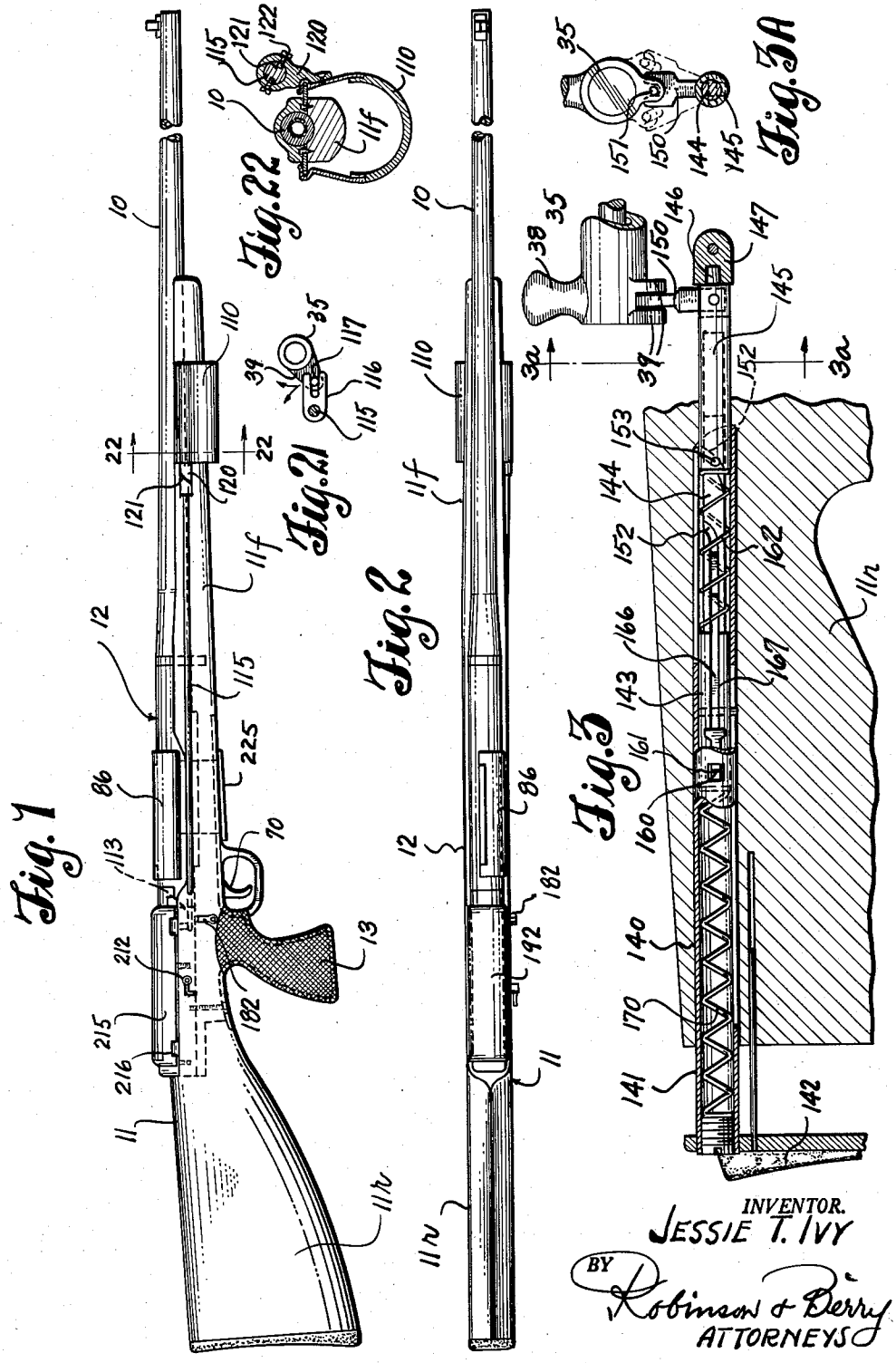
Jan. 10, 1961 J. T. IVY 2,967,367

FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

Filed Nov. 15, 1957 7 Sheets-Sheet 1



INVENTOR.
JESSIE T. IVY
BY Robinson & Berry
ATTORNEYS

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FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

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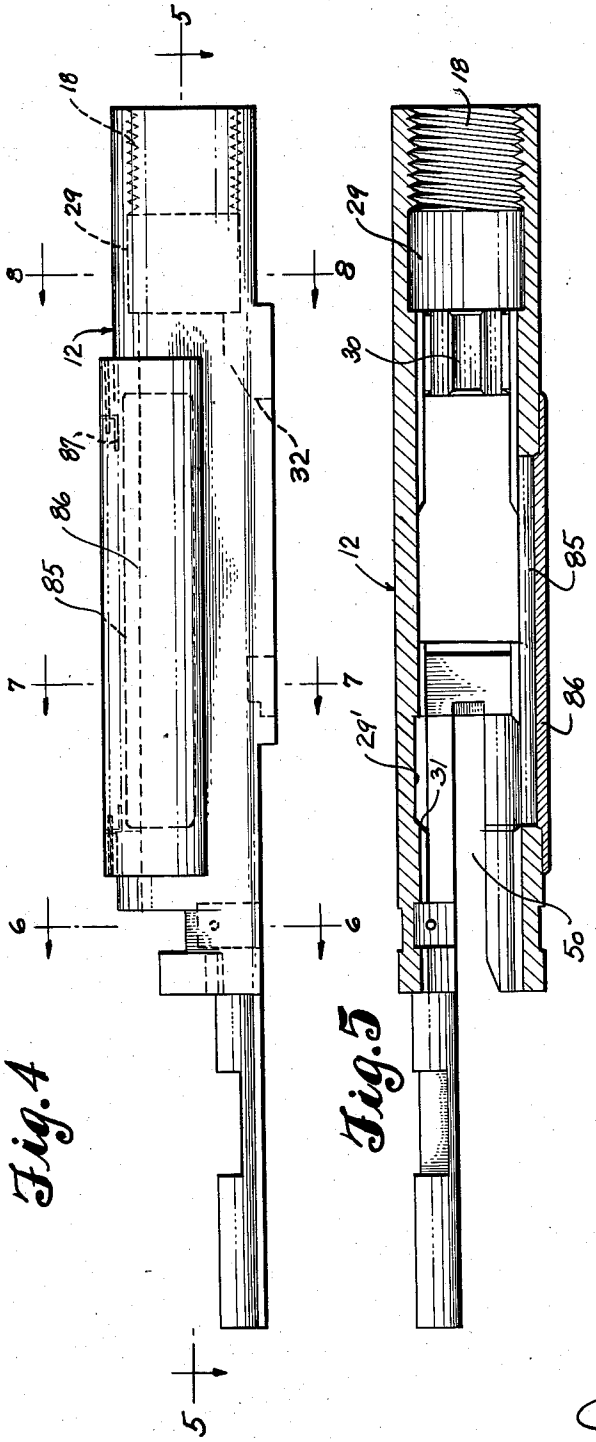

Fig. 4

Fig. 5

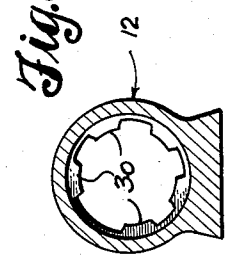

Fig. 8

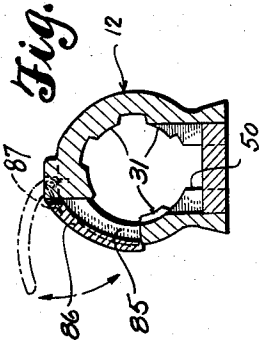

Fig. 7

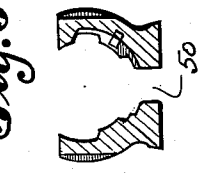

Fig. 6

INVENTOR.
JESSIE T. IVY
BY
Robinson & Berry
ATTORNEYS

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FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

