DOUBLE-DIAPHRAGM BREECH FOR ATMOSPHERIC PRESSURE

RICHARD GRANHOLM

Department of Physics
Washington State University
Pullman, Washington
99164-2814

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This apparatus is suitable for shooting rigid foam projectiles in the 4 inch gun using atmospheric pressure. The velocity range for this system is approximately 0.12 to 0.16 millimeters per microscecond, with only a modest dependence on projectile weight up to at least 700 grams. Velocity versus weight data are shown in Table I and in Figure 1.

The apparatus screws into the Wrap-Around breech in place of the usual plug, and consists of two aluminum foil diaphragms. A spacer inserted in front of the Double-Diaphragm breech positions the projectile ahead of the gas ports inside the Wrap-Around breech.

Each aluminum foil diaphragm has a rupture-pressure of 2/3 - 3/4 atmospheres. The chamber enclosed by the two diaphragms is evacuated to 1/2 atmospheric pressure while the rest of the gun, target tank, etc., is evacuated completely. The projectile is fired by furthur evacuating the chamber between the diaphragms until the outer diaphragm is ruptured by atmospheric pressure which subsequently ruptures the inner diaphragm and launches the projectile. A diagram of the apparatus is shown in Figure 2. (Photographs are included in the file copy of this report).

DETAILS OF OPERATION

Each aluminum foil diaphragm consists of four layers of 0.0007 inch foil (supermarket grade) with 2 or 3 drops of vacuum pump oil spread between each layer to exclude air and to minimize leakage. Because leaks could ruin an experiment by causing premature rupture of the diaphragms, each vacuum port (shown in Fig. 2) is equipped with appropriate plumbing

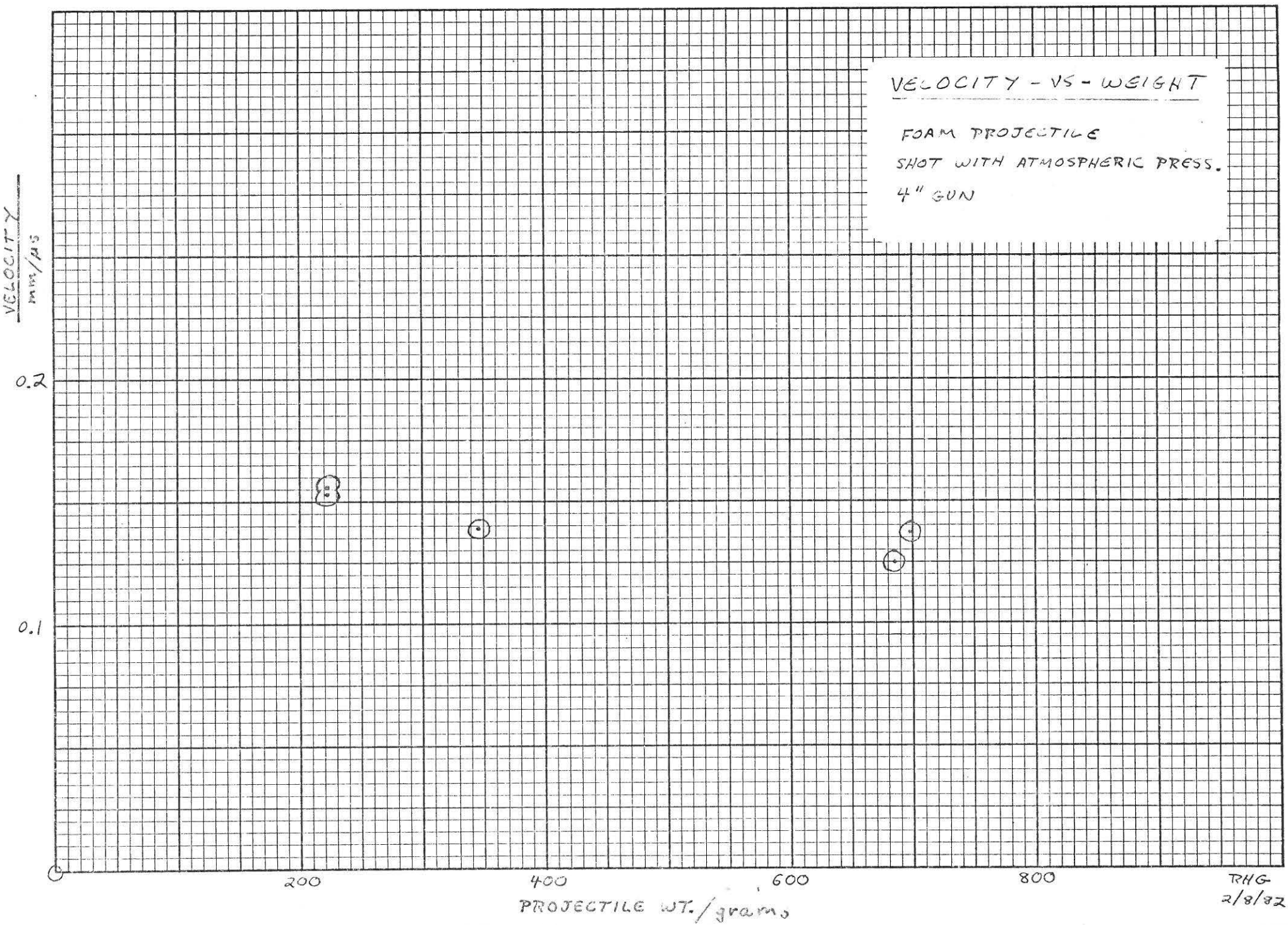
to correct the chamber pressure for leaks either to vacuum or to atmosphere. You must be pumping on the space between the projectile and the diaphragm chamber BEFORE AND DURING evacuation of the target chamber and gun. This is to prevent the projectile from being sucked down the barrel. The base of the Double-Diaphragm breech forms a vacuum seal against the O-ring of the spacer shown in Figure 2. Thus, this base must be kept smooth and should be lightly lubricated with vacuum grease.

