May 20, 1969 L. E. BATES 3,444,778

ROCKET LAUNCHER

Filed Feb. 8, 1967 Sheet 1 of 3

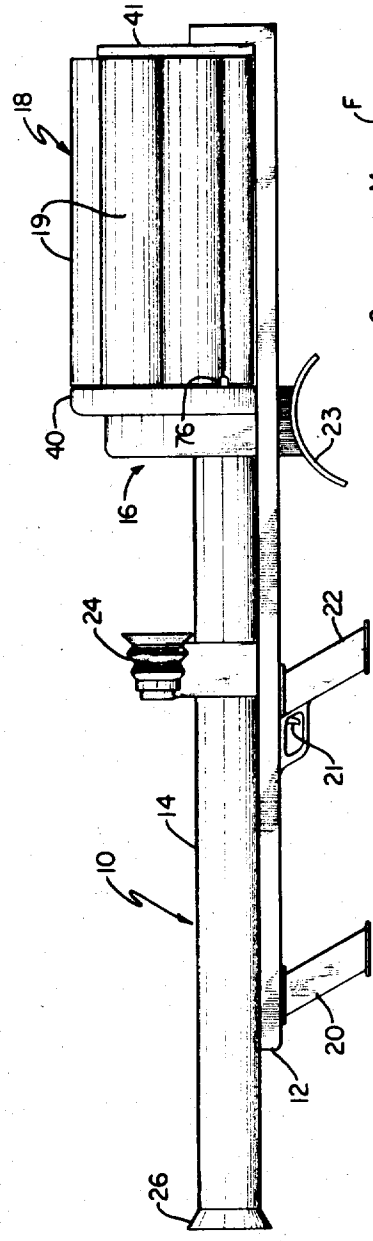


FIG. 1

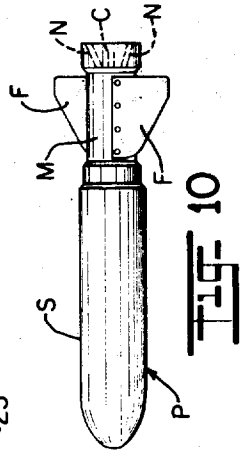


FIG. 10

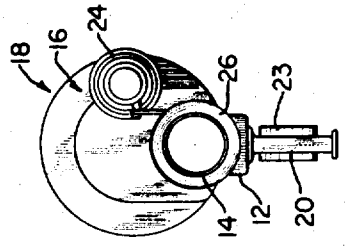


FIG. 2

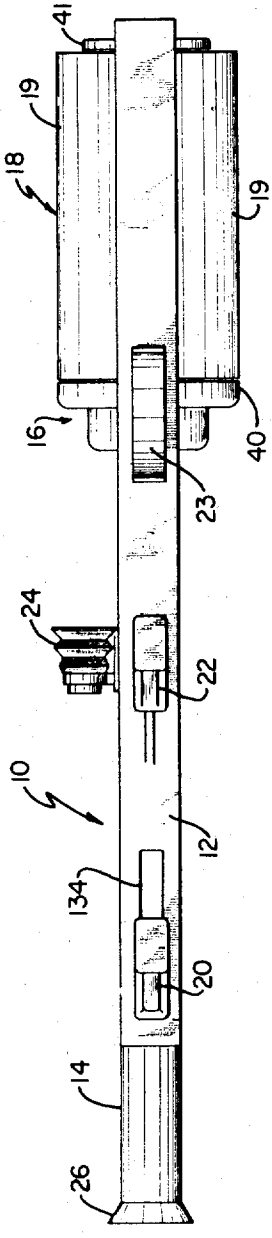


FIG. 3

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May 20, 1969 L. E. BATES 3,444,778

