Jan. 14, 1969 F. P. REED 3,421,244

FIRING MECHANISM FOR A RIFLE MOUNTED AUXILIARY FIREARM

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Fig-1-

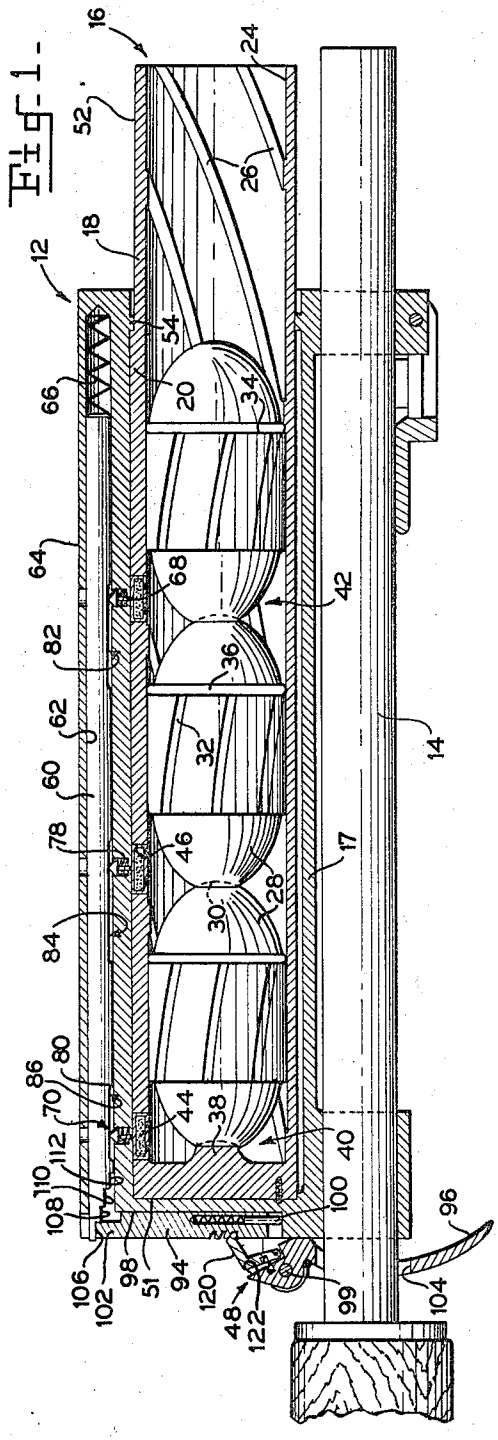
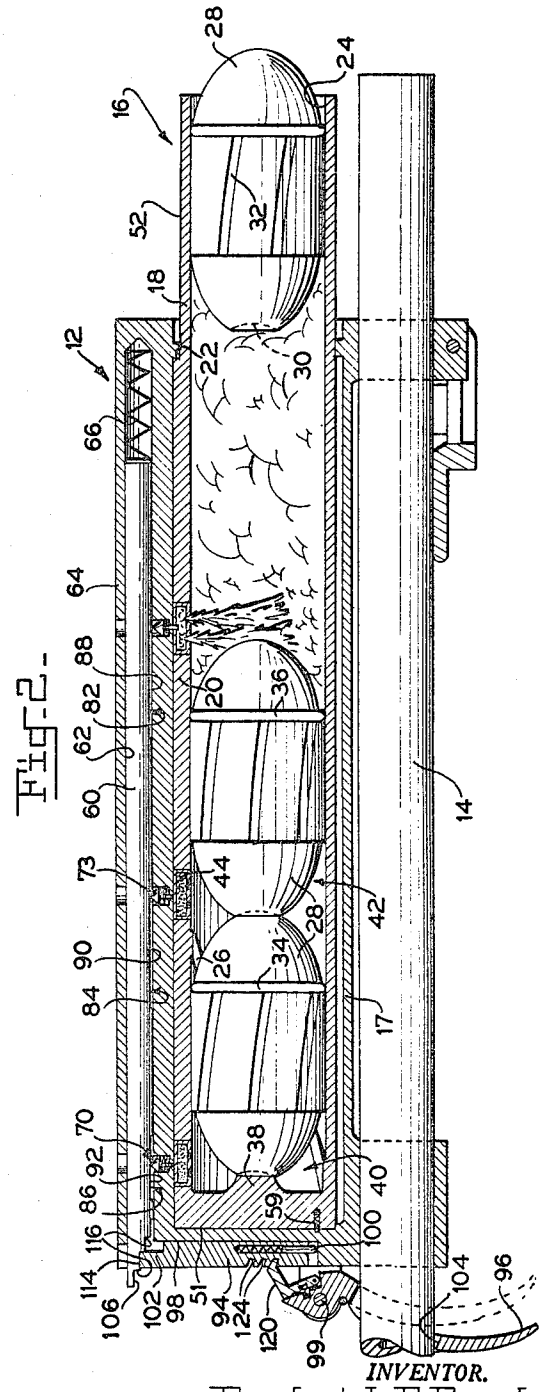


