No. 783,770. PATENTED FEB. 28, 1905.

F. K. YOUNG & J. E. SHERIFF.

FIREARM.

APPLICATION FILED MAR. 28, 1903.

12 SHEETS—SHEET 1.

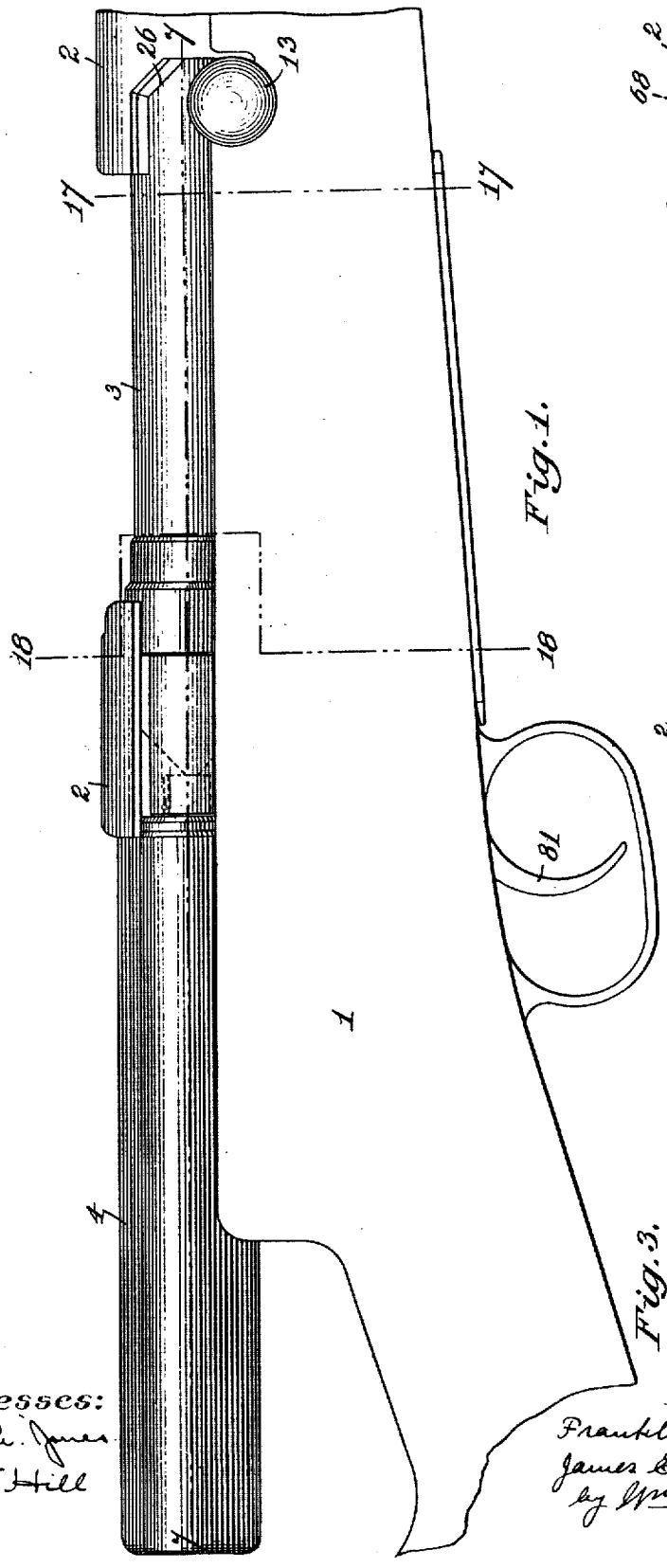


Fig. 1.

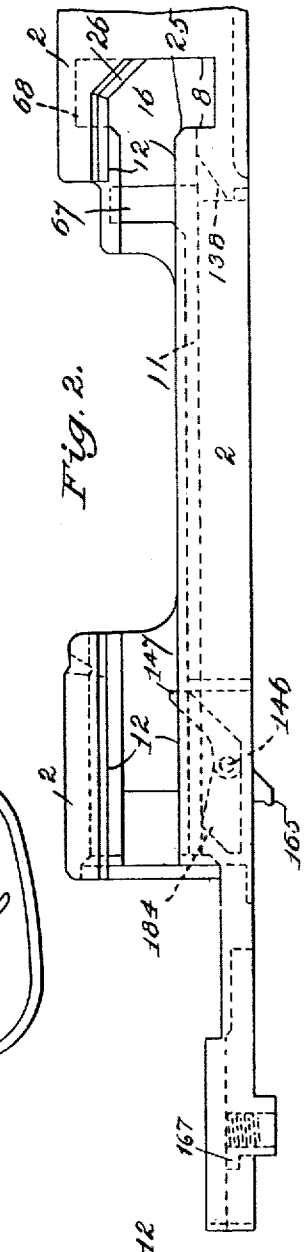


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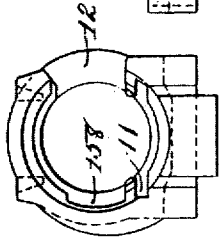


Fig. 3.

Witnesses:
Louis A. James
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney

No. 783,770. PATENTED FEB. 28, 1905.

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12 SHEETS—SHEET 2.