ROCKET LAUNCHER

Filed Feb. 8, 1967 Sheet 2 of 3

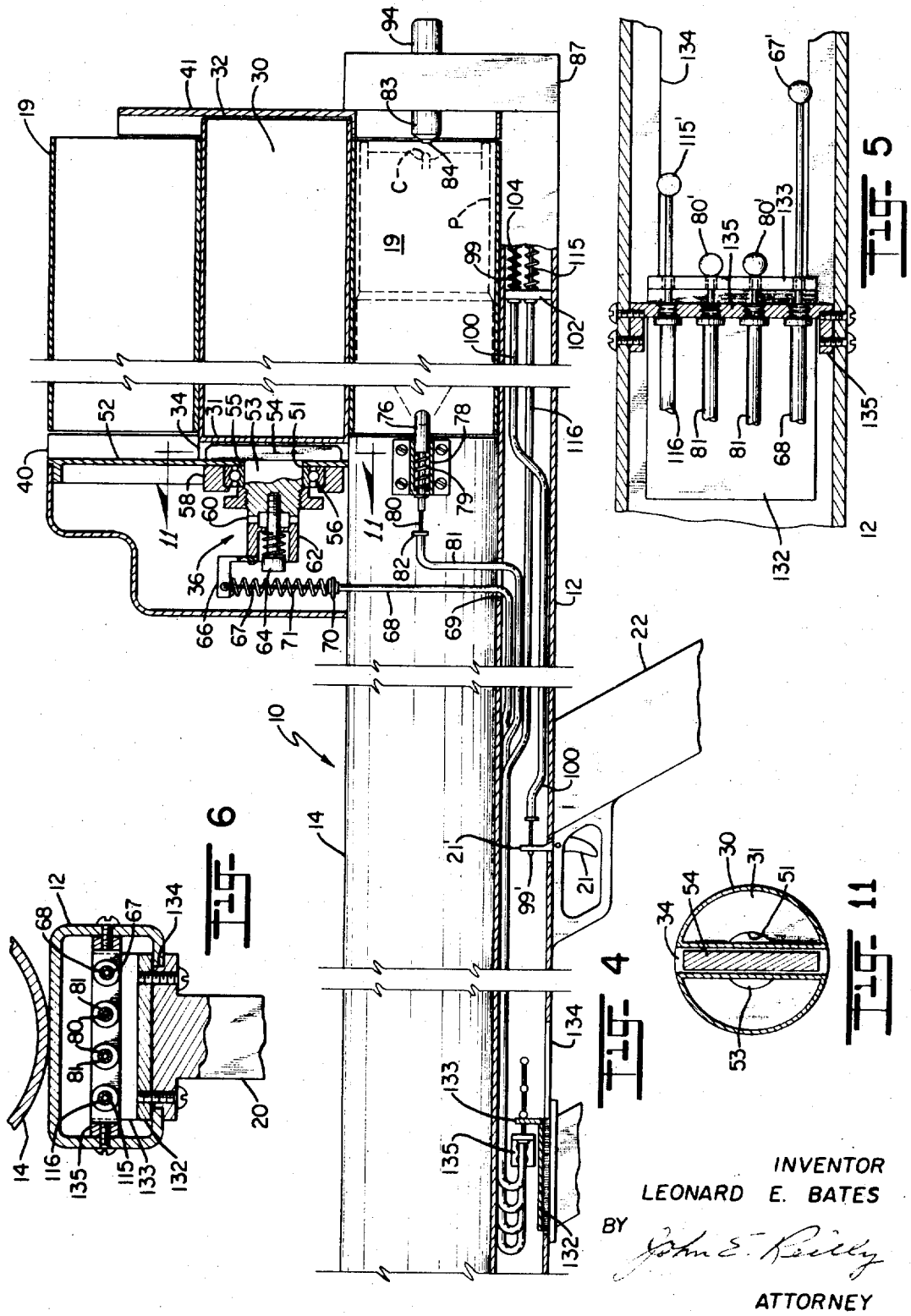

FIG. 5

FIG. 6

FIG. 4

FIG. 11

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May 20, 1969 L. E. BATES 3,444,778

