

Diamond Cutters

Contributed by Administrator
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Diamond crystals, in their natural state, normally look as dull and uninteresting as pieces of ordinary washing soda. It is only the skill and craftsmanship of the diamond cutter that reveals their inherent beauty. Other gem minerals, too, must be cut and polished before they can be used in jewelry, but here an important distinction must be made. The cutting and polishing of gem stones is grouped under two distinct headings: (1) the cutting and polishing of diamonds, and (2) the cutting and polishing of all other gem materials. Those who cut diamonds are called diamond cutters, while those who cut and polish other types of gems are known as lapidaries.

The explanation of this distinction is simple. Because of the extreme hardness of diamonds, certain problems concerning the method of cutting and polishing arise that are not encountered when cutting and polishing other gems. Since diamond is the hardest known mineral on earth, how can the cutting and polishing of such an unyielding object be achieved? A fact-finding tour of the works of a progressive diamond cutter will reveal more about this highly technical subject.

Gem diamonds usually occur in nature in the crystal shape of a double pyramid, or octahedron, but such crystals are often badly misshapen and show internal flaws. It is important, therefore, to decide whether a crystal is sufficiently faultless and of the correct size to be cut into a jewel stone and, if not, how best to split it to remove the faults that exist. This splitting operation is known as cleaving, and requires great skill and knowledge, for, should a diamond cleaver strike the stone in the wrong place, a diamond worth many thousands of dollars may be ruined.

It is possible to cleave a diamond, in spite of its extreme hardness, because diamond crystals can be split in the four planes parallel to the crystal faces of the octahedron. This is one of their directional properties. Once the diamond cleaver has ascertained the direction in which the crystal is to be cleaved, it is cemented to the end of a wooden holder, and a smaller diamond is used to scratch a groove in it. A heavy steel blade is now placed in this groove in the correct position, and smartly struck. If the operation has been correctly carried out, the stone will split across exactly in the desired direction. Except in the case of large stones, this cleaving operation is not very often employed, and diamond sawing is usually the first process.

The sawing department may consist of a spacious room around the walls of which are arranged stout benches fitted with a multitude of diamond saws. One question that immediately arises is how it is possible to cut through a diamond, which is the hardest natural substance on earth, with a saw. Actually, saws, in the accepted sense, are not used: instead the diamond cutter uses extremely thin phosphor-bronze disks 1/300 inch thick, the edges of which are charged with a mixture of diamond dust and oil.

The diamond saws are under the care of a skilled foreman who watches carefully over the whirling disks, which spin at the phenomenal speed of 6,000 revolutions per minute. During the sawing operation, the diamond crystals are secured in special holders by means of clamps or set in plaster of Paris, and, unlike most other sawing operations, they rest on top of the whirling sawblades. Great care has to be taken in deciding in which direction a diamond shall be sawed, since there are certain directions in every stone that are so hard that even these specialized saws could not accomplish their task.

The time required for sawing a diamond may vary from a few hours to as long as several days, depending upon the size of the stone. Once a stone has been sawed to the correct size, it is taken to another department for an operation called bruting. This means shaping the actual stone to round it. At one time, two stones of similar size were selected, each being firmly embedded in suitable hollows already prepared in the ends of two wooden holders, leaving exposed only the parts to be shaped. One holder was held in each hand and the stones rubbed hard together against each other until both were shaped as required. This operation seems onerous, but today modern machinery has greatly eased the task of bruting.

The diamond is cemented into a cup-shaped object called a dop which is then screwed to the end of a metal shaft attached to a turning lathe. Another stone is mounted in another dop screwed to the end of a metal rod. The bruter now firmly grips the rod and rests it near the dop against a firm vertical support fixed to the bench. The lathe is now set in motion, and as the two stones are pressed against each other, rotates at about 400 revolutions per minute. In this way, the bruter brings considerable pressure to bear between the two diamonds, but great care must be exercised in the course of this operation in order to prevent overheating. The resulting diamond dust is carefully collected for future use in the sawing and polishing operations.

The bruting completed, the diamonds are now taken to the cutting and polishing shop, where a number of craftsmen are busy attending to machinery arranged on long wooden benches. Unlike other gem stones, diamonds are cut and polished in one operation, which is carried out on polishing laps; these are horizontal disks measuring about one foot in

diameter and half an inch in thickness. These disks, composed of soft iron, spin at 2,500 revolutions per minute, and each lap is charged with a small amount of diamond dust mixed with olive oil. The diamonds are held in special dops similar to those used in the bruting operation. Since the heat developed by the friction between the fast rotating lap and the diamond is far too great to allow the gem to be held in position by ordinary cement, a special solder containing one part of tin to three parts of lead is employed. The dop containing the solder is placed into a gas flame and heated until it softens.

Once the solder has become pliable, the dop is removed with the aid of tongs and placed upright on a stand. Tongs are used to shape the solder into a cone at the apex of which the diamond is placed. The operator then proceeds to work the solder well over the stone so that it is firmly secured, with only the part to be polished exposed (see Fig. 63). Finally, in order to be cooled, the dop, with the stone in position, is plunged into water.

Such dramatic treatment would cause other gems to fly to pieces immediately, but not the diamond, which allows heat to be conducted away so quickly that even drastic temperature changes do not affect it in the least. Once the diamond has been fixed in the appropriate manner in the dop, the copper stalk fixed to the bottom is fastened to the polishing arms resting over the polishing lap. The operation can now commence. Nowadays, much of this work is done with mechanical dops, the stone being gripped firmly by steel claws. This facilitates more accurate working and saves much time in resetting the stone. Conventionally, diamonds are cut in the shape of the brilliant cut, each little facet on the crown and base being separately cut and polished onto the stone. There are 58 facets on a brilliant-cut diamond, so that the cutter must reset the stone 58 times before his task is accomplished. Frequent inspection is necessary to insure that each facet has been cut and polished to the right degree.

Apart from cutting the conventionally shaped diamonds, A. Nagy, an English diamond cutter, has particularly distinguished his stones by the invention of the completely novel profile cut. This new shape, first shown publicly in 1961, took 13 years to perfect. It represents a completely new form of cutting and is the first innovation of its kind since the development of the brilliant cut.

Normally, for the conventional brilliant cut, an octahedral diamond crystal is sawed into halves, each producing a conventional brilliant-cut diamond. For the new profile cut, the same crystal is sawed into four plates, each of equal thickness. A specially adapted three-bladed saw disk is used for this operation. When cutting diamonds of any shape it is vitally important that the correct angles at which the facets should be set are achieved, otherwise the diamonds will lack the maximum fire and sparkle that makes them so attractive. If a diamond has been cut correctly, the same amount of light that enters the stone from the top should be totally reflected from the base facets, to be returned again through the top of the stone. When, finally, a stone has been cut and polished to the satisfaction of the craftsman, it is cleaned in boiling sulphuric acid to remove all traces of grease and dirt.

This drastic treatment leaves the stone completely unharmed —once again illustrating its extreme resistance to all chemical influences. The cutting and polishing of other gem stones is a relatively simple matter compared with that employed for diamond. None of them approach diamond in hardness, so that sawing is speedily accomplished by fast-rotating soft-metal wheels, the edges of which are charged with diamond dust.

There is no necessity to carry out the operation of bruting, described earlier. The grinding of the facets and their polishing is completed in two distinct operations. Grinding is done on metal laps charged with a suitable abrasive, such as diamond or carborundum powder, according to the hardness of the stone concerned. To carry out the polishing process, the cut stones are applied to wooden laps faced with leather or cloth to which a softer polishing agent has been applied. This removes all slight scratches and blemishes.