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[54] **LOW VELOCITY CARTRIDGE HAVING TOTAL PROPELLANT IGNITION**

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[73] Assignee: **The United States of America as represented by the Secretary of the Army**

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[52] **U.S. Cl.** **102/38,** 102/92.4, 102/93

[51] **Int. Cl.**.....**F42b 13/16**

[58] **Field of Search**.....102/38, 40, 93, 92.1, 102/92.7, 56, 41

[56] **References Cited**

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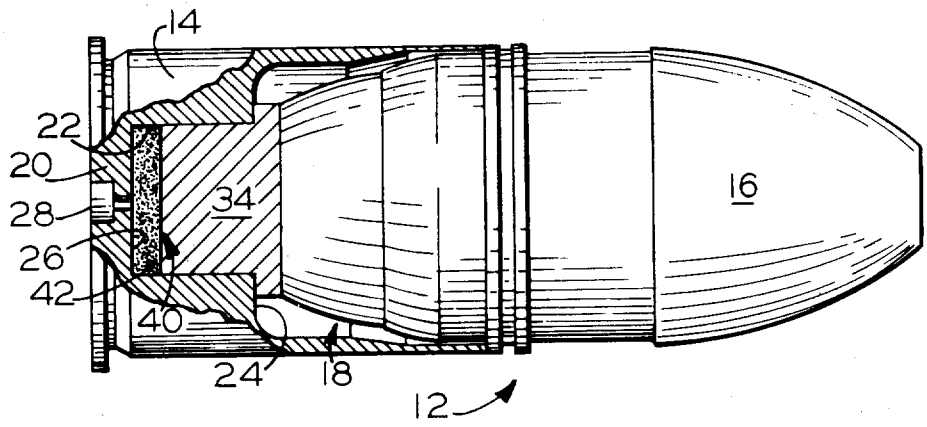
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[57] **ABSTRACT**

An ammunition round is provided with a high pressure chamber containing the propellant which is contained therein by a piston or pusher sabot having contact with the projectile. The inertia of the projectile is applied against the force of the propellant gasses when the propellant is ignited to delay the release of the propellant gases from the high pressure chamber to a low pressure chamber rearwardly of the projectile until the propellant is entirely ignited.

1 Claim, 2 Drawing Figures



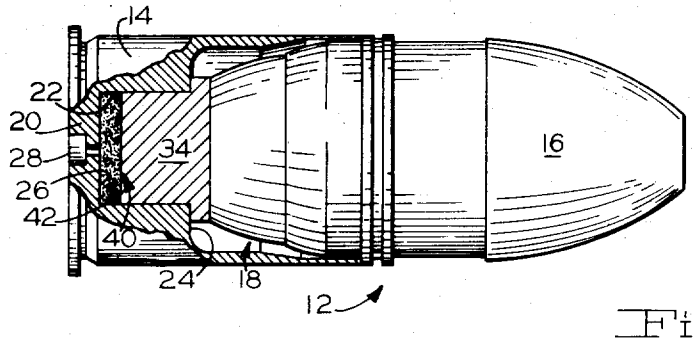


Fig 1

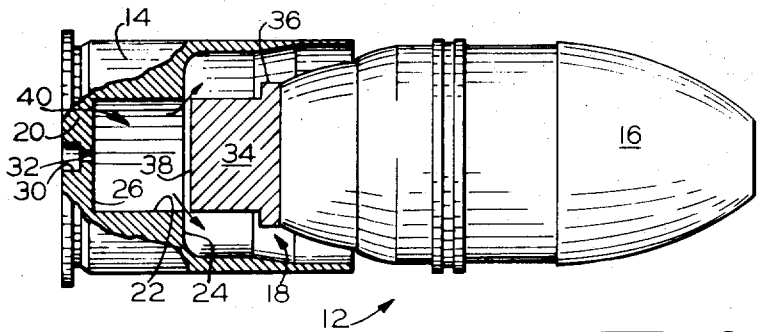


Fig 2

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LOW VELOCITY CARTRIDGE HAVING TOTAL PROPELLANT IGNITION

BACKGROUND OF THE INVENTION

This invention relates to ammunition rounds and pertains more particularly to rounds which produce a very low projectile velocity, as those rounds in which the projectile is a grenade.