ROCKET LAUNCHER

Filed Feb. 8, 1967 Sheet 3 of 3

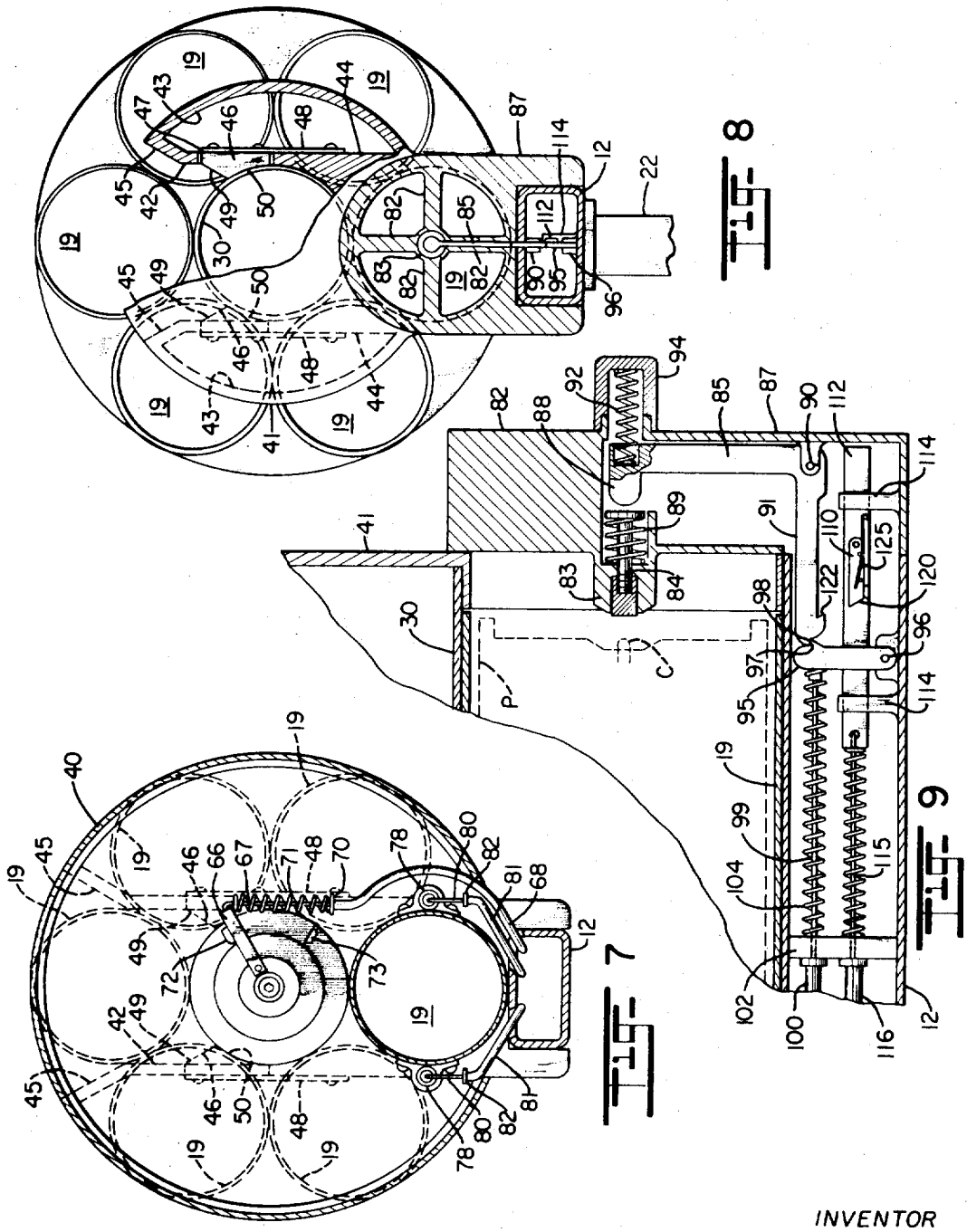

FIG. 8

FIG. 9

FIG. 7

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3,444,778

# ROCKET LAUNCHER

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U.S. Cl. 89—1.804 10 Claims

## ABSTRACT OF THE DISCLOSURE

The launcher is a multi-shot, shoulder-borne weapon for launching rocket projectiles of the type having outer, collapsible stabilizer fins which when launched can be accurately delivered on target in the range of one thousand yards. The weapon consists of a barrel section with an open breech behind the barrel to detachably lock the magazine in place; an indexing and cocking mechanism is controlled by a slide action hand grip to successively advance each round into position and to cock the firing mechanism, the latter being triggered in a conventional manner.

*Specification*

This invention generally relates to fire arms and more particularly to a multi-shot, rapid fire, shoulder-borne weapon for launching rocket-type projectiles over intermediate ranges.

Reference is made to co-pending application for patent, Ser. No. 610,094, filed Jan. 18, 1967, wherein a rocket projectile is characterized by having a solid propellant reaction motor for imparting a relatively high muzzle velocity to the projectile without recoil or flashback. In its preferred form the rocket projectile contains a pyrophoric gel which is hermetically sealed within the shell of the rocket and which upon impact is released to undergo highly intense, controlled burning over a relatively wide target area. Weapons and launchers presently in use possess limited range and accuracy and are not capable of handling larger sized rocket shells, especially for firing multi-shot rounds; and if such weapons were designed to fire multi-shot rounds would be unduly large and bulky for one-man operation. It is, therefore, highly desirable to launch projectiles of this type from a hand-held weapon which will deliver the projectiles accurately on target. In the field, it is important that the projectiles can be rapidly and conveniently loaded into the weapon for firing; further that the weapon be capable of firing multiple-shot rounds so as to possess maximum destructive capacity.