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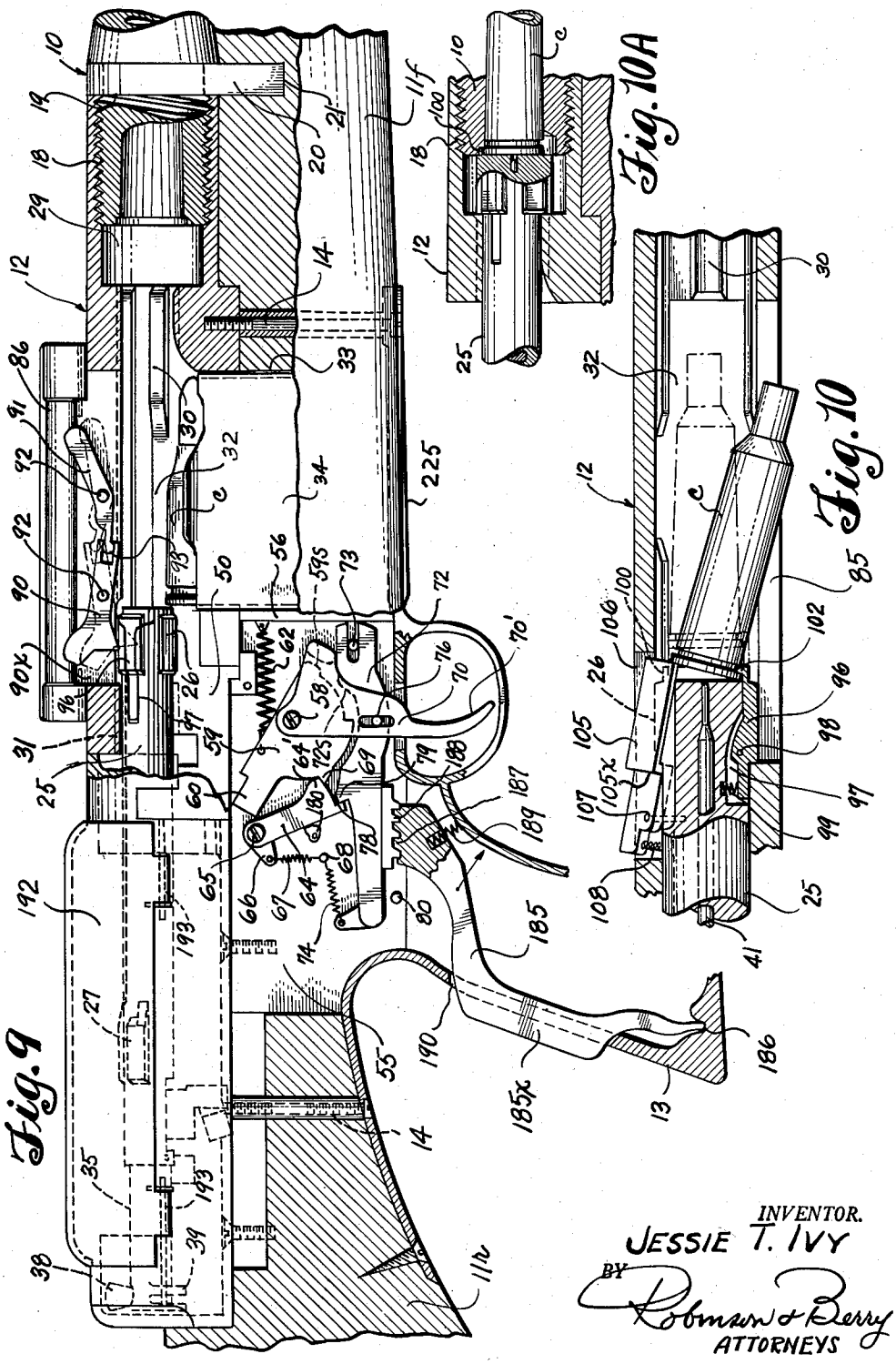

Fig. 9

Fig. 10

Fig. 10A

INVENTOR.
JESSIE T. IVY
BY
Robinson & Berry
ATTORNEYS

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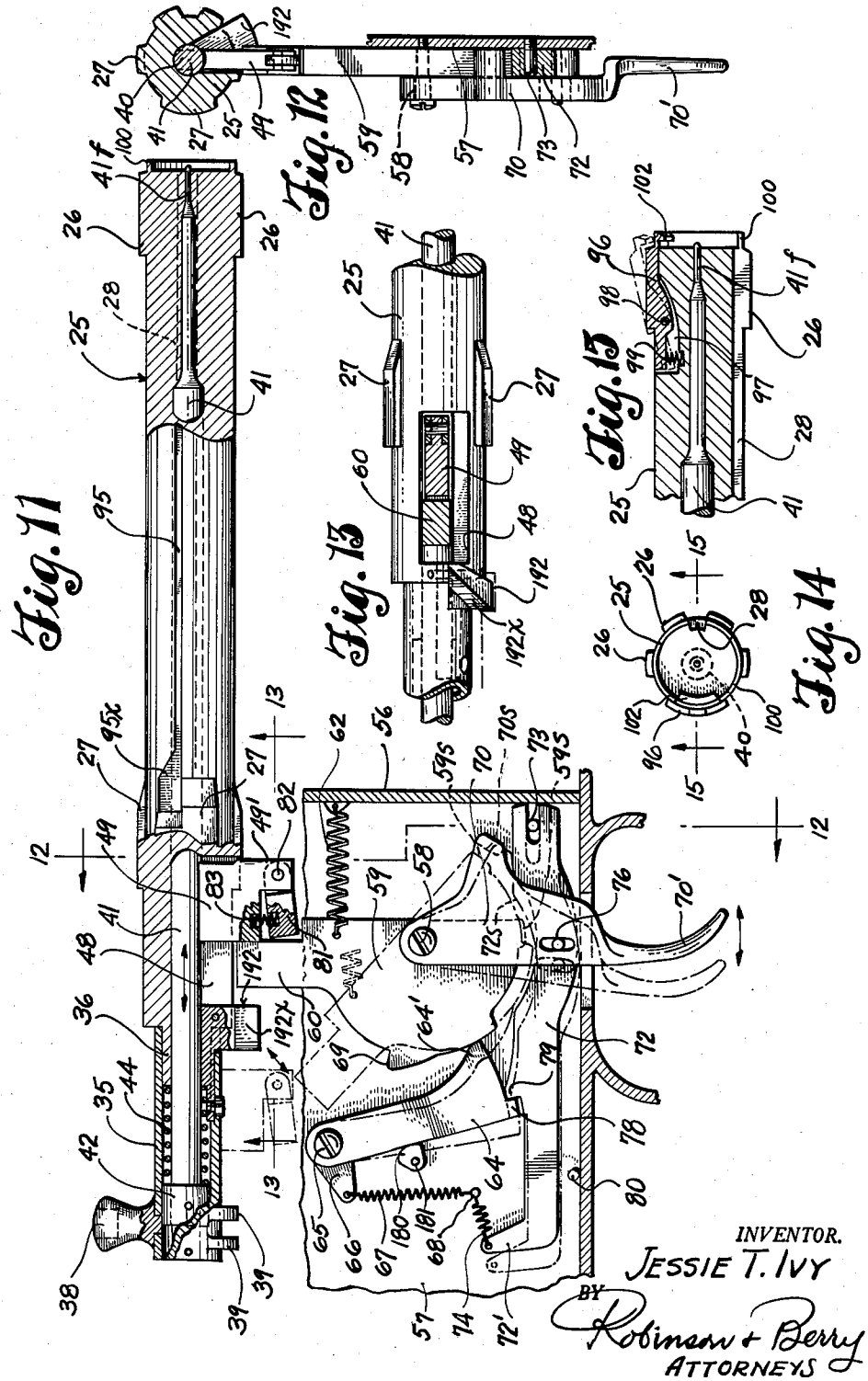

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FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