Fig-2-



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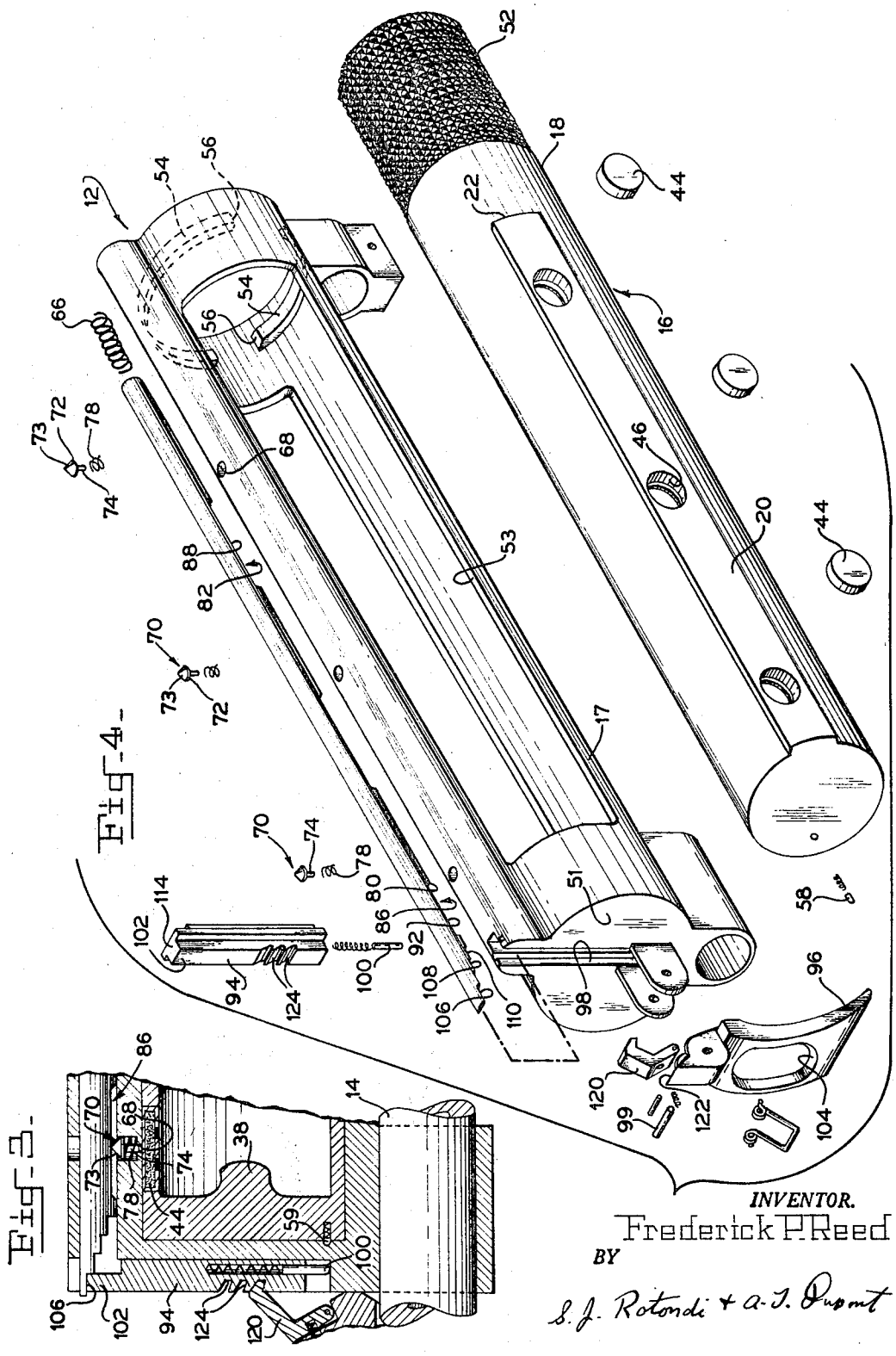


