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[73] Assignee **the United States of America as represented
by the Secretary of the Army, by mesne
assignments to**

[56] **References Cited**
UNITED STATES PATENTS
666,084 1/1901 Burgess 89/149
3,303,743 2/1967 Lanizzani 89/149

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[54] **FIRING MECHANISM FOR AUTOMATIC
GRENADE LAUNCHER**
8 Claims, 6 Drawing Figs.

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ABSTRACT: In order to reduce the overall size of a current externally powered automatic grenade launcher, the firing mechanism previously contained in a housing attached to the rear end of the receiver is relocated so that the impact arm at the rear end of a longitudinal striker is the only structure which extends rearwardly beyond the firing pin at the rear end of the receiver. The means for cocking the striker, the sear, and the sear release are each located forwardly of the firing pin in a suitable recess in the bracket attached to the side of the receiver for supporting the motor utilized to operate the launcher.

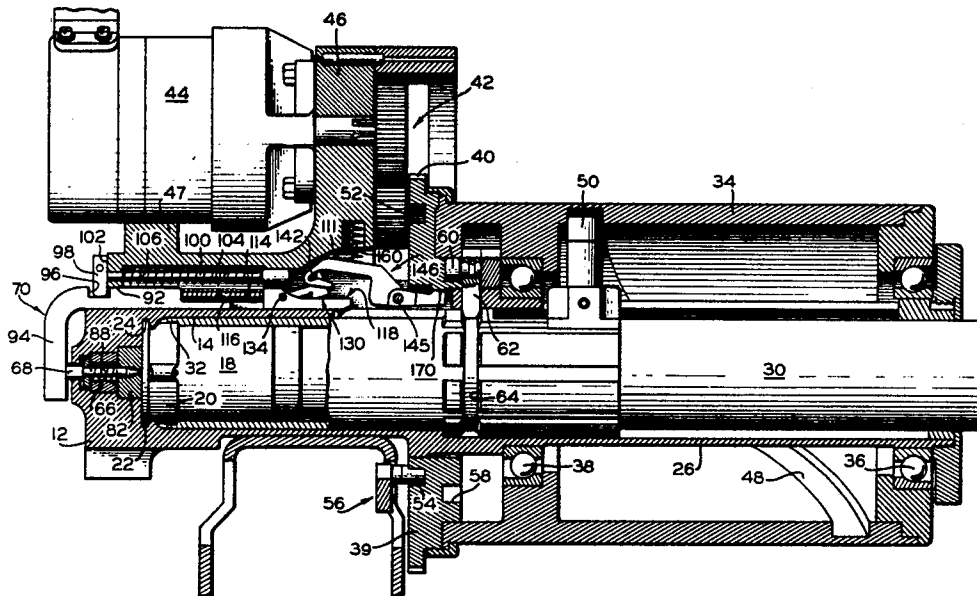
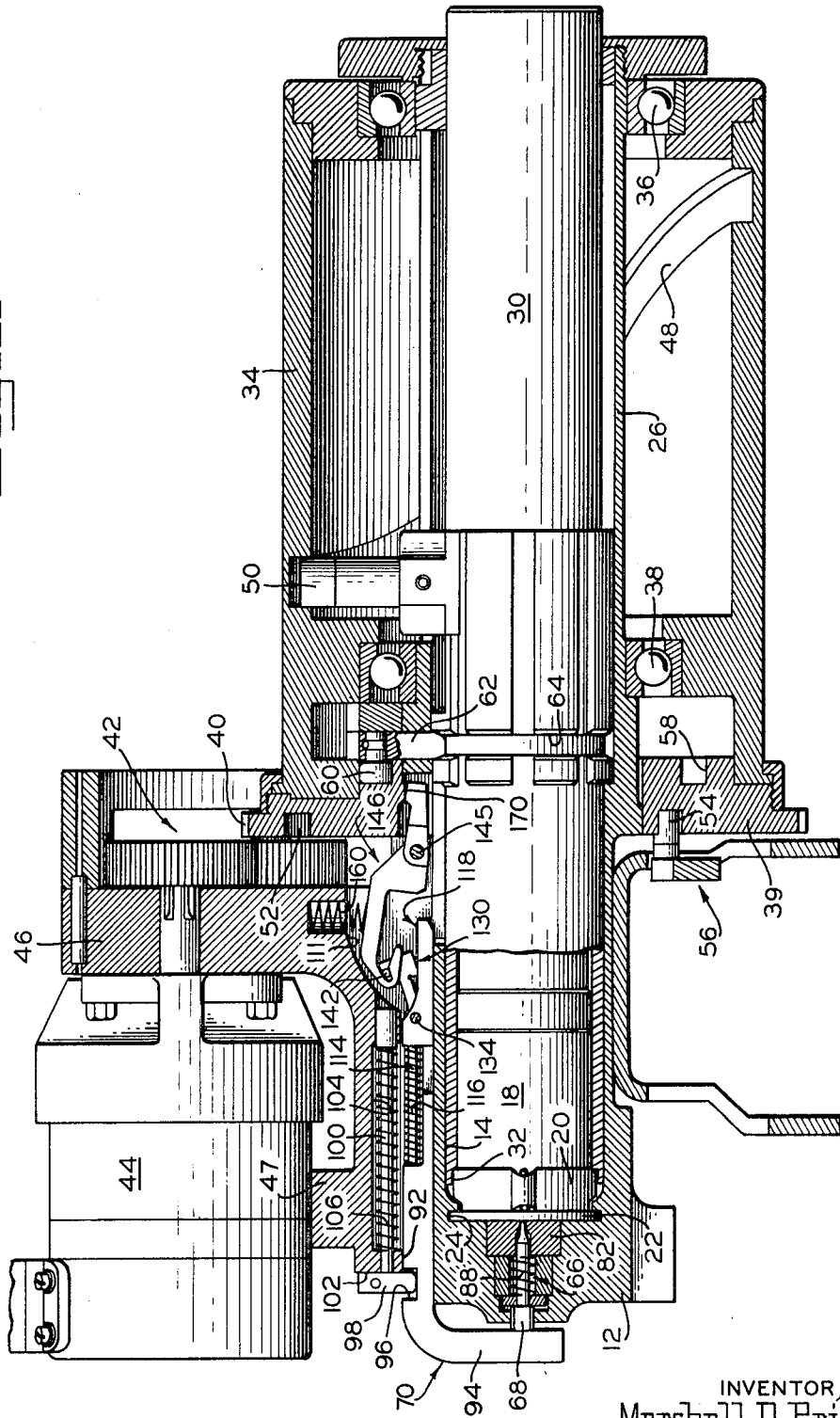
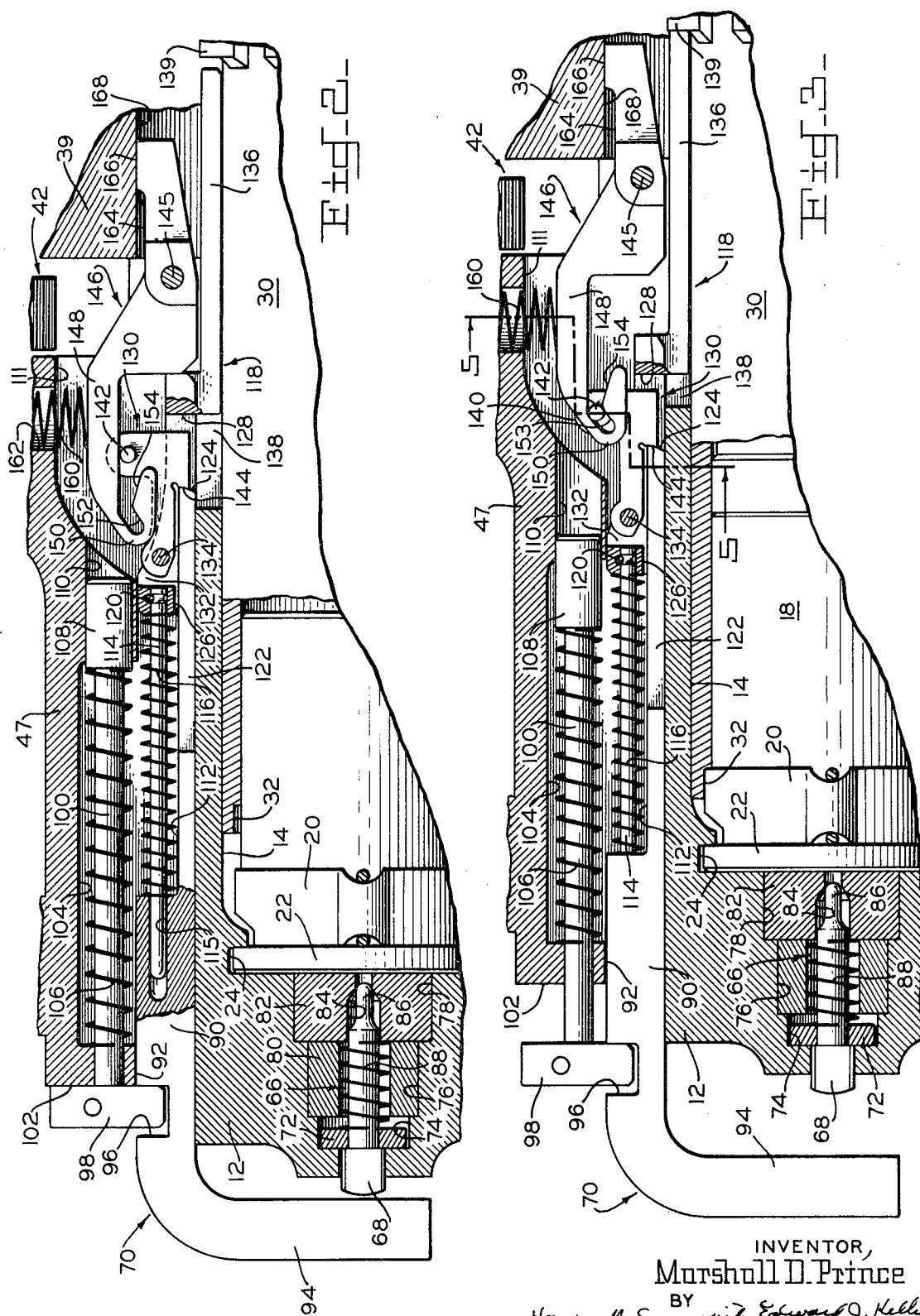


