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OF GREAT BRITAIN
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SOME DIAMOND PROBLEMS

By R. WEBSTER, F.G.A.

OF all the gems with which the jeweller trades, and which the public so greatly appreciate, diamond has supreme importance. It is the gemstone which forms the greater part of a jeweller's stock and is the stone which he understands best. Indeed, unless there is something unusual with regard to a specimen, diamond presents little trouble in identification. In this short article something will be told of those diamonds which show anomalous appearance and thus give rise to doubt.

A cut diamond owes its brilliance, fire and characteristic adamantine lustre to its high index of refraction (2·42), coupled with the exceptional hardness of the mineral, which surpasses all other natural and synthetic substances (except perhaps the synthetic compound borazon, boron nitride). This superior hardness, which allows a perfect polish, coupled with the high index of refraction, results in the brilliancy and lustre of the gem. The high refractive index of diamond means that the critical angle is small, when the second medium is air, and is about 24½° for yellow light. Hence, as shown by the diagram (Fig. 1), in a well-made brilliant-cut diamond practically all the incident light falling on the crown (top facets) of the diamond will be returned by total internal reflection and refracted out again through the front of the stone.

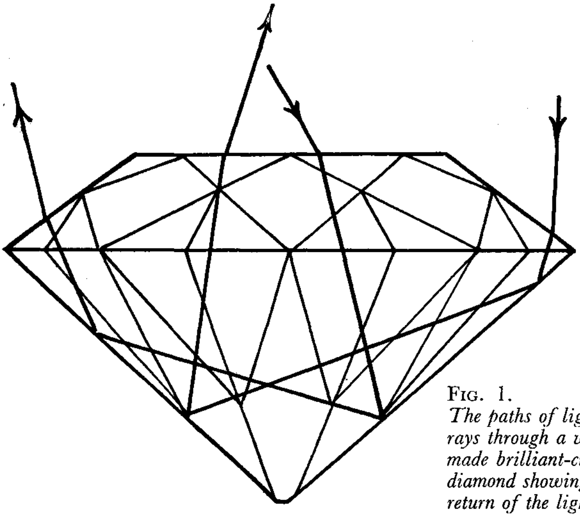

FIG. 1.
The paths of light rays through a well-made brilliant-cut diamond showing the return of the light out through the top facets.

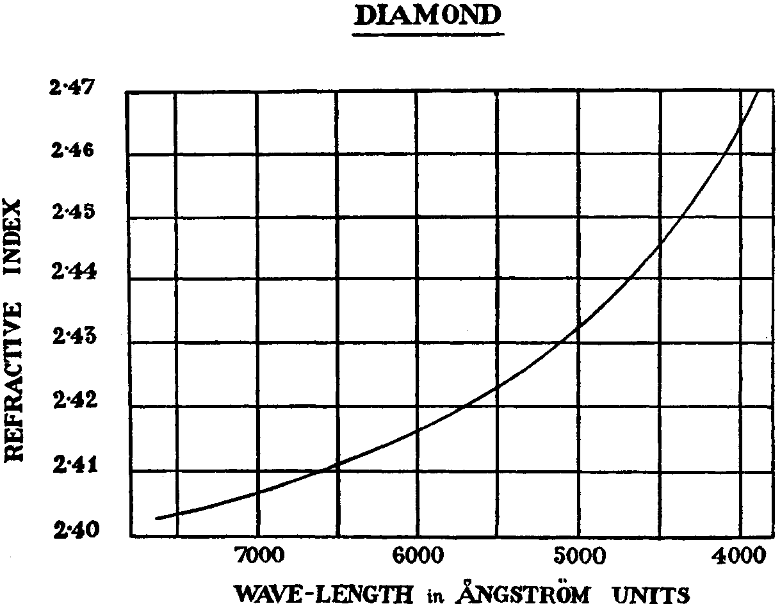

FIG. 2. *Curve showing the refractive index to wavelengths of light in respect of diamond.*
Taken from *Gemstones* by G. F. Herbert Smith, by courtesy Methuen & Co, Ltd.

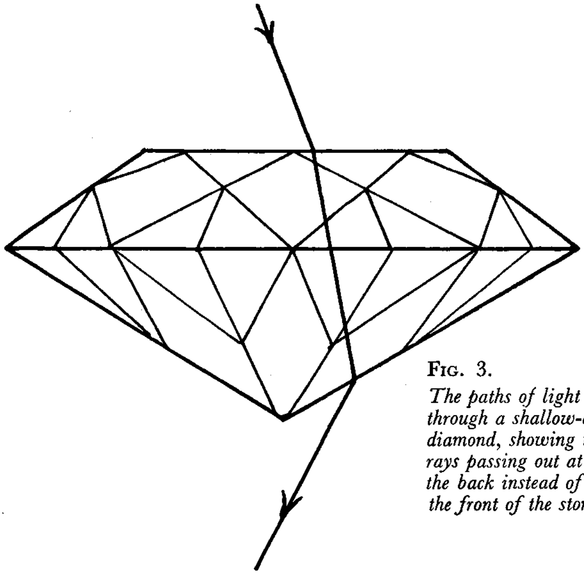

FIG. 3.
The paths of light through a shallow-cut diamond, showing the rays passing out at the back instead of the front of the stone.

Further, as the refractive index differs for light of different wavelengths (colours), as shown by the graph in Fig. 2, white light will be split up into its component colours, and, owing to the long path of the light rays passing through the stone twice, the rays will be all the more dispersed. It is this colour dispersion which constitutes the fire of a stone and this effect is well seen in diamond.

The more common causes of a diamond " looking wrong " are that the stone is cut with incorrect proportions or has an unusual tinge of colour. A diamond which is cut without sufficient depth for the spread of the stone gives a so-called " fish-eye " effect. Such diamonds are often called " laxey," a term probably derived from *lasques,* the name applied to the flat tablets into which many Indian diamonds were cut. Shallow-cut diamonds, owing to the angle of the crown and the rear facets not being at the correct inclination to totally reflect the rays out through the front, lose much of the light and the brilliancy suffers (Fig. 3). If a diamond is cut too thick the stone is said to be " lumpy," and again the optical effects are not at their optimum for the production of full brilliancy, although such stones do not appear to lose the diamond appearance so much as flat stones (Fig. 4). Such thick cutting, probably done to conserve weight in the finished stone, was common in earlier days and diamonds so cut are often called " Brazilian stones," for before 1866 most of the gem diamonds came from Brazil.

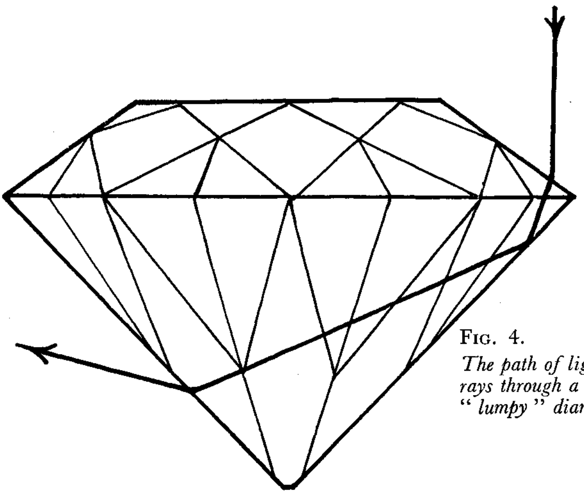

FIG. 4.
The path of light rays through a "lumpy" diamond.

A diamond full of dust-like inclusions may appear cloudy or milky and such stones may engender doubt. Further, a diamond which has been accidentally burnt will show a ground-glass effect on the surface of the facets, and when magnified this surface may be seen to be made up of pits, which take the form of the crystal face nearest to which the facet is parallel.

Colour in diamonds may be divided into two groups, diamonds which have a pronounced and pleasant colour, such as pink, blue, canary yellow, and green, termed fancy diamonds, and diamonds which have only a tinge of colour or an unpleasant brownish shade. In some cases these stones can look wrong, and this is especially so with those diamonds which have a peculiar blackish look. The causes of colour in diamond are not known with certainty. Except for the pink stones, in which the colour is said to be due to a trace of manganese, the colour in diamonds is thought to be due to lattice defects, and not to trace-impurities as in most other gemstones.

Quite often ill-made diamonds or those of unusual tint, which inspire doubt as to their being diamonds, may be confirmed as diamonds by the presence of *naturals* on the raw edge (the unpolished edge) of the girdle. These are traces of the original faces of the crystal and are often purposely left on by the cutter, either to enable him to recognize the grain of the stone, or to show the owner of the crystal that he has not cut away too much of the crystal in making the finished stone. Fig. 5 shows such a natural. Further,

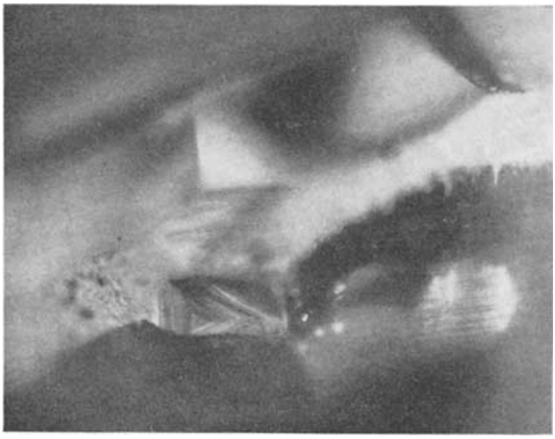

FIG. 5.
A " natural " on the edge of a brilliant cut diamond.

in the case of diamond a hardness test is applicable and is most useful. To do this the stone should be tested by applying the girdle of the stone to a piece of corundum (a piece of corundum boule or an old synthetic ruby or sapphire makes a good test plate) and examining the scratch mark, after rubbing any powder away, with a lens to see if the corundum has been scratched or not. A scratch on the corundum surface indicates that the stone tested is a diamond, except for the very rare case when a cut carborundum is encountered. A stone should not be tested by applying the test piece of corundum, for, if the stone does not happen to be a diamond, it will be badly marked.