Specifically, rocket projectiles of the type described in my co-pending application are designed with outer collapsible or resilient stabilizer fins which will collapse or bend inwardly against the shell when loaded into a chamber, and when discharged from the barrel will immediately spring outwardly to greatly stabilize and increase the accuracy of the rocket in flight. It is therefore important that the weapon or launcher be capable of handling rockets of this type and of providing a smooth continuous path of travel from the magazine through the bore so as not to obstruct or retard movement of the projectile upon firing. Further, the barrel must be of sufficient length to permit complete burn-out of the propellant reaction motor prior to release in order to prevent recoil and flashback against the operator; yet must contribute to maximum range, accurate launching of the projectile. In addition, it is desirable that the weapon be capable of firing multiple-shot rounds with positive advancement of each projectile into accurate alignment with the barrel for firing in rapid sequence while nevertheless obviating the use of delicate or complex parts or mechanisms which are subject to malfunctioning from rough handling or misuse in the field.



It is, therefore, an object of the present invention to provide a novel and improved launcher for firing projectiles, and more specifically to provide for a hand-held weapon capable of firing self-propelled rockets either in single shot or multi-shot rounds and of loading and firing accurately in a safe, dependable manner.

It is another object of the present invention to provide for a rocket launcher which is lightweight, being comprised of a minimum number of parts, and is easy to assemble, load and maintain in the field.

It is a further object of the present invention to provide in a rocket launcher for a permanent or throw-away magazine which permits safe, rapid loading and being so constructed and arranged as to be detachably locked to the launcher to facilitate positive, rapid advancement of each shell into accurate alignment with the barrel for rapid firing in sequence.

It is a further object of the present invention to provide for a magazine adaptable for use in rocket launchers and the like which will accommodate rockets having outer collapsible stabilizer fins and will cooperate to effect recoilless firing of each shell or projectile without flashback.

It is a still further object of the present invention to provide in a rocket launcher for a novel and improved indexing and cocking mechanism for firing multi-shot rounds, said mechanism being under the complete control of the operator at all times and in a single motion will permit the operator to sequentially advance each rocket into position, lock the rocket in place in accurate alignment with the barrel, cock the firing mechanism and prepare for firing.

It is an addiitonal object of the present invention to provide for a multi-shot, shoulder-borne rocket launcher for rocket projectiles of the type described, the launcher being rugged but lightweight and being so constructed as to permit rapid loading, sighting and accurate firing by a single person in the field.

In accordance with the present invention the preferred form of rocket launcher is designed for loading and firing rocket projectiles of the type having outer collapsible stabilizer fins and a percussive ignitor at the aft end; however it will be readily apparent that the weapon is conformable for use in firing different forms and types of rockets, for example, those of the type described in my co-pending application. Specifically the rocket launcher is constructed to include a barrel section of a length exceeding the burnout rate of the rocket projectile, an open breech rearwardly of the barrel which includes fore and aft releasable lock members to accommodate a throw-away type magazine having a series of tubes or chambers each dimensioned for insertion of a rocket therein with the fine yieldingly collapsed against the inner surface of the chamber to frictionally retain the rocket in place. Releasable locking elements serve to lock each chamber in succession in accurate alignment with the barrel whereby to effectively form a continuous smooth bore tube for fir-

ing. An indexing mechanism is engageable with the magazine to successively advance each of the chambers into coaxial alignment with the barrel while a cocking mechanism is correlated with actuation of the indexing mechanism to cock a hammer in preparation for firing when each rocket is advanced into alignment with the barrel. A separate triggering device is provided to release the hammer and fire each shell. Preferably, a slide action grip is positioned for convenient handling by the operator and which in a single motion will effect indexing of each rocket into position, locking in place and cocking of the hammer or firing mechanism for each shot.

The above and other objects, advantages and features of the present invention will become more readily appreciated and understood from the following detailed description of a preferred form of the present invention when taken together with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a preferred form shown in FIGURE 1.

FIGURE 2 is a front end view of the preferred form shown in FIGURE 1.

FIGURE 3 is a bottom view of the preferred form of launcher.

FIGURE 4 is a fragmentary view, being enlarged and partially in section of the preferred form of launcher.

FIGURE 5 is a bottom sectional view in detail of the cable controls for the indexing and cocking mechanism.

FIGURE 6 is a cross sectional view of the cable control section shown in FIGURE 5.

FIGURE 7 is a cross sectional view of the indexing mechanism and front portion of the breech and magazine.

FIGURE 8 is a cross sectional view of the aft portion of the breech and magazine.

FIGURE 9 is an enlarged sectional view in more detail of the cocking and hammer mechanism in the preferred form of rocket launcher.

FIGURE 10 is a perspective view representing one form of rocket projectile for launching by the weapon of the present invention; and

FIGURE 11 is a cross-sectional view taken about lines 11—11 of FIGURE 4.