Fig. 1-



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FIRING MECHANISM FOR AUTOMATIC GRENADE LAUNCHER

BACKGROUND OF THE INVENTION

This invention relates to externally powered automatic guns and is more particularly directed to firing mechanism therefor.

Included in the current military arsenal of small arms weapons is an automatic grenade launcher for firing antipersonnel ammunition at a rate of fire which can be readily varied by the operator to best suit the tactical use required at any particular time. This is accomplished by utilizing an electric motor with a variable output to furnish the motive power for the automatic operation of the launcher instead of depending on the pressure of the expanding discharge gases generated upon the firing of the ammunition. The motor is arranged to rotate a hollow drum containing a helical cam track within the interior thereof which surrounds the barrel of the launcher and engages a suitable follower thereon so that rotation of the drum reciprocates the barrel to open and close the breech. Individual cam tracks in the rear end face of the drum control the feeding, locking, and firing functions of the launcher in timed relation with the reciprocation of the barrel.

Heretofore, as best shown in U.S. Pat. No. 3,303,743, the firing mechanism for this type of automatic grenade launcher has been located in a suitable housing secured to the rear end of the receiver and interiorly dimensioned to accommodate a pivotal hammer and sear assembly as well as the rear portions of the levers utilized to cock the hammer and release the sear. While such prior art firing mechanism has been functionally adequate, the location and size of the required housing therefor extends the overall length of the launcher to the point where considerable difficulty has been encountered in fitting the entire weapon in the confined quarters normally available in current aircraft and tank installations.