Unpleasing brownish and yellowish diamonds are called " off-colour " stones and are less highly prized. It is such stones which are treated with dye to improve the colour for fraudulent purposes. Before 1890 yellowish Cape diamonds, which had been "whitened," were sold to Belgian and French diamond dealers at some 25 to 30 per cent above their market value. In 1891 M. Gilot (or Guillot) a French chemist, investigated this whitening of diamonds. Starting on the scientific principle that violet is the complementary colour of yellow, he bathed some yellowish diamonds in an alcoholic solution of violet aniline, to which were added a few grams of benzoin gum. This whitened the diamonds, but the treated stones lost their fire to a great extent. Gilot found, however, that if aniline solution was used alone, the brilliancy and fire were not impaired to a great extent.

Periodically " painted " stones treated with aniline dye solution—usually water coloured mauve with a copying-ink pencil —have been sold to unwary jewellers. As, usually, a water-soluble dye is used, a thorough washing of a suspected painted stone will remove the dye and reveal the true colour of the stone. There have been instances, however, where the dye has been more tenacious and has resisted ordinary washing. In such cases washing in alcohol, or in extreme cases with nitric acid (*aqua fortis*) with subsequent washing in water, will be necessary to remove the dye and show up the true colour of the diamond. Should a tinted lacquer, such as used for nail varnish, be used, acetone or amyl acetate might be the best solvent for the coating.

During the past twelve months a warning has been issued by the Jewellers' Vigilance Committee in the United States of America that diamonds have been whitened by a new coating process, which is only removable by treatment with strong acids. What method of coating is being used here to counteract the yellowish colour has not yet been disclosed. One could surmise that a sputtering technique resembling that used for coating stones to give a greater brilliancy, which is analogous to the "blooming" of camera and field-glass lenses, may be the method used.

Examination of the girdle of a suspected " painted " diamond by a hand lens may show up traces of the dye clinging to the unpolished edge and give away the faking. It should be realized that only off-coloured yellowish or maybe pale brownish diamonds will be colour-corrected by the use of violet dye. The painting of greyish stones by such a dye will be ineffective, for this colour correction is based upon the use of a complementary colour.

One of the more dangerous fakes of diamond is the diamond doublet. This composite stone is made with a crown of real diamond which is cemented on to a pavilion of some other inferior colourless material, which may be rock crystal, colourless topaz, synthetic white sapphire or spinel, or glass. Fig. 6 illustrates the construction of a diamond doublet. Diamond doublets, owing to the adamantine lustre of the diamond crown, might well be taken for a genuine diamond if only casual observation be made. However, identification is not difficult, for on looking into the stone it is seen to be lifeless and lacking in fire ; the optical effects appear wrong. Owing to the light rays striking the back facets at a smaller

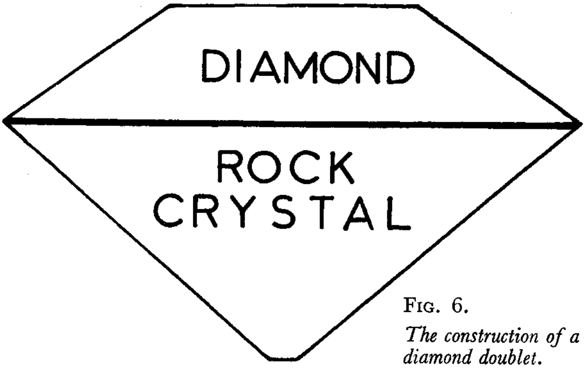

FIG. 6.
The construction of a diamond doublet.

The base need not be rock crystal but may be any inferior colourless stone.

angle than the critical angle for the medium—the critical angles for the inferior materials used for the base are greater than for diamond itself—much of the light will be refracted out through the back and not returned to the front by total internal reflection.

As the cement used to join the two pieces of material together in these diamond doublets, which is probably Canada balsam, deteriorates with age and forms white " feathery inclusions " in the cement layer, these, and " Newton's rings," circularly arranged coloured rings, due to air films between the cement and the stone, may be seen near the edge of the girdle.

What may be the best test is given by the reflection of the edge of the table facet on the cement layer, which shows up as a dark shadow edge when the top of the stone is inclined away from the observer and the stone is held between the source of light and the observer (Fig. 7). If the stone is unset, detection is easy, for not only may the line of joining be seen but a refractive index measurement may be made on the rear facets, which will at once tell the nature of the inferior base material of this composite stone.

The artificial coloration of diamond has attained some commercial importance, owing to the colouring effect produced when the stone is bombarded with particles of sub-atomic size. The production of a green colour in diamond by bombardment with radioactive particles from radium compounds has been known since early in the present century. With the advance of atomic science since the Second World War other methods of colouring diamonds

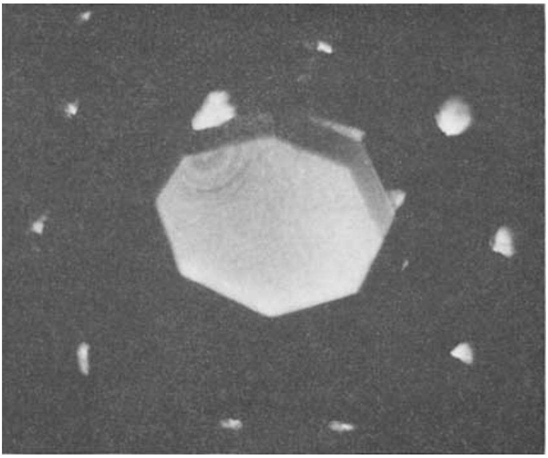

FIG. 7.
The shadow of the edge of the table facet on the cement layer, and Newton's rings, in a diamond doublet.

by particle-bombardment, using modern high-voltage particle-accelerators, have led to some commercialization of artificially coloured diamonds.

Sir William Crookes, as early as 1904, carried out a number of experiments on the action of radium on diamond and found that alpha-particles (i.e. Helium nuclei), which are emitted from radium, caused the diamonds gradually to change to a green colour. Crookes also found that such greened diamonds became radio-active, and that the radio-activity, like the colour, persisted for an indefinite number of years. He also found that vigorous chemical treatment had no effect, or only a temporary one, on the radio-activity and had none on the colour. Repolishing the stone did remove the colour, which is therefore only skin-deep.

S. C. Lind and D. C. Bardwell showed that heating such greened diamonds to a dull red heat (about 450°C) for several hours had the effect of destroying the colour and the radio-activity, and, further, they found that the gas radon (radium emanation) acted more quickly than the salts of radium itself in inducing a green colour in diamond.

Radium and radium compounds are expensive and are dangerous chemicals to handle, so that facilities for the green colouring of diamonds are not easily available. Still, there are a number of radium-greened diamonds known to be on the market. Their detection is, however, easy, for leaving the diamond in contact with a bare photographic film or plate overnight in a light-tight box will cause a marked blackening of the emulsion on development of the film (or plate), the resultant autoradiograph showing the shape of the stone and a curious echo of the facet pattern beyond the borders of the stone (Fig. 8). Heavily treated diamonds may even glow in the dark, and scintillations may be seen when a radioactive diamond is placed on a zinc sulphide screen in a dark room, and the screen near the stone examined with a lens after the eye has become dark-adapted. These scintillations, each tiny splash of light representing the effects of one alpha-particle striking the screen, make a very beautiful and impressive sight. A radium-treated diamond will also discharge an electroscope in a few minutes, and this, except for a Geiger counter, provides the speediest and most sensitive test for such diamonds.

Experiments have shown that the radio-activity of a radium-greened diamond does not consist entirely of alpha-particles, but that the stones also emit some beta-particles (electrons). There is also the question of the physiological danger in wearing such a radium-treated diamond. Experiments using a Geiger counter have shown that the danger cannot be great, for the radiation given off was found to be no greater than that emitted by the radium on the dial of a luminous wrist watch.

The first of the post-war experiments in the artificial coloration of diamond was by the use of a cyclotron, and in the United States of America diamonds so treated have become an established feature in North American commerce. Cyclotroned diamonds are coloured by bombardment with fast moving protons (nucleus of the hydrogen

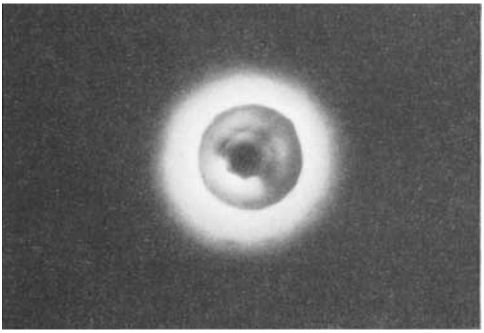

FIG. 8.
An autoradiograph of a radium-treated "greened" diamond.

atom with unit positive electrical charge), by deuterons (the nucleus of deuterium, the isotope of heavy hydrogen), and by alpha-particles. The colour produced is, like radium-treated diamonds, a green colour, or, if over-exposed, a black colour.

For treatment the diamonds are mounted on a long probe which is mounted in the vacuum chamber of the cyclotron (in some types of apparatus), or on special holders, usually made of aluminium, for those cyclotrons which can produce external beams. The heat generated when the atomic particles hit the target, in this case the diamonds and the holder, is intense and some means of cooling must be used. The probe or holder is usually water-cooled and further cooling is carried out by a jet of liquid helium. If the cooling is not efficient and the stone heats, the resulting colour produced in the diamond is brown and not green, and, further, cyclotroned-green diamonds may be turned to a golden-brown or to a yellow colour by subsequent heat treatment at about 800°C. In the short exposures used the coloration is only skin-deep and disappears on re-cutting. In all cases, whatever the type of particle used, bombarded diamonds are intensely radio-active for some hours after treatment, but this does not persist and dies out, and the stones cease to be radio-active. The colour, however, remains, and, as far as yet can be said, the colour is permanent.