Fig. 4.

Fig. 3.

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FIRING MECHANISM FOR A RIFLE MOUNTED AUXILIARY FIREARM

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U.S. Cl. 42—69 6 Claims
Int. Cl. F41c 17/00

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

This invention relates to firearms and more particularly to the firing mechanisms thereof.

In copending application by Earle M. Harvey for "Rifle Mounted Auxiliary Firearm and Multiprojectile Cartridge Therefor" filed Mar. 2, 1962, Ser. No. 177,707, there is disclosed an auxiliary fiearm which is attachable to a rifle barrel for support thereby and which is designed to fire cartridges in which a plurality of tandem-arranged projectiles are to be discharged separately.

In such a cartridge, an energizing detonator is disposed rearwardly of each projectile and each detonator is initiated by a separate firing pin in the cartridge case. It is the object of this invention to provide for such a firearm a simple but rugged and positive firing mechanism whereby the detonators are successively initiated, starting from the one nearest the muzzle of the barrel, each time a trigger is pulled.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a longitudinally, cross-sectioned view of the front end of a rifle barrel with the fully charged auxiliary firearm mounted thereon;

FIG. 2 is a view similar to FIG. 1 but showing the first detonator initiated and the first projectile energized thereby;

FIG. 3 is an enlarged, fragmentary view similar to FIG. 1 of the firing mechanism; and

FIG. 4 is an exploded, perspective view of the receiver and cartridge.

Shown in the figures is an auxiliary firearm 12 which is releasably attached to a rifle barrel 14 and includes a replaceable multiprojectile cartridge 16 and a tubular receiver 17 therefor. Cartridge 16 includes a tube 18 with an integral rib 20 which extends longitudinally along the outside thereof and is provided with a front end 22. Tube 18 is provided with an axial bore 24 which is rifled, as noted at 26, and is closed at the rear end.

Located tandemwise inside bore 24 and in coaxial alignment are three projectiles 28 which are essentially elliptical in longitudinal cross-section. Projectiles 28 are held in bore 24 by the addition of a suitable adhesive applied between the front one of the projectiles and the wall of the bore. References to front and rear positions herein are relative to the muzzle and breech ends of barrel 14, respectively, or to the right and left sides of the drawings. Provided in the rear end of each of the projectiles 28 is a concave recess 30 which is symmetrical to the longitudinal axis thereof and is arranged to matingly receive the nose of another projectile which is disposed to the rear thereof in tube 18.

The larger diameter portion of projectiles 28 is preengraved, as noted at 32, to mate with rifling 26 so as to spin the projectiles as they are moved along bore 24. The front ogive of projectiles 28 is reduced in diameter immediately forward of the larger diameter portion thereof

to form a forwardly facing annular shoulder 34. An O-ring 36 of elastic gas sealing characteristics is mounted over the front ogive on each of the projectiles 28 to contact shoulder 34. O-ring 36 has interference fit with bore 24 so that, when gas pressure is applied against the O-ring, it will be displaced to fill grooves of rifling 26 and provide a gas seal.

The length of tube 18 is arranged so that the front end thereof extends about four inches in front of the first one of the projectiles 28 therein. This provides sufficient length of tube 18 to start the trajectory of the first one of the projectiles 28 towards its target and for such first projectile to be energized by gas pressure applied rearwardly thereof as hereinafter explained.