Accordingly, it is a general object of this invention to provide an externally powered automatic grenade launcher of minimum overall length.

A further object of the present invention is to provide a firing mechanism for an automatic grenade launcher wherein the engagement between the sear and the impact member utilized to actuate the firing pin is located forwardly of the closed breech.

Still another object of the invention is the provision of a firing mechanism, as aforesaid, wherein the impact portion at the rear end of the striker is the only structure which extends rearwardly of the firing pin.

A final object of this invention is to provide a firing mechanism, as aforesaid, wherein the operation thereof will not be affected by the angle at which the ammunition is fed thereto or by the attitude at which the launcher is fired.

SUMMARY OF THE INVENTION

It has been found that these objects can best be attained if the firing pin is located so as to project from the rear end of the receiver and the striker is formed as an elongated member longitudinally mounted for slidable movement in the receiver with the transverse impact portion at the rear end thereof being the only structure to extend rearwardly of the firing pin. The cocking mechanism, the sear, and the sear release are each located in the receiver forwardly of the breech in the area between the barrel and the motor and only the plunger on which the striker spring is mounted extends as far as the rear end of the firing pin. This desirable compact arrangement is accomplished by pivotally mounting the sear in a longitudinally slidable carrier arranged to be engaged by the barrel during the return thereof to the closed breech position. As the carrier is forced to the rear by the barrel, the engagement between the sear and the front end of the striker effects the required cocking thereof. Once the breech is closed and locked, the firing cam on the rotating drum actuates a release pivotally mounted in the receiver to lift the sear and free the striker for firing impact with the firing pin. Such arrangement permits the striker to be retracted no more than the minimum

distance required to provide the necessary impact force against the firing pin and consequently minimizes the overall length of the launcher.

BRIEF DESCRIPTION OF THE DRAWINGS

The exact nature of the invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawings wherein:

FIG. 1 is a vertical section through an automatic grenade launcher with the firing mechanism of the present invention shown in the position assumed at the instant the chambered cartridge is fired;

FIG. 2 is a fragmentary section of FIG. 1 on an enlarged scale but with the operating parts in the position assumed during the initial portion of the forward movement of the barrel;

FIG. 3 is a view similar to that of FIG. 2 but showing the relationship of the parts at the conclusion of the rearward movement of the barrel;

FIG. 4 is a fragmentary section of FIG. 1 on an enlarged scale showing the relationship between the sear, the sear release, and the striker;

FIG. 5 is a cross section taken along line 5-5 in FIG. 3; and

FIG. 6 is an exploded view of the components which participate in the firing release of the striker.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As best shown in FIG. 1, the present invention is particularly adapted for incorporation in an automatic gun of the type disclosed in U.S. Pat. No. 3,303,744 entitled "Barrel Surrounding Mount for Operating Drum of Externally Powered Automatic Gun" and assigned to the U.S. Government. Such gun is provided with a receiver 12 having a transverse feedway 14 in the rear end thereof adapted for the passage of grenade cartridges 18 which are connected by links 20 into an articulated belt. Since the base of each cartridge 18 terminates in a circumferential outwardly projecting rim 22, the rear end of feedway 14 is formed with a mating configuration 24 which engages rim 22 to retain the leading cartridge 18 of the belt against forward movement in feedway 14 without interfering with the required transverse passage therethrough. Forwardly of feedway 14, receiver 12 is longitudinally extended to provide a forwardly opening tubular housing 26 arranged to slidably receive a barrel 30. As indicated at 32, the breech end of barrel 30 is stepped to clear link 20 encircling cartridge 18.