Considering in more detail the preferred form of invention, there is shown in FIGURES 1 to 3 a rocket launcher **10** comprised of a stock **12**, and a barrel section **14** and an open breech **16** are disposed in end-to-end relation on the stock. The breech detachably secures a magazine **18** above the stock for succesnive advancement of a series of magazine chambers **19** into alignment with the rear end of the barrel **14** for successively firing the rocket projectiles. The stock **12** is formed of a relatively flat, thick-walled tubular member and serves to support a slidable hand grip **20**, a trigger **21** on handle **22** and a shoulder rest or pad **23** in downwardly depending, spaced relation from the underside of the stock. A conventional sight **24** projects upwardly from the stock in offset but spaced relation above the barrel section and forwardly of the shoulder pad **23**.

The barrel section **14** takes the form of an elongated smooth bore tube which is welded or otherwise permanently attached to the top surface of the stock and is dimensioned generally such that the front end will extend beyond the stock and be of a length which will exceed the burn-out rate of the rocket projectile to be fired. The front end of the barrel section has a flared end portion **26** and the rear end terminates in a circular opening in the fore portion of the breech **16**.

The preferred form of launcher is constructed to launch a rocket projectile which, as illustrated in FIGURE 10 may broadly consist of a streamlined shell S propelled by a thrust reaction motor M, the motor section including canted nozzles N, outer spring-like fin stabilizers F tangentially mounted on the external surface of the motor, and an ignition system, not shown, for the motor which is activated by a percussion cap C at the aft end of the shell, all as set forth and described in more detail in my hereinbefore referred to co-pending application for patent. In order to safely handle and load the projectiles for multi-shot, rapid firing, the magazine **18** is defined by chambers **19**, each in the form of an open-ended, thin-walled tube and each being connected in circumferential side-by-side relation about a central supporting shaft **30**. The shaft **30** similarly is in the form of a tube having opposite ends **31** and **32** projecting beyond the ends of the magazine chambers for detachable connection in the breech section **16** in a manner to be described. In order to successively advance or rotate each chamber into alignment with the barrel for firing, the front end **31** of the supporting shaft **30** is closed by a disk provided with an open diametrical slot **34**.

Generally, the magazine may be composed of lightweight but rigid materials and by virtue of its simplicity in design and inexpensive construction may either be loaded and reused after each use, or may be thrown away and replaced by another loaded magazine. In the preferred form, the magazine comprises an array of six magazine chambers **19** in a common circle about the supporting shaft **30** and are suitably composed of a lightweight metal or plastic, such as, a glass, fabric or linen-reinforcing phenolic resin material. The supporting shaft and magazine chambers are of equal diameter whereby the chambers can be arranged uniformly in contacting relation to the external surface of the supporting shaft with adjacent chambers in contact with one another and be bonded or otherwise attached together, for example, by application of an epoxy resin or other suitable bonding agent to the contacting surfaces. As a result the chambers **19** and shaft **30** cooperate mutually to support and reinforce one another thereby defining a rigid, high strength structure. Individually, each magazine chamber **19** is dimensioned to permit close-fitting insertion of a rocket projectile P by collapsing the fins F inwardly against the external surface of the projectile and inserting into the chamber. The fins, being composed of a spring steel material will spring outwardy against the inner surface of the chamber to frictionally retain the projectile in place. The barrel section **14** is also dimensioned to correspond to the diameter of the chambers so that when each chamber is advanced into alignment with the barrel will form a continuous passage for discharge of each projectile.

In order to detachably connect the magazine in a rapid positive manner, the breech section **16** consists of upstanding end support housings **40** and **41** being mounted in spaced, fore and aft relation on the stock to receive opposite ends **31** and **32** of the magazine shaft **30** within generally U-shaped, upwardly directed open grooves **42** aligned in facing relation in the housings. The housings are of generally circular configuration and are recessed as at **43** along opposite sides **44** of the grooves **42** merely to reduce the weight of the weapon. Each groove **42** has an upwardly divergent entrance **45**, and spring-biased dogs or latches **46** are disposed in facing relation to one another on opposite sides of each groove directly beneath the entrance. Each latch is disposed in a slot, not shown, in a side **44** of the groove and the latch is pivoted about its upper end **47** while being biased inwardly through the slot by a leaf spring **48**, each spring **48** fixed at its ends to the outer surface of each side **44**. Each pair of latches has upper edges **49** inclining downwardly and inwardly toward one another and lower concave edges **50** which are formed on a line of curvature corresponding to the curvature of the lower closed end of the slot. In this way, opposite ends **31** and **32** of the supporting shaft **30** must be pressed downwardly to overcome the bias of the latches thereby forcing the latches outwardly and permitting insertion of opposite ends into the lower closed end of the slot. The latches will then spring back into place to retain the supporting shaft within the slot against shifting or release while permitting rotation of the shaft within the grooves **42**.