Extending axially forward into bore 24 from the rear end of the tube is an ogive-shaped spacer 38, the nose of which is received by concave recess 30 in the rear one of the projectiles 28. Spacer 38 holds the last one of the projectiles 28 forwardly away from the rear end of tube 18 to establish a chamber 40 between the rear end of the tube and such last projectile. Other inclosed chambers 42 are also established respectively between the last and middle ones of the projectiles 28 and between the middle and first ones thereof.

Energy for propelling projectiles 28 from tube 18 is provided by three impact-initiated detonators 44 which are arranged to be respectively dischargeable into chambers 40 and 42. Detonators 44 are each mounted in an accommodating aperture 46 which extends through rib 20 to communicate with bore 24 at chambers 40 and 42 and are successively initiated starting with the first one by a firing mechanism 48, to be described hereinafter, in receiver 17.

Receiver 17 is closed at the rear end by an end wall 51 and is adapted to slidingly receive cartridge 16. Lightening holes, such as are shown at 53, may be formed in receiver 17 to reduce the weight thereof and such receiver may be fabricated from one of the light-weight metals as aluminum or titanium. Receiver 17 is shorter than cartridge 16 so that a section 52 of tube 18 at the front end thereof extends from the receiver and such front end is knurled to facilitate the manual turning of the cartridge for locking purposes. This locking is achieved through the cooperation of front end 22 of rib 20 and an annular flange 54 disposed inside of receiver 17 at the front end. Flange 54 is interrupted by an opening 56 which is coincident with the central lateral plane of receiver 17 and is wide enough to permit the passage of rib 20 past the flange. After cartridge 16 is fully inserted into receiver 17, it is turned 90° to the firing position where rib 20 projects upwardly coincident with the central vertical plane of the receiver.

Contact of front end 22 of rib 20 with flange 54 and the rear end of tube 28 with end wall 51 of receiver 17 prevents longitudinal displacement of cartridge 16. Cartridge 16 is indexed in firing position and is releasably held therein through the cooperation of a spring-biased plunger 58 in the base of tube 18 with a mating detent 59 in end wall 51 of receiver 17.

Firing mechanism 48 includes a hammer 60 which is of rod configuration and is slidingly mounted in a mating hole 62 which extends longtudinally through a section 64 of the wall of receiver 17 which is increased in thickness to provide sufficient metal for forming the hole. A coiled compression spring 66 is disposed in the front end of hole 62 to press against the front end of hammer 60 to bias the hammer rearwardly.

Extending between hole 62 and the inside of receiver 17 are three radial, counterbored orifices 68 which, when cartridge 16 is indexed in the firing position, are each in coaxial alignment with one of the detonators 44. Each

of the orifices 68 slidingly mounts a firing pin 70 which includes a cylindrical striker portion 72 of substantially the same diameter as the larger diameter bore of orifices 68 and which is conically formed, as noted at 73, at the outer end. A pin 74 extends coaxially from the inner end of striker portion 72 and is slidingly received by the smaller diameter bore of orifice 68 so as to be actuatable against the associated one of the detonators 44 for initiation thereof. A compressible coil spring 78 is located in each of the orifices 68 for biasing firing pins 70 upwardly and holding pins 74 clear of detonators 44.