A hollow cylindrical drum 34 is concentrically mounted on housing 26 for rotation therearound by means of front and rear roller bearing assemblies 36 and 38, respectively. The rear end of drum 34 is provided with a closure member 39 having a circumferential ring gear 40 adapted to mesh with a gear assembly 42 driven by a variable output motor 44 mounted on a bracket 46 extending outwardly from a longitudinal support 47 suitably connected to receiver 12. Although the gun is shown with motor 44 disposed above receiver 12 and feedway 14 extending laterally therethrough, it should be understood that the orientation thereof about the bore axis of barrel 30 is not limited to this particular arrangement. Actually, the gun can be mounted so as to feed from the top, bottom, either side, or any angle which may be required by the space available for installation. A helical cam track 48 is formed into the hollow interior of drum 34 for engagement with a follower 50 projecting outwardly from barrel 30 through housing 26. Thus, the rotation imparted to drum 34 by motor 44 is converted to reciprocal movement of barrel 30 toward and away from a battery position in which the stepped breech end 32 thereof is spaced forwardly of configuration 24 in accordance with the control exerted by the dwell portion of helical cam track 48. The rear face of closure member 39 is formed with an eccentric cam track 52 engageable with a cam follower 54 connected to a suitable feed lever mechanism 56 which intermittently advances the leading cartridge 18 in the linked belt into position to be chambered by the rearward movement of barrel 30 into battery position.

Closure member 39 also includes a cam track 58 in the front face thereof engageable with a follower roller 60 projecting rearwardly from a barrel lock 62 slidably mounted in housing 26 for transverse movement into and out of locking engagement with a circumferential groove 64 in the exterior periphery of barrel 30. The camming portions of cam tracks 48 and 52 are specifically located to insure that the feeding advance of the cartridge belt is limited to the period in which the breech end of barrel 30 is spaced forwardly of the rear end wall of feedway 14 at a distance in excess of the length of cartridge 18. In addition, the location of the camming portion of cam track 58 is such that the actuation of barrel lock 62 is limited to the period during which barrel 30 is in the battery position thereof.

The discharge of each cartridge 18 is effected by a firing pin 66 slidably mounted in receiver 12 rearwardly of feedway 14 and provided with an enlarged diameter section 68 at the rear end thereof arranged to receive the impact of a striker 70. Immediately forward of section 68, firing pin 66 is formed with a circular flange 72 slidably seated in the rearmost of three adjacent counterbores, 74, 76, and 78 in receiver 12, each of greater diameter than the one rearwardly adjacent thereto. Counterbore 76 contains a hollow bushing 80 while counterbore 78 seats a hardened breech insert 82 having an opening 84 therethrough for the passage of the tip of firing pin 66 which is of reduced diameter as indicated at 86. Bushing 80 houses a coil spring 88 seated between circular flange 72 on firing pin 66 and the rear wall surface of insert 82 to normally bias firing pin 66 rearwardly so that impact section 68 thereon will protrude from the rear end of receiver 12.

Striker 70 is formed with a relatively rectangular body 90 slidably seated in a corresponding opening 92 extending forwardly into motor support 47 in parallel relation to the longitudinal axis of feedway 14. An impact arm 94 is arcuately joined to the rear end of striker body 90 to extend perpendicularly therefrom beyond the rear end of firing pin 66. Striker body 90 is provided with a transverse notch 96 in the exterior periphery thereof at a location forwardly of the arcuate connection with impact arm 94. Notch 96 accommodates a portion of the head 98 on a longitudinal plunger 100 slidably mounted in motor support 47 parallel to striker body 90. The width of notch 96 is greater than that of head 98 to permit a limited overtravel of striker during the firing movement thereof. The rear face of motor support 47 forms a stop surface 102 for plunger head 98 which limits the forward travel of plunger 100. Opening 92 in motor support 47 is enlarged as indicated at 104 to accommodate a coil spring 106 surrounding plunger 100 and seated between the rear end wall surface of enlarged opening portion 104 and a sleeve 108 fixed to the front end of plunger 100. Sleeve 108 is arranged to slidably engage in a hole 110 extending forwardly from the front end of enlarged opening portion 104 in axial communication therewith. As best shown in FIG. 2, hole 110 opens into an additionally enlarged area 111 in motor support 47 for a purpose to be explained.

