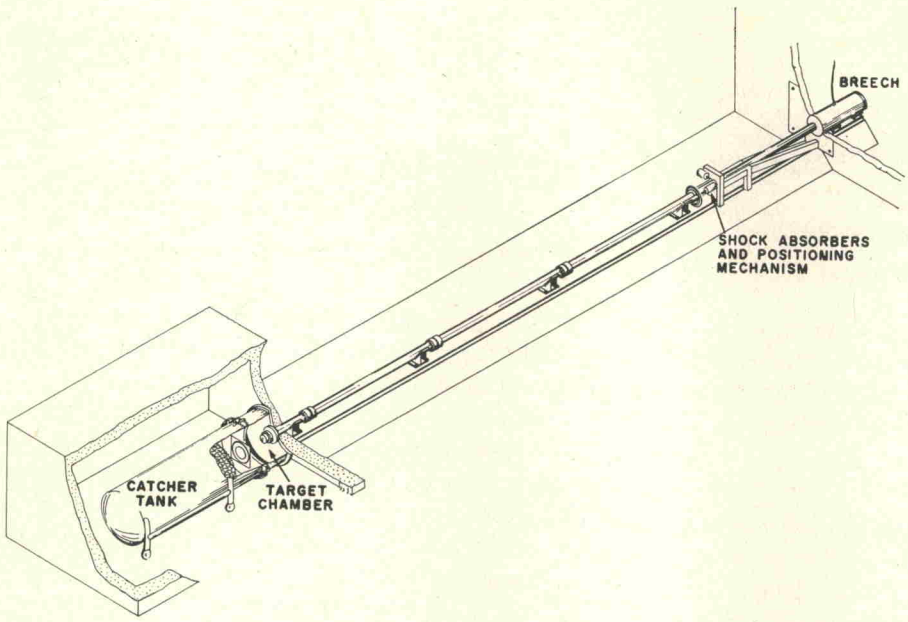

FIG. 3. Over-all view of gun and gun room.

door is 1.27 cm thick steel plate and weighs 272 kg. This room was designed to withstand the maximum overpressure of the gas in case of rupture of the catcher tank (approximately $\frac{1}{4}$ bars).

Concrete blocks with reinforcing rods were used to shield the breech and compressor room from the central part of the main room. The central portion, between the breech and muzzle rooms, is used as a working area and houses the instrumentation and the control console. The gun is mounted on an I-beam which in turn rests on a solid concrete foundation. A sketch of the layout is shown in Fig. 3.

B. Barrel

The barrel is constructed in four 3 m sections and one $1\frac{1}{4}$ m muzzle section. It was drilled from 4140 HT steel heat treated to 38 Rockwell C. The sections have bayonet joints at each end and are held together with flanges threaded onto each barrel section with buttress threads (Fig. 4). The flanges are in turn bolted together with eight 1.90 cm, high strength (Unbrako) cap screws.

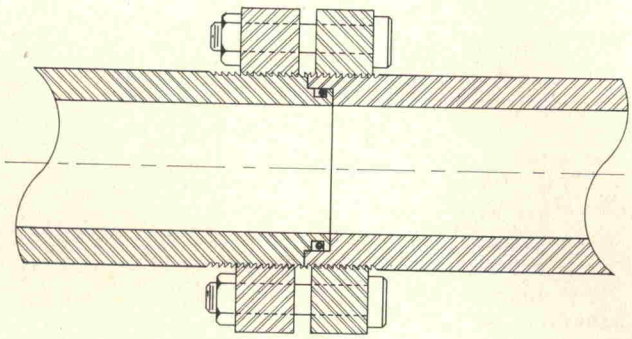

FIG. 4. Barrel joint detail.

The inside diameter of the barrel is 10.162 ± 0.002 cm; the muzzle section tapers slightly from 10.162 to 10.161 cm over the last 30 cm. This taper was initially greater but was honed out after test firings indicated excessive friction in the tapered section. The outside diameter is approximately 15 cm.

C. Barrel Supports

In order to minimize torque on the barrel while the projectile is in the gun, it rests on oiled porous bronze bearings constructed as caps for bolts threaded through V-blocks (Fig. 5). These are located at 3 m intervals along the I-beam. Some sagging of the barrel occurs between supports but it has apparently not affected performance.

The muzzle of the gun protrudes into the target chamber mounted on the muzzle room wall; a gas seal between tar-

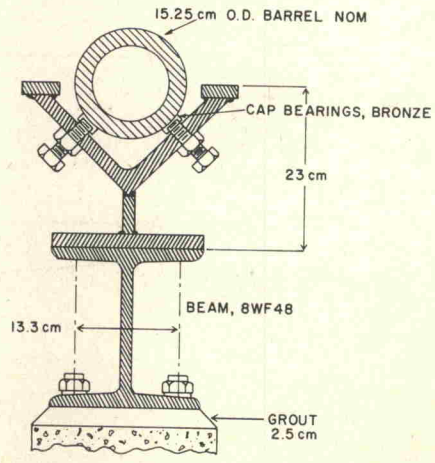

FIG. 5. Barrel supports. Scale: 1/4.