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Fig. 16

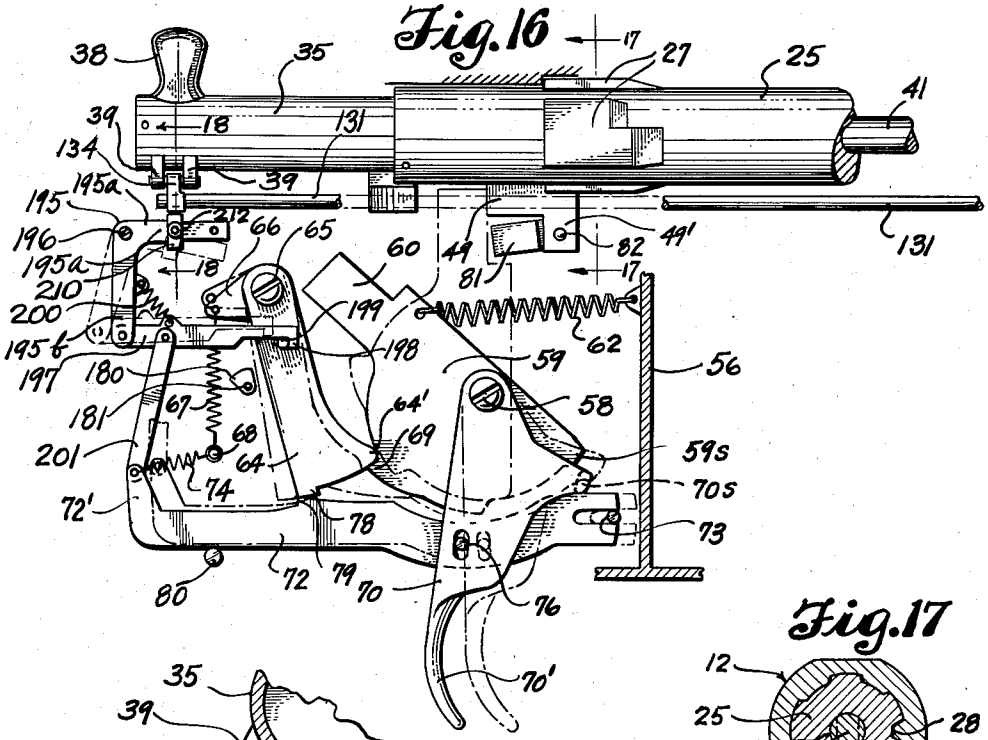


Fig. 17

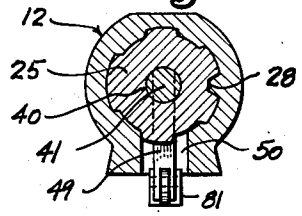


Fig. 18

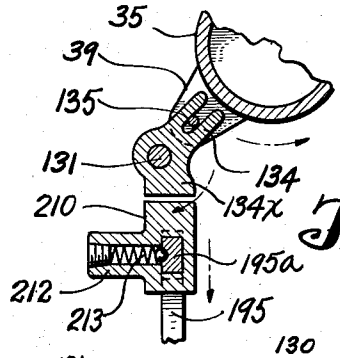


Fig. 19

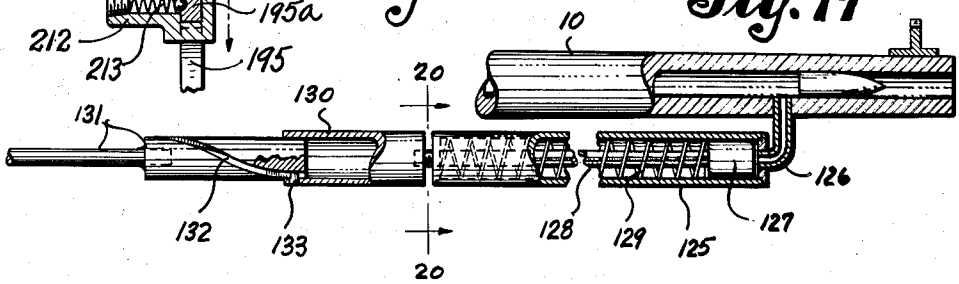
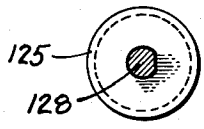


Fig. 20



INVENTOR.
JESSIE T. IVY
BY Robinson & Berry
ATTORNEYS

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FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

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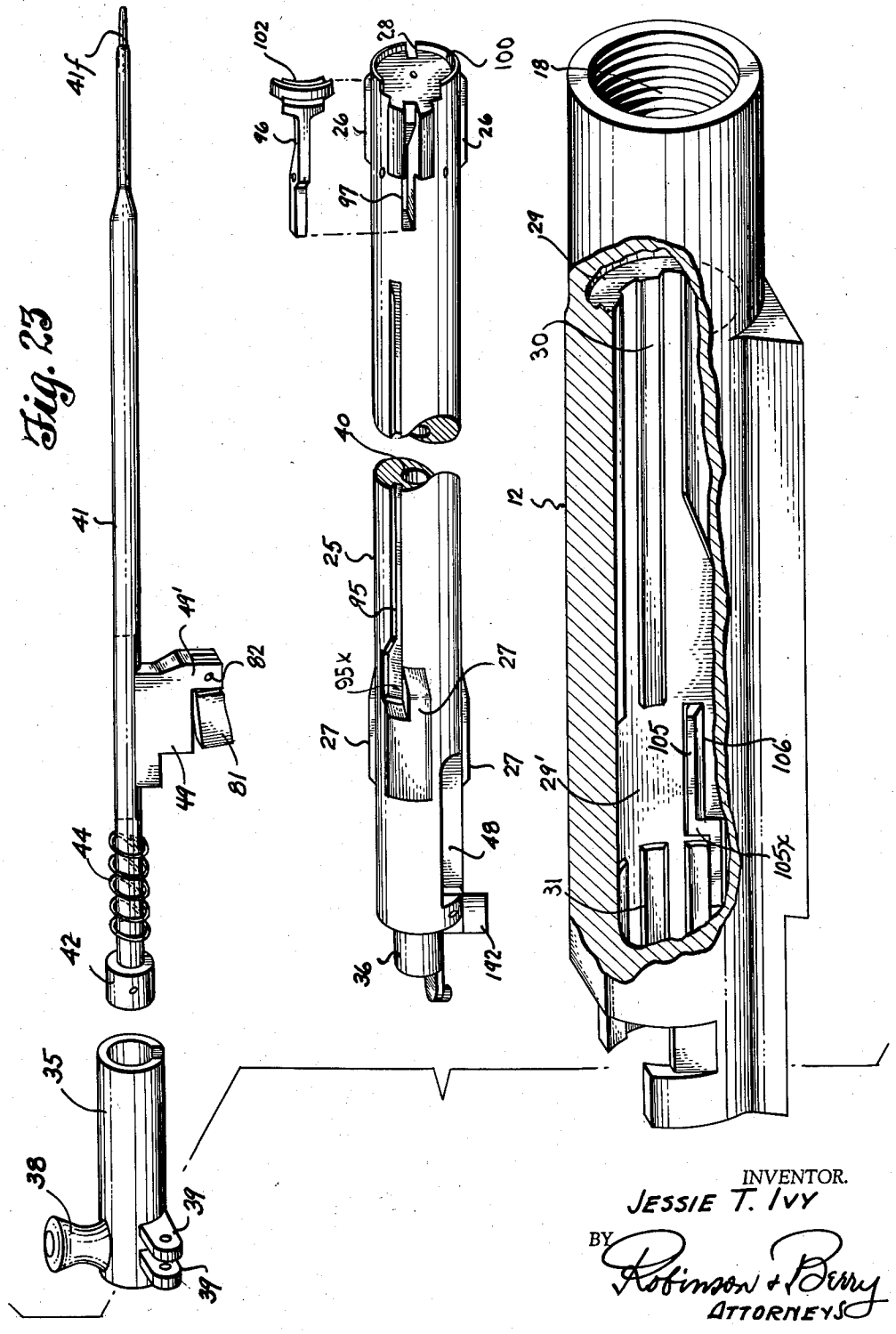
Fig. 23



INVENTOR.
JESSIE T. IVY
BY
Robinson & Berry
ATTORNEYS

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FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