The forward end of striker body 90 is reduced in cross section as indicated at 112 to provide access for a rod 114 surrounded by a coil spring 116. The rear end of rod 114 is longitudinally supported in a suitable recess 115 formed into the vertical wall produced by the reduced cross section of striker body 90 while the front end thereof is pinned, as indicated at 120, into the rear end of a carrier 118. Since spring 116 is of greater length than rod 114 and is arranged to ride freely thereon, equal and opposite forces are exerted thereby on striker 70 and carrier 118 for a purpose to be hereinafter shown. Striker body 90 is additionally cut away on both sides thereof forwardly of the wall formed by the reduced cross section 112 to provide a rectangular tongue 122 terminating in a forwardly facing sloped surface 124.

Carrier 118 is a substantially rectangular member provided with a rectangular channel 126 extending forwardly from the rear end thereof and of sufficient width to slidably receive striker tongue 122. In addition, carrier 118 is provided with a rectangular recess 128 therethrough intersecting channel 126

for accommodating a pivotal sear 130. In order to mount sear 130 in carrier 118, the rear portion of the latter is elevated to form spaced-apart shoulders 132 for receiving the ends of a transverse mounting pin 134 passing through the rear end of sear 130. A rectangular slide 136 is suitably connected to the underside of the front end of carrier 118, as best shown in FIG. 6, and extends forwardly therefrom for slidable engagement in a corresponding longitudinal opening 138 formed vertically through the wall of receiver 12 in communication with enlarged area 111. Slide 136 is so positioned that the front end thereof will be contacted by a lug 139 projecting from the exterior of barrel 30.

As best shown in FIG. 6, the pivot point of sear 130 is located at the rear end thereof while the forward end is provided with a vertically enlarged head 140 containing a laterally projecting follower pin 142 in the upper end thereof. The lower end of sear head 140 is provided with a rearwardly facing sear nose 144 arranged to contact the correspondingly sloped front end 124 of striker tongue 122. The sloped surfaces of sear nose 144 and the front end 124 of striker tongue 122 are radially formed to permit the pivotal movement of sear 130 about pin 134. Pivotaly mounted at 145 in motor support 47 below gear assembly 42 in a sear release 146 disposed in enlarged area 111 and having a rearwardly extending arm 148 terminating in a reverse hook portion 150 contoured to form a rearwardly and downwardly inclined pathway 152 for the passage of follower pin 142 on sear 130. The entry to pathway 152 is enlarged to provide an upwardly inclined cam surface 154 which will insure proper engagement with follower pin 142 in the event sear release 146 is still in a pivoted position during the rearward travel of sear 130. However, in order to provide a more positive entry of follower pin 142 into pathway 152, sear release arm 148 is provided with an outwardly extending plate 156 containing a circular seat 158 for a coil spring 160 disposed in a vertical recess 162 in motor bracket 46. Forwardly of pivot point 145, sear release 146 is provided with a longitudinally extending lever arm 164 having a raised surface 166 at the front end thereof which projects into a cam track 168 formed into the rear face of ring gear 40 to produce a firing cam 170.

Thus, as drum 34 is rotated by motor 44, a firing cam 170 in track 168 contacts surface 166 to pivot sear release 146 so that hook portion 150 thereon lifts sear 130 about its pivot point to free striker 70 as best shown in FIG. 4. Thereupon, the stored energy of spring 106 advances plunger 100 to actuate striker 70 forwardly against the rear end of firing pin 66 which is, in turn, driven into firing contact with the cartridge 18 then in feedway 14. The forward movement of plunger 100 is terminated by contact of head 98 thereon with stop surface 102 at the rear of motor support 47 while the corresponding travel of striker 70 is ended as the rear wall of notch 96 strikes head 98 on plunger 100. By this time, the dwell portion of the operating cycle of cam track 48 in drum 34 has terminated and the helical cam portion thereof begins to advance barrel 30 to open the breech.