An indexing mechanism **36** is enclosed within the hous-

ing 40 and is mounted in an opening 51 in an intermediate vertical wall 52 directly in front of and in communication with the closed end of the groove 42 for the purpose of advancing each magazine chamber into alignment with the barrel section 14. The indexing mechanism includes a stub shaft 53 projecting forwardly through the opening 51 and a wing-like projection 54 on the shaft 53 abuts the back surface of the wall 52 and is proportioned and aligned for insertion into the slot 34 in the front end 31 of the shaft. The shaft 53 is externally threaded for engagement with the inner race 55 of a bearing 56, the latter including an outer stationary bearing retainer 58 secured to the front surface of the wall 52. The front end of the shaft 53 has ratchet teeth 60 which intermesh with complementary ratchet teeth at the end of a sleeve 62; and in turn the sleeve is urged in a rearward direction against the front end of the shaft 53 and aligned therewith by means of a spring-loaded screw 64 threadedly connected to the end of the shaft 53. Under clockwise rotation, as viewed in FIGURE 7 the ratchet teeth will cause the shaft 53 to follow rotation of the sleeve 62 and consequent rotation of the magazine-supporting shaft 30 by virtue of the engagement of the projection 54 within the slotted end 34. Conversely, when the sleeve 62 is rotated in a counterclockwise direction its teeth will slip past the teeth on the shaft 53 so that the shaft 30 and magazine 19 will remain stationary. As shown, the sleeve 62 is rotated by an indexing lever 66, the outer free end of which is connected to a flexible cable 67 extending through a cable jacket 68 downwardly through an opening 69 in the top surface of the stock 12 and forwardly through a cable control section to be described. The end of the cable jacket 68 is mounted in a stationary bracket 70, and a tension spring 71 is coiled between the end of the cable jacket 68 and the free end of the index lever to bias the index lever in a counter-clockwise direction. The travel of the lever 66 is controlled between a pair of limit blocks 72 and 73 on the front surface of the bearing retainer 58 so that when the index lever is advanced in a clockwise direction against the lower limit block 73 the magazine will be advanced exactly one-sixth of a revolution to align each next magazine chamber in succession with the end of the barrel; when the index lever is released tension of the spring will force the lever to return against the upper limit stop 72.

Once indexed, the magazine is locked against rotation by releasable locking pins or plungers 76, each being slidable in a chamber 78 mounted on opposite sides of the barrel and being urged rearwardly by a coiled spring 79 to flank opposite sides of the lowermost magazine chamber aligned with the barrel. To release the magazine for rotation, the pin members 76 are drawn forwardly and away from the magazine by a flexible cable 80 housed in a cable jacket 81. The leading end of the cable jacket is secured to bracket 82, and the cable members also extend downwardly through the opening 69 and forwardly into the cable control section.

The percussion cap C at the aft end of the rocket projectile is detonated by a hammer 85 disposed in a housing 87 directly above and in communication with the rearward end of the stock 12. The upper end of the housing 87 is of open generally circular configuration with radial flanges 82 extending outwardly from a central chamber 83. The upper end of the hammer has a forward projection 88 which is aligned to drive a striker or firing pin 84 forwardly through the chamber 83 against the urging of a spring 89 to strike the percussion cap and detonate the ignition system in the projectile. In turn, the lower end of the hammer 85 is pivotally mounted at 90 to the rear end wall of the housing 87, and a lower forwardly extending arm 91 is normally held in a horizontal position within the stock to hold the upper end of the hammer rearwardly away from the striker or firing pin 84, against the urging of a spring 92 secured in a separate housing portion 94 behind the hammer 88. As shown in FIGURE 9, the hammer is held in the cocked position by a detent 95 pivotally mounted at its lower end 96 and having a lateral projection 97 at its upper end engageable with a flat projecting end surface 98 at the forward extremity of the arm 91. The hammer portion 88 is released for firing by moving the detent 95 forwardly away from the arm 91. This is accomplished by means of a trigger cable 99 extending rearwardly from the trigger 21 through a cable jacket 100 for connection to the upper end of the detent 95. The terminal end of the cable jacket 100 is mounted in a stationary block 102, and a spring element 104 interposed between the block 102 and the detent 95 is biased to urge the cable and detent rearwardly against the hammer arm 91.