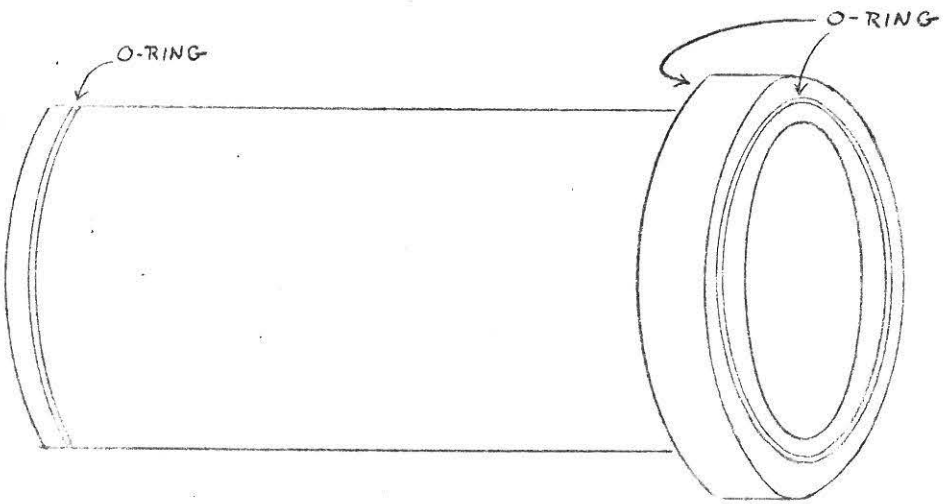
Table I

The following are velocity versus weight data for polyurethane foam projectiles shot with atmospheric pressure form the 4 inch gun. The foam projectile alone weighed 220 grams. Higher weights were obtained by adding copper impactors.

Shot #	Projectile Weight	Velocity
81-023	686 grams	0.125 mm/μsec
81-024	698	0.137
82-001	346	0.139
82-004	222	0.156
82-005	222	0.153

Figure 1





SPACER

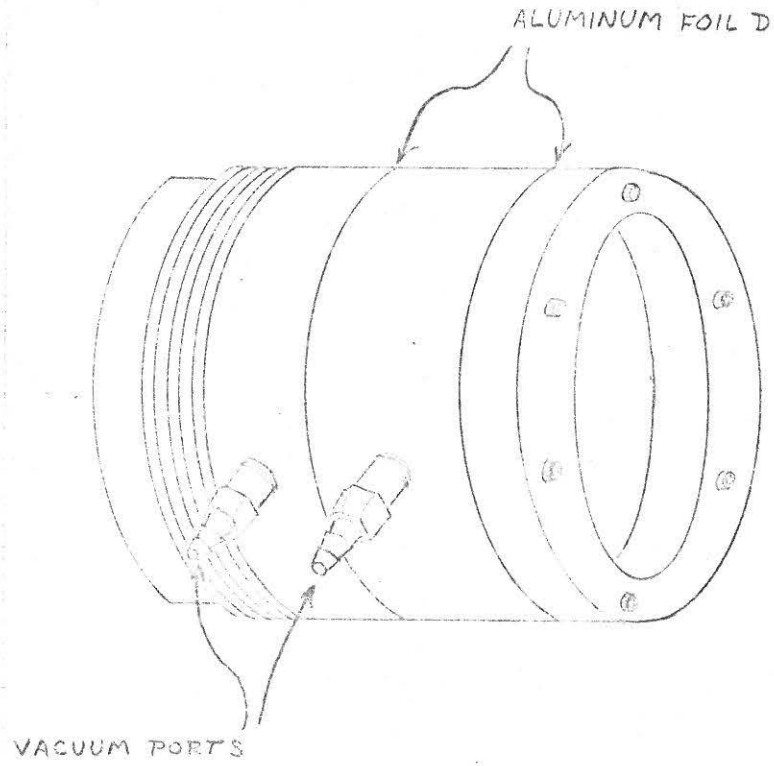


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Figure 2