A lug 139 on barrel 30 moves away from carrier slide 136, carrier 118 is urged forwardly, as best shown in FIG. 2, in response to the stored energy of spring 116 which was compressed during the firing movement of striker 70. At the same time, striker 70 is biased rearwardly to bring the front wall of notch 96 therein into contact with plunger head 98. As carrier 118 advances sear 130, follower pin 142 is withdrawn from pathway 152 in sear release 146 so that the latter will be pivoted to return to the prefired position thereof in response to the urging of spring 160. During this pivotal movement of sear release 146, sear 130 is being carried forwardly beyond the front end of striker tongue 122 and is thereby free to be pivoted downwardly as the underside of sear release arm 148 contacts follower pin 142. The forward travel of carrier 118 is eventually halted by contact with the body of sear release 146.

Thus, once helical cam 48 in drum 34 reverses the direction of movement of barrel 30, carrier 118 is contacted by lug 139 on barrel 30 and is moved rearwardly to return sear 130 into

reengagement with the front end of striker tongue 122. As carrier 118 continues to move rearwardly, sear 130 retracts striker 70 which, in turn, actuates plunger 100 to compress spring 106. At the same time, sear pin 142 is moved into pathway 152 in sear release 146. Accordingly, when barrel 30 reaches the battery position thereof, as shown in FIG. 3, striker 70 is fully cocked and held in that position by sear 130 until firing cam 170 initiates another cycle of operation.

In the firing mechanism described above, sear 130 serves as a positive mechanical connection between barrel 30 and striker 70. Such arrangement permits striker 70 to be cocked in a relatively simple and positive manner in comparison to the action of the prior art structure shown in U.S. Pat. No. 3,303,743 wherein a separate cocking rod is required to engage a spring-biased lug projecting from the side of a pivotal hammer in order to pivot such hammer into latched engagement with a sear during the return of the barrel to battery position. The utilization of a separate cocking rod in this prior art mechanism is complicated by the necessity for arranging the parts so that the cocking rod can override the cocking pawl on the hammer during the initial forward travel of the barrel. Another advantage of the present invention over the aforesaid prior art structure lies in the fact that the spring 116 which imparts firing movement to striker 70 is a separate member arranged to normally urge such striker 70 to the rear away from firing pin 66 during the interval between the firing and recoiling movements thereof. Such arrangement prevents accidental actuation of firing pin 66 prior to the firing release of striker 70 without the necessity for interposing a separate safety member in the path of the firing pin as is done in the aforesaid prior art firing mechanism. In addition to such advantageous simplification in the structure and operation of the firing mechanism of the present invention, the ingenious arrangement which positions the carrier, the sear, and the sear release forwardly of the striker provides a highly desirable reduction in the overall length of the entire gun. As a result, this particular type of automatic launcher can now be employed in various aircraft and tank installations wherein the mounting space has heretofore been a prohibitive or complicating factor.

I claim:

1. In an automatic grenade launcher having a receiver, a barrel slidably disposed in the receiver, and an external source of power attached to the receiver for reciprocating the barrel from and toward a battery position, the combination of:

- a. a spring-biased firing pin slidably mounted in the receiver to project from the rear end thereof;
- b. a longitudinal striker slidably mounted between the barrel and the external source of power, said striker having an impact arm projecting outwardly therefrom to extend behind said firing pin;
- c. spring means for biasing said striker forwardly to actuate said firing pin;
- d. means for transferring the movement of the barrel toward battery position to said striker for compressing said striker spring means;
- e. a pivotal sear engageable with the front end of said striker for retention thereof against the forward bias imparted thereto by said spring means; and,
- f. means for lifting said sear to free said striker for impact with said firing pin when the barrel is in battery position.

2. In an automatic grenade launcher having a receiver, a tubular housing extending forwardly from the receiver for rotatably supporting an operating drum thereon, a barrel slidably disposed in the tubular housing for reciprocating movement into and out of battery position within the receiver, and an external source of power secured to the receiver for rotating the operating drum to reciprocate the barrel, the combination of:

- a. a spring-biased firing pin slidably mounted in the receiver to project from the rear end thereof;
- b. a longitudinal striker slidably mounted in the receiver between the barrel and the external source of power, said

striker having an outwardly projecting impact arm disposed rearwardly of said firing pin;

- c. spring means for biasing said striker forwardly to bring said impact arm thereon into firing contact with said firing pin.
- d. a sear carrier slidably disposed in the receiver for rearward travel during the return of the barrel to battery position;
- e. a sear pivotally mounted in said carrier in position to engage with said striker and impart the rearward movement of said carrier thereto for compressing said striker spring means; and,
- f. means responsive to the rotation of the operating drum for releasing said sear from engagement with said striker to free the latter for firing impact with said firing pin.