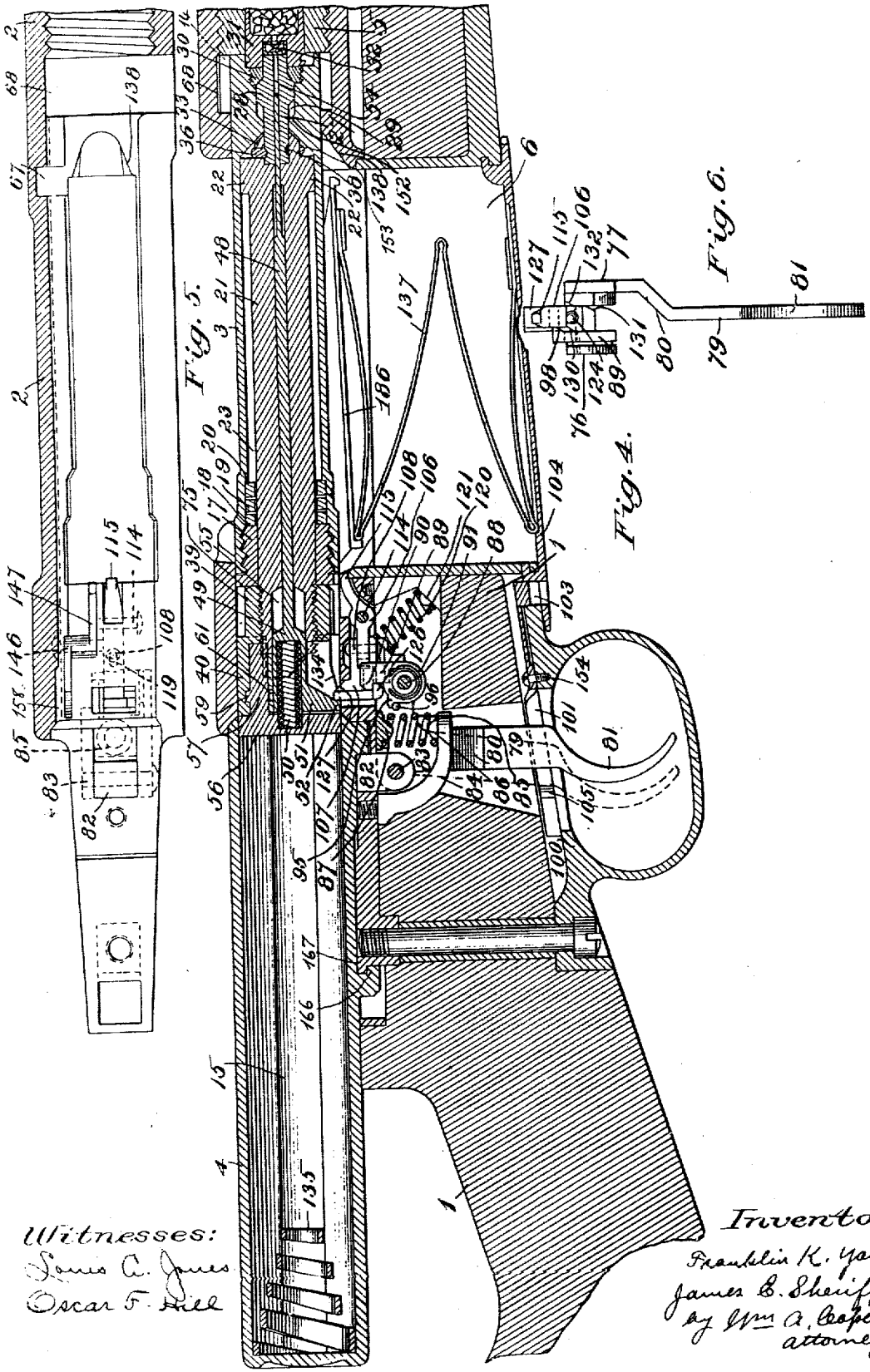


Fig. 5.

Fig. 6.

Fig. 4.

Witnesses:
James A. James
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney.

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12 SHEETS—SHEET 3.

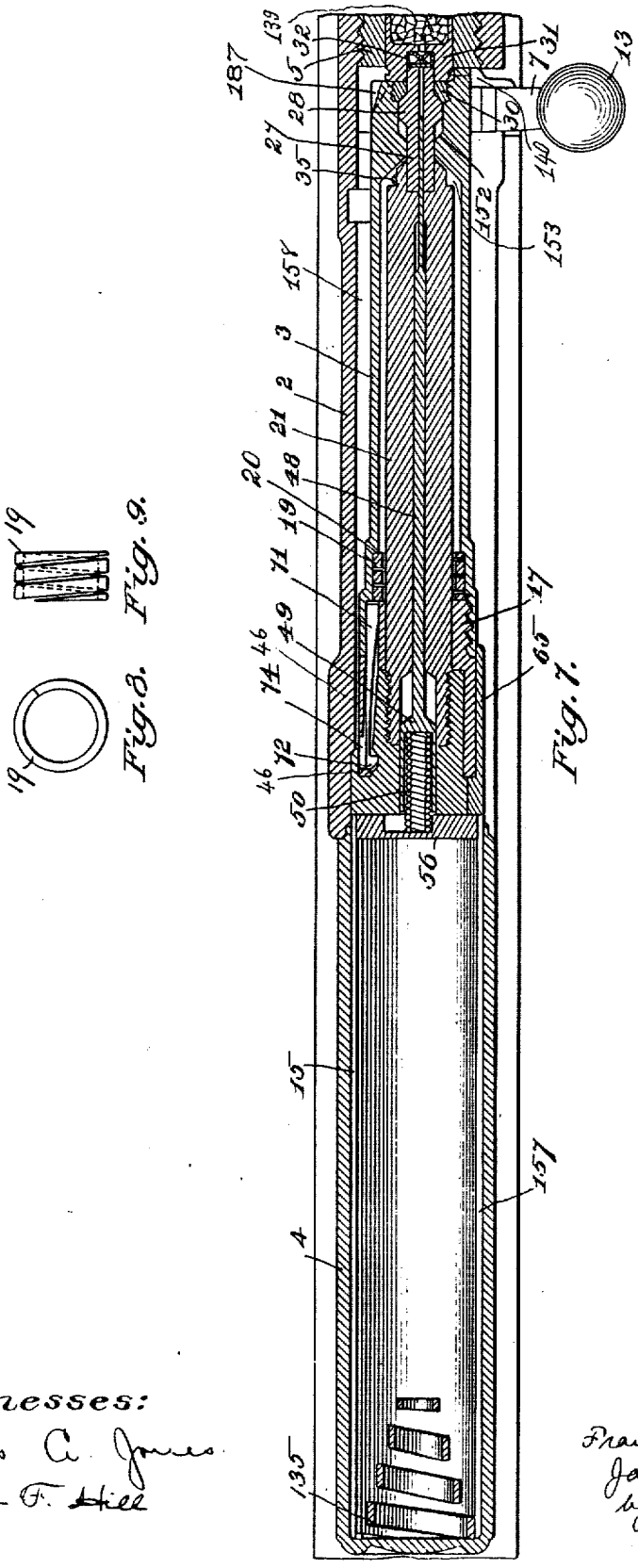


Fig. 7.

Fig. 8.

Fig. 9.

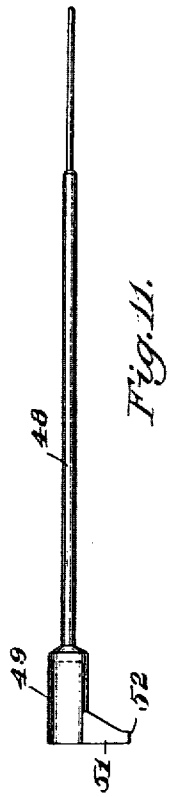


Fig. 11.

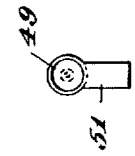


Fig. 10.

Witnesses:
Louis A. Jones
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney.

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12 SHEETS—SHEET 4.

