EXHIBIT OF MAN-MADE DIAMONDS

H. T. Hall

For ages men have prized the diamond. 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 its 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.

(Movie begins)

1. This is a slightly yellow, gem-quality diamond with unusually perfect crystal symmetry.

2. 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.

3. These ballas diamonds are rare compared with other types. They consist of minute crystals grouped concentrically around a nucleus.

4. Carbons, or black diamonds, are a conglomerate of microscopic crystals which nature has cemented together. They are important industrially.

With this brief introduction concerning diamonds, I wish to project on the screen photomicrographs of some diamonds grown here at the Research Laboratory. Dr. F H. Horn has taken the pictures you are about to see.

Slide 6: Largest diamond produced compared to phonograph needle (diamond tipped).

This diamond is the largest that has been made at the present time. It measures 1.2 mm in length. The comparison in the slide shows that it could make several diamond-tipped phonograph needles. This diamond was grown from a carbon-containing matrix which had been submitted to high pressure and high temperature for a period of 16 hours. The crystal is water white and transparent.

Slide 7: These diamond fragments were broken from a polycrystalline mass of diamonds synthesized under more extreme conditions of temperature and pressure than those used to synthesize the diamond of the previous slide.

The polycrystalline aggregate weighed approximately 0.1 carat. Before the aggregate was broken up, dozens of triangular faces such as the one visible on the slide could be seen. The edges of these triangular faces have been as large as 500 microns (1/2 mm) long. This triangle is one of the octahedral faces of the diamond previously spoken of. Triangular etch and growth patterns are often characteristic features of diamond crystals as found in nature. The same has been found true of diamonds made in the Laboratory. The next slide —

<u>Slide 8</u> — is an enlarged view of the triangular crystal of the previous slide. Note the triangles within triangles. The triangles in this case form an inverted pyramid or pit in the face of the diamond. Sometimes the triangles form a pyramid above the surface of the diamond.

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.

Following the lead given by the initial attainment of a reproducible synthesis, other systems that grow diamond were found.

Slide 9: This slide shows a diamond octahedron.

Slide 10: Here are some water-white crystals. The crystals are about the same size as those shown previously.

Slide 11: Here, a triangular face of an octahedron is again visible. Note the markings on the face.

Slide 12: This is a cluster of diamond crystals making up what is called a polycrystalline mass. Octahedral faces are found oriented in many directions.

Slide 13: Note the roundish appearance of this octahedron. This same sort of feature is typical of diamonds found in nature.

Slides 14, 15: The slides that follow are additional views of diamonds made in the Laboratory. Their size is of the same order as those seen on previous slides.

Now you have noted that the man-made diamonds shown to you this day are very small. You have no doubt wondered if diamonds this size are useful. The answer is yes. Over one-half of the industrials (4, 000, 000 carats) of diamonds of the size shown here and smaller are used each year as industrial diamond powders for the sawing, grinding, and polishing of hard materials.