March 11, 1969 G. M. CHINN ET AL 3,431,820

GRENADE LAUNCHER

Filed March 13, 1968 Sheet 1 of 5

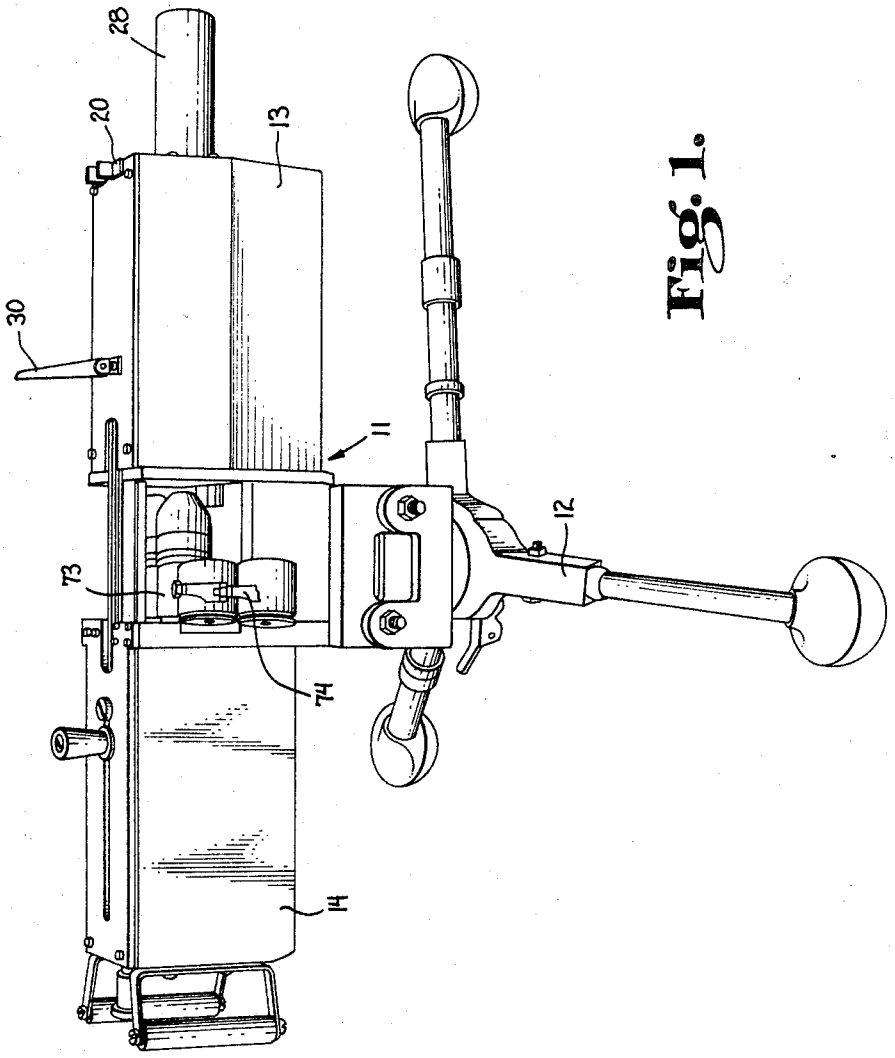

Fig. 1.

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GRENADE LAUNCHER

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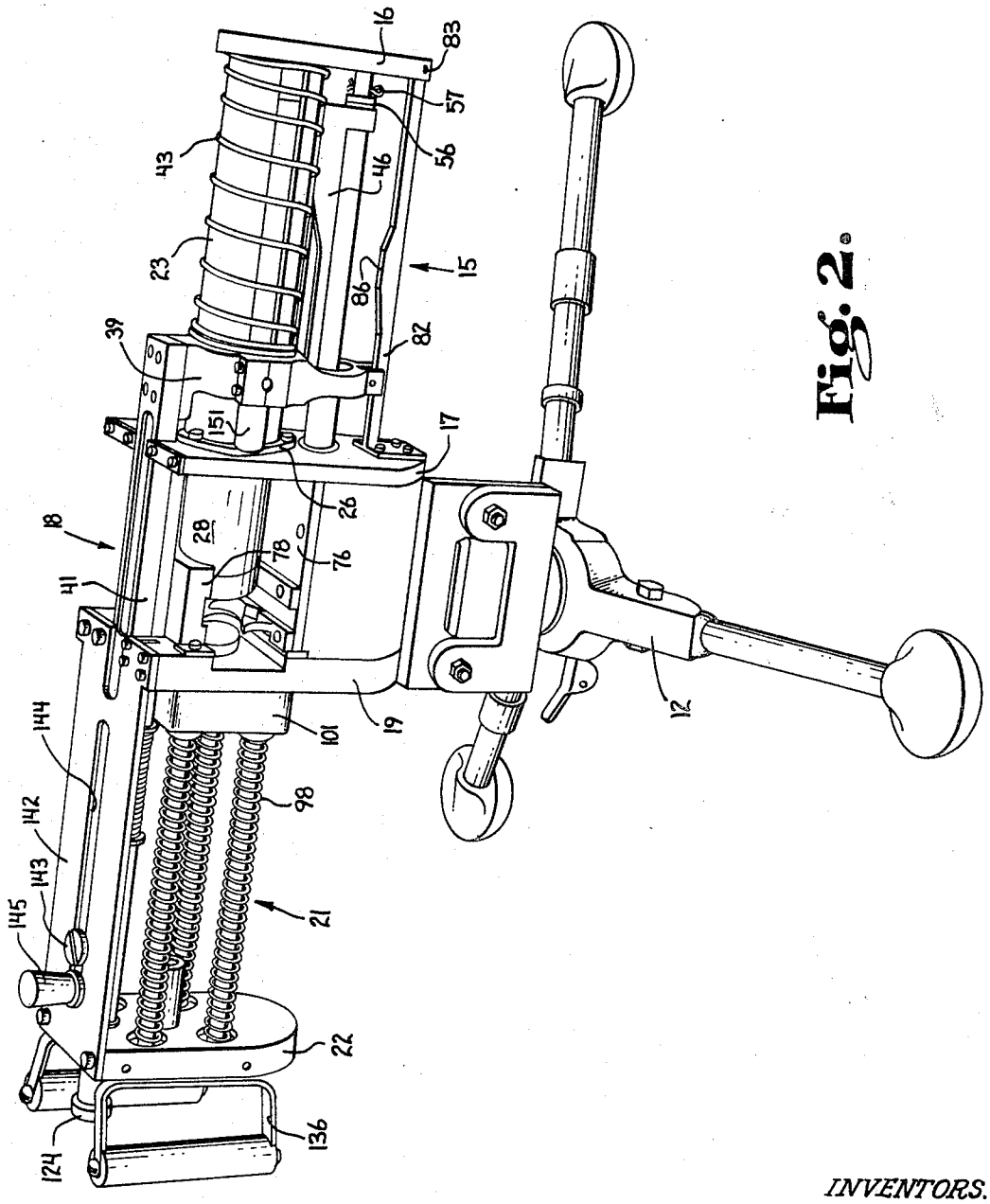