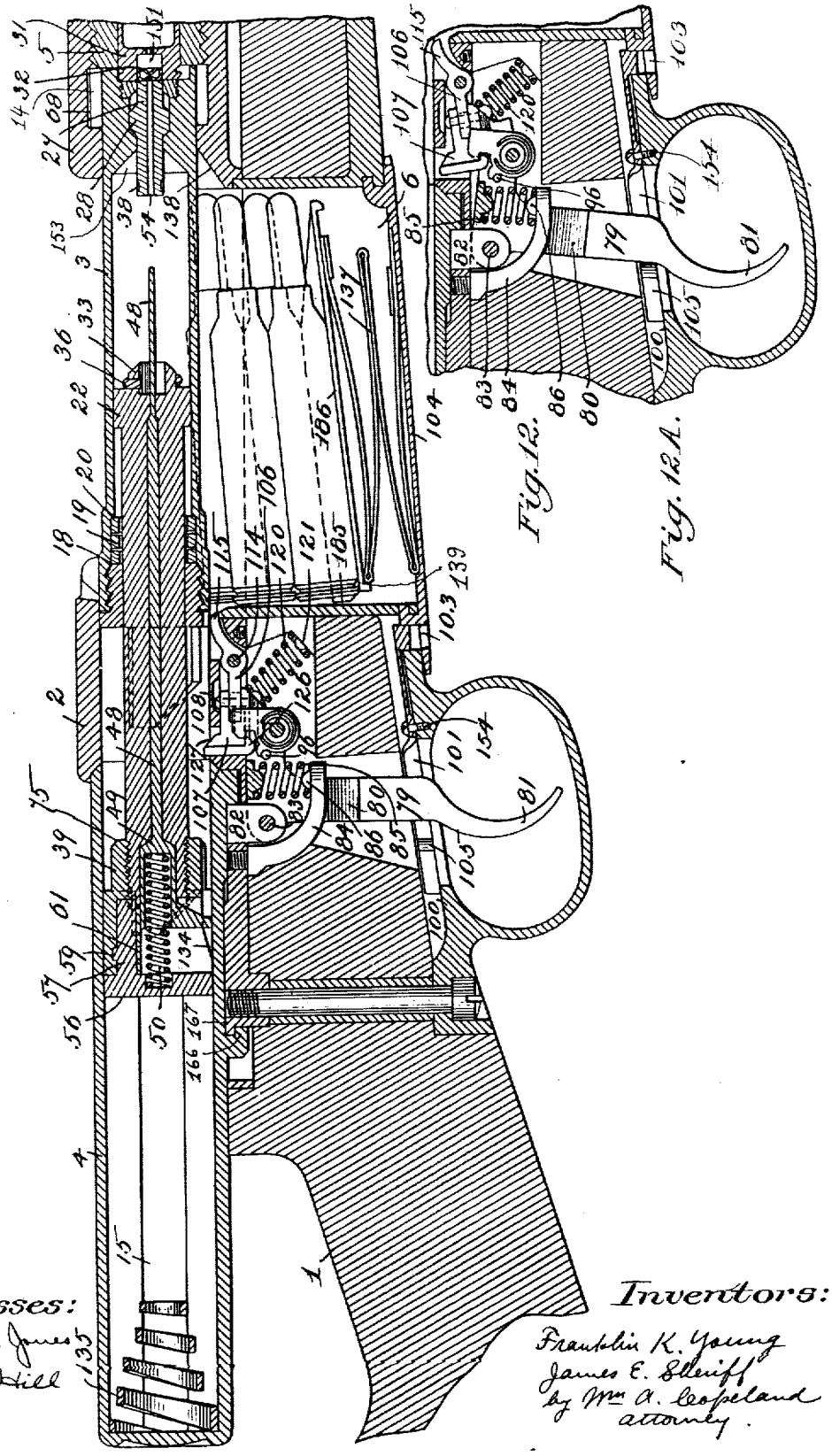


Fig. 12.

Fig. 12A.

Witnesses:
Louis A. Jones
Oscar F. Hill

Inventors:
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James E. Sheriff
by Wm A. Copeland
attorney.

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12 SHEETS—SHEET 5.

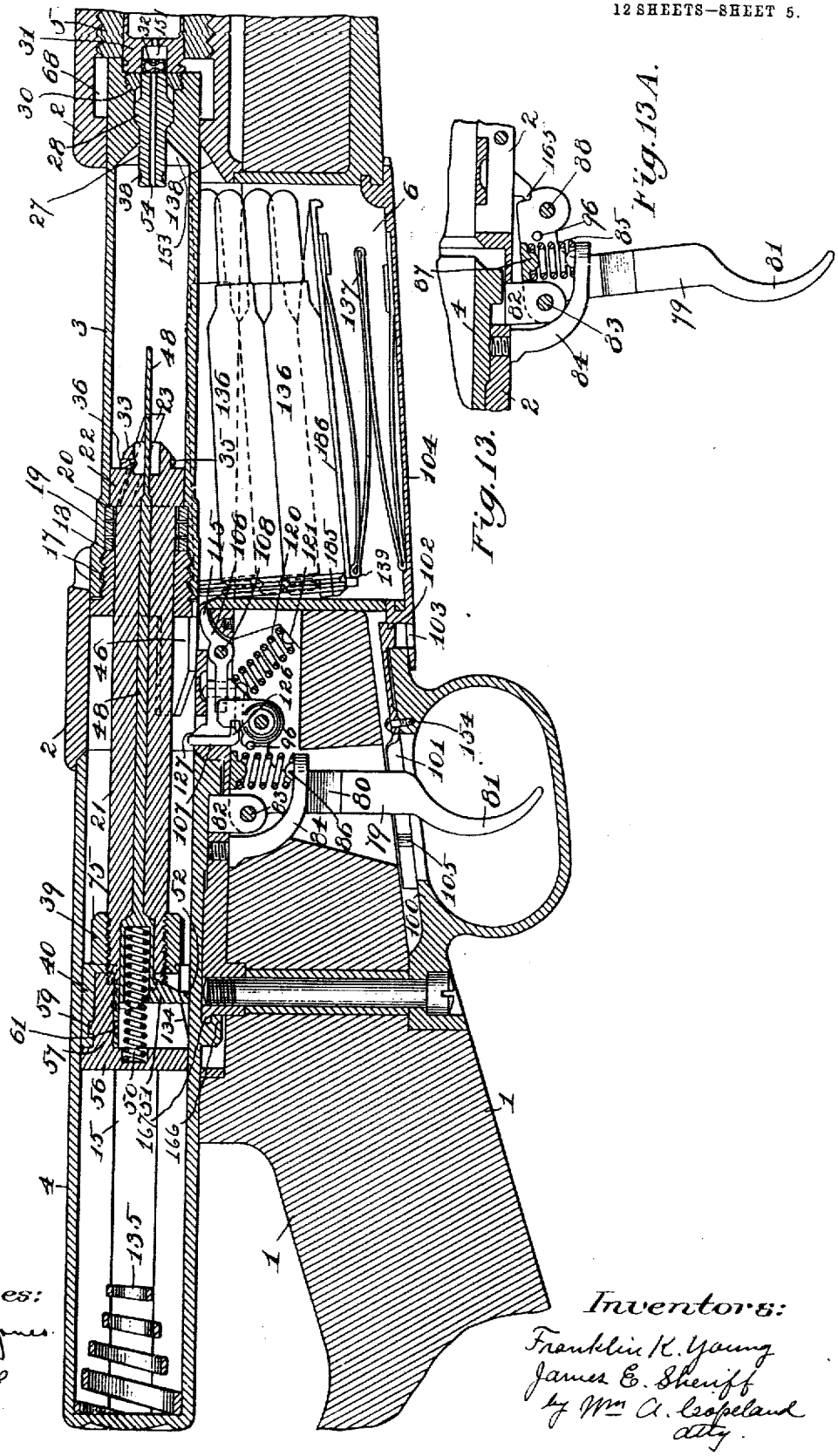


Fig. 13.

Fig. 13A.

Witnesses:
Louis A. James
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
atty

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12 SHEETS—SHEET 6.

