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(54) Recoilless projectile launcher

(57) A recoilless launcher (1) housing a projectile (11), a counter mass (12) consisting of a flowable medium of relatively high density, and an intermediate propellant unit consisting of a front piston (9), a rear piston (10), a web or bellows (13) connecting both pistons and a propellant (8). Upon firing all combustion gasses from the propellant are retained within the bellows.

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Description

Background of the invention:

[0001] In many tactical situations, and in particular in urban warfare, there is great importance in reducing the signatures associated with launching a projectile. When launching a projectile from a tube with a rocket motor, the exhaust gases create a high-pressure area and significant acoustical and optical signature is observable. These effects preclude firing from enclosures and makes the gunner easily detectable.

[0002] In order to reduce such unwelcome effects, closed launched systems have been designed, which confine the gaseous products of propellant combustion between two pistons moving in opposite directions in the launch tube. Schnabele et al. in US Pat. 3,771,417 and Schnabele in US Patent 3,779,130 present a design of a launching system for firing projectiles which has since been known as the double "trapped piston" design. One of the piston pushes and accelerates the projectile in the launch direction, while the other piston pushes a counter-mass until it is ejected in the backward direction. The pistons move until they run into mechanical stops at the forward and backward end of the launch tube. Even if the weights on both sides of the propelling charge are carefully matched, there might be some mismatch in the timing of the two pistons running into the stops, resulting in possible recoil effects that might adversely affect accuracy and gunner safety.

[0003] In addition, since at the end of the stroke momentum is transferred from the pistons to the tube, the tube has to be structurally designed to withstand the impulsive tensile forces, a requirement that undoubtedly contributes to the tube weight.

[0004] Alternatively, it might be necessary to incorporate into the design a deforming braking device such as taught in US Patent 4,148,244 by Schnabele at al. Such a device adds to the complexity of the design and to its weight.

[0005] The current invention presents solutions for containing the high-pressure gaseous products of propellant combustion without axially loading the launch tube and without generating recoil forces.

Summary of the invention

[0006] According to the current invention, a projectile is launched from the tube after being pushed by a plate, which might serve as a piston, while another plate, which might serve as a piston, pushes a counter-mass until it is ejected in the backward direction. The counter-mass consists of a flowable medium of relatively high density. The two plates are interconnected and the structure connecting the two end-plates arrests them as soon as the distance between them reaches a pre-designed value. In one embodiment, the interconnecting structure is a sealed bellow that contains the gases between the two end-plates, without at all exposing the launch tube to the high pressure. In another embodiment, the interconnecting structure is a multitude of ropes, the gases being contained between the launch tube, serving as a pressure-vessel and the end-plates, serving as pistons.

Description of the Figures

[0007]

Fig. 1a shows a launching system according to a first embodiment of the invention prior to launching the projectile.

Fig. 1b shows a launching system according to a first embodiment of the invention after launching the projectile.

Fig. 2a shows a launching system according to a second embodiment of the invention prior to launching the projectile.

Fig. 2b shows a launching system according to a second embodiment of the invention after launching the projectile.

Detailed description of preferred embodiments of the invention.

[0008] Figure 1 shows a first embodiment of the invention. The launching system consists of a, preferably, throw-away launch tube 1 with removable covers 2,3 on both ends. An optical sight 4 and a firing mechanism 5 are attached to launch tube 1. The output of the firing mechanism (electric or pyrotechnic) is transferred through an electric conductor or a pyrotechnic cable (such as a Nonel-type pyrotechnic cord) 6 to the propellant ignition system 7. A propelling charge 8 is enclosed between two end-plates, 9,10, serving as pistons.