Fig. 2.

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GRENADE LAUNCHER

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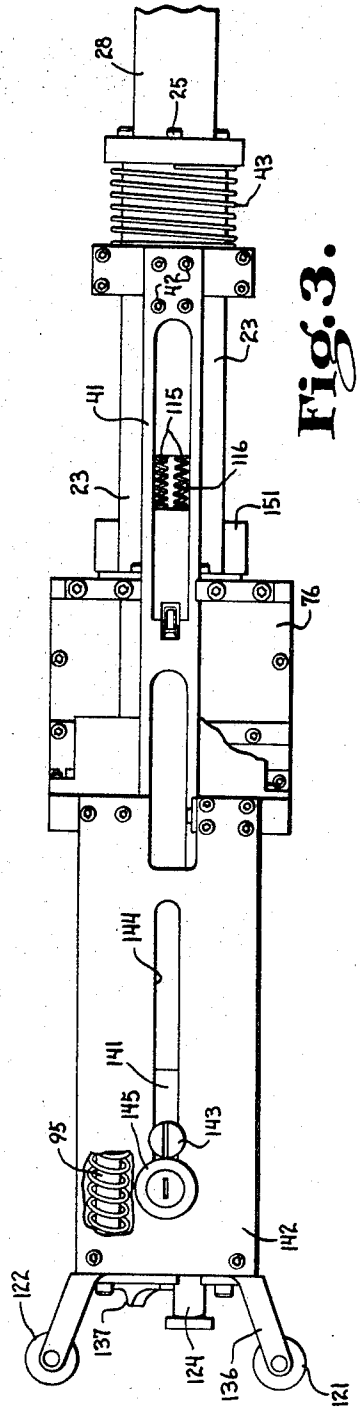

Fig. 3.

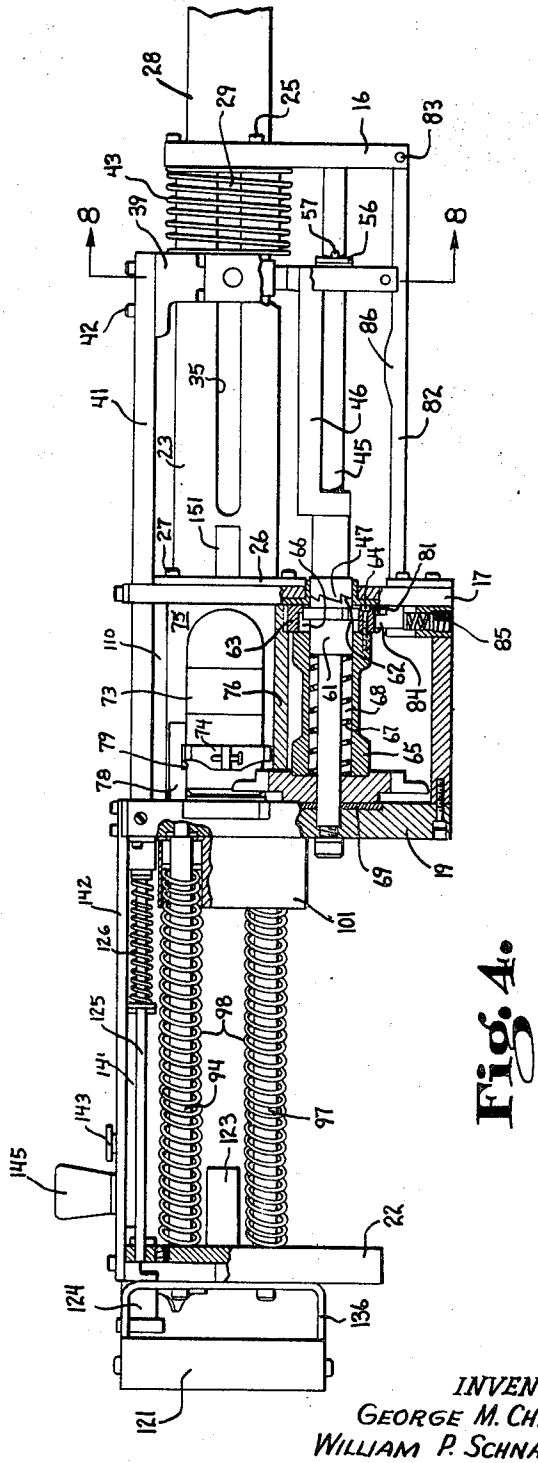

Fig. 4.

