IX. STROBOSCOPIC RESEARCH

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A. PRESSURE-TESTING FACILITY FOR OCEANOGRAPHIC EQUIPMENT

Because equipment that is used in oceanography is subjected to such high pressures, the strength of the casings for the underwater devices should be tested. Recently, we built a test facility that is based on the one devised and used by the Woods Hole Oceanographic Institution for several years. L. Hoadley of W. H. O. I. gave us assistance in our design problems, and the Research Committee of the National Geographic Society provided the funds.

A 16-inch Naval Ordnance shell of a type that is no longer of military importance (HC projectile Mark 13, Mode 1) was obtained from the U. S. Navy. This shell, which weighs 1900 lb, provides a volume that is 9.7 inches in diameter and 36 inches long. The chamber is filled with water and pumped up to the desired pressure.

After several unsuccessful attempts were made to weld a pressure-resisting plug into the regular nose cone of the shell, a nose plug was made with 6-inch diameter shaft material. It was then found that expansion of the shell caused the nose plug to open sufficiently to blow out the 1/8-inch O-ring. This problem was solved by chilling the nose cone in liquid air before screwing it in place as tightly as possible with a 4-foot pipe wrench with a 3-foot pipe extension on the handle.

A brass retainer ring was installed at the breech end of the shell, as shown in

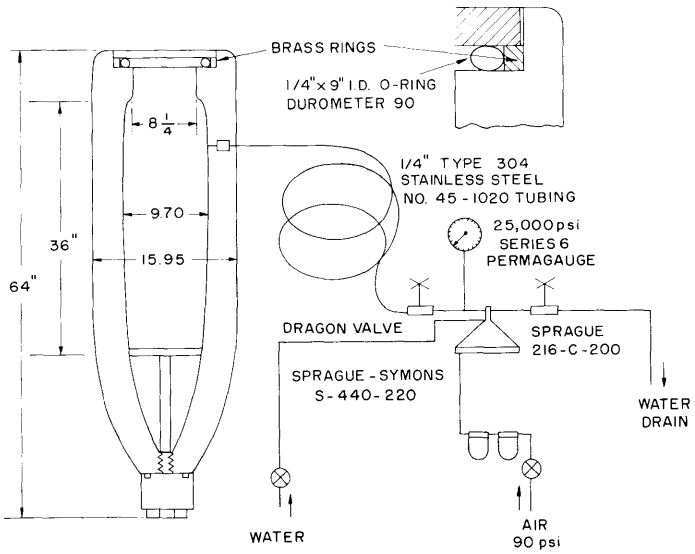

Fig. IX-1. Hydraulic and air systems for pump used with pressure-testing facility.

Fig. IX-2. Mobile mount for pressure-testing facility; pressure cylinder is shown suspended from crane.

Fig. IX-1. This ring is in contact with a flat area on the breech plug at the end of the travel. The ring is 0.25 inch thick so as to match the seating of a hard rubber O-ring (durometer 90) that has an inner diameter of 9 inches.

During several tests of the nose plug, an O-ring of durometer 70 was used at the breech. This ring became wedged into the crack between the brass ring and the breech plug. Removal was extremely difficult. Heat was applied to the shell with a torch, then a crane was used to put 3000 ft-lb of torque on the breech plug.

It was found that there were some slight defects on the surface of the breech plug which resulted in a crack where the O-ring extruded. The brass ring was made level with grinding compound, and a hone was used on the breech-plug surface. Even after grinding, a 70-durometer O-ring at an internal pressure of 10,000 psi became slightly extruded. Durometer-90 O-rings of the same size are now used with success, although slight extrusion occurs at a pressure of 20,000 psi.

When air is furnished by an air compressor with a 3 1/2-inch stroke and a 3-inch diameter piston, the following pressure-time values are obtained:

Pressure (psi)	Time (minutes)
5,000	1
10,000	4
15,000	6
20,000	15

A dial displacement gauge showed that the diameter of the shell expanded approximately 16/1000 inch at an internal water pressure of 20,000 psi.

The pressure testing facility, which has been mounted on wheels for mobility (Fig. IX-2), is being readied for testing an improved model of an underwater camera and several cameras for bathyscaph use.

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