A careful examination of cyclotroned stones will reveal a series of reflections of triangular cubist patterns that show varying intensity of green. A stone which has been treated through the table will, when examined with the pavilion up, show a dark ring around the girdle. A diamond treated through the pavilion will show a light ring around the girdle, and will show, when viewed through the table facet, a "watermark" rather like an opened umbrella surrounding the culet (Fig. 9). It is said that by irradiating the diamond through the side these tell-tale markings can be eliminated. In such a case the only distinction is by the unnatural green colour, which is rather a deep tourmaline green. With the brown colours, as G. R. Crowningshield has pointed out, there is always a narrow absorption line at 5920Å in the treated yellow and brown stones, whereas this line is absent in natural brown and yellow diamonds. It has been further reported that irradiated diamonds of a brownish-pink colour show absorption lines at 6370Å and a pair of lines at 6200 and 6100Å in conjunction with the 5920Å line.

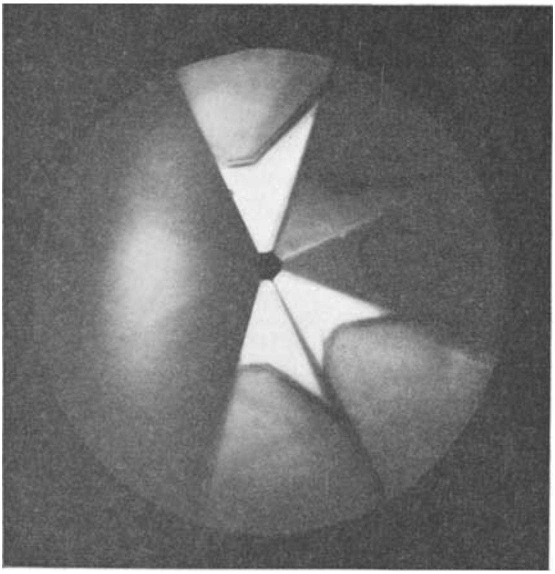

FIG. 9.
The " umbrella " seen around the culet in some cyclotroned diamonds.

A similar state of affairs occurs when the diamonds are treated in an atomic reactor (atomic pile) in which neutrons (the uncharged particles found in the nuclei of all atoms except those of hydrogen) are the particles used. The colours produced are, like those of cyclotronic coloration, green, brown and yellow, the brown and yellow colours being obtained after subsequent heat treatment. The diamonds when they come from the pile are green in colour and are intensely radio-active. The radio-activity quickly dies out, and by subsequent controlled heat treatment any of the colours named may be obtained. In pile-treated stones the coloration is throughout the stone and hence cannot be removed by polishing. There are no characteristic markings to be seen in pile-treated diamonds and with the green-coloured stones the unnatural colour is virtually the sole guide, but with the brown stones, and the yellows, the 5920Å absorption line is present and gives conclusive evidence of treatment.

By the use of fast-moving electrons from an accelerator, such as a Van de Graaf generator, diamonds have been coloured a pale aquamarine blue to a greenish-blue hue. Such stones are not easy to detect, but the treatment is not extensively carried out. It is known that all natural blue diamonds are Type 2, a type which is transparent much further down in the ultra-violet than are the Cape stones, which are normally used for coloration experiments, and, further, the natural blue diamonds are electro-conducting. Therefore, if it can be proved that a blue diamond conducts electricity and is transparent to ultra-violet light to, say, 2200Å, then the stone can be taken as a naturally coloured one. Such determinations need laboratory apparatus and techniques. Bombardment with gamma rays will also produce a bluish-green colour, but this method is not commonly used.

All colourless stones might be said to simulate diamond, but to approach in any way the appearance of diamond such colourless stones must be somewhat similar in lustre and fire, and this limits the possibles to some half a dozen stones. The stone most commonly used to simulate gem diamond, fraudulently or otherwise, is the heat-treated colourless zircon. White zircon has a high index of refraction, a resinous-adamantine lustre and a dispersion (fire) nearly as great as that of diamond itself. Unlike diamond, zircon is a doubly-refractive mineral, and, further, is so strongly doubly-refractive that the rear facet edges as seen through the thickness of the stone appear doubled, an effect which can be clearly seen with a 10x lens (Fig. 10).

It must be realized, however, that zircon is a tetragonal mineral and thus has one optic axis, that is one direction along which light rays do not split into two rays. At a position at right angles to this direction of single refraction there is a direction where the full double refraction may be seen and hence the widest separation of the two images of the facet edges. Therefore, the doubling of the rear facet edges of a cut zircon may not necessarily be seen through the table facet, but may appear strongest when the stone is examined through the side. This doubly-refractive effect, which tends to give zircons a misty look, is so clearly evident that it seems inexplicable why such stones should ever be mistaken for diamonds. On the other hand, as pointed out by R. K. Mitchell, a spurious doubling of the back facets may sometimes appear in gem diamonds cut in the brilliant-cut style. This pseudo-doubling is due to a reflective effect in certain types of badly cut diamonds (Fig. 11).

The refractive indices of zircon (1·93–1·99) are too high to be measured on the normal refractometer, but complete identification of white zircon can be easily accomplished by examination of the absorption spectrum, even if the stones are set. The fine line at 6535Å, the strongest and most persistent line seen in zircon spectra, is always present in white zircon, and other weaker lines may also be present with it.

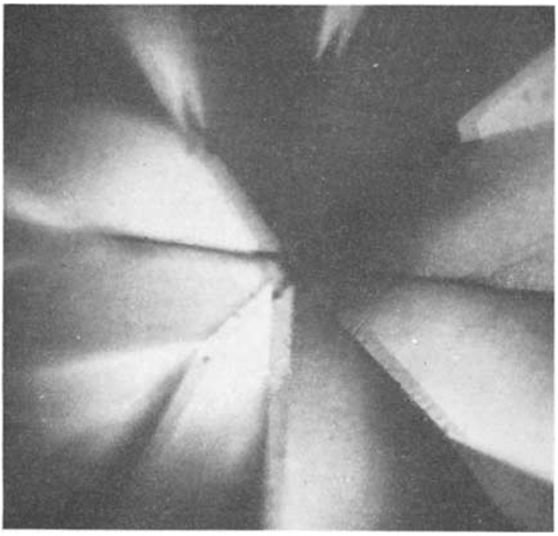

Fig. 10.
Doubling of the back facet edges, due to double refraction, seen in a white zircon.

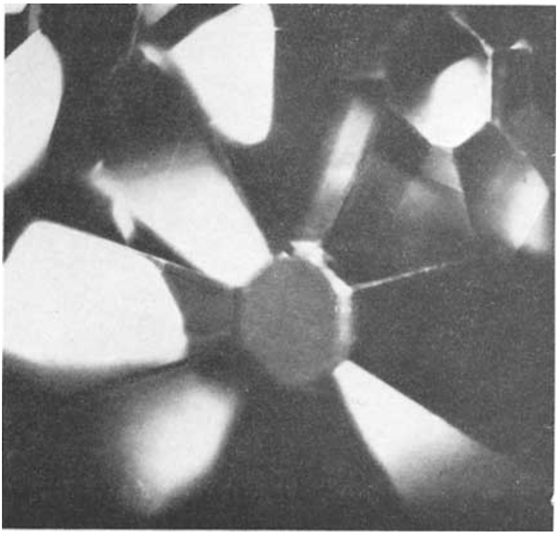

Fig. 11.
Pseudo-doubling of the facet edges seen in an ill-cut brilliant-cut diamond.

Natural white sapphires are not so often encountered, but the synthetic white sapphire is quite commonly met with in jewellery. When first produced, just before the First World War, synthetic white sapphire was shamefacedly sold as " synthetic or scientific diamonds." Synthetic white sapphire has too low an index of refraction and too vitreous a lustre effectively to imitate diamond and the stones have only a third the fire that is shown by diamond. Stones of this synthetic material of half a carat and over do not pose any difficulty in identification, despite the fact that the double refraction is insufficient to separate the two images of the rear facet edges except for the most practised eye. The index of refraction can be obtained by the use of a standard refractometer. It is when small stones are encountered, and synthetic white sapphire is fashioned into calibre and baguette-shaped stones of small size for use in multi-stone jewellery, that the position is not so easy and the stones more readily mistaken for diamonds. In such a case if the piece of jewellery can be immersed in a cell containing methylene iodide (R.I. 1·74), or α-monobromonaphthalene (R.I. 1·66), the relief will be high if the stones are diamonds and low if synthetic sapphires (or any other stones with similar refractive indices). (Fig. 12.)

Although it has a slightly lower index of refraction, 1·73 as against 1·77 for the synthetic sapphire, the colourless synthetic spinel has a particularly brilliant lustre and apparent fire, although the dispersion is only 0·020, which is less than half that of diamond. When the synthetic white spinels first came on the market about 1935 the stones were miscalled " Jourado diamonds," after the name of the dealer who was retailing the stones. Most of these stones were of large size, 6 carats and upwards, and mostly cut in the emerald-cut style, a style of fashioning which has a vogue for gem diamond. However, such a style of cutting does not bring out the best in diamond so that there is a nearer approximation in the appearance of the two stones. Thus, those who have had little experience with step-cut diamonds may be deceived by these synthetic stones.

Like the synthetic sapphire it is the small calibre and baguette synthetic spinels which can cause confusion. Such stones are considerably used in jewellery to-day, being sold for what they are. It is when such pieces come on the secondhand market that trouble could occur.

