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A Solution To Diamond Color Grading Problems*

by

ROBERT M. SHIPLEY AND R. T. LIDDICOAT

For generations two important problems have faced the men who grade diamonds. They are, first, an accurate method of imperfection detection, and, second, the accurate determination of the slight color nuances present in the gems. Research conducted at the Los Angeles laboratory of the Gemological Institute of America brought about the introduction to the trade some time ago of the Diamondscope, which has effectively solved the problem of accurate imperfection detection.

Continued research on the part of the Robert Shipleys, Senior and Junior, brought about the recent introduction of a uniform diamond-grading lamp and of a method of grading diamond colors against a standard in the form of a definitely set and constant scale, as incorporated in the new G.I.A. Colorimeter. This is the first time a color-grading "yardstick" has been established.

The presence, or absence, of imperfections plays an important role in the evaluation of diamonds, but imperfection detection does not offer as great a problem as the determination of color grades. To persons inexperienced in color grading, most of the gem variety diamonds appear colorless, and many of them slightly bluish. This is particularly true when the gem is observed "table up" under bright daylight and certain types of direct artificial light. However, when their body color is examined under the exacting conditions of the laboratory, some are colorless, but the vast majority are found to contain varying intensities of yellow. An occasional diamond possesses a blue body tint, but if so, it should probably be considered a "fancy" and command a high price.

There are several difficulties that confront the diamond expert when he attempts to reach a decision in regard to the color grade of a stone. Federal Trade Commission fair-trade-practice rules in the United States and the rulings established by the American Gem Society in both the United States and Canada require that the color of the stone be graded entirely on the basis of its body color. Even to the most experienced diamond man, without specially designed scientific aids there are many factors that have made this difficult.

Need for Constant and Controlled Light Source and Environment

The problems that face diamond color graders that could, in part at least, be solved by a standardization of grading conditions, were summed up by Robert M. Shipley as follows:

*A.G.S. Research Service.

"Diamond has a very high dispersive power, and as a result flashes of the various colors of the spectrum continually strike the eye, the predominance of any one of which seriously influences the decision of the grader.

"A second difficulty is caused by direct reflections from the mirror-like surfaces of the diamond of the source of the light that is falling upon the stone. These reflections both obscure the body color and cause confusion between the color of the reflections and the true body color of the stone. When the stone is being observed table-up, this problem is increased.

"A third important problem is presented by the examination of the stone under too bright lighting conditions. Here the extreme brilliancy of the light, even when reflected from inside the facets of the pavilion, tends to prevail over the true body color.

"Fourth, light reflected into the diamond from surrounding objects, from the walls of the room, the walls of the nearby buildings, yellowish and brownish store fixtures, and also from the blue of the sky, is another source of error to the diamond man. Reflections from buildings, walls, or fixtures usually make the diamond appear more yellowish or brownish, and reflections from the blue sky more bluish (because of the reflection of the blue sky from the mirror-like surface of the diamond). Stones graded too close to a door or window often reflect the color of the sky resulting in incorrect decisions as to their true color.

"Fifth, one of the most important causes of the anomalies that so often trouble a diamond grader is the change of color shown by many fluorescent stones when viewed under different light conditions. Often a fluorescent diamond which appears slightly yellowish under artificial light appears distinctly bluish in daylight. Many fluorescent diamonds even vary in interior daylight, depending upon the amount of ultra-violet light which has been filtered out by the glass of the windows and doors. Such diamonds are more bluish near an open window.

"Sixth, daylight itself varies so markedly from one part of the day to another, as well as one time of the year to another, that many graders are led astray. There is a concentration of light of the wave lengths at one end of the spectrum during certain times of the day, and the other end at other times. Also, different qualities of light are found on sunny and cloudy days. The red and yellow glow at sunrise and sunset affects color. Smoke and dust in the atmosphere tend to make daylight more yellowish.

"Seventh, nearly as important as variations in quality of daylight are the variations in quality found in various types of artificial light used in color grading. Some graders use frosted bulbs, others use fluorescent light, a third common method of grading is to use a light with a blue filter, still a fourth man might use a frosted blue bulb, and a fifth a common bulb with a blue reflector. Even by the most experienced of diamond graders, the varying qualities of the artificial lights mentioned affect greatly the color grade determination."

It was in an effort to solve the many problems here set forth that the research was carried forward in the G.I.A. laboratory which lead to the perfection of the new Diamolite. The instrument satisfies the need for ideal grading conditions by establishing a constant and controlled light source and environment.

The Diamolite

The Diamolite (Figs. 1 and 2) affords a light source as closely approximating daylight as possible. In addition, it controls the intensity of the light and the direction from which light falls upon the stone, preventing unwanted and falsifying reflections. The overabundance of the long rays of the spectrum, counterbalanced by a special blue filter, give, as a result, a light that lacks only the ultra-violet rays of daylight.