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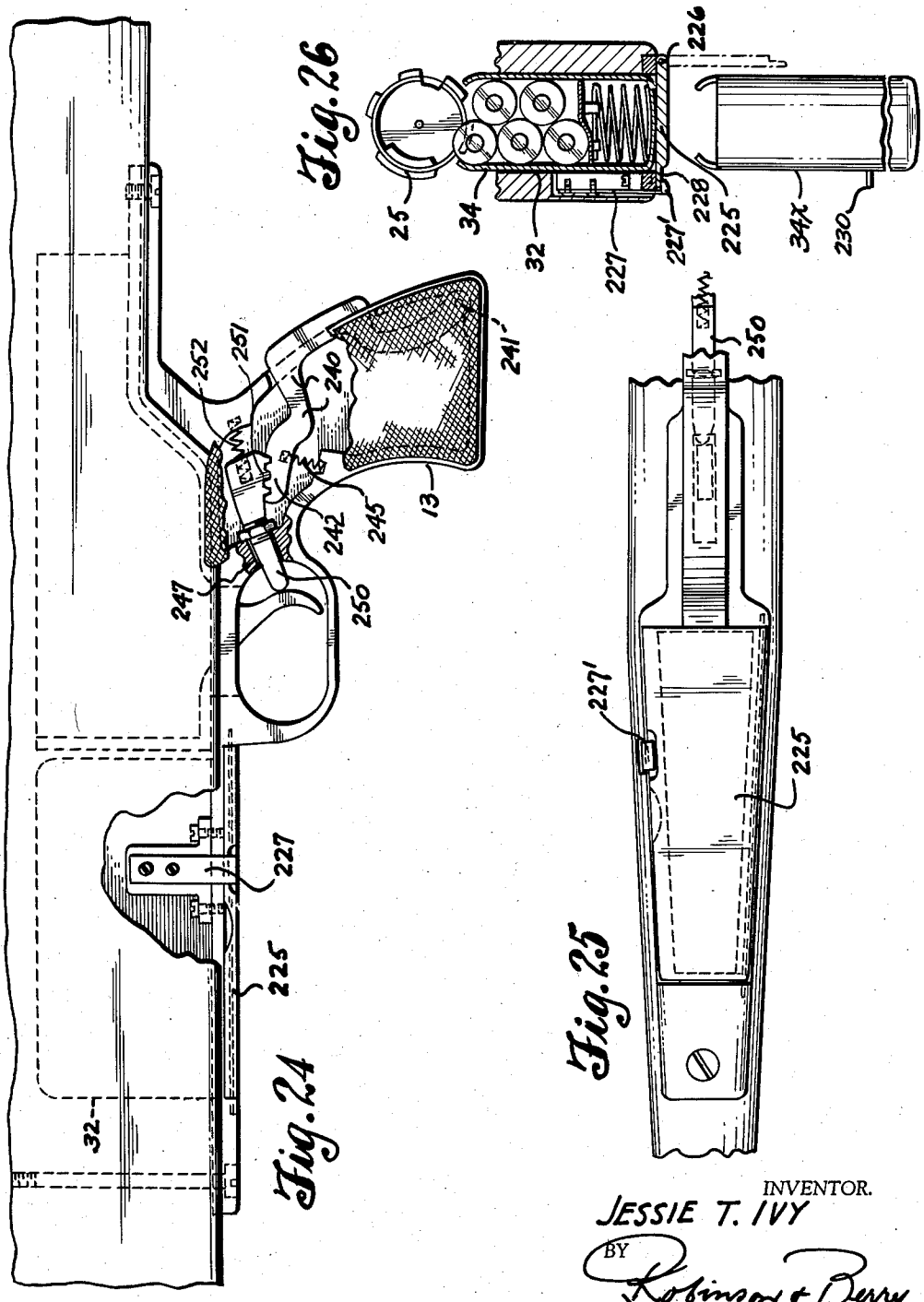

INVENTOR.
JESSIE T. IVY
BY
Robinson & Berry
ATTORNEYS

United States Patent Office 2,967,367 Patented Jan. 10, 1961

2,967,367

FIRING MECHANISM FOR BOLT ACTION REPEATING RIFLE

Jessie T. Ivy, 523 Henderson St., Seattle, Wash.

Filed Nov. 15, 1957, Ser. No. 696,738

5 Claims. (Cl. 42—69)

This invention relates to rifles and has reference more particularly to novel and practical improvements in bolt action rifles of the repeating types.

It is the principal object of this invention to provide a rifle having improved features of construction and combination of parts that result in a stronger and more satisfactory bolt action as provided for loading and for the extraction and ejection of the shells of fired cartridges; whereby a more positive and a safer locking of the bolt when closed is insured; that embodies an improved and more satisfactory hammer and trigger mechanism together with novel means that provide for continuous rapid firing so long as the trigger is held depressed and providing also for the firing of only one cartridge at a time even though the trigger may be held depressed; and which has a bolt action that is adapted for use therewith of various powering means for the automatic ejection, reloading and repeating operations of the rifle.

It is also an object of this invention to provide the present improved mechanism with safety locks of novel character which prevent the possibility of accidental firing and with manually operable devices whereby the rifle is changed from semi-automatic to full automatic operation.

Further objects and advantages of the invention reside in the details of construction and combination of the various parts employed therein, and in their mode of use, as will hereinafter be fully described.

In accomplishing the above mentioned and other objects of the invention which will become apparent as the description progresses, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a side view of a rifle embodying the improvements of the present invention therein, and showing it as equipped with a "hand operated slide action" for shell ejection and reloading.

Fig. 2 is a top view of the rifle as equipped and as shown in Fig. 1.

Fig. 3 is a sectional detail illustrating the bolt action of the rifle as associated with an automatic recoil actuated operating mechanism.

Fig. 3*a* is a section taken on line 3*a*—3*a* in Fig. 3.

Fig. 4 is a side view of the receiver, or bolt guide housing of the rifle, detached from the stock and barrel.

Fig. 5 is a horizontal section of the receiver taken on line 5—5 in Fig. 4.

Figs. 6, 7 and 8 are vertical sectional views taken, respectively, on lines 6—6, 7—7 and 8—8 in Fig. 4.

Fig. 9 is an enlarged side view of the receiver shown partly in section, and showing the receiver chamber; the bolt in its retracted or open position; the shell ejector mechanism, and the trigger and hammer assembly in "cocked" setting.

Fig. 10 is a sectional detail of portions of the bolt and receiver, illustrating a shell ejecting operation.

Fig. 10*a* is a similar sectional detail showing the relationship of the forward end of the bolt and a cartridge

as loaded into the barrel and as held there by the locked bolt.

Fig. 11 is a side view of the trigger and hammer mechanism, showing it as related to the firing pin and bolt when in locked position, and fired.

Fig. 12 is a vertical cross-section taken on line 12—12 in Fig. 11.

Fig. 13 is a horizontal sectional view taken on line 13—13 in Fig. 11.

Fig. 14 is a forward end view of the bolt.

Fig. 15 is a horizontal section of the forward end portion of the bolt, taken on line 15—15 in Fig. 14.

Fig. 16 is a side view of the rear end portion of the bolt, the trigger and hammer mechanism and an automatic trigger pulling latch mechanism for a gas operated bolt action.

Fig. 17 is a cross-sectional view of the bolt taken on line 17—17 in Fig. 16, showing it as contained in the receiver.

Fig. 18 is a cross-sectional detail on line 18—18 in Fig. 16.

Fig. 19 is a detail of a gas operated reloading mechanism applicable to the present rifle mechanism.

Fig. 20 is a cross-section taken on line 20—20 in Fig. 19.

Fig. 21 is a detail of the bolt operating means as used with the rifle as shown in Fig. 1.

Fig. 22 is a cross-section on line 22—22 in Fig. 1.

Fig. 23 is a perspective view of the receiver, with parts broken away to show interior construction; the bolt removed from the receiver, and the firing pin removed from the bolt.

Fig. 24 is a side view of a portion of the rifle showing the chambered portion of the stock for the cartridge clip, and the clip retaining latch. Also showing an alternative form of safety lock for the trigger.

Fig. 25 is an underside view of the parts shown in Fig. 24.

Fig. 26 is a cross-section taken on line 26—26 in Fig. 24 showing a cartridge clip applied to the rifle, and showing also a longer clip ready for application.

Referring more in detail to the drawings:

In Figs. 1 and 2, I have shown a rifle to which improvements embodied by the present invention have been applied; this rifle being typical of those for which the present improvements have been designed. The rifle comprises the barrel portion, which is designated in its entirety by reference numeral **10**; the stock **11** and the receiver, or bolt guide housing which is designated in its entirety by reference numeral **12**. The stock **11** comprises the rear end or shoulder engaging portion **11***r* and a forward or hand grip portion **11***f* that extends along the underside of the barrel and cradles it therein. It is also shown that the present rifle is equipped with a pistol grip **13** that is fixed to the stock below the receiver and in close association with the trigger guard. The stock, which may be of wood, is recessed in the usual manner, as has been shown best in Fig. 9, and the receiver, or bolt housing **12** is fitted therein and is secured in place by bolts **14** that are applied upwardly through the stock and threaded into the base portion thereof.

The receiver **12**, which is shown apart from the rifle in Fig. 5, comprises a single or one-piece housing, bored from end to end as shown, to contain the bolt as presently explained, and is formed at the forward end of the bore with a threaded socket **18** into which the rear end portion of the barrel **10** is threaded. It will be observed by reference to Fig. 9, that the barrel is shouldered as at **19**, near its rear end and the shoulder seats firmly against the forward end of the receiver. Also, it is shown that the barrel is formed at its shouldered end, with a downwardly directed flange or anchor **20** that fits

within a socket 21 in the forward portion of the stock in which the barrel is cradled.

Slidably contained in the receiver 12, in axial alignment with the bore in the barrel, is the bolt 25; this being shown apart from the receiver 12 in Figs. 11 and 23 and in part in various other views. At its forward end the bolt 25 is formed at spaced intervals circumferentially thereof with locking lugs 26, as shown particularly in Figs. 9 and 14. Likewise, it is formed near its rear end with locking lugs 27. Along one side thereof the bolt is formed with a longitudinal channel 28 that extends from just forward of the rear lugs 27 through the forward end portion of the bolt; this channel being located in the back side of the bolt as seen in Fig. 11, wherein it is shown in dotted lines, and it is seen also in the bolt as shown in Figs. 12, 14 and 15.

