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Guthrie

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[54] **TRAVELING TUBE EJECTOR SYSTEM**

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[52] **U.S. Cl.** **89/1.8,** 89/1.816, 102/34.4, 102/38, 102/49.3

[51] **Int. Cl.** **F41f 3/04**

[58] **Field of Search** 89/1, 1.3, 1.7, 1.8, 1.816; 102/38, 41, 43, 99, 49.3, 34.4

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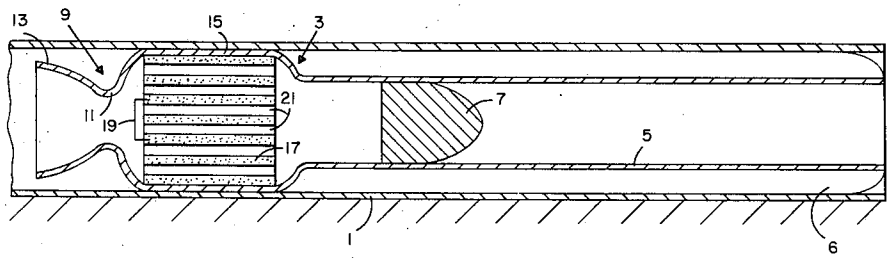
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[57] **ABSTRACT**

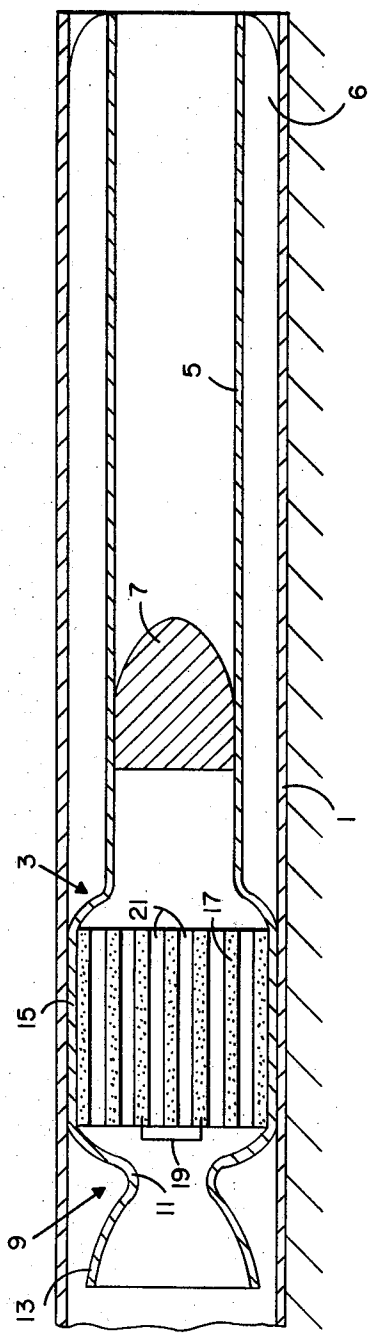
A projectile launching device in which a projectile or warhead is mounted in an ejection tube in the form of a piston and the ejection tube is mounted in a launching tube. A propellant charge in the ejection tube supplies gas pressure to the projectile to force the projectile out the ejection tube, and a rocket nozzle located to the rear of the propellant charge receives gases from combustion of propellant charge to eject the ejection tube from the launching tube.

8 Claims, 1 Drawing Figure



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TRAVELING TUBE EJECTOR SYSTEM

BACKGROUND OF THE INVENTION

This invention is concerned with the launching of a projectile. In the past, projectiles of the type herein employed have been launched by being an integral part of a rocket or by rocoilless rifle means. With a rocket launching means of the abovementioned type, the rocket motor must be of sufficient size to project both the rocket and the projectile to its intended destination. In the recoilless rifle device, the launching tube must be a predetermined length in order to accurately guide the projectile to a predetermined destination. With the limitations of the above devices, a need exists for a launching device in which the overall weight of the launching device is reduced to a minimum and the overall length of the device is also limited to a minimum and the overall length of the device is also limited to a minimum without sacrificing the limits as to range.

SUMMARY OF THE INVENTION

A combination rocket and projectile launcher in which the launching features of a rocket and recoilless rifle projectile launcher are combined to reduce the overall weight of the launching mechanism and to reap the full advantage of the power produced by the propellant charge of the rocket.

With the above considerations in mind, it is an object of this invention to provide a launching device that is more efficient than a rocket propelled projectile or a recoilless rifle propelled projectile.

Another object of this invention is to use a short launch tube but provide means within the launching tube for effectively lengthening the ballistic properties of the short launch tube.

A further object of this invention is to achieve a substantially equal ejector tube travel in the launching tube to the distance traveled by the projectile in the ejector tube so that the effective launch tube length will be the sum of the projectile and ejector tube travel.

