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M. C. HENGEL ETAL

3,212,402

HAND WEAPON

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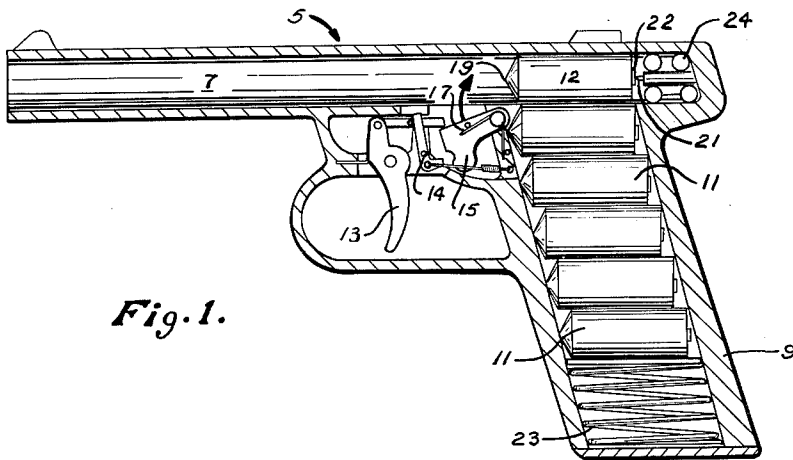


Fig. 1.

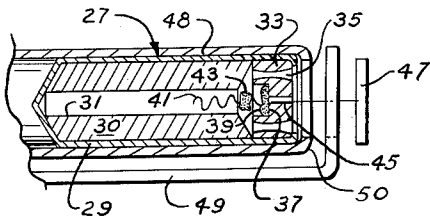


Fig. 2.

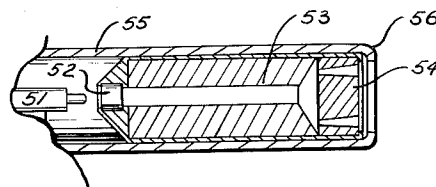


Fig. 3.

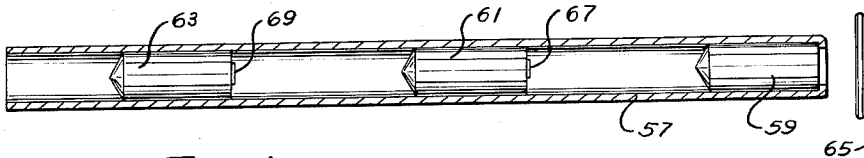


Fig. 4.

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HAND WEAPON

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6 Claims. (Cl. 89-1.7)

This invention relates to hand-held weapons, and more particularly, to a hand-held weapon of the pistol-type side-arm variety wherein novel construction features are employed to ignite and initially restrain miniature ballistic rockets.

Characteristically, small arms weapons have employed bullets which typically have high initial acceleration. This is the result of the containment of high temperature and pressure gases in a relatively heavy barrel wherein the projectile acceleration occurs. Similarly, to contain and absorb the energies released from the ignition of gun powder, the entire weapon has been required to be of heavy durable material. Furthermore, conventional weapons have utilized a percussion ignition system consisting of a movable hammer or mass to impart energy directly or through a firing pin to a percussion sensitive primer cap located in the aft-end of the bullet.

In accordance with the present invention, unique structural features are provided which take advantage of the performance characteristics of miniature ballistic rockets. Hand-held weapon systems should be compact and should, therefore, have relatively short launchers or barrels; however, it is an inherent characteristic of the ignition of most miniature ballistic rockets that an ignition pressure pulse occurs before stable and uniform burning of the rocket propellant is achieved. This pressure pulse may cause rockets to be prematurely ejected from short launchers at unstable velocities resulting in unpredictable and dangerous projectile attitudes when uniform ignition and thrust of the rocket is finally achieved. This disadvantage may be overcome by making use of the characteristically low initial rocket acceleration. A mass may be employed which provides a restraining or hold-down force to the rocket during its ignition period, whereby ignition pressure pulses will not result in forward motion of the rocket. This mass may also be used to ignite the miniature rocket by allowing it to impact the nose-end of the rocket thus igniting a primer cap directly or indirectly. The mass or hammer is allowed to impact the rocket nose, and when sufficient thrust is developed in the rocket, the rocket will push aside the restraining mass, thus imparting energy to it, and proceed down the launch tube. The energy imparted to the restraining mass may be stored in a spring mechanism or directed to create potential gravitational energy whereby this stored or potential energy may be used to drive the mass and thus impact, ignite, and restrain subsequent rockets.

This principle may be used to achieve very high firing rates suitable for machine gun devices. As miniature rockets do not depend on high temperature and pressure gases in the weapon, a rocket hand weapon is recoilless and its barrel tends not to become corroded or over heated. Moreover, reduction or elimination of these disadvantages allows the firing rate of the weapon to be increased by almost an order of magnitude (from 2 to 7 rounds per second for conventional machine guns to 40 rounds per second for rocket weapons).