[0009] The projectile 11 is located ahead of the front end-plate 9 and the counter-mass 12 which may, for example, be a flowable medium of relatively high density, is located behind the aft end-plate 10. The two end-plate 9,10 are interconnected by an open connecting structure 13 consisting of several ropes or cables made of high-tensile strength material such as high-strength steel or high-strength fibers such as Kevlar or a combination thereof. If non-metallic, the ropes or cables might be coated with an insulating material such as rubber. When the gunner activates the firing mechanism 5, a signal is transferred through to the propellant ignition system 7. The propellant charge 8 is ignited and burns, generating high temperature, high pressure gases. The pressure generated within the launch tube 1 and between the end-plates, serving as pistons 9, 10, impinges on the pistons. The projectile 11 is pushed forward by end-plate 9 and subsequently ejected from tube 1. The counter-mass 12 is pushed backwards by end-plate 10 and is dispersed when leaving tube 1.

[0010] The structure 13 connecting the two end-

plates arrests them as soon as the distance between them reaches a pre-designed value as determined by the extended length of the ropes. The ropes or cables might be of equal length or slightly different lengths and might vary in thickness as well. Accordingly, the arresting of the pistons can be spread over a certain time interval and not conducted abruptly.

[0011] In order to facilitate the dispersion of the counter-mass and in order to gradually release the pressure between the end-plates once the projectile has been launched, several openings 14 such as holes or blow-out ports might be provided in the pistons.

[0012] Figure 2 shows a second embodiment of the invention. The elements which are in common with the embodiment of Figure 1 are not shown or numbered. Reference is made herein to Figure 1 where appropriate. The launching system consists of a, throw-away launch tube 1 with removable covers 2,3 on both ends. An optical sight 4 and a firing mechanism 5 are attached to the launch tube 1. The output of the firing mechanism (electric or pyrotechnic) is transferred through an electric conductor or a pyrotechnic cable (such as a Nonel-type pyrotechnic cord) 6 to the propellant ignition system 7.

[0013] A propelling charge 8 is enclosed between two end-plates 9,10 which are connected by bellows 23. The two end-plates 9,10 together with the bellows 23 connecting them form a closed structure which serves as a pressure vessel. The bellows are made, for example, of high-tensile strength material such as high-strength steel or fabric reinforced with high-strength fibers such as Kevlar or a combination thereof. If non-metallic, the bellows might be coated with an insulating material such as rubber. It should be noted that according to this second embodiment, the launch tube 1 is not pressurized, a feature that enables a reduced-weight design. The end-plates 9,10 do not serve in this case as pistons and no sealing is required between them and the launch tube 1.

[0014] The projectile 11 is located ahead of the front end-plate 9 and the counter-mass 12 which consists of a flowable medium of relatively high density is located behind the aft end-plate 10. When the gunner activates the firing mechanism 5, a signal is transferred through to the propellant ignition system 7. The propellant charge 8 is ignited and burns generating high temperature, high pressure gases. The pressure generated within the bellows 23 and between the end-plates 9, 10 impinges on the end-plates. The projectile 11 is pushed forward by end-plate 9 and subsequently ejected from the tube. The counter-mass 12 is pushed backwards by end-plate 10 and is dispersed when leaving the tube.

[0015] The bellows 23 connecting the two end-plates arrests them as soon as the distance between them reaches a pre-designed value as determined by the extended length of the bellows 23. It would be possible to connect the endplates with some high-strength ropes in addition to the bellows connection. Accordingly, the arresting of the end-plates can be spread over a certain time interval and not conducted abruptly.

[0016] In order to facilitate the dispersion of the counter-mass and in order to gradually release the pressure between the end-plates once the projectile has been launched, several openings 14 such as holes or blow-out ports might be provided in the pistons.