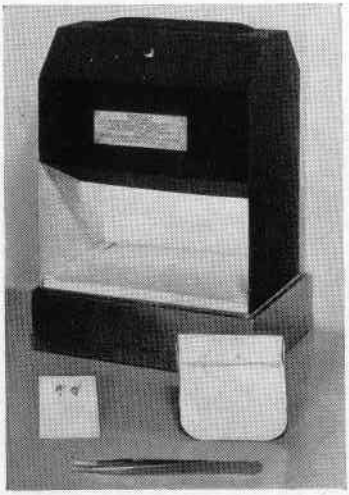

Figure 1
The new G.I.A. Diamolite

Figure 2
Grading a group of stones on the Diamolite

Filters are made to exact specifications so that all light given is the same quality. A dull-white finish on the interior diffuses the light, also preventing unwanted reflections. To be conveniently used in a retail store the instrument is made as small and compact as possible.

In general, the Diamolite accomplishes three objectives:

(1) It establishes a constant light source.

(2) The light source is controlled as to the direction in which it falls as well as to the amount of diffusion it undergoes before striking the stone.

(3) The environment for grading is also controlled, because reflection is completely cut out from all directions except from the front lower portion of the instrument, and this direction can be easily controlled.

By accomplishing the first objective (a constant light source) the Diamolite eliminates the fifth, sixth, and seventh problems of the seven

mentioned that confronted the diamond grader. The fifth problem is solved because a fluorescent stone will grade approximately the same in any Diamolite and, therefore, is not subject to variations of color as when observed in different types of daylight. The constancy of the light source also solves the sixth and seventh problems caused by variations in light sources.

The second objective (controlled light) solves the first, second and third problems. Control of the light source prevents the old trouble due to flashes of fire as well as the difficulties caused by direct reflections of the light source. In the same manner, control of the light source prevents too intense a light from falling upon the stone.

The third objective (controlled environment) solves one of the most troublesome of problems confronting the diamond grader—that listed as the fourth problem—which refers to the anomalies arising from surface reflections of surroundings.

Thus it is easily seen that the establishment of the Diamolite enables the diamond grader to work without being troubled by most of the problems that have so long made for poor diamond grading.

The Need for a Color "Yardstick"

The Diamolite was introduced to bring about the solution of the problems of ideal grading conditions. Even when using a Diamolite, a further difficulty presents itself to the jeweler grading a paper of diamonds. In most cases the jeweler grades a group of stones relative to one another, arriving at their order from best to poorest as he sees it under the lights he is using. One paper of stones may be confined in color to only one or two grades. Another may be evenly distributed over the whole color range. A third may have a concentration of stones in the better or poorer colors. Patently, it is difficult under such conditions to keep the grades used constant. The only available means by which the jeweler can maintain the constancy of the grades he sells is to maintain a series of key stones established for comparison of diamond color nuances and to keep the series intact. Even with the key stones, most jewelers have no idea of how their series of comparison stones compares with that of other jewelers. Even if his best grade corresponds closely with that of a competitor, the other grades used probably differ markedly from those of other diamond men. Even if such a series has been maintained, no substitution has been practical as the substitute diamond may possess anomalies which would change the relationship of the stones in the series. As a result, the jeweler's business may be suffering either from criticism by competitors of stones he has sold, or he may be paying higher prices for his grades than are being paid by competitors. In addition, he may be classifying his diamonds in one of the widely used systems for which no standard exists, such as River, Wesselton, etc., or blue-white, white, etc. Many persons in the trade have urged the discontinuance of these trade terms because their definitions now vary widely and to redefine them and obtain the co-operation necessary to establish them as a standard would probably be impossible.

Until the jeweler knows exactly the position of each of his key stones in relation to some fixed standard (i.e., in relation to the units of a standard "yardstick"), he has no accurate method of grading new stones that come to him. Upon consideration of these problems it becomes evident that the solution must lie in a definite and constant standard by which diamonds can be graded with great accuracy. Nine years of research in the G.I.A. laboratory has finally borne fruit with the introduction to the trade of the new G.I.A. Colorimeter and its use as a diamond yardstick for A.G.S. members, which was authorized by the A.G.S. at their 1941 annual conclaves.

The Colorimeter

The Colorimeter (Figs. 3 and 4) consists of an indirect light source illuminating two trays placed side by side, in one of which a diamond is placed. Above the tray is a colored wedge that is just out of focus in the field. The "yardstick," or scale, is attached to the color wedge used for comparison and the divisions marked on the scale make it possible to read exactly the movements (controlled by an external rack and pinion) of the wedge within the instrument. The microscopic attachment shows a divided field bringing the two troughs into focus so that they are in juxtaposition, one on each side of the field. When looking through the eyepiece, the scale is moved in and out until the color of the wedge matches exactly the color of the diamond.

