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HIGH VELOCITY GUN

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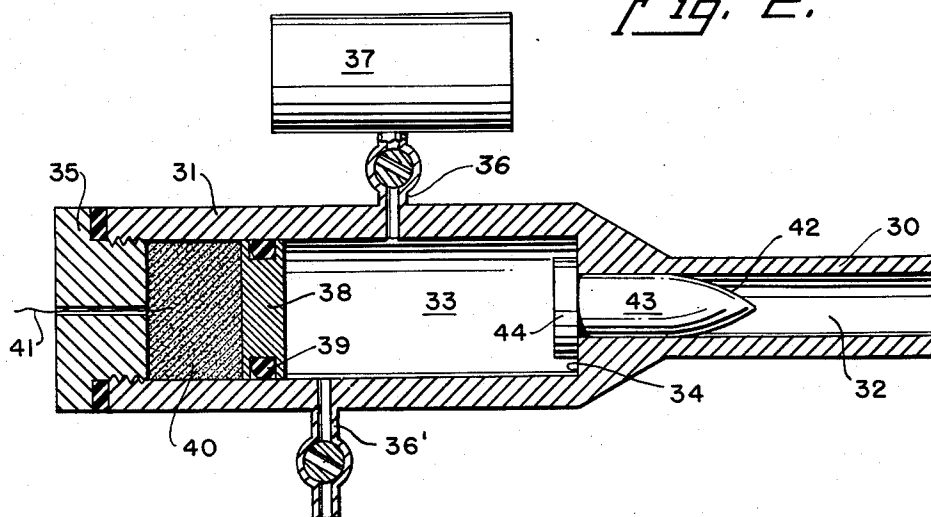
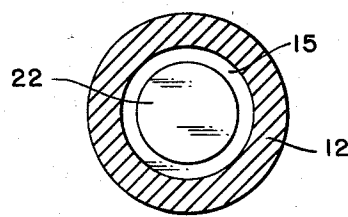
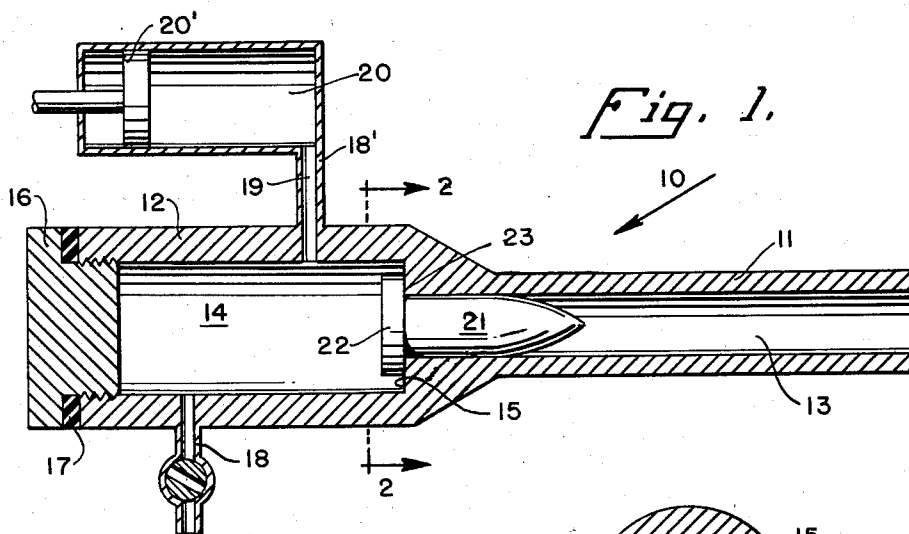


Fig. 3.

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HIGH VELOCITY GUN

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5 Claims. (Cl. 89—7)

The present invention relates to guns and more particularly to an improved light gas gun for attaining high projectile velocities.

The prime obstacle to the attainment of extremely high muzzle velocities in guns employing conventional propellants, such as nitrocellulose, has been the relatively large mass of the gas, forming the propelling column in such guns, which had to be accelerated along with the projectile. Various attempts have, heretofore, been made to overcome this obstacle whereby to achieve increased projectile velocities. Thus, a proposed arrangement comprised a projectile of reduced mass and a propelling charge of increased mass. Such an arrangement, however, gave rise to the formation of a large pressure gradient along the gaseous propelling column which resulted in a severe limitation of the pressure at the projectile base and a corresponding limitation in muzzle velocity.

