Exhibit of
MAN - MADE DIAMONDS

H. T. Hall

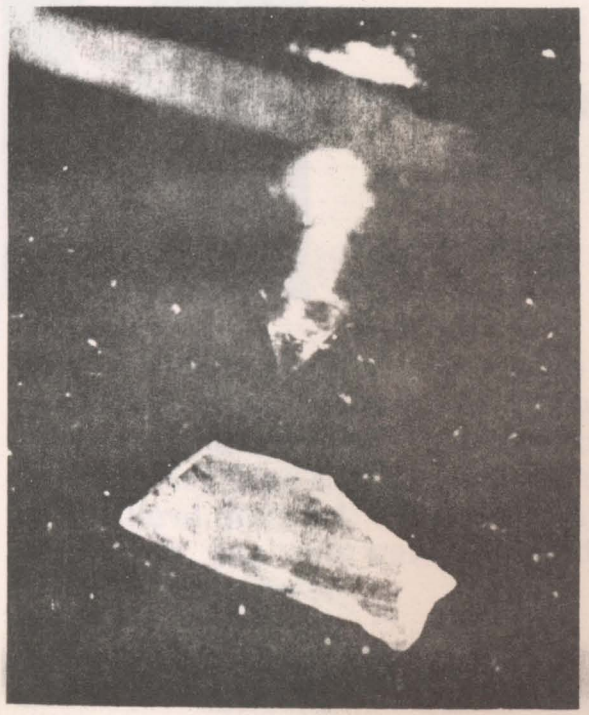
For ages men have prized diamonds. They have collected them, studied them, smuggled them, stolen them, fought wars over them, and invented legends about them. In times past, the diamond has been valued mostly as a gem. Today, however, it is as highly valued for its use in industry in the cutting, grinding, and polishing of hard materials. Modern technology could hardly do without it. The distinguishing feature of diamond that makes it so useful is that it is by far the hardest material in the world.

Natural diamonds are obtained from certain river gravels or from the blue ground of volcanic pipes. To bring you one carat of cut diamond from the volcanic pipes requires the removal from great depths of a mass of blue ground 640,000,000 times the diamond's own weight. About two and one-half tons of diamonds are mined each year. One-half ton is of gem quality and eventually, after cutting and polishing, graces milady's finger, etc. The remaining two tons are used in industry.

Diamonds, as they come from the mine (even those selected for gem use), are not particularly beautiful until they have been cut. Usually the diamond looks like a bright pebble. The surface of many crystals appears frosty and the crystals are often rather lopsided. To the touch the diamond feels greasy and somewhat cold because of its high heat conductivity.

Natural diamonds are found in several forms. There are gem-quality diamonds with nearly perfect crystal symmetry. If a diamond is off-color and cannot be used for a gem-stone, it is classified as boart. Most boart is crushed to make diamond powder. There are ballas diamonds, which are rare compared with other types. They consist of minute crystals grouped concentrically around a nucleus. Important industrially are carbons, or black diamonds, a conglomerate of microscopic crystals which nature has cemented together.

Photomicrographs of some of the diamonds grown at the Research Laboratory have been taken by Dr. F.H. Horn. The largest diamond



produced so far is shown here in comparison with a phonograph needle. It measures 1.2 mm in length. The comparison in the picture shows that it could make several diamond-tipped phonograph needles. This diamond was grown from a matrix which had been submitted to high pressure and high temperature for a period of 16 hours. The crystal is water-white and transparent.

Another photomicrograph in this series is shown facing Page 1. In it appear diamond fragments which were broken from a polycrystalline mass of diamonds synthesized under more extreme conditions of temperature and pressure than those used to synthesize the diamond just described. The polycrystalline aggregate weighed approximately 0.1 carat. Before the aggregate was broken up, dozens of triangular faces could be seen. The edges of these triangular faces have been as large as 500 microns (1/2 mm) long. Triangular growth and etch patterns are often characteristic features of diamond crystals as found in nature. The same has been true of diamonds made in the Laboratory.

The rate of growth in the process used to make these diamonds is rapid. The diamonds form in a matter of minutes. Within a short time after the process by which these diamonds were made was discovered, the synthesis was repeated a dozen times, the material identified by chemical and physical means as diamond, and another scientist had duplicated the process. A scientific management, however, deemed it proper to have more proof that diamonds had been synthesized. Accordingly, two scientists from other departments in the Laboratory were asked to individually duplicate the work, using independent sources of starting materials to which our group did not have access. This they did and conclusively identified the material produced as diamond.

These man-made diamonds described here are very small. Are diamonds this size useful? The answer is yes. Over one-half of the industrials (4,000,000 carats) of diamonds of this size and smaller are used each year as industrial diamond powders for the sawing, grinding, and polishing of hard materials.