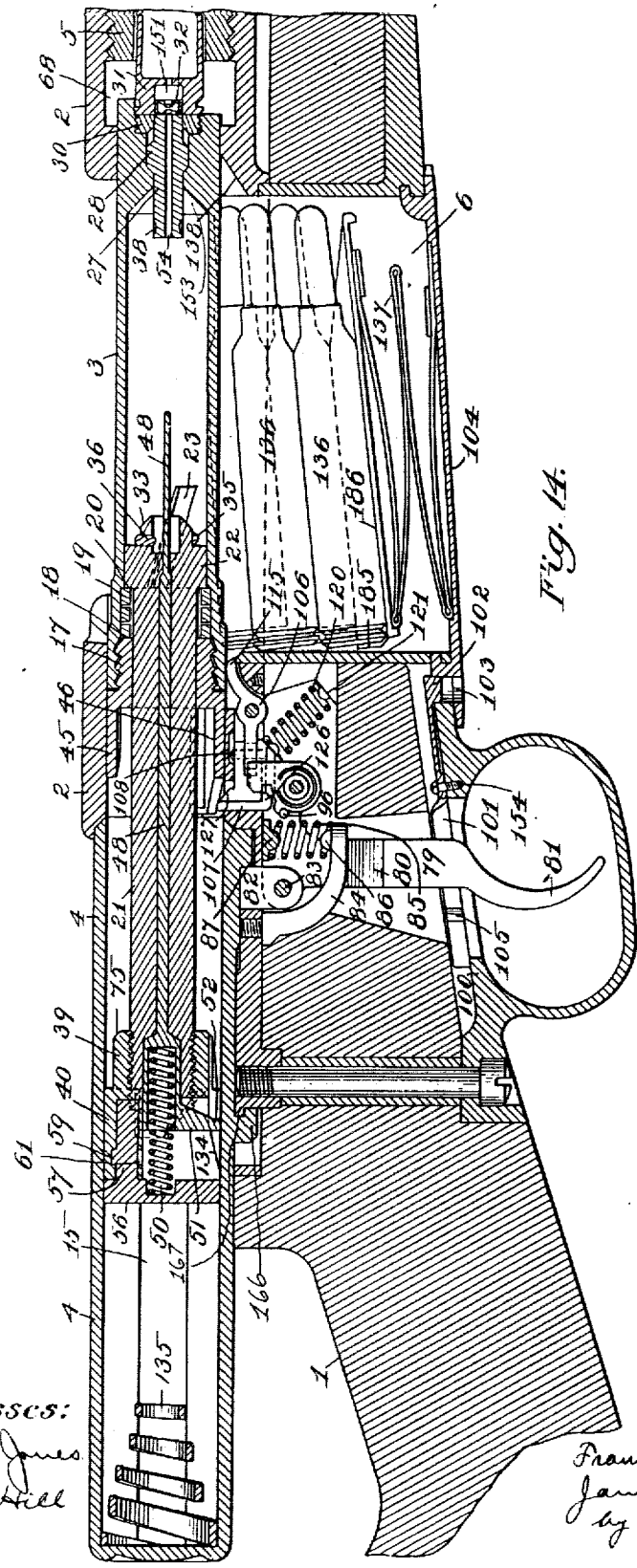


Fig. 14.

Witnesses:
Louis A. James
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney.

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FIREARM.

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12 SHEETS—SHEET 7.

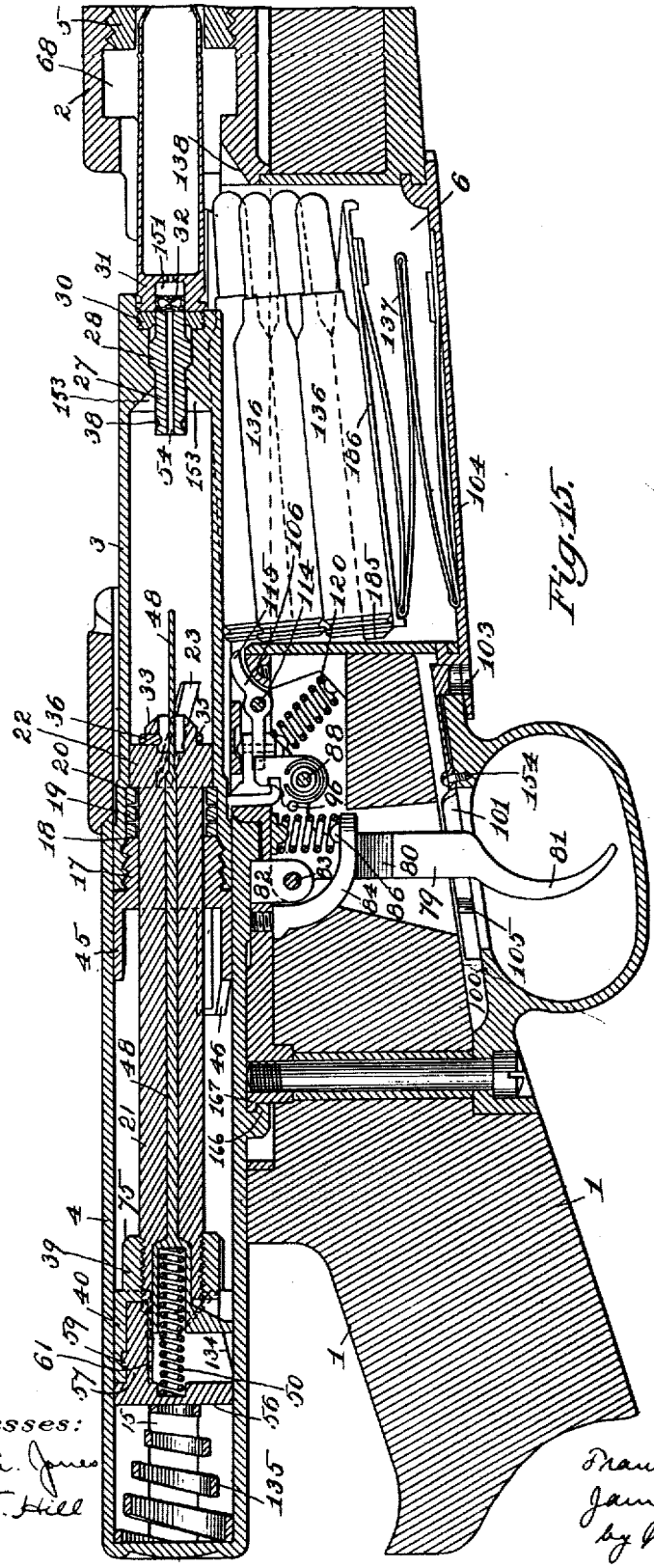


Fig. 15.

Witnesses:
Louis A. Jones
Oscar F. Hill

Inventors:
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James E. Sheriff
by Wm A. Copeland
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12 SHEETS—SHEET 8.