The present invention successfully avoids the disadvantages inherent in the prior projectile propelling arrangements by providing an improved high velocity light gas gun wherein the propelling column is comprised of a gas of relatively low molecular weight, the projectile being restrained against movement through the bore of the gun until the pressure of the propelling gas has been increased to a desired high value. Upon release of the projectile, the latter will be propelled through the bore at a very high velocity by the approximate adiabatic expansion of the gas.

In accordance with the foregoing, it is an object of the present invention to provide an improved high velocity gun.

Another object of the invention is to provide an improved high velocity gun wherein the propelling column is comprised of a gas of relatively low molecular weight.

Still another object of the invention is to provide an improved light gas gun as in the foregoing wherein the projectile is restrained against movement through the bore until the pressure of the propelling gas has attained a desired high value whereupon the projectile is caused to be suddenly released and is propelled along the bore by the approximate adiabatic expansion of the gas with the resultant attainment of an extremely high muzzle velocity.

And a further object of the invention is to provide an improved projectile for use in a high velocity light gas gun.

Other objects and many of the attendant advantages of the present invention will become apparent as the same becomes better understood from the following detailed description had in conjunction with the annexed drawings wherein:

Fig. 1 is a longitudinal sectional view of one physical embodiment of the light gas gun of the present invention;

Fig. 2 is a transverse sectional view taken substantially along line 2—2 of Fig. 1; and

Fig. 3 is a longitudinal sectional view of a modified form of the instant invention.

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Referring now to the drawings and more particularly to Fig. 1, wherein one form of the present gun is illustrated, 10 designates broadly a gun comprising a barrel 11 and an enlarged breech portion 12. Bore 13, formed within barrel 11, is communicated with an enlarged chamber 14 within breech portion 12 whereby there will be defined an annular shoulder 15 at the juncture of bore 13 and chamber 14. The after end of chamber 14 is closed by a breech plug 16 which is removably secured, as by a threaded connection, for example, to breech portion 12. A seal ring 17 may, if necessary, be disposed between the breech plug 16 and breech portion 12, as shown, to provide a gas-tight seal at the breech end of the gun. Integrally formed with, as shown, or if desired formed separately from and secured to, the wall of breech portion 12 are conduits 18 and 18', conduit 18 including a shut-off valve as shown and communicating chamber 14 to atmosphere, and conduit 18' defining a flow passage 19 which communicates chamber 14 with source 20 of a gas, such as helium or hydrogen, having a relatively low molecular weight. Source 20 includes a piston 20', or other suitable compression means, operated by mechanism not shown, whereby the pressure of the gas in chamber 14 may be raised to a desired value. While there has been illustrated a conduit 18, incorporating a shut-off valve, to provide for the flushing of air from chamber 14, if desired, as described below, such conduit and valve are not absolutely essential inasmuch as the mass of entrapped air in chamber 14 at atmospheric pressure would be very small compared to the mass of the light gas introduced at the very high pressure necessary for high velocity propulsion.

The projectile for use in the present gun may comprise a cylindrical body portion 21 having a substantially conical nose, as shown, and a flanged after end portion 22 defining a shoulder 23 of predetermined thickness.

In operation, the body portion 21 of the projectile is inserted into bore 13 until shoulder 23 of the projectile engages shoulder 15 on the gun. With the valve in conduit 18 open, low molecular weight gas, from source 20, is forced into chamber 14, by the operation of piston 20', until substantially all of the air has been expelled from chamber 14. The valve is then closed and the pressure of the gas in chamber 14 is increased causing shoulders 15 and 23 to be urged into intimate contact and form a gas-tight seal between chamber 14 and bore 13, the pressure of the gas in chamber 14 being increased to such a value that the flange 22 on the after end of the projectile will be sheared off whereupon the body 21 of the projectile will be propelled along bore 13 by the approximate adiabatic expansion of the gas. The thickness of flange 22 is made such that shearing thereof will occur at a desired predetermined pressure. Owing to the greatly reduced mass of the gas in the propelling column, which must be accelerated along with the projectile, much higher muzzle velocities are obtainable than with guns employing conventional propellants.