Figure 4
R. T. Liddicoat grading with the Colorimeter

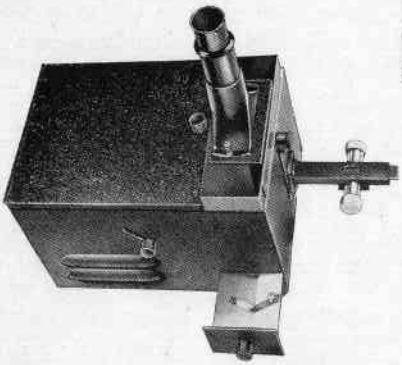

Figure 3
The new G.I.A. Colorimeter

The scale, or "yardstick" of the Colorimeter is of considerable importance because it is one of the key points of the new system. Following the recommendations of the Diamond Importers' Advisory Group of the American Gem Society's International Nomenclature Committee, the use of terms to indicate color grades is avoided. In grading stones on the Colorimeter a system of symbols was adopted which corresponds to the diamond grades on the "yardstick." The scale is divided into seven equal parts between zero and six. These

are further separated by half-division marks. The scale may be said to cover the same terms as were covered by grades from River (colorless) to yellow. The half-division of the scale above zero is absolutely colorless. A *very* slight tinge of color appears in the next half-division. V nearly corresponds to what some diamond men call a Cape; others a Top Cape. This is a very rough comparison, for in general the grades between 0 and VI are not comparable to the old terms as the new divisions are simply mechanical. Between each one of the seven divisions is a half mark, thus recording twelve color grades between the faintest blue and yellow. The instrument also grades quarter divisions (not marked on the scale).

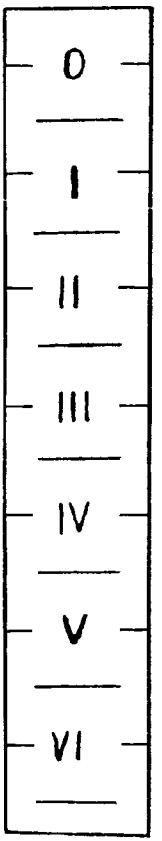

Figure 5
The "yardstick"

The 1941 Conclaves of the American Gem Society recommended the use of the Colorimeter scale as the standard, and the Gemological Institute is now grading a series of key or master stones for A.G.S. members which they will use as comparators in grading their diamonds, but no member will be allowed to sell key stones as having been graded by the American Gem Society. Using stones graded on the G.I.A. Colorimeter as key comparison stones in connection with the Diamolite, the diamond man can determine grades down to at least the half division. Unlike the infrequently used key series of the past, any stone sold from a key series graded on the Colorimeter may be replaced by a stone of the exact color.

It will be noticed on the scale (Fig. 5) that the zero division could be considered to extend to I and the next division from I to II. Working on this idea, the following symbols can be envisioned. Suppose the stone was in a position on the scale equal to the half mark between one and two. This can be marked by the symbol +, which is, of course, the symbol "one" crossed in the middle by a dash. Thus, verbally, the symbols would mean nothing to a customer, but among A.G.S. members could be called "line one dash" instead of grade one and a half, thus avoiding the use of a numeral. When grading on the Colorimeter, if the stone is found to be approximately between + and II (one and a half and two) which would be one and three-quarters, it could be marked in this manner, ‡. Similar markings could be followed on each of the other divisions. This system of symbols has been adopted and is being applied to the diamond papers in the series of master (key) stones now being graded by the G.I.A. on its Colorimeter for A.G.S. members.

Thus, the problem of the relative color of the grades seems to have been largely solved for the jeweler who has a series of key stones graded on the "yardstick" and who does all of his own color grading under the constant light of the Diamolite.

An International Standard Established

Now, for the first time, a standard for the color grading of diamonds has been established in the United States and Canada. Two A.G.S. members who have had identical series of master stones graded on the Colorimeter, and who use them as comparators when grading in the Diamolite, are, in effect, comparing their purchases against the same master stones, under the same light, and in the same room!

ARKANSAS DIAMOND MINE CHANGES HANDS

The Arkansas Diamond Corporation sold its "pipe" mine in Pike County to a Chicago syndicate. The increased demand for industrial diamonds, together with the high wartime prices, has evidently led the buyers to the belief that development on a commercial basis may soon be possible.

ANDERSON'S THEORY OF THE CAUSE OF SILK SUPPORTED

The latest report on the silk in corundum adds weight to B. W. Anderson's findings that indicated the cause to be rutile. Conclusions drawn by Lala Penha, C.G., in an address given in March, 1941, before the Eastern Conclaves of the A.G.S. and later appearing in the September, 1941, issue of *Jewelers Circular Keystone* show that her findings lend support to those of Anderson.