To properly contain the bolt for reciprocation and limited turning therein, the bore of the receiver is milled out just rearwardly of the threaded forward end portion, as seen in Fig. 5, to provide a cylindrical chamber 29 of slightly greater diameter than the bore, and just rearwardly of this chamber, the bore is formed circumferentially thereof with spaced bolt locking lugs 30. Also, the bore is formed circumferentially thereof and in its rearward portion, with a second set of circumferentially spaced lugs 31, and just forwardly of these is milled out to provide a cylindrical chamber 29'. These lugs, 30 and 31, are aligned in the bore and are so spaced that when the bolt is applied to the receiver and moved forwardly in the bore, the lugs 26 and 27 as formed thereon, can pass between them. The spacing of the sets of lugs is such that when the bolt reaches its forward limit, which is its "closed position" and its forward and rearward lugs are located in the chambers 29—29' respectively, a slight rotative movement thereof will then dispose them, in end to end, bolt securing or locking abutment with the opposedly related lugs 30 and 31 of the receiver to resist the rearward driving force of the fired cartridge.

It is further to be explained that the receiver 12 is formed in its underside and just forward of the bolt when it is in its open position as shown in Fig. 9, with a passage 32 which leads upwardly into the receiver chamber. This slot 32 registers with a similar opening 33 formed upwardly through the forward portion of the stock 11f. The stock opening 33 is designed to receive the usual cartridge containing clip such as that designated at 34 in Figs. 9 and 24, from which cartridges C are spring fed automatically, one at a time into the chamber of the receiver in accordance with the bolt action.

In this connection, it will be explained that, in a loading operation, a cartridge is received from the clip into the bore of the receiver when the bolt is fully retracted, as in Fig. 9, then as the bolt is moved forwardly, it pushes the received cartridge into the barrel. Then, the bolt, by a rotative movement effected as presently explained, is locked, thus to hold the cartridge for firing. After the cartridge has been fired, the empty casing or shell is extracted by the subsequent rearward movement of the bolt. However, to permit this rearward movement, the bolt must first be rotated slightly to disengage its lugs 26 and 27 as formed thereon from the lugs 30 and 31, as formed in the bore of the receiver.

For effecting this rotative movement of the bolt in opposite directions as required for locking and unlocking it, and also to effect its longitudinal actuation, it is equipped at its rearward end, as seen in Fig. 11, with a short extension in the form of a sleeve 35 that is fitted at one end over and fixed relative to a mounting portion 36 of reduced diameter formed coaxially of and on the rear end of the bolt. Mounted on the rear end portion of the sleeve, at its top side, is a knob or handle 38 for the manual actuation of the bolt when such is desired, as, for example, when initially loading the rifle. Also, it is formed on its underside and spaced longitudinally thereof, with paired ears 39—39 which are employed for the attachment to the bolt of the selected means for its automatic operation, as will presently be fully described.

Contained coaxially of and extending to the full length of the bolt is a bore 40 and movable endwise in this bore is the firing pin 41. The pin has a short forward end portion 41f of reduced diameter that is adapted to strike the cap of the cartridge as loaded into the barrel, for firing the cartridge as will presently be explained. At its rear end the firing pin extends into the sleeve 35 and has a head portion 42 fixed thereon. A coiled spring 44, contained under compression in the sleeve and bearing against the head 42 normally retains the firing pin in a slightly retracted position.

Fixed rigidly to the rear end portion of the firing pin as best shown in Fig. 11, and extended downwardly therefrom and through a longitudinal slot 48 formed in the underside of the bolt, is a block or anvil 49 against which a hammer is caused to strike to fire the rifle. This slot 48 is wider than the anvil 49, as seen in Fig. 13, in order to permit the required rotative movements of the bolt. It is to be understood also that the base portion of the receiver is formed with a longitudinal slot 50 leading thereinto from its rearward end, as shown in Figs. 5 and 17, through which the anvil, as projecting downwardly from the bolt extends, to place it in position for being struck by the hammer. The anvil has no turning action.

The trigger and hammer mechanism is as shown best in Figs. 9 and 11. Fig. 9 shows the stock 11 as being formed, below the rear end portion of the receiver 12, with a chamber 55 which opens upwardly therethrough and in which a metal frame is fixed. This frame comprises a front end wall 56 as seen in Figs. 11 and 16, and a sidewall plate 57 as seen in Figs. 11 and 12. Fixed in the side plate 57, perpendicular thereto as noted in Fig. 12, is a shouldered stud 58 and pivotally mounted on this is the hammer 59; this being in the form of a flat plate which is disposed below and in the vertical plane of the firing pin. As here shown, the hammer forming plate comprises a substantially semi-circular body portion that is mounted at the center of curvature of its periphery, on the pivot stud, 58, and from which body portion an arm 60 extends radially in an upward direction. The arm 60 is of such length that it can be caused to strike the firing pin anvil 49 incident to a certain rotative action of the hammer.

To power the hammer for a cartridge firing operation, I provide a coil spring 62 that is attached at its opposite ends, under tension, to the front wall 56 of the supporting frame and to the body plate 59 at a point substantially above the pivot stud 58.

Rearward movement of the bolt after the cartridge has been fired, that may be effected manually, or which also may be effected by automatic means as presently explained, causes the hammer 59 by reason of the engagement of the anvil 49 with the hammer arm 60, to be rotated counter-clockwise, in reference to its showing in Fig. 11, thus to move it to the dotted line position of Fig. 11. When the hammer is actuated to this "cocked position," it is normally latched and held there in readiness for trigger release, by a sear 64 as shown in Fig. 9. This sear is pivoted on the side plate 57 of the frame by a pivot stud 65 passed through its upper end. Fixed to the upper end of sear 64 is a short rearwardly directed lever arm 66 to which one end of a coil spring 67 is attached. The other end of this spring is attached to a stud 68, fixed in plate 57. The spring operates to yieldingly urge the lower end toe portion 64' of the sear against the periphery of the hammer plate 59. The hammer body 59 has a shoulder 69 projecting therefrom toward the sear, and when the hammer is rotated by bolt action to cocked position, as from position of Fig. 11 to that of Fig. 9, the toe drops over the shoulder and the hammer is thereby locked in cocked position by sear 64.

The release of the hammer for firing the loaded rifle is effected by actuation of the trigger mechanism. This comprises a trigger lever 70 that is pivoted at its upper end on the stud 58 as shown in Figs. 11 and 12. At its lower end, the trigger lever is formed with a finger hold 70' which is protected by the usual trigger guard. Immediately below and in the plane of the hammer plate 59 is a horizontal, slidably supported latch bar 72 with a pin and slot mounting 73 at its forward end and a coil spring support 74 at its rearward end; this spring being attached, under tension, at one end to stud 68 and at its other end to an upward extension 72' of the bar. Between its ends, the bar 72 has a pin and vertical slot connection 76 with the trigger lever which provides for the longitudinal actuation of the bar by a rearward pull on the finger hold 70'.

The sear 64 is formed at its lower end with a downwardly projecting lug or shoulder 78. When the hammer is cocked and held by sear 64 ready for firing by trigger release, as shown in Fig. 9, the lug or shoulder 78 is engaged at its forward side by an opposedly related shoulder 79 formed on the top edge of the bar 72. Pull on the trigger 70 as for firing, shifts bar 72 rearwardly, causing its shoulder 79 as engaged with lug 78 to swing the sear 64 to the left and clear its toe portion 64' from the shoulder 69 on the hammer plate. The coil spring 62 then forcibly acts on and rotates the hammer plate to cause its arm 60 to strike the anvil 49 of the firing pin 41 and thus cause the forward end of the firing pin 41 to strike the firing cap of the cartridge. As the hammer rotates, for firing, a shoulder 59*s* on its lower edge is caused to engage a shoulder 72*s* on the bar 72 thus to actuate the bar downwardly and release the shoulder 79 from the sear 64, thus to free the latter for subsequent latching.

It is also provided that if the trigger is squeezed to the limit, a projecting shoulder 70*s* formed therein, as shown in Figs. 11 and 16, will engage lever 72 to hold it depressed and freeing the sear as for semi-automatic firing. When the trigger pull is released, the coil spring 74 restores the slide bar 72 and the trigger to their normal positions, as seen in Fig. 11. A pin 80, applied to plate 57 below the rear end of the slide 72, limits the downward movement of the slide.