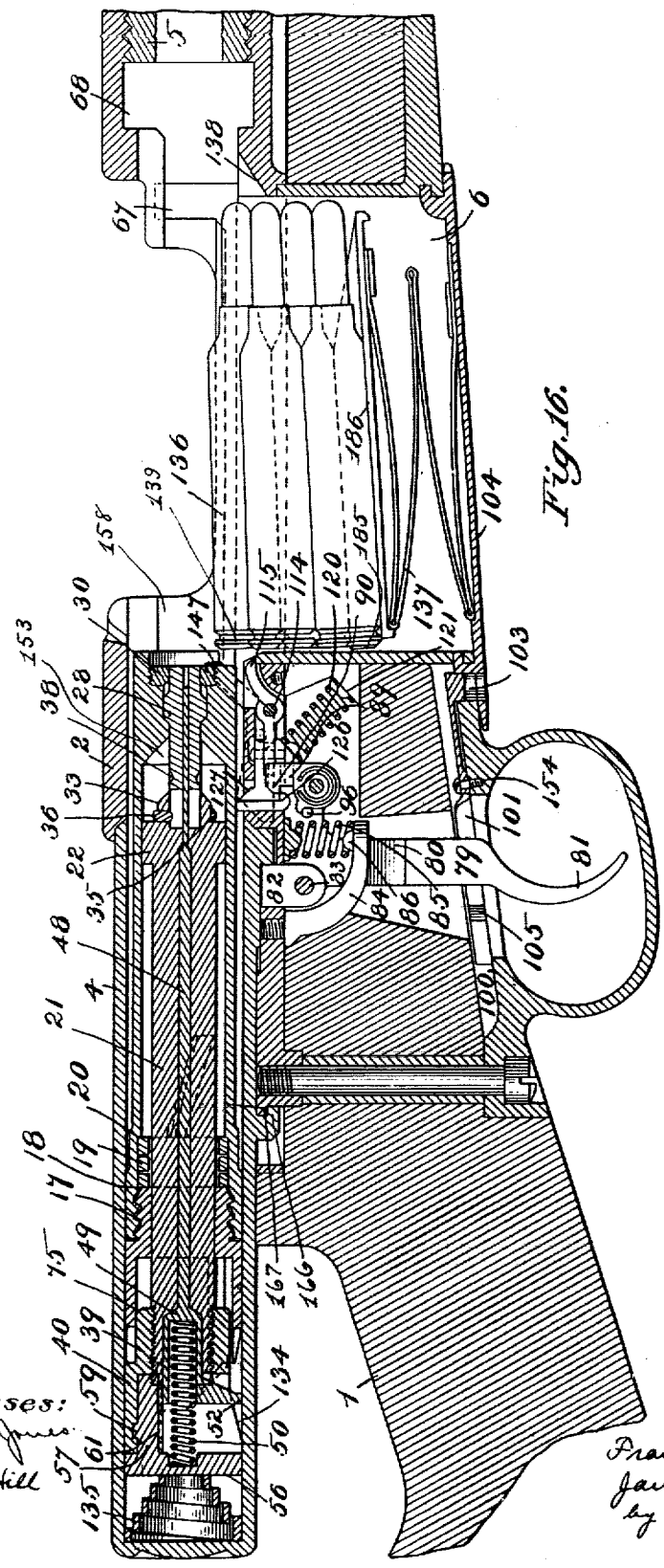


Fig. 16.

Witnesses:
Louis A. Jones
Oscar F. Hill

Inventors:
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by Wm A. Copeland
attorney

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FIREARM.

APPLICATION FILED MAR. 28, 1903.

12 SHEETS—SHEET 9.

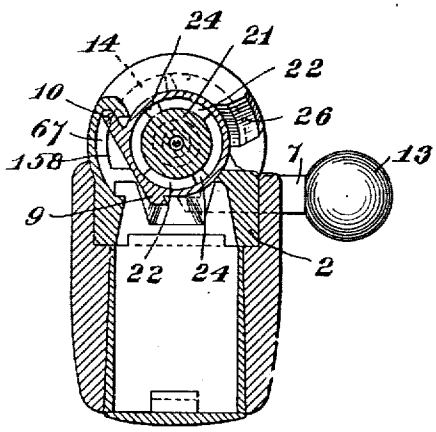


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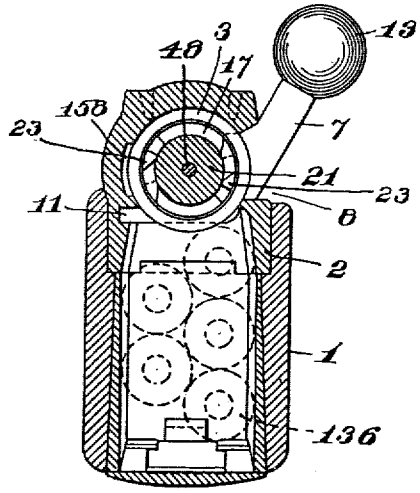


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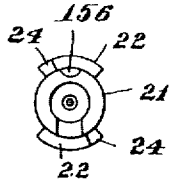


Fig. 19

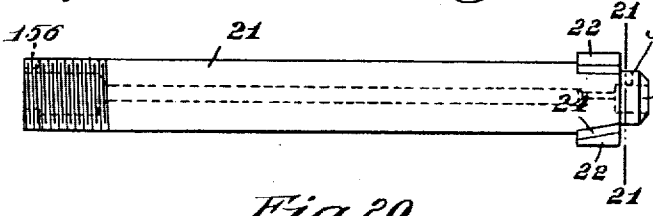


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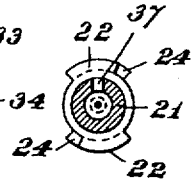


Fig. 21.

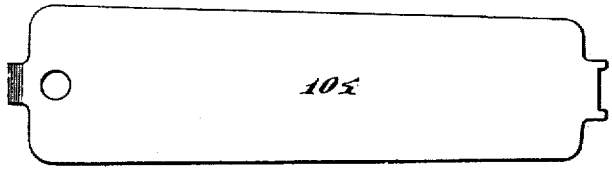


Fig. 23.



Fig. 22.

Witnesses:
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Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney.

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FIREARM.

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12 SHEETS—SHEET 10.

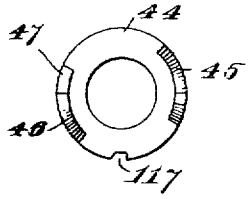


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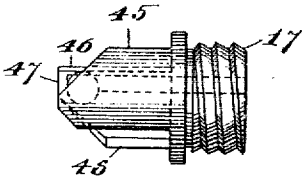


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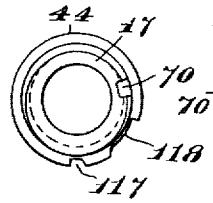


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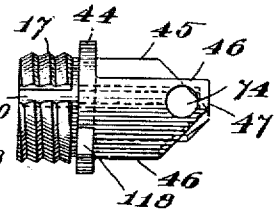


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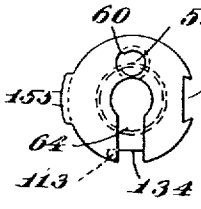


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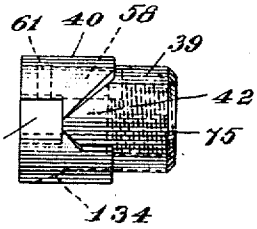


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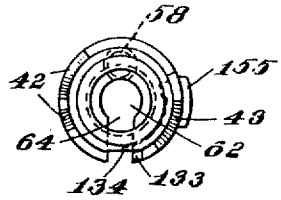


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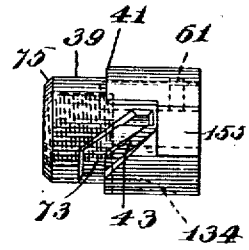


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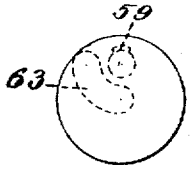


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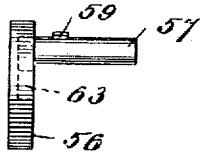


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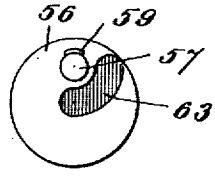


Fig. 34.



Fig. 35.

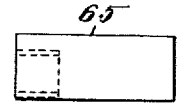


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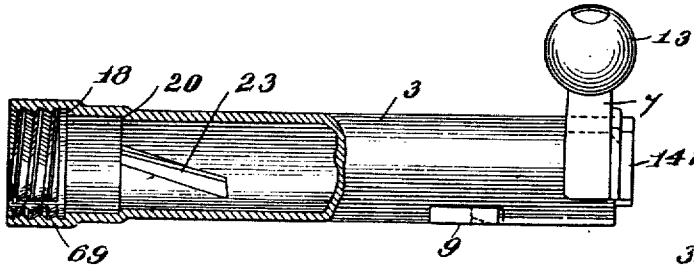


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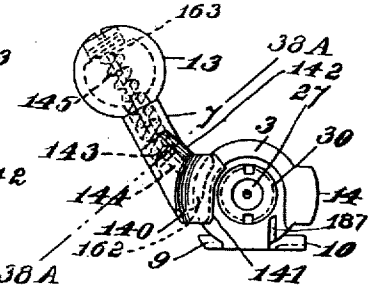


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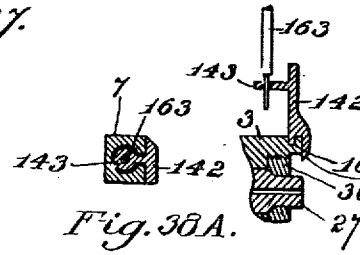


Fig. 38A.

