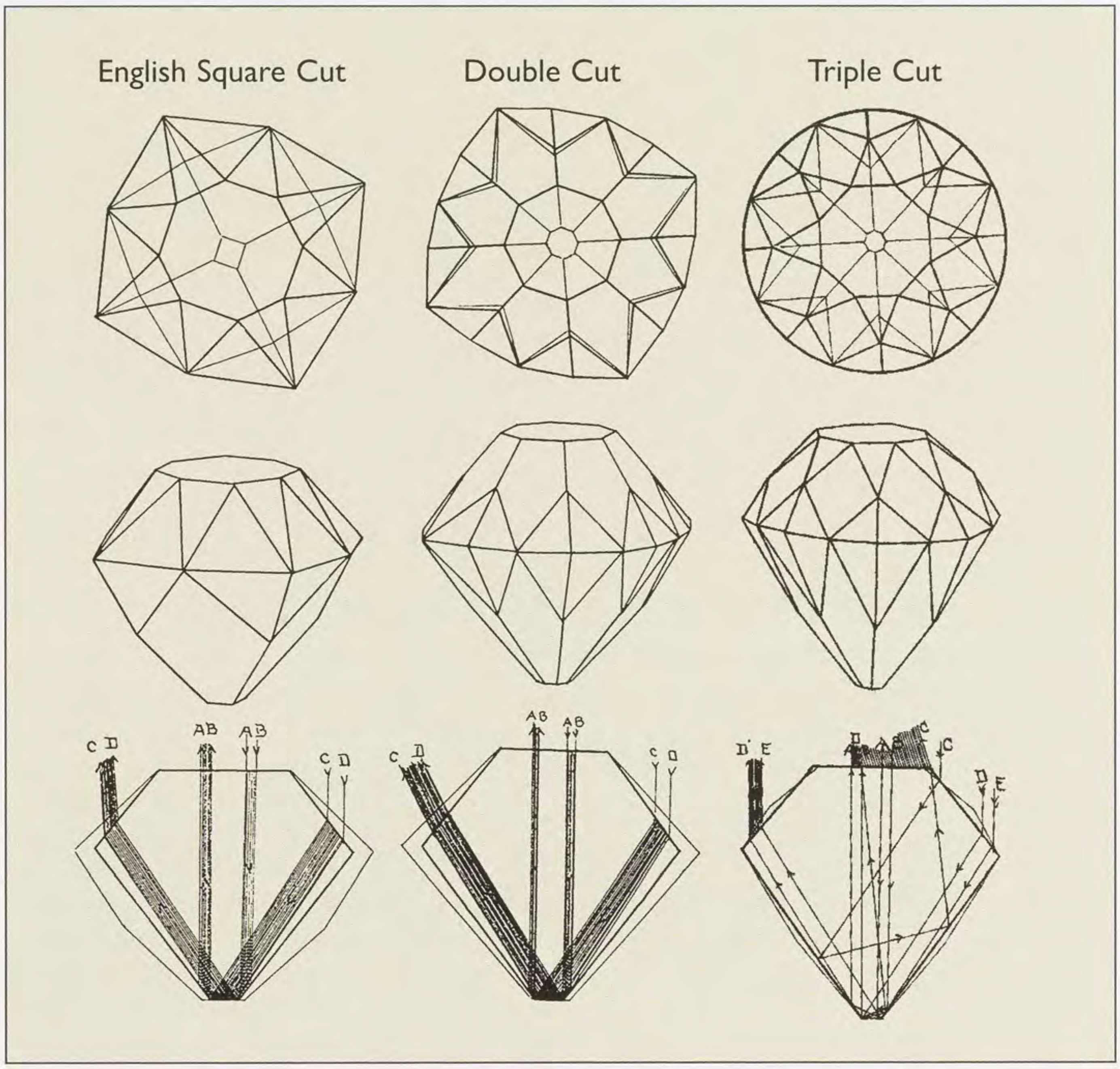


Fig. 4-16: *The Jewelers' Circular-Weekly* ran a series of articles by Dr. Herbert Whitlock that discussed the reasons why certain shapes of various gem materials should be cut at certain angles. The top two images show the facet arrangement of what Whitlock called American Cut, and the third image is a map drawn by Whitlock to show light rays (lettered a, b, c, d and e) entering a diamond, traveling through it and returning upward. He referred to the American Cut or Modern Cut diamond as "ideal," and the proportions matched those proposed by Wade. *Whitlock, 1917a.*

Fig. 4-17: Whitlock provided ray-tracing for a variety of cuts, such as the English square cut, double cut and triple cut shown here. The top two images of each style are their respective facet arrangements, while the third image is a map that shows light rays entering a diamond and then traveling through the diamond and returning upward. *Whitlock, 1917a.*



with any gemological authority to name it so in writing, which gave the term greater prominence in the trade.

Whitlock provided ray-tracing images to show the strengths and weaknesses of the various cuts (Figs. 4-16 and 4-17), including rose cuts,[174] the double cut brilliant, the triple cut brilliant (sometimes referred to as a "Peruzzi" cut), the modern American Cut and various fancy shapes.

He not only discussed the specifics of what he called "the ideal proportions of the brilliant" in one article, but led the reader through a number of ray-tracing diagrams to demonstrate how they were calculated for the individual optics of different gemstones. These included beryl, chrysoberyl, quartz, spinel, topaz, tourmaline and zircon.

[174] Whitlock, 1918

He even used ray-tracing to demonstrate why the angles used to cut a diamond would not work for a sapphire.

To analyze the outcome of his calculations and determine the best sets of proportions, Whitlock established criteria:

> THERE STANDS AS a solid basis upon which all diamond cutting must rest, the ideal proportions of the brilliant cut as theoretically worked out for diamond ... the highest percentage of the light falling on the crown should ... be returned to the eye through the crown. Again the reflected light ... should be so distributed as to emerge, if not from all the facets of the crown, at least from most of them, and particularly from the table ... the better cut stone is that in which the rays of light have been subjected to the greatest number of total reflections within the stone, thus emerging as refracted light, characterized by rainbow-like colors. Calculations ... have led to the assumption of the ideal proportions of the brilliant cutting for diamond to be close to the following: Top angle, 35°; back angle, 41°. Depth of pavilion, full 2/3 total depth. Depth of crown scant 1/3 total depth.[175]

Although we have a wealth of information from Wade, Whitlock and Chester, they did not use the term "scientific cutting"; they equated American cutting with the term "ideal."

The American Cut Table Size

Corresponding with the push to educate jewelers, J. R. Wood & Sons provided detailed cutting information in its 200-page hardbound supply catalog from 1918. It also included pictures with the caption, "A glimpse of our diamond cutting works which we are told has no equal, either in America or abroad."

The company was a sightholder[xviii] with the Rough Diamond Syndicate of London for many years—one of only a handful of American companies to hold that distinction.[176] Most importantly, it still was a frequent user of the term "scientific cutting."

The J. R. Wood & Sons 1918 catalog claimed, "Science has computed the exact proportions in which the diamond must be cut to attain maximum brilliancy. These proportions are accurately shown in the illustration" (Fig. 4-18).

[175] Whitlock, 1917b
[176] J. R. Wood & Sons, 1914; J. R. Wood & Sons, 1918

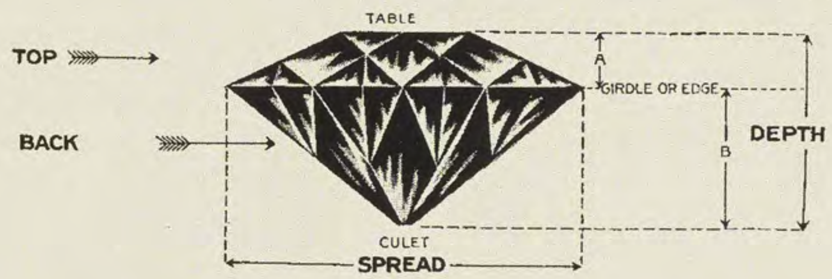
Fig. 4-18: J. R. Wood & Sons marketed proportions in its 1918 catalog. The copy reads, "Science has computed the exact proportions in which the diamond must be cut to attain maximum brilliancy." *J. R. Wood & Sons, 1918.*

Diamonds

Rough Diamonds as mined, have little or no brilliancy and must be "cut" to reveal their hidden charms.

To "cut" diamond means to shape it so that the rays of light reaching the stone will be reflected back through the top of the stone instead of passing through it. In other words to make the stone a mirror—not a window pane.

Science has computed the exact proportions in which the diamond must be cut to attain maximum brilliancy. These proportions are accurately shown in the illustration below.



To obtain the utmost reflection of light, that portion of the diamond above the girdle must be in exact relation to the portion located below the girdle. The angle of the facets between the girdle and the table must be in exact relation to the facets between the girdle and the culet. The actual angle, proven by science, to give maximum brilliancy, is from 35 to 37 degrees for the facets between the girdle and table and from 40 to 42 degrees for the facets from girdle to culet, with 30% to 33⅓% of the depth of the stone above the girdle (A), and 70% to 66⅔% of the depth of the stone below the girdle (B).

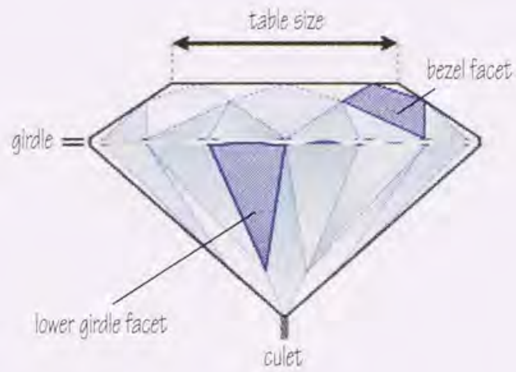
The Brilliancy secured by closely adhering to the above proportions makes possible almost perfect refraction and reflection of all light reaching or passing into the stone. Any proportion other than the above gives considerably less brilliancy.

The brilliancy of a diamond can be greatly impaired by cutting the stone a bit too thick or too thin. Diamonds cut in this manner are termed "cut for weight" or cut so as to produce the heaviest possible stone regardless of brilliancy.

Fig. 4-19: This drawing of the Tiffany II shows how its culet is reflected so it can be seen through the bezel facets from the face-up view. It appeared in an article titled "Four Large South African Diamonds," by George Kunz. *Kunz, 1887.*

The catalog also included silhouettes of various types of inferior proportions to show how cutters might cut for weight instead of brilliancy. (These are the same as shown in Fig. 4-11, page 92.)

The angles and percentages used by J. R. Wood & Sons correspond to noted diamond historian Herbert Tillander's assessment of the American Cut from the 1900s through the 1920s.[177] Tillander wrote, that until World War II, the most obvious differences in cutting style between America and Europe were table sizes. His research, along with the writings of Chester and Wade and the drawings of J. R. Wood & Sons and others, demonstrates that the table of the American Cut was around 40 to 50 percent.

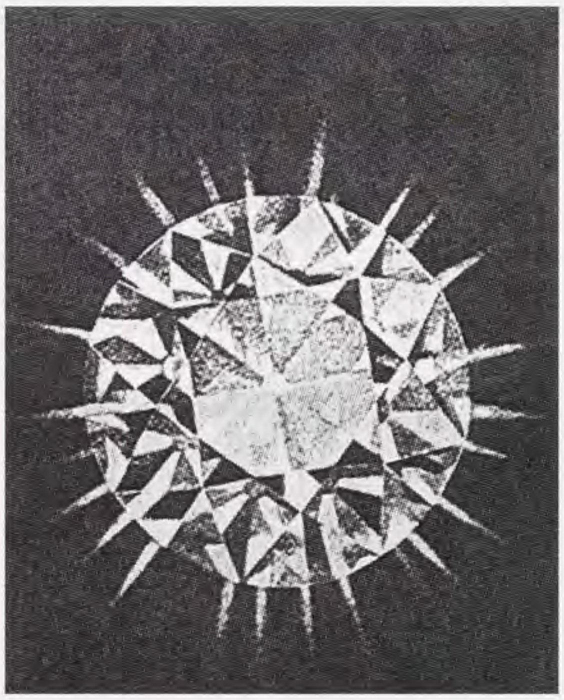


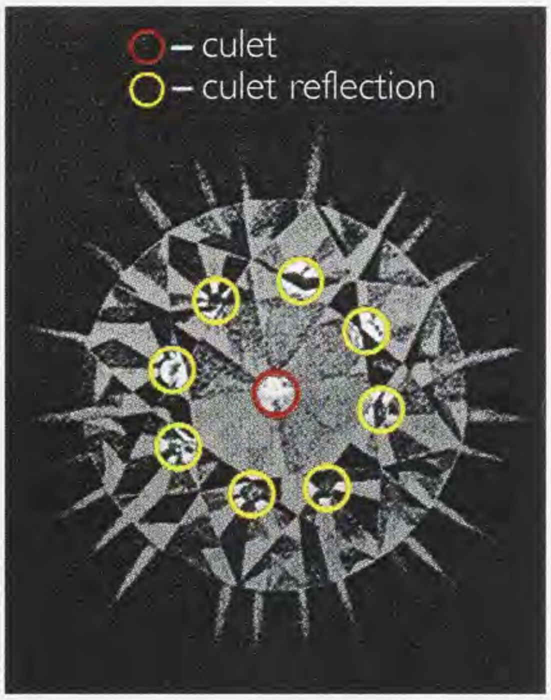
This table size has particular significance for the diamond's appearance, since in Europe the length of the lower halves (also called the "lower girdle" facets) was much shorter. Tillander credited Morse with extending these facets to around 60 percent.[xix] [178] ("Lower girdle length" refers to the percentage from the girdle edge to the end of the lower girdle facet, compared to the girdle distance to the culet.)

By making the table so small, the culet is quite visible through the bezel facets (Figs. 2-29, 3-3, 4-19 and 4-20). If the lower halves were shorter and the tables larger, there would be less of a pattern visible[xx] in each of the bezels, and the diamond's appearance would be rendered less scintillating in that portion of the diamond. The longer lower halves (along with the small table) gave an appearance some described as "snappy" compared to diamonds from Europe.[xxi]

[177] Tillander, 1995
[178] Ibid.

Fig. 4-20: This early close-up photo of the American round brilliant in a J. R. Wood & Sons advertisement shows how the culet can be seen through the bezel facets when viewed face-up. It has a table of around 50 percent. *J. R. Wood & Sons, 1904.*





A J. R. Wood & Sons advertisement emphasized the point that the culet was visible through the bezel facets when referring to a photo in a 1904 advertisement (Fig. 4-20): "Notice the reflection of the bottom facets in each of the top facets, and the light leaving the stone."[179]

The original American Cut diamond, credited to Morse, was designed to show reflections of the culet in the bezel facets, which is why the crown angles were slightly steep (35 to 37 degrees) and the table size small. Wade's 1917 description of its appearance, with the culet visible in every crown facet,[xxii] confirms this.

As mentioned earlier, though, the cutting angles Morse considered optimal for round diamonds are unknown, and it is impossible to derive them from any of his papers or articles written about him during his lifetime (see "Morse's 'Specimen Grade,'" page 40). There is only circumstantial evidence that his preferred table size was 40 to 50 percent, since a diamond does not carry the pedigree of who cut it unless it is rare in color or size. The only diamond documented to be cut by Morse is the Tiffany II, which was not a round brilliant (Figs. 2-25, 2-27, 2-29, 2-30 and 4-19), but had a 46 percent table.

There is evidence, however, that Morse's table size, and therefore the early American Cut table diameter was in the 40 to 50 percent range:

- Stern Bros. & Co. of New York, at the time the largest cutting factory in America (Fig. 4-21) with no ties to Dutch or other international cutters, did not advertise its proportions.[xxiii] It produced a

[179] J. R. Wood & Sons, 1904

diamond cutting book for its clientele in 1914, however, that included a picture of a diamond that was "ready for final touch-up." The table can be measured at 45 percent[180] (Fig. 4-22). Stern Bros. & Co., like other American cutting firms, gave credit to Morse for its cutting style.[xxiv]

- J. R. Wood & Sons published a photo of a diamond in 1904 (Fig. 4-20), claiming, "This photograph is the first successful one ever taken of a diamond[xxv] (enlarged four diameters)."[181] Its table is nearly 50 percent.
- An image found on the business card of J. B. Humphrey[182] (Fig. 4-24) who purchased Morse's shop after his death in 1888, depicts a diamond with a 40 percent table.

The J. R. Wood & Sons photo is from early advocacy of the American cutting style, as is the Stern Bros. & Co. diamond picture. J. B. Humphrey's business card represented what he was cutting, not necessarily what Morse was doing. We have no direct record of the table size Morse advocated.

J. C. Fergusson, a Los Angeles jeweler, provided a diagram of the "correctly proportioned brilliant" as late as 1927.[183] Fergusson was one of the last to call a diamond that had a table just under 50 percent "scientifically cut" (Fig. 4-23).

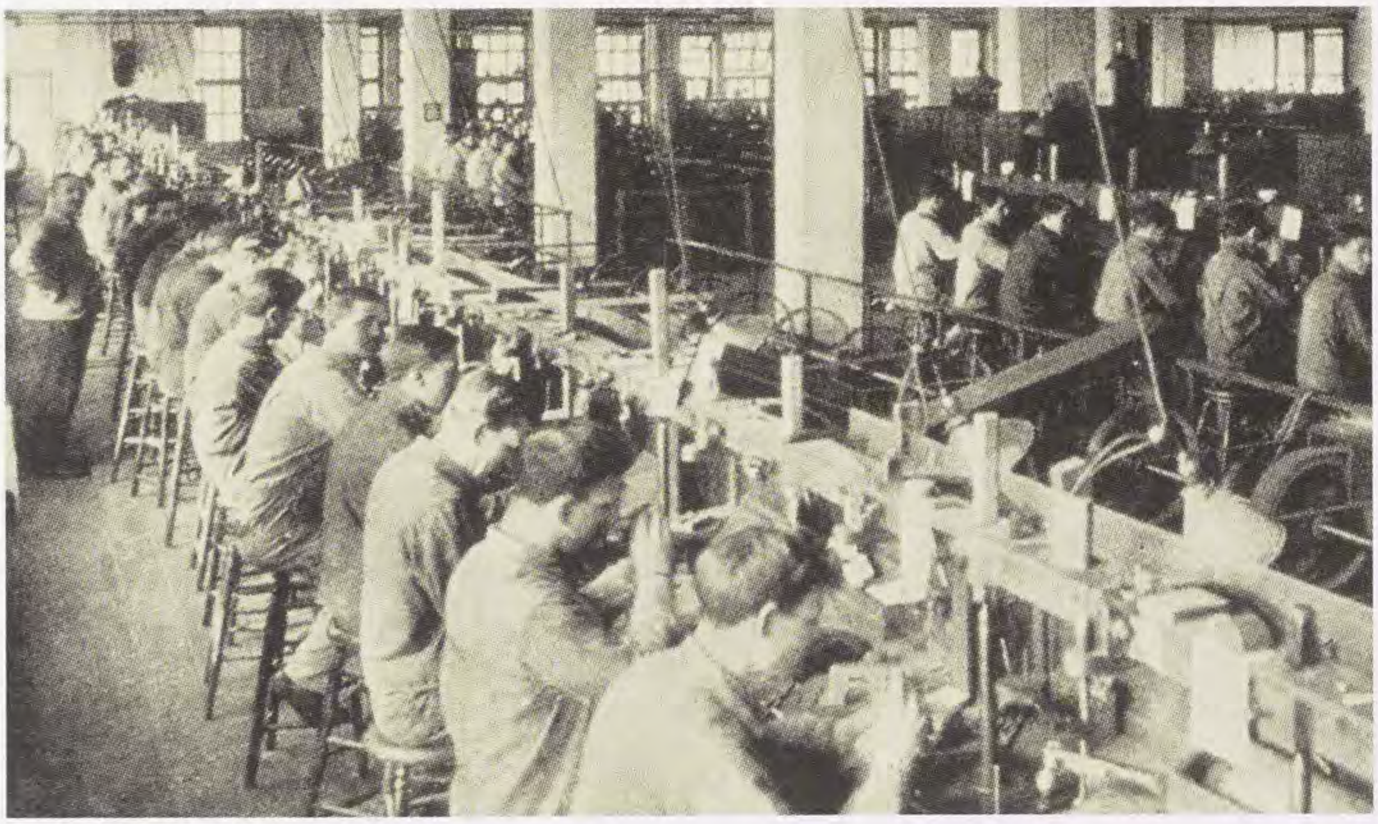


Fig. 4-21: This is a picture of the Stern Bros. & Co. New York cutting shop, which employed 325 workers in 1914. Stern's was considered the largest cutting shop in the United States at the time. *Stern Bros. & Co., 1914.*

[180]Stern Bros. & Co., 1914
[181]J. R. Wood & Sons, 1904
[182]Field, undated
[183]Fergusson, 1927

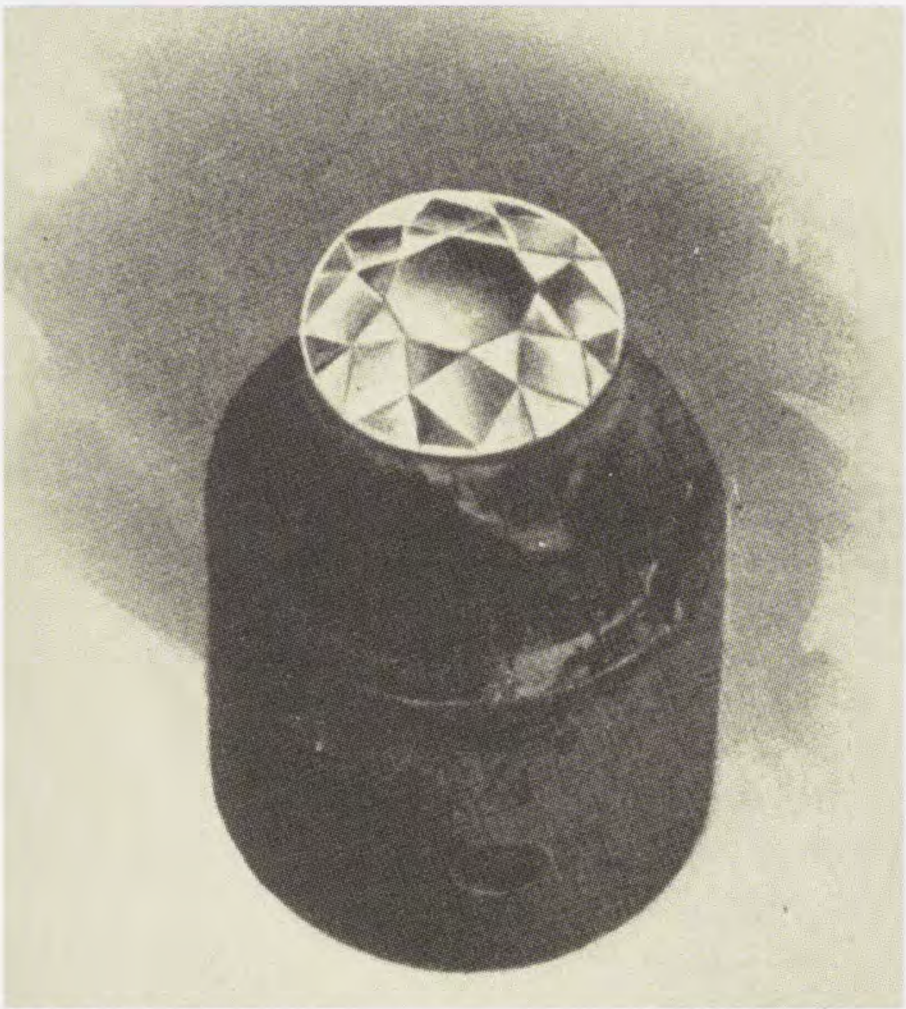


Fig. 4-22: A Stern Bros. & Co. diamond, still on the dop, "ready for final touch-up." It has a small, 45 percent table. While Stern Bros. & Co. did not use the term "American Cut" in its advertising, it credited Morse for the diamond style it was cutting. *Stern Bros. & Co., 1914.*

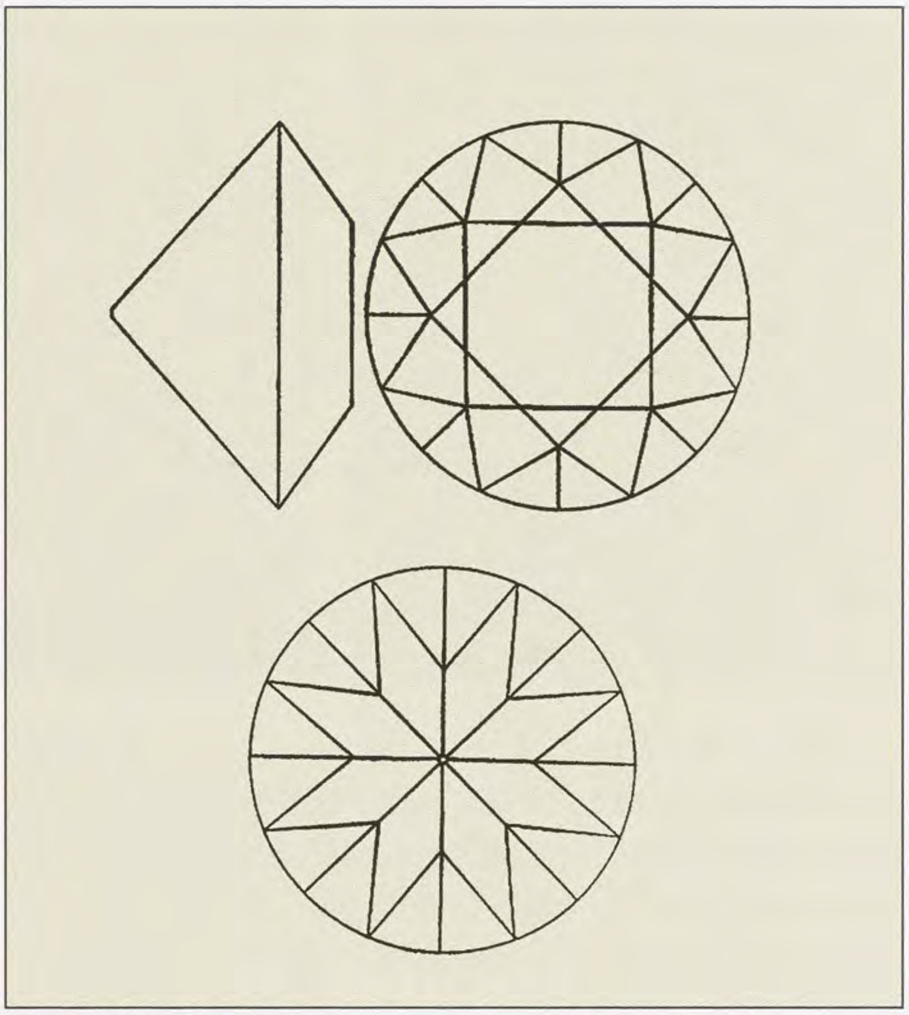


Fig. 4-23: The American Cut diamond was noted as having a 50 percent or smaller table as late as 1927. This diagram is from the frontispiece of J. C. Fergusson's *Diamonds and Other Gems.* Fergusson referred to the American cutting style as "scientifically cut." *Fergusson, 1927.*

Fig. 4-24: Morse's shop was purchased by J. B. Humphrey after his death in 1888. Humphrey's business card demonstrates the 40 percent table size that was the cutting standard during this period. The business card is from the Charles Field Scrapbook in the Cartier Archives of GIA's Richard T. Liddicoat Gemological Library and Information Center. Field, Morse's long-time foreman and inventor of the bruting machine, became Humphrey's shop foreman. *Field, undated.*

The Gemological Institute of America (an educational institute founded in the 1930s to help professionalize the jewelry industry) course material from the late 1940s seems to support the view that such small tables were the accepted standard for early round brilliant styles. It presents "old style European cuts" and points out that such diamonds have crown angles about the same as the modern style (i.e., about 34 degrees), and "the table, instead of being from 51 to 56% of the girdle width was only about 40%."[184]

Robert M. Shipley, founder of GIA and the American Gem Society (AGS), was evidently unaware that diamonds with these measurements might not be European in origin;[xxvi] Tillander indicated that such small tables came only from American cutters during that period,[xxvii] [185] and Goodchild maintained that the table for the brilliant in England at that time was five-ninths the diameter (55.6 percent).[186]

Fig. 4-25: This ad appeared in *The Jewelers' Circular-Weekly* many times in 1912. Cross & Beguelin stated that its diamonds were "American cut." Although the term meant something to retailers, it may not have meant as much to cutters in America. By 1915, many advocates of American Cut diamonds were complaining about how poorly the stones were being cut. While the term was supposed to mean certain proportions, including a table size between 40 and 50 percent, the U.S. trade caused confusion by referring to a wide variety of proportions as "American Cut." *Cross & Beguelin, 1912.*

With such leaders as Wade and Whitlock saying the table of the American cutting style was around 40 percent, J. R. Wood & Sons cutting tables up to 50 percent, and GIA noting the existence of these stones in the late 1940s—even mentioning in course material that Wade had a 40 percent table—the limited evidence available supports the notion that the table size of the early American Cut was 40 to 50 percent.

Even though proponents of ideal cutting equated the American style and scientific cutting with tables less than 50 percent from 1900 to 1920, advertisements from American cutting factories showed pictures of diamonds with larger tables (Fig. 4-25).[187] This led to a confusion of terms.

[184] Shipley, 1949b
[185] Tillander, 1995
[186] Goodchild, 1908
[187] Cross & Beguelin, 1912

The term "American Cut" initially meant certain proportions to many cutters, but to others it meant merely cut in America. The term "American Cut" was advertised as late as 1942[xxviii] and was taught by GIA as a distinct cutting style equated with the "Ideal Cut" for many years after.

Revival in London with a Possible American Influence

The discovery of diamonds in South Africa led to an increased demand for cut diamonds,[188] and the establishment of the Rough Diamond Syndicate of London brought more rough to the city to be cut, thus reviving the industry there.

Although London was reportedly down to only one diamond cutter in 1869, American firms were importing £3,000,000 [$34,000,000 in 1887 U.S. dollars] worth of cut diamonds from England annually by 1887.[189] Kunz reports that there were more than 1,000 cutters in London by 1902 (see Fig. 4-1, page 79). The English already preferred round shapes, and Charles Field's patent for bruting had been registered in England and the United States (possibly due to this preference).[190] For this reason, the existence of a well-cut round shape, fashioned in London (or for London retailers from other cutters) with proportions similar to the American Cut, was not surprising.