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GRENADE LAUNCHER

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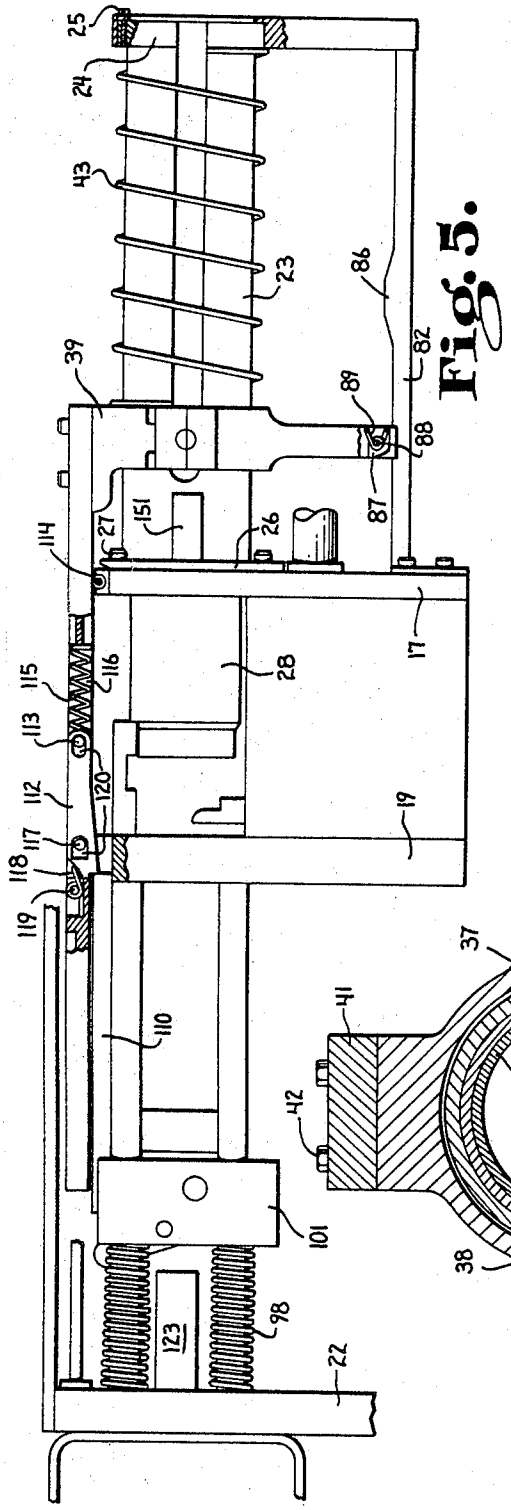

Fig. 5.

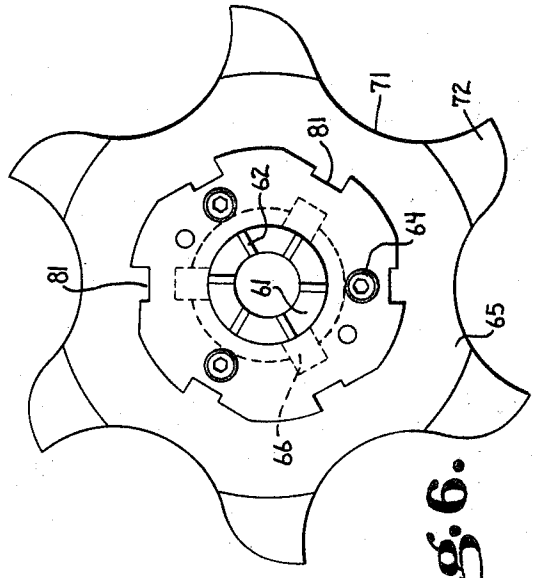

Fig. 6.

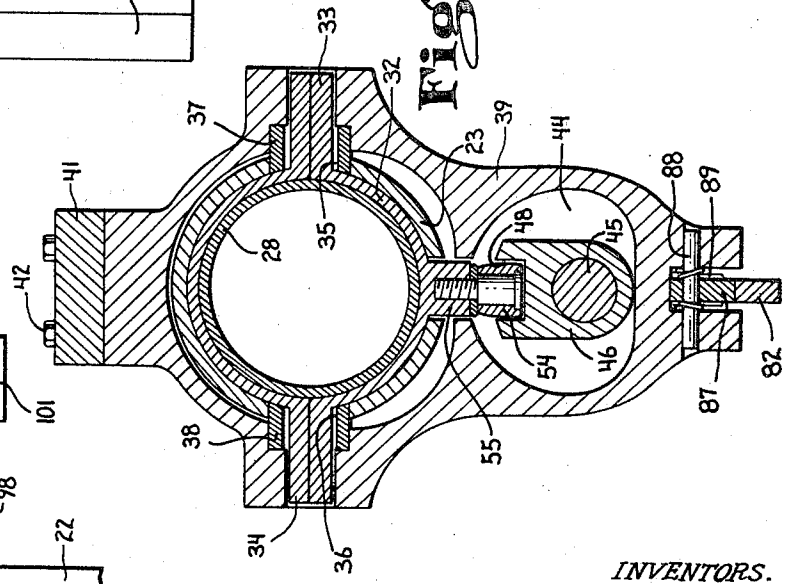

Fig. 8.