Fig. 38B.

Witnesses:
Louis A. Jones.
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm. A. Leefeland
attorney.

No. 783,770. PATENTED FEB. 28, 1905.

F. K. YOUNG & J. E. SHERIFF.

FIREARM.

APPLICATION FILED MAR. 28, 1903.

12 SHEETS—SHEET 11.

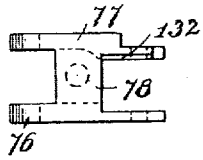


Fig. 39.

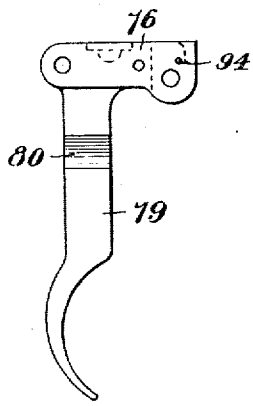


Fig. 40.

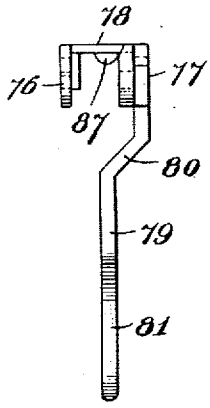


Fig. 41.

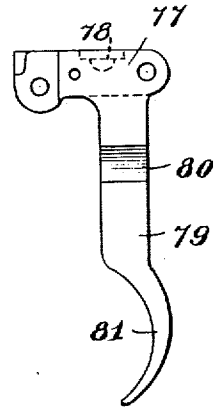


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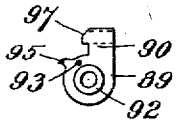


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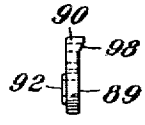


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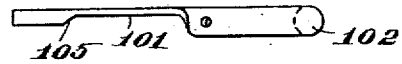


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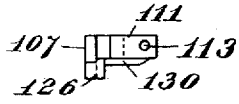


Fig. 47.



Fig. 46.

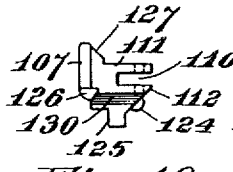


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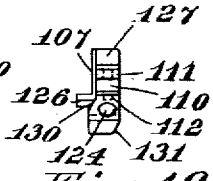


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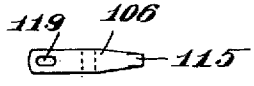


Fig. 50.



Fig. 51.

Witnesses:
Louis A. Jones
Oscar F. Hill

Inventors:
Franklin K. Young
James E. Sheriff
by Wm A. Copeland
attorney.

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12 SHEETS—SHEET 12.

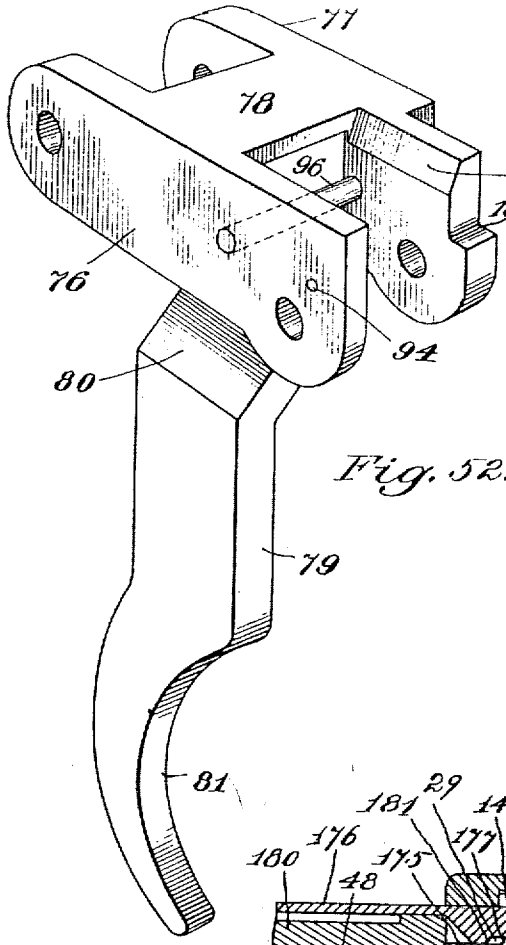


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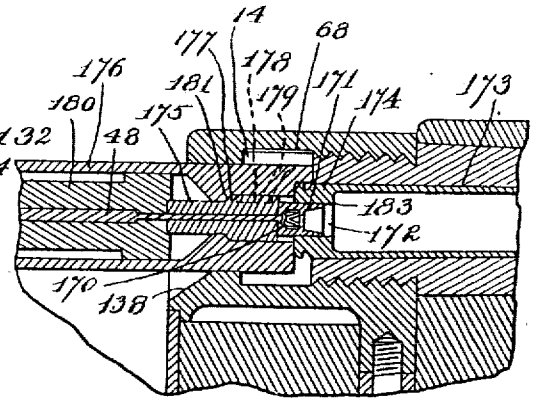


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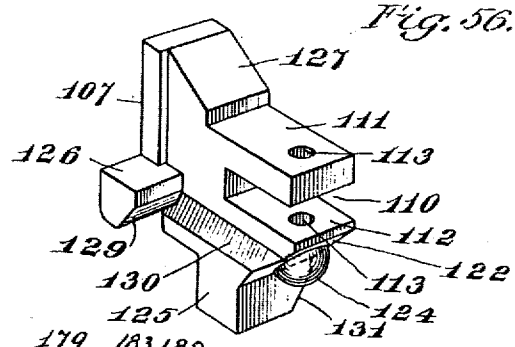


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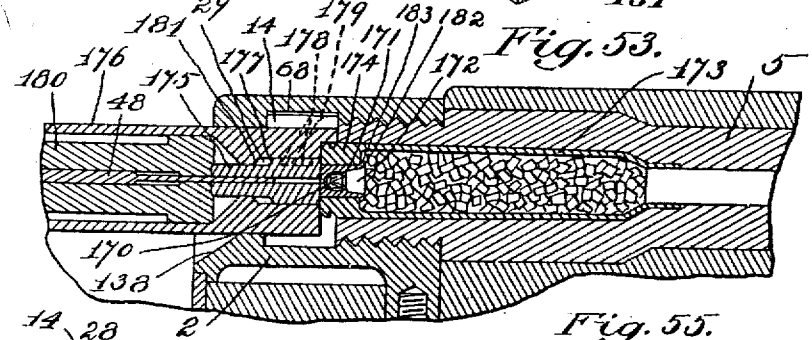


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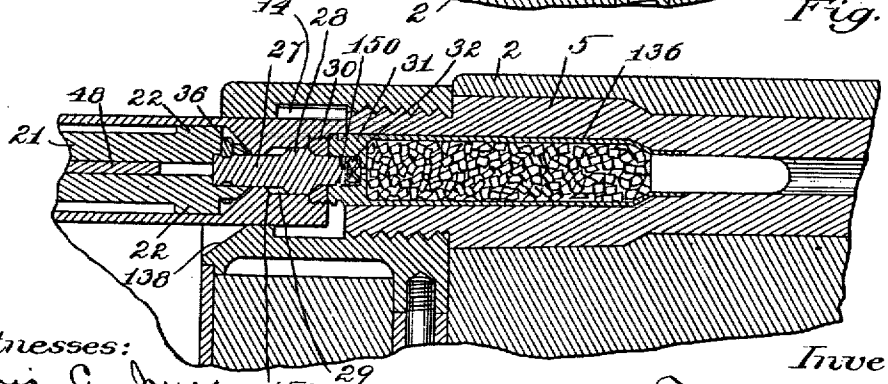


Fig. 54.