In any gun system which uses cartridge ammunition, the propellant is burned in a case behind the projectile and the hot gases generated thereby expand to propel the projectile from the case and along the gun bore. Where the projectile velocity is only a few hundred feet per second, it is generally impossible to obtain consistent muzzle velocities with conventional cartridges where the length of the case to its diameter is low, as of the order of one to two. This is because the rate of increase of the case volume is so rapid, as the projectile is propelled forwardly therein by the initial ignition, that a variable proportion of the propellant is driven along the gun bore after the projectile without being ignited. Thus, round to round combustion is inconsistent, resulting in a low military efficiency.

To overcome this problem, cartridges incorporating a high-low pressure system have been provided in which the propellant is loaded in a relatively small high pressure chamber screwed into the base of the case. When the propellant is ignited, it remains contained in the high pressure chamber until the pressure generated therein reaches a level which assures that all of the propellant is ignited, then, a brass cap covering the propellant and closing the chamber ruptures at the vents therein, thereby permitting the discharge gases to expand into a low pressure chamber in back of the projectile which is propelled thereby from the case.

SUMMARY OF THE INVENTION

It is a principal object of this invention to provide a high-low type of low velocity round wherein release of the propellant gas from the high pressure chamber, where the propellant is ignited, to the low pressure chamber rearwardly of the projectile for forward action thereagainst is delayed by the inertia of the projectile for a period of time which assures complete ignition of the propellant.

It is another object of this invention to provide such a high-low type of low velocity round wherein the period of time during which release of the propellant gas is delayed and the degree of initial impact thereof against the projectile are readily varied according to requirements.

It is a further object of this invention to provide such a high-low type of low velocity round which is economical to manufacture, is simple in construction and is positive in operation.

These objects are obtained in the round according to this invention by locating in the high pressure chamber a piston or pusher sabot which retains the propellant gas therein until it is propelled therefrom.

The piston has contact with but is separated from the projectile so that the inertia thereof, multiplied by the ratio of the cross-sectional area of the large diameter of the projectile to the cross-sectional area of the piston, resists the forward travel thereof from the high pressure chamber. Thereby, the resistance of the augmented inertia to the forward travel of the piston, and the length thereof, delay the release of the gases from the high pressure chamber into the low pressure chamber in back of the projectile until all the propellant is ignited. The period of delay between the time the propellant is ignited and the time that the discharge gases are released into the low pressure chamber, and the degree of the initial impact by the discharge gases against the projectile through the piston, are obtainable as desired by selectively varying the diameter and length of the piston.

Further objects and advantages of the invention will be apparent from the following specifications and the accompanying drawings which are for the purpose of illustration only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-section of an ammunition round, according to this invention, shown before discharge; and

FIG. 2 is a view similar to FIG. 1 but showing the relationship of the parts during ignition when the piston is propelled from the cooperating bore and the discharge gases are released thereby from the high pressure chamber into the low pressure chamber.

DESCRIPTION OF A PREFERRED EMBODIMENT

Shown in the drawings is a round **12** comprising a case **14** and a grenade **16** inserted into the front end thereof to form a low pressure chamber **18** between the grenade and base **20** of the case. A central bore **22** extends from inside surface **24** of base **20** to an end wall **26** and a primer **28** is installed within a cooperating recess **30** formed in the base from the outside face thereof. Aperture **32** provides communication between recess **30** and bore **22**. A cylindrical piston **34** of uniform diameter is received by bore **22** with a sliding fit therewith, which piston comprises a plate **36** fixed to one end and a planar surface **38** formed on the other. Both plate **36** and surface **38** are disposed perpendicular to the central axis of piston **34**. Surface **38** is spaced from plate **36** a distance whereby, when piston **34** is located in bore **22** and the plate is in contact with inside surface **24**, surface **38** is spaced from end wall **26** thereby forming a high pressure chamber **40** therebetween. The inner end of grenade **16** is in contact with plate **36** when installed in case **14** so that the piston **34** serves as a separate pusher type sabot.