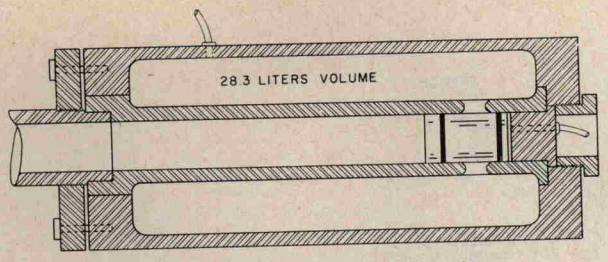

FIG. 6. Wrap-around breech assembly.

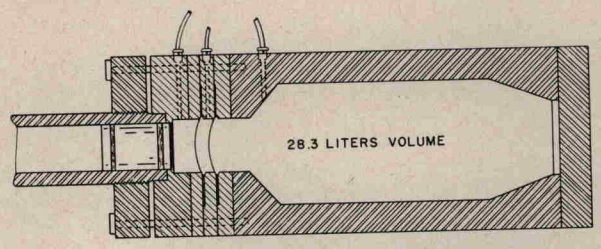

FIG. 7. Double-diaphragm breech assembly.

get chamber and muzzle is provided by a brass bushing and an O-ring. This bushing was initially made of steel, but it was found to seize to the barrel on occasion. No problems have been experienced with the brass bushing.

D. Breeches

Diagrams of the two interchangeable breeches are shown in Figs. 6 and 7. Each contains 28.3 liters of gas; the wrap-around model is designed for 206 bars, the double diaphragm for 413 bars; both have been tested to approximately twice the design pressures.

In the wrap-around design the projectile seals the ports between the barrel and the annular reservoir by means of O-rings at each end of the projectile. Firing is accomplished by injecting a small amount of high pressure gas behind the projectile, causing it to move past the ports. This design is convenient and reliable. Its only disadvantage is the restriction on projectile weight imposed by the requirement of sufficient strength to stand off the initial pressure. The minimum projectile weight we have attempted with this breech is 600 g with a projectile constructed of 7075-T6 aluminum.

For the higher velocity range (~0.9 to 1.5 mm/μsec) the double diaphragm breech is available. The diaphragms are selected to withstand slightly more than half the reservoir pressure and to open cleanly and quickly when subjected to full pressure. Firing is accomplished by exhausting the region between the diaphragms (initially pressurized to half-pressure) so that each diaphragm in turn experiences the full pressure. With this breech it is hoped that projectiles as small as about 450 g can be fired. It has not been tested at the time of this writing but no serious problems are anticipated.

E. Projectiles

In order to reduce the costs of the projectiles a standard design was chosen which could be made in quantity by a production shop (Fig. 8). The projectiles are machined from solid 6061-T6 aluminum, so there are no joints to leak or fail when used in the wrap-around breech. Moreover, the Hugoniot of this material is well known so that impedance match solutions can be readily obtained.[9] The wall thickness was chosen to withstand an outside pressure of

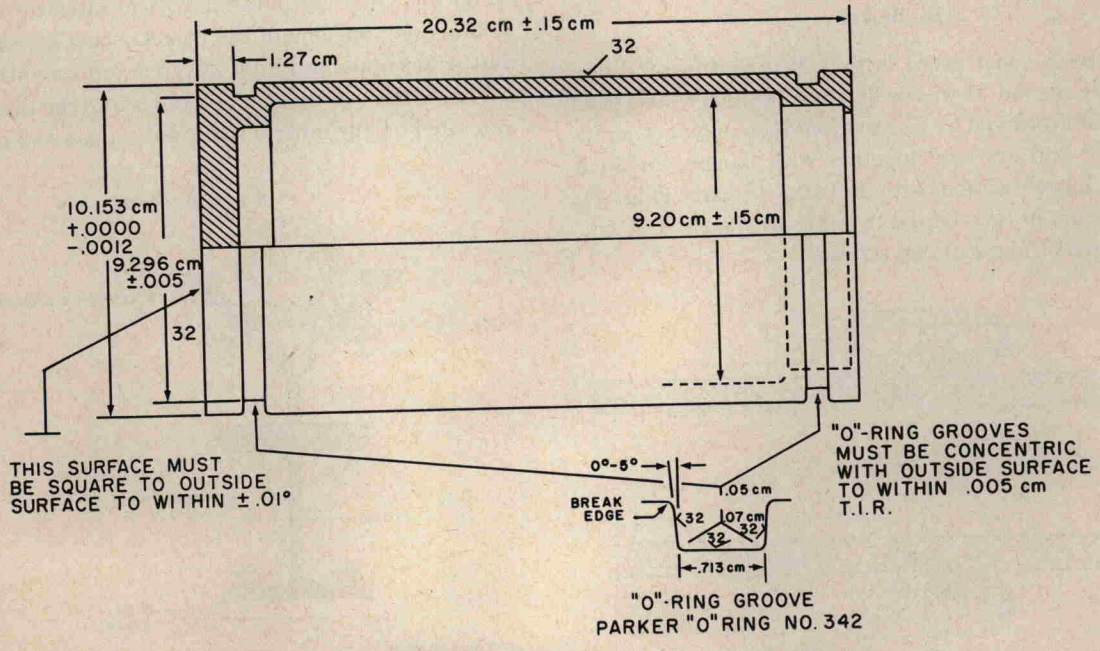

FIG. 8. Drawing of "standard" projectile. Material is 6061-T6 aluminum.