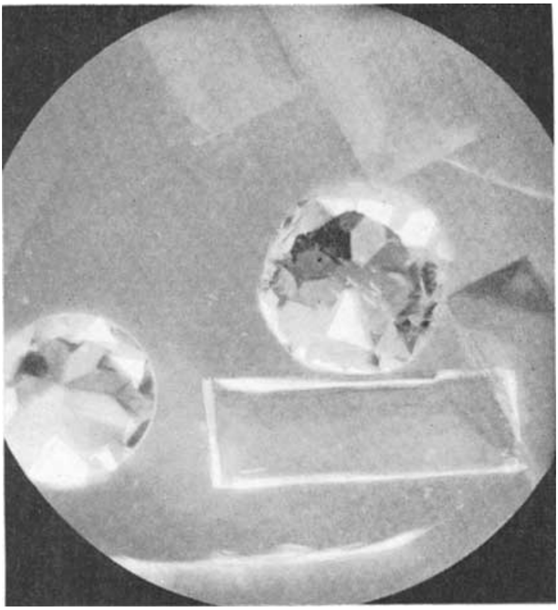

FIG. 12.
The strong relief of diamonds and the low relief shown by synthetic white sapphires and spinels when immersed in monobromonaphthalene.

As in the case of the very similar synthetic white sapphires the immersion test in liquids of high refraction will serve to separate them from diamonds, but not by this direct method from the synthetic white sapphires. These two species may, however, be separated by the contact immersion method devised by B. W. Anderson. In this method the stones, or piece of jewellery, are immersed in a cell filled with methylene iodide (*n*—1·74) which is illuminated by an overhead light and with a suitably placed reflecting mirror arranged so that the underside of the cell can be viewed. The synthetic white sapphires, which have a higher refractive index than the liquid in the cell, will show a dark border to the stone and the facet edges will show as white lines. In the case of the synthetic spinels the reverse will be seen, the edges of the stones being light and the facet edges dark (Fig. 13).

Short-wave ultra-violet light can assist in identifying diamond, synthetic white sapphire and synthetic white spinel. Under the short-wave lamp, with an emission at 2537Å, diamonds, which under the long-wave ultra-violet lamp (3650Å) generally glow with a violet or blue glow of varying intensity (sometimes with a yellow

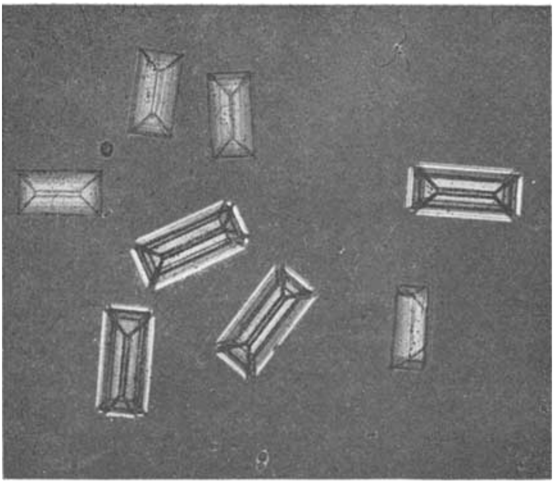

FIG. 13.
Contact immersion photograph of synthetic sapphire and synthetic spinel in methylene iodide.

or green glow), respond only weakly to the short-waves. Neither white synthetic sapphire nor spinel respond to the long-waves, but under the short-wave lamp the white spinels glow with a bluish-white light and the synthetic sapphires with a dull deep blue glow. Anomalies have been found, however, where in some cases the synthetic white sapphire has shown a glow rather similarly to the response given by the synthetic white spinel.

The research work carried out during the Second World War for materials of strategic importance resulted in the synthetical production of at least two new gemstones. The first of these is synthetic rutile, which has been produced in colours which are rarely, if ever, found in natural rutile.

Synthetic rutile, often known as Titania, has not been produced in a water-white colour—there is always a cast of yellow. Attempts have been made to improve the whiteness by surface sputtering with alumina, and these *sapphirized* stones are indeed much whiter in appearance, but the method does not seem to be extensively carried out. The most prominent characteristics of synthetic rutile are the strong double refraction and the exceptional fire. These adequately distinguish the stone from diamond. Synthetic rutile has a hardness of only 6½ on Mohs's scale, hence it would be scratched by quartz, or, better as a test, it will not scratch rock crystal. The density is 4·25, which is greater than that of sapphire, so a synthetic rutile will not have the spread of a diamond for a given weight. The refractive indices are 2·61 and 2·90 for the two rays of this uniaxial mineral. Such indices are too high, indeed higher than that of diamond, for them to be measured on the standard refractometer, but the double refraction of 0·287, which surpasses all other diamond simulants in this respect, is readily visible even with the low power of a watchmaker's eyeglass.

The most striking aspect of synthetic rutile is the exceptional fire, 0·300 for the B to G interval, which is about six times that shown by diamond. The remarkable display of spectrum colours in this stone makes it look to some extent something like an opal. Synthetic rutile does not show a fluorescent glow under ultra-violet light, but does show an absorption band at 4250Å which cuts short the violet end of the spectrum.

Although it is the nearly colourless synthetic rutiles which are the types which may be said to simulate diamond, other colours have been produced. These are, particularly, a yellow and a golden-brown, but a red colour has been produced and so has a sapphire-blue coloured stone. The red coloured stones are not often encountered and the blue stones do not now seem to be made for they were found to have too great a tendency to chip at the facet edges.

Of more recent manufacture is strontium titanate, a synthetically produced material which has no counterpart in nature. This synthetic stone, which is known in the United States of America under the name of Fabulite, has what are probably the nearest characteristics to diamond. The colour is water-white and the stone is, like diamond, singly refracting, for the material is cubic in crystallization. Thus there can be no doubling of the back facet edges. The hardness, however, is low and is only 5½ on Mohs's scale, and the stone is rather brittle, which makes it prone to damage during the process of setting. The density is remarkably high at 5·13, so that, much more than rutile, the stone will have a small spread for a given weight. Indeed, such a stone which came into a dealer's hand was suspected by him because on weighing the stone he noted that it was far too small to be a diamond of that weight. The index of refraction is 2·41, and, hence, differs from diamond only in the third place of decimals.

It is the display of prismatic colours, that is the fire, which distinguishes strontium titanate from diamond, for if the stone is set in jewellery, then the high density will not assist in detection. Although strontium titanate has only four times as much fire as diamond (about 0·180 for the B to G interval), as against six times for rutile, the flashes of colour displayed by the stone are sufficient to tell that it is not a diamond. Again, like rutile, strontium titanate does not show luminescence under ultra-violet light, and, although with great difficulty seen, there is an absorption band in the extreme violet.

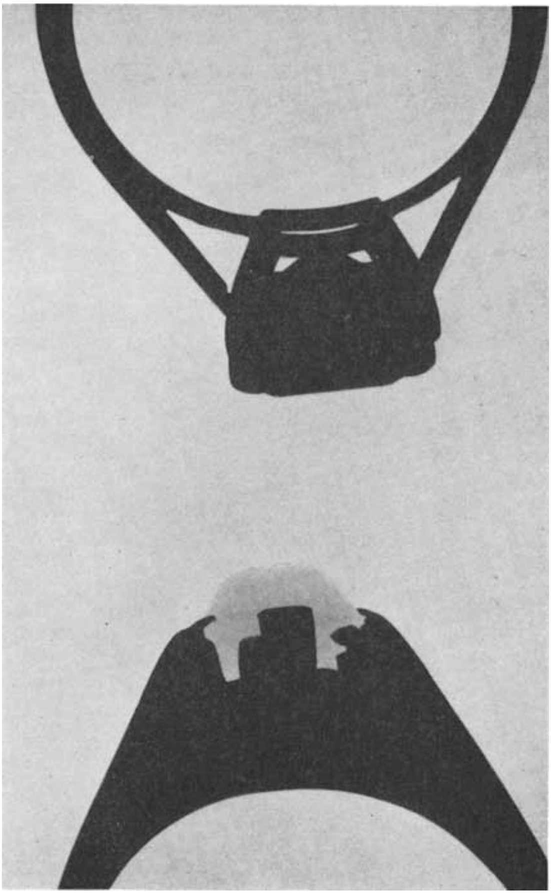

FIG. 14.

A diamond (lower ring) is transparent to X-rays while strontium titanate (upper ring) is opaque to the rays.

NOTE.—Rutile, zircon and synthetic white sapphire and spinel are also opaque to X-rays.

Like all the diamond simulants strontium titanate is much more opaque to X-rays than is diamond (Fig. 14). While such a test will prove whether a stone is a diamond or not, it will not distinguish the stone, nor, in general, is an X-ray machine readily available.

One characteristic of strontium titanate is the moulded look of the facet edges of a cut stone when it is examined by a lens. This effect tends to give the impression that the stone may be a paste of high dispersion, but even the more highly dispersive glasses do not seem to have the fire shown by strontium titanate. The low hardness of this gem has led to the suggestion that a needle point carefully pressed on to the surface will make a small mark and indicate the low hardness of the stone. Such a test if carried out needs to be most carefully controlled in order to prevent damage. Bearing in mind that this synthetic stone is far from inexpensive, such a test is better left undone.

It may seem impertinent to suggest that a glass imitation diamond could fool anyone, and nor it should with those who have had at least some experience of handling stones. However, with some of the brilliant and fiery pastes that are occasionally met with a cursory glance may not be enough, and this is specially so with small stones. A glass will always give a refractometer reading, so that a positive test can be applied here, except when the stone is *bloomed*, or the stones are small and inaccessible. The blooming may be removed by polishing the facet with a rouged leather to enable a refractometer reading to be obtained, and in the case of highly dispersive pastes, as pointed out by A. E. Farn, an Anderson/Payne spinel refractometer is the best instrument to use, for with these stones a pronounced spectrum edge forms the shadow-edge of the critical angle in the case of this instrument.