The energy of hammer 60 is impactly transferred to firing pins 70, for successive actuation thereof, by means of three cooperating striking surfaces 80 on the hammer. Striking surfaces 80 are respectively formed at the front ends of a first segmental notch 82, a second segmental notch 84 rearwardly thereof, and a rearmost third segmental notch 86, which face downwardly toward firing pins 70. Notches 82, 84 and 86 also form chordal surfaces 88, 90 and 92, respectively, which have sliding contact with striker portion 72 of the associated firing pin 70 to hold the firing pins in orifices 68. Striking surfaces 80 incline downwardly and forwardly from the associated surfaces 88, 90 and 92 so that, when one of the striking surfaces strikes the associated firing pin 70 during rearward displacement of hammer 60, the rearward displacement thereof is converted to downward displacement of the firing pin. In addition, as striking surfaces 80 are displaced rearwardly of the associated firing pins after impact therewith, the firing pins are cammed thereby into sliding contact with the outside surface of hammer 60. Striking surfaces 80 are spaced in hammer 60 so that, when the front one of the striking surfaces is in contact with the associated firing pin 70, the middle and rear striking surfaces are spaced forwardly of their associated firing pins 70. When the middle striking surface 80 is in contact with its associated firing pin 70, the rear striking surface is spaced forwardly of its associated firing pin and the front striking surface is rearward of the first firing pin which is in contact with the outside surface of hammer 60 forwardly of first segmental cut 82 as will be more fully explained hereinafter.

The sequential step displacement of hammer 60 for separate and successive initiation of detonators 44 is achieved through the cooperation of a sear 94 with the hammer and a trigger 96 with the sear. Sear 94 is slidingly mounted in a vertically disposed slot 98 in the outside of end wall 51 by T-slot means and includes a spring-biased plunger 100 which presses resiliently against the bottom end of the slot to bias the sear upwardly. Trigger 96 is pivotally mounted on end wall 51 below sear 94 by means of a laterally disposed pin 99 and is biased to a normal forward position by a spring 101. An opening 104 in trigger 96 receives barrel 14.

The top of sear 94 is terminated by a lip 102 which has cooperation with a stepped section formed at the rear end of hammer 60 as hereinafter described. Such stepped section includes a first step 106, a second step 108 which progresses stepwise downwardly and forwardly therefrom, a third step 110 which similarly progresses stepwise from the second step, and a fourth step 112 which similarly progresses stepwise from the third step. Each of the steps 106, 108, 110 and 112 is provided with a longitudinally disposed top surface 114 and a vertical front surface 116 which depends from the front end thereof so that the top of lip 102 has contact with such top surface and the front face of the lip has contact with the surface 116 of each of the steps as sear 94 is progressively displaced downwardly and hammer 60 is displaced rearwardly.

Front surfaces 116 are spaced relative to each other similar to the spaced relationship of striking surfaces 80 so that, when lip 102 is in first step 106, the contact of front surface 116 thereof with lip 102 limits the rearward displacement of hammer 60 by spring 66 to a

cocked position wherein striking surfaces 80 are all positioned forwardly out of contact with firing pins 70. When sear 94 is actuated downwardly a first increment of displacement by trigger 96 to where lip 102 no longer contacts front surface 116 of first step 106, hammer 60 is released to be impelled rearwardly by the bias of spring 66 causing the front striking surface 80 to strike the associated firing pin 70. The actuated firing pin 70 initiates the related detonator 44 which discharges into the associated chamber 40 or 42 to energize for flight the projectile 28 forming the front wall thereof. The rearward displacement of hammer 60 is stopped by contact of front surface 116 of second step 108 with lip 102. When sear 94 is depressed still further a second increment of displacement by trigger 96 to where lip 102 clears front surface 116 of second step 108, hammer 60 is freed to be biased rearwardly to cause the middle one of the striking surfaces 80 to strike the associated firing pin 70 for initiation of the related detonator 44. When sear 94 is depressed a third increment of displacement to where lip 102 clears front surface 116 of third step 110, hammer 60 is freed to be rearwardly displaced and cause rear striking surface 80 to strike its associated firing pin 70 and initiate its related detonator. The rearward displacement of hammer 60 is limited by contact of lip 102 with front surface 116 of fourth step 112 to retain the hammer in receiver 17 after cartridge 16 is completely fired.

Sear 94 is pulled downwardly in the aforementioned increments of displacement by a pawl-ratchet device which includes a pawl 120 pivotally mounted in a receiving recess 122 in trigger 96 on a pin 123 and three ratchet teeth 124 formed in the rear face of the sear. A spring 126 is mounted in recess 122 for biasing pawl 120 into contact with ratchet teeth 124 to assure engagement with successive ones thereof. Pin 123 is disposed forwardly of pin 99 which pivotally mounts trigger 96 on receiver 17 whereby, when the trigger is pulled rearwardly, pawl 120 is displaced downwardly against the engaged one of the ratchet teeth 124 to actuate the sear downwardly one increment of displacement. When trigger 96 is returned to its normal forward position by spring 101, sear 94 is maintained in engagement with the respective step of hammer 60 by the bias of spring-biased plunger 100 which presses lip 102 against top surface 114 of such engaged step.