British writer Wilbert Goodchild noted in 1908, "English cutters prefer to have the gem perfect technically even at the sacrifice of a good deal of weight. ... An English-cut stone can often be distinguished by the greater accuracy given to the angles of the facets, so that the resulting gem is exactly symmetrical."[191]

Morse noted the skill of London cutters: "As to the cutting of diamonds, I know we are doing work as well as it is done by the most skillful polishers in London."[192]

Some in England also acknowledged the preference Americans showed for good diamond cutting: "The Americans are the finest judges of diamonds in the world, and insist upon having the finest stones and the most perfect cutting"[193] and "The American jeweler, by supporting the cutters in his own country, is incidentally raising the standard of this skillful trade … creating a standard for a craft too long neglected."[194]

188 "One Carat, Perfect: $100," 1969
189 Scott and Atkinson, 1887
190 Field, 1873b, 1873a
191 Goodchild, 1908
192 Morse letter, Feb. 1, 1878
193 "The Trade in Diamonds," 1892
194 Ruff, 1932

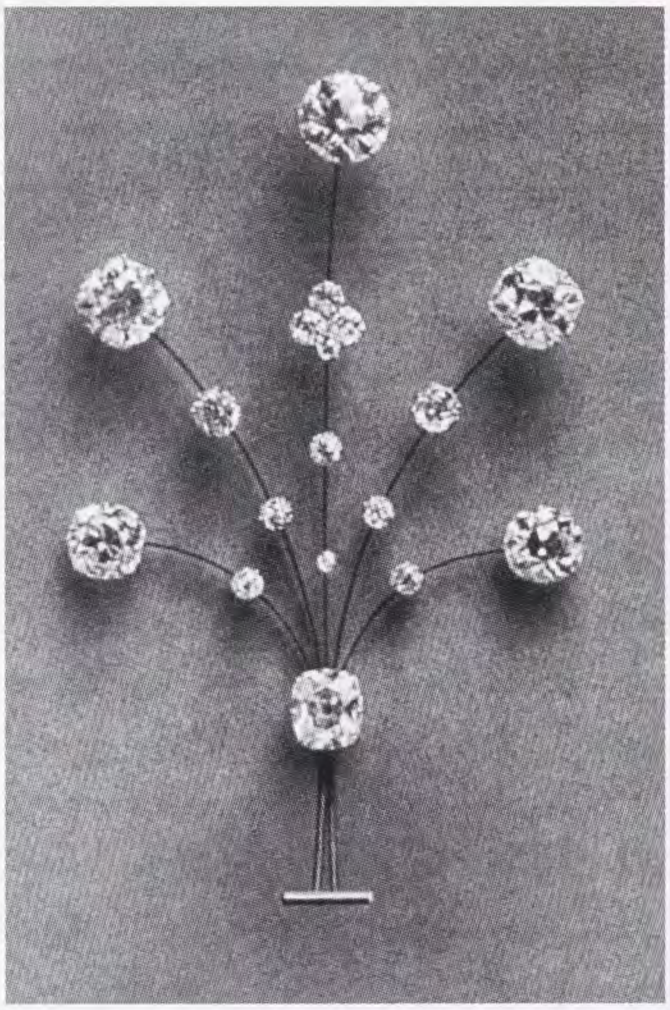


Fig. 4-26: This brooch (far left) is from a 1913 French auction catalog. The squarish cushion and round shapes provide a glimpse into what was being cut in the late 1800s in Europe. All have steep crown and pavilion angles with table sizes ranging from 45 to nearly 60 percent *(Catalogue D'un Important Collier De Perles, 1913).* The Czar's Tooth necklace (left), a Russian and English silver and gold necklace from the late 1800s, is also set with round brilliants with widely varied proportions, cut in Europe. It was a gift from Russian Emperor Paul I to Nadeja Ivanova Kotaisova, daughter of Count Ivan Pavlovich Kotaisov, to commemorate the loss of a tooth. *Photo by Harold & Erica Van Pelt/GIA.*

Competing European Cut Styles

Tillander noted distinct sets of proportions associated with specific cutting centers soon after the turn of the century. But not all cutting houses in one location cut to the same proportions. In Antwerp, for example, many firms fashioned diamonds almost exclusively for the American market.[xxix] [195]

America was the largest importer of finished diamonds through the early part of the 20th[xxx] century. Americans wanted brilliant styles of cutting, not the rose cut diamonds from Antwerp and Amsterdam that were still relatively popular in Europe.[196] (For examples of cutting styles in the mid-to late-1800s, see Figs. 4-26 and 4-27.)

Prior to mechanized bruting and the advent of the mechanical saw, most brilliants were either cushion shaped or fashioned in other fancy shapes, as dictated by the rough. As America became interested in the round brilliant, cutting styles changed to keep up with demand.

[195] George Kaplan, 2003, personal comments; Balfour, 1978
[196] "The Rose-Diamond Industry," 1904; Kockelbergh et al., 1992

Fig. 4-27: These jewelry pieces all reflect different diamond cutting styles from the mid- to late-1800s.

(a) Round and pear shaped brilliant cut diamonds (approximately 17.50 carats), silver, gold and tortoise shell make up the Kemp tiara, created by Tiffany & Co. in 1894. *Photo by Harold & Erica Van Pelt/GIA.*

(b) This silver and gold English butterfly brooch, circa 1850, is set with rose cut diamonds. Butterflies and other insects were popular as jewelry motifs during the 19th century. *Photo by Harold & Erica Van Pelt/GIA.*

(c) This circa 1850 Victoria Cross is set with squarish old-style brilliant cut diamonds. *Photo by Robert Weldon/GIA.*

(d) This silver and gold star motif tiara was made by the prominent London jeweler Streeter of Bond Street. It was probably made circa 1870, and is mostly set with round brilliant cut diamonds. *Photo by Harold & Erica Van Pelt/GIA.*

Tillander classified several cuts—ignoring Leviticus' diagrams that suggest Belgium was starting to cut this new style of round—and associated them with specific cutting centers for the period from 1900 until just before World War II. (For a detailed discussion on the differences of the various cutting styles of the early 1900s, see "Early 1900s Diamond Cutting styles," facing page.)

The way diamonds were being cut was radically changing.

Early 1900s Diamond Cutting Styles

These drawings (Fig. 4-28) are from Herbert Tillander's *Diamond Cuts in Historic Jewellery, 1381–1910*. They provide an overview of the round diamond cutting styles that existed between 1900 and 1939. The city labels he uses to distinguish certain proportions, however, should not be considered absolute. Leviticus' drawing and Wade's American Cut, for example, are both similar to Tillander's London Cut, the prominent style of cutting in England in the late 1800s and early 1900s.[197] Kunz credited Morse with much of this newer style of cutting in London.[xxxi]

Those who preferred the newer style of brilliant would complain about those who still followed the older cutting styles. The American jeweler Fergusson lamented that:

> EVEN EUROPE TODAY LACKS the nerve to demand fine cutting in preference to bulky stones, and for that reason alone it has fallen upon the extravagant American to demand of his own workmen the ultimate of perfection at any sacrifice of weight. So stones cut in this country [America] stand comparison with the best which come from the European countries which have for many years made the diamond industry a principal business.[198]

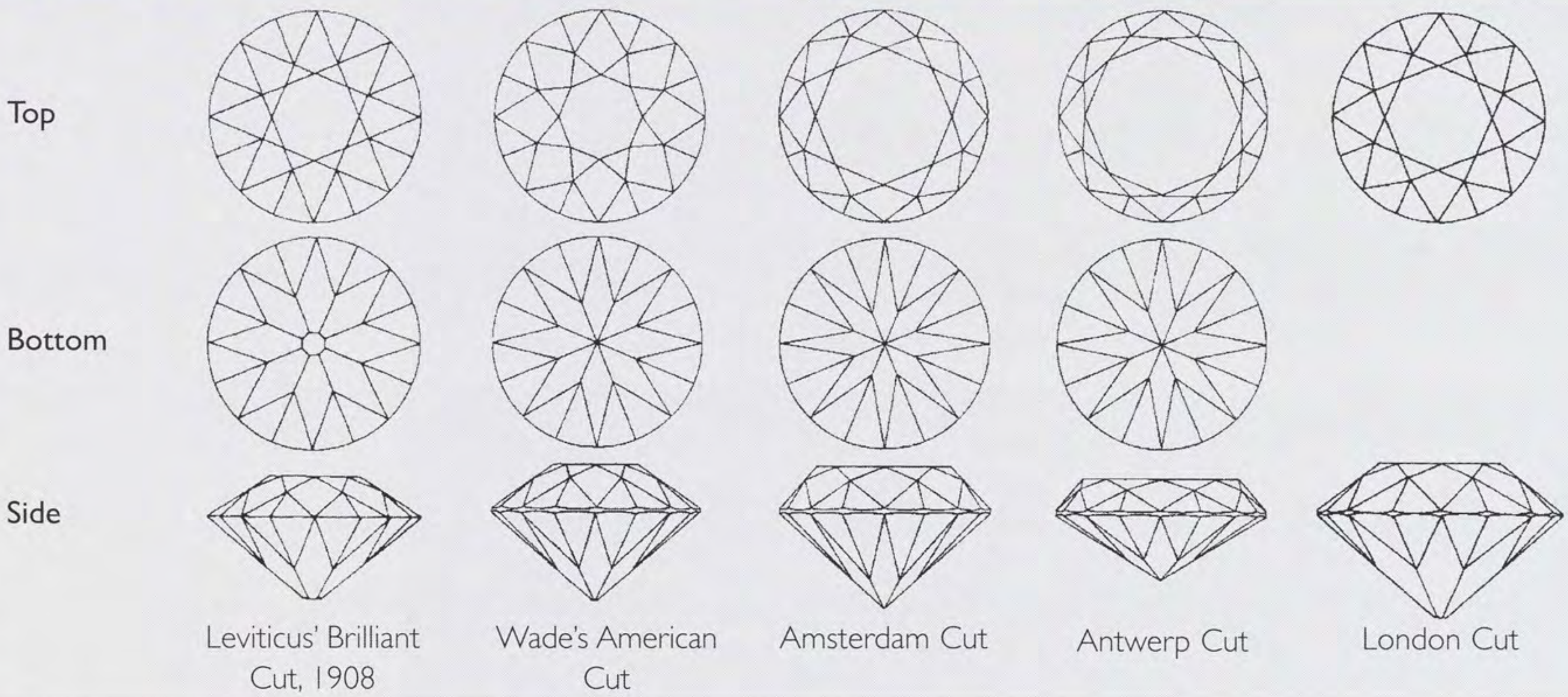
There was still some adherence to the older Victorian-style angles in England as late as 1935. An article in *The Gemmologist* reported, "According to Wade, the angle of the bezel of a well cut brilliant should be 35° with the girdle and of the pavilion slightly over 41°. The London style of cutting gets nearer to 42° for each."[199]

Two decades earlier, however, G. F. Herbert Smith, of the British Museum, wrote that angles for the crown were "about 40°" and the pavilion angle "at not much more than 40° to the culet."[200]

Despite the variety of proportions that Tillander and others noted, each cutting house and locality had its own preferences, probably based on its clientele.[xxxii] If a region was accustomed to a certain look and preferred it, that's how diamonds were cut for them.

[197] Tillander, 1995
[198] Fergusson, 1927
[199] "Diamond Cutting and Polishing," 1935
[200] Smith, 1912

Tillander's Diamond Cut Drawings (1900–1939)



	Leviticus	American	Amsterdam	Antwerp	London
Pavilion Angle	Not provided	41°	42°	32°	40°
Crown Angle	Not provided	35°	45°	45°	35–36°
Crown Height	Not provided	20%	20%	15%	Not provided
Pavilion Depth	Not provided	40%	45–46%	31%	Not provided
Table Size	Not provided	40%	60%	70%	50%
Culet Size	Not provided	2%	pointed	pointed	2–3%

Fig. 4-28: These diamond cut drawings are reproduced from Herbert Tillander's *Diamond Cuts in Historic Jewellery, 1381-1910. Tillander ©Art Books International, 1995.*

Despite all the regional preferences, however, any one European region could have a variety of cuts being sold in it, just as in the United States. While it is convenient to associate Tillander's names for cuts with geographic regions, they are probably just labels he used to distinguish certain cutting styles.

Notes

[i] Some manufacturers (e.g., Fox Bros. and Randel, Baremore & Billings) referred to the new style as "modern cutting," but it's not clear why they used this term (Fox Bros., 1895; Randel, Baremore & Billings, 1895).

[ii] Not to be confused with American labor laws. Stern Bros. & Co. was one of several companies charged with violating the American Contract Labor Law ("Stern Bros. & Co.'s Fight with Labor Agitators," 1893).

[iii] Kunz only states the imports' cost at $7,000,000 and value of the labor in America at $3,000,000, but does not say what the value of the finished goods would be.

[iv] For a brief time (only a few months), rough diamonds were taken off the duty-free list in 1878. Diamonds were imported in the U.S. duty-free until 1890. There was a 10 percent duty on cut diamonds until 1894 when it increased to 25 percent. A 10 percent duty on rough diamonds was also imposed in 1894. The tariff lasted four years, then returned to former levels. The duty on cut diamonds went up again in 1913 to 20 percent, and rough diamonds were taken off the duty-free list. The Smoot-Hawley Tariff of 1930 changed the tariff to 10 percent for cut diamonds and put rough diamonds back on the duty-free list ("One Carat Perfect: $100," 1969).

[v] Humphrey helped build some experimental equipment for Morse and later built mills for Cohenno (Morse's first shop manager). Humphrey learned cutting from both Morse's and Cohenno's firms. He later became supervisor with the diamond cutting company Randel, Baremore & Billings in New York, before returning to Boston to buy Morse's shop after his death (Leviticus and Polak, 1908; "Boston a Brilliant Solitaire in the Diamond World," 1924).

[vi] The complete text reads: "Every stone in Mr. Humphrey's shop is cut by gauge and every facet polished with the grain. As has already been stated, American buyers demand a much better quality of work than would satisfy the ordinary buyer in the European marts. Those, however, who have seen a mediocre diamond transformed into a snapping, blazing gem, full of fire, simply by being re-cut with a proper regard for the accuracy of the facets, cannot blame the American public for its choice. Owing its brilliancy to refraction, a pure white stone, badly cut, may not possess one-half the beauty of another of not nearly as good color, but properly cut" ("The Diamond Cutting Industry in America," 1894).

[vii] The complete text reads: "Highest and Only Awards for Scientific Cutting at Antwerp Expositions, 1885 and 1894. Our fortunate purchase of ... the first shipment of rough diamonds direct from

Africa to the United States, will be cut by the best artists in the world at our new factory (to the highest degree of perfection), and will be offered to the trade without profit to establish our reputation as unexcelled artistic diamond cutters in the New World, as testified to by highest awards in the Old" (Coetermans-Henrichs-Keck, 1895).

[viii] As seen in *The Jewelers' Circular-Weekly* and *The Keystone*. For example, their ads are found on the first two pages of *The Jewelers' Circular-Weekly* from 1901 until 1919.

[ix] If earlier records exist, they were inaccessible; it is not until J. R. Wood & Sons published a catalog in 1918 that we find a record of this company's "scientific" proportions (J. R. Wood & Sons, 1918). An ad from 1903 tells readers to look at a recent mailing for details about their "correct cutting and dimensions of diamonds."

[x] "Paradoxical as it may seem, it is in the United States, far from the source of supply, that diamond cutting has attained the highest degree of perfection. Nowhere else are such beautiful effects brought out and nowhere else is the brilliancy so pronounced as in the American-cut stones" (The Hallmark Store, 1917).

[xi] "Diamonds cut either too thick or too shallow are not very brilliant—not so desirable as scientifically cut stones, and therefore not worth as much per carat. ... The Diamond's chief value to the wearer lies in its brilliancy and it is therefore essential the purchaser make a comparison of stones rather than of weights and prices. It frequently occurs that of two stones, the one of lesser weight, perfectly cut, appears larger and more brilliant, and is consequently more desirable. The accompanying illustrations will convey some idea of the advantages to be gained by scientific cutting. They show the direction light rays take as they are reflected back from the stone. It is this reflection of light that produces brilliancy in the Diamond, and it will be readily observed that the perfectly cut Diamond is the only one in which the reflection of light is complete and evenly distributed over the entire surface of the stone" (Marshall Field & Co., 1918—1919). The copyright information reads: "Scientific Cutting, Copyright, 1914, Marshall Field & Company, Chicago."

[xii] It was not until 1920, in an article by Wade on Tolkowsky's book, that he introduced a method for making a gauge to measure the crown and pavilion angles of a diamond (Wade, 1920). While the Moe gauge could measure some of the proportions of a diamond, this was the first time the trade was told how they could measure the angles on their stock. He wrote that "knowledge of the exact proportions required for the greatest brilliancy should also be helpful to diamond dealers and should make them more exacting in their requirements" (Wade, 1915a). He provided a variation of the same instructions for making a gauge for determining the best angles for zircon several years later (Wade, 1928).

[xiii] The term "perfect cut" would continue to be misused for many years. The National Jewelers' Board of Trade eventually provided a definition of the term. Afterwards, Wade complained that "so badly has the expression been abused, however, by unscrupulous and irregular dealers that the best practice probably lies in avoiding it altogether" (Wade, 1930).

[xiv] *McClure's Magazine*, an American literary and political magazine, was founded by Samuel McClure in June 1893. It was involved in investigative journalism by 1902, and considered to be the originator of reform journalism (*McClure's Magazine*, 2003a, 2003b).

[xv] *Everybody's Magazine*, considered one of the most popular magazines just after the turn of the century, was founded in 1899 and primarily committed to investigative journalism. Circulation was around 500,000 in 1909, selling over 150 pages of advertising per issue (*Everybody's Magazine*, 2003b).

[xvi] Whitlock would become the curator of the American Museum of Natural History in 1918 (Sofianides and Harlow, 1990).

[xvii] Note that the term "ideal" was used as a description rather than a title at this time.

[xviii] Sightholders get first "sight" or choice of diamonds to be sold by the mining companies before they go on the market.

[xix] Morse "considerably lengthened the lower girdle facets which, in the classic Standard Brilliant, were supposed to be the same as the upper girdle facets" (Tillander, 1995).

[xx] The photograph of the Tiffany II shows that Morse made the lower girdle facets longer. The lower girdle length in the photograph of the J. R. Wood & Sons diamond (Fig. 4-20) shows that they were still around 60 percent.

[xxi] This would make the area within each bezel fairly plain in appearance, much like the large facets seen in emerald cuts.

[xxii] "In conclusion, it may be added that without a culet there is a slight change in the appearance of a brilliant, for we are accustomed to see a reflection of the tiny octagonal culet surrounded by its eight attendant facets, through every one of the front facets of the stone. When, instead, we see the reflections of the eight facets sharply meeting in a point, we miss the culet, for, small as it now is, it still, to a slight degree, reflects portions of light that would otherwise be lost or misdirected, as may be seen from the fact that the image of the culet, even in the modern cut stone, is always brilliantly lighted up" (Wade, 1917).

[xxiii] The fact that Stern Bros. & Co. was not an American extension of a European cutting house is relevant to understanding what Americans were cutting for table size.

[xxiv] Stern Bros. & Co. did not use the terms "scientific cut" and "American Cut" in its advertising, but gave credit to Morse for the cutting innovation he provided. "It was the New World that gave new stimulus to the art. In the sixties, Mr. Henry Morse, of Boston ... opened the first diamond cutting establishment in America. Morse realized how important mathematical precision is to the beauty and radiance of the gem. He trained several workers and succeeded in attaining a rare perfection. He might be said to have given the final grounding of science to the art of diamond cutting" (Stern Bros. & Co., 1914).

[xxv] Diamond jewelry photos were already in existence, such as those taken by Tiffany & Co. This is possibly the first successful close-up of a diamond.

[xxvi] Shipley notes that Wade's brilliant had a 40 percent table, but he continued to state a small table was European in design.

[xxvii] Tillander seems to ignore the small table size he finds in Leviticus' work from 1908. "*Leviticus's Geillustreerde Encyclopadie der Diamantnijverheid* (1908) is a highly professional Dutch encyclopedia of diamonds, based on consultations with numerous diamond experts. It is therefore surprising that there is no actual written description of the Brilliant Cut, only the rather poor illustrations reproduced here ... which are supposed to be self-explanatory," he says about the diagram in Leviticus (Tillander, 1995).

[xxviii] "Kornberg Bros. & Swaab, Cutters of High Grade American Cut Diamonds, extend hearty wishes" (Kornberg Bros. & Swaab, 1942).

[xxix] The Kaplan firm (at the time a major cutting house in Antwerp) sent most of its production to New York, where Lazare's brother Sam had a diamond importing firm (Balfour, 1978).

[xxx] "Americans take about one-third of the diamonds of the world now, and these are, as a rule, the finest" ("$7,000,000 Worth Imported in Eight Months," 1887). "The American people buy as many diamonds as all the rest of the world together do, and in money value twice as much, for America demands only the better grades—that is, the finest colors and flawless or slightly flawed stones" (J. R. Wood & Sons, 1914).

[xxxi] "His treatment of the diamond has given a great stimulus to the industry both in the United States and abroad. Shops were opened here and in London in consequence of his success" (Kunz, 1888a).

[xxxii] For example, Thomas Wigley would have disagreed with Tillander. Wigley wrote in 1898 that Amsterdam was the source of shallow and spread stones, which Tillander called "Antwerp Cut" (Wigley, 1898).

"LOOK INTO THE FACE OF A DIAMOND AND YOU WILL SEE THE IMPRISONED LIGHT SCINTILLATING ON THE BURNISHED FACETS AT THE BACK. TURN IT AS YOU WILL AND WHEREVER YOU LOOK, THERE IS THE SHEEN OF LIGHT PLAYING OVER TRANSPARENT WALLS, ADAMANTINE TO IT; AN IMPRISONED STAR BENEATH A COVERING OF LIMPID DEW."[201]

Wallis Cattelle, 1911
English-born New York jeweler

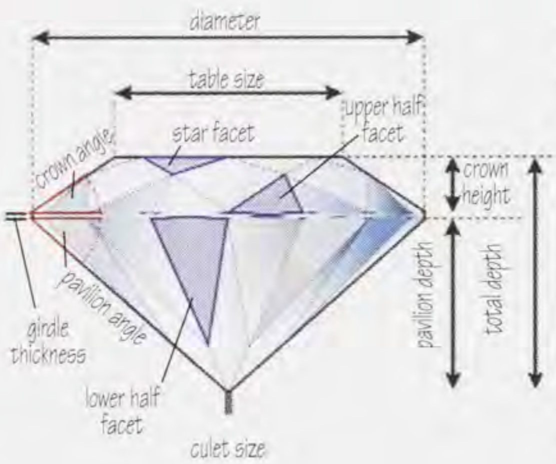
Chapter 5

Tolkowsky, Shipley and GIA

The evolution of the American Cut round brilliant diamond can be separated into three distinct phases: changes in diamond cutting methods that gave greater control over cutting; ray-tracing that gave a scientific basis to the "ideal proportions" of the American Cut; and the use of cut theory and practice in marketing. In the third stage, specific diamond proportion choices were embraced by groups and individuals with great influence on the jewelry industry and consumers.

Proportions validated by the first ray-tracing studies in the early 1900s gave way to those proposed by Marcel Tolkowsky in 1919, which took hold by the 1930s. Advocates for the American Cut, such as Frank Wade and GIA founder Robert Shipley, gave it greater prominence in the minds of many throughout the jewelry industry, but the key endorsement of the beauty and value of the American Cut came with changes in GIA course materials in 1953. The Institute's curriculum stated that cut quality was an integral aspect of value; when the American Cut was incorporated into its system of assessing color, clarity and carat weight, this firmly entrenched the term, and the proportions

[201] Cattelle, 1911



it had come to represent, as a standard in the American and international jewelry industry.

Various grading systems and the jewelry trade media used proportion terms such as pavilion angle, crown angle, table size, crown height, pavilion depth and total depth to describe standard proportions. Within the diamond cutting industry, however, other proportional aspects evolved: sizes of lower and upper half facets, star facets, culet size and girdle thickness. As some of these other factors came together with the evolution of the American Cut, the next logical step was to determine how to analyze these aspects and provide a grade that represented the appearance of the diamond.

The Changing World of Diamond Cutting

Diamond cutting in Antwerp was disrupted during World War I when the city fell under the control of the Germans (this was also the case during the first part of World War II), who brought rough from their own mines in southern Africa to be cut.[202] Many expert cutters fled occupied Belgium for Britain and America; those who ended up in Britain were allowed to cut diamonds during the war if they agreed to return home when it ended.[203]

American cutting houses flourished during World War I because imported fashioned diamonds merely trickled in from Europe.[204] Most European cutting centers knew little about what had transpired in America since the German occupation of Antwerp in late 1914.[i] Europeans were largely unaware of the campaign undertaken by *The Jewelers' Circular-Weekly* and several American organizations to explain the American Cut diamond to the jewelry industry and public, or the mathematical calculations and "ray-tracing" that were being done by Americans.

The British government, determined to find jobs for its wounded soldiers when the war ended in 1918, began to set up cutting works. Bernard Oppenheimer, the brother of Ernest Oppenheimer (the diamond and gold mining entrepreneur who controlled De Beers), funded the enterprise. He also founded the Anglo-American Corporation of South Africa in 1917 in Brighton, about 60 miles from where Marcel Tolkowsky was attending the University of London.

[202] "Nazis Tighten Belgian Cutting Rules," 1942
[203] Cook, 1931; Hahn, 1956
[204] Austin and Mercer, 1941

The British factory was partly operational by 1919, and complete with 1,500 "mills" set up for diamond cutting by 1920.[205] The factory sold over £100,000 (or $324,000) worth of finished goods in Antwerp in October of that year. Despite this, control of most of the world's diamond cutting returned to the Dutch and Belgians after the war.

Tolkowsky's Point of View

Marcel Tolkowsky (Fig. 5-1) was born into a prominent diamond cutting family in Antwerp in 1899 and was related to the Kaplans, another important diamond family; the two families were very close.

Fig. 5-1: Marcel Tolkowsky, 1899-1991, received his Doctor of Science in Engineering from the University of London in 1920. *Illustration by Peter Johnston/GIA.*

Lazare Kaplan explained the connection: Abraham Kaplan "was the third son. There was my father Joshua, another brother, and then Abraham. The Czar in those days insisted that the third male heir be turned over to the government to be trained from infancy to be a professional soldier. In my village, a family with three sons would look for a childless couple and buy their family name for the youngest boy. So my uncle grew up with the family name Tolkowsky."

When things became increasingly dangerous for Jews living in Russia in the mid-1800s, Abraham Tolkowsky moved to Belgium as an adult. Marcel Tolkowsky was Abraham Tolkowsky's grandson.[206]

Marcel Tolkowsky began his education at the German School in Antwerp. His family moved to London, where he continued his studies at the Lycée Français and finally at the University of London, where he worked on a doctorate of science in engineering.[ii] He wrote his influential book, *Diamond Design: A Statistical Assessment of Brilliance and Fire for the Round Brilliant Cut Diamond*, while studying at the City of Guilds College (now the engineering school of Imperial College at the University of London).[iii]

Tolkowsky, along with the rest of Europe, was isolated from America during World War I, which accounts for his remark in the introduction to *Diamond Design* that "nowhere can one find mathematical work determining the best shape for the gem."[207] He was not aware of Wade's and Whitlock's proportion calculations and geometric ray-tracing for gemstone shapes.

[205] "A Phenomenal Success," 1920
[206] "Lazare Kaplan: A Very Remarkable Man," 1979
[207] Tolkowsky, 1919

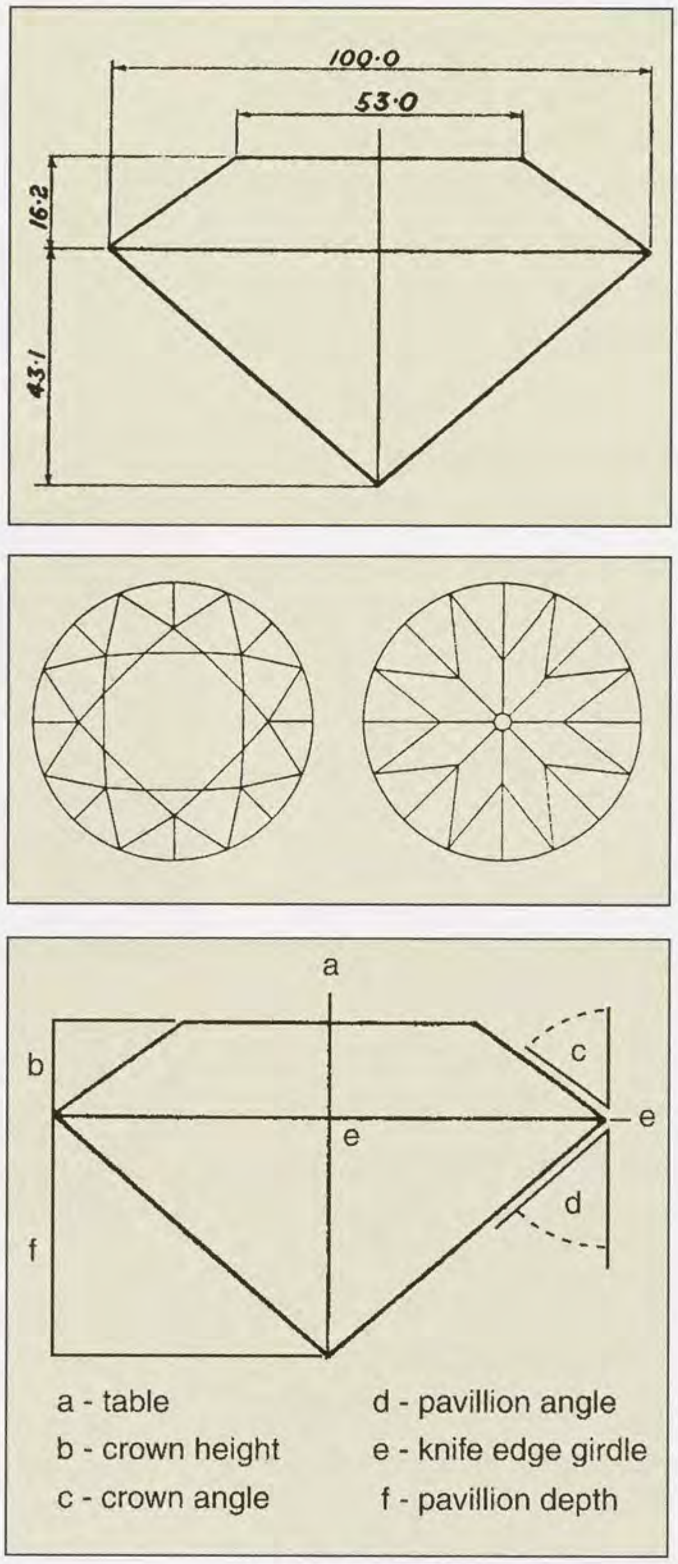


Fig. 5-2: Tolkowsky's calculations result in a knife-edge girdle, as shown in his illustrations (top two figures). The bottom illustration is labeled to show the parts of a diamond. *Tolkowsky, 1919.*

Tolkowsky's calculations for what he called the "best proportions of the brilliant" are well known today. The table is 53 percent, pavilion depth 43.1 percent, crown height 16.2 percent, pavilion angle 40.75 degrees, crown angle 34.5 degrees, and girdle thickness (while not reported in his book) was knife-edged (Fig. 5-2).[208]

Creators of various cut grading systems have made many assumptions about these proportions over the years. Many designers of cut grading systems claim to base their proportions on Tolkowsky's work, but ignore the context in which he derived his conclusions.

