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RECOILLESS RIFLE WITH A VENA CONTRACTA ORIFICE

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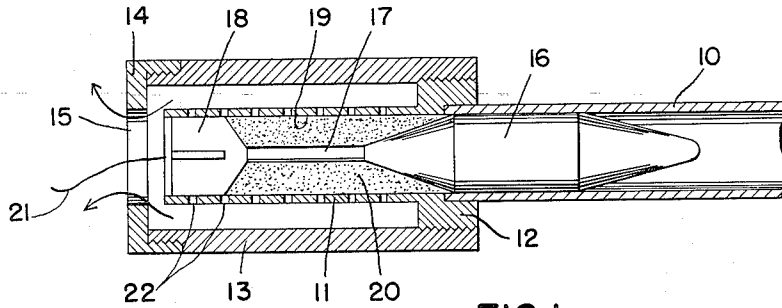


FIG. 1.

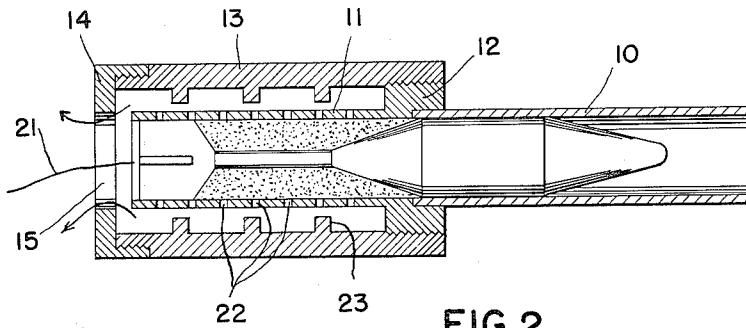


FIG. 2.

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RECOILLESS RIFLE WITH A VENA  
CONTRACTA ORIFICE

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3 Claims. (Cl. 89-1.7)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to recoilless rifles wherein a gas produced by propelling powder during the firing of a projectile is discharged into a chamber from which it escapes through an aperture at the breech end of the rifle. A principal object of the invention is to provide an improved chamber and orifice design which is more readily fabricated and replaced than those heretofore available.

The conventional recoilless rifle employs a central nozzle of the venturi type. This nozzle has a throat adjacent the chamber, its throat blending into a rearwardly extending truncated cone section. Such a nozzle is difficult to manufacture. After repeated firings of the rifle, the throat becomes eroded resulting in forward recoil of the weapon. When the recoil is beyond prescribed limits, the nozzle must be replaced. With the standard venturi-shaped nozzle it has always been necessary to have a breech-operating mechanism. As a consequence, all of the recoilless rifles that have been made to date either have a chamber which swings open, or they have an expanding nozzle. Unfortunately, the area of opening in a nozzle is somewhat smaller than that occupied by the cross-section of the projectile. As a consequence, the projectile cannot be passed through the nozzle unless the nozzle is increased in size so that the projectile could be passed through it; then the gun would have an objectionable forward recoil. In order to eliminate the breech mechanism, and thereby bring about a material saving in weight as well as a considerably lower cost in manufacture, the vena contracta effect is utilized. In this case, a nozzle opening which would be sufficiently large to pass the projectile through it, is used, and by having the edge of the orifice sharp, the gas flow is reduced in area due to the vena contracta effect so that the gas, at its smallest diameter, approximates the diameter of the nozzle used in a recoilless rifle which has a nozzle operating at the zero recoil level. When a square-edged orifice is used, the gas breaks or tears away from the orifice edge and produces a flow of gas which closely approximates that of a nozzle having a venturi-shaped orifice. A weapon of this particular nature not only provides a saving in weight and cost to manufacture, but it can be loaded considerably faster. All of these things are of major importance to a lightweight, shoulder-fired weapon.

In accordance with the present invention, these results are achieved by substituting for the venturi nozzle a plate having a square-edged circular orifice. As is well known, the orifice differs from the nozzle in that the constricted flow of the gas occurs, not within the orifice, but downstream from it owing to the non-axial direction of the fluid particles as they approach the orifice. If repeated firings of the rifle erode the sharp edges of the orifice and change the recoil characteristics, the simple operation of replacing the plate restores the rifle to its original state.

The invention will be better understood from the following description when considered in connection with

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the accompanying drawings and its scope is indicated by the appended claims.

Referring to the drawings:

FIG. 1 illustrates a preferred form of the invention, and

FIG. 2 shows a modified embodiment including means for effecting a more complete combustion of the explosive utilized to propel the projectile.

The rifle of FIG. 1 includes a barrel 10 which is brazed or otherwise fixed to a perforated cylinder having a threaded flange 12 at its forward end. Threaded onto the flange 12 is a cylinder 13 which forms the outer casing of the chamber. A cap 14 is threaded onto the breech end of the cylinder 13. Cap 14 has an axially aligned, circular, square-edged orifice 15 disposed therein of sufficient diameter to permit the insertion of the projectile.

The cartridge fired by the rifle of FIG. 1 includes a head 16, a boom 17 and fins 18. Surrounding the boom 17 is a combustible or frangible casing 19 which encloses an explosive charge 20. The cartridge has a conventional electric primer which is fired by a voltage applied through a lead 21. Firing of the primer ignites the charge 20 and some of the resulting gas is discharged through the perforations 22 into the chamber from whence it escapes, through the orifice 15. As previously indicated, the size and location of the orifice 15 is such that recoil of the rifle is restricted within a desired range of values.

The rifle of FIG. 2 differs from that of FIG. 1 in that a plurality of longitudinally spaced circumferential inwardly extending flanges 23 are arranged along the inner periphery of the chamber to force the gas to travel a longer path. This has the advantage that more complete burning of the explosive is effected. The circular, ring-like protrusions from the chamber 23 act as powder traps so as to increase the period of time that the powder has to burn. Since the time from the ignition of the powder to its exit through the nozzle is only a matter of milliseconds, anything that can be done to impede their flow will tend to increase the efficiency of the rifle. As a consequence, as the solid powder particles are propelled through the orifices in the chamber wall, they run into the annular grooves between the rings 23 and then have to reverse their direction in order to move towards the rear of the chamber. This takes an additional amount of time, and permits the powder to burn more fully.

I claim:

1. A breechless non-venturi recoilless rifle including a barrel for receiving a projectile, a perforated cylinder axially mounted to a rear end of said barrel, a chamber concentrically mounted about said cylinder, means for releasably securing a forward end of said cylinder to a forward end of said chamber, a replaceable cap around a rear portion of said chamber, said perforated cylinder extending rearwardly short of said cap and axially aligned therewith, means for releasably connecting said cap to said rear portion of said chamber, said cap having a centrally disposed, axially aligned, circular, square-edged orifice disposed therein of such diameter to provide vena contracta effect and to permit insertion of the projectile therethrough.

2. A breechless non-venturi recoilless rifle including a barrel for receiving a projectile, a perforated cylinder axially mounted to a rear end of said barrel and having a threaded flange at a forward end, a chamber concentrically mounted about said cylinder having screw threads at a forward portion for receiving said threaded flange and screw threads at a rear end; a replaceable cap having screw threads for engaging with said chamber rear end, said perforated cylinder extending rearwardly short of

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said cap and axially aligned therewith, said cap having a centrally disposed, axially aligned, circular, square-edged orifice disposed therein of such diameter to provide vena contracta effect and to permit insertion of a projectile therethrough.

3. The device of claim 1 further characterized by the inner periphery of said chamber having a plurality of longitudinally spaced circumferential powder trap flanges extending inwardly therefrom.

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