Still another object of this invention is to relieve problems of the prior art devices such as the problems associated with length limited in tube burning rockets and recoilless weapons, which are, predominately, the short burning time and ultra high thrust levels.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing is a sectional view of the traveling tube ejector system according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, cylindrical launching tube **1** has an ejector tube **3** slidably mounted therein. Ejector tube **3** has a forward barrel end **5** with outer guide fins **6** and a projectile or warhead **7** slidably mounted therein. Projectile **7** is slidably fitted into barrel end **5** to act as a piston. The rear of ejector tube **3** has a sonic rocket exhaust nozzle **9** with a nozzle throat **11** and a supersonic expansion cone **13.** An expanded portion **15** of ejector tube **3** slidably fits the interval surface of launching tube **1** and has a conventional propellant charge **17** therein. Propellant charge **17** is ignited by conventional igniter means **19** when it is desired to fire the projectile. Passages **21** in propellant charge **17** communicate the gas pressures from the burning propellant to the projectile at the same time the gases are being exhausted through sonic exhaust nozzle **9.**

In order to achieve simultaneous emergence of the projectile from the ejection tube and the ejection tube from the launching tube, a certain ratio of nozzle throat and piston cross-sectional area of the projectile, along with the associated nozzle expansion cone have to be maintained. A ratio of 4.82 square inches nozzle throat area to 4.92 square inches at the projectile base with an expansion cone of 12.5 square inches C_f of 1.41 has been found to work acceptably. The sonic nozzle has to be constructed such as to absorb the recoil from the accelerating projectile and still provide sufficient thrust to accelerate the ejector tube to the desired velocity.

In operation, propellant charge **17** is ignited by igniter **19** in a conventional manner. After ignition, the gases from the burning propellant charge push projectile **7** down barrel **5,** and at the same time, part of the gases exit nozzle **9** and accelerate the ejector tube. The gases pushing on the projectile accelerate the projectile at a rate proportional to the internal pressure and the cross-sectional area of the projectile, but inversely proportionately to the mass of the projectile. This acceleration is in reference to the projectile inertial reference. Hence, since the ejector tube is also undergoing acceleration, the net effect is an increase in the dwell time of the projectile in the barrel, which may be expressed as ballistically lengthening the barrel length. With the emergence of the projectile and the ejector tube from their respective tubes near simultaneously, the effective ballistic length of the launch tube is the summation of the length of the barrel and that of the launching tube. The net result of this lengthening is that of relaxing the short burning time, high thrust levels, high chamber pressure and low delivered I_{sp} restrictions associated with short launch tubes.

I claim:

1. A traveling tube ejector system comprising:

an open ended launching tube having rear and forward ends; an ejection tube slidably mounted in said launching tube for ejection out said forward end of said launching tube, said ejection tube having a forward barrel portion, an intermediate portion and rear rocket nozzle; a projectile mounted at one end of said barrel portion and adjacent said intermediate portion, and a propellant charge mounted in said intermediate portion, said propellant charge, upon ignition, simultaneously communicating gases to the nozzle and the projectile to thereby cause the projectile to be moved forward in said barrel portion and out the other end of said barrel portion at the same time said ejection tube is being forced forward through said launching tube and ejected out said forward end of said launching tube by the gases exhausted through said nozzle.

2. A traveling tube ejector system as set forth in claim **1,** wherein said propellant charge has openings therethrough to communicate gases to the projectile.

3. A traveling tube ejector system as set forth in claim **1,** wherein the area of the projectile, the area of the nozzle throat and the expansion cone of the nozzle are chosen such that said projectile will exit said other end of said barrel portion at substantially the same time said ejection tube exits said forward end of said launching tube.

4. A traveling tube ejector system as set forth in claim

1, wherein said propellant charge is a solid propellant.

5. A traveling tube ejector system as set forth in claim 1, wherein said nozzle is a sonic exhaust nozzle.

6. A traveling tube ejector system as set forth in claim 1, wherein said intermediate portion has a diameter greater than said barrel portion, and said barrel portion has a plurality of circumferentially arranged guide fins.

7. A traveling tube ejector system as set forth in claim 1, wherein said intermediate portion has a diameter greater than said barrel portion and said barrel portion has a plurality of circumferentially arranged guide fins, wherein said nozzle is a sonic exhaust nozzle, wherein said propellant charge is a solid propellant with openings therethrough, and wherein the area of the projectile, the area of the nozzle throat and the expansion cone of the nozzle are chosen such that said projectile will exit said barrel portion at substantially the same time said ejection tube exits said launching tube to thereby effectively increase the dwell time of the projectile in the barrel portion and effectively ballistically lengthen the barrel portion.

8. A traveling tube ejector system as set forth in claim 1, wherein the effective ballistic length of the launching tube is the summation of the length of the barrel portion and that of the launching tube.

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