He offered empirical proof of his calculations in a section titled, "Comparison of the Theoretically Best Values with Those Used in Practice." He chose five diamonds from "production." (He doesn't say whose production; it can only be presumed to be from his family's factories. Tolkowsky's family was in London during the war, but it is not known whether they set up a new shop there or worked for someone else.)

He describes the five diamonds he chose as "all cut regardless of loss of weight, the only aim being to obtain the fire and the greatest brilliancy. The most brilliant larger stones were measured and their measures noted. It is interesting to note how remarkably close these measures, which are based upon empirical amelioration and rule-of-thumb correction, come to the calculated values."

The diamonds listed have total depths from 55.4 to 61.4 percent and crown height percentages from 13.3 to 18.6; the table sizes (calculated from the proportions and measurements Tolkowsky listed) range from 46.9 to 61.3 percent (Fig. 5-3).[iv]

[208] Tolkowsky, 1919

TOLKOWSKY'S DIAMONDS OF MAGNIFICENT BRILLIANCY

	C	1	2	3	4	5
Pavilion Angle	40.75	40.75	40.75	40.00	41.00	41.00
Crown Angle	34.50	35.00	35.00	34.50	33.00	34.00
Total Depth %	59.30	58.70	61.40	55.40	58.50	60.00
Pavilion Depth %	43.10	43.00	42.80	42.10	42.80	42.20
Crown Depth %	16.20	15.70	18.60	13.30	15.70	17.80
Table %	53.00	55.70	46.90	61.30	51.60	47.20

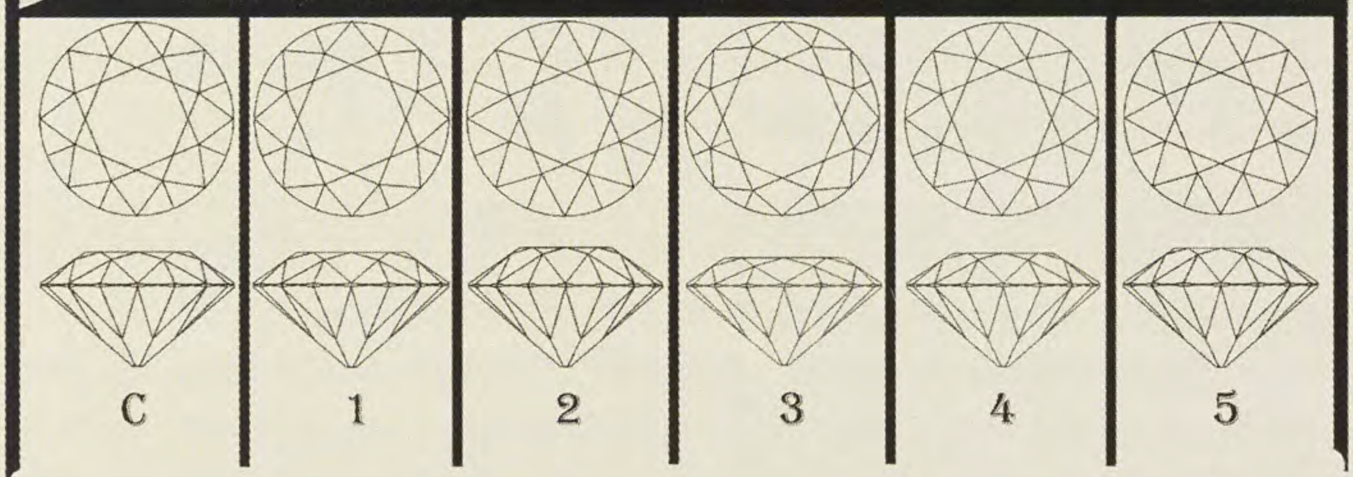


Fig. 5-3: In *Diamond Design*, Tolkowsky's recommended proportions are presented for the five diamonds he says have "magnificent brilliancy." (In this chart, the "C" indicates Tolkowsky's "calculated" best proportions and each of his five examples has its own numbered column.) The calculated table sizes for the five diamonds are based on their other proportions. Note the highlighted areas: These would be considered outside the best ranges today. *Green et al./GIA, 2001.*

Fig. 5-4: The diamond on the left (a1, a2) was recently cut to the proportions proposed by Marcel Tolkowsky, including his shorter lower halves, large culet facet (by today's standards) and extremely thin girdle. Note that its pattern has a slightly blocky appearance compared to the diamond on the far right. The diamond in the center (b1, b2) is also cut to proportions close to Tolkowsky's, but with modern changes (no culet, a thicker girdle and longer lower girdle facets). The diamond on the far right (c1, c2) has a pavilion angle (40 degrees) and table size (40 percent) in the range of typical American cutting from 1870 through the 1930s. The shallow crown angle (27 degrees) demonstrates that cutters were trying to achieve the look of the period, but were probably cutting from shallow rough crystals to retain weight. Correctly cutting to the proportions of the American Cut for that period (with the slightly steeper crown angle), would have yielded a smaller diameter and less carat weight. *Photos by Eric Welch (face-up) and Don Mengason (profile)/GIA.*

Given the range of proportions of diamonds that impressed him, it is not surprising that Tolkowsky wrote, "Brilliancy is not greatly diminished by making the stone slightly thicker over the girdle."

Tolkowsky was not presenting a narrow range of "best proportions" by today's standards, but a wide one.[v] The cutters who worked on these diamonds did not use measurement gauges; they had been cutting diamonds in these proportions long enough that they could visually approximate the correct angles.[vi] Tolkowsky felt that "the high-class brilliant is cut as near the theoretic values as is possible in practice, and gives a magnificent brilliancy to the diamond." This indicates that he was unaware that some in America had developed a tighter range of acceptable proportions for the crown (around 35 degrees).

Tolkowsky included a diagram of the facet arrangement of his "best proportions" (see Fig. 5-2) to show that he had also lengthened the lower halves to just over 50 percent, compared to the short lower half length (about 30 percent) that was still in fashion, which were reminiscent of Jeffries' diagrams from 1750.

Tolkowsky was the first to write that lower halves needed to have a specific relationship to the rest of the diamond (Fig. 5-4), a relationship that was not followed with the traditional short length. He pointed out that an approximately 2 degree difference between the pavilion main facets and the lower half facets was necessary, but that "where the cut is somewhat less fine and the girdle is left somewhat thick (to save weight), that facet is sometimes made 3° steeper, or even more, than the pavilion." Polishing the lower half angle steeper made the facets much shorter.[209]

Wade Comments on Tolkowsky's Work

Wade, who was covering the diamond industry for *The Jewelers' Circular-Weekly*, introduced Tolkowsky's work to America in a 1920 article.[210] It was primarily a summary of the mathematical steps Tolkowsky had taken and a review of Tolkowsky's conclusions at each step.

"Any diamond cutter who will make a brilliant to the above proportions will find that he has produced a stone of splendid brilliancy. He will also find that it varies very little in 'make' from the shape that he has learned by experience produces the best results," Wade wrote. He also noted that "cutters had arrived at about the best possible make before the work of Tolkowsky."

Tolkowsky himself said that manufacturers were already cutting to what he determined were the best proportions.

Wade also articulated the importance of Tolkowsky's work: "Knowledge of the exact proportions required for the greatest brilliancy should also be helpful to diamond dealers and should make them more exacting in their requirements. They will thus come to handle mainly the more beautiful stones and in the long run more business will be done by them."

Wade later wrote that Tolkowsky's father had already been cutting this shape based on experience, and that "Tolkowsky Junior found

[209] Tolkowsky, 1919
[210] Wade, 1920

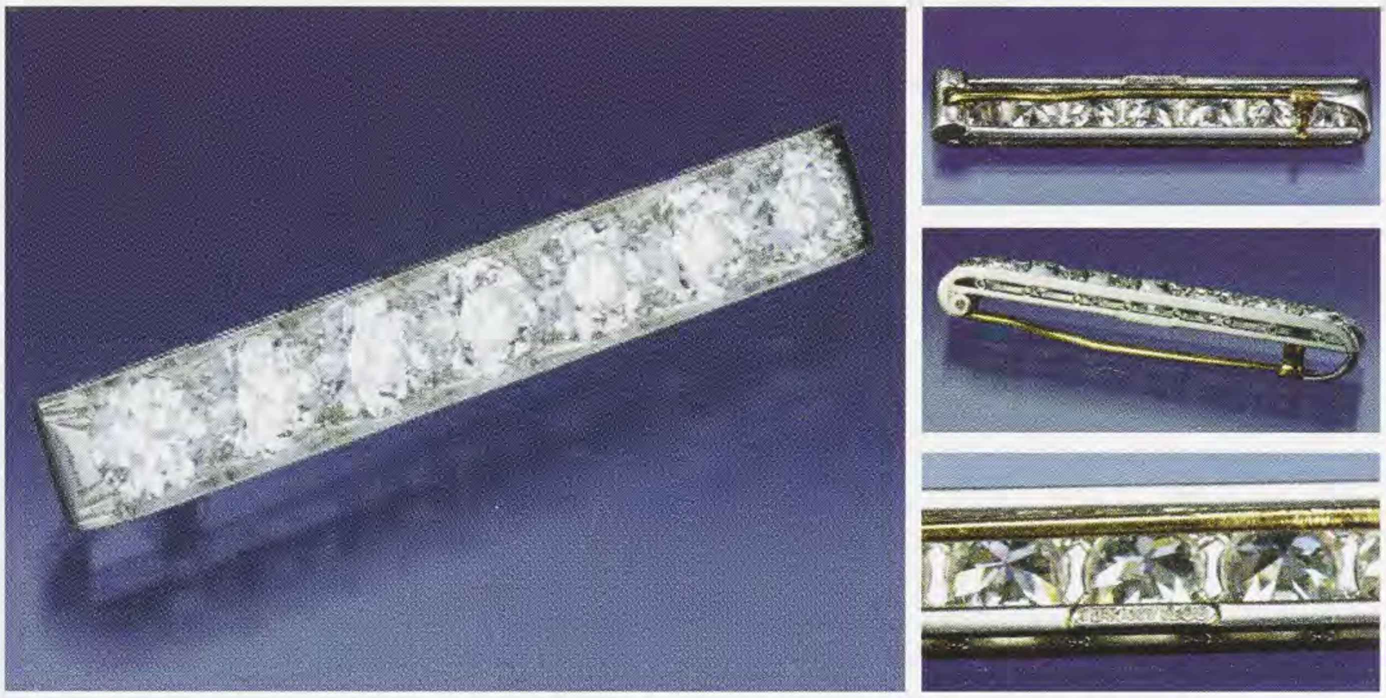


Fig. 5-5: This Tiffany & Co. brooch contains seven diamonds that weigh a total of approximately 5 carats. The diamonds are all very well-matched round brilliants with lower facet lengths and culet sizes typical of the period 1870 to 1945. The estimated angles of the pavilion and crown are consistent with the American Cut of 1890 to the present. The table sizes range from 52 to 54 percent, which falls into Tolkowsky's calculated best standards. The cutting is extremely well-matched and the diamonds are set with nearly the same orientation in the mounting. It is impossible to determine if the diamonds were cut after 1919 to Tolkowsky's standards, or if the table size was already being used in America before Tolkowsky (though unlikely). *Photos by Robert Weldon/GIA.*

out why that shape did its work so well."[211] Wade was essentially saying that Tolkowsky was merely calculating the proportion sets that had already been established.

Wade equated the term "ideal" with Tolkowsky's proportions in 1927 when he wrote, "The experience of many diamond cutters over many years agrees with the extremely thorough mathematical calculations of Marcel Tolkowsky of Antwerp to the effect that the ideal shape for a diamond brilliant is as follows. … "[212]

This appears to be the first time that Tolkowsky's proportions were called "ideal." But Wade also felt that departures from the ideal were justified in most cases.[vii] If cutting to ideal proportions resulted in a diamond just under a carat, whereas a slightly spread stone could exceed one carat, he felt the sacrifice in quality was justified, but he also warned against making it spread so much that it becomes a fish-eye (see Glossary for "spread" and "fish-eye").

[211] Wade, 1928
[212] Wade, 1927

Wade did not think many diamonds anywhere were being cut correctly. As an article on one of his lectures reported, "Mr. Wade insisted that many of them might be still better made and that he was of the opinion that dealers would do well to make a close study of 'make,' for with more widely spread expertness in the matter on the part of the retailers better 'make' will surely follow."[213]

In his many lectures on diamond cut, Wade used a chalkboard to explain how light worked in a diamond[viii] and advocated Tolkowsky's proportions, even pointing out the 53 percent table[214] (Fig. 5-5).

With Wade's endorsement of Tolkowsky's proportions, the table size of the American Cut changed (compare Fig. 4-15, page 101, with Fig. 5-6). Still, not everyone accepted it immediately. Two years after Wade's published talk, *The Keystone Jewelers' Index* still stated that the "surface of the table should be 40%."[215] Wade advocated slightly different proportions (i.e., 53 and 54 percent tables) over the next few years, but all of his documented talks and articles referenced Tolkowsky and used the term "ideal."[ix]

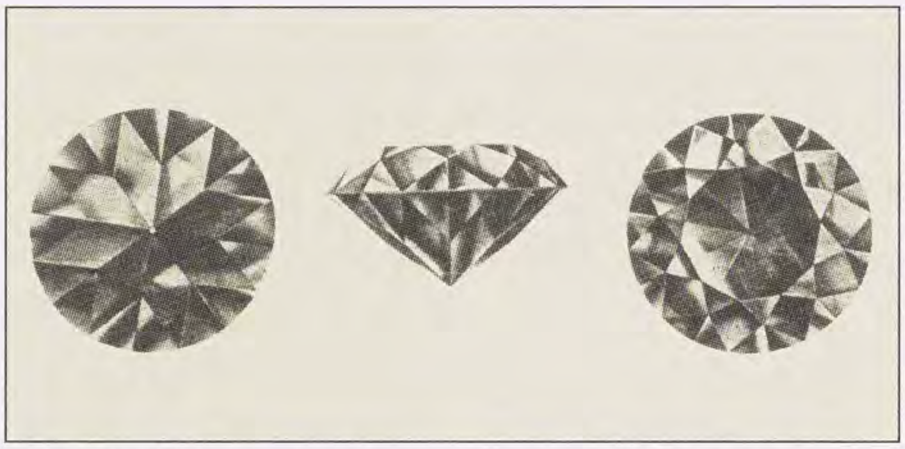


Fig. 5-6: These images accompany an article about a lecture Wade gave in 1929. The table size is 54 percent, which is larger than the 40 percent he stated as the proportions he advocated in his 1916 book. *"A Talk on Diamonds," 1929.*

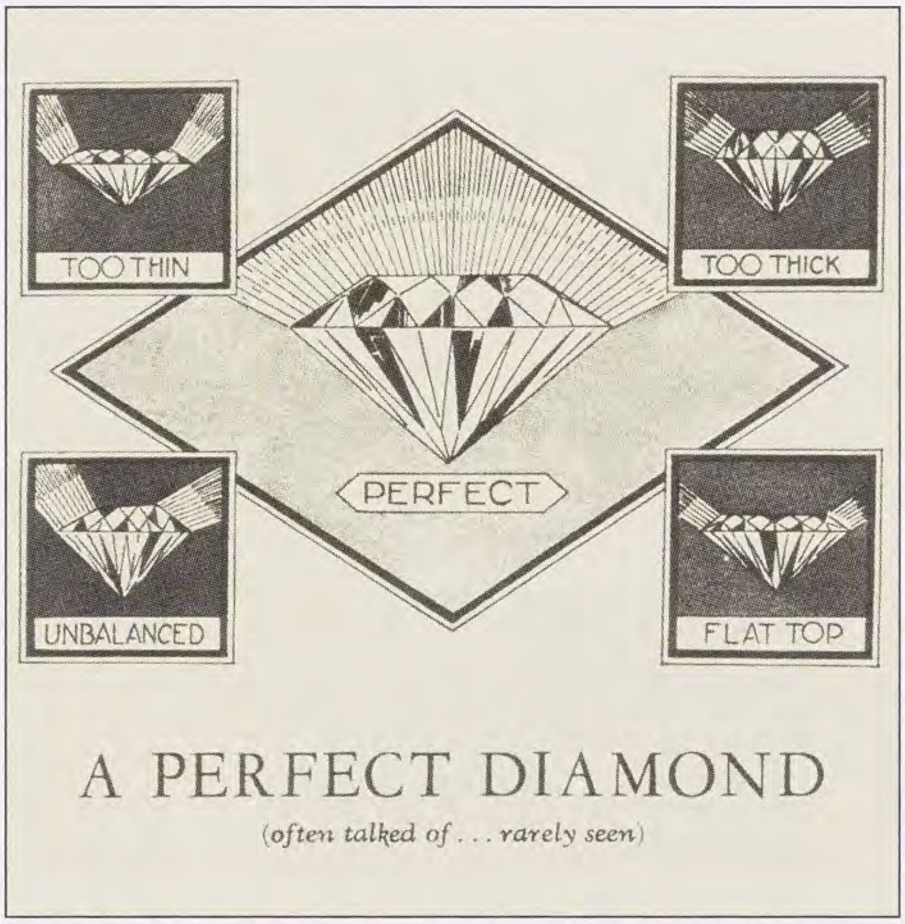


Fig. 5-7: Note the term "perfect" associated with the approximately 50 percent table in this Barth Co. of Minneapolis, Minnesota, advertisement (*Barth, undated, from The John and Marjorie Sinkankas Gemological and Mineralogical Collection*). Advertising copy was provided to AGS members, who banned the use of the term "perfect" in 1937, but continued to use the ad by simply changing it to "correct." *Guilds (Supplement), 1939.*

Jewelry retailers and wholesalers were still widely using the term "perfect," however, when referring to cutting (Fig. 5-7), color and clarity. This was despite the educational campaign started in 1916 by *The Jewelers' Circular-Weekly* and several jewelers' organizations. Use of this problematic term would continue for many years. Wade suggested dropping "perfect" in 1930, even though the National Jewelers' Board of Trade tried to endorse the term and adopt a definition of it at about the same time.[x]

213 "A Talk on Diamonds," 1929
214 Wade, undated; Wade, 1925
215 Cook, 1931

Robert Shipley and GIA

Robert M. Shipley

Robert M. Shipley started out as a successful jeweler in Wichita, Kansas, and worked there in the surrounding area for more than 15 years in the early 1900s. He eventually bought out his father-in-law's chain of jewelry stores and opened a second chain in the region (Fig. 5-8). Although he became highly successful, his knowledge of gems, like many jewelers of his day, was quite limited.[xi]

Shipley had several important clients, including Midwest oil millionaire Dillard Clark, who purchased more than $250,000 in diamonds from Shipley over the years. Clark was quite enthralled with diamonds and decided to visit one of Europe's diamond cutting centers. He called on Shipley after he returned and proceeded to show him that most of the diamonds he had been sold were of poor make.

Shipley was humiliated. Clark had learned how important cut quality was, but Shipley only understood clarity and color.[216] Shipley's lack of knowledge was

Fig. 5-8: Shipley owned and operated several jewelry stores in Wichita, Kansas, in the early 1900s. These photos show his retail showrooms E. Vail & Co. (top) and the Blue Lantern Gift Shop (right). *Photo by Smith & Hodge; both photos from Wichita Eagle/1925.*

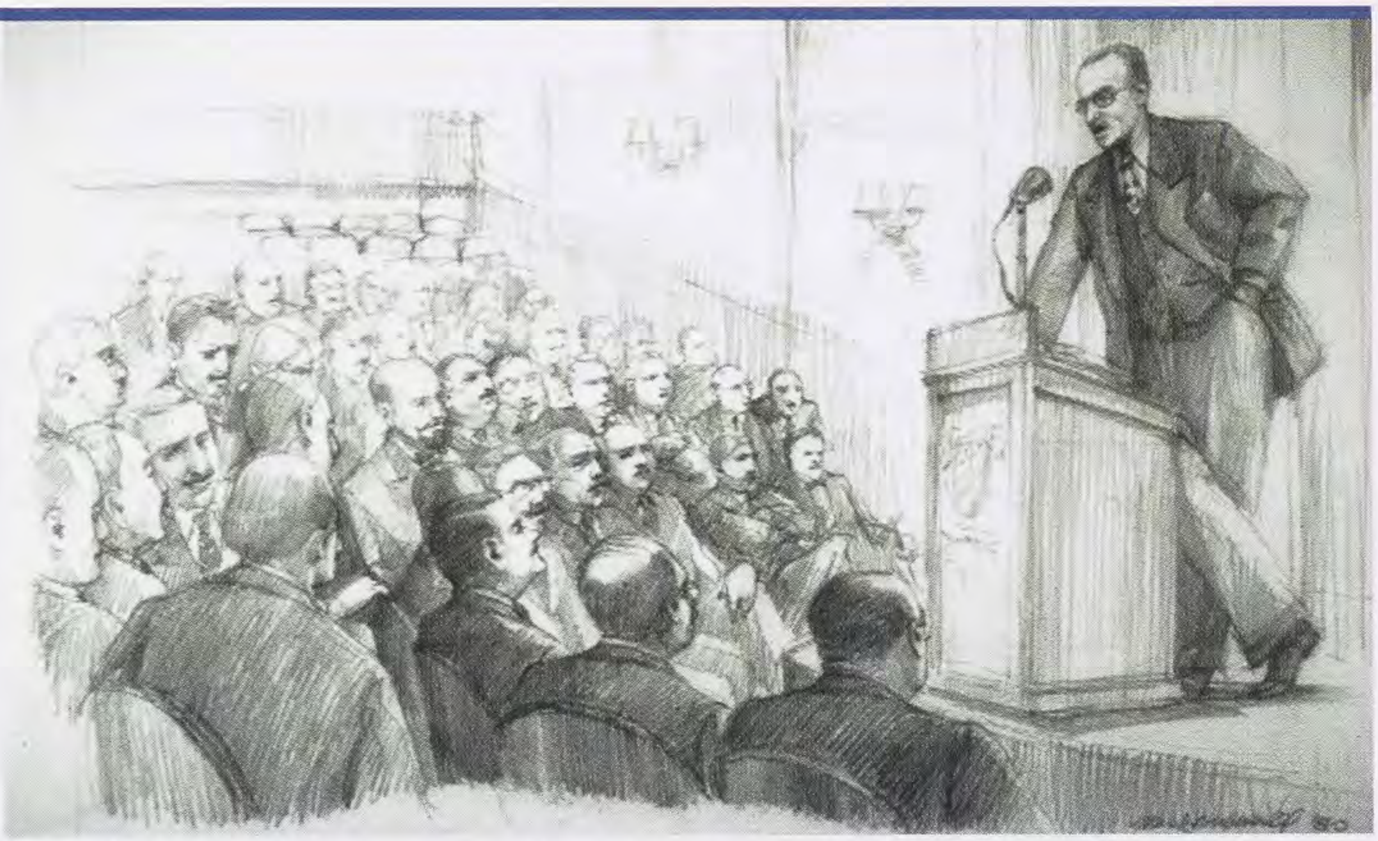


Fig. 5-9: Shipley (facing page) founded the Gemological Institute of America in 1931. More than 60 California jewelers attended his first gemology lecture for the University of Southern California's evening school (left). *Illustration by Marek Buchwald; both/GIA.*

typical for the time, and illustrates why *The Jewelers' Circular-Weekly* considered this such an important issue.

"A few of my own customers had revealed my own ignorance in soul-searching experiences," Shipley later lamented. "I had lost the confidence and business of my star customer, a diamond-fancying oil-millionaire."[217]

Shipley's business faltered during the 1920s.[xii] He sold all of his stores in 1927 and moved to Europe, where he eventually took the correspondence gemological coursework offered by London's National Association of Goldsmiths (NAG). He received his NAG diploma in 1929 and returned to the United States.

Shipley began to teach an evening gemology course at the University of Southern California in Los Angeles in 1930 for jewelers who wanted to learn more about gemstones and how to sell them better (Fig. 5-9). Interest in the course was so high that he soon started to teach the program under the name of the Gemological Institute of America, which he and his wife, Beatrice, organized in 1931.

[216] Shuster, 2003
[217] Shipley, 1959

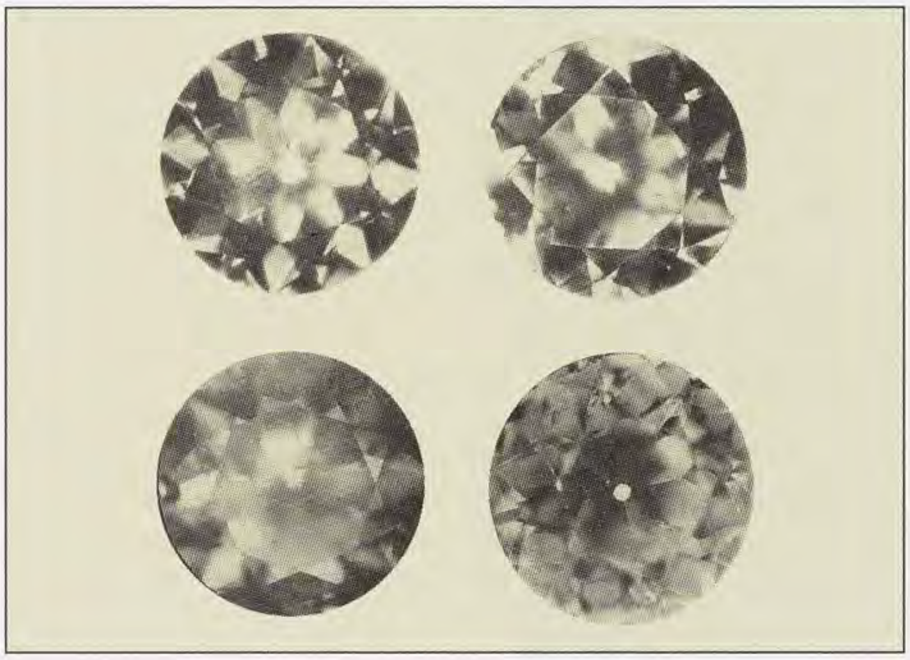


Fig. 5-10: These diamond photographs from GIA's first course material in 1931 show the mixture of cut quality that was typical of that time (*Shipley, 1931*). American Cut diamonds were not readily available for Shipley to portray in the coursework.

Was Anyone Cutting the American Cut Diamond?

"The majority of stones now sold in America are based on the American style," Shipley declared in his 1931 course material.

Photos of diamonds from that coursework (Fig. 5-10)[218] and the jewelry trade press of the time (Fig. 5-11) show that few were actually cut to Tolkowsky or American Cut proportions, despite lobbying efforts of Wade and others.

Even though there was evidence that tied appearance to certain proportions, many were more concerned with weight retention from the rough than with appearance, just as Morse encountered in the mid-1800s. If a cutter could get a little more weight out of a piece of rough, he could get a little more profit.