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GRENADE LAUNCHER

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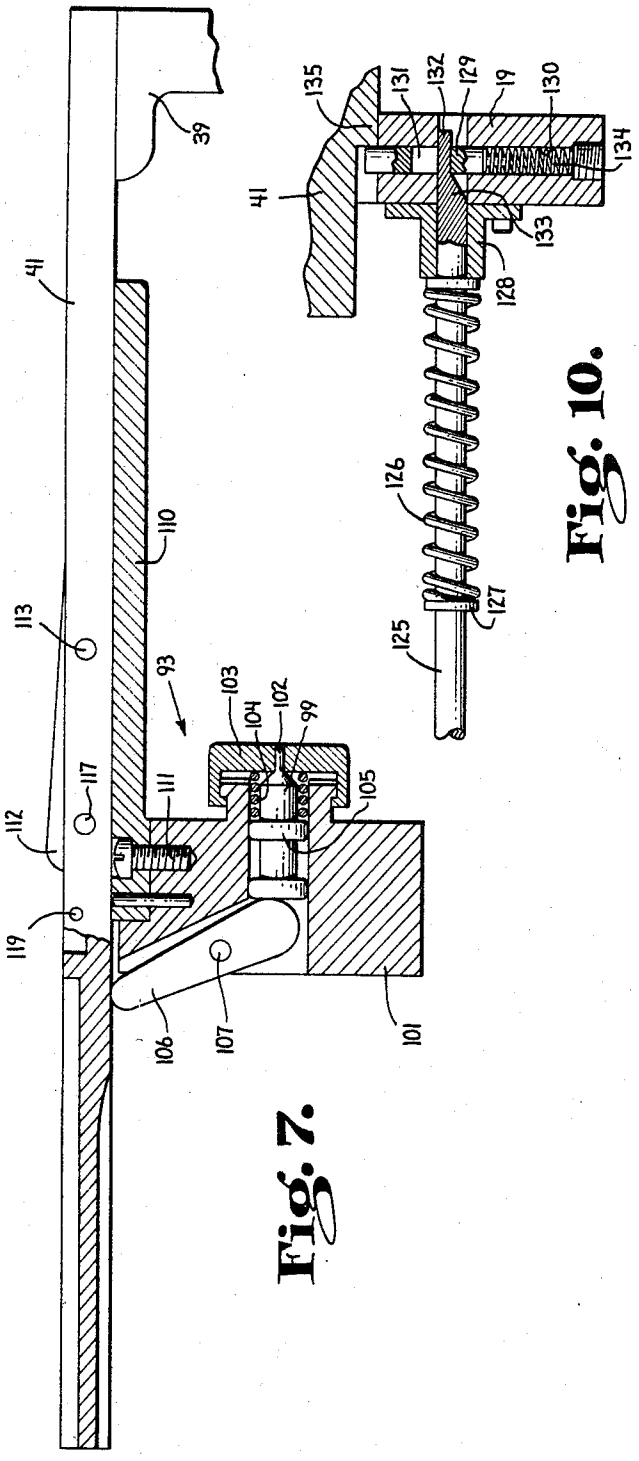

Fig. 7.

Fig. 10.

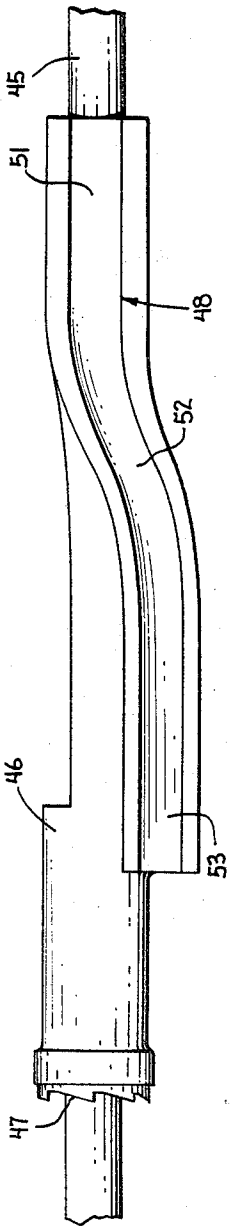

Fig. 9.

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3,431,820

GRENADE LAUNCHER

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Filed Mar. 13, 1968, Ser. No. 712,637
U.S. Cl. 89—161 6 Claims
Int. Cl. F42b 3/02; F42d 7/00

ABSTRACT OF THE DISCLOSURE

An automatic grenade launcher having a reciprocating barrel which chambers a projectile and forces said projectile against a firing pin in a bolt assembly. Upon firing, the projectile moves the barrel forwardly while simultaneously the bolt assembly moves rearwardly, thereby recocking the launcher, while movement of the reciprocating barrel indexes a rotor assembly which moves another projectile into a firing position.

Background of the invention

The present invention relates to a light weight, low velocity, grenade launcher, and more particularly to a fully automatic grenade launcher which will have a rapid rate of fire.

Various types of guns and launchers have been utilized to fire missiles, such as rockets and grenades. One of the more common type of firing device utilizes a magazine which holds a fixed number of projectiles or shells. One such gun is shown in U.S. Patent 2,380,024, which issued July 10, 1945, to Edward F. Chandler. In this patented gun, the firing unit is comprised of a rotatable magazine and barrel which are supported by frame elements, and the gun is fired by hand cranking, which operates firing and indexing mechanisms.

Another rotary magazine gun is shown in U.S. Patent 2,835,171, which issued May 20, 1958, to George Albert Lyon. A magazine is rotatably mounted to a frame, and the magazine is provided with an indexing track. A gun barrel is reciprocally mounted to the frame, and an indexing pin, which engages the indexing track on the magazine, is attached to the gun barrel. Upon firing of a projectile, the forward motion of the projectile moves the gun barrel forward, thereby compressing a coiled spring, and the forward motion of the gun barrel causes the magazine to be indexed one-half cycle. Upon the projectile clearing the gun barrel, the coiled spring returns the gun barrel to a firing position and the return motion of the barrel indexes the magazine the remaining one-half cycle.