Small paste stones set in jewellery may need a different method of attack. Immersion contrast methods may be usefully used here, specially when all that is needed to be known is that the stones are not diamonds or are. Short-wave ultra-violet light will cause most glasses to glow with a deep blue or a whiteish-blue light which is not unlike the glows given by synthetic spinel.

There are a number of natural coloured stones of different species, which, owing to their high optical qualities, may resemble a coloured diamond. The first of these is sphene, the monoclinic silicate of titanium and calcium, which is usually yellow or brownish-yellow in colour, but in rare cases may be green. Sphene has a density of 3·53, which is near to that of diamond. The refractive indices, which are round about 2, are too high to measure on the standard refractometer, and the stones have a sufficiently large double refraction for the rear facet edges to be clearly seen doubled when viewed through the thickness of the stone. The dispersion of 0·051 for the B to G interval, is greater than that of diamond, so sphene exhibits strong fire, but, as is the case in all coloured stones the fire is to some extent masked by the body colour. Sphenes have a hardness of only 5 on Mohs's scale and the lustre is decidedly resinous. The dichroism is fairly strong in this species and observation of this will immediately tell that the stone is not a diamond, nor a yellow zircon, which has so little dichroism as to be scarcely seen. Sphene may show, but very weakly, the group of fine lines in the yellow of the spectrum which are due to the rare-earth elements collectively known as didymium, and the mineral does not luminesce under ultra-violet light.

More important as an ore of tin, the naturally occurring crystalline oxide of tin, cassiterite, has, when found in transparent crystals, been cut as faceted stones. Brown in colour with a hardness of about 6½ on Mohs's scale, such stones have an adamantine lustre due to the high refractive index, which is not far removed from that of sphene. The double refraction is strong so that the back facet edges will be seen doubled. The fire is strong but is masked by the brown colour of the stone, and, unlike sphene, the dichroism is extremely weak. Cassiterite has a density of 6·8 which is so high that it clearly identifies it from any other stone by its heft, if the stone be unset. Cassiterite is rarely encountered except in the hands of collectors.

The green demantoid garnet, owing to its high optical properties, must be considered. The refractive index of this green garnet is 1·88, but the colour dispersion of 0·057 for the B to G interval exceeds that of diamond. Again the exceptional fire is masked by the body colour of the stone. The density of demantoid is 3·84, and like so many highly refractive minerals demantoid suffers from a low hardness, which in this case is 6½ on Mohs's scale. The most useful tests for demantoid as against diamond, apart from the hardness test, are the facts that demantoid shows a reddish hue under the Chelsea colour filter, and that invariably the stones contain inclusions of byssolite fibres in radial or horse-tail groups.

Zinc blende, which has a refractive index of 2·37, may be considered as a possible stone to be mistaken for diamond. It is, however, very unlikely that this could happen, for the resinous lustre, strong dodecahedral cleavage making it difficult to cut into faceted stones, and the extremely low hardness of 3½ to 4 on Mohs's scale, go against it. True the colour dispersion of zinc blende is considerable, over three times that of diamond, but zinc blende makes a poor imitation of diamond. The density of this stone is 4·09, which is just a little higher than sapphire.

It has been reported that stones have been cut from the green crystals of silicon carbide (SiC), which is best known as the artificial abrasive carborundum. This material, of which there are several modifications, including a hexagonal and a cubic form, has a hardness of about 9¼ on Mohs's scale. The type from which the few stones have been cut is the more common hexagonal modification and this material has a refractive index of about 2·66 with a double refraction of 0·043. The dispersion is given as 0·103 (B to G ?) and the density is 3·17. From experiments on the carborundum abrasive powder it is known that the material exhibits a dull mustard-yellow glow when irradiated with long-wave ultraviolet light. As a diamond substitute it is unimportant, for it is doubtful whether there are many of these stones in existence.

Other colourless stones, such as rock crystal, white topaz, phenacite and white beryl, some of which have quite good brilliancy, lack the other optical characters which would allow them to vie with diamond.

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PRECIOUS OR SEMI-PRECIOUS

By A. E. FARN, F.G.A.

TRADE usage cannot be pleaded in defence of misnomers any more than sheer perpetuation of " understood " terms makes for clarity when gemmologists clash with " rule of thumb " jewellers. The latter it is true are conversant with gemstones by the constant handling of them, and if this knowledge can be combined with a true gemmological knowledge, then of course we have the ideal.

By precious stones it is assumed that diamond, ruby, sapphire and emerald are the imperative choice and until recently little else could challenge the field. However, since alexandrites obtain astronomical figures and even demantoid (still often miscalled olivine) fetches quite satisfactory prices, and black opal, topaz (not quartz) and especially chrysoberyl cat's-eye command high prices, it seems hardly logical to term them semi-precious.

So what are the semi-precious stones to be termed—and which are they ? Pale rubies from Burma can grade down to near colourless but still retain all the characteristic inclusions of Burma origin—silk, treacle and crystalline inclusions. These can hardly be termed precious, and to my mind are not even semi-precious. Similar cases occur with sapphires and emeralds. It is quite easy to buy very cheap but nevertheless genuine emerald and genuine sapphire ; although commercially they are rubbish, yet their name invokes the term precious.

So far all this is common knowledge and generally agreed, but in actual fact the term " semi-precious " means, I suppose, half precious and it is difficult to imagine how to explain this. It would be better to drop entirely the terms precious and semi-precious and treat all jewellery stones on a basis of expensive, rare and less expensive, and regard them all as important and stress their respective merits, i.e. colour, hardness, occurrence and suitability to each particular style of jewellery or type of article.

Necklaces of beads composed of golden quartz, tourmaline, garnet, jadeite, nephrite, rose-quartz or opal with matrix, can be very durable and beautiful items. As such, though costing quite a bit more than paste or costume-type jewellery, they do represent much better value for money than either the poorest type of " precious " stone jewellery or the more expensive of the imitation jewellery. In fact we do not exert enough energy in putting over the lesser-known gemstones to the public. There are so many pretty and inexpensive stones available that it is time we educated the public into a true appreciation of something which is good, durable and attractive.

It is imperative, therefore, to drop the terms precious and semi-precious and to concentrate on true descriptions of goods. It is so much better to describe a stone as golden quartz than incorrectly as " topaz quartz " and have the customer find out later on that he hasn't a true topaz and thus leave a slightly nasty taste behind. If, however, an article is truly described, as it must be, and suitably praised with regard to its merits, it will always be a source of pleasure and have the merit of re-saleability, which is more than can be said for any form of imitation jewellery. (Although golden quartz has been quoted here, there are of course many more instances where misnomers are still perpetuated, which would be better discarded and the true gemstone accurately described.) Nothing is quite so poor-looking as an old and worn imitation pearl necklace or rubbed paste jewellery, whereas a good stone bead necklace can last for years and years and still command a fair price.

Having rather stressed the worn out appearance of secondhand imitation jewellery I am reminded of the humorous occasion when a dealer produced a pair of genuine lapis-lazuli ear-studs complete with minute traces of pyrites and complained that his customer said the brass was showing where the enamel had worn off ! !

Recently some jadeite was sold as such by a dealer who was somewhat concerned to find it was " Chinese Jade." So it seems there is room for teaching at all levels, " sublime and ridiculous," " precious and semi-precious."

X-RAY PICTURE OF AN ABALONE PEARL

Abalone pearls, which come from abalones or ear-shells (Haliotidae), with their striking iridescent colours of greens and blues are rarely met with set in jewellery. The X-ray examination of such a pearl, which was mounted as a pendant, gave interesting results. It was known that these pearls were hollow inside but details of the structure of the actual pearl substance were lacking. The X-ray picture reproduced below shows the structure of the abalone pearl to be convulated and layered.

In some abalones the quality of the nacre is outstanding and superior to that of many pearl-oysters. In general the pearls are of small size, the main interest being in the colour, usually green but sometimes blue and yellow, which they display.

The large colourful ear-shells are found in the American waters off California and Florida, and are there known as abalones. Paua shell, from the Maori, is the name given to similar shells from New Zealand and Australian waters. These shells are related to the smaller " ormers " fished around the Channel Islands. The hollow nature of these pearls gives them an extremely low density and this would serve to identify them if doubt existed as to their nature.

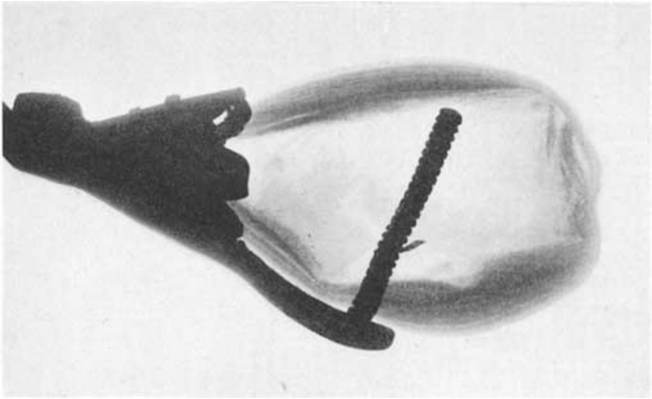


Photo : R. Webster

Gemmological Abstracts

Raal (F. A.) *A new absorption band in diamond and its likely cause.* Proc. Phys. Soc., Vol. 71, pp. 846-847. May, 1958.

A new absorption band, very broad at room temperatures, is located at approximately 5500Å and cannot be resolved into component lines even at the temperature of liquid oxygen. It is found in all pink and mauve diamonds and its strength is correlated with the intensity of coloration of the diamond. Spectrographic analyses showed the presence of Mn, in addition to the Si, Al, Mg and Ca normally found in diamond, and the Mn was found to vary with the depth of colour. The new absorption band is thus correlated with the presence of Mn in these diamonds.

R.A.H.