A propellant **42** is loaded into high pressure chamber **40** whereby, when primer **28** is detonated by the firing mechanism of the supporting launcher (not shown), the propellant is ignited and the propellant gases formed thereby act against surface **38** to move piston **34** forwardly with grenade **16** which is propelled thereby from case **14**. When surface **38** is located outside of bore **22**, during the forward travel of piston **34**, the propellant gases expand into low pressure chamber **18** for continued application, at a reduced pressure, against grenade **16**. The diameter of piston **34**, the length thereof, and consequently the diameter and length of bore **22**, are determined by the combustion characteristics of propellant **42**. These dimensions are important factors in obtaining constant round to round velocities as they control the period of time during which the propellant is contained in high pressure chamber **40** so that complete ignition is effected and

optimum velocity obtained. Through piston **34**, the inertia of grenade **16** is applied against the pressure of the propellant gases generated in high pressure chamber **40**, thereby retarding the displacement of piston **34** in bore **22** and increasing the time of ignition before the propellant gas is released into low pressure chamber **18**. The ratio of the cross-sectional area of grenade **16**, at the large diameter thereof, to the area of surface **38** determines the degree to which the inertia of the grenade opposes the force of the propellant gases applied against such surface to thereby retard the propulsion of piston **34** from bore **22**. The length of piston **34**, obviously, further controls the time period wherein propellant **42** after being ignited is contained within high pressure chamber **40**. The area of surface **38** also determines the amount of initial force applied by the propellant gas against grenade **16**, and this is important as the fuse system in some grenades are more efficiently armed by heavy initial impact of the propellant force thereagainst while others are better armed by a lower impact force. The length of piston **34** and the diameter thereof can be varied to obtain the desired time delay, for complete ignition of propellant **42**, and the desired initial force applied against grenade **16**. Once the piston and grenade leave the weapon from which they are fired, the two become separated and the ballistics of the grenade in flight are not interfered with.

In the illustrated embodiment, grenade **16** is of 40mm type, the diameter of piston **34** is 0.804 inches and its length is 0.5 inches. Propellant **42** comprises 3 grains of M9 ignition propellant powder. The maximum pressure achieved in high pressure chamber **40** by ignition of propellant **42** is 8,000 psi and this pressure is reduced to a maximum pressure of 3,500 psi when piston **34** is propelled from bore **22** and the discharge gas is released into low pressure chamber **18**. The resulting muzzle velocity of grenade **16** is 275 fps and the standard deviation in velocity, computed from the discharge of a number of rounds **12**, is less than 5 fps.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. An ammunition round comprising a case having a stepped bore of two different diameters and a base, said base including means for receiving a primer centrally thereof, the bore of lesser diameter being disposed adjacent to said base and in communication with said primer receiving means, the bore of larger diameter being disposed coaxial with said lesser diameter bore and remote from said base, the relative diameters of said bores being dimensioned such that said lesser diameter bore defines a chamber of significantly smaller volume than the chamber defined by said larger diameter bore whereby said lesser diameter bore defines a higher pressure chamber relative to the chamber defined by said larger diameter bore, propellant means disposed in said lesser diameter bore adjacent to said base, a projectile axially disposed in said larger diameter bore to extend thereinto toward said lesser diameter bore, and sabot means disposed within said lesser diameter bore and in contact with said projectile for propelling said projectile axially from said case, said sabot means being dimensioned axially to prevent expansion of gasses produced by said propellant into said larger diameter bore in response to predetermined axial movement of said projectile from said case.

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