One disadvantage of a magazine gun is the relative low rate of fire. Although the firing rate might be high once the magazine is in position, after the magazine is emptied, it must be removed and a full magazine inserted, and thus the overall rate of fire is greatly reduced. By way of example, U.S. Patent 2,835,171, shows a magazine capable of holding ten projectiles and thus after firing ten projectiles the gun must be reloaded by changing magazines.

Summary of the invention

The present invention relates to an automatic grenade launcher that fires belt fed rounds of ammunition, with the belt being preferably made of metallic links. The operation of the launcher is novel in that the barrel is reciprocally movable and, upon triggering, a projectile is chambered by the barrel. The riflings of the barrel jam against the rifling bands on the projectile and force the primer of the round against a firing pin in a bolt. The barrel is spring loaded, and it is the force of the barrel spring which drives the barrel around the projectile.

The bolt is also spring loaded, and upon firing, the bolt recoils and compresses the bolt springs. At the same time, the forward motion of the projectile through the barrel causes the barrel to move forward and partially compress the barrel spring. As the barrel spring must exert a large force in driving the barrel rearwardly to chamber the projectile, the energy absorbed by the bolt springs is utilized to both return the bolt to a firing position and also to help compress the barrel spring. This latter function is accomplished by a bridging mechanism that temporarily couples the bolt mechanism to the barrel mechanism.

A cam mechanism is operated by the barrel mechanism to intermittently drive a rotor assembly which feeds ammunition rounds to the breech chamber. A locking mechanism is provided to lock the rotor assembly, and means operable by the barrel mechanism are provided to unlock the rotor assembly at the time it is to be rotated.

By having the barrel chamber the projectile portion of the ammunition round, it is not necessary to de-link the rounds as is done in many automatic weapons, and the empty cartridges remain linked together. Thus no extra mechanism is required for either de-linking or ejecting the spent cartridges.

It is therefore a general object of the present invention to provide a light-weight, a high rate of fire, automatic launcher for firing grenades.

Another object of the present invention is to provide a launcher for firing linked grenades without first de-linking the grenades.

Other objects and advantages of the present invention will be readily apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawings.

Brief description of the drawings

FIGURE 1 is a perspective view of a preferred embodiment of the present invention with the barrel being in a cocked position;

FIGURE 2 is a perspective view similar to FIGURE 1, with front and rear cover plates being removed and with the barrel being in an uncocked position;

FIGURE 3 is a top view of a preferred embodiment with parts being broken away to show underlying parts;

FIGURE 4 is a side view of a preferred embodiment, partly broken away to show parts in section;

FIGURE 5 is a partial side view showing a bridging mechanism between a bolt assembly and a barrel assembly;

FIGURE 6 is an end view of rotor assembly which feeds cartridges into a breech;

FIGURE 7 is a sectional view of a bolt assembly;

FIGURE 8 is a sectional view taken on line 8—8 of FIGURE 4;

FIGURE 9 is a top plan view of a ratchet cam; and

FIGURE 10 is a partial sectional view showing a sear pin arrangement.

Referring now to the drawings, and particularly to FIGURES 1 and 2, there is shown a launcher **11** according to the present invention mounted on a standard military tripod **12**. The manner of mounting, however, is optional and many different mounts might be used depending on the manner in which the launcher **11** is to be utilized. As shown in FIGURE 1 of the drawings, a front cover **13** and a back cover **14** are provided for safety purposes so that fingers, clothing, and the like, will not become entangled with any moving parts, and also covers **13** and **14** keep dirt and debris out of the working parts.

A front sight 20 and rear sight 30 are attached to the top portion of front cover 13 to facilitate aiming of launcher 11.

As best seen in FIGURES 2, 3, 4, and 5, of the drawings, launcher 11 is comprised of a barrel assembly 15 which extends from a forward plate 16 to a front breech plate 17, a breech assembly 18, which extends between front breech plate 17 and an aft breech plate 19, and a trigger and bolt assembly 21 which extends between aft breech plate 19 and a buffer plate 22. A barrel tube 23 is provided with a front flange 24 which is attached to forward plate 16 by bolts 25, and an aft flange 26 on barrel tube 23 is attached to front breech plate 17 by bolts 27. A gun barrel 28 is slidably mounted in barrel tube 23 by a front sleeve 29 and a reduced diameter portion in the rear of barrel tube 23. By way of example, sleeve 29 might be of a material which facilitates sliding of the gun barrel, such as Teflon.

Referring specifically to FIGURES 4 and 8 of the drawings, a split collar 32 is attached to barrel 28 with split collar 32 having outwardly extending arms 33 and 34 that pass through elongated slots 35 and 36, respectively in barrel tube 23, and arms 33 and 34 are rotatably supported in bearings 37 and 38, respectively, which are housed in yoke 39. A push bar 41 is attached to the top of yoke 39 by means of screws 42, and a barrel spring 43 is positioned between yoke 39 and forward plate 16. As yoke 39 is attached to barrel 28 through split collar 32, longitudinal movement of push bar 41 will cause movement of barrel 28 and, likewise, any movement of barrel 28, as by spring 43, will cause movement of push bar 41.