Stephen (M. J.). *The infra-red spectrum of diamond.* Proc. Phys. Soc., Vol. 71, pp. 485-490. March, 1958.

The contribution of lattice vibrations to the infra-red spectrum of diamond in the 2 to 6μ region has been calculated from the vibrational frequency distribution where second nearest neighbour central forces are taken into account. Most of the details of the observed spectrum are reproduced in the calculated spectrum.

R.A.H.

Webster (R.). *Pearls—ancient and modern.* Gemmologist, Vol. XXVIII, No. 331, pp. 21-29. February, 1959.

An article based on the talk given by the author to the Gemmological Association. The pearl oyster is discussed as is the early use of pearls for ornamentation. The conch, abalone and freshwater pearls are mentioned. The history and the methods of the cultivation of oysters and culturing pearls are given. The new Australian cultured pearls are discussed.

7 illus. P.B.

TOMBS (G. A.). *Synthetic diamonds through the microscope.* Australian Gemmologist, Vol. I, No. 6, p. 12. December, 1958.

Reports the examination of some American synthetic diamonds. The size of the crystals was approximately 300 to the carat and under twenty times magnification the crystals were seen to be of a typical rough diamond shape and to have the lustre of diamond. Under higher magnification (60 and 250 times) the pieces were seen to be aggregates of crystals, three or four crystals apparently fused together. Some crystals showed octahedral habit and some dodecahedral. The colour was mostly greyish.

R.W.

CROWNINGSHIELD (G. R.). *Highlights at the Gem Trade Laboratory in New York.* Gems and Gemology, Vol. IX, No. 8, pp. 227-229 and 254. Winter, 1958/9.

Some reports on exceptional items brought in for testing at the New York laboratory. These included an unusual greenish brown diamond containing black needles oriented in three directions; a gold tie-pin set with 24 yellow stones which were mostly zircons but included a brown sinhalite and a yellow kornerupine. More than a dozen sinhalites were tested during the past few months. The fluorescence test for emeralds is commented upon and the artificial coloration of turquoise discussed.

R.W.

JESSOP (J. E.). *Glittering oasis.* Gems and Gemology, Vol. IX, No. 8, pp. 232-239. Winter, 1958/9.

An account of the diamond mining along the south-west African seaboard by the Consolidated Diamond Mines of South-West Africa. The diamond fields extend 220 miles north from the Orange river and from 50 to 60 miles inland from the Atlantic. Great quantities of sand overlie the diamondiferous gravel and this is removed by earth-moving machines and bucket-wheel excavators. On the completion of the stripping of the overburden the diamond-bearing gravel is dug out and loaded into trucks and taken to the screening plants where only the gravel of a size known to contain the richest diamond concentration is saved. Final recovery is by heavy media separation and by electrostatic separation, for the

grease tables are not effective with the seashore diamonds. The uneven bedrock below the diamondiferous gravel is swept and shovelled to collect the last layers of gem gravel. Some notes are given on the town of Orangemund and of the social life there.
8 illus. R.W.

BENSON (L. B.). *Highlights of the Gem Trade laboratory in Los Angeles.* Gems and Gemology, Vol. IX, No. 8, pp. 230-231 and 254. Winter, 1958/9.

Reports on unusual pieces tested at this American laboratory. A dark green emerald, which was much lighter in colour when removed from the setting, was found to owe its deeper colour to the black enamelling carried out on the inside of the bezel of the setting. An 8 carat radium-treated yellowish-green diamond was reported upon. Discussion is made of the fact that a number of jewellers are unaware of the true nature of " Fabulite " (synthetic strontium titanate) and " Walderite," the name apparently given in the United States to synthetic white sapphire. A drop-shaped demantoid garnet of 9·73 carats was tested.

R.W.

ANON. *Smaragd — Synthese oder Kultur ?* Emeralds, synthetic or cultured ? Zeitschr.d.deutsch.Gesell.f.Edelsteinkunde, No. 26, pp. 21-22, 1958/1959.

Referring to the discussion as to whether an emerald, which has grown from solution, and not been produced in a Verneuil furnace, should be called synthetic or cultured, the Paris Chamber of Commerce has come to the conclusion that all stones which are not natural stones, should be called either imitation or synthetic.

E.S.

GÜBELIN (E.). *Synthetische Diamanten.* Synthetic diamonds. Gold und Silber, Vol. 12, No. 2, pp. 23-24, 1959.

Most synthetic diamonds are too small to be of interest to jewellers, also they are mostly not crystals, but aggregates. In one of three microphotographs the synthetic diamond chosen showed an octahedron broken from a crystalline mass. The centre of the octahedron face showed small porous holes, which indicate that the stone grew very quickly. Most of the small crystals are grey, yellow, brown to green. Some are black. The powder produced from these crystals is grey to black. Indications of stress were seen under polarization which must be a disadvantage. The X-ray diffraction points are not as clear as in the natural mineral, which also indicates stress.

E.S.

EPPLER (W. F.). *Ein überzeugendes Beispiel für die Entstehung von Heilungsrissen in Edelsteinen.* An explicit example of the formation of healing cracks in gems. Deutsche Goldschmiedezeitung Vol. 57, No. 4, pp. 190-191, 1959.

Great speed of growth of the gem crystals is the main cause for the formation of healing cracks. This is the case in many natural gems (with the exception of diamonds) and in synthetic emeralds. In many instances the healing cracks, which are generally regarded as flaws, are very attractive as far as form and colour are concerned. Photomicrographs show the growth of a synthetic quartz crystal with healing cracks which form at the lower end of the crystal and decrease as the speed of growth is reduced.

E.S.

GÜBELIN (E.). *Noch einmal Zuchtperlen oder — Ehre, wem Ehre gebührt.* Once again cultured pearls or — honour to whom honour is due. Zeitsch.d.deutsch.Gesell.f.Edelsteinkunde, No. 26, pp. 20-21, 1958/59.

On the occasion of the 50th Jubilee of the cultured pearl and in addition to a report by T. G. Flood, Stockholm, on Carl von Linné, the author reminds us that Prof. Alverdes of Marburg succeeded in 1913 in inducing the formation of cultured pearls by injecting epithelium cell tissue into the inner part of the oyster mantle. In 1914 Alverdes sent his patent to Japan and seven years later the first cultured pearls appeared on the market.

W.S.

EPPLER (W. F.). *Die Sandmeier-Plato Streifung im synthetieschen Korund.* Sandmeier-Plato striation in synthetic corundum. Deutsche Goldschmiedezeitung, Vol. 57, No. 2, pp. 62-64, 1959.

Typical striation in synthetic corundum was first observed about 1920 by Sandmeier and confirmed by Plato. In 1952

Müller used them as a determining factor in distinguishing between natural and synthetic corundum. In 1958 these striations were used to distinguish between American and German synthetic star-rubies and sapphires. These striations were only to be observed in polarized light and then only in the direction of the optic c-axis. Sandmeier thought they were twin lamellae formations. The Sandmeier-Plato striations seem to consist of very thin lamellae. In etch tests, they are dissolved to a greater degree on the basal plane of the host crystal than in the surrounding synthetic corundum and therefore stand out in kind of " walls." The author assumes that the lamellae are arranged parallel to the prism face as twinning plane in such a way that the c-axes of both lamellae and host crystal are at right angles to each other. Optical confirmation is still outstanding. 8 figs.

E.S.

Brusius (O.). *Opal — aktuelles über Bearbeitung und Verwendung.* Opal — facts about working it and using it. Deutsche Goldschmiedezeitung, Vol. 57, No. 2, pp. 67-69, 1959.

Working of opals is most difficult, and from the raw material one cannot definitely say whether finished gem is likely to be good. During working, opals crack easily. Sometimes cracks are seen in the stone, once it is set, but these can close again by themselves. The author warns against cutting opals too thinly.

E.S.

Schlossmacher (K.). *Brillianten mit Farbyerbesserungsüberzug.* Briliants with colour-improving coats. Zeitschr.d.deutsch.Gesell. f.Edelsteinkunde, No. 26, pp. 22-23, 1958/59. Abstract from Gold und Silber.

Diamonds with this type of cover are increasingly in use in U.S.A. What the coat consists of is unknown, also how it is actually covered. The covering can be dissolved in a 20 per cent solution of sulphuric acid. Another way of showing whether a stone is so treated or not is by viewing the polishing marks under an interference microscope. The covered stones show completely even interference lines, the uncovered stones show these lines at both ends somewhat frayed.

E.S.

SALLER (X.). *Die Färnung von Perlen.* Colour of pearls. Deutsche Goldschmiedezeitung, Vol. 57, No. 4, pp. 201-202, 1959. Abstract from the Jahrbuch des Goldschmiedes, 1959.

Pearls are coloured or dyed, so as to improve poor natural colours or produce very rare beautiful ones. The colour-absorption of a pearl depends on its mother-of-pearl layer, the type with high lustre being less suitable than the matt variety. The organic conchiolin is coloured more slowly than the mineral parts, aragonite, calcite. The colouring is carried out cold or at 50°C, the dye being in aqueous, alcoholic or acetonic solution. The dyes themselves are inorganic, synthetic or natural materials. Metal chlorides are usually used in vapour form. Most important are the synthetic dyes; these are usually used in 1/3 solution at 50°C and kept in the solution till the wanted colour is effected.

E.S.

BOLSCHE (R.). *Neue Aquamarinefundstelle im Habachtal.* New aquamarine find in the Habach valley. Zeitschr.d.deutsch.Gesell. f.Edelsteinkunde, No. 26, pp. 19-20, 1958/59.

A few well-developed crystals of pencil size have been found.

E.S.

GÜBELIN (E.). *Das neue Smaragdvorkommen in Rhodesien.* The new emerald occurrence in Rhodesia. Zeitschr.d.deutsch.Gesellschaft.f.Edelsteinkunde, No. 26, pp. 4-15, 1958/59.