Other embodiments which utilize a restraining force to effectively control rocket launching and to insure uniform ignition of miniature rockets are contemplated. The restraining force which is applied may take the form

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of a wire which is pulled through a cup in the rocket nozzle whereby friction of the wire and pyrotechnic coating material may be used to ignite the coating and the miniature rocket. This friction force also restrains the rocket during the propellant ignition. Similarly, hold-down systems do not necessarily have to be mechanical, for example, a magnetic field furnished by a permanent magnet may be used to hold back or restrain the miniature rocket during its early flight period.

All of the above systems may be incorporated into a relatively light housing. As the miniature rockets employed do not require containment of hot gases nor high pressures in the launcher, launcher materials may be lightweight plastics or metals. An entire hand weapon system with six rocket projectiles would weigh about one half pound as compared to standard service automatics which weigh about two and a half pounds unloaded. The advantages of such a system in applications where there is a premium on the weight of a weapon that may be effectively handled, may be readily seen. Other advantages, such as lack of weapon recoil and the unusual ordnance effects achieved by the miniature ballistic rockets may be seen.

An object of this invention is to provide a lightweight system suitable for hand launching of miniature ballistic rockets.

Another object of this invention is to provide a hand weapon system which insures controlled launching and ignition of miniature ballistics rockets.

Another object of this invention is to provide an ignition and launching system which allows much higher firing rates than have been heretofore possible.

Other features and objects of the invention will be brought out in the specification which follows.

In the drawings forming part of this application:

FIGURE 1 is a side view, in section, of a hand weapon illustrating the present invention.

FIGURE 2 is a side view, in section, of an alternate embodiment illustrating the miniature ballistic rockets suitable for the present invention as well as an alternate ignition and hold-down means.

FIGURE 3 is a side view, in section, of a miniature ballistic rocket illustrating an alternate ignition system.

FIGURE 4 is a side view, in section, illustrating still another means of achieving ignition and controlled launching by exploiting the initial performance characteristics of the miniature rockets of the present invention.

Referring now to FIGURE 1, there is shown a pistol-type side-arm or hand weapon generally designated 5 which is comprised of a launch tube, or barrel 7, and handle 9, in which miniature rockets 11 are disposed; and a trigger mechanism 13, which activates a mass 15. The barrel 7 and the handle 9 may be made of a lightweight plastic such as polyethylene or nylon or a metal such as aluminum. As the performance of the miniature ballistic rockets of the present invention do not require the containment of hot gases in the barrel; barrel corrosion and strength requirements are eliminated. This is particularly important in applications which require, or in which it would be advantageous, to employ very high projectile firing rates.

The exact trigger mechanism 13 should not be considered critical, as most trigger mechanisms suitable for conventional weapons will be suitable for this purpose. The impacting-restraining means includes a mass or hammer 15 which operates against gravity, with energy provided by a spring 17, but could readily operate as well by using gravity to activate it. The trigger mechanism 13 with the single round catch 14 releases the mass 15, which the spring 17 causes to swing up into the barrel 7 and impact with the rocket 12 on the nose 19. This im-

pact forces the rocket 12 back against the firing pin 21 which ignites a percussion cap 22, whereby the rocket propellant is ignited. The ports 24 allow exhaust gases to escape from the barrel 7. The mass 15 and the spring 17 then restrain the forward motion of the rocket 12 until the rocket propellant is completely and uniformly ignited; whereupon the mass 15 is pushed or thrust down to its initial position against the force of the spring 17 as the rocket 12 proceeds down the barrel 7 and is launched. The effect of the mass 15 upon the rocket 12 is two-fold: (1) the mass 15 achieves ignition of the rocket 12; (2) it prevents premature launching of the rocket 12 and thus insures uniform launching conditions. Once the rocket 12 has left the launcher 7, the next rocket in the handle 9 is forced upward into the barrel 7 by means of the spring 23, and if the trigger mechanism 13 is still clear (triggering systems which allow single and automatic operation are contemplated and well developed in conventional weapons) of the mass 15, the spring 17 will cause the mass to again move into the barrel 7 and impact this next rocket on the nose, thus igniting it. Mechanisms to eject rockets which have malfunctioned and failed to leave the launch tube 7 may be provided and would be analogous to the mechanisms used to remove bullet cartridges from conventional weapons. Similarly a mechanism may be provided to cock the hammer 15 for subsequent rounds.

The use of a mass-spring combination to ignite and restrain miniature rockets may be effectively done with negligible decrease in the projectile's energy. The extremely high acceleration of bullets makes the operation of this system unsuitable for conventional weapons as the acceleration force on the hammer would be too severe.