The GIA Research Service wrote about the lack of demand for ideal cut diamonds in a 1939 *Gems & Gemology* article:

> THE DECREASE IN PURCHASING POWER among more discriminating diamond customers has resulted in an increase in the demand for "spread" diamond brilliants by a majority of retailers. This overbalances the increasing demand from gemological graduates and students for diamonds which approach as closely as possible the ideal proportions established for the so-called American-cut brilliant. Until this situation changes, the cutters cannot be expected to make and stock a special line of diamonds which will approximate ideal proportions.
>
> Gemological students and graduates should keep in mind that while ideal proportions are desirable for maximum brilliancy and fire, the important point that they have been taught is that variations from such proportions decrease value per carat. ... If ideal proportions are unobtainable, those which closely approach such proportions offer a reasonably non-competitive item to sell to more discriminating customers. But spread stones are also necessary in an attempt to meet price competition.[219]

GIA course material reviewed the problem and used line diagrams (reminiscent of J. R. Wood & Sons' silhouette images) to show the

[218] Shipley, 1931
[219] "Demand for Ideal Proportions in Diamond," 1939

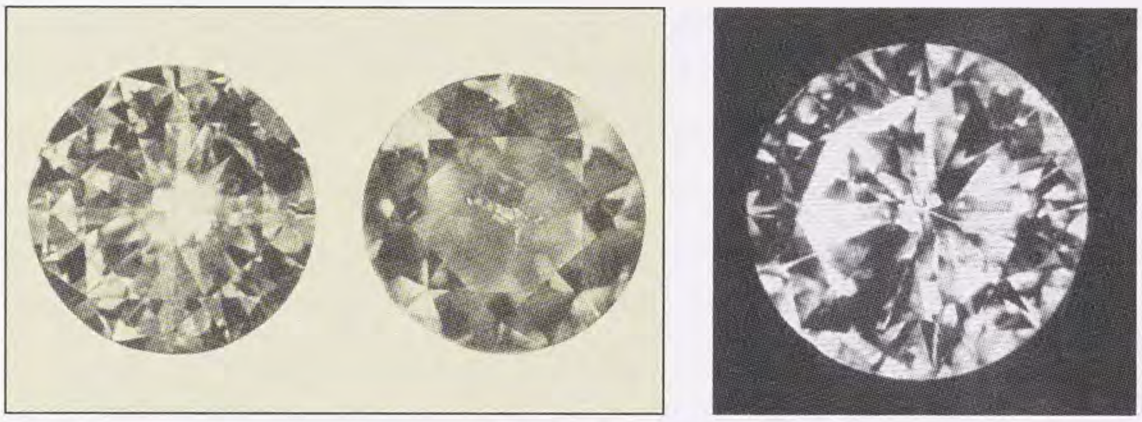


Fig. 5-11: These pictures from the trade press in 1935 (left) and 1958 (right) show that diamonds were being sold with proportions that differed from the American Cut, even though many of them were cut in America. *Austin, 1935 (left); Patton, 1958 (right).*

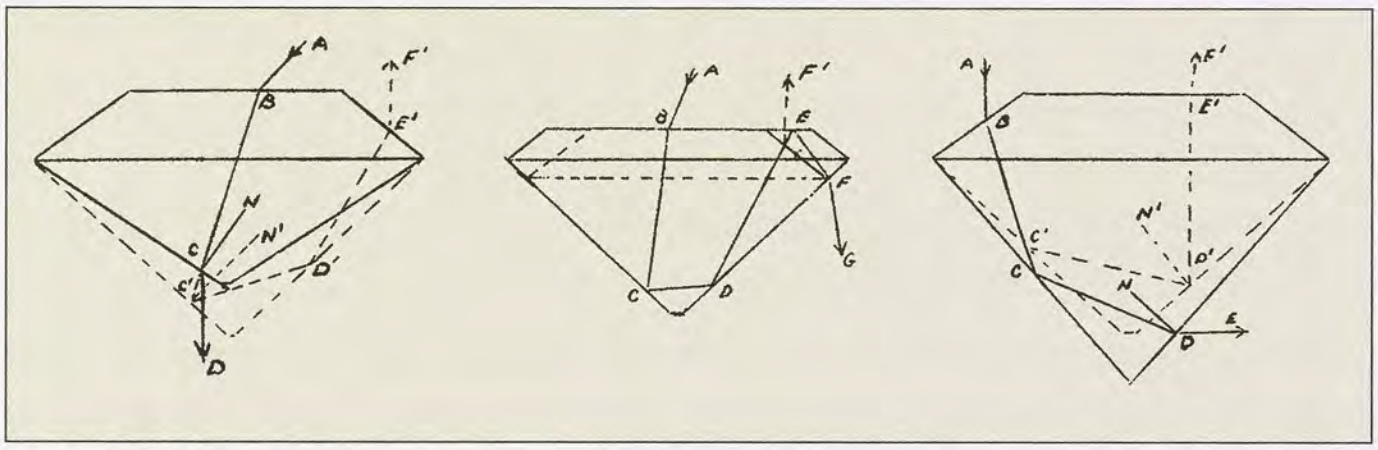


Fig. 5-12: GIA's 1936 coursework shows the silhouettes (dotted lines) of poorly proportioned diamonds. Shipley used ray-tracing to show how light traveled though the diamond and to demonstrate why certain proportions were more efficient at returning light. The profile on the left illustrates a ray of light entering a diamond with shallow angles on the pavilion main facets and how it simply passes through. The diamond in the middle has the correct pavilion angle, which causes the ray of light to be returned back to the observer. The crown, however, is too spread. The third diamond profile shows a deep pavilion angle that sends the light in the wrong direction, where the observer cannot see it. *Shipley, 1936.*

outline of a properly cut diamond compared to a shallow or deep one. Ray-tracing was added to show why some proportions failed (Fig. 5-12).

Shipley also reinforced the concept of avoiding spreading a stone to save more weight:

> ESPECIALLY IN AMERICAN CUTS, the attempt is sometimes made to secure a greater "spread" by reducing the proportion of the finished stone above the girdle ... the solid lines indicate the proportions used to secure maximum "spread" and the dotted lines show the correct proportions for maximum brilliancy. If the crowns were made the correct proportions, the girdles would necessarily be lowered and the "spread" would be less.[220]

The preponderance of poorly cut diamonds led many retailers to compare them to diamonds from European sources, and to conclude

[220] Shipley, 1939b

that the American Cut was a poorer quality of make. GIA addressed the growing perception in its coursework:

> THERE HAS BEEN MUCH DISCUSSION among the American retailers that the American cutting is much inferior, but this, I believe, is due to a misunderstanding. Many persons selling diamonds which have been "swindled" in the cutting of their crowns represent them to the retailer as being American cut. In fact, so many have been thus represented that many retailers believe "American cut" means only 1/5th, 1/6th, or even 1/8th of its depth is above the girdle. An American cut stone, cut with the proper proportions, i.e. those shown in the accompanying section, can scarcely be criticized. The reason that the proportion above the girdle is probably to get more weight from the rough stone. ... The term "swindled" is used to refer to the reducing of this proportion above the girdle, and the term has apparently been imported from Europe.[221]

A large part of the diamond cutting industry was ignoring the proportions advocated by GIA and AGS. Some may ask, "Was anyone cutting the American Cut diamond?"

Shipley and GIA's Approach to Cutting Styles of the Day

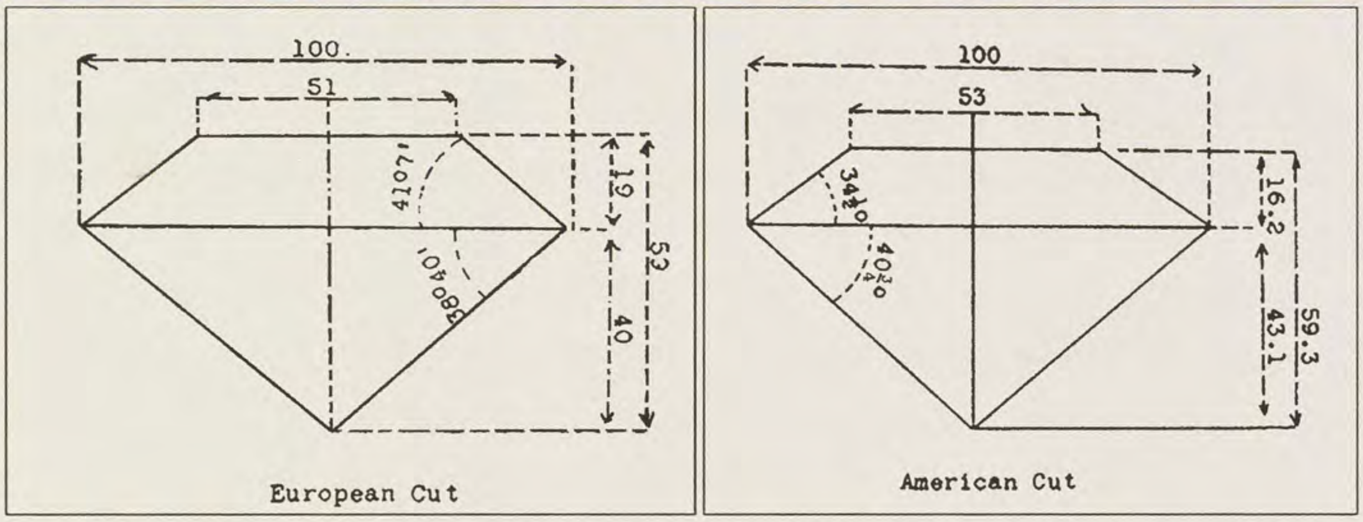
Shipley returned to the United States after studying gemology in Europe in the late 1920s with a new zeal for diamond make. He punctuated his GIA courses with material about diamond cutting proportions and theory. There had been much debate about diamond cut in the time between Tolkowsky's publication of *Diamond Design* in 1919 and the establishment of GIA in 1931.

How much of the debate Shipley was exposed to, and what he knew about the various theories being proposed, can only be gleaned from his publications. Some of the early course materials archived at the Richard T. Liddicoat Gemological Library and Information Center are difficult to date. Most carry copyright dates, but Shipley changed individual pages in the curriculum as he modified his lectures.

The Institute does not have any course materials known with absolute certainty to be Shipley's initial work. The earliest that seems to be intact (and probably is the first edition) has a front page that states it is "#24 of a set of 500" and "prepared exclusively for

[221] Shipley, 1939a

European vs. American Cuts in 1931 GIA Course Materials



Summary of the proportion differences in Shipley's 1931 course materials	European Cut	American Cut
Width of table	51.0%	53.0%
Total depth, table to culet	59.0%	59.3%
Depth from table to girdle	19.0%	16.2%
Depth from girdle to culet	40.0%	43.1%
Angle of bezel facets to girdle	41.0° 7'	34.5°
Angle of pavilion facets to girdle	38.0° 40'	40.75°

Fig. 5-13: *The Gemmologist*[222] reported that crown angles of 42 degrees were associated with European and London cutting (above), which is almost the same as pointed out in Shipley's course material. The perception that this was European was reinforced by the works of A. Johnsen and Dr. S. von Rösch, both of Germany.[xiii] Note that the smaller table is associated with European styles. *Shipley, 1931.*

Frank P. M. Palumbo;" the copyright date is 1931. Subsequent editions contain more detail and discussions.

The key element that makes the original 1931 coursework unique is that it is solely Shipley's work. Shipley asked a number of experts around the country to evaluate later coursework. Quite a bit of correspondence passed back and forth among members of GIA's "Committee of 100 World Gem Authorities."[223] It was probably the consensus of these authorities that helped Shipley evolve his later thinking regarding the American Cut and the Ideal Cut.

The earliest GIA course materials[224] simply divided cutting styles into two types: European and American (Fig. 5-13). The

[222] "Diamond Cutting and Polishing," 1935
[223] Shuster, 2003
[224] Shipley, 1931

differences between the two styles were described as follows in the 1931 courses:

> EUROPEAN CUT—With the measurement of the width, i.e. the spread of the girdle represented by 100 the proportions of the ideal European cut is shown. ... (From Bauer's *Edelsteinkunde*, 1931). These proportions actually return to an observer, directly in front of the stone, a maximum number of the rays which enter vertically from the front. The height of the crown also makes a much more pleasing shape when used in most jewelry, than a thin crown.[xiv]

> AMERICAN CUT—The proportions for the ideal American cut brilliant, while a matter of much discussion, was [*sic*] perhaps established by Tolkowsky in his "Diamond Design," published in 1919. ... The measurements of both styles are of course more or less flexible but too much variation will affect the beauty and value of a stone.[225]

Although Shipley condensed the various ideas on diamond cut into two camps—European and American—Tolkowsky's Antwerp cutting house was cutting to proportions Shipley called "American."

Round Brilliants in the 1920s and 1930s

	Johnsen, 1926	von Rösch, 1926	Eppler, 1931	Eppler, 1939
Pavilion angle	38.7°	38.7°	38.0°	40.8°
Crown angle	41.1°	42.0°	41.1°	33.2°
Crown height	19.2%	19.0%	19.0%	14.4%
Pavilion depth	40.0%	40.0%	40.0%	43.2%
Table size	46.1%	56.0%	56.6%	56.0%
	Bauer calls it "Ideal" in 1931		Eppler calls it "Ideal" in 1931	Eppler calls it "Practical" in 1939

Fig. 5-14: Several German mineralogists and gemologists suggested various sets of angles for diamonds in the mid-1920s through the 1930s, calling them "ideal." Those sets of angles were quite different from what Morse, Wade, Whitlock and Tolkowsky advocated. Because of these German proportion sets, U.S. jewelers tended to associate European sources with larger tables than Americans preferred[xv] until the 1990s.[226] The 2001 edition of a well-known European guide to diamond grading, *Diamond Grading* ABC by Verena Pagel-Theisen, still refers to those early German round brilliant proportions with the classification "ideal brilliant."[227] Today, European and American preferences are almost alike; most prefer a 56-57 percent table size.

[225] Shipley, 1931
[226] Ward, 1975; "Upfront; The Diamond Cut War," 1975
[227] Pagel-Theisen, 1990, 1993, 2001

Fig. 5-15: Johnsen's Brilliantoscope. A diamond was placed in each of the two globes and their patterns were compared to determine which was better. *Bauer, 1932, Table 14, figure 161.*

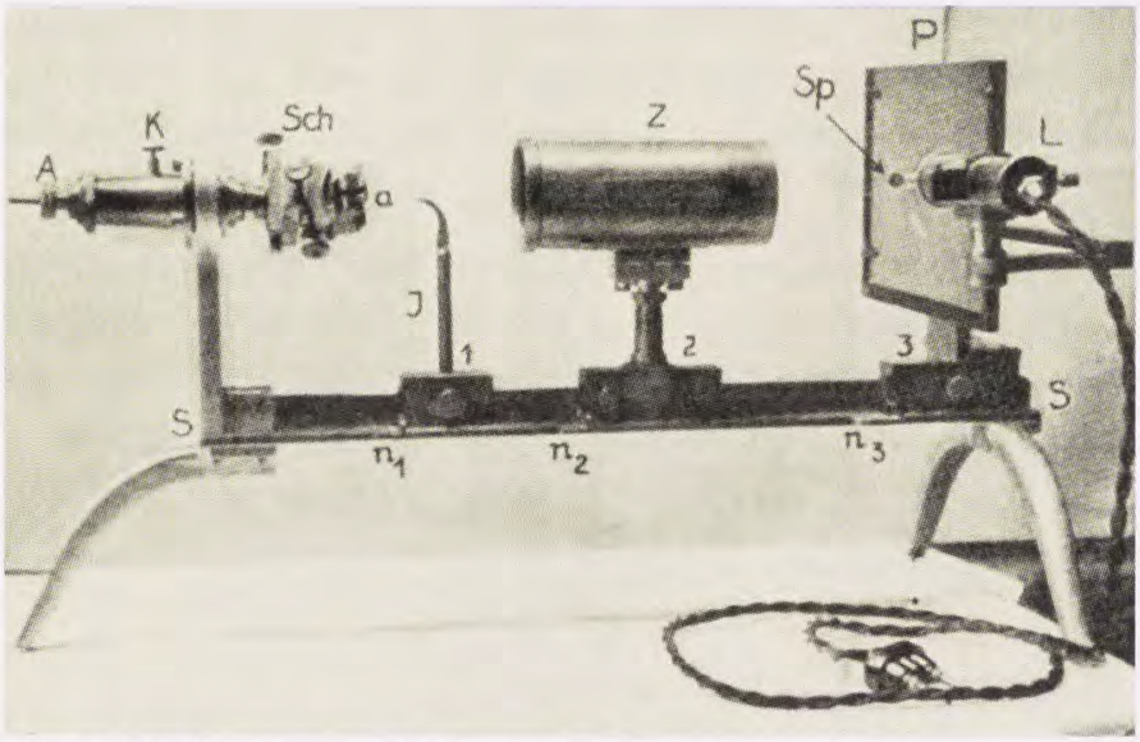


Fig. 5-16: German gemologists used this device from the 1920s, the Reflectograph, to validate their concept of "ideal" proportions. *Eppler, 1933.*

The European proportions came from several German mineralogists and gemologists who independently arrived at similar proportions, called "ideal" in Europe (Fig. 5-14).

One German mineralogist, A. Johnsen, had done his own ray-tracing calculations by 1926 and determined the proportions for "maximum brilliance." He developed a Brilliantoscope to back his findings[xvi] (Fig. 5-15).

Johnsen was soon followed by von Rösch, a German gemologist who calculated the proportions for the round brilliant. He developed the Reflectograph for his research (Fig. 5-16).[xvii] Max Bauer, a professor of mineralogy at Marburg University in Germany and a well-recognized author after the 1896 publication of his *Edelsteinkunde* (*Precious Stones*), also adopted these angles as the "ideal brilliant" in his updated 1932 book.[228]

Dr. W. Fr. Eppler, another German gemologist, used ray-tracing and cited the research of von Rösch and Johnsen in 1931 to determine the proportions of his "ideal brilliant"(Fig. 5-14). The German gemological community embraced the steeper crown angles Shipley referred to as "European."

[228] Bauer, 1932

Eppler abandoned his use of the term "ideal" and the angles he had associated with it in 1939, proposing new proportions he called "practical fine cut." The proportions he calculated for this new set were near the range of what Americans knew as the American Cut.

Shipley might not have read the publications by Johnsen and von Rösch,[xviii] but he was aware that the noted gem authority Bauer labeled their proportion sets as ideal, and he cited Bauer in his original course material.[229]

He amended the GIA coursework in 1939 to read:

> THE AMERICAN CUT BRILLIANT, which is the most efficient form of diamond cutting so far devised, has been accredited to Henry Morse, a diamond cutter of Boston. Tolkowsky remarks that this style is a logical development of the attempts to produce a brilliant with a perfectly circular girdle. However, not every brilliant possessing a circular girdle is as efficient as the American cut.[230]

The course went on to state that "Tolkowsky worked out mathematically ... the proper proportions for maximum brilliancy and dispersion from a brilliant. His mathematical results correspond almost exactly with the proportions of the so-called American-cut, which had previously been developed by experiment."

Shipley also changed his opinion of the European cutting style:

> THE FORM OF BRILLIANT FAMILIARLY known as the "European Cut" has proportions rather different from those of the American Cut. Several German scientists have formulated proofs that the European cut is perfectly efficient; however, these proofs take into consideration only the light falling upon the crown from a direction perpendicular to the table of the cut stone ... it is necessary to consider—as Tolkowsky has—light falling upon the crown from *all* directions.

Shipley concluded that the "European cut is somewhat too heavy above the girdle for maximum brilliancy and dispersion." In its post-1931 course material, and up until 2000, GIA ignored the fact that their term "European Cut" represented only the proportions associated with German scientists. It also ignored the many other cutting styles coming from Europe, including ones remarkably similar to the American Cut.

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[229] Shipley, 1931
[230] Shipley, 1939b

Early Evolution of GIA Course Material on Cut

The treatment of cut in GIA's course material evolved in other ways as well. Shipley added a section titled "The Stages in the Development of the Brilliant" in 1939. He also pointed out how close Wade's proportions were to Tolkowsky's. He showed Whitlock's ray-tracing diagram for the ideal rose cut in later versions, and compared Whitlock's and Eppler's calculations for various "maximum brilliancy and dispersion" proportions for colored stones.[231]

Some things were taken out of Shipley's course material. The term "perfect," for example, which he used in the first courses, disappeared almost immediately. He was writing about the term's misuse by 1936,[xix] and the American Gem Society banned it from use by members in 1937.[232] The Federal Trade Commission (FTC) declared use of the term an unfair trade practice in 1938.[233]

GIA course content was not always consistent. By relegating cutting styles into two camps—European and American—GIA had to fit diamonds that were of different proportions into its own definitions. Some references to Wade, Whitlock and 40 percent table size were dropped in 1939 course materials, and a section that describes "old style European cuts" incorrectly pointed out that these poorly proportioned diamonds had crown angles about the same as the modern style (34 degrees), but "the table, instead of being from 51 to 56% of the girdle diameter in width, was only about 40%."[234]

The course material also omitted conflicting references to American cut diamonds with 40 percent tables and ignored the possibility that they might not be European in origin. Tillander later indicated that such small tables only came from American cutters.[235]

GIA produced separate course materials designed for the AGS by the late 1940s. Material from both organizations described how to check the "fashioning" of a diamond by using several instruments: the "bezel gauge,"[xx] a Leveridge gauge, a Moe gauge, a graticule (or eyepiece micrometer) and a micrometer, many of which could be used in conjunction with a microscope.[xxi] GIA would introduce the Proportionscope (see Fig. 6-14, page 161) a few years later.

By 1953, GIA course material reached a point where the various parameters for the American Cut were standardized, and deviations from that standard could be evaluated.

[231] Shipley, 1949d
[232] "Diamond Terminology Recommended," 1937; Shuster, 2003
[233] "New FTC Jewelry Trade Rules," 1938
[234] Shipley, 1949b
[235] Tillander, 1995

Terms for the American Cut Evolve

The industry was ready for a term to define the most favorable set of proportions for the best diamond appearance. The term "perfect" disappeared when the FTC labeled it an unfair trade practice in 1938, and "scientific cut" fell away because it represented early American Cut proportions no longer in use.

The term "ideal," already in use by authorities like Wade,[xxii] was the obvious choice; it helped elevate what Americans saw as their own set of cut proportions—an American set—to a new level. GIA accepted the popularization of the term and included it in its course-work. Americans were proud of their ingenuity, so the term American Cut would also continue to be used.

GIA used these two terms interchangeably for many years and was hailed by the American trade press for making great strides to educate the industry. Since traditional educational leaders (such as Wade) also embraced them, the terms came of age.

The timing was perfect. Outside forces would create an increased demand for diamonds and, ultimately, the need for more information about them.

Notes

[i] A few cutters had gone to America during the war and then returned to Antwerp. Some may have paid attention to what the Americans were discussing in their trade press.

[ii] Tolkowsky received his bachelor of science in engineering in 1917 and his doctorate in engineering in 1920 from the University of London.

[iii] There is a common misconception that Tolkowsky's book *Diamond Design* was a doctoral thesis. The University of London confirmed that Tolkowsky did not submit a thesis on diamond design, but he did write a "Thesis Accepted for the Degree of Doctor in Science (Engineering)" titled *Research on the Abrading, Grinding or Polishing of Diamond.*

[iv] None of the grading systems that claimed to be based on Tolkowsky's work accepted tables as small as 47 percent except when they were placed in the lowest possible grade (until 2005, when AGS added this range to their top grade).

[v] Tolkowsky also considered these diamonds "well-cut." "The results of the calculations for the form of brilliant now in use were verified by actual mensuration from well-cut brilliants. The measures of these brilliants are given at the end of the volume both in a tabulated and in a graphical form" (Tolkowsky, 1919).

[vi] "What makes the agreement of these results even more remarkable is that in the manufacture of the diamond the polishers do not measure the angles, etc., by any instrument, but judge of their values entirely by the eye. And such is the skill they develop, that if the angles of two pavilions of a brilliant be measured, the difference between them will be inappreciable" (Tolkowsky, 1919).

This stands in contrast to the factory that was set up in Brighton, England, and operating at the time Tolkowsky wrote his book. In the Brighton factory, "[T]he preliminary setting out of the stones, gauges are used to get the angles on the top and bottom correct, but in finishing no gauge is used" ("A Phenomenal Success," 1920).

[vii] "If the departure from the ideal shape is not too pronounced this economizing of the material is probably justifiable in most cases. Take for example the case of a piece of rough which is not suitable to be sawed but must be 'made up' into a single stone and let us suppose that it will make a .95 carat stone if made absolutely right. In such case it is undoubtedly better business to make it to a 'four grainer' i.e. to a full carat, rather than to bring it under that desirable weight by giving it finer cutting. Again, take the case of a rather flat piece of rough that should be cut to a 45 point stone to be made right but that will return a full half carat if cut a bit overspread" (Wade, 1927).

[viii] "Mr. Wade gave a chalk talk, using the blackboard, on the simple physics of the diamond brilliant [and] gave a brief account of the mathematical calculations of Tolkowsky" ("A Talk on Diamonds," 1929).

[ix] For example, "The ideal brilliant should have a 'back angle' of $40\frac{3}{4}$ degrees, a 'top angle' of $35\frac{1}{2}$ degrees, the 'table' should be 54 per cent of the diameter, the part above the girdle should be a bit more than one-fourth of the thickness and the part back of the girdle a bit less than three-quarters. The top 'half' facets should be of about 42 degrees, the back 'half' facets 2 degrees steeper than the 'pavilions' and finally the 'star' facets should be about 15 degrees to the horizontal" ("A Talk on Diamonds," 1929).

[x] "Use of the term 'perfect' in describing diamonds should therefore be very carefully guarded. If it is used at all, jewelers should live conscientiously up to the definition of 'perfect' made by the National Jewelers' Board of Trade. So badly has the expression been abused, however, by unscrupulous and irregular dealers that the best practice probably lies in avoiding it altogether" (Wade, 1930).

[xi] In 1923, for instance, Shipley was president of the Kansas State Convention for the American National Retail Jewelers' Association and a second vice president of the American National Retail Jewelers' Association (*Yearbook of the American National Retail Jewelers' Association*, 1923).

[xii] The main reason Shipley's business faltered was that he was over-extended, in debt and burned out. These instances where he lacked gemological knowledge only added to the mounting burden, and later spurred him to educate the trade (Shuster, 2003).

[xiii] "According to Wade, the angle of the bezel of a well-cut brilliant should be 35° with the girdle and of the pavilion slightly over 41°. The London style of cutting gets nearer to 42° for each" ("Diamond Cutting and Polishing," 1935). Many cutting factories were using their own proportions, depending upon their markets; therefore, categorizing cutting style by regions, according to proportions, is not always accurate.

[xiv] Although Tolkowsky's works refer to the maximum number of rays returned to the viewer, and state that this must yield a maximum brilliancy in some fashion, Bruce Harding later pointed out, "Rays which are reflected to the viewer's eye must come from directions which missed his head ... at a viewing distance of one foot, as when examining a stone prior to purchase, the angle (or divergence) between incident and reflected directions of the same ray must be at least 10°; otherwise the viewer will see reflections of himself" (Harding, 1975).

[xv] This association may have come from the time when American cutting meant 40 to 50 percent tables (53 percent tables after Tolkowsky); though Americans associated larger table sizes with Europe, they were only 56 percent when measured. Yet Europeans had a perception that larger tables were better.

This was probably based on European thoughts about light return: "According to a German study performed in 1949, if you view the same two diamonds from, say, a 45° angle, the difference is enormous. From that angle, the diamond with the 57% table is still reflecting out at least half the light that went in. The diamond with the 53% table is only reflecting about 10% of the light that went into the stone" (Ward, 1975).

[xvi] "The value of a stone depends almost entirely upon its brilliancy and colour disperment [*sic*], which in turn depend to a great extent upon the correctness of the cut and the kind of cut applied to the jewel. ... The Brilliantoscope consists of a metalhousing [*sic*] on 4 legs, with two vertical extensions rising from the top of the housing and bearing on their upper ends globular cups of ground milkglass with a ground glass covering unto which the jewel is placed. Incandescent lamps in the interior send their lightrays ... into the jewels which again reflect these rays to the surface of the glass-globes. ... Two or more diamonds can be compared with each other ... and the Quality of Diamonds judged and classified as to their quality of light dispersion as well as the quality of their cutting. It is the best jewelery Salesman possible" (Michel, 1929).

[xvii] A Reflectograph was a device that used photographic film to capture a pattern of light from a diamond using a single small light source perpendicular to the table (Eppler, 1933).

[xviii] Shipley was studying in Europe immediately after their work was published, so he may have seen discussions prior to Bauer's 1931 compilation.

[xix] "It is apparent that the greater amount of advertising of 'perfect cut diamonds' is done through ignorance. An unscrupulous merchant, perhaps thinking to confuse the public by offering 'perfect cut' instead of perfect diamonds, unwittingly often commits a flagrant misrepresentation because perfect cuts are probably even rarer than diamonds free from internal imperfections" (Shipley, 1936).

[xx] The bezel gauge is probably a form of what Wade had suggested. GIA's sister organization, AGS, had introduced the "AGS angle gauge" (Vedder, 1942), which was probably some form of the bezel gauge mentioned by Shipley.

[xxi] "Unless a diamond approaches fairly closely to the proportions listed ... the stone will lack the maximum brilliancy and dispersion of which it is

capable and therefore will be of less value than a correctly fashioned gem. The correctness of cutting can be checked by several methods. ... The use of the bezel gauge for checking the angle between the table and the bezel facets is explained in this same assignment. ... The size of the table and the thickness of the stone above and below the girdle can be measured by a number of different instruments, but the only measurements which can be made accurately by means of measuring devices in the possession of the average jeweler are the girdle diameter and the thickness of the stone from table to culet. These measurements may be made by the Moe gauge, which is definitely not an accurate instrument, by one of the two forms of Leveridge gauge—a more accurate instrument than the Moe gauge, or by a millimeter screw micrometer, such as the one by the Starrett Tool Company which gives readings accurate to within 1/100 of a mm—the absolute accuracy depending more upon the user than upon the instrument itself. ... The measurements of the width of the table, the distances from table to girdle and from girdle to culet cannot be measured with absolute accuracy by any other means than some optical device, since a mechanical measuring device depends for its accuracy upon fitting its jaws on either side of the object to be measured. A variation of the method of optical measuring which has been applied with some success by jewelers is the use of the Diamondscope or Detector in conjunction with an accurate mechanical measuring device, such as a screw micrometer. ... Another optical measuring device of value is the eyepiece micrometer which is inserted in one of the oculars (eyepieces) of the Diamondscope. This is a fixed scale, which by means of the optical system of the instrument, is seen superimposed on the stone in focus" (Shipley, 1939a).

[xxii] Frank Wade was also part of GIA's "Committee of 100 World Gem Authorities" (Schuster, 2003) and a member of GIA's Advisory Board (Gravender, 1933) (see Fig. 4-14, page 98).

"IF IDEAL PROPORTIONS ARE UNOBTAINABLE, THOSE WHICH CLOSELY APPROACH SUCH PROPORTIONS OFFER A REASONABLY NON-COMPETITIVE ITEM TO SELL TO MORE DISCRIMINATING CUSTOMERS. BUT SPREAD STONES ARE ALSO NECESSARY IN AN ATTEMPT TO MEET PRICE COMPETITION."[236]

***Gems & Gemology*, 1939**

Chapter 6

Putting It All Together

Many jewelry stores in the 1930s and '40s operated differently from what's common today. They frequently offered a variety of products and services—from household appliances and electric shavers to optical supplies and floral decor. Shipley's 1920s store had an interior design department. Diamonds were often just a small part of the inventory, even in the stores that did focus mainly on jewelry.

The focus began to shift, however, at about the same time the evolution of the American Cut diamond was nearly complete. The attractive, sparkling diamond, along with dynamic marketing initiatives, created more demand for them in America. This put pressure on jewelers to become more knowledgeable about diamonds and to look for ways to set themselves apart from their competitors. They also needed to get better at selling diamonds.