The cocking mechanism includes a lever arm 110 secured to a slide member 112 the slide member being movable lengthwise of the stock through brackets 114 under the control of a flexible cable 115 disposed in spaced relation beneath the trigger cable 99. The cable 115 is housed in a jacket 116 the end of which is mounted on the stationary block 102 with the rearward extremity of the cable 115 passing through the block for connection to the end of the slide member 112. It will be noted that the lever 110 has a forward tapered end 120 engageable with a projection 122 on the underside of the arm 91 when the latter is released by the detent 95 and travels downwardly across the slide member; and when the trigger cable 99 is released the detent 95 is drawn rearwardly under the urging of spring 104 to overlie the upper end of the arm portion 91. The hammer 85 is cocked by drawing the slide member 112 forwardly under the control of the cable 115 whereupon the lever 110 will engage the projection 122 on the arm portion 91 and, under continued forward movement, will swing forwardly and upwardly to carry the arm portion 91 upwardly until its forward extremity 98 clears the lateral projection 97 on the detent 95. When the cable 115 is released, the lever 110 is returned away from the detent 95 by a spring member 125 attached to the slide member 112.

It is important that the proper sequence be followed in releasing the magazine for rotation, cocking the hammer, and indexing the magazine to advance the next loaded chamber into position and that these steps be carried out in rapid order. To this end, a bracket 132 including a flange 133 is attached to the upper end of the hand grip and is slidable with the hand grip 20 through a longitudinal slot 134 in the underside of the stock. The ends of the cable jackets 68, 81 and 116 are secured to a mounting bracket 135 and their respective cables extend through laterally spaced openings in the flange 133 and terminate at different selected distances rearwardly of the plate 133. Each of the cables is provided with an enlarged terminal end 67', 80' and 115', respectively, which are retracted in that order by the flange 133 under rearward sliding movement of the hand grip. Thus, the enlarged ends 80' of the locking pin cables 80 are first retracted to release the locking pins and allow the magazine to rotate; under continued rearwardly sliding movement the enlarged cable end 115' of the control cable 115 is retracted to cock the hammer in position as described; and the enlarged cable end 67' of the indexing cable 67 is retracted to rotate the magazine and advance the next loaded chamber in position for firing whereupon the hand grip is returned to the original disposition and the cables automatically returned under spring tension. Similarly, the trigger cable 99 has an enlarged end 99' engaged by a pivot plate 21' at the upper end of the trigger to retract the cable and release the hammer. Accordingly, each rocket can be fired in rapid succession by sliding the hand grip back and forth then depressing the trigger when the next loaded chamber is in firing position. As each magazine is emptied it may be reloaded or replaced by another loaded magazine; and the magazine is removed by pressing upwardly against the latches until the ends of the supporting shaft are released

from the grooves. In positioning the magazine in the breech, the slotted end of the supporting shaft must be vertically aligned with the wing-like projection at the end of the stub shaft 53; and by rotating or indexing the magazine one position the wing-like projection is rotated away from its vertical disposition to positively lock the magazine one position the wing-like projection is rotated have been fired and the magazine emptied, the projection will have returned to its original vertical disposition to enable the magazine to be removed from the breech.

Although the weapon of the present invention has been described for use with rocket projectiles of the type incorporating collapsible, tangentially mounted fins or stabilizers it will be apparent that it is readily conformable for use in firing other types of projectiles employing modified collapsible fin members; or in the absence of external fin stabilizers auxiliary keepers or retention means may be employed to releasably secure the projectiles in place within each magazine chamber. Moreover it will be evident that the weapon may be equipped with an electrical triggering system for igniting projectiles of the type employing electrical ignition systems, such as, the modified form set forth and described in my co-pending application; and the triggering system may take the form of a battery-powered capacitor-transformer spark system which would be operated off the primary trigger.

It is, therefore, to be understood that while a preferred form of rocket launcher has been described various modifications and changes may be made in the composition, specific construction and arrangement of elements and parts as well as in its intended application without departing from the spirit and scope of the present invention.

What is claimed is:

1. A recoilless rocket launcher comprising in combination a stock, a barrel supported on said stock, a magazine including a central supporting shaft and a series of rocket-receiving magazine chambers in the form of open-ended tubes symmetrically arranged in a common circle about said supporting shaft for successive rotation into alignment with said barrel and each dimensioned for insertion of a rocket therein, a magazine-supporting section attached to said stock rearwardly of said barrel including releasable latch means arranged in a common circle about said supporting shaft with opposite ends of said shaft engageable with said releasable latch means to detachably connect said magazine in said magazine-supporting section, indexing means engageable with said magazine to successively advance each of said chambers into coaxial alignment with said barrel, releasable locking means to lock each chamber in succession in alignment with said barrel, and a firing mechanism for firing each rocket advanced into alignment with said barrel.

