CHEMISTRY

Diamonds Manufactured

Diamonds have been produced for the first time by man by using immense heat and pressure. The synthetic stones are equal in quality to natural diamonds.

See Front Cover

➤ REAL DIAMONDS have been made artificially by a once-discredited process, extremely high pressure and heat.

Success in manufacturing diamond crystals so hard that they scratch other diamonds was demonstrated in Schenectady, N. Y., by research scientists of the General Electric Co., Drs. Francis P. Bundy, H. Tracy Hall, Herbert M. Strong and Robert Wentorf.

Combining enormous pressure, 800,000 pounds or 400 tons per square inch, with a reaction chamber which can be heated to more than 5,000 degrees Fahrenheit, the G.E. scientists have so mastered the conditions under which diamonds form that they have been able to produce these, the hardest crystals in nature, in more than one way, out of more than one material.

Diamonds have been made every time, in more than 100 runs. This success contradicts earlier researchers who believed, after a number of failures, that increase of heat and/or pressure would never yield the crystalline form of carbon.

But the new man-made crystals pass the same X-ray test that is used to assay natural diamonds. Their hardness is greater than that of any other material. Some of the new crystals have been burned to carbon dioxide, to prove that they are really crystalline carbon. They easily scratched sapphire, silicon carbide and boron carbide as well as natural diamonds.

Diamonds have been found in meteorites. These heavenly missiles are believed to be fragments of an ancient planet which exploded, perhaps about the time our earth was formed. Study of the way these naturally occurring diamond crystals are found always imbedded in iron meteorites, never in stony ones, led General Electric scientists to select the temperatures, pressures and surroundings that proved successful for production of diamonds.

Iron meteorites would have come from the center of the exploded planet, and would have been subjected to heat and pressure similar to conditions calculated to exist some 240 miles below the surface of the earth.

Greatest obstacle to making diamonds according to these theories was a press capable of producing very high pressures in a container which could be heated and held at the high temperature. Both are necessary for rearrangement of the carbon atoms into the diamond's crystalline lattice form.

Chief problem in development of such a press was creation of a material for the container which would keep its contents intact during the time the pressure acts. Both these problems have been solved by the diamond-makers. The clusters of very small diamonds they have made were crystallized in a few minutes. To make the largest so far produced, the melt was held under constant conditions at a high temperature for 16 hours.

Earlier attempts to make diamonds in the laboratory have usually started with the element carbon in the form of graphite. The French chemist, Henri Moissan, who created great excitement by his claim to have made diamonds in 1894, used carbon in solution in molten iron. Scientists at the General Electric laboratories start with carbonaceous compounds. They have produced crystals of various colors, such as are found in the jewels produced in nature. The man-made crystals are up to 1/16th inch in length. The size of this crystal in comparison with a diamond high-fidelity phonograph needle is shown on the cover of this week's SCIENCE NEWS LETTER.

Jewelers would not scorn some of the artificially produced diamonds. They would pronounce them genuine. However, laboratory-made diamonds are not expected to invade the jewelry market. Industrial diamonds, the so-called "black diamonds," offer a more useful outlet if the General Electric Company should wish to put its diamond-making technique on a production basis. Cutting with diamond-studded drills and polishing with diamond dust are technical processes always in need of the super-hard carbon crystals.

The first artificial diamonds were made "late last year." Discovery that diamonds actually were made came when the core of super-hard matter from the pressure chamber wore away the polishing wheel.

There is some doubt whether extreme heat must always be used with the high pressure to make diamonds. All previous experiments with high heat, although with less pressure, gave graphite instead of diamonds. Measurements of free energy changes in carbon had suggested that intense cold such as found in outer space might aid in bringing about the change from graphite to diamond.

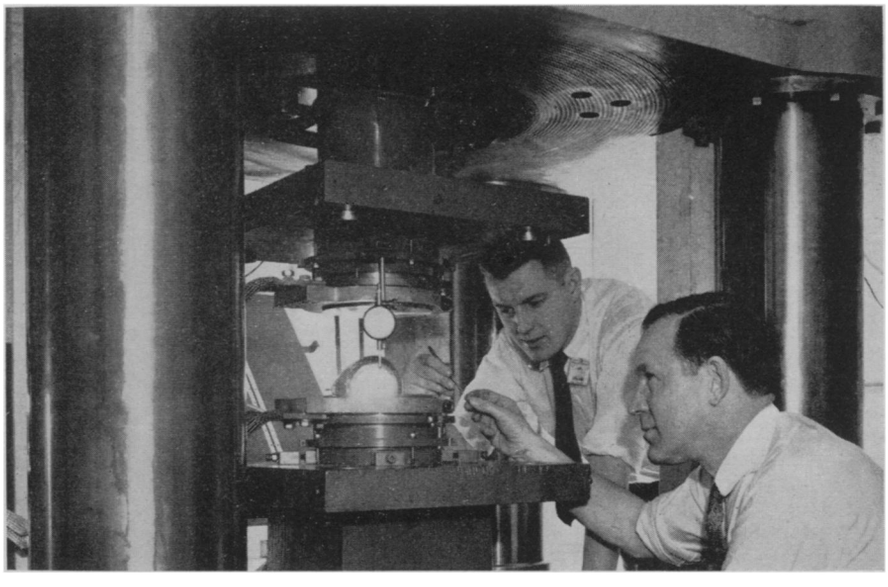
The giant press used in diamond production is capable of 1,500,000 pounds per square inch pressure, which is roughly equivalent to the squeeze computed for points 240 miles beneath the earth's surface. This equipment makes small diamonds in a matter of minutes.

The G.E. scientists bowed to Dr. Percy Bridgman of Harvard University whose discoveries in measuring extreme pressures were used in the diamond production.

The method of applying pressure in the giant press is similar to that pioneered by Dr. Bridgman. The further step taken by the General Electric team was in adding the heating device. The energy added to the syystem by heating turned the trick of shaking the carbon atoms out of their common arrangement into the special one which makes diamonds.

Dr. Bridgman's experiments were in the range where diamonds are possible.

Science News Letter, February 26, 1955



DIAMOND MAKERS—Dr. Herbert Strong (right) and J. E. Cheney watch General Electric's new 1000-ton press, capable of delivering pressures greater than 100,000 atmospheres, or 1,600,000 pounds per square inch, on an area of approximately one square inch.