When cartridge 16 is completely fired, it is replaced by turning front section 52 to where front end 22 of rib 20 aligns with opening 56 in flange 54 and then pulling the cartridge forwardly from receiver 17. Hammer 60 is recocked by pressing forwardly against the rear end thereof which protrudes from hole 62. Spring-biased plunger 100 automatically holds hammer 60 in the cocked position after being displaced thereto.

From the foregoing it is clearly apparent that there is provided herein for rifles a simple and compact auxiliary firearm which provides additional firepower for the troops by making available for semiautomatic discharge ammunition which is of larger caliber than that of the rifle and which has special capabilities. Such auxiliary firearm is light in weight, easy to manufacture and positive in operation.

I claim:

1. The combination including a cartridge having a rifled tube, a plurality of projectiles arranged in said tube in coaxial tandem alignment, an inclosed chamber formed rearwardly of each of said projectiles, detonators located in said tube for discharge into each of said inclosed chambers, a receiver attachable to a rifle barrel for support thereby, said receiver being of tubular configuration designed to receive said cartridge for discharge, and a receiver-mounted firing mechanism including a trigger, a trigger actuated sear, a hammer of rod configuration disposed in said receiver for longitudinal displacement therein, a spring located in said receiver so as to press against the front end of said hammer for biasing said

hammer rearwardly from a cocked position, a plurality of firing pins respectively positioned for actuation against said detonators for discharge thereof, and striking surfaces arranged on said hammer for respective displacement against successive ones of said firing pins for discharge of the corresponding ones of said detonators.

2. The combination as defined in claim 1 wherein said striking surfaces are respectively formed at the front ends of segmental notches therein.

3. The combination as defined in claim 1 wherein said firing mechanism also includes means for pivotally mounting said trigger, means disposed between said trigger and said sear for converting pivotal displacement of said trigger to vertical displacement of said sear in progressive increments, means disposed on said hammer and said sear for releasing said hammer for progressive step displacement from the cocked position each time said trigger is pulled, and wherein said striking surfaces are arranged to strike successive ones of said firing pins each time said hammer is released for step displacement.

4. The combination as defined in claim 3 wherein said means for converting pivotal displacement of said trigger to incremental vertical displacement of said sear includes a pawl pivotally mounted on said trigger and ratchet teeth formed in said sear.

5. The combination as defined in claim 3 wherein said means disposed on said hammer and sear for releasing said hammer for progressive step displacement includes a lip formed at the top end of said sear and a plurality of steps formed in the rear section of said hammer so as to be engageable by said lip, said steps being arranged so as to progress downwardly and forwardly, and each of said steps includes a top surface contactable by said lip for holding said sear in each increment of displacement after being displaced thereto during return of said

trigger to the normal position thereof, and a front surface which is contactable by said lip for limiting the rearward displacement of said hammer to the predetermined step displacement thereof from the cocked position and for releasing said hammer to strike the next successive one of said firing pins when displaced clear of said lip.

6. The combination as defined in claim 3 wherein said firing pins are each mounted in a counterbored orifice extending between a hole which slidingly receives said hammer and the inside of said receiver and each is provided with a striker portion having a conical end disposed for contact by the associated one of said striking surfaces and a pin extending from said striker portion for impact with the associated one of said detonators, and wherein said striking surfaces are respectively arranged to extend downwardly and forwardly to cooperate with the conical end of respective ones of said firing pins for converting longitudinal displacement of said hammer to vertical displacement of said firing pins for initiating the associated ones of said detonators and for cammingly displacing the firing pins to the periphery of said hammer while the striking surfaces are moved past the associated ones of said firing pins.

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U.S. Cl. X.R.

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