As a detail of construction of anvil 49, it will be observed especially by reference to Fig. 11, that a block 81 is pivoted at its right hand end as at 82, on an extended portion 49' of the lower end of the anvil 49. This block 81 is yieldingly held in a slightly downwardly inclined position by a small coiled spring 83 disposed between the lower end of the anvil and top of the pivoted block. The block 81 is adapted to engage the end of the hammer arm 60 during the hammer cocking operation as effected by the rearward action of the bolt, to rotate the hammer plate 59 slightly more than is required for moving the shoulder 69 past the toe 64' of the sear 64. This block 81 ultimately slips off the arm 60 and moves substantially beyond it, thus allowing the hammer latching operation as in Fig. 9. Then, with the return of the bolt to its forward position, the block 81 yields upwardly and rides over the end of the hammer arm. The over travel of the hammer plate in the cocking operation causes the shoulder 69 thereon to pass beyond the latching toe of the sear 64 sufficiently so that there will be no possibility of the sear failing to latch.

Cartridges as automatically advanced from the shell clip 34 into the receiver chamber are pushed into the breech end of the barrel by the bolt 25 as it is moved from retracted to forward or locked position. Cartridges are arranged in the clip in the staggered relationship shown in Fig. 26, and are urged upwardly by spring pressure. The uppermost cartridge lies against the under side of the bolt until it is fully retracted. Then, the extracting rim at the base of the cartridge is free to slip up against a stop at the top edge of the clip, into the path of the bolt. When the bolt is actuated forwardly, it pushes this cartridge from beneath the cartridge stop, freeing it to spring upwardly directly in front of the bolt, and properly positioned for loading into the barrel by the forward action and locking of the bolt. After firing the cartridge, the shell is extracted and ejected by the rearward action or retraction of the bolt. This may be effected by any one of the means presently to be described.

As the cartridge shell is extracted by the retraction of the bolt, two lugs 26 on the under side of the forward end portion of the bolt restrain the cartridges remaining in the clip, and it is for this reason that these lugs are slightly inclined at the rear ends to give them easier passage over the cartridges. As the bolt nears the end of its retracting movement, the lugs move rearwardly of the cartridges in the clip, and the uppermost cartridge springs into the path of the bolt.

The receiver 12 is formed, as will be best understood by reference to Fig. 7, with a longitudinally extending shell discharge opening 85 along one side thereof. Normally this opening is covered by a door or lid 86 hingedly mounted on the receiver to swing upwardly and outwardly, as indicated. This lid is normally urged to the closed position in which it is shown, by spring means 87 associated with its hinge mountings, and it is caused to be opened automatically with the retraction of the bolt and the extraction of a fired cartridge by means which will now be described; reference being directed particularly to Figs. 4, 7 and 9.

In Fig. 9, the lid or cover 86 is shown in its open position, and it is also shown in that view that a pair of rocker levers 90 and 91 extend along the flat, vertical top edge surface of the receiver shell discharge opening 85; each lever being pivoted intermediate its ends, by a stud 92, fixed in said flat surface. The inner ends of these levers have an interfitted, sliding joint connection as at 93, whereby the levers are caused to rock in unison. When the lid 86 is moved from the open, dotted line position of Fig. 7, to its closed position, it engages against the outer ends of the levers and rocks them downwardly to the position of their dotted line showing in Fig. 9, and in doing this, a downwardly directed outer portion, 90*x*, of lever 90 is depressed against the adjacent surface of the bolt 25. Then with the subsequent retraction of the bolt for the extraction of the fired cartridge, one of the lugs 26 that is formed on the forward end portion of the bolt moves beneath the lever portion 90*x* and rocks the lever 90 upwardly. This causes the outer end portions of both levers 90 and 91 to swing upwardly against the lid, thereby actuating it to the dotted line "open position" of Fig. 7. The cartridge extracted from the barrel by the retraction of the bolt 25 is then ejected out through the opening 85. Then, with the closing or forward movement of the bolt, the lug 26 moves from its contact with the lever toe 90*x*, and the spring hinge mounting of the lid 86 actuates the lid back to its closed position, where it remains while the gun is not being operated, thus keeping out dust, dirt or moisture.

In order that the rocker arms 90—91 may move to the position for full closing the cover member 86, the bolt 25 is formed with a longitudinal channel 95 into which the inwardly projecting end portion 90*x* of arm 90 can be received; this channel being shown best in Fig. 11. It is observed in this view that the rear end portion of the longitudinal channel is widened, as at 95*x*; this being to permit that slight turning of the bolt, after it has reached its locking position, that is required for locking it.

To effect the extraction of a fired cartridge from the barrel into the receiver chamber and its subsequent forcible ejection by the bolt action, I provide that means shown particularly in Figs. 10 and 15. It is shown in

these views, that a cartridge shell extracting latch **96** is contained in a longitudinal channel **97** formed in the forward end portion of the bolt. This latch is pivotally mounted intermediate its ends by a pivot pin **98**, and a coil spring **99** is disposed under compression between the rearward end of the latch inwardly to yieldingly urge its forward end portion inwardly.

At its forward end, the bolt **25** is formed coaxially thereof, with an extending annular flange **100** within which the flanged base end of a cartridge will be seated, as in Fig. 10*a*, as the bolt moves forwardly in a loading operation. Also, the latch lever **96** is formed at its forward end with an inturned and arcuately extending hook **102** overlapping the flange **100**. This has its forward surface inwardly beveled in such manner as to cause it, upon engaging the rim flange of the cartridge with the forward travel of the bolt, to snap thereover. Then when the bolt is subsequently retracted, this hook retains its hold on the cartridge flange and the cartridge will be pulled from the barrel into the unloading chamber of the receiver as indicated by its dotted line showing in Fig. 10.

As the bolt **25** approaches the end of its extracting movement, the base end of the extracted cartridge is engaged, at a point directly opposite the extracting hook **102**, by the forward end of a stop or ejection lever **105**, as shown in Fig. 10. This engagement causes the cartridge to be flipped laterally through the side opening **85** of the receiver.

The stop lever **105** is contained, as seen in Fig. 10, in a recess **106** formed in a sidewall of the receiver, and extends in the lengthwise direction of the bolt. It is pivoted near its rear end in the recess, as at **107**, and a coil spring **108** acts against its rearward end to yieldingly urge its forward end inwardly. The forward end portion of this lever **105** is laterally offset from the rearward end portion and rides at its end in the longitudinal channel **28** of the bolt, and thus its forward end is positioned properly for striking the base of the extracted cartridge in the intended manner for causing the cartridge to be ejected incident to full retraction of the bolt.

The purpose of the offset in the lever **105** is explained as follows: The offset portion, designated in Fig. 10 at **105***x*, is in the nature of a stop shoulder that extends transversely of the bolt. It is so positioned as to be engaged by the square cut rear end surface of one of the lugs **26** on the forward end of the rearwardly moving bolt, thus to limit its rearward travel. However, if it is desired to remove the bolt from the rearward end of the receiver, the rear end of the lever, which is exposed through an opening in the side of the receiver, is pressed inwardly, thus clearing its forward end from the bolt retaining lug.

The stop **105***x* also acts as a guard when the bolt is moved to its closed position, since, as the bolt moves forwardly, one of its rear end lugs **27** engages the lever **105** just forwardly of its mounting pin **107** and pushes its forward end portion outwardly. Then, when the bolt in closed position, is rotated for locking it, the offset portion of the lever continues to ride on the engaging lug and this retains the forward end of the lever clear of the bolt channel **28** until the rear lugs clear the rear end of the lever **105**. The lever **105** is left free to swing into the channel **28** when the bolt is rotated back to an unlocked position.