Yoke 39 is provided with a large aperture 44 through which rotor shaft 45 passes, with rotor shaft 45 being stationarily supported by forward plate 16 and aft breech plate 19. A ratchet cam 46 having ratchet teeth 47 on one end thereof and an elongated grooved surface 48, as shown in FIGURE 9 of the drawings, is rotatably mounted on rotor shaft 45. Grooved surface 48 is comprised of a first straight section 51, a curved section 52 and a second straight section 53. A cam follower 54 is threadedly attached to a downwardly extending foot 55 on collar 32, and cam follower 54 engages with grooved surface 48 of ratchet cam 46. As will be more fully explained hereinafter, when cam follower 54 moves from straight section 51 through curved section 52 ratchet cam 46 is rotated such that ratchet teeth 47 ratchet with matching teeth of a mating part and, on the other hand, when cam follower 54 moves from straight section 53 through curved section 52, ratchet teeth 47 will drive the teeth of a mating part. Ratchet cam 46 is positioned on rotor shaft 45 by means of washer 56 and pin 57.

As best shown in FIGURES 4 and 6 of the drawings, a rotor ratchet 61, having teeth 62 on one end which mate with ratchet teeth 47 on ratchet cam 46, is slidably mounted in a rotor collar 63. Rotor collar 63 is attached by screws 64 to rotor 65. Three keys 66 are provided in rotor collar 63, and these keys 66 permit slidable movement of rotor ratchet 61 relative to rotor collar 63, however, rotation of rotor ratchet 61 causes both rotor collar 63 and rotor 65 to be rotated. A spring 67 is provided in a bore 68 of rotor 65 and biases teeth 62 in engagement with teeth 47 on ratchet cam 46. A thrust bearing 69 is provided between the end of rotor 65 and aft breech plate 19 and thrust bearing 69 provides sufficient drag on rotor 65 so that a ratchet effect takes place between teeth 47 and 62 when cam follower 54 moves from straight section 51 through curved section 52 of ratchet cam 46. Rotor 65 is provided with six radius cuts 71 that form six impeller teeth 72. Radius cuts 71 are of such dimensions that they fit the contour of a round 73, which is to be fired in launcher 11.

Rounds 73 are linked together by a metallic link 74 and the operation of launcher 11 is such that the rounds are not de-linked before or after firing. Rounds 73 are fed into a firing position by impeller teeth 72 when rotor 65 is rotated by the action of cam follower 54 moving in grooved surface 48 of ratchet cam 46. The breech 75 from which rounds 73 are fired is formed by front breech plate 17, aft breech plate 19, and guide plate 76. An upper guide 78, which is provided with a notch 79 to accommodate link 74, is attached to aft breech plate 19 and guides rounds 73 into position.

Rotor collar 63 is provided with six slots 81 on its outer periphery and a locking bar 82, which has one end pivotally connected to forward plate 16 by means of pin 83, has a tang 84 engageable with slots 81. A spring 85 is provided to bias loacking bar 82 upwardly so that tang 84 remains engaged in one slot 81 and, when so engaged, rotor collar 63, and consequently the entire rotor assembly, remains locked against rotation. A protuberance 86 is provided on locking bar 82, and a tear-drop cam 87, which is attached to yoke 39 by means of shaft 88 is engageable with protuberance 86. A spring 89 is provided around shaft 88 and biases tear-drop cam 87 toward front breech plate 17 such that when yoke 39 moves toward front breech plate 17, tear-drop cam 87 is pivoted about shaft 88 to become ineffective and does not unlock bar 82 from the rotor assembly. On the forward travel of barrel 28, however, cam 87 cannot pivot as it wedges against yoke 39, and consequently, tear-drop cam 87, upon passing over protuberance 86, causes locking bar 82 to pivot about pin 83 thereby disengaging tang 84 from slot 81 and unlocking rotor 65.

Referring now specifically to FIGURES 3, 4, and 7 of the drawings, a bolt assembly 93 is slidably mounted on four bolt guides 94, 95, 96, and 97, which are attached to aft breech plate 19 and buffer plate 22. A coil spring 98 is provided around each bolt guide, and coil springs 98 bias bolt assembly 93 against aft breech plate 19. A firing pin 99 is positioned in bolt 101, and the firing tang 102 of firing pin 99 is surrounded by a protective cap 103 which is spring biased outwardly to protect pin 99 from breakage by a round 73 during indexing. Firing pin 99 is provided with an enlarged diameter portion 105 and spring 104 is positioned between enlarged diameter portion 105 and protective cap 103. A firing pin lever 106 is pivotally attached to bolt block 101 by means of shaft 107. When round 73 is forced against protective cover 103 by action of barrel 28 against round 73, protective cover 103 moves to the rear, compressing spring 104, and, simultaneously, firing pin lever 106 is pivoted about pin 107 by push bar 41 thereby permitting tang 102 of firing pin 99 to protrude beyond the front surface of protective cover 103, thereby permitting the primer of round 73 to be driven into tang 102 of firing pin 99. Firing pin lever 106 is a safety feature which insures that firing pin 99 is not in a position to engage the primer of round 73 until barrel 28 has enchambered round 73 to a sufficient depth so as to not create a dangerous condition.

A recock bar 110 is attached, as by screws 111, to the top of bolt block 101 and, as best shown in FIGURE 5 of the drawings, recock bar 110 is engageable with a recock sear 112, which is pivotally attached to push bar 41 by pin 113. A pair of compression springs 115 are provided in opening 116 and these springs bias recock sear 112 in a rearward direction. Pin 117 is provided to limit the travel of recock sear 112. Spring 118 is attached to the top of push bar 41 by pin 119, and spring 118 biases recock sear 112 downwardly. Recock sear 112 is provided with elongated slots 120 through which pins 113 and 117 pass. In operation, when recock bar 110 engages recock sear 112, springs 115 serve as shock absorbers and elongated slots 120 permit recock sear 112 to move and compress springs 115.