As GIA's influence grew, jewelers across the country started to realize the importance of cut quality. Its relationship to the value of a diamond, and the role of carat weight, color and clarity, was still a mystery, though. Jewelers didn't know how to explain how each of

[236] "Demand for Ideal Proportions in Diamond," 1939

these factors influenced the price. They needed standards and a common language to talk about diamonds, including how to explain the importance of cut.

An advertising blitz by the largest diamond conglomerate in the world pushed the issue to a head.

Recovery from the War and De Beers' Influence

Demand for diamonds fell in America and Europe during the Depression.[237] As demand for diamonds fell, so did prices.

World War II ushered in a new set of obstacles, especially for the diamond giant De Beers, whose stockpile of rough diamonds had begun to accumulate with only the United States as a viable market.

Anti-monopoly laws prohibited De Beers from conducting business in the U.S., so the firm hired N. W. Ayer & Son in 1938 to help promote diamonds in the American market.[238] The company believed that if it could stimulate consumer demand for diamonds, manufacturers that supplied the wartime American market would turn to De Beers for rough.

N. W. Ayer & Son, one of the first advertising agencies in America, was already famous for a number of slogans, including "When it rains it pours" for Morton Salt (1912) and "I'd walk a mile for a Camel" for R. J. Reynolds Tobacco (1921).[239] De Beers counted on the agency to create an equally successful national advertising campaign for diamonds.

Several consumer perceptions posed a challenge to the advertising firm. Americans, if they could afford them at all, felt guilty buying expensive items during the war. They also thought diamonds were needed in machines and tools for the war effort and felt it would be unpatriotic to use them in something as frivolous as jewelry.

So N. W. Ayer & Son developed a patriotic theme to alleviate those concerns in their wartime American ads. Titles included: "Diamonds and the Call to Arms," "Fighting Diamonds" and "Diamonds Go to the Front."[240] The advertisements (Fig. 6-1) stressed that women were "helping pay for the great quantity of industrial diamonds needed"[241] by buying and wearing diamond jewelry.

[237] Epstein, 1982
[238] Ibid.
[239] "Top 100 Advertising Campaigns," 2007
[240] Roberts, 2003
[241] De Beers, 1943

Fig. 6-1: De Beers advertising urged Americans to buy diamonds to help the war effort. *De Beers, 1943a ©1943 De Beers Consolidated Mines LTD.*

The ads also tapped into the romantic yearnings of the times: "How far its beam. A little light, so constant and so sweetly clear it finds his heart across the widest waters and hours of loneliness. That is the diamond on her finger—an ever-fixed beacon, pledge to safe home-comings and fair rewards in their new-day life to be."[242]

[242] De Beers, 1943b

Fig. 6-2: N. W. Ayer & Son sponsored bridal shows that promoted the image of a serviceman in uniform with his bride. *"Diamonds: 'With Discretion' is Rule for Brides," ©JCK, 1943.*

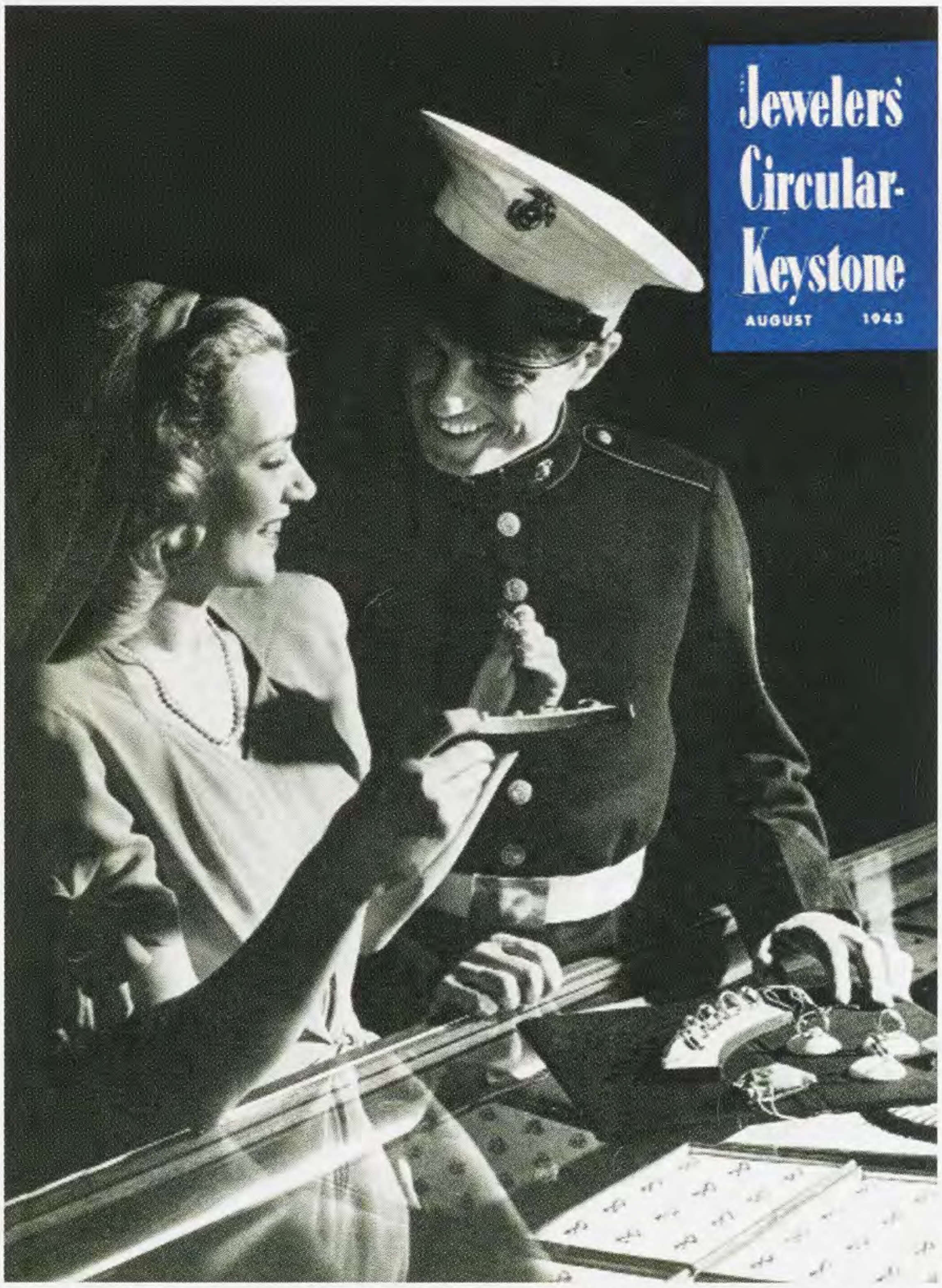

Fig. 6-3: N. W. Ayer & Son placed photos in jewelry and fashion industry magazines that depicted brides and servicemen picking out engagement rings. *The Jewelers' Circular-Keystone, 1943.*

N. W. Ayer & Son was not shy about trying to sway U.S. servicemen to give diamond engagement rings as a symbol of commitment before they were sent overseas. "[So] brief the hours you spent together. How can you know she understands ... the things you will be able to say only when years once more grow long and tranquil? The steadfast flame of your diamond engagement ring brings deep assurance."[243]

[243]De Beers, 1944

Fig. 6-4: Society page editors, movie stars, politicians and their wives were invited to N. W. Ayer & Son-sponsored fashion shows in the 1940s and 1950s. *"Diamonds U.S.A.," 1949; "Diamonds U.S.A., 1952," 1951. Both ©JCK.*

The ad agency also sponsored war-themed fashion shows. "Bugle calls and martial music" accompanied couples as they walked down runways, with grooms in uniform (Figs. 6-2 and 6-3) and brides dressed for "furlough or formal ceremonies."[244] These themes caught on with some of the major retailers and, following its lead, Harry Winston put on a "luncheon style show" in the Cotillion Room of the Hotel Pierre in New York titled, "Diamonds for Furlough Festivities" in late 1944.[245]

N. W. Ayer & Son did its best to saturate the market by addressing future brides in high school assemblies across the country, "spreading the message that a girl was not truly engaged until she wears a diamond."[246]

The company took advantage of all the high-profile connections it could, including those in the movie industry and society pages. It loaned De Beers-supplied diamond jewelry to celebrities including Mickey Rooney, Merle Oberon and Joan Bennet. It hosted fashion shows for society page editors[247] (Fig. 6-4) and threw engagement parties for actresses.

"We spread the word of diamonds worn by stars of screen and stage, by wives and daughters of political leaders, by any woman who can make the grocer's wife and the mechanic's sweetheart say 'I wish I had what she has,'" noted a 1948 strategy paper by the firm.[248]

[244] "Diamonds: 'With Discretion' is Rule for Brides," 1943
[245] "Diamonds Featured in Hotel Pierre Style Show," 1950
[246] Roberts, 2003
[247] Epstein, 1982
[248] Ibid.

N. W. Ayer & Son also convinced Paramount Pictures to place scenes of diamond engagement ring buying in movies, and helped magazines create cover stories about why the public needed diamonds and engagement rings.

It claimed to have placed 3,500 "diamond [related] movie stories" and 16,500 diamond news stories in the media over the first nine months of 1940. The list was a "who's who" of the publishing world, including: *Brides Magazine*, *Harper's Bazaar*, *Ladies' Home Journal*, *Life*, *The New Yorker*, *New York Evening News*, *Readers Digest*, *Saturday Evening Post*, *Time* and *Vogue*, as well as many teen magazines.[249]

De Beers and its advertising firm also created another campaign that connected the price a groom paid for a diamond engagement ring to the level of his love and commitment to his fiancée. The campaign initially claimed one month's salary would show true devotion. (Today, De Beers' advertising measures devotion as two months' salary.)

The effort to promote diamonds as a symbol of love reached new heights in 1948 when N. W. Ayer & Son launched the slogan "A Diamond is Forever," which remains De Beers' tagline to this day.

"A Diamond is Forever" played right into the economic boom that followed the war. The hunger to rebuild and restore all that had been destroyed went beyond Europe. Americans were also determined to overcome the poverty of the Great Depression and years of wartime sacrifice.

Determination and hope characterized the time as the "American Dream" came of age. Millions of post-war Americans had faith that if they worked hard enough, they could own a house and create a comfortable, middle-class lifestyle.

Other symbols of prosperity defined the new middle-class success: new cars, television and movies with stars like Marilyn Monroe, who exemplified the glitz of the era with her sexy rendition of "Diamonds Are a Girl's Best Friend" in the 1953 movie "Gentlemen Prefer Blondes."

The "A Diamond is Forever" campaign was so successful that 50 percent of young Americans got married with a diamond engagement ring by 1950; that number grew to 80 percent by 1960.

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[249] De Beers, 1941; Epstein, 1982; Roberts, 2003

Rising consumer awareness and the new symbolic images of diamonds created by De Beers made it more essential than ever for jewelers to take the mystery out of diamonds at the sales counter to sell them more effectively.

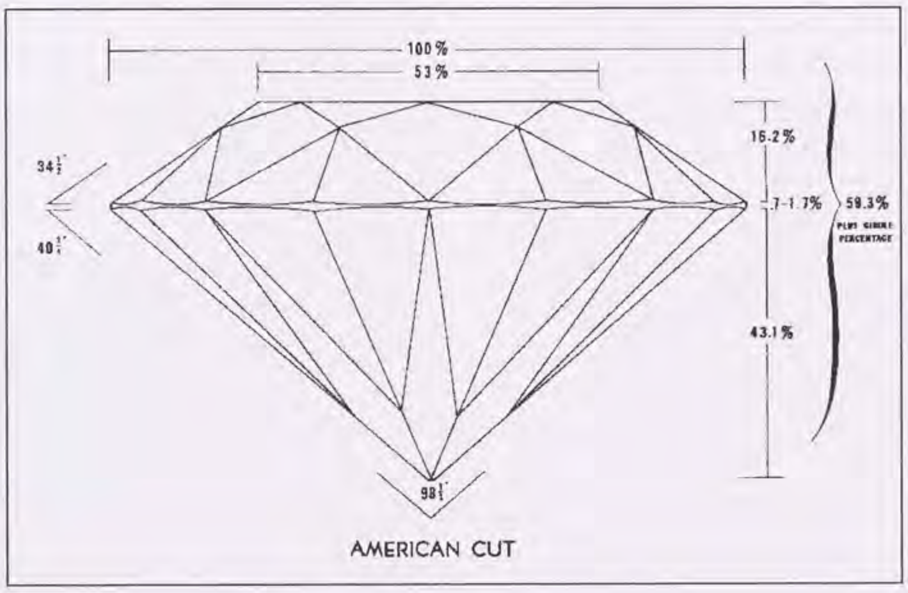
The Need for a Cut Grade Becomes Obvious

By the mid-1940s, experts gathered together by Shipley, including Wade; Dr. Cornelius S. Hurlbut Jr., of Harvard University; and Edward H. Kraus, of the University of Michigan, agreed that there was a certain set of proportions that should be used to cut a round diamond to make it the best, or ideal. This was unusual for the times; it was not common for multiple gemological experts to work on a single issue. Shipley brought them together to hash out the disagreements and reach a consensus.

As a result of Shipley's efforts, GIA had become the United States' predominate source of information on diamond cut during this time.[i] This gave Shipley the advantage of using the discussions with experts as the basis for his course work. He understood the topics and arguments and addressed them; as the discussions evolved, so did his course material.

Once the experts agreed on a standard for the American Cut, they turned their attention to evaluating diamonds for cut. Grading scales existed for color and clarity (although their specifics were not agreed upon), but not for cut. The experts agreed on the ideal, the American Cut (Fig. 6-5), but not on a scale for deviations from that ideal. Very few diamonds were cut with anything resembling the best proportions.

Fig. 6-5: Experts agreed that these proportions were called Ideal and American Cut in the 1940s:
Crown angle: 34.5°
Pavilion angle: 40.75°
Table size: 53%
From GIA and AGS course materials.



Some jewelry retailers and wholesalers used the color and clarity grading systems to try to establish consistent price lists; the jewelry industry had used price scales for variations in quality since Jeffries' time.[ii] Some equated cut quality, or a specific set of proportions, i.e., Scientific Cut, with price.

Although well-cut diamonds sold for more than others,[iii] there was no system that related price to cut quality, even though GIA was pushing for one.

Introduction of a Cut Grade: GIA Reaches Within

Shipley continued to pull together an impressive set of science, education and jewelry industry authorities to help GIA grow. He had two goals: "to create an educational institute and to develop a national guild of ethical, knowledgeable jewelers."[250] But he didn't want to simply preach from his position of authority; he thought jewelry industry members working together could bring about more internal change than he could alone.

He began to recruit members for what was to become the American Gem Society (AGS) in 1933 and encouraged critical industry leaders to get involved with trade issues. The first AGS Conclave[iv] was held in April of 1937. There, a group of leaders helped standardize diamond terms, banning the use of terms such as "perfect cut."[251]

M. E. Vedder, of Detroit-based Traub Manufacturing Co. (which was later called "Orange Blossom," a company whose main products were diamonds and wedding sets), was on the AGS Diamond Committee. Vedder was a very active participant in AGS and GIA for a number of years and was a member of the AGS International Committee,[v] the organization's governing body.

He was also a member of the GIA Research Service, one of the interim organizational committees the Institute formed as it quickly grew. He wrote an article in *Gems & Gemology*[252] that explained a system of diamond grading he devised[vi] and then introduced at one of the key education sessions[vii] at the 1942 AGS Conclave in Philadelphia.[viii] His system not only included color and perfection (clarity), but also incorporated cut evaluation and made reductions as the diamond's proportions departed from Tolkowsky's calculated ideal.

Vedder's article was not clear in several areas, however. His system deducted for a large culet, but he didn't explain how he evaluated culet size. He reviewed the importance of examining the girdle, and a number of negative factors that can be associated with it, but it's unclear how he decided that some of those factors affected the grade. Lastly, somehow "two 'D' factors count as three," although he does not explain what is meant by a "D" factor.

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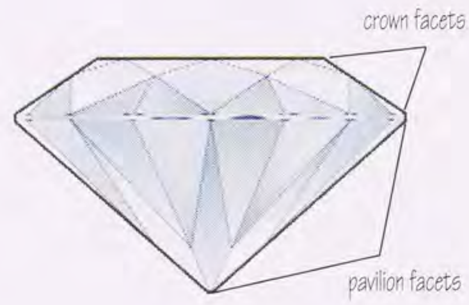
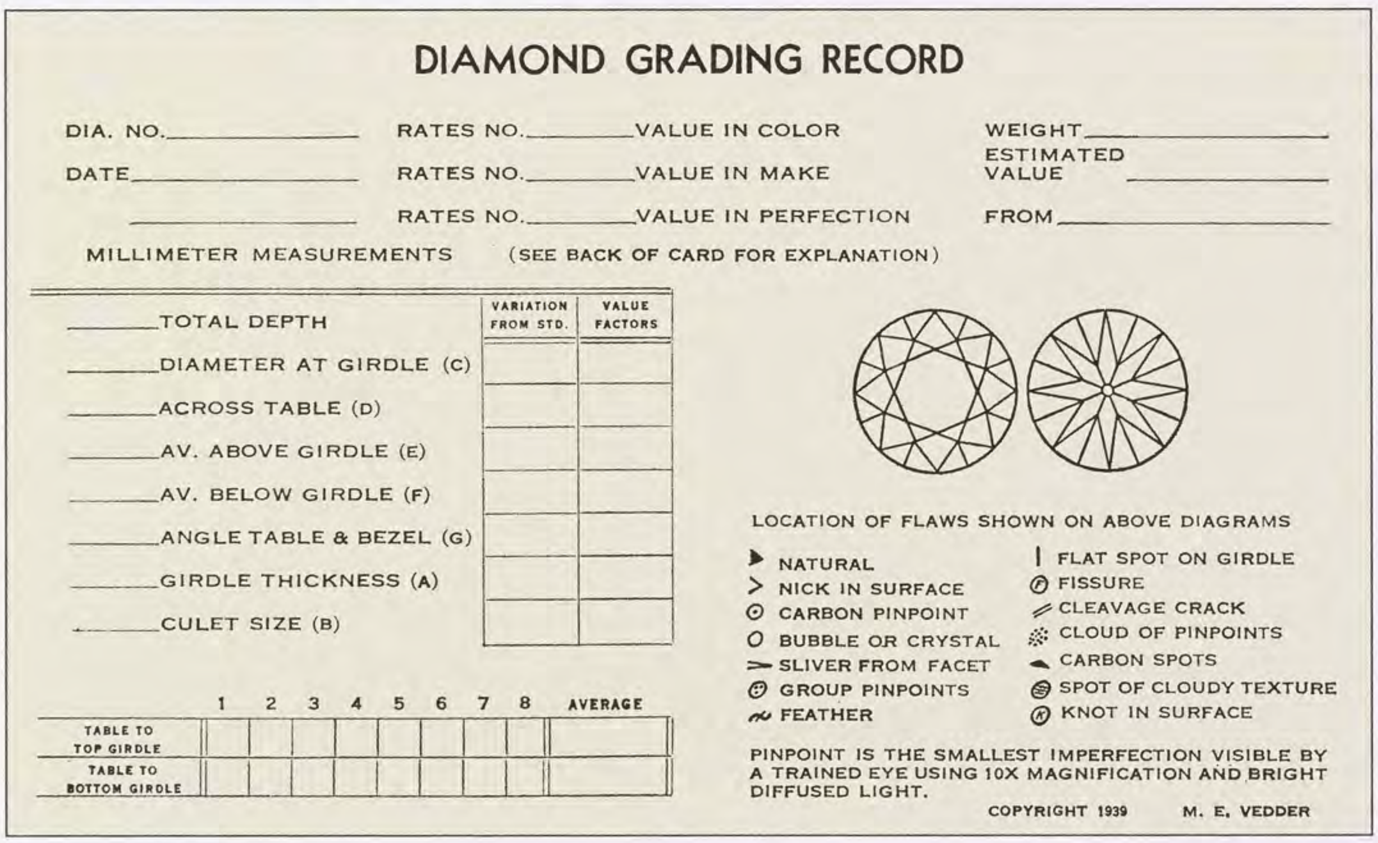
[250] Shuster, 2003
[251] "Diamond Terminology Recommended," 1937
[252] Vedder, 1942



It's also difficult to understand how Vedder measured diamonds, but he directs graders to take a number of significant measurements. For example, he takes measurements around the girdle for the depth of the diamond's crown and from the top of the stone to the furthest extent of the scallop at the girdle (on the crown side); and makes the same kind of measurement for the pavilion at each of the scallops. These measurements are averaged to get the above-the-girdle (crown height) and below-the-girdle (pavilion depth) values.

Some proportion information in Vedder's article seems unusually lenient by today's standards. One glaring example allows a reduction for cut quality for each 5 percent difference in table size (half a deduction for 2.5 percent) from 53 percent. Thus, if all other factors are within tolerance of Tolkowsky proportions, a diamond with a 73 percent table would earn a cut grade of 4 (out of 12), with 1 as the best grade. This would seem absurd to most jewelers or diamond cutters today; all cut grading systems place diamonds with tables that large in the lowest category.

Vedder also created individual grading cards (copyrighted in 1939) that showed a top and bottom diagram of a round brilliant's facet arrangement to plot the inclusions of the diamond being graded. The symbols he used were already in use by GIA and AGS as part of the course material designed by GIA (Fig. 6-6).[253]



DIAMOND GRADING RECORD

DIA. NO.______ RATES NO.______VALUE IN COLOR WEIGHT______

DATE______ RATES NO.______VALUE IN MAKE ESTIMATED VALUE ______

______ RATES NO.______VALUE IN PERFECTION FROM______

MILLIMETER MEASUREMENTS (SEE BACK OF CARD FOR EXPLANATION)

	VARIATION FROM STD.	VALUE FACTORS
______TOTAL DEPTH		
______DIAMETER AT GIRDLE (C)		
______ACROSS TABLE (D)		
______AV. ABOVE GIRDLE (E)		
______AV. BELOW GIRDLE (F)		
______ANGLE TABLE & BEZEL (G)		
______GIRDLE THICKNESS (A)		
______CULET SIZE (B)		

	1	2	3	4	5	6	7	8	AVERAGE
TABLE TO TOP GIRDLE									
TABLE TO BOTTOM GIRDLE									

LOCATION OF FLAWS SHOWN ON ABOVE DIAGRAMS

NATURAL
NICK IN SURFACE
CARBON PINPOINT
BUBBLE OR CRYSTAL
SLIVER FROM FACET
GROUP PINPOINTS
FEATHER
FLAT SPOT ON GIRDLE
FISSURE
CLEAVAGE CRACK
CLOUD OF PINPOINTS
CARBON SPOTS
SPOT OF CLOUDY TEXTURE
KNOT IN SURFACE

PINPOINT IS THE SMALLEST IMPERFECTION VISIBLE BY A TRAINED EYE USING 10X MAGNIFICATION AND BRIGHT DIFFUSED LIGHT.

COPYRIGHT 1939 M. E. VEDDER

Fig. 6-6: M. E. Vedder, a member of the GIA Research Service, pulled together a comprehensive cut, color and clarity grading system for diamonds. He used a system with "value reduction factors for make," based on Tolkowsky. *Gems & Gemology* published his diamond grading system in Spring of 1942. Note that he used clarity grading symbols that GIA was using by 1936, and that are similar to the ones used by GIA today. *Vedder, 1942.*

[253] American Gem Society, 1936

His system also pulled together what was soon called the Four Cs of diamond quality (cut, color, clarity and carat weight). He listed the grades for color, make (cut), perfection (clarity), carat weight and estimated value at the top front of each card. His 1942 article briefly went over how some features affect value, but not how to arrive at a final value for a diamond from this collection of information. For example, in regard to diamonds that don't have the crown aligned properly with the pavilion, he wrote: "Unfortunately they are being offered for sale at the same prices as fine make, and in my opinion are really worth from 20% to 30% less."[254]

Vedder provided some insight into the quality of cut available at that time. Most manufacturers' diamond inventories in 1942 were from America because World War II restricted the flow of diamonds from Europe.[255] Vedder was concerned about the proportions of diamonds he found. "The most confusing and difficult measurement for me is the table. It is not only hard to measure but is always too large anyway," he wrote. "Out of about 400 diamonds which I have measured only three have had nearly perfect proportions. These three all have tables from 4.5% to 7.5% too large."[256]

He did not find any of the smaller-tabled (40 to 50 percent) early American Cut diamonds being produced,[ix] further evidence that the large-tabled diamonds photographed for GIA courses were quite common.

For all that Wade and *Jewelers' Circular* had invested to educate them, jewelers were not selling American Cut diamonds; they were selling diamonds cut in America (not cut to any standards). Vedder's system was the earliest attempt to grade the cut quality and associate lower value with diamonds that deviated from Tolkowsky's proportions (which had become the standard for the American Cut through Wade's influence).

Vedder's method never gained much acceptance, but his evaluation of cut quality using deductions, though cumbersome, is an early forerunner of cut grading methods such as the one created a decade later by Richard T. Liddicoat, who succeeded Robert Shipley as president of GIA.

[254] Vedder, 1942
[255] McCarthy, 1942
[256] Vedder, 1942

GIA Creates the Four Cs

The four factors of a diamond's value were evident as early as the 1500s.[257] But it wasn't until the 1940s that these factors were called the "Four Cs." Robert M. Shipley, founder and executive director of GIA and AGS,[x] coined the phrase in GIA course materials as a mnemonic device to help students and jewelers learn and explain the factors that determine a diamond's value—color, clarity, carat weight and cut.

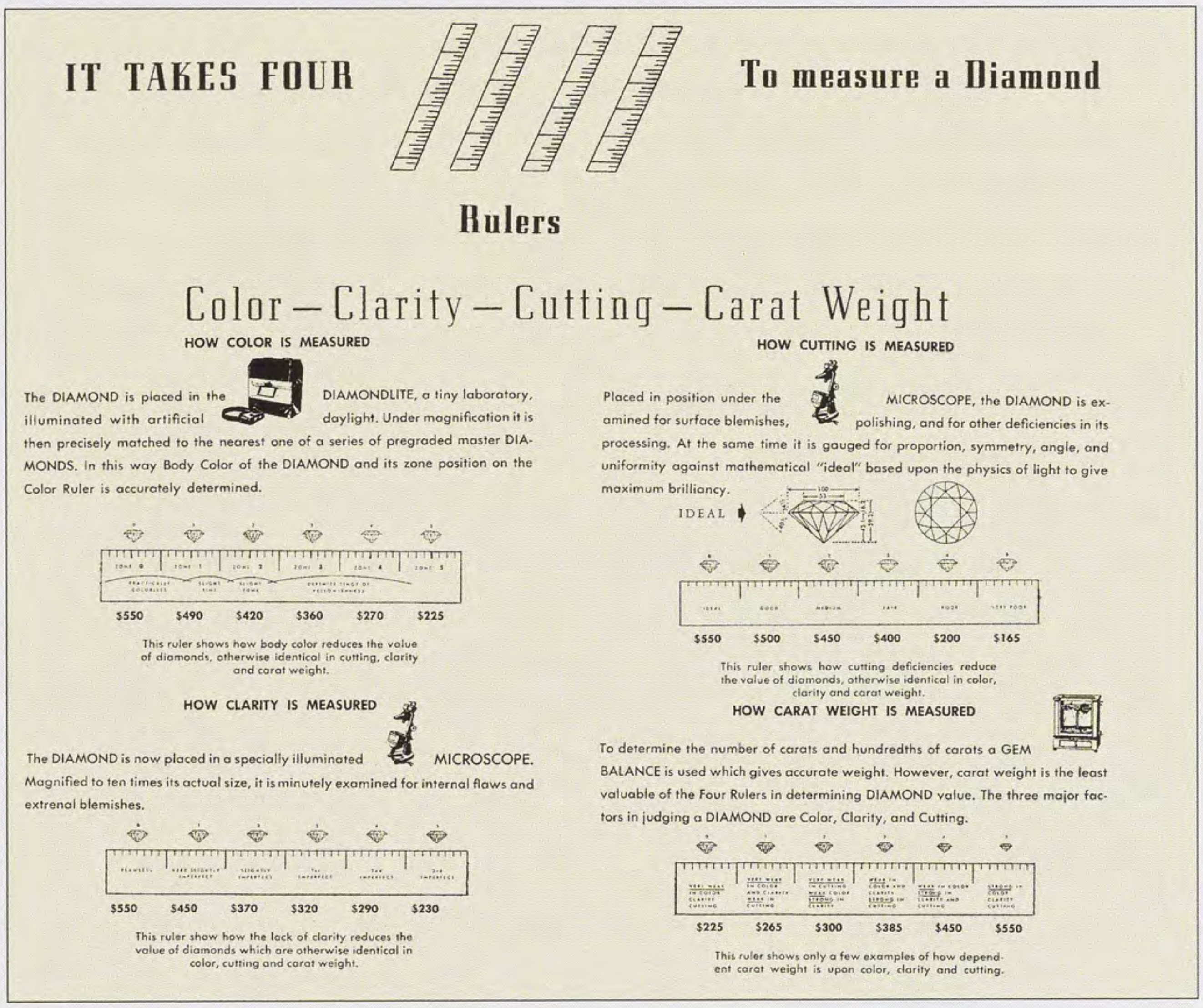
Under Shipley's direction, the Four Cs became part of industry vernacular through GIA course materials and the advertising GIA prepared for AGS-member retailers. Beginning in 1940, GIA collaborated with De Beers to create advertising specially designed to stimulate an interest in diamonds.[258] Later, Shipley arranged to have Gladys Babson-Hannaford, a lecturer for N. W. Ayer & Son (the U.S. advertising firm that represented De Beers), travel around the country to teach jewelers how to talk about the Four Cs to their customers. Her tour kicked off at the AGS Conclave in 1947.[259]

She described the fourth C as "the cut of the stone, or as they say in the trade, 'How well is it made?' If it is too shallow, too deep, a dealer will call it a 'fisheye' or say that it 'leaks' light, but if the faceting is properly done and the angles are right, the rays that enter the stone are imprisoned. They bounce around within the stone making it a very lively, beautiful thing."[260]

To sell diamonds, she told them, "Explain the price range of diamonds, explain the four factors determining the value of a diamond. We call them the four Cs."