2. A rocket launcher according to claim 1, further including a hand grip and a handle having a trigger member extending in spaced, downwardly depending relation from said stock beneath said barrel, and a shoulder rest depending downwardly from said stock in rearwardly spaced relation to said hand grip and handle.

3. A rocket launcher according to claim 2, said hand grip depending downwardly from said stock in spaced relation in front of said handle.

4. A rocket launcher according to claim 1 further including a hammer and firing pin at the aft end of said magazine-supporting section, said firing pin being driven forwardly when struck by said hammer through the aft end of each magazine chamber aligned with said barrel, a cocking mechanism being operative to cock said hammer in spaced relation behind said firing pin, and release means associated with said cocking mechanism being activated in response to depression of said trigger for releasing said hammer to strike said firing pin.

5. A rocket launcher according to claim 4, further including a common control mechanism including a hand grip slidable in a longitudinal slot in said stock being operative in response to slidable movement of said hand grip to sequentially release said locking pins, actuate said indexing mechanism to advance each magazine chamber in succession into alignment with said barrel section and to cock said hammer in preparation for firing each rocket.

6. A shoulder-borne weapon for launching rockets and the like comprising an elongated hollow stock having a rearwardly disposed shoulder rest depending downwardly therefrom, a hand grip extending downwardly from said stock in space relation forwardly of said shoulder rest, said hand grip being slidable longitudinally through a slot in said stock, an elongated barrel mounted on the upper surface of said stock for forward extension therefrom, a pair of upstanding first and second magazine-supporting members being disposed in spaced fore and aft relation on said stock rearwardly of said barrel section, said magazine-supporting members having releasable latch means disposed in coaxially aligned, vertically directed grooves; a magazine including a central support shaft and a series of open-ended rocket-receiving chambers arranged in a common circle about said support shaft with each of said chambers being sized to correspond with the diameter of the bore in said barrel section, said support shaft having opposite ends projecting beyond opposite ends of said chambers and being insertable in the grooves in said magazine-supporting members for detachable connection by said latch means whereupon said chambers are rotatable about said support shaft successively into coaxial alignment with said barrel section; a ratchet-type indexing mechanism in said first magazine-supporting member being engageable with the forward end of said support shaft for successive advancement of said magazine chambers into alignment with said barrel section, locking pins on one of said magazine-supporting members releasably engaging said magazine chambers to prevent rotation thereof; a firing mechanism including a hammer to fire the rocket in each chamber aligned with said barrel, and actuating means between said hand grip and each of said indexing mechanisms and said locking pins being responsive to sliding movement of said hand grip through the slot to sequentially release said locking pins and advance said indexing mechanism to rotate a chamber into alignment with said barrel section followed by rturning said locking pins into locking engagement with said magazine.

7. A shoulder-borne weapon according to claim 6, said indexing mechanism including a rotating part engageable with a slot in the forward end of said supporting shaft, an indexing sleeve with complementary ratchet teeth between said sleeve and said rotating part, an indexing lever on said sleeve being movable to rotate said sleeve and rotating part for advancing each magazine chamber in succession into alignment with said barrel section, and said actuating means including a flexible control cable connected to said indexing lever and a pair of flexible control cables connected to said locking pins and pin return means normally urging said pins to the locking position.

8. A shoulder-borne weeapon according to claim 7, said firing mechanism including a cocking mechanism being disposed within said stock beneath said second magazine-supporting member, said cocking mechanism including a detent engageable with said hammer to hold it in a cocking position and a slide member being movable to return said hammer to a position of engagement with the detent after each firing, said actuating means including a control cable for said slide member being movable to advance said slide member in a direction returning the hammer to its cocked position, and trigger-controlled release means being defined by a control cable engageable with said detent to release said hammer for firing.

9. A shoulder-borne weapon according to claim 8, said actuating means including a cable control section on

said hand grip being defined by a bracket with spaced apertures to receive each of said indexing, locking and cocking control cables, said bracket being slidable with said hand grip to successively pull said cables in a direction to sequentially release said locking pins, cock said hammer in preparation for each firing sequence, and index said magazine.

**10.** A shoulder-borne weapon according to claim **6**, said magazine being defined by a series of magazine chambers in the form of open-ended, thin-walled tubes and a tubular supporting shaft being of a diameter with respect to said magazine chambers to position said chambers in contacting relation to the external surface of the supporting shaft with adjacent chambers in side-by-side



contacting relation to one another, and said supporting shaft and chambers being attached in mutually reinforcing relation.

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U.S. Cl. X.R.

89—1.816; 42—71