A roller 114 is rotatably mounted to the top of breech plate 17. Upon firing a round 73, the projectile moving through the riflings in barrel 28 causes barrel 28, yoke 39, and push bar 41 to move forwardly. Barrel spring 43, however, provides a resisting force whereupon the force of springs 98 is utilized to further compress barrel spring 43. Springs 98 move bolt block 101, and recock

bar 110 pushes against the end of recock sear 112 to move push bar 41 forwardly. Simultaneously with barrel 28 reaching the end of its forward travel, roller 114 causes recock sear 112 to be pivoted up into a slot in push bar 41 and a portion of recock bar 110 moves beneath recock sear 112. With recock bar 110 being beneath recock sear 112, push bar 41 is now free to move to the rear of launcher 11, while bolt assembly 93, including recock bar 110, remains stationary.

A pair of handles 121 and 122 are attached by bracket 136 to the outer end of buffer plate 22, and a buffer or bumper 123 of resilient material is attached to the inner end of plate 22 for preventing any excess travel of bolt assembly 93. A firing button 124 is positioned between handles 121 and 122, and is attached to shaft 125 which is spring biased outwardly by spring 126. As best shown in FIGURE 10 of the drawings, an enlarged diameter portion 127 is provided on shaft 125, and spring 126 is positioned between enlarged diameter portion 127 and shaft guide 128 which is attached to aft breech plate 19. A sear pin 129, having an elongated slot 131 therein, is positioned in a bore 130 in aft breech plate 19 and the end of shaft 125 is engageable in slot 131. The end of shaft 125 which engages in slot 131 of sear pin 129 is provided with a tang 132 and a tapered portion 133. A spring 134 is positioned in bore 130 and biases sear pin 129 toward push bar 41 which is notched to provide a shoulder 135. When sear pin 129 is extended, shoulder 135 engages sear pin 129 to retain push bar 41, and consequently barrel 28 in a cocked position. Upon pushing firing button 124, tapered portion 133 of shaft 125 wedges sear pin 129 away from push bar 41 whereby shoulder 135 is released and barrel spring 43 drives barrel 28 and push bar 41 toward hand grips 121 and 122. As long as push button 124 is depressed, sear pin 129 will not engage shoulder 135 of push bar 41 and, provided rounds 73 are fed into breech 75, the launcher will continue to fire automatically.

A safety lever 137 is slidably attached to bracket 136 so that firing button 124 can be restrained from movement when it is desired to secure the launcher in a safety condition. A cocking bar 141 is slidably attached beneath top cover plate 142 by means of a guide pin 143. Guide pin 143, which has an enlarged head, slides in slot 144 in top cover plate 142. A knob 145 is attached, through slot 144, to cocking bar 141. Cocking bar 141 is at the same level as push bar 41 and, when barrel 28 is in an uncocked position, cocking bar 141 can be moved forwardly whereby the end of cocking bar 141 engages the end of push bar 141 to move push bar 41 forwardly thereby compressing barrel spring 43. As best shown in FIGURE 10 of the drawings, when shoulder 135 of push bar 41 clears sear pin 129, spring 134 biases sear pin 129 outwardly thereby permitting sear pin 129 to engage shoulder 135 and retain barrel 28 in a cocked position.

Operation

In operation, assuming first that launcher 11 is in an uncocked condition, as shown in FIGURE 2 of the drawings, launcher 11 is first cocked by moving knob 145 forwardly. This motion causes cocking bar 141 to engage and move push bar 41 forward. As yoke 39 and barrel 28 are attached to push bar 41, yoke 39 and barrel 28 move forwardly thereby compressing barrel spring 43. During this traveling of yoke 39, cam follower 54 moves in groove surface 48 of ratchet cam 46 and, simultaneously, tear-drop cam 87 moves along locking bar 82. When tear-drop cam 87 passes over protuberance 86, locking bar 82 is depressed and tang 84 on locking bar 82 is withdrawn from a slot 81 in rotor collar 63 thereby unlocking rotor 65. During the time that rotor 65 is unlocked, cam follower 54 moves through curved section 52 of grooved surface 48 of ratchet cam 46 to rotate rotor 65 and, assuming a supply of rounds 73 are available, impeller teeth 72 will index a round 73 into breech 75, so that round 73 is in line with barrel 28. This condition is illustrated in FIGURES 3 and 4 of the drawings.

Assuming now that safety lever 137 is in a "fire" position, launcher 11 is fired by depressing firing button 124 which in turn moves shaft 125 forwardly thereby compressing spring 126. Tapered portion 133 of shaft 125 causes sear pin 129 to be drawn back from shoulder 135 of push bar 41 and, upon clearing, barrel spring 43 moves barrel 28, yoke 39, and push bar 41, which are attached together, toward breech 75. Barrel 28 moves to enchamber the projectile portion of round 73, and the force created by the barrel riflings engaging the riflings bands on the projectile portion causes round 73 to move protective cap 103 thereby compressing spring 104. Simultaneously, push bar 41 engages firing lever 106 and causes firing pin lever 106 to pivot about pin 107 thereby driving firing pin 99 outwardly so that firing pin tang 102 protrudes through protective cap 103 whereupon the primer of round 73 is driven against tang 102 of firing pin 99 thereby causing round 73 to fire.

During the rearward travel of barrel 28, cam follower 54 moves from straight section 51 on ratchet cam 46 through curved section 52 and into straight section 53 thereby causing teeth 47 on ratchet cam 46 to ratchet against teeth 62 on rotor ratchet 61. This ratchet action permits rotor 65 to remain stationary during the rearward travel of barrel 28 and yet permits ratchet cam 46 and cam follower 54 to be returned to a position for driving rotor 65 on a return cycle. The tear-drop design of cam 87 permits cam 87 to pass over protuberance 86 of locking bar 82 without causing locking bar 82 to pivot about pin 83, and thus tang 84 on locking bar 82 remains engaged in one slot 81 of rotor collar 63.