The bolt action can be manually effected by a means as shown in Figs. 1 and 2 wherein **110** designates a hand grip that is mounted on the forward portion **11***f* of the stock for limited reciprocal action therealong. Extended rearwardly from the grip **110**, along the stock and slidably and rotatably contained in a bearing **113** fixed to the receiver, is a rod **115**. At its rear end this rod has an inwardly directed crank arm **116** fixed thereto, as shown in Fig. 21, and this arm has a pin and slot connection, **117**, with the downwardly directed ears **39—39** that are formed on the sleeve extension **35** of the bolt. At its forward end, the rod **115** extends slidably and rotatably through a bearing **120** fixed in the slide **110**, and is formed along that end portion with a spirally directed channel **121**. A stud **122**, mounted in bearing **120**, extends into this channel. When the slide is pulled rearwardly as for unloading, its initial travel causes the stud to move rearwardly in and along the spiral channel **121** and thus effect slight rotation of the rod which, through arm **116**, effects sufficient rotation of the bolt to unlock it for rearward travel. The stud, immediately after unlocking the bolt, engages against the rear end of the spiral channel, and the rod **115** is pushed rearwardly by action of the slide, thus causing the bolt to be opened, the cartridge extracted and ejected from the barrel. Except when in its forward position, the bolt **25** cannot be rotated. This is by reason of those parts, **90***x* and **105**, mounted in the receiver which are then slidably contained in the bolt channels **28** and **95**. Therefore, when the hand grip **110**, after extraction of a cartridge, is actuated forwardly as for loading, the rod **115**, through its rear end connection with the bolt, is held against rotation as it pulls the bolt forwardly with it. When the bolt reaches its forward position, and the locking lugs thereon have moved forwardly of the complemental lugs in the receiver bore, the bolt is then permitted that slight rotative movement required for locking it, and this movement is effected by that slight turning of the rod **115** that is incident to the forward movement of the stud **122** in the spiral channel **122** during the final forward action of the hand grip **110**.

The hand loading mechanism, above described, is substantially like that described and illustrated in my U.S. Patent No. 2,832,165, issued April 29, 1958.

One means for an automatic action of the bolt has been illustrated in Figs. 16 to 20. In Fig. 19, I have shown a gas pressure cylinder **125** supported along and parallel with the forward end portion of the barrel **10**. This cylinder is connected at its forward end by tube **126** with the forward end of the bore of the barrel. Fitted reciprocally in the cylinder is a piston **127**, and a piston rod **128** extends therefrom and rearwardly from the cylinder; this rod being keyed against turning in the cylinder. A coil spring **129** is contained under compression in the cylinder and acts against the piston to urge it forwardly. When the rifle is fired, gas confined under pressure in the barrel back of the bullet, after it passes the pipe **126**, is applied through tube **126** to the cylinder and drives the piston rearwardly.

Fixed against turning on the rear end of the piston rod **128**, is a sleeve **130**, and this sleeve contains the forward end portion of a rod **131** therein for limited reciprocal and turning movement. The cylinder contained end portion of this rod is formed with a spirally directed cam slot **132** in which a stud **133**, fixed in the sleeve, is slidable as a cam follower. At its rear end the rod **131** has a radial arm **134** fixed thereto, as in Fig. 18, and this has a pin and slot connection **135**, with the ears **39—39** formed on the rear end of the bolt extension **35**.

When the piston **127** is forced rearwardly by gas pressure incident to the firing of the cartridge, the sleeve **130** is similarly forced rearwardly by the piston rod. This first causes the sliding cam pin **133** acting in the cam slot **132** to effect that slight turning of the rod **131** required to unlock the bolt. Then, the continued rearward travel of the rod **131** moves the bolt to its full open position and effects extraction and ejection of the shell. When the gas pressure is dissipated, the spring **129** returns the piston **127** to its initial position and this, through the connections shown, moves the bolt **25** back to its locked position.

Still another means for effecting an automatic reloading operation has been shown in Fig. 3; this means being in accordance with that mechanism which has been

described in my U.S. Patent No. 2,807,113, issued on September 24, 1957, that comprises mechanism operated by force of recoil of the rifle upon its being fired. It is shown in Fig. 3 that the stock **11** has a longitudinal bore **140** opening to the rear thereof. This opens at its forward end into the chamber **55**. Fitted in the bore **140** for limited reciprocal movement, is a tubular slide **141** which, at its rear end has a shoulder pad **142** fixed thereto.

Reciprocally contained in the medial portion of the slide **141** is a plunger **143** which, at its forward end has an integrally formed coaxial stem **144**. Fitted in the forward end portion of the tubular slide, for rotary and also for longitudinal movement, is a sleeve **145**, closed at its forward end but adapted to telescopically contain the forward end portion of the stem **144** therein. The sleeve **145** has a bearing trunnion **146** at its forward end seated in a socket in a bearing block **147** that is fixed against movement in the receiver body. It is shown in Fig. 3*a* that the sleeve **145** has an upwardly directed arm **150** fixed thereto and this has a pin and slot connection **151** at its upper end with the ears **39—39** of the bolt extension sleeve **35**.

It is also seen in Fig. 3, that the forward end portion of the stem **144** is formed lengthwise thereof and diametrically therethrough with a spirally directed slot or channel **152** and that a pin **153**, fixed in and extending diametrically through the rear end of the sleeve **145**, is contained in this channel. Therefore, it will be understood that a relative telescopic movement of the sleeve **145** and the plunger stem, while the latter is held against rotation in slide **141**, will effect axial rotation of the sleeve in accordance with the pitch of the spiral channel and extent of forward movement of the plunger and stem. This rotative action of the sleeve **145** in opposite directions effects the unlocking and locking of the bolt. This particular operation is the same as previously described in connection with the hand operated slide **110** and the gas operated device disclosed in Fig. 19.

The plunger **143** is normally latched against rotation in the slide **141** by a spring pressed latch device **160** that is carried in a recess in the plunger and releasably engaged in a hole **161** in a wall of the slide. It is also noted that a coil spring **162** surrounds the plunger stem **144** and is held under compression between the adjacent ends of the sleeve and plunger. This spring operates to urge the sleeve **145** forwardly at all times. Also, there is a latch release bar **166** slidably contained in a longitudinal channel **167** in the plunger. This provides that, when the forward end of the bar engages the rear end of the sleeve, the bar acts against and released the latch **160**, thus to free the plunger for its relative rearward movement in the slide **144**. It will now be understood that when recoil drives the gun rearwardly, the slide **141** moves forwardly in the stock. This causes the plunger stem to move forwardly in the sleeve **145**, causing the sleeve to rotate and thus unlock the bolt. Then the sleeve, acting against bar **166**, releases latch **160** and frees the plunger for rearward movement in the slide **141**. The unlocked bolt is then driven rearwardly, extracting the fired shell casing, and ejecting it from the receiver.

With the recoil forces expended, the parts are then returned to starting position; this being effected by a heavy coiled spring **170** that is contained under compression in the tubular slide and operates to force the plunger forwardly to its latched position. This latching is followed by the coil spring **162** moving the sleeve **145** back to bolt closing and locking position.

Various safety devices have been shown in connection with the rifle. For example, in Figs. 9 and 11, I have shown a cam member **180** supported on the frame plate **57** by a pivot shaft **181**, equipped at the side of the stock, as shown in Fig. 1, with a turning piece **182**. By swinging this turning piece, the cam lock **180** is engaged with the latch arm **64** and holds it against release from the cam shoulder **69** on the hammer plate **59**. This prevents release of the hammer from cocked setting.

Another safety lock is shown in Fig. 9 wherein a locking lever **185** is shown as contained in the pistol grip **13**. It rests pivotally at its lower end in a notch **186** in the bottom bar of the pistol grip frame. At its upper end it is equipped with teeth **187** adapted to lockingly engage with teeth **188** of a rack bar fixed to the base edge of bar **72**. A coil spring **189** acts against the upper end portion of the lever to urge it to this locked position. It is further noted that a medial portion **185***x* of the lever **185** projects rearwardly through a slot **190** in the pistol grip frame, providing that when the gun user firmly grasps the pistol grip **13** as for pulling the trigger, the lever will be pressed inwardly, thus disengaging its locking teeth from those of slide **72**, and thus releasing the slide.

Yet another safety device associated with the firing of the rifle has been shown in Figs. 11, 12 and 13; this being a device for preventing accidental firing before the bolt has been fully closed and locked. It is shown in Fig. 11 that a block **192** is fixed on the underside, rear end portion of the bolt. When the bolt is in an open position, this block lies in the path of the hammer arm **60** and would stop the hammer if the trigger was accidentally pulled. However, the greater danger would be if the trigger was pulled after the bolt was in a forward position but not fully locked. In such case the block **192** still lies in the path of the hammer arm. However, it has a sloping side surface **192***x* against which the hammer would engage with camming action thus to rotate the bolt to its fully locked position before the hammer arm could pass to engage the firing pin anvil **49**. It is only when the bolt is fully locked that the hammer arm can pass it.

In Fig. 16, I have illustrated means whereby, in a rifle having, for example, a gas operated bolt action, the trigger will be automatically pulled as required for continuous, rapid firing of shells. This means, as directly associated with the latch lever **64**, slide bar **72** and bolt rotating rod **131**, comprises a bell crank lever **195** mounted by a supporting pivot **196**. One arm of the bell crank lever, designated at **195***a*, extends parallel with and below the rear end portion of rod **131**. Its other arm, **195***b*, extends downward from the pivotal support. Pivotally fixed to the lower end of arm **195***b* is a horizontally directed link **197** which overlaps, at its forward end, with the latch lever **64**, and is formed at that end with a hook **198** that can be engaged with a stud **199** on the latch lever. A short coil spring **200**, attached to arm **195***b* and to the link, normally holds the hook **198** disengaged from the stud **199**.