It's not known when Shipley first began to teach the Four Cs at GIA because there are a few gaps in the dates or missing pages from his 1940s course materials. The earliest GIA course materials in the Richard T. Liddicoat Gemological Library and Information Center that mention the Four Cs are from 1949. The text reads, "These principal properties can be described as the writer [Shipley] first did in preparing advertising for AGS students as Color, Clarity, Cutting and Carat size—the Four Cs of Diamond Value."[261]

257 Arfe y Villafane, 1572
258 "AGS Sales Promotional Helps," 1939
259 "Conclave Action," 1947
260 "National Lecturer Advises Jewelers at Conclave," 1947
261 Shipley, 1949c


IT TAKES FOUR — To measure a Diamond

Rulers

Color – Clarity – Cutting – Carat Weight

HOW COLOR IS MEASURED

The DIAMOND is placed in the DIAMONDLITE, a tiny laboratory, illuminated with artificial daylight. Under magnification it is then precisely matched to the nearest one of a series of pregraded master DIAMONDS. In this way Body Color of the DIAMOND and its zone position on the Color Ruler is accurately determined.

$550 $490 $420 $360 $270 $225

This ruler shows how body color reduces the value of diamonds, otherwise identical in cutting, clarity and carat weight.

HOW CLARITY IS MEASURED

The DIAMOND is now placed in a specially illuminated MICROSCOPE. Magnified to ten times its actual size, it is minutely examined for internal flaws and extrenal blemishes.

$550 $450 $370 $320 $290 $230

This ruler show how the lack of clarity reduces the value of diamonds which are otherwise identical in color, cutting and carat weight.

HOW CUTTING IS MEASURED

Placed in position under the MICROSCOPE, the DIAMOND is examined for surface blemishes, polishing, and for other deficiencies in its processing. At the same time it is gauged for proportion, symmetry, angle, and uniformity against mathematical "ideal" based upon the physics of light to give maximum brilliancy.

IDEAL

$550 $500 $450 $400 $200 $165

This ruler shows how cutting deficiencies reduce the value of diamonds, otherwise identical in color, clarity and carat weight.

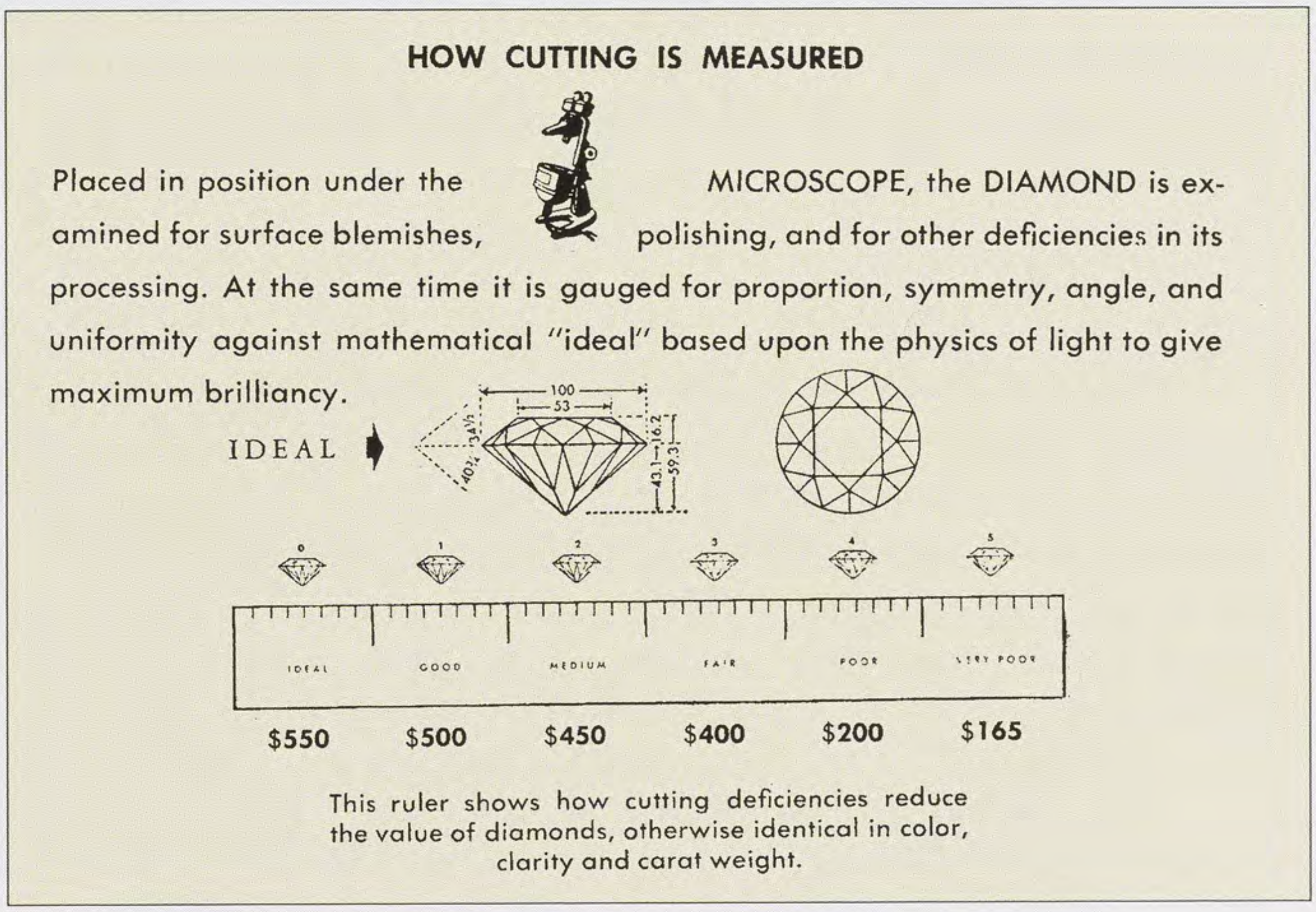
HOW CARAT WEIGHT IS MEASURED

To determine the number of carats and hundredths of carats a GEM BALANCE is used which gives accurate weight. However, carat weight is the least valuable of the Four Rulers in determining DIAMOND value. The three major factors in judging a DIAMOND are Color, Clarity, and Cutting.

$225 $265 $300 $385 $450 $550

This ruler shows only a few examples of how dependent carat weight is upon color, clarity and cutting.

Fig. 6-7: The original Four Cs from GIA's course material. *Shipley, 1949c.*


HOW CUTTING IS MEASURED

Placed in position under the MICROSCOPE, the DIAMOND is examined for surface blemishes, polishing, and for other deficiencies in its processing. At the same time it is gauged for proportion, symmetry, angle, and uniformity against mathematical "ideal" based upon the physics of light to give maximum brilliancy.

$550 $500 $450 $400 $200 $165

This ruler shows how cutting deficiencies reduce the value of diamonds, otherwise identical in color, clarity and carat weight.

Fig. 6-8: "American Cut" and "Ideal" were used interchangeably throughout GIA's courses in the 1940s and 1950s.

A GIA student helped produce the first chart used in GIA's course materials about the Four Cs, "explaining how diamonds can be compared in value by measuring them with these four rulers" (Figs. 6-7 and 6-8). The term also appeared in the AGS booklet *Diamonds*,[262] and continues to be part of GIA and AGS materials.[xi]

Trade magazines wrote about the success of various AGS jewelers' advertising, which used copy written by GIA and De Beers, and printed the AGS-sponsored ads depicting the Four Cs in the 1950s (Fig. 6-9).[263] AGS members used the ads, along with the AGS *Diamonds* booklet, to teach customers about the Four Cs.

N. W. Ayer & Son wrote "Secrets of the Diamond Expert" for *The Jewelers' Circular-Keystone* in 1954. It focused on the Four Cs and seems to have evolved from the talks given in 1947. It was meant as a "speech for jewelers to use to address consumer groups," according to a secondary headline in the article.[xii] De Beers started using the Four Cs at about the same time.[xiii] It also launched a national magazine advertising campaign using the Four Cs in August of 1962.[264]

Dona Mary Dirlam, director of the Richard T. Liddicoat Gemological Library and Information Center, interviewed Liddicoat about the Four Cs in 1980:[265]

> I REMEMBER TALKING to Mr. Liddicoat about his early years at GIA. When I asked him about where the term "the Four Cs" came from, he told me that Robert M. Shipley had developed it in connection with the four Cs of diamond value: color, cut, clarity and carat weight.

It's evident that Shipley's Four Cs helped emphasize the importance of cut quality to the beauty of a diamond. Despite GIA's educational efforts and the far-reaching ads for De Beers and AGS members, however, large portions of the jewelry industry continued to ignore the importance of cut.

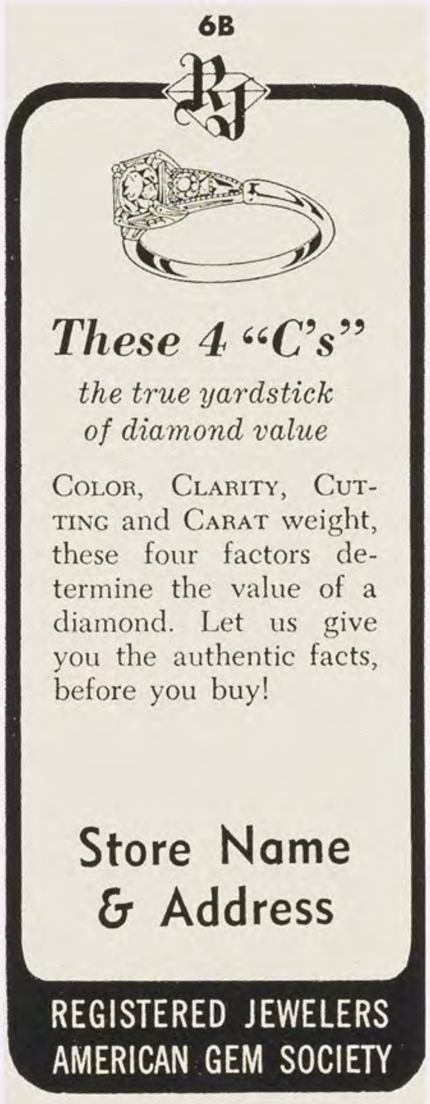


Fig. 6-9: *Guilds (Supplement), 1952.*

[262] American Gem Society, 1951
[263] "Keys to Public Confidence," 1953
[264] "A Diamond Tells of Love," 1962
[265] Dirlam, 2006, personal comments, director, Richard T. Liddicoat Gemological Library and Information Center

Liddicoat Establishes Cut Evaluation

The establishment of a GIA cut evaluation system was needed more than ever by the 1950s. Jewelers wanted more information so they would be seen as experts by the public and be able to sell more diamonds, but there was no common language in the industry. GIA needed to establish standard definitions and methods for grading diamonds in three distinct categories: color, clarity and cut.[266]

At the same time, GIA was facing a financial crisis. The post-World War II GI Bill, which brought a flood of new students,[xiv] would be discontinued after July 25, 1951. The Institute's leaders were worried about the loss of income from the thousands of soldiers who had become GIA students since the war ended. A comprehensive grading system had the potential to help the American jewelry industry and revive GIA's finances.

The seeds of the system were planted by Vedder and the GIA Research Service, but Vedder's system was awkward and impractical. The cut grading system needed to be user-friendly for it to be successful. There was also a need for standardized color grading nomenclature that was different from all other commercial systems in existence. Clarity grading needed firm standards, but its nomenclature was already in place. Cut grading was the biggest challenge.

Richard Liddicoat, Shipley's second in command and soon to be executive director of GIA in 1952, put together a small team and went to work. He introduced concepts of the system[267] and provided the first glimpse of a GIA Cut Grading System when he addressed the AGS Conclave in May 1952. Liddicoat only hinted at the nature of the system he would unveil the following year.

"How the proportions of brilliant cut diamonds may be determined by eye with a high degree of accuracy was explained, as well as the importance of proper proportions on beauty," the AGS magazine *Guilds* reported about the 1952 lecture. "The lecture was accompanied by many slides emphasizing judgment of make."[268]

Liddicoat, encouraged by the response of the AGS jewelers, finished his work. GIA conducted its first classes on the new system in early 1953.[269] "Significant progress has been made … [since] the time of the 1952 Conclave of the AGS,"[270] he proudly reported at the 1953 Conclave.

[266] Shuster, 2003
[267] "New Device Measures Diamond Proportions," 1954
[268] "Diamond Grading," 1952
[269] "GIA to Conduct First Class in Diamond Grading," 1953; "Diamond Class Repeated in May," 1953
[270] Liddicoat, 1953

CHART A
PERCENTAGE REDUCTION CHART
FOR DIAMOND PROPORTIONS

Step #1: Measure and record depth, diameter, table size and girdle thickness.
Step #2: Translate these into percentages.
Step #3: If the depth is between 63.0% and 62.6%, the deduction is..............5%

62.6	62.2	4
62.2	61.8	3
61.8	61.4	2
61.4	61.0	1
61.0	60.0	0
60.0	59.6	1
59.6	59.2	2
59.2	58.8	3
58.8	58.4	4
58.4	58.0	5
58.0	57.6	6
57.6	57.2	7
57.2	56.8	8
56.8	56.4	9
56.4	56.0	10
56.0	55.6	11
55.6	55.2	12
55.2	54.8	13
54.8	54.4	14
54.4	54.0	15
54.0	53.6	16
53.6	53.2	17
53.2	52.8	18

Step #4: If the crown angles approximate those of the "American cut" and the table is between.............52% and 55%, deduct nothing.
If the table is........56% to 57%, the deduction is............... 2%

58	59	3
60	61	4
62	63	5
64	65	6
66	67	7
68	69	8
70	71	9
72	73	10

(Note: If the crown angles are shallow, estimate what the table diameter would have been had the correct angles been used; then refer to the percentages above.)

Step #5: If girdle is thin to medium, deduct nothing.
If girdle is medium to thick, the % deduction is...............1% to 2%
If girdle is thick, the % deduction is.........................3 to 4
If girdle is very thick, the % deduction is....................5 to 6
(Note: On stones under 1/4 carat, extremely heavy girdles could warrant deductions up to 10%.)

Step #6: Finish. Deductions generally range from 0% to 5%.
Step #7: Total the percentages obtained under steps #3, #4, #5 and #6.
Step #8: Multiply the present weight of the stone by (100% less the percentage obtained in Step #7) to obtain the corrected weight. The corrected weight will be used in the final evaluation of the stone after it has been graded for color and imperfections.

Fig. 6-10: Chart A, from Liddicoat's system, shows how deductions were made from the original weight of the diamond based on certain proportions. *Liddicoat, 1955.*

CHART B

PERCENTAGE REDUCTION CHART FOR DIAMOND COLOR AND IMPERFECTION GRADES

COLOR →	D to F				G				H				I			
PURITY ↓	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
F	100%	100	100	100	94	95	97	98	89	91	93	94	83	86	87	90
VVS_1	91	91	91	94	86	87	87	89	80	82	82	85	74	78	78	82
VVS_2	82	82	82	86	78	79	81	83	73	75	77	79	69	71	73	76
VS_1	75	76	76	79	70	72	74	76	67	68	71	74	63	64	67	70
VS_2	67	68	68	75	64	64	67	69	61	61	64	67	58	59	60	63
SI_1	61	62	63	69	58	59	62	64	55	55	58	61	53	53	55	58
SI_2	55	56	58	63	53	54	56	58	50	51	54	57	48	48	51	54

COLOR →	J				K				L				M			
PURITY ↓	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
F	76	78	79	83	63	67	70	74	44	46	49	56	36	39	41	47
VVS_1	69	72	72	76	57	60	64	68	41	44	47	54	33	36	41	45
VVS_2	62	64	65	69	52	55	59	62	38	44	44	52	29	33	37	43
VS_1	57	59	59	63	47	50	54	58	35	38	41	48	26	30	35	40
VS_2	51	51	54	58	43	45	49	54	33	36	40	46	24	28	32	37
SI_1	46	48	50	53	39	41	44	50	30	33	37	43	22	26	30	35
SI_2	42	44	45	50	36	38	38	46	28	31	35	41	20	23	27	33

I_1	Deduct 25% of the SI_2 percentages	(This is merely a guide. In actual trade practice, stones in the imperfect) (grades are likely to be priced individually depending on the nature and) (visibility of flaws.)
I_2	Deduct 50% of the SI_2 percentages	

EXPLANATION OF SYMBOLS:
a -- Includes sizes from 1.50 ct. thru .90 ct.
b -- Includes sizes from .89 ct. thru .41 ct.
c -- Includes sizes from .40 ct. thru .30 ct.
d -- Includes sizes from .29 ct. thru .18 ct.

Fig. 6-11: Chart B introduced color and clarity deductions from a D-color Internally Flawless diamond. *Liddicoat, 1955.*

Liddicoat's system was based on simple deductions: Starting with a specific set of proportions, a student or grader made deductions[xv] as the diamond's proportions departed from the American Cut.

"As a result of each of these determinations, a percentage deduction will be obtained, the total of which will be deducted from the present weight of the stone to determine what it would have weighed had the stone been cut to 'American-cut' proportions,"[271] according to GIA's 1955 course materials.

GIA's "Chart A" (Fig. 6-10) listed the potential deductions made from the original weight of the diamond, based on its proportions. Once the measuring was complete, clarity grading and color grading, from Chart B (Fig. 6-11), and finish grading, from Chart C (Fig. 6-12), were used to finalize the value of the diamond (see worksheet example, Fig. 6-13).

[271] GIA, 1955

CHART C
CHART OF WHOLESALE DIAMOND BASE PRICES

The prices compiled below are net cash prices for flawless, finest color stones (entirely without body color and highly transparent) of finest "American" cut (those which average less than a 5% deduction for proportions and finish).

Stone Size	Average Weight Range Covered*	Value per Carat
1 Ct.	.97 Ct. to 1.05 Ct.	$830.00
Lt. 1 Ct.	.90 Ct. to .96 Ct.	760.00
7/8 Ct.	.84 Ct. to .89 Ct.	690.00
3/4 Ct.	.68 Ct. to .83 Ct.	650.00
5/8 Ct.	.57 Ct. to .67 Ct.	550.00
1/2 Ct.	.47 Ct. to .56 Ct.	500.00
Lt. 1/2 Ct.	.42 Ct. to .46 Ct.	460.00
3/8 Ct.	.36 Ct. to .41 Ct.	415.00
1/3 Ct.	.30 Ct. to .35 Ct.	370.00
1/4 Ct.	.225Ct. to .29 Ct.	315.00
1/5 Ct.	.18 Ct. to .225Ct.	295.00

*These ranges will vary slightly with different firms.

These cash prices for top-quality stones have been obtained from the price lists of various distributors who specialize in finely finished "American-cut" stones; i.e., the form of brilliant cutting which is the most expensive in terms of weight yield and labor, as compared to "spreading." The list will probably not correspond to that of any single distributor.

Price lists are meaningless without accurate color, imperfection, proportion, and finish grading constants. For example, proportion and finish differences alone make it possible to obtain colorless, flawless stones for $600 or less for 1-carat brilliants. Unless one considers the great effect of proportions on diamond prices and the fact that few stones on the market today have been cut to "American-cut" proportions, these prices are likely to seem high in relation to those asked for stones of average proportions and finish.

IMPORTANT! THIS LIST HAS BEEN PREPARED FOR GIA STUDENTS FOR INSTRUCTIONAL PURPOSES ONLY AND MAY NOT BE QUOTED OR REPRODUCED IN ANY FORM WHATSOEVER.

Spring, 1955

Fig. 6-12: After deductions from Charts A and B were taken for proportions, finish, color and clarity, final deductions were taken against the base prices from Chart C (see Fig. 6-13 for sample worksheet). The top reads: "The prices compiled below are net cash prices for flawless, finest color stones (entirely without body color and highly transparent) of finest 'American' cut (those which average less than a 5% deduction for proportions and finish)." *Liddicoat, 1955.*

A deduction system that first reduced the weight of the diamond and equated it to what it should have been as an American Cut gave the jeweler the corrected weight. This was followed by a percentage reduction for deviations in color and clarity.

Example #2:

1) Stone weight: 1 ct.
2) Stone diameter: 6.60mm.
Depth measurement: 3.55mm.
3) Depth percentage (3.55 ÷ 6.60)........................53.8%
4) Estimated table diameter percentage...................67%
5) Estimated girdle thickness.....................Medium to thick
6) Finish: fair to poor--obvious polishing marks,
crown facets slightly unsymmetrical.
7) Percentage deductions obtained from Chart A for the
characteristics listed in Steps 3, 4, 5 and 6: Depth
16%, table 7%, girdle 2%, finish 4%. Total........................29%
8) 1 ct. minus 29% = ... .71 ct.
Corrected Wt.
9) Imperfection grade....................................Flawless
10) Color grade...D
11) Percentage value for a D, Flawless stone of .71 ct. 100%
12) Base price for a .71-ct. stone (i.e., 3/4 ct.).........$650
13) $650 x 100% = per ct. value...........................$650
14) $650 x .71 ct. = ...$461.50
STONE VALUE

Fig. 6-13: This is an example of the worksheet that took the student through the steps of evaluating the impact of the proportions, finish, color and clarity on the value of a diamond. Information from all three charts was used to finalize a stone's value. *GIA, 1955.*

The last step was to consult Chart C to find the wholesale price[xvi] and put the weight, color and clarity factors together. The steps were laid out in a clear, logical way that any jeweler with equipment and training could easily follow.

Early Success of GIA's Cut Evaluation System

The course was a huge success, and soon AGS members and jewelers all over the country were signing up for "Proportion Grading, Weight Estimation and Effects of Improper Cutting on Weight and Price" and "Supervised Diamond Grading and Appraisal Practice." There were several reasons, aside from its simplicity, for the success of GIA's new system.

The Four Cs' Relationship to Market Values

Liddicoat, perhaps not intentionally, had done a form of market research when he contacted diamond dealers as he worked on the system. The results made it possible for him to coordinate the factors of carat weight, color, clarity and cut quality, and to find a corresponding price relationship in the current market. His new system helped jewelers determine whether prices from cutters were out of line. More importantly, it standardized how jewelers might then price their goods and be able to demonstrate the legitimacy of those prices to the public.

"The fact that we had a diamond grading system that arrived at a specific price really appealed to the small retailer," Liddicoat said.[272]

This was a major breakthrough. Retailers who had fought strongly against misrepresentation from ignorant or dishonest competitors finally had tools to show why their diamonds were priced differently.

The GIA course was so successful in educating jewelers and giving them solid product knowledge that it drew the attention of De Beers, which donated rough diamonds (many later cut by Lazare Kaplan International, an early proponent of "ideal" cutting) to the Institute in 1955 to teach its students, most of whom took the growing diamond grading courses through correspondence.[273] GIA's diamond grading instruction took the jewelry industry by storm.

Accurate Measurement of Proportions

Measurement of angles had always been difficult at best, and never tied to a careful methodology that produced consistent results. Jewelers could use an angle gauge to estimate the angles, but they were not as adept at using the gauges as cutters were.

GIA taught students how to measure depth percentages and table sizes by conventional means (e.g., Leveridge gauges, Moe gauges and screw micrometers) with a specific methodology, but an innovative proportion grading device developed by GIA helped push the cut grading system even further. The device was later called the Proportionscope[274] (Fig. 6-14).

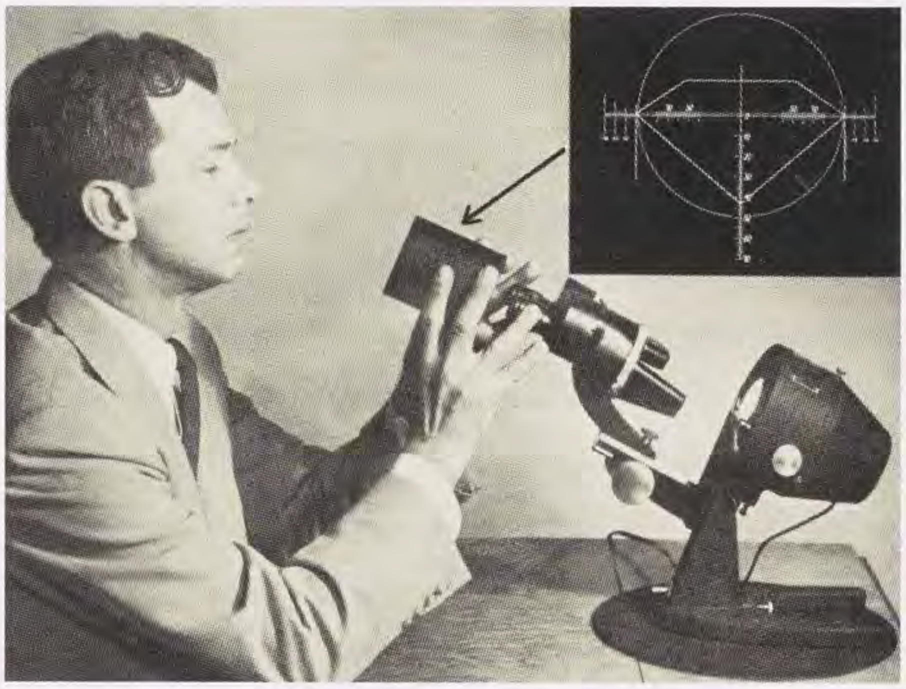


Fig. 6-14: The first version of the Proportionscope – an early proportion grading device – did not attach to the microscope, but was held in front of it. The Proportionscope is demonstrated here by Kenneth Moore, head of GIA's Gem Instruments in the 1960s. *GIA, 1955.*

[272]Shuster, 2003
[273]Shuster, 2003
[274]GIA, 1955

Liddicoat reported, "Use of the proportion instrument, plus accurate color and imperfection grading discloses that the prices of most importers fall very closely into place when weight retention in cutting is taken into consideration," at the 1953 Conclave.[xvii] [275]

A 1954 *Guilds* article described the new device:

> ABOUT THE SIZE AND SHAPE of a beer can, the device is essentially a tube that is open at both ends. A frosted glass screen at one end is etched with the proper proportions and angles of the American cut. The device is held with the hand a few inches above one of the eye pieces of the Diamondscope [GIA's microscope]. A diamond is placed in the tweezers of the Diamondscope, first table-up then girdle-up. When brought into focus a shadowgraph of the stone remarkably appears on the frosted glass screen. By lining up the shadowgraph against the etched markings, the cut can be compared against ideal proportions.
>
> This device rounds out the qualified jeweler's equipment. It now makes it possible to measure accurately the cut, as well as the clarity, color and carat weight of a gem. Although precise measurement of color is yet to come, acceptable gradings can be made with pre-graded master stones.[276]

A large desktop version of the Proportionscope was introduced in the 1960s.[277]

Cut Evaluation Fulfills a Dream

A disillusioned Henry Morse often complained that he couldn't sell his diamonds for the prices he felt they deserved and that their beauty was being ignored. (Fig. 6-15 shows how Morse's vision for diamonds had evolved by 1920.) Then, as now, a diamond's value was ultimately determined by the market.

Since Morse's time, some cutters and jewelers had been able to command higher prices for well-cut diamonds. They were frustrated because there was no reliable method to match price with cut, color, clarity and carat weight. This situation persisted until the GIA diamond grading system was introduced in 1953.

The Institute's classes empowered jewelers as they learned what made a diamond valuable and how to communicate that knowledge to their customers. A diamond's relative value finally made sense, and

[275] Liddicoat, 1953
[276] "New Device Measures Diamond Proportions," 1954
[277] Liddicoat, 1967

Morse's dream was realized. The most beautiful diamonds were also the most valuable.

Fig. 6-15: This diamond is very close to Henry Morse's original style, with a small table and large culet, typical of the late 1800s. The style he created evolved until the 1950s, and would eventually have a larger table, longer lower girdle facets, smaller culet and a slightly thickened girdle. *Photo by Al Gilbertson/GIA.*

GIA's diamond grading system eventually led to the detailed grading reports used by retailers and consumers to this day. Its success was measured by the fact that its terms and grade definitions were mirrored in diamond grading laboratories around the world.

Grading reports enumerate the qualities of a diamond—carat weight, color, clarity and cut—and ensure that quality is appropriately represented through each of these individual value factors. Cut quality, however, remains at the heart of a diamond's beauty.

Expressing a diamond's beauty has never been easy, but some feel that reducing it to a "grade" or some singular value on a report makes a cold statistic of the romance and excitement ignited by a diamond's appearance. Morse, however, would probably be delighted that the beauty derived from the quality of cutting can be assessed and given such status in a diamond's price.

Thank you, Mr. Morse, for advocating the importance of cut and its relevance to the true beauty of a diamond.

Notes

[i] This is not to suggest that all serious study of cut ended outside of GIA. But that era reflects the final stages of the evolution of the American Cut that GIA and AGS advocated. Part of the reason this happened is that GIA asked various experts for advice in guiding its coursework. One example was M. E. Vedder, who helped GIA with some of its first evaluations of cut methodology.

[ii] A copyrighted grading system for color and clarity appeared in *The Jewelers' Circular-Weekly* ads for Henry Ginnel & Co. (Henry Ginnel & Co., 1890, 1901, 1904). Price lists also appeared or were advertised for: Cooper & Forman, 1902; Marshall Field & Co. catalog, 1918; and J. R. Wood & Sons, 1918.

[iii] Wade, for example, cited a situation in which a 0.87-ct. diamond was recut to improve it to the point where the stone had "ideal brilliancy and had improved in color. ... The few dollars that were paid for the recutting and the slight loss in weight were more than compensated for by the increased value per carat" (Wade, 1915b).

[iv] "For those fortunate enough to be there, it was an experience never to be forgotten. For the first time a large group ... all dedicated to the same aims, [was] able to exchange ideas, to come into contact with the leaders of the gemological profession" (Schuster, 2003).

[v] "The governing body of the Society is the *International Committee*. ... The Chairman of this committee also serves as President of the Society. ... The International Committee has jurisdiction over all matters of Society policy" (Manual of the American Gem Society, 1948).

[vi] He claimed a copyright of the *grading cards* for the system (thus, anyone could use his system, they just could not reproduce his grading cards).

[vii] Vedder did not give the only presentation about diamonds at this 1942 Conclave. J. R. Wood & Sons, the early advocate of scientific cutting, actively involved in AGS, also gave a presentation on diamond cutting; it was presented by Arthur W. Muller, C.G. ("Plans for Associate Membership," 1942).

[viii] AGS had two conclaves in 1942. The first was in Philadelphia, the second in Chicago ("Plans for Associate Membership," 1942).