Claims

1. One or more aspects of system and method for low signature launch of projectile substantially as described herein.

Fig. 1A

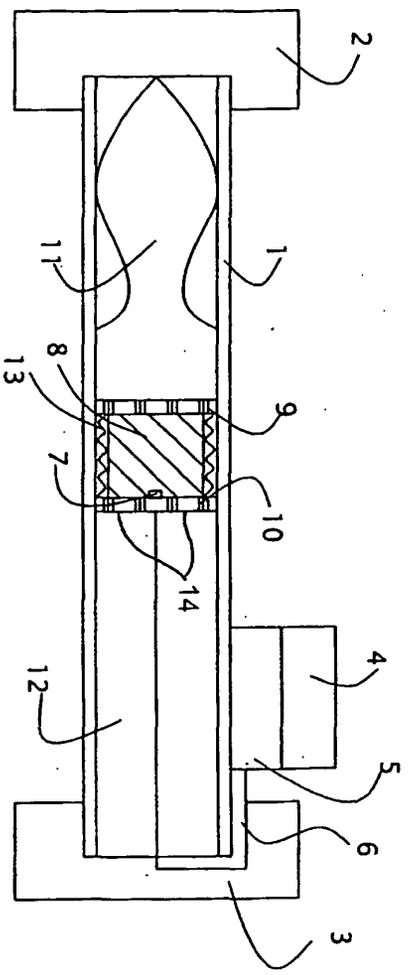


Fig. 1B

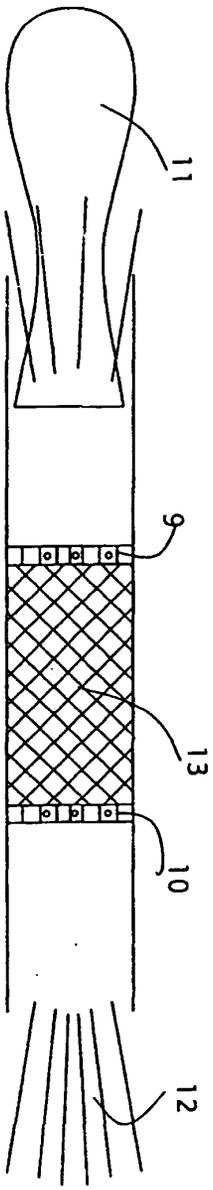


Fig. 2B

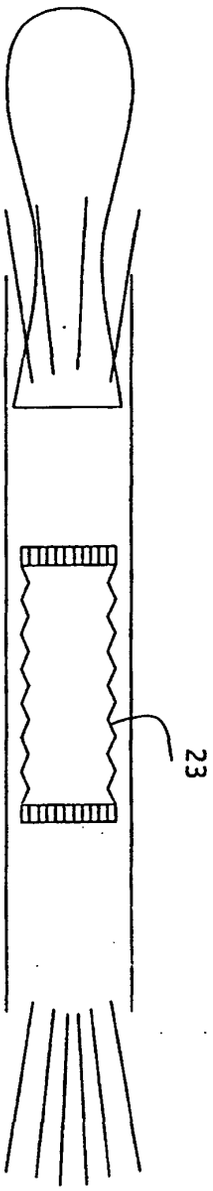
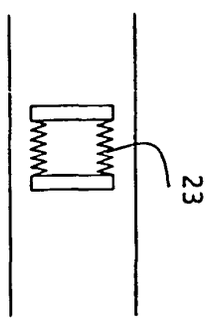


Fig. 2A



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EUROPEAN SEARCH REPORT

Application Number
EP 03 25 1870

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 406 209 A (ARENE ET AL.) 27 September 1983 (1983-09-27) * column 1, line 35 - column 4, line 60; claims 1-14; figures 1-9 * ---	1	F41A1/10
X	FR 2 534 681 A (SOCIETE D'ETUDES DE REALISATION ET D'APPLICATIONS TECHNIQUES) 20 April 1984 (1984-04-20) * the whole document * ---	1	
X	US 3 800 656 A (SCHNÄBELE) 2 April 1974 (1974-04-02) * column 6, line 33 - line 49; figure 4 * ---	1	
X	DE 30 48 598 A (DYNAMIT NOBEL) 29 July 1982 (1982-07-29) * page 8, line 26 - page 12, line 12; claims 1-8; figures 1-7 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F41A
F41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 June 2003	Giesen, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 25 1870

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82