Survey of emeralds from Rhodesia. In 1958 the author was asked to examine these emeralds, and was given 92 stones. The occurrence is about 29° 56′ east and 20° 55′ south. Most of the material found is either broken up or very small, so that most Sanadawana emeralds, which are cut and of commercial interest are under $\frac{1}{4}$ ct. Most stones are of a beautiful colour. A chemical analysis found the stones to be : SiO_2—65%, Al_2O_3—14·2%, BeO—13·6%, Cr_2O_3—0·5%, Fe_2O_3—0·5%, MgO—3%, Na_2O—2·0%, Li_2O—0·15%. The refractive inditi were 1·5877 to 1·5949 (ord. ray) and 1·5806 to 1·5884 and the double refraction was between 0·0069 and 0·0071. Sp. gravity was from 2·744 to 2·768. Dispersion 0·009. Sandawana emeralds were formed by contact metamorphosis of a granite melt with tremolite; shaped tremolite inclusions are characteristic. In the stones of good quality the needles are either small or very fine and long, in poorer quality stones there are masses of short or long needles. A table gives optical data of emeralds from various sources. (Journ. Gemmology, Vol. VI, p. 8, 1958).

E.S.

WIRTH (A. A.). *Prasiolite.* Australian Gemmologist, Vol. I, No. 5, pp. 6-8. November, 1958.

A general introduction to the heat-treated greened quartz from Montezuma, Minas Gerais, Brazil, to which the name prasiolite has been applied.

R.W.

MELLOR (D. P.). *A new method for producing synthetic ruby.* Australian Gemmologist, Vol. I, No. 5, pp. 10-11. November, 1958.

An account of the experiments carried out at the Bell Telephone Laboratories in the United States of America on the hydrothermal production of synthetic ruby crystals. (Abstract. Journ. Gemmology, Vol. VII, No. 1, p. 16. January, 1959).

R.W.

WIRTH (A. A.). *Introducing precious gemstones.* Australian Gemmologist, Vol. I, No. 7, pp. 17-19. January, 1959.

A discussion on the changing aspect of the cardinal virtues usually ascribed to gemstones in textbooks. Beauty, rarity, durability, fashion and value are commented upon. Some discussion on the use of the terms precious stones and ornamental stones.

R.W.

VOLL (R.). *Deutschland ist der Welt drittgrösster Verbraucher von Zuchtperlen.* Germany is the worlds third largest consumer of cultured pearls. Deutsche Goldschmiedezeitung, No. 9, pp. 496-497. 1958.

The article gives the Japanese export figures for 1957. An illustration shows the instruments used for the operation on the oysters; another illustration depicts the plastic containers now used to protect the oysters against certain parasites.

W.S.

ANDERSON (B. W.) : WEBSTER (R.). *Variations in the luminescence of emerald.* Gemmologist, Vol. XXVIII, No. 332, pp. 41-45. March, 1959.

A discussion on the fluorescent effects shown by synthetic and natural emeralds when various types of ultra-violet lamps are used to excite the glow. Comparison is made of the value of low-pressure short-wave ultra-violet radiating lamps giving an emission at 2537Å, the normal medium-pressure long-wave lamps fitted with a Wood's glass filter which have a maximum emission at 3650Å, and the American Burton and the English Longlamp types, these latter being a modification of the fluorescent tubes used in office and factory lighting. In these tubes the powder coating on the inside of the tubes is such that it emits light in the long-wave ultra-violet region and in the visible violet, the emission being from about 3100 to 4100Å. Such ultra-violet fluorescent lamps were found to be best for separating synthetic emerald from its natural counterpart.

5 illus. P.B.

ASSCHER (L.). *The rebirth of a diamond city—Amsterdam.* Gemmologist, Vol. XXVIII, No. 333, pp. 70-73. April, 1959. Reprinted from *Optima.*

An article on the history of Amsterdam as a diamond city. The effects caused by the various wars and setbacks since the 14th century are told. The article explains how the diamond industry of the city was reformed after the Second World War.

P.B.

BATCHELOR (H. H.). *Mining in Australia.* Gemmologist, Vol. XXVIII, No. 333, pp. 66-68. April, 1959.

Some notes on the present day mining in Queensland and New South Wales. Mainly opal, sapphire and diamond.

P.B.

ANON. *Falsified diamonds.* Gemmologist, Vol. XXVIII, No. 333, p. 69. April, 1959.

A note taken from a report published in the 1890's on the fraudulent whitening of diamonds by " painting " the rear facets with violet dye.

P.B.

WEBSTER (R.). *Quartz in many varieties.* Gemmologist, Vol. XXVIII, No. 333, pp. 61-65. April, 1959.

A review of many types of the crypto-crystalline chalcedonic varieties of quartz. Some notes on the staining of agate are given. Forms with dendritic inclusions and chalcedonic pseudomorphs after other materials discussed.
4 illus. P.B.

WEBSTER (R.). *Amethyst—the best of the quartz.* Gemmologist, Vol. XXVIII, No. 332, pp. 46-49. March, 1959.

A general article on the amethyst variety of quartz, including crystallization and geological occurrence. The suggested causes of the colour and the changes of colour on heating are discussed. When heated to between 400°C and 500°C usual colour change is to a brownish-yellow. Above 500°C stones become colourless. Amethyst so heated provides a simulation of moonstone. Some properties of the violet quartz and the inclusions noted are mentioned. A number of localities where amethyst is found are given.
P.B.

WEBSTER (R.). *Infra-red photography of gemstones.* Gemmologist. Vol. XXVIII, No. 330, pp. 1-5. January, 1959.

A report on the results of some experiments on the photography of gemstones using Gevaert infra-red 35mm film. Some information is given about infra-red rays, the response of photographic emulsions to infra-red light, and of the techniques used in the photography. The most striking results were shown by the photograph of synthetic and natural emerald. The infra-red photography of turquoise and various imitations of turquoise was found to give no difference in the effect shown by the real and the false.
4 illus. P.B,

ANON. *Improved diamonds—a U.S. warning.* Gemmologist, Vol. XXVIII, No. 330, p. 18. January, 1959.

Reports the coating of diamonds by a special technique to improve the colour of off-coloured diamonds. It is more permanent than the method of painting the back facets with aniline dye and the new coating needs acid to remove it.
R.W.

ASSOCIATION NOTICES

GIFTS TO THE ASSOCIATION

The Council of the Association gratefully acknowledges the following gifts:

A collection of 2″ × 2″ coloured slides of inclusions, synthetics, and cultured pearl, from Mr. R. Webster.

A copy of *The World of Jewel Stones,* from the author, Mr. M. Weinstein.

A collection of slides of inclusions in natural and synthetic emerald, from Professor W. F. Eppler.

Anon. Two artificial silica glass cat's-eyes.

29th ANNUAL GENERAL MEETING

The twenty-ninth Annual General Meeting of the Association was held at Saint Dunstan's House, Carey Lane, London, E.C.2, on Wednesday, 1st May, 1959. Mr. F. H. Knowles-Brown presided.

In his comments upon the work of the year the Chairman said the annual report showed a satisfactory year, with growing interest in the work of the association, growing circulation for the JOURNAL OF GEMMOLOGY and a satisfactory number of successful candidates for the diploma courses. During the year the second year course had been extensively revised, and Mrs. V. Hinton had been appointed an additional instructor. Students from all over the world had sat for the examinations, and the international character of the Association was emphasized by the co-operation with the associations in Australia and the United States. There had also been a large number of members' meetings held in London, Birmingham and the West of Scotland, and the branches were especially commended for the work their officers and committees had done in the interests of gemmology.

They were very pleased with the continued extension of the educational work and the examinations. The latter were being taken by students in many parts of the world. This cost money and created difficulties for the staff, but these considerations were insignificant compared with the satisfaction which the entrants gave everyone. It meant that the examination was valued and respected all over the world, and it was well worth the trouble of sending samples, arranging invigilation and so on.

Mr. Knowles-Brown felt that the factor which had built up the prestige of the examinations more than anything else was the sincerity behind them and the training course.

The chairman also wished them to know how sorry he was that, due to ill-health, he had had to be absent from a number of council and association meetings during the past year. He offered his thanks to Mr. Norman Harper and to the Secretary, Mr. G. F. Andrews, for taking his place on those occasions.

Mr. F. E. Lawson Clarke, Treasurer, presented the audited accounts and the annual report and accounts were adopted.

The following officers were re-elected :—

President : Sir Lawrence Bragg, F.R.S.
Chairman : Mr. F. H. Knowles-Brown.
Vice-Chairman : Mr. N. A. Harper.
Treasurer : Mr. F. E. Lawson Clarke.

Sir Lawrence sent his apologies for non-attendance, as the annual meeting of the Royal Institution was also being held at the same time.

Messrs. D. J. Ewing, W. Stern and R. Webster were re-elected to serve on the Council.

MIDLANDS BRANCH

Recent developments in synthetic gemstones formed the subject of a talk given by Mr. B. W. Anderson to members of the Midlands Branch of the G.A. at the Auctioneers' Institute, St. Philip's Place, Birmingham, on Friday, 17th April, 1959.

Mr. B. Shipton, Vice-Chairman of the Midlands Branch, presided in the absence of the Chairman, Mr. T. Solomon.

This meeting, the last of the present series, was attended by a record number of members and friends.

Mr. Anderson began his talk by outlining the types of stones made synthetically to-day, and by explaining how they originated. The first synthetic stones mentioned were reconstructed rubies, which made their first appearance in 1882 and were made by fusing together small chips of inferior natural ruby under the flame of an oxy-hydrogen blow-pipe.

From reconstructed rubies Mr. Anderson then described how stones were produced by Verneuil and how to-day the same principle is used to produce such modern synthetics as red spinels, rutiles and strontium titanates, as well as corundum.