[ix] This does not mean they weren't being produced, but Vedder, examining 400 diamonds that probably came mostly from American cutters, found no diamond with a table below 57 percent.

[x] GIA and AGS officially separated in 1947.

[xi] Earlier usage of the term in the *Diamonds* booklet is likely, probably in the mid- to late-1940s, but those copies have not been found.

[xii] "To the average person, diamond quality is a mystery. Thus, he lacks confidence in his ability to buy wisely. To take the mystery out of diamonds and thereby increase its desirability, N. W. Ayer has prepared a speech for jewelers' use in addressing consumer groups. Presented here is a condensation of the speech" ("Secrets of the Diamond Expert," 1954).

[xiii] Prior to 1962, De Beers used the terms "purity," "color," "excellence of cutting" and "weight" in their advertising.

[xiv] By 1951, 95 percent of GIA's students were World War II veterans (Shuster, 2003).

[xv] Vedder called them "reductions." The deduction in Liddicoat's system was a raw number that equated to a percentage of weight loss. If the total deductions were 14 percent, then 14 percent was deducted from the weight value and the new weight value was used for the color and clarity price chart (Fig. 6-11, Chart B—from Liddicoat, 1955). Some pricing charts used by jewelry professionals today have formats very similar to Chart B.

[xvi] Chart C included this important note: "Unless one considers the great effect of proportions on diamond prices and the fact that few stones on the market today have been cut to 'American-cut' proportions, these prices are likely to seem high in relation to those asked for stones of average proportions and finish" (Liddicoat, 1955).

[xvii] Part of the early presentations of the new cut grading system at the Conclaves included demonstrations of a new proportion grading device. *Guilds* reported, "Members at the last several Conclaves have particularly encouraged the Gemological Institute of America to perfect this accessory. Prototypes shown at the last Conclaves were enthusiastically received by members" ("New Device Measures Diamond Proportions," 1954). According to former Institute president Glenn Nord, John Holtzclaw of Ada, Oklahoma, designed a desktop model and gave it to GIA in the 1960s. The Institute refined it and it is still in use by some jewelers (Glenn Nord, 2007, personal comments, past president of GIA).

"OF THE HISTORY OF AMERICAN DIAMOND CUTTING, THERE IS LITTLE AVAILABLE IN WRITTEN RECORDS."[278]

Arthur Muller, 1949
J. R. Wood & Sons

Epilogue

Bringing It to the Present

There have been numerous changes in how cut is perceived and its quality graded since GIA launched its groundbreaking diamond grading system in the 1950s. The success of the GIA system spawned imitations and variations from gem labs around the world. Most created their own systems, and virtually all tried to use some kind of baseline—some best set of proportions—to determine where the boundaries for various grades should be. As proportions deviated from these "best sets," a diamond's cut grade was lowered.

Over the years, however, GIA and the trade grew to recognize weaknesses in these types of grading systems. Debate about the best cut quality has raged through the years. "Cut a fine, large diamond to ideal American proportions for a round brilliant. Sell this perfectly cut stone to a European gem dealer. And there's a good chance he'll recut it; even though it means losing weight! To most European experts, our ideally proportioned stone is as old-fashioned as an old mine cut diamond might be to us!" Allen Ward wrote in a 1975 article.[279]

[278]"Modern Diamond Cutting Began in U.S. in Mid-'70s," 1942
[279]Ward, 1975

Although GIA's method of cut evaluation brought about a change in thinking, it didn't account for market trends. The system assumed that there was only one fixed preference. Market preferences changed by the 1980s, and prices became more volatile, so GIA stopped teaching its original cut evaluation technique.

This "spurred an uproar among those who were taught that there was one best—the American Cut, also known as the Ideal Cut," wrote diamond industry journalist Russell Shor. "The controversy reached a peak at a 1988 AGS Conclave in San Francisco where some AGS members accused GIA of downgrading the importance of cut and of 'selling out' to the New York diamond industry. GIA came to accept the prevailing trade view that no one has yet proved Ideal Cuts are more beautiful than well made round stones cut to other proportions."[280]

AGS, not satisfied with what it saw as the dethroning of the Ideal Cut, lobbied GIA to reconsider its position in its course material and asked that a cut grade be included on grading reports. When GIA declined, AGS eventually opened its own laboratory in 1996. It included a cut grade on the AGS Laboratory Diamond Quality Document®, which used a version of the grading methodology that had been in use by AGS since 1965. Ironically, Richard T. Liddicoat of GIA was a key member of the committee that designed that cut grading system. GIA, after many years of research, added a cut grade for round brilliant diamonds to their grading reports in 2006.

Other groups have since developed their own cut grading systems. Some use computers to analyze the way light moves through and back out of a 3D model of a diamond; others use equipment that analyzes the way light moves through and exits an actual diamond, or a device to observe specific pattern charateristics of light in a diamond. Each method has supporters who believe their system provides critical insights into the cut quality of a diamond. Some work only on the classic 57- or 58-facet round brilliant diamond, while others work with a variety of shapes and facet patterns. Regardless, all agree that an evaluation of cut quality is now an integral part of diamond grading.

[280] Shor, 1988

How to Choose the "Best" Diamond

Fig. e-1: Top cut quality diamonds can have different appearances. Look at a diamond and compare it with others to make sure it has the look you want. *Photo by Valerie Power/GIA.*

The importance of diamond grading reports has grown because people want an easy way to sort through the options available; they want a guide that tells them what to choose or what is best. Today's diamond grading reports come with a plethora of numbers and proportion details that describe one vital thing: the final appearance of a diamond.

Some in the jewelry business, however, believe the romance and appeal of a diamond is diminished when the stone is simply summarized with a string of numbers on a grading report. They believe diamonds lose their individual personalities as the report tries to focus the look of what's best into a narrow range of appearances. Advice to diamond shoppers should emphasize the following points:

- Locate a reputable diamond expert in your area. Look for a jeweler who believes in continuing education and has taken classes from or earned diplomas from GIA or the Gemmological Association of Great Britain, or is a member of AGS.
- Learn about the Four Cs (cut, color, clarity and carat weight) and how they affect the cost of a diamond. Compare diamonds of varying grades and observe them with your own eyes (Fig. e-1). See for yourself how each aspect affects the diamond's appearance. Look at the diamonds under different lighting conditions (natural light, fluorescent light, bright or dark rooms). A well-cut diamond will look better than diamonds of lesser quality in all these conditions.

- Learn how to read a diamond grading report. A grading report from a reputable independent laboratory—not an appraisal—is your assurance of quality because they do not have a financial interest (since it will not affect their profits). It also gives you an objective method to compare diamonds from various jewelers. Information about the Four Cs on these reports is critical in selecting a diamond that best meets your needs. The other information on the report will help you insure your diamond against loss and assist with replacement. This information will enable you to replace your diamond with one of similar quality and appearance.

- GIA did not assign cut grades on grading reports until 2006. The cut grade (whether that of GIA, AGS or another laboratory) categorizes the diamonds that many agree are the best looking; ultimately you need to look at the diamond to see if you agree. Decide which look or cut appeals to you the most. Which diamond absorbs and infatuates you? That's the one you should take home. Choose the one that expresses your thoughts and passions, the one that makes you happy or proclaims your devotion. Remember, you or your loved one won't be wearing a piece of paper with numbers: You'll be wearing a diamond you fell in love with.

- Decide what carat weight range fits your budget and then start to make choices. Perhaps you'll like one that is not perfectly colorless, or has slight inclusions or is a smaller carat weight. Any of these characteristics will be enhanced by a diamond that is well cut. Make sure you compare a lot of diamonds to find the one "best" for you (Fig. e-2).

The infatuation with the dance of light that explodes from a well-proportioned diamond is what drove Henry Morse to perfect diamond cutting and start the evolution of the American Cut.

Fig. e-2: Compare diamonds in different lighting conditions to discover how they will look in different places. You alone can determine which diamond looks best to you. *Photo by Melissa Jacobs and Cliff Hanks/Creative Keepsakes Photography.*

Illustration by Al Gilbertson/GIA.

"A myth is like a stained-glass window. The stained-glass window tells us something about the light that shines behind it. The window is not the light itself. We should not remain affixed to its lines and colors. They point to the light that shines behind." [281]

Willigis Jäger, 2000
German Benedictine monk

Afterword

The diamond industry built a myth around the American Cut diamond that has become ingrained in the jewelry industry, even if its name has changed over the years. We call it the "American Ideal Cut" or sometimes just the "Ideal Cut."

The myth is that the American Cut was created by Marcel Tolkowsky. Many believe that the cutting style he wrote about was his "ideal," and that somehow he only saw a narrow set of proportions as the best. That he himself did not call it "ideal," and that he did indeed see other widely ranging proportions he thought had been cut to "obtain the liveliest fire and the greatest brilliancy,"[282] should give some pause.

While Tolkowsky's influence did modify the American Cut's table size, he was not the first to advocate many of the proportions proposed in his book. That started in the late 1800s with Henry Morse in Boston, who wanted to cut diamonds for beauty, not weight. The story of Morse, and later Frank Wade, the industry trade press and Robert M. Shipley's influence on cut, has, until now, been obscured by the Tolkowsky myth.

My vision for this book was to share the real evolution of the American Cut and in doing so, credit all of the diamond cutters and industry advocates who contributed to what many think are the best proportions to make a diamond sparkle.

Today's technology has made it possible for us to better understand what people really see as the "best" when they look at a diamond. A number of groups have been hard at work on the subject. GIA's recent research, after more than 70,000 observations of real diamonds, has shown that there are a number of bests.[283]

Most observers in GIA's observation tests agreed when a diamond was unattractive or even marginal in appearance. As better sets of proportions improved diamond appearance, individual tastes came into play. While there were some proportions that most agreed looked really good, there was no one narrow set of proportions that was unanimously superior to the rest.

[281] Jäger, 2000
[282] Tolkowsky, 1919
[283] Moses et al., 2004

So GIA began a fundamental shift in the way it thought about cut quality and diamond appearance. It found that there is a plurality of perfection; observers agree that a number of looks are better than others (the traditional "ideal" cut is among the preferred), but can't agree on any one look as the absolute best (see "The Plural Nature of Perfection," facing page).

Today, when diamonds can accurately be measured to a much higher degree of precision, we find that there is a relatively wide range of appealing proportions. Diamonds with proportions disliked by Morse or Tolkowsky are rarely cut today.

But what does this mean for diamond sales to the public?

It means we should not look at a diamond grading report (which documents the color, clarity, weight and proportions of a diamond) and assume we know what a diamond looks like, as many jewelers have been taught. Diamond grading reports that analyze cut merely help the consumer understand the overall grades and appearances that are preferred. We should look at the diamond itself to see if its appearance is what we personally deem the most pleasing to our eyes, making it our own ideal.

Does that destroy the quest for the ideal? It shouldn't. The desire for the best will continue for each of us. New understandings show us there are a variety of "ideals," which allow for individual tastes.

And the classic Ideal Cut does not need to go away.

Jewelers today should follow Morse's lead and disregard the assumptions of the past and re-evaluate what is really best for their customers. They need to understand that differences in opinion and individual preferences have an important role to play when their customers are choosing a diamond—and that's OK. Without that understanding, they are missing an important aspect of appearance and an important opportunity to build relationships with their customers.

Jewelers need to remember that their customers' diamond buying decisions are important and special to them in a very elemental way. Many jewelry purchases—whether a ring or pendant or pair of earrings—are chosen to mark special occasions or accomplishments, or are given to someone close to the heart.

The Plural Nature of Perfection

GIA's research found that as diamond appearance improved, personal preference became more significant; most observers felt some proportions were superior, but there was no limited range of proportions that all chose as a single best. This parallels research in other industries, and provides useful insight about how people come to have preferences.

Food industry research provides a good example. Howard Moskowitz, fresh from Harvard with a doctorate in experimental psychology, set up shop in the 1970s to conduct taste and preference research for the food industry.[284] He came to believe, based on the results from Pepsi Cola and other food testing, that there were multiple bests when it came to the senses. He called this the plural nature of perfection.

Moskowitz, for example, received a call from the Campbell's Soup Company in 1986. Its Prego spaghetti sauce was up against Unilever's Ragú, and needed an edge to outsell its competitor. Moskowitz knew there were a lot of subtleties to spaghetti sauce recipes: spiciness, sweetness, tartness, saltiness, thickness, aroma, mouth feel, cost of ingredients and so forth. So he formulated 45 prototypes, took them to New York, Chicago, Los Angeles and Jacksonville, and asked people to taste and rate them on a scale of one to 100.

He discovered that everyone had a slightly different definition of what a perfect spaghetti sauce tasted like, but most people's preferences fell into one of three broad categories: plain, spicy and extra chunky. Of the three, extra chunky was the most significant to his project. Why? There was no extra chunky spaghetti sauce being sold in supermarkets.

That new category proved to be worth hundreds of millions of dollars to Prego over the next decade. And today many food brands come in multiple varieties.

How does this relate to diamond cut? Many jewelry professionals have been looking for the one best set of round brilliant proportions (spaghetti sauce) for some time now. GIA's research confirms what Moskowitz would suggest—there may be many different proportion sets (spaghetti recipes) and diamond appearances (spaghetti tastes) that people prefer.

[284] Gladwell, 2004

If all diamonds looked exactly alike, these purchases would no longer feel as special or personal.

The traditional American Cut taught by GIA starting in the 1930s, and considered the Ideal Cut by the American jewelry trade for more than three-quarters of a century, will not only continue to have a significant role in the history of diamond cutting, but will also continue to be desired and deemed the best looking diamond by many. That others choose other cut styles they consider to be the best doesn't weaken its history. Without the vision of beauty that drove the evolution of the American Cut, the appearance of diamonds today would be as Jeffries worried, "unavoidably ... lifeless, and dull."[285]

The image Morse, Wade, Whitlock, Tolkowsky and Shipley had of the most beautiful diamonds is being realized today. The myth has given way to a new reality. People should choose diamonds that explode with life, what Morse called, "gems of superior beauty and brilliancy."[286] Morse pointed the way and now it is within everyone's reach to wear a beautifully cut diamond.

[285] Jeffries, 1750
[286] Henry D. Morse, undated

"OUR PURPOSE IS TO UNIFY AND STANDARDIZE CERTAIN TERMINOLOGY... ."[287]

American Gem Society, 1937

Appendix

Other Proportions and Some Notes on Their Evolution

Until recently, most cut grading systems focused on a few standard proportions when evaluating diamond cut: pavilion angle, crown angle, table size, crown height, pavilion depth and overall depth. Lower and upper halves, star facets, culet size and girdle thickness were only mentioned occasionally, usually described indirectly or implicitly through drawings. These cutting aspects also have an impact on a diamond's appearance, and their proportions have changed over time.[288] Their evolution is another demonstration of how appearance drove the changes to the round brilliant cut diamond.

[287] "Diamond Terminology Recommended," 1937
[288] e.g., Reinitz et al., 2001

Lower Girdle Facet Length

In the illustrations (Fig. a-1), the lower half facets (also called lower girdle facets) are outlined in red. When looking through the table of the diamond (the octagon outlined in yellow) at short lower half facets (such as the 60 percent length of 1 and 2), the ends of the lower halves are barely visible (2 and 4). When they are longer (such as the 90 percent length of 5 and 6), the effect is to break up the light in the area under the table (6 and 8).

The diamonds in the photos have relative actual lower girdle lengths of 65 percent and 90 percent. Greater lower girdle length adds more scintillation to a diamond because it helps break up the reflections of facets into more reflections. GIA's research recently found that the optimal lengths for lower girdle facets range from 75 to 85 percent.

Jeffries' lower halves, which he refers to as "skill facets," were about 30 percent of the length of the pavilion.[289] Short lower halves were widespread in Europe as late as the early 1900s.

Smith, as late as 1912,[290] showed diagrams with lower half lengths just short of 30 percent (Fig. a-2). Tillander points out that until Morse lengthened the lower halves to about 60 percent, they "were supposed to be the same as the upper girdle facets."[291] Tolkowsky's lower girdle lengths are about the same as Morse's; he proposed that lower girdles should be 2 degrees steeper than the pavilion main facets. The lower girdle facets, calculated from Tolkowsky's proportions, are 59.3 percent long (for a pointed culet). Tolkowsky's book, however, shows the lower girdles at only about 50 percent (Fig. 5-2, page 122).[292]

By 1939, Shipley indicated that the lower halves had lengthened slightly more: "In the form of cutting with extended lower girdle facets, this angle is approximately 41°30'. This form, with lower girdle facets about 2/3 as long as the pavilions, is common in America today, and is held by many dealers to be more effective than Tolkowsky's design."[293]

Although diamond cutters were slowly lengthening the lower girdle facets, there is no record of when length was standardized. Tillander

[289] Jeffries, 1750, 1751, 1753
[290] Smith, 1912
[291] Tillander, 1995
[292] Tolkowsky, 1919
[293] Shipley, 1939b

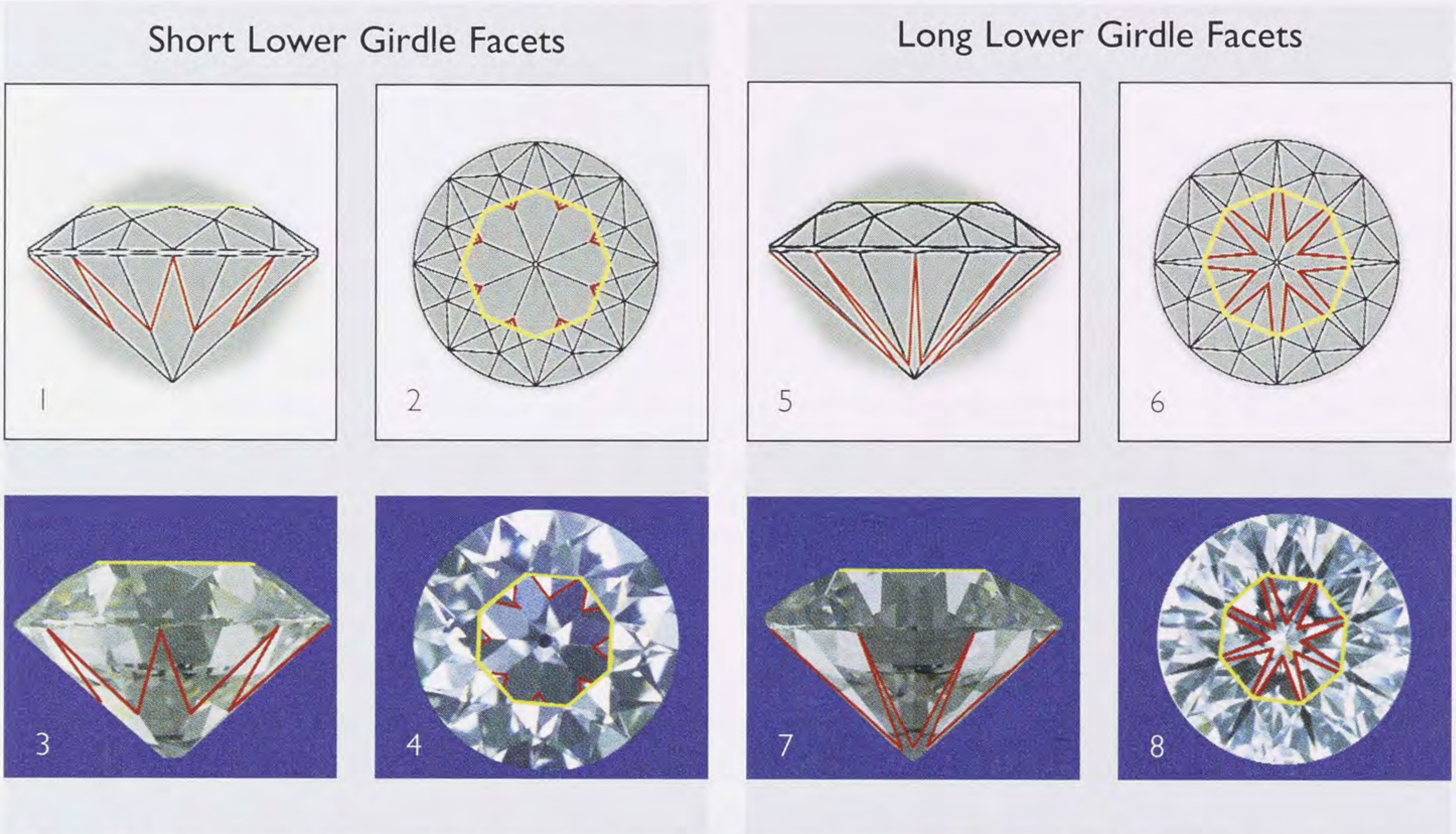


Fig. a-1: Short lower girdle facets give a diamond a blockier appearance than long lower girdles. *Photos by Al Gilbertson (face-up) and Don Mengason (profile)/GIA.*

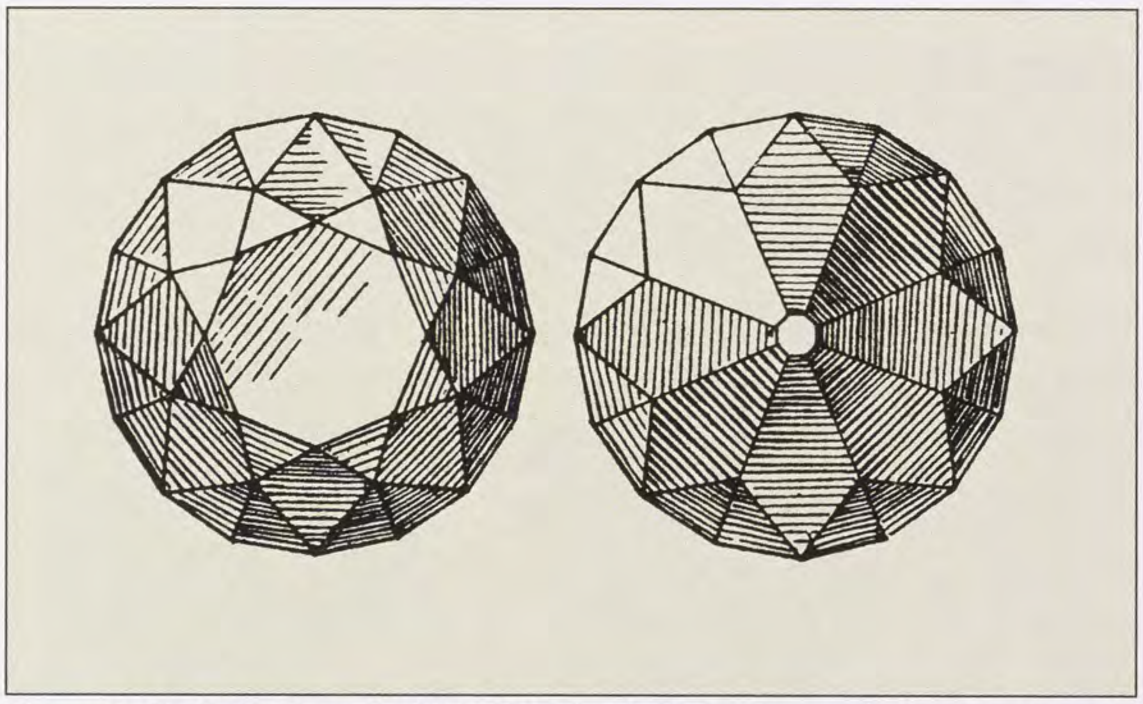


Fig. a-2: G. F. Herbert Smith's 1912 book shows lower girdle facet lengths that were much shorter (around 30 percent) than those cut by Morse (around 60 percent) in the 1870s. *Smith, 1912.*

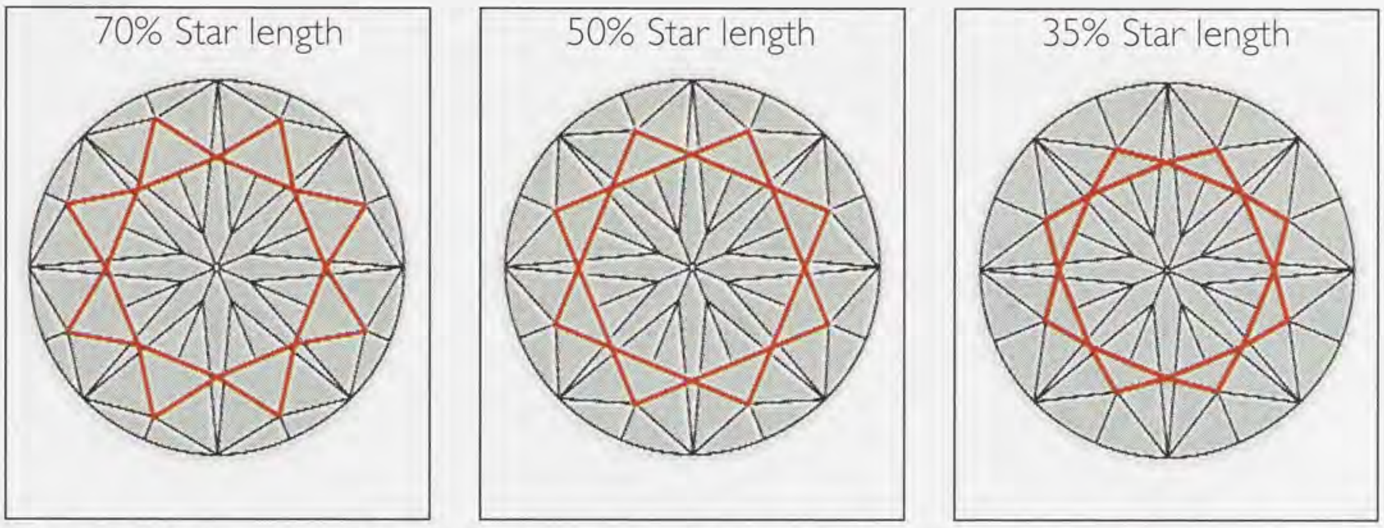


Fig. a-3: Different star facet lengths (outlined in red) with the same table size facets create different face-up appearances. *Illustrations by Al Gilbertson/GIA.*

mentioned that "round the turn of the [20th] century O. M. Ferrand[i] elongated them further, from 75 to nearly 90 percent of the distance from the girdle to the culet."[294] Ferrand, however, is a rather obscure figure; there is little mention of him in the literature, and there is no indication that anyone adopted his lower girdle facet lengths.

Lower girdle facets have grown to be most commonly cut between 75 and 85 percent today. When they are cut short, the immediate impression for those in the jewelry industry is that of an older style.

Star Facet Length

The illustrations for star facets (Fig. a-3) are outlined in red and frame the table (the center octagonal facet). The relative lengths shown are 70 percent (left), 50 percent (middle) and 35 percent (right).

Jeffries mentions star facets, but there is no real discussion of them until Tolkowsky and Wade. Some suggest that the stars "chamfered" (rounded off) the table to eliminate sharp corners that could chip.[295]

Wade essentially echoed Tolkowsky:

"STAR" FACETS ARE USUALLY added around the table, largely to make a more pleasing design to the top surface. ... Calculations as to their optical effects show that while they slightly diminish the fire they make up for that loss by decreasing the leakage of light that occurs through the bezils [*sic*]. ... They also cause a somewhat better distribution of the light, giving what might be described as a better "pattern." [296]

[294] Tillander, 1995
[295] Harding, 2004, personal comments, mechanical design engineer/mathematician, amateur gem cutter
[296] Wade, 1920

GIA research recently found that the optimal lengths for star facets ranged from 45 to 65 percent. Star facets that are shorter or longer than this detract from the face-up pattern in the diamonds, confirming Wade's comment that star facets do affect the pattern seen in a diamond.

Culet Facet Size

The drawings of culet sizes (Fig. a-4) illustrate small, medium and very large culet sizes. The diamond in the photograph, with a large culet and short lower girdle facets, is typical of diamonds cut for the American market from about 1900 until 1940. Smaller culets began to show up in some American diamonds starting about 1915, and by 1950 the culets were typically very small.

Culet facets were calculated by Jeffries in the 1750s as 20 percent of the table size.[ii] Early American Cut culet facets were large by today's standards—at first over 4 percent of the diameter of the stone (or 10 percent of the 40 percent size table)—but by the 1930s became much smaller. Tillander, in his review of cutting styles from about 1900 until the start of World War II, associates pointed culets with Antwerp and Amsterdam, and culet facets that were a few percentage points larger with London and American cuts.