In FIGURE 2 there is shown a miniature ballistic rocket generally designated 27 which is comprised of casing 29, propellant 30 with cylindrical perforation 31, and nozzle 33 with nozzle ports 35 and ignition cup 37. The casing 29 may be constructed of steel or aluminum while the propellant 30 may be any suitable double-base propellant such as JPN. The nozzle 33 may be fabricated from aluminum, nylon, phenolic base resin, or steel or other materials. The nozzle ports 35 are skewed to the longitudinal axis of the rocket 27 to provide stabilization. The nozzle ports 35 may also be parallel to the longitudinal axis of the rocket with fins being provided to maintain stability. The rocket ignition structure comprised of the cup 37 formed in the nozzle 33; a pyrotechnic material 39 disposed in said cup 37; a wire material 41, which is coated with another pyrotechnic material 43; and a means to pull the wire 41 through the cup 37. As the wire 41 is drawn through the cup 37, friction between the pyrotechnic materials 43 and 39 will cause ignition of said materials, which will discharge against the propellant perforation 31 and ignite the propellant 30.

The rocket 27 is located in a launch tube or barrel 48 and ignition of the rocket 27 is achieved by thrusting the triggering arm 49 away from the rocket thus pulling on the ignition wire 41. This causes the rocket 27 to bear against the rolled over portion 50 of the launch tube 48. The rocket 27 is ignited and then proceeds to move forward against the curved portion of the wire 41 as it is pulled through the opening 45 in the rocket nozzle 33. The curved portion of the wire 41 restrains the rocket 27 during its initial propellant burning and thereby insures uniform and complete rocket ignition. This restraining, or hold-down force may be varied by suitably designing the curved portions of the wire 41 and selecting wire materials. The effect is similar to that shown in FIGURE 1, wherein the ignition means is used as a restraining force during the stage when the internal ballistics of the miniature rocket are approaching a steady state condition (about the first 1 to 5 milliseconds of burning).

When extremely high firing rates are desired (about 20 rounds/second) the firing pin may become excessively heated or corroded from the rocket exhausts. This prob-

lem may be eliminated by utilizing the hammer as a firing pin as is illustrated in FIGURE 3. There is shown a firing pin 51 which acts as the movable hammer 15 in FIGURE 1 and impacts the front end of the rocket on the primer cap 52. The primer cap 52 discharges down the propellant perforation 53 igniting the propellant. Exhaust gases discharge out the nozzle 54 but now may pass out the end of the launch tube 55 causing no heating or corrosion. (Suitable shielding may be provided for various weapon designs.) The launch tube may be slightly rolled over 56 or tapered to resist the force of the hammer blow. The inertia of the rocket could also be used to overcome the force of the hammer blow as could the friction of the rocket with the launch tube caused by a spring or other mechanism used to feed successive rockets.

For larger devices (rapid fire machine guns) it may be advantageous to employ an externally driven hammer 51. Similarly, for both large and small devices the hammer-firing pin 51 could be spring loaded so as to move axially with the launch tube 55. A variety of loading mechanisms could be employed some being more suitable to rapid firing than others. Actual models of the device of FIGURE 1 have achieved firing rates above 30 rounds/second.

The weapon shown in FIGURE 4 illustrates an alternate embodiment of the principles of FIGURES 1 and 2. There is shown a launch tube 57 wherein three rockets, 59, 61, and 63 are disposed. The aft rocket 59 is provided with an ignition means as shown in FIGURE 2, wherein a trigger 65 ignites the rocket 59 and propels it toward the rocket 61 down the launch tube 57. Impact of the rocket 59 with the rocket 61 causes a percussion cap 67 to ignite the rocket 61. Both rockets are then propelled toward the rocket 63, which the rocket 61 impacts and ignites the percussion cap 69. All three rockets then leave the launcher in succession. This system may be used to achieve extremely high fire power from a very simple and compact launcher or gun.

Although multiple embodiments of the invention have been depicted and described, it will be apparent that these embodiments are illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

We claim:

1. A pistol-type weapon adapted to fire rocket-type missiles comprising a launching means including a firing pin in the rearward end thereof, a rocket-type projectile including a nose portion positioned in said launching means said projectile including rearward igniting means, a spring biased impacting-restraining means carried by said weapon and pivotally mounted adjacent to said launching means and beyond the nose of said projectile for pivotal movement into said launching tube, latch means engaging said impacting-restraining means, and trigger means for releasing said latch means for actuating said impacting-restraining means to cause it to strike the nose of said projectile thereby driving it rearwardly against said firing pin to ignite the propellant thereof and to delay forward progress of the projectile until said propellant is completely ignited.

2. A pistol-type weapon as claimed in claim 1, wherein the launching means includes a cylindrical chamber adapted to receive said rocket-type projectile.

3. A pistol-type weapon as claimed in claim 1, wherein means are provided for feeding said projectiles in seriatim to said launching means.

4. A pistol-type weapon as claimed in claim 1, wherein the projectiles are fed serially from a magazine chamber into the launching means.

5. A pistol-type weapon as claimed in claim 4, wherein the magazine chamber forms a hand-grip portion integrated with said launching means.

6. A pistol-type weapon as claimed in claim 1, wherein the aft portion of the launching means is provided with

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exhaust ports whereby spent gases from the ignited projectile are vented to atmosphere.

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