Witnesses:
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Oscar F. Hill

Inventors:
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by Wm. A. Copeland
atty

No. 783,770. Patented February 28, 1905.

UNITED STATES PATENT OFFICE.

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FIREARM.

SPECIFICATION forming part of Letters Patent No. 783,770, dated February 28, 1905.

Application filed March 28, 1903. Serial No. 149,946.

To all whom it may concern:

Be it known that we, FRANKLIN K. YOUNG, residing at Boston, county of Suffolk, State of Massachusetts, and JAMES E. SHERIFF, residing at Brooklyn, New York city, in the county of Kings and State of New York, citizens of the United States, have invented certain new and useful Improvements in Firearms, of which the following is a specification.

One object of the invention is to provide mechanism by which the gun may be made to work either semi-automatically or automatically, as desired—that is, so that by pulling the trigger back a certain distance one cartridge will be fired, another thrown into the chamber and made ready for firing again; but the trigger will have to be released and again pulled before the second cartridge can be fired, and by pulling the trigger back a certain farther distance and holding it back all the cartridges in the magazine will be fired in rapid succession without further manipulation or movement of the trigger.

Another object of the invention is to provide mechanism by which after the explosion the rearward movement of a sliding member or secondary bolt which carries the firing-pin unlocks the bolt. For convenience of description the secondary bolt is termed the "weight" and will be hereinafter so called. The weight travels a certain distance before it unlocks the bolt in order to give time for the projectile to move some distance before the bolt becomes unlocked.

Another feature of the invention relates to the mechanism for locking the bolt after each forward movement of the bolt between firings.

Another feature of the invention relates to the mechanism for actuating the weight.

Another feature of the invention relates to the construction of the sear.

Another feature relates to the construction of the trigger and its connections with the sear.

Another feature is the mechanism for untelescoping and retelescoping the weight and bolt.

Other features of the invention will be hereinafter set forth.

The bolt has a partially rotary as well as a sliding movement, there being a rotary or turning movement in one direction to unlock the bolt after a discharge before it can move rearwardly and a turning movement in the reverse direction to again lock the bolt at the end of it forward movement. In its rearward movement it telescopes into the bolt-case. The bolt is locked by means of lateral projections which engage with notches in the side of the frame. The weight has a sliding, but not a rotary, movement. It has a sliding movement within the bolt independent of the bolt, as well as a sliding movement with the bolt. It has an initial rearward movement before the bolt moves. During its rearward movement it engages with spiral projections on the interior of the bolt to rotate the bolt and partially unlock it, the completion of the rotary movement and of the unlocking being produced by engagement of the bolt with a cam-face on the frame. After the bolt is unlocked it moves rearwardly, and the weight also continues to move rearwardly. The rearward movement compresses the air in the air-cylinder, which after compression throws the bolt, weight, and firing-pin forward. A spring in the air-cylinder aids in driving the bolt forward. On the forward movement the bolt is turned in part by the reverse engagement of the lever on the bolt with the cam-face on the frame, and the completion of the turning is caused by engagement of a cam attachment on the bolt with a cam attachment on the weight. The firing-pin has a sliding but not a rotary movement. It has a sliding movement within the weight independent of the weight, as well, as a sliding movement with the weight. The forward end of the weight is engaged by a plunger which has a limited movement in the head of the bolt. The plunger is actuated rearwardly by the rearward movement of a piston in the head of the cartridge when a cartridge is fired. The rearward movement of the plunger is suddenly

checked by a stop on the bolt, and the impulse given to the weight causes the weight to continue its rearward movement. The sear has a compound movement, being composed of two members secured together by a vertical pivot, and one of the members is mounted on a horizontal pivot in such manner that the entire sear has a vertically-rocking movement on the horizontal pivot and the rearward member has a laterally-turning movement on the vertical pivot. The rocking movement causes the sear to release the firing-pin when the trigger is pulled. The horizontal movement on the vertical pivot is given to it by the peculiar form of the trigger when the trigger is pulled back into the automatic or full-back position, thereby throwing the sear into position where it will still engage the firing-pin on its forward rebound and compress the firing-pin spring; but it is in position where it engages an inclined surface on a fixed part of the weight in such manner as to depress the sear, so that as soon as the firing-pin spring is compressed to operative tension the sear will be released from engagement with the firing-pin and allow the firing-pin to be driven forward without again pulling the trigger.

The invention will now be fully described by reference to the accompanying drawings, and the several novel features will be particularly pointed out in the claims at the close of the specification.

Figure 1 is a side elevation of the breech portion of a gun embodying the invention. Fig. 2 is a detail side elevation of the frame, showing the ejector in position to eject an empty shell. Fig. 3 is a rear end elevation of Fig. 2. Fig. 4 is a central longitudinal section with the parts in their normal position ready for firing and showing one cartridge in the chamber and the magazine empty, the position of the trigger when pulled into the semi-automatic position being shown in dotted lines. Fig. 5 is a plan section of the frame, showing the trigger mechanism and ejector in position. Fig. 6 is a front elevation of a portion of the trigger mechanism, tumbler, and sear assembled, showing the cam-faces thereon. Fig. 7 is a horizontal section on line 7 7 of Fig. 1. Fig. 8 is a rear elevation, and Fig. 9 is a side elevation, of a spring which forms a cushion for the weight. Fig. 10 is a rear elevation, and Fig. 11 is a side elevation, of the firing-pin. Fig. 12 is a section similar to Fig. 4 with the parts in the position after the trigger has been pulled and cartridge exploded and the weight partially thrown back and the lugs about to engage the spiral projections on the interior of the bolt. In this section and in the following similar section there are shown four cartridges in the magazine. Fig. 12^a is a detail section showing the trigger pulled part way back into the semi-automatic position. Fig. 13 is a section similar to Fig. 12 after the lugs have traversed the spirals and have cushioned against the spring, the bolt being turned the amount of the spiral projections. Fig. 13^a is a detail section showing the trigger engaged with the pivot 165 on the frame and pushed forward to disengage the trigger and the block to which it is pivoted and the air-cylinder partly withdrawn. Fig. 14 is a section similar to Fig. 13 after the bolt-handle has traversed the cam on the frame and the bolt is entirely unlocked. Fig. 15 is a section similar to Fig. 14 just as the rear end of the weight has struck the spiral compression-spring at the rear end of the casing. Fig. 16 is a section similar to Fig 15, the weight having completed its rearward movement, compressing the spring behind it, and the bolt telescoped onto the weight, the empty shell having been thrown out by its rear end striking the ejector. Fig. 17 is a section on line 17 17 of Fig. 1. Fig. 18 is a section on line 18 18 of Fig. 1 after the bolt has been entirely unlocked, as in Fig. 14, and showing in dotted lines the full complement of cartridges in the magazine. Fig. 19 is a rear elevation, and Fig. 20 is a side elevation, of the weight. Fig. 21 is a section on line 21 21 of Fig. 20. Fig. 22 is a detail front elevation of the spring which partially encircles the front end of the weight. Fig. 23 is an underneath plan of the magazine cover-plate and showing its adaptation for use as a screw-driver and as a spanner in assembling the parts. Figs. 24, 25, 26, and 27 are details of a screw-threaded bushing in the rear end of the bolt, Fig. 24 being a rear end elevation, Fig. 25 being a right-hand side elevation, Fig. 26 being a front end elevation, and Fig. 27 being a left-hand side elevation, the expressions "right" hand and "left" hand meaning when the gun is in position for firing. Figs. 28, 29, 30, and 31 are details of a screw-threaded collar which encircles the rear end of the weight, Fig. 28 being a rear end elevation, Fig. 29 a right-hand side elevation, Fig. 30 a front end elevation, and Fig. 31 a left-hand side elevation. Figs. 32, 33, and 34 are details of the disk which covers the rear end of the collar on the weight and of the key formed thereon which locks the collar and weight together. Figs. 35 and 36 are details of a dust-plate which is fast to the collar shown in Fig. 28 and which is held in position by the disk shown in Fig. 32. Fig. 37 is a right-hand side elevation of the bolt, partly in section and with the extractor in place on the front end thereof. Fig. 38 is a front elevation of Fig. 37. Fig. 38^a is a cross-section on line 38^a 38^a of Fig. 38. Fig. 38^b is a detail longitudinal section through the extractor, showing its engagement with the bolt and showing the stop-pin which limits its movement. Figs. 39, 40, 41, and 42 are details of the trigger, Fig. 39 being a plan, Fig. 40 a right-hand side elevation, Fig. 41 a front elevation, and Fig. 42 a left-