Mr. Anderson then described the hydro-thermal process of synthesizing emeralds. He was most emphatic that these should be called " synthetic emeralds" and not just "Chatham emeralds," lest the public be confused into thinking they are real emeralds originating from a place called Chatham.

Synthetic diamonds were the next to come under consideration and Mr. Anderson said that he did not feel we need worry about synthetic diamonds so far as gem quality stones were concerned, at least not for a very long time.

The second part of the evening was devoted to the showing of slides which Mr. Anderson had brought along. These were microphotographs of both natural and synthetic stones showing the differences in their internal structures. Also shown were some microphotographs of synthetic diamonds.

The third part of the evening was devoted to a practical demonstration to show the differences in the transparency of natural and synthetic emeralds to ultra-violet light. The technique used was to place a piece of Velox photographic contact printing paper in a shallow dish, sensitive side upwards. The natural and synthetic emeralds were then placed on top of the paper and water was gently poured over the paper until the stones were completely covered, this whole operation being carried out in subdued lighting. The dish was then illuminated by light from a short-wave ultra-violet lamp of the American Mineralite type for three seconds at a distance of two feet. The paper was then removed and developed ; after a brief rinse it was handed round for all to see. The results were excellent and no difficulty was had in picking out the natural and synthetic stones.

The Annual General Meeting of the Midlands Branch will be held in Birmingham on Friday, 9th October, 1959.

WEST OF SCOTLAND BRANCH

The sixth annual meeting of the West of Scotland Branch of the Association was held in Glasgow on 17th April, 1959. Mr. Ian Mackenzie was elected Chairman and Mr. C. D. Wade was re-elected as Secretary. Messrs. E. McDonald, H. McDonald and J. McWilliam were elected to serve on the committee.

In presenting the annual report the retiring Chairman, Mr. J. D. S. Wade, welcomed new members and expressed satisfaction at a successful year's work.

Members of the branch held their annual summer outing on 7th June, when they went to Elie-Fife, in the ancient Kingdom of Fife.

TALKS BY MEMBERS

Blythe, G. : " Gems," Rotary Club of E. Ham, London, 14th April, " Gemstones," Senior Supervisors' Association, Marconi Ltd., Basildon, 28th April, 1959.

Bowden, A. : " Gemstones," St. German's Women's Institute, 6th May ; Stoke Townswomen's Guild, 12th May ; St. Dominic's Women's Institute, 13th May ; Callington Women's Institute, Cornwall, 24th June, 1959.

Forsey, Mrs. P. : " Diamond," Dunnville Baptist Chapel Men's Club, Ontario, May, 1959.

Parry, Mrs. G. I. : " Gemstones," Cardiff and District Hard-of-Hearing Club, 1st June, 1959 ; National Federation of Business and Professional Women's Clubs (Cardiff and District Branch), 4th June, 1959 ; National Federation of Women's Institutes (Dinas Powis Branch), 5th June, 1959.

THE LATE DR. L. J. SPENCER — A TRIBUTE

By B. W. Anderson

Dr. Leonard J. Spencer, F.R.S., Keeper of Minerals at the British Museum from 1927-1935, died on April 14th aged 88.

Dr. Spencer was one of the foremost mineralogists of his time, and his name was also well-known to gemmologists, since he was the translator (in collaboration with his wife) of Max Bauer's massive *Edelsteinkunde* and, much more recently, author of that lively little book *A Key to Precious Stones.*

Spencer's translation of Bauer's great classic appeared in 1904. Long out of print, it now ranks as a valuable collector's item, and is still the most extended treatise on gemstones in the English language. Prof. Schlossmacher, it may be remembered, prepared a revised German edition of Bauer's *Edelsteinkunde* in 1931.

A Key to Precious Stones, published by Blackie in 1936 and still available, is very different in its character and scope. It is perhaps the most readable text on the subject, and contains incidental information not found in other books, with touches of erudition unexpected in so advowedly " popular " a work. In this book the jeweller has to accept some hard knocks from Dr. Spencer on the subject of synthetic stones, as the following extract will indicate :—

" The operations of the chemist are strictly analogous to those of a gardener, but nobody would suggest that products of the latter are " artificial " cabbages or roses. They may be cultivated, like ' cultured ' pearls or gentlemen. Adjectives are apt to get a little mixed when applied to different nouns. We may talk of wild roses and tame rabbits, but not of wild rubies and tame rubies; of artificial rubies, but not of artificial babies. ' Artificial ' flowers and eyes are made artificially but are neither flowers nor eyes. . . . " and so on.

Though in his early years as a mineralogist Dr. Spencer carried out some original researches, and his scientific papers numbered over 100, it was as a curator and bibliographer that his chief services to mineralogy lay. No other man had so intimate and profound a knowledge of the relevant literature. His record with the *Mineralogical Magazine* (the Journal of the Mineralogical Society) was quite astonishing. He served as editor from 1901 until 1955, and when Mineralogical Abstracts were first incorporated with the Magazine in 1920, Spencer wrote the majority of the abstracts and he compiled all the indexes until 1955.

His reviews of books in the Magazine (Abstracts) were usually full and fair, but occasionally he succumbed to the temptation to be brief and rude.

Dr. Spencer took a special interest in meteorites, of which the Museum has a fine collection. It was this interest and the prospect of an unusual adventure which led him in 1934 to join an expedition to the Libyan Desert in search of the source of the extraordinary masses of yellowish silica glass which are to be found over a wide area on the surface of that sandy waste. He had some of this mysterious material cut as gems—though its cloudiness and insipid colour and lustre hardly justified this except as a collector's curiosity.

Spencer devoted almost all his waking hours to mineralogy, to the service of the Museum, the Mineralogical Society, and its Magazine, to their lasting benefit. As Editor of the Magazine for more than fifty years he must have attended far more Council meetings of the Society than anyone else in history, and for a similar period he also took a leading part in the discussions arising out of papers read at meetings of the " Min. Soc."

As with Dr. Johnson or G. K. Chesterton, Spencer was perhaps even more notable as a " character " than as a mineralogist or scholar. His personality and his pen both made their mark for more than half a century.

COUNCIL MEETING

A meeting of the Council of the Association was held at Saint Dunstan's House, London, E.C.2, on Wednesday, 10th June, 1959. Mr. F. H. Knowles-Brown presided.

The following were elected to membership :

FELLOWS

Berry, Harold W., Wellington, N. Zealand D.1935
Jeffery, Albert C., Newton Abbot D.1938

PROBATIONARY

Ellis, John R., Reading
Elout, Helene (Miss), Paris, France
Kothari, Udai C., Jaipur, India
Manley, John J., London
Schidlowski, Dietrich, Pretoria, S. Africa

ORDINARY

Aungchi, U., Rangoon, Burma
Beattie, Mary M. (Mrs.). Cleveland, Ohio, U.S.A.
Bloom, Geoffrey I., Cricklade
Bradley, C. Zeslawa (Miss), Nairobi, Kenya
Briggs, James R., Cromer
Grupe, William A., Los Angeles, U.S.A.
van Halem, Adrianus C., Singapore
Hollis, Jerome P., Hamilton, Bermuda
Hunter, John W., Glasgow
Nicholls, George W. A., Bromley, Kent
Smith, Reginald A., Benson, Oxford
Whitehead, Henry J., Edinburgh
Whitley, Peter, Rise Park, Essex

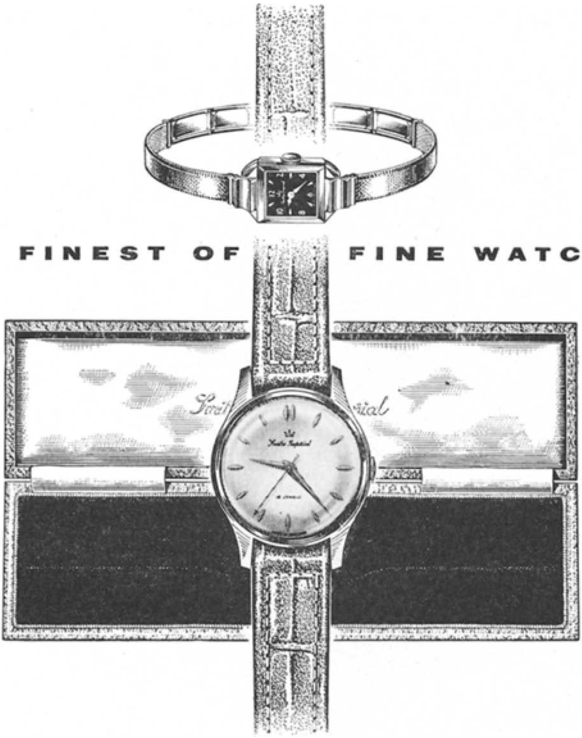
The 1959 presentation of awards and reunion of members was arranged for the evening of Tuesday, 17th November, at Goldsmiths' Hall, London.

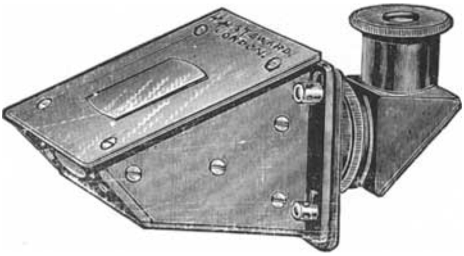
Upon the recommendation of the examiners the Council awarded a research diploma to Mr. L. C. Trumper, B.Sc., F.G.A., for his thesis on the measurement of refractive index by reflection.

The Council revoked by-law 7, relating to the payment of life membership subscriptions.

Approval was given to a request from the Gemological Institute of America to use the filter in the Chelsea colour filter in their instruments. The Council also considered arranging visits for members to scientific and similar establishments.

183 entries for the preliminary and 70 for the diploma examinations for 1959 were reported.




J. H. STEWARD LONDON

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