higher reservoir volumes increase the cost of gas which, in the case of helium, is not trivial. For projectile masses of 450 gm, which is about the minimum weight that can be fired with adequate strength and rigidity, the corresponding reservoir volume for Helium at 6000 psi is one cubic foot and this value was therefore adopted. The curves shown in Figs. 1 and 2 were taken from Siegel,[5] and were verified by similar calculations in this laboratory by Richard White.[6]

Thus, within the bounds of reasonable practicality the gun is designed to give nearly the maximum velocity ($\sim$1.5 mm/μ s) and maximum diameter attainable in a single stage gun. Improved performance would result from use of hydrogen, but this gas was ruled out because of handling and safety problems.

Aside from the choice of operating parameters indicated above the most important feature of the gun is the method for absorbing recoil. Detailed gas dynamical calculations indicate a maximum momentum of about 2×10^8 dyne-sec, and a maximum unbalanced force of 75,000 pounds.[6]

It was decided, rather than to attempt to hold the gun rigidly with the target fastened to the barrel, to let the gun slide freely while holding the target stationary. By this means the recoil forces are substantially reduced and can be accommodated by standard shock absorbers. This has the additional advantage that no appreciable vibrations are transmitted to the target from the barrel. The principal concern with this scheme is whether or not sufficient control can be maintained of the tilt of the projectile with respect to the target. It is necessary to maintain the tilt below about one milliradian in order not to cause degradation of the time resolution available from recording techniques. Consideration of the possible extent of misalignment during the approximately one-inch of motion of the gun barrel before impact indicated, however, that significant bending or rotation would not be expected.[7] This conclusion has been subsequently verified by tilt measurements that are consistently below 0.5 milliradians, and are frequently much less.