Some thought that a pointed culet would be more likely to chip.[iii] There was also the notion, however, that the culet facet played an important role in reflecting light back to the observer. This was demonstrated in the first ray-tracing diagrams.[297]

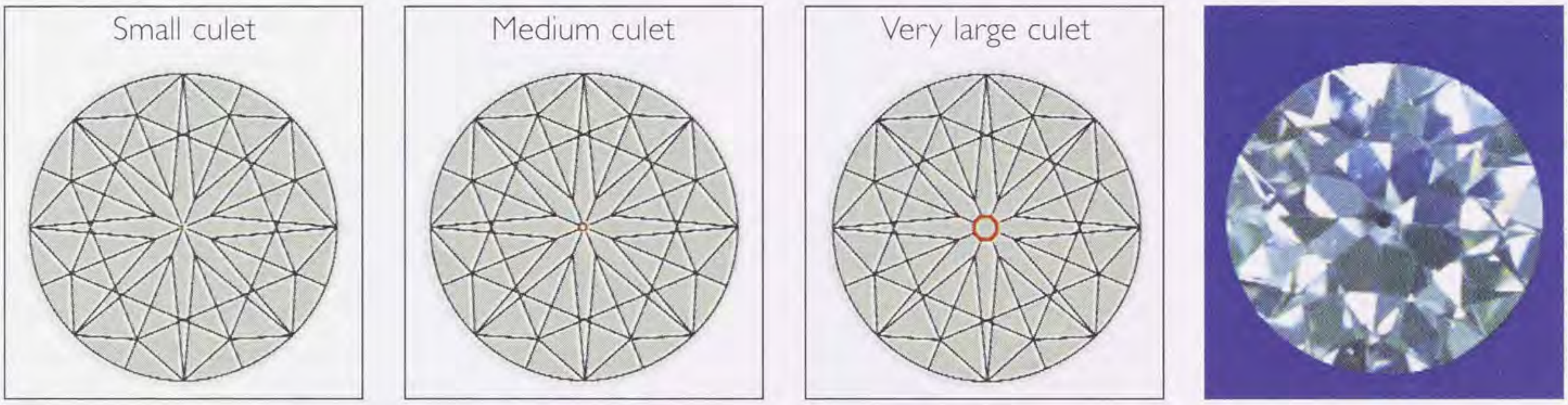


Fig. a-4: Culet sizes (outlined in red) are much smaller today (small and medium culets) than in early round brilliant diamonds (very large culet). The photograph (far right) illustrates a large culet typical of the cutting style from 1900 to 1940. *Illustrations and photo by Al Gilbertson/GIA.*

[297] Bauer, 1896

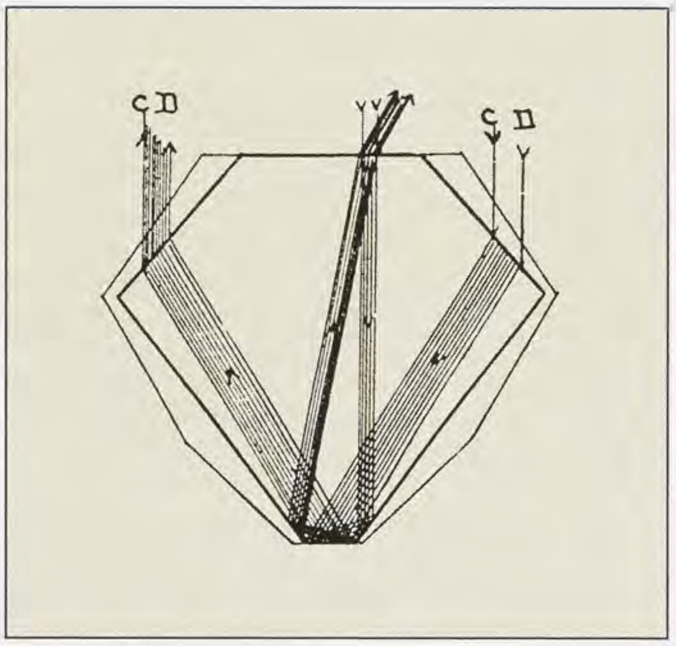


Fig. a-5: Frank Wade wrote about the importance of the culet in older cut styles. He felt that the culet was a key component in reflecting light back to the observer. In this side view of a diamond, the top flat area is the table and the bottom flat area is the culet facet. *Wade, 1917.*

Wade wrote about the importance of the culet facet for the old mine cut style:

> THE SERVICE WHICH this small facet gave, and still gives to a slight extent, can best be understood by reference to the "Old Mine" type of brilliant ... this was a necessary procedure—to prevent loss of light—as will be seen by referring to the lines in the figure, which represent the path of beams of light that enter the stone from above. If the culet were not present and the back facets met in a point, the light, that is totally reflected from the culet in the figure, would have met the steeply sloping opposite facets too squarely (within less than 24° of the perpendicular to the point where it struck), and, instead of being totally reflected, it would have penetrated the back of the stone and would have been lost—thus lessening the brilliancy of the stone.[298] (Fig. a-5)

Eppler, the German gemologist, also wrote a manuscript on the importance of the culet facet:

> IN SUMMARIZING it can be said, that in old brilliant-cut diamonds, with steep facets or great angles of the main facets in the crown and in the pavilion, a culet of adequate size is necessary to gain a maximum of brilliancy.[299]

Wade also noted in 1917 that "if all diamonds were cut to the ideal 'make,' the culet would be less necessary."[300] He said that even in the modern make of his day, culet facets, though smaller than they used to be, were still observable in the bottom of modern cut diamonds.[iv] He called this facet "brilliantly lighted up" (Fig. a-5).

Shipley thought the culet facet "should be as small as possible since the vertical rays leak through it and an undesirable dark spot may easily result from too large a culet."[301] This is true when more modern cutting angles are used; the larger culet tends to look like a black spot in the center of the diamond.

Despite the notion that the culet facet might be important for light return, from Morse's time until the 1930s it gradually became as small as possible while still offering some practical protection for the

298 Wade, 1917
299 Eppler, undated
300 Wade, 1917
301 Shipley, 1931

diamond's point. Nearly 80 percent of the round brilliant diamonds sold in America today have no culet facet because mountings protect the points so well.

Girdle Thickness

Girdle thickness in diamond cutting was seldom debated in the early- to mid-1800s. However, diamond industry tradespeople could sometimes distinguish an English diamond from a Dutch one just by looking at the girdle. English cutting was mostly marked by a knife-edged girdle; Dutch girdles were usually slightly thicker[v] [302] (Fig. a-6).

Two techniques were being used to form girdles at this time: bruting (shaping it with another diamond) and cutting the main and bezel facets on a scaife until they met at an edge. Each method was widely used, and neither can be specifically attributed to the Dutch or English.

Perceptions about the correct girdle thickness became more important as tastes transitioned from cushion to round shapes in the early 1900s.[vi] Round brilliant girdles were often considered best if they were knife-edged or nearly knife-edged.

"Ideal cutting [meant that] ... The edge of the stone should be cut evenly," Cattelle wrote. "Some prefer the finished appearance of a polished knife edge, though there are those who think it better to leave a very thin line of the skin of the stone around the edge, as it is less liable to chip and split. ... If, on looking into a stone, reflections of the edge appear in the body, its proportions are not exact."[303] Cattelle added that thickness should be avoided at and above the girdle.

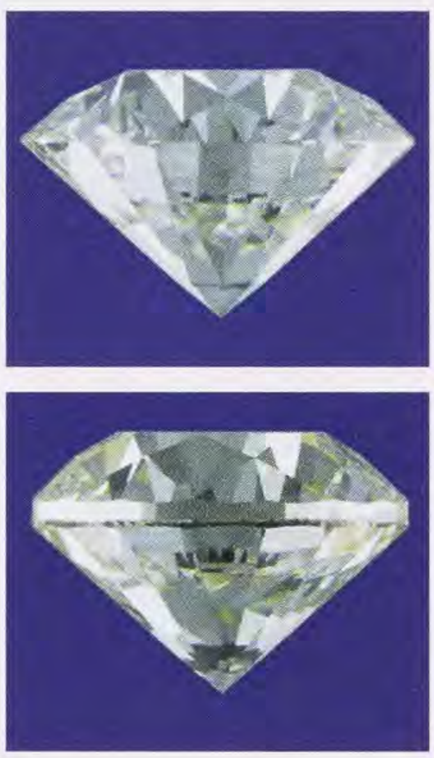


Fig. a-6: The girdle of the diamond on the top is knife-edged and will chip easily when worn. The diamond on the bottom has an extremely thick girdle, which adds unnecessary weight. *Photos by Don Mengason/GIA.*

A 1906 U.S. patent awarded to Ernest Schenck for his method of polishing the entire edge of the girdle demonstrates turn of the century perceptions about the girdle's role. Schenck, a Belgian living in New Jersey, noted that his objective was to "lessen the liability of chipping and which will increase

[302] Streeter, 1877
[303] Cattelle, 1903

the ease of polishing or repolishing the stone."[304] Schenck's method resulted in a thicker girdle. Prior to his patent, the edge of the girdle was rough or unpolished. Schenck's patent states:

> IT HAS SOMETIMES been the practice to make the bases of the facets lying adjacent to the girdle meet in a line or edge at the girdle, and consequently such stone in plain view has been bounded not by a complete circle, but by a series of short straight lines. This is objectionable for one reason, because it results in the adjacent facets on top and bottom of the stone meeting in a sharp edge, which is extremely liable to, and usually does, chip during the ordinary wear of the stone, thus detracting somewhat from its brilliancy.

Schenck was not shy about the advantages of the polished girdle for popular cutting styles. He made several statements about his method's effects in a letter to Marcell Smith, a gemologist who was writing a book about gems:

> THE SUPERIORITY OF THIS DIAMOND resides in its dominant feature: The polished curved facet encircling the edge of the stone, forming a continuous narrow girdle, establishing in harmony with every detail of its cutting a connecting link joining all its facets into one final attainment of perfection.
>
> This patented Polished Girdle, with its resultant increase in luster and brilliancy, produces a maximum diffusion of light with corresponding depth of attraction.
>
> The smooth finish of the edge protects the patented Polished Girdle diamond against injury by "chipping,"—an advantage that both setter and wearer will appreciate.
>
> The Polished Girdle of this diamond furthermore provides efficient means of identification; the cylindrically shaped facette acting as an indelible hallmark embodied in the stone.
>
> It is indisputably the first and only perfectly finished brilliant,—a Standard for all time.[305]

Some of Schenck's ideas[vii] were accepted by authorities such as Wade by 1915:

> THE MAKE OF THE GIRDLE should be especially scrutinized, as a good deal depends upon it. If too thick one has to pay for weight that is worse than useless, for if unpolished the dull gray edge may be reflected within the stone, hurting the color and brilliancy. The very best stones have either a knife-edge

[304] Schenck, 1906
[305] Smith, 1913

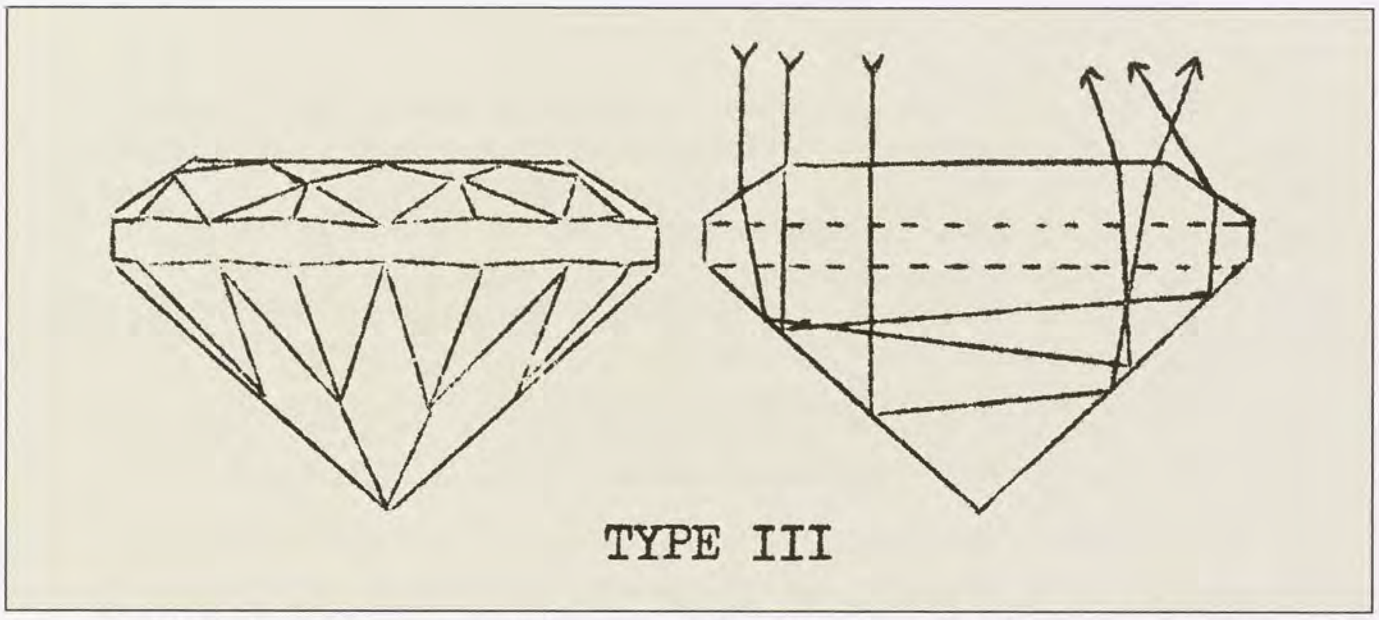


Fig. a-7: GIA's 1949 course materials show girdle differences for different sized diamonds. The German Type III was used for diamonds under 1/5 carat, and it was called "weight cutting" because it recovered the greatest amount of the original weight from most rough stones. Note the extremely shallow top, wide table and wide girdle. Shipley and other advocates of the American Cut frowned upon thick girdles. *Shipley, 1949a.*

> girdle or one that is polished. Commercial stones seldom have either. Too thin an edge may result in chipping during setting. Of the stones with polished girdles some have a curved polished surface and some have a series of tiny facets polished on them. Optically the latter are to be preferred, as curving surfaces do not give the sharp reflections given by perfectly plain ones.[306]

Knife-edge or near knife-edge girdles appear to have been the standard until the 1930s. Tolkowsky's calculations were based on a knife-edge girdle,[307] and early GIA course material stated that the "perfect girdle of a brilliant is 'knife-edged,'" though it conceded that thin, polished girdles were more practical.[viii] Thicker girdles were generally frowned upon (Fig. a-7).

By today's standards, a girdle needs to be thick enough to reduce the risk of chipping without adding extra weight that can't be considered face-up. If a 1-ct. diamond has a very thick girdle and allows its diameter to give it the face-up appearance of a 3/4-ct. diamond, for example, it is viewed as having excess hidden weight.

[306] Wade, 1915a
[307] Gilbertson, 1997; Paulsen, 2001

Notes

[i] Cattelle spells the name "Farrand," adding, "Mr. O. M. Farrand discovered a method of remedying over-spread stones, by elongating the bottom corner facets, carrying the points down to 3/4 to 7/8 of the distance to the culet" (Cattelle, 1911).

[ii] "The small lower facet has the fifth part of the width of the table" (Jeffries, 1750).

[iii] "The culet is placed upon the stone for safety, as a sharp point could be easily splintered" (Shipley, 1931).

[iv] "In conclusion, it may be added that without a culet there is a slight change in the appearance of a brilliant, for we are accustomed to see a reflection of the tiny octagonal culet surrounded by its eight attendant facets, through every one of the front facets of the stone. When, instead, we see the reflections of the eight facets sharply meeting in a point, we miss the culet, for, small as it now is, it still, to a slight degree, reflects portions of light that would otherwise be lost or misdirected, as may be seen from the fact that the image of the culet, even in the modern cut stone, is always brilliantly lighted up" (Wade, 1917).

[v] "The English make the girdle rather sharp; but the Dutch make it broader. The former method brings out the play of color better" (Streeter, 1877).

[vi] "Prior to these innovations, diamonds were cut in a nearly square shape, with the corners somewhat rounded off, the object being to secure as much brilliancy and also to save as much weight as possible. Diamonds are now cut, as everyone knows, practically round. Formerly and even now in most of the ordinary cutting comparatively little attention is paid to the girdle; but the better the quality of the cutting the more attention is paid to the desirability of having the girdle as thin as possible, and yet not so thin as to chip easily" (Smith, 1913).

[vii] Schenck made several additional statements about his patent's effects in a letter to Marcell Smith that is quoted here from Smith's book: "The superiority of this diamond resides in its dominant feature: the polished curved facet encircling the edge of the stone, forming a continuous narrow girdle, establishing in harmony with every detail of its cutting a connecting link joining all its facets into one final attainment of perfection. ... This patented Polished Girdle, with its resultant increase in luster and brilliancy, produces a maximum diffusion of light with corresponding depth of attraction. ... The smooth finish of the edge protects the patented Polished Girdle diamond against injury by 'chipping'—an advantage that both setter and wearer will appreciate. ... The Polished Girdle of this diamond furthermore provides efficient

means of identification; the cylindrically shaped facet acting as an indelible hall-mark embodied in the stone. ... It is indisputably the first and only perfectly finished brilliant—a Standard for all time" (Smith, 1913).

[viii] "The perfect girdle of a brilliant is 'knife-edged,' but such a girdle is easily chipped and requires extremely careful handling; therefore polished girdles, either smooth or with tiny facets, are often used in finely made stones. The latter are, of course, preferable. However, because a knife-edged girdle is dangerous and polished girdles add more expense than beauty, girdles are usually left unfinished. Lumpy girdles should be avoided" (Shipley, 1936).

Glossary

These definitions are adapted from those developed by GIA's Research Department as part of its work on diamond cut and appearance.

Appearance. The response of an observer to a visual stimulus; this term includes both sensations (recognition) and perceptions (interpretation).

Bezel or Bezel facet. Any of the large, four-sided, kite-shaped facets on the crown of a brilliant cut gemstone, located between the table and the girdle, and aligned over the pavilion facets.

Break facets. The facets that border the girdle of a polished gemstone; also known as upper and lower girdle facets, or upper and lower halves.

Brilliance. The intensity of the internal reflections and external reflections (glare) of white light returned from the crown of a polished gemstone. Refractive index, reflectivity, polish, luster, symmetry and proportions all affect a gemstone's brilliance.

Brillianteering. The act of placing and polishing the remaining 40 facets (16 halves and 8 stars on the crown, 16 halves on the pavilion) on a polished diamond after the bezel and pavilion main facets have been added.

Brilliant cut. A cutting style consisting mainly of triangular and kite-shaped facets. The most common brilliant cut is the standard Round Brilliant Cut, although this cutting style can be applied to nearly any shape.

Bruted girdle. A girdle that is finished with a textured (rough) surface.

Chipped girdle. A damaged girdle; usually a result of a thin- to knife-edge girdle.

Closed culet. A culet that has not been faceted or is so small it can't be seen; also known as a pointed culet or no culet.

Color grade. The relative position of a diamond's bodycolor on a colorless-to-light-yellow scale, denoted by standard nomenclature such as letters, numbers, words or a combination thereof. Color grades are established by comparing a diamond to a set of standard master diamonds under controlled conditions. Such grade ranges are normally assigned only to colorless, near colorless, or light yellow, light brown and light gray diamonds. Other natural colors in diamond are considered "Fancy" colors and are described with a different series of grade terms.

Color grading scale. A graduated series of color grade ranges normally covering diamonds in a range from colorless to light yellow, light brown or light gray. A different series of Fancy grade terms is used to describe diamonds with color ranges more intense than the Z color grade.

Color grading system. A standardized set of procedures and terms for evaluating a diamond's bodycolor that compares it to a set of standards. The color grading systems in use today employ a variety of nomenclatures, ranging from letters and/or numbers to descriptive or historically derived terms.

Crown. The part of a polished gemstone above the girdle.

Crown angle. The angle measured between the girdle plane and the bezel facets.

Crown facets. The facets above the girdle, including the table, bezel, star and upper girdle facets.

Crown height. The distance between the girdle and table planes, usually measured in millimeters.

Crown height percentage. The distance between the girdle and table planes expressed as a percentage of the average girdle diameter on a round brilliant cut gemstone, or as a percentage of the width on fancy shapes.

Culet facet. The small facet on the point of the pavilion of a brilliant cut gemstone, or on the keel of a step cut, fashioned to reduce the risk of damage.

Cushion shape. Rectangular or squarish brilliant with curved sides and rounded corners.

Cut. A term that often refers to the "make" or proportions of a polished gemstone.

Cut grading. The process of evaluating and describing the proportions and finish of a polished gemstone, principally with regard to their overall effect on appearance.

Cutting style (or faceting arrangement). The particular choice of facet arrangement on a polished gemstone (e.g., brilliant cut, step cut or mixed cut).

Depth (total depth). The dimension of a polished gemstone measured from the table to the culet; usually recorded in millimeters.

Depth percentage. The depth dimension expressed as a percentage of the average girdle diameter on a round brilliant or as a percentage of the width of a fancy shape.

Diamond Design. Marcel Tolkowsky's 1919 book, which used hand-drawn, two-dimensional ray-tracing and simple mathematical formulas to suggest a set of proportions for a round brilliant cut diamond that he believed would lead to the "best balance of fire and brilliancy."

Diamond grading system. A comprehensive set of methods, terms and standards for determining and describing the relative quality of a polished diamond's clarity, color and cut.

Diamond rough. Diamond crystals before they are polished.

Dispersion. The separation of white light into spectral colors, each of which vibrates at a different frequency. As light passes through an optically dispersive material at any angle other than perpendicular, different wavelengths are refracted (bent) to different degrees (they have different paths, since they have slightly different refractive indices). The visual appearance of these flashes of colored light in a polished gemstone is called fire.

Facet. One of the flat surfaces on a polished gemstone.

Facet alignment. Placement of the crown and pavilion facets so that the bottom points of the bezel facets are directly above the top points of the pavilion mains. In this position, the junctions of the upper girdle facets should be just above those of the lower girdle facets.

Facet angle. The angle between the plane of a facet and the girdle plane (for facets other than the table and culet).

Facet design. The shape and arrangement of the facets on a polished gemstone.

Faceted girdle. A girdle that has been polished with a series of flat facets.

Faceting. The process of grinding and polishing facets on a gemstone.

Facet junction. The line on a polished gemstone where two adjoining facets meet.

Face-up appearance. The optical appearance (e.g., brilliance, fire, scintillation, life, color and clarity) of a polished gemstone when examined through the crown facets.

Finish. The visual appearance of the surface of an object (e.g., bright, mirror, matte, satin, rough or black); also the aspect of craftsmanship defined by the two components of polish and symmetry. See Polish and Symmetry.

Finish grading. The process of evaluating and describing the finish details of a polished gemstone.

Fire. The visual appearance or extent of light dispersed into spectral colors in a polished gemstone.

Fish-eye. A circular gray reflection of all or part of the girdle as seen through the table of a polished diamond when it is viewed face-up, perpendicular to the table or tilted slightly.

Four Cs. The four factors—color, clarity, cut and carat weight—that determine the value of a polished diamond.

Frosted girdle. The normal appearance of a well-bruted, unpolished and unfaceted girdle.

Full-cut brilliant (full cut). A brilliant cut diamond with the complete set of 32 crown facets, 24 pavilion facets, a table and (usually) a culet. The term is usually applied to very small stones called melee, since they are not always fully faceted because of their size.

Girdle. Rounded shapes (such as round, cushion, pear, marquise, etc.) are typically bruted to obtain the shape; the girdle then may or may not be polished or faceted. On shapes with straight sides (e.g., square, triangle, rectangle, etc.) the girdle is polished.

Girdle diameter. The distance from one edge of the girdle on a polished round gemstone to a point directly opposite on the other side. Most of the proportions used to evaluate the make of a gemstone are expressed in relation to the average girdle diameter.

Girdle facets. The triangular facets that adjoin the girdle of a brilliant cut gemstone. Those on the crown may also be called upper girdle, upper break, top break or top half facets; those on the pavilion, lower girdle, lower break, bottom break or bottom half facets. They are also called halves. Sometimes used for the small facets placed on the girdle. See also Break facets.

Girdle line. An imaginary line drawn on the girdle to indicate the depth of the crown facets.

Girdle outline. The form delineated by the girdle edge of a gemstone (i.e., the shape of a gemstone seen face-up).

Girdle plane. The imaginary plane that passes through the girdle of a gemstone—theoretically parallel to the table and the culet—that separates the crown from the pavilion.

Girdle reflection. The image of the girdle reflected in the pavilion facets of a brilliant cut gemstone.

Girdle thickness. The dimension of the outer edge of a fashioned gemstone measured between the upper and lower girdle facets.

Half facets or halves. See Break facets or Girdle facets.

Knife-edge girdle. An extremely thin girdle on a polished gemstone that is often highly susceptible to physical damage.

Life. The combined optical effect of brilliance, fire and scintillation in a polished gemstone.

Lower girdle facets. See Break facets or Girdle facets.

Lower half facets. See Break facets or Girdle facets.

Main facets. General term for the large four-sided, kite-shaped crown and pavilion facets on a brilliant cut polished gemstone. Strictly speaking, only the first four of these facets to be polished are considered "mains."

Make. The term used to describe the relative quality of the proportions and finish of a polished gemstone.

Modified brilliant cut. A cut based on the round brilliant, with either more or fewer facets than the standard 58 (or 57), or a varied facet arrangement from the standard round brilliant.

Off-center (ecentric) culet. A culet that is not centered in relation to the girdle outline.

Off-center (ecentric) table. A table that is not centered in relation to the girdle outline; caused by polishing opposing crown facets at different angles or opposing bezel facets of different sizes. An off-center table may also be inclined in relation to the girdle plane.

Open culet. A large culet, usually visible to the unaided eye through the table.

Out-of-round diamond. A round-shaped diamond that does not truly have a circular girdle outline; it may vary from slightly oval to squarish.

Pattern. See Scintillation.

Pavilion. The portion of a polished gemstone below the girdle; sometimes called the base. Also one of a set of four facets below the crown mains referred to during the blocking procedure.

Pavilion angle. The angle between the girdle plane and the pavilion main facets.

Pavilion depth percentage. The distance from the girdle plane to the culet, expressed as a percentage of the average girdle diameter on a round brilliant, and as a percentage of the width of a fancy shape.

Pavilion facets. The facets on the pavilion of a polished gemstone; often, the pavilion main facets.

Pavilion main facets. The large kite-shaped facets that extend from the girdle to the culet on a brilliant cut polished gemstone. Sometimes called "quoin" or bottom-corner facets on round brilliants; strictly speaking, only the first four of these facets are called mains or quoins.

Polish. The quality of the diamond's surface condition as a result of the polishing process or blemishes created after the cutting process (often referred to as wear and tear).

Polished girdle. A girdle that has been finished to a smooth surface (not to be confused with a faceted girdle).

Proportion grading. The process in which the make, or cut, of a polished gemstone is evaluated through an analysis of its proportions.

Proportions. The dimensions and angles of the facets on a polished gemstone relative to its diameter or width, and the relationships between them.

ProportionScope™. A commercial instrument used to analyze the proportions of a brilliant cut diamond by projecting its silhouette onto a calibrated screen.

Ray-tracing. The act of calculating and mapping the path of light rays as they travel through a transparent medium (such as a diamond). Initially accomplished by hand-drawing measured lines on paper, ray-tracing is now often accomplished using computers.

Rough girdle. Irregular, pitted or granular girdle surface that results when the surface is rounded up or bruted too quickly.

Round brilliant cut. A diamond polished into a round shape with brilliant cut faceting style; sometimes abbreviated as RBC.

Scintillation. A quality of a polished gem that includes these components:

- **Sparkle** – the spots of light in a polished diamond that flash as the diamond, observer or lighting moves.
- **Pattern** – the size and arrangement of light and dark areas that are a result of internal and external reflections. The relief of light and dark areas creates the face-up pattern of a diamond.

Besides the gemstone's inherent optical properties, scintillation depends on the number, placement and size of the facets; the precision of the facet angles; and the quality of the polish.

Shallow crown angle. A small crown angle that may make a polished gemstone with a thin girdle more susceptible to chipping at the girdle.

Shallow diamond. A diamond with a total depth of less than 57 percent, which often causes increased light leakage and loss of brilliance; such a diamond may show a fisheye.

Shallow pavilion. A pavilion depth considerably less than 40 percent, often causing increased light leakage and loss of brilliance. Among other faults, shallow pavilions can cause internal reflections of the girdle—called fisheyes—that are sometimes visible through the table.

Shape. The face-up girdle outline of a polished gemstone, such as round, pear, marquise, heart, oval or square.

Spread stone. A polished diamond with a shallow crown or pavilion, or both, and a large table. Spread stones sometimes display fisheyes.

Standard round brilliant. A round brilliant cut, the shape of which was originally based on the octahedron. It has 57 or 58 facets; a table, 8 bezel facets, 8 star facets and 16 upper girdle facets on the crown; and 8 pavilion main facets and 16 lower girdle facets on the pavilion. It may or may not have a culet facet on the pavilion. Girdle surfaces are faceted or bruted. Even if the girdle is faceted, this shape is still described as having 57 or 58 facets.

Star facets. Small triangular facets lying next to and surrounding the table facet on a brilliant cut polished gemstone.

Step cuts. A group of faceting styles characterized by fairly long and narrow trapezoidal facets on the crown and pavilion.

Symmetry. A grading term for the exactness of shape, placement and alignment of facets on a polished gemstone. In more general terms, an object with symmetry can be separated into two or more parts that are equal, or can be related by a given transformation.

Table. The large facet in the center of the crown of a polished gemstone, generally parallel to the girdle plane.

Table diameter. On a round brilliant cut gemstone, the distance between any two opposing corners of the table, usually expressed in millimeters. On fancy cuts, the distance between table corners measured across the width of the diamond. On an emerald cut, the width of the table measured across its narrowest direction.

Table measurement. The dimension of a polished gemstone's table diameter, measured directly, normally using a table gauge or a non-contact optical measuring instrument.

Table percentage. For round brilliant cuts, the size of the table expressed as a percentage of the average girdle diameter; determined by dividing the largest table diameter by the average girdle diameter. On fancy cuts, the size of the table expressed as a percentage of the narrowest girdle diameter or width; determined by dividing the width of the table by the width of the girdle.

Table reflection. The reflection of the table facet seen in the pavilion facets of a round brilliant cut polished gemstone. The apparent size of the table reflection depends on the crown height and the pavilion depth.

Thick crown. A crown height noticeably greater than 16.2 percent of the average girdle diameter; usually seen in older cuts.

Thick girdle. A girdle obvious to the unaided eye and thicker than is needed to prevent chipping. Often used to add unnecessary weight to a polished diamond.

Thin crown. A crown height noticeably less than 10 percent of the average girdle diameter; commonly seen in spread stones.

Tilt. The degree to which a diamond or other gemstone is angled away from a perpendicular face-up view; often used to evaluate a gemstone's appearance aspects.

Total depth percentage. The depth from table to culet, expressed as a percentage of the average girdle diameter in round brilliant cuts; and as a percentage of the girdle width in fancy cuts.

Upper girdle facets. See Break facets or Girdle facets.

Upper half facets. See Break facets or Girdle facets.

Wavy girdle. A girdle that does not remain parallel to a single plane.

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Index

About the Author

Al Gilbertson has had a notable career in the gem and jewelry industry for more than 30 years. He began cutting gemstones as a youngster in his father's lapidary business in Tehachapi, California. He was later employed as a custom gem cutter for an American Gem Society (AGS) fine jewelry store, where he completed the GIA courses to become a Graduate Gemologist.

Gilbertson went on to earn the title of Certified Gemologist Appraiser from the American Gem Society, and was one of the first Independent Certified Gemologist Appraisers in the country, operating a highly respected jewelry appraisal firm that provided services to more than 50 jewelry stores in the Pacific Northwest. He is a noted speaker for national jewelry and appraisal associations and the published author of numerous articles related to the jewelry and appraisal business.

A member of the GIA Research Department, Gilbertson is part of the team that developed the GIA Cut Grading System for round brilliant diamonds introduced in 2006. He and his associates continue to research the visual aspects of diamond appearance and identify methods to quantify those aspects for other diamond shapes and cutting designs.

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