3. The combination defined in claim 2 wherein the receiver includes an internal recess between the external source of power and said striker, and said spring means for biasing said striker forwardly comprises:

- a. a plunger slidably disposed in said internal recess with a sleeve fixed to the front end thereof and an enlarged head at the opposite end thereof projecting from the rear end of the receiver in engagement with said striker; and,
- b. a coil spring seated between said sleeve and the rear end of said internal recess in said receiver whereby the rearward movement imparted to said plunger by said striker compresses said spring to provide the firing movement for said striker upon the release thereof by said sear.

4. The combination set forth in claim 2 wherein the operating drum includes a cam track and a firing cam therein, and said means for releasing said sear from engagement with said striker comprises:

- a. a release member pivotally mounted in the receiver adjacent said carrier, said member having a rearwardly extending hook-shaped arm and a forwardly extending lever arm engageable with said firing cam in the operating drum; and
- b. a follower pin projecting from said sear in position to engage with said hook-shaped arm of said release member during the return of the barrel to battery position whereby said firing cam in the operating drum pivots said forwardly extending lever arm in one direction to actuate said hook-shaped arm in the opposite direction for pivoting said sear out of engagement with said striker.

5. In an automatic grenade launcher having a receiver, a tubular housing extending forwardly from the receiver for rotatably supporting an operating drum thereon, a barrel slidably disposed in the tubular housing for reciprocating movement between a rearward battery position in the receiver and a forward open breech position, and an external source of power supported by a bracket secured to the rear portion of the receiver, a firing mechanism comprising:

- a. a spring-biased firing pin slidably mounted in the receiver to project from the rear end thereof;
- b. a longitudinal striker slidably mounted in the receiver between the barrel and the external source of power, said striker having an outwardly projecting impact arm disposed rearwardly of said firing pin;
- c. a plunger slidably disposed in the receiver parallel with said striker, said plunger having an enlarged head at the rear end thereof engageable with said striker;
- d. first spring means for biasing said plunger forwardly to actuate said striker for bringing said impact arm thereon into firing contact with said firing pin;
- e. a sear carrier slidably disposed in the receiver forwardly of said striker;
- f. a projecting lug on the barrel engageable with said carrier for imparting rearward movement thereto during the return of the barrel to battery position;
- g. a sear pivotally mounted in said carrier in position to engage with the front end of said striker whereby the concurrent rearward movement imparted thereto compresses said first spring means;

- h. second spring means seated between said carrier and said striker for ensuring positive engagement between said enlarged plunger head and said striker and for biasing said carrier forwardly during the forward movement of the barrel away from battery position; and,
- i. a sear release pivotally mounted in the receiver in engagement with said sear and in position to be pivoted by the operating drum to disengage said sear from said striker whereby the latter is automatically biased forwardly to actuate said firing pin.
6. The firing mechanism defined in claim 5 wherein said second spring means comprises:
- a. a rod having one end secured to the rear end of said carrier and the other end slidably mounted in said striker; and,
- b. a coil spring surrounding said rod and of lesser bias than

said first spring means to minimize the effect on the firing movement of said striker.

7. The firing mechanism defined in claim 5 wherein said sear includes an outwardly projecting follower pin and the rear end of said sear release terminates in a hook-shaped arm engageable with said follower pin upon movement of the barrel into battery position.

8. The firing mechanism defined in claim 5 including means for biasing said sear release into position to engage with said sear at the conclusion of the rearward movement of said carrier regardless of the orientation of the launcher about the longitudinal axis thereof and regardless of the attitude at which the barrel is inclined.

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