The modified form of the gun illustrated in Fig. 3 comprises a barrel 30 and an enlarged breech portion 31. Bore 32 is communicated with an enlarged chamber 33 in breech portion 31 whereby to define a shoulder 34 at the juncture of bore 32 and chamber 33. A removable breech plug and seal assembly 35, similar to that of Fig. 1, serves to provide a gas-tight closure at the after end of chamber 33. A conduit 36, incorporating a shut-off valve, as shown, secured to or formed integral with, the wall of breech portion 31 serves to communicate chamber 33 with a high pressure source 37 of a gas of low molecular weight, while a conduit 36', having a shut-off valve, as shown, communicates chamber 33 to atmosphere as in the case of Fig. 1. Conduit 36' and its valve serve to permit expelling of the air from chamber 33 if desired. As

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set forth with reference to Fig. 1, however, such conduit and valve are not absolutely necessary to the successful operation of the present gun owing to the relatively small mass of air that would be entrapped in chamber 33 if conduit 36' and its valve were omitted. Slidably disposed within chamber 33 is a piston 38 which may include a resilient seal ring 39 for providing a gas-tight seal between the piston and wall of chamber 33. Disposed between piston 38 and breech plug assembly is a charge 40 of any conventional propellant powder which is adapted to be detonated, for example, by the application of an electrical current to the leads 41.

The projectile 42 is similar to that in the modification of Fig. 1 and includes a body portion 43 and a flange portion 44 which is adapted to sealingly engage the shoulder 34 as in the modification of Fig. 1.

In operation, gas of a low molecular weight, such as helium or hydrogen is introduced into chamber 33 from high pressure source 37 with the valve in conduit 36' open until all of the air has been expelled from chamber 33. The valve is closed and additional gas from high pressure source 37 is admitted to chamber 33 until the pressure therein rises to as high a value as can be conveniently attained. The valve in conduit 36 is closed and propellant charge 40 is detonated whereupon piston 38 will be driven toward projectile 44 and additionally compress the gas in chamber 33. The arrangement is such that movement of piston 38 will cause compression of the gas in chamber 33 to such a high value as to cause shearing off of flange 44 whereupon projectile body 43 will be propelled at an extremely high velocity through the bore 32 by the approximate adiabatic expansion of the gas in chamber 33.

While the drawing and the foregoing description disclose a shearable flange for restraining the projectile until the pressure in the gun chamber has been increased to a desired release value, it will be obvious that other and various arrangements may be employed for preventing propulsion of the projectile body through the gun bore until the gas pressure has attained the release value.

It will be apparent from the foregoing that the present invention provides a relatively simple and inexpensive gun for attaining high projectile velocities.

Obviously, many modifications are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically disclosed herein.

What is claimed is:

1. In combination, a gun comprising a forward barrel portion and an after breech portion, the bore of the barrel opening at its after end into a breech chamber formed in said breech portion, a source of gas having a

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relatively low molecular weight and having substantially adiabatic expansion properties communicated with said breech chamber, a piston in said breech chamber and means including an explosive charge for causing said piston to move against the gas in said chamber and operative to compress said gas to a desired relatively high value; a projectile comprising a body portion adapted to be propelled forwardly through the bore under the force of gas in said chamber; and means integral with said projectile for preventing the leakage of gas through said bore and for preventing propulsion of the projectile body through said bore under the force of said gas until the pressure of the gas in the chamber has been increased to a predetermined value; said projectile body, upon the gas pressure attaining said predetermined value, being adapted to be propelled at a relatively high velocity through the bore by direct force exerted on said projectile by the gas.

2. The combination according to claim 1 wherein said gas is hydrogen.

3. The combination according to claim 1 wherein said gas is helium.

4. The combination according to claim 1 wherein said second mentioned means comprises a rearwardly facing shoulder in said gun at the juncture of the bore and chamber and an annular flange carried by the projectile body and engaging said shoulder, said flange being urged into gas-tight contact with said shoulder under the force of the gas, said projectile body being adapted to be released from said flange upon the pressure of the gas in said chamber attaining said predetermined value.

5. The combination according to claim 4 wherein said flange is integrally formed with the projectile body and is of a predetermined thickness whereby the flange will be sheared off of the body upon the gas pressure reaching said predetermined value.

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