Also, it is shown in Fig. 16 that a link **201** is pivotally joined at its opposite ends to the link **197** and the rearward end portion of bar **72**, which serves, as presently explained, to move link **197** to and from its functional positions.

Fixed on the rear end of the bolt operating rod **131**, is the arm **134** whereby rotation of the bolt is effected for locking and unlocking it. This arm is formed, as shown in Fig. 18, with a head **134***x*. It is also shown in Figs. 16 and 18 that a block **210** is slidably adjustable on the arm **195***a* of the bell crank to and from a position at which it will be engaged by the arm head **134***x* when rod **131** is rotated in its locking action. When this block is so engaged, the bell crank **195** is actuated from the full line position to its dotted line showing in Fig. 16.

Assuming then that it is desired to set the rifle for rapid continuous firing, the block **210** is set on arm **195***a* in position as shown in Fig. 16. Then, the operator, when ready to fire, pulls the trigger **70** rearwardly and holds it there. This trigger action shifts bar **72** rearwardly and downwardly and holds it against return,

causing link **201** to pull link **197** downwardly to engage its hooked end portion with stud **199**. Then with each bolt locking operation, as effected by the rotative movement of rod **131** as previously explained, the bell crank **195** is actuated by head **134***x* to cause link **197** to pull the latch lever **64** free from the hammer shoulder and thus cause the firing of the rifle. Then when the rod **131** rotates to unlock the bolt for ejection and reloading, the bell crank momentarily returns to normal position, thus moving lever **197** to release latch **64** for hammer engagement as the latter is rotated to cocked position by the ejecting action of the bolt. The latch **64** then holds the hammer until the bolt is locked. The firing continues until trigger release.

The block **210** is adjustable on arm **195***a* of the bell crank by a stem **212** that extends outwardly through a horizontal slot in the housing wall, as shown in Fig. 1. Spring means contained in the stud and shown at **213** in Fig. 18, operates to yieldingly retain the block in functional or non-functional position. When in the latter position, it is not acted on by the arm head **134***x*.

To prevent weather damage to mechanism in the rearward portion of the receiver, a lid or cover **215** is hinged thereto, as at **216** in Figs. 1 and 9. This lid may be opened to give easy access to the knob **38** for hand operation of the bolt as is required for the initial loading of a cartridge into the barrel. When closed, it forms a weather and dust tight closure.

In Figs. 24, 25 and 26, I have shown a cartridge clip as applied, and the means whereby it is held in the cartridge chamber. It is best shown in Fig. 26 that the clip **34** is contained in the chamber **32** in proper relationship to the bolt **25** for the automatic delivery of the cartridges thereto as it is moved to open position. The clip is retained in position in the chamber by a door **225**; this being hinged at one edge, as at **226**, to swing across the entrance to the chamber **32** and to engage, for its support in chamber closing and clip supporting position, with a spring latch **227**. The latch end hook **227'** engages beneath a lip **228** formed on the door edge thus to retain the door. By pressing the latch away from the lip, the door will be released for opening.

I have also shown in Fig. 26, an elongated clip **34***x* in a position ready for application to the chamber. When using such an elongated clip, the door **225** is opened, as to the dotted line position, and the clip is inserted. A tongue **230** extends from one side of the clip in position to be engaged by the latch **227** to hold the clip in position. The door remains open when this elongated clip is used.

In Fig. 24, I have also shown a trigger safety latch which is a modification of that seen in Fig. 9. In this device, a locking lever **240** is contained in the pistol grip portion **13**. It is pivotally supported at its lower end, as at **241**, and at its upper end it is formed with a toothed, segmental portion **242**. The medial portion of this lever projects through a slot in the back side of the pistol grip so that when the grip is grasped tightly as in shooting, the lever will be pressed forwardly. Normally it is held in its rearward position by a coiled spring **245** contained in the grip and pressing against the upper end of the lever.

Associated with lever **240** is a trigger stop **250**. This is contained in the grip and is slidable endwise in a guide channel that opens to the trigger guard. The forward end of this latch **250** engages the trigger and the rearward end portion is formed with teeth **251** engaged by the toothed portion **242** of lever **240** to prevent the trigger being accidentally pulled. A spring **252** urges stop **250** toward functional position.

When the user of the rifle tightly grasps the grip **13**, the lever **240** will be swung away from the latch lever and the trigger can be pulled. All parts are returned to normal position by the spring means shown, when the grip is released.

While all of the various improvements described herein are of importance and each contributes to the provision of a rifle having advantage of use and safety not found in present day rifles, it is believed that one of the most advantageous and important features resides in the rigidity of the bolt and the provision for its secure locking in closed position, thus to adapt it for use with exceedingly high powered ammunition with safety.

The present receiver and bolt combination used in conjunction with a recoil operated reloading mechanism, makes it possible to use cartridges of much greater power or caliber, with much less shock and with more safety to the rifle user.

What I claim as new is:

1. In a rifle of the character described, a receiver, a bolt mounted therein for reciprocal movements between breech closing and open positions, a firing pin mounted in the bolt and movable therewith to the full extent of its reciprocal movement, an anvil fixed to the firing pin and projecting downwardly from the bolt, a spring loaded hammer pivotally mounted in the receiver for oscillation and having a shoulder thereon, a spring loaded sear pivoted in the receiver for releasable holding engagement with said shoulder to normally restrain the hammer in anvil striking position, and a trigger mechanism for releasing said sear from the hammer shoulder; said hammer having a radially extending arm for striking the anvil for firing the rifle; said anvil having a block pivoted thereto at its lower end for limited upward and downward movements, said block being engageable with said hammer head with the opening reciprocal movement of said bolt after firing to return the hammer slightly beyond its latching position and cause said block to pass rearwardly beyond the hammer head to clear it for return of said hammer to latched position, and to yield upwardly and slide across the hammer arm with return of the bolt to closed position.

2. The combination recited in claim 1 wherein said sear is formed at its latching end with a releasing shoulder, and wherein a slide bar is supported for endwise movement and has a shoulder thereon engageable with said releasing shoulder of said sear for its actuation, and wherein said trigger mechanism comprises a pivoted trigger lever connected to said slide bar for its endwise actuation, to effect release of the sear from the hammer, and spring means for returning the slide and the trigger lever to their normal positions after actuation.

3. The mechanism of claim 2 wherein said bolt and said receiver are equipped with coacting means for locking the bolt in breech closing position and which means are brought into and moved from bolt locking relationship by limited rotative adjustments of the bolt in opposite directions, and wherein said bolt is slotted for the passage of the anvil from the bolt to the path of travel of the hammer arm and wherein the receiver is formed with a longitudinal slot through which the anvil, as fixed to the firing pin extends for maintaining its movement in the line of travel of the hammer arm when the bolt is reciprocally actuated.

4. The mechanism of claim 3 including a hammer stop fixed to the bolt in position for stopping any striking contact of the hammer arm with the firing pin anvil if said hammer should be released by the sear before the locking of the bolt and wherein said hammer stop is movable with the bolt out of the path of travel of the hammer head by the final rotative locking adjustment of the bolt in breech closing position.

5. In a rifle of the character described, in combination with a frame, a receiver, a bolt that is reciprocally movable in the receiver between open and breech closing positions; a firing pin mounted in the bolt and an anvil fixed to the pin and extending from the bolt; a hammer comprising a pivotally mounted plate, formed with an extended anvil striking arm and a latching shoulder, a spring loaded sear pivoted at one end in the frame and

having a toe portion at its other end engagable with said latching shoulder to normally retain the hammer in anvil striking position, a spring attached under tension to the hammer plate for its functional actuation for firing, when released from the sear; said sear having a releasing shoulder at its latching end, a slide bar equipped with a shoulder for engaging the releasing shoulder of the sear, said slide bar having a support at one end on which it is pivoted and also movable in an endwise direction, and having a yielding spring support at its other end, a pivoted trigger lever extended across the slide bar and having a pin and slot connection therewith for effecting its endwise movement for releasing the sear from the hammer, and said trigger lever having a shoulder engagable with the slide bar, incident to actuation of the trigger for releasing the sear, to swing the slide bar on its pivot mounting and retain it out of the path of return travel of the sear.

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