The explosive reaction from round 73 causes bolt assembly 93 to move toward buffer plate 22 thereby compressing springs 98. Simultaneously with the rearward travel of bolt assembly 93, the projectile portion of round 73 which travels through barrel 28 creates a force which moves barrel 28 forwardly thereby partially compressing barrel spring 43. It can be seen that recock bar 110 and push bar 41 are traveling in opposite directions, and when recock sear 112 is clear of recock bar 110, spring 118 causes recock sear 112 to pivot downwardly. When springs 98 have absorbed all the recoil energy from bolt assembly 93, springs 98 reverse the travel of bolt assembly 93 and drive it forwardly. Recock bar 110 engages recock sear 112 whereby the force of springs 98 is utilized to continue the forward movement of barrel 28. In the event that round 73 would have an overload of powder, thereby causing an extremely large reactive force, bumper 123 of some suitable resilient material will absorb any excess force thereby protecting launcher 11 from shock.

During the forward travel of barrel 28 and yoke 39, tear-drop cam 87 again causes locking bar 82 to pivot about pin 83 thereby unlocking rotor 65 which is then rotated by ratchet cam 46. The spent round 73 is thus moved out of breech 75 and a new round is moved into breech 75 by rotor 65.

In the event that firing button 124 remains depressed, sear pin 129 will remain clear of shoulder 135 of push bar 41 and, provided there are available rounds 73, launcher 11 will continue to fire automatically. Upon the gunner removing his finger or thumb from firing button 124, spring 126 will move shaft 125 toward buffer plate 22 thereby moving tapered portion 133 of shaft 125 away from sear pin 129 thus permitting spring 134 to bias sear pin 129 outwardly after shoulder 135 of push bar 41 passes sear pin 129 on the forward cycle of push bar 41. Thus sear pin 129 prevents spring 43 from again moving barrel 28 toward breech 75, and barrel 28 remains in a cocked position.

Assuming that all rounds 73 are now expended and that the gunner is still depressing firing button 124, sear pin 129 will still be withdrawn, and barrel spring 43 will again drive barrel 28 toward breech 75. As there will not

be a round 73 in breech 75, gun barrel 28 will move rearwardly until yoke 39 strikes resilient bumper 151.

It can thus be seen that the present invention provides a new and novel weapon for launching grenades. Obviously many modifications and variations of the present invention are possible in the light of the above teachings.

We claim:

1. An automatic grenade launcher comprising:
a breech assembly for receiving grenade rounds to be fired,
a stationarily mounted barrel tube attached forwardly of said breech assembly,
a gun barrel reciprocally mounted within said barrel tube and adaptable for making forward and rearward strokes,
a rotor assembly mounted within said breech assembly for feeding grenade rounds into said greech assembly,
a yoke assembly surrounding said barrel tube and attached to said gun barrel and having means for intermittently driving said rotor assembly,
a barrel spring surrounding said barrel tube for biasing said gun barrel and said yoke assembly toward said breech assembly,
a bolt assembly having a firing pin, said bolt assembly being slidably attached rearwardly of said breech assembly and being drivable by recoil upon firing of said grenade rounds,
spring means biasing said bolt assembly toward said breech assembly,
means attached to said yoke assembly for intermittently engaging said bolt assembly with said yoke assembly whereby force of said spring means is utilized to compress said barrel spring on a forward stroke of said gun barrel, and
trigger means engageable with said yoke assembly for releasably holding said yoke assembly and said gun barrel in a cocked position whereupon actuation of said trigger means causes said barrel spring to drive said gun barrel in a rearward stroke whereby said gun barrel enchambers a round in said breech and moves said round against said firing pin in said bolt assembly.

2. An automatic grenade launcher as set forth in claim 1 having locking means for intermittently locking said rotor assembly, said locking means being actuated synchronously with said means for intermittently driving said rotor assembly whereby said rotor assembly is selectively unlocked for rotation during a forward stroke of said gun barrel.

3. An automatic grenade launcher as set forth in claim 1 wherein means attached to said yoke assembly for intermittently engaging said bolt assembly includes a rearwardly extending push bar having a recock sear pivotally attached thereto, and said volt assembly includes a forwardly extending cocking bar, said cocking bar being engageable with said recock sear during a portion of said forward stroke of said barrel.

4. An automatic grenade launcher as set forth in claim 3 wherein said bolt assembly includes:
a bolt block, with said firing pin being slidably mounted in said bolt block and said firing pin having a tang on the forward end thereof,
a protective cap attached to said bolt block for intermittently covering said tang of said firing pin, and
a firing pin lever pivotally attached to said bolt block, said firing pin lever having one end engagable with said push bar and an opposite end engagable with said firing pin whereby said push bar is adaptable to actuate said firing pin lever to engage said firing pin and thereby to extend said tang of said firing pin beyond the end of said protective cap.

5. An automatic grenade launcher as set forth in claim 3 having means for selectively pivoting said recock sear during said forward stroke of said barrel whereby said cocking bar is disengagde from said push bar whereupon a portion of said cocking bar slides beneath said push bar to maintain said recock sear in a disengaged position thereby permitting relative motion between said push bar and said cocking bar during a rearward stroke of said gun barrel.

6. An automatic grenade launcher as set forth in claim 5 wherein shock absorbing means are provided between said push bar and said recock sear for absorbing shock when said cocking bar engages said recock sear.

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U.S. Cl. X.R.

89—33, 148