hand side elevation. Figs. 43 and 44 are a right-hand elevation and a front elevation of a hook or pawl which is pivoted on the trigger. Figs. 45 and 46 are a plan and right-hand side elevation of a spring having on it a cam which the trigger encounters and which also locks the magazine-cover in place. Figs. 47, 48, and 49 are detail views of the rear member of the compound sear. Figs. 50 and 51 are details of the front member of the compound sear, the rear member being pivoted to and having a sliding movement on the front member when they are assembled. Fig. 52 is a perspective view of the trigger enlarged. Fig. 53 is a perspective view of the rear member of the sear enlarged. Fig. 54 is a modification of the front part of the bolt and the parts therein. Figs. 55 and 56 are views showing another form of plunger, cartridge, bolt, and weight and are the preferred forms, Fig. 55 showing the parts in the position before firing, and Fig. 56 showing them just after the explosion, with the plunger driven back and just as the weight is about to separate from the plunger.

Referring now to the drawings, 1 is the breech portion of the gun-stock, and 2 is the receiver, which will be hereinafter called the "frame," which supports and guides the bolt 3 and which supports the air-cylinder 4. The barrel 5 is screwed into the forward end of the frame 2, and within the stock, on the under side of the frame, is secured the magazine 6. In the rear part of the air-cylinder 4 there may be a spring 135, which aids in driving the weight and bolt forward.

Projecting laterally from the bolt 3, at the forward end thereof, is a lever 7, which serves both as a means to turn the bolt and to lock the bolt when it engages with the notch 8 in the frame 2. (See Figs. 1, 2, 17, 18, 37, and 38.) Projecting laterally near the forward end of the bolt, from both sides of that portion of the bolt which is at the bottom when the bolt is unlocked, are lugs or short flanges 9 10, (see Figs. 17 and 38,) which when the bolt is in the unlocked position are in alinement with longitudinal grooves 11 11 in the inner sides of the frame. (See Figs. 1 and 3.) Said grooves form guideways for the flanges 9 10 when the bolt moves back and forward and prevent turning of the bolt except when the lever 7 is opposite the notch 8. Formed in the inside of the frame is a recess 67 for the flange 10 to permit turning of the bolt in locking and unlocking. (See Fig. 17.) The frame 2 has a longitudinal slot 12 through one side, through which the lever 7 extends to permit reciprocation of the bolt. For convenience of operating the lever 7 by hand it is preferably provided with a handle 13.

Projecting from the side of the bolt, near the forward end thereof, on the opposite side from the lever 7, is a lug 14, which when the bolt slides backward and forward moves in a guide-groove 158 in the side of the frame, which is in alinement with groove 15 in the air-cylinder. (See Figs. 3, 4, 5, 7, 16, 17, 18, and 38.) Formed in the side of the frame is a recess 68 to receive the lug 14 when the bolt is locked and to permit the bolt to be turned to lock and unlock it. To completely unlock the bolt, the lever 7 has to be turned up out of the notch 8 and through the inclined way 16. (See Fig. 2.) In the rear end of the bolt there is formed a female screw-thread, into which is screwed a bushing 17, the inner end of said bushing butting against a spring 19. (See Figs. 24 to 27 and Fig. 37.) The wall of the bushing is sufficiently thick so that the internal diameter of the bushing is less than the diameter of the bolt, and its end forms a butt for the spring 19. The interior diameter of the bushing affords a close sliding fit for the weight 21. There is sufficient looseness or clearance between the male and female threads to allow a slight longitudinal movement of the bushing and bolt relative to each other. The purpose of this longitudinal movement is to cushion the blow of the bolt against the weight, through the medium of the bushing, at the end of the rearward movement of the bolt. Inside of the bolt there is a stiff spring 19, the outer end of which butts up against the inner end of the bushing 17 and the inner end of which butts against a shoulder 20 on the bolt, said shoulder being formed by reducing the internal diameter of the bolt. The weight 21 is slidable within the bolt and is formed with two lugs 22 projecting laterally near its forward end.

Projecting inwardly from the interior of the bolt, on opposite sides thereof, and extending forwardly from the shoulder 20 are two spiral cams 23, with which the lugs 22 on the weight engage when the weight moves rearward, the face 24 of each lug which engages with the spiral being inclined in such manner that the continued movement of the weight causes the bolt to turn on its axis, the weight being prevented from rotation, as will be hereinafter described. This turning is sufficient to lift the lever 7 up out of the notch as far as the inclined faces thereof. The backward pressure after the explosion will cause the lever 7 after reaching the short incline or beveled corner 25 at the left side of the entrance to the notch as viewed in Fig. 2 to ride on said beveled edge entirely out of the notch, at which time the flanges 9 10 on the bolt will be in alinement with the grooves 11 in the frame, and the bolt will then be in position to slide straight rearward. The inclined face 26 on the upper right-hand side of the notch 8 engages the lever 7 in the forward movement to start the lever down into the notch 8. The reason for giving to the bolt a slight rearward movement longitudinally before it entirely turns out of the notch and for giving it a slight turning on the forward

movement before it enters the square part of the notch will be hereinafter explained.

In the form shown in Figs. 1 to 54 the forward end of the weight 21 has a nose 33, which enters a recess 153 in the head of the bolt.

There is a passage entirely through the head of the bolt, within which is a plunger 27, said plunger being formed with an intermediate boss 28, the said passage being enlarged to form a chamber 29 for said boss 28. Said chamber is long enough to allow a certain amount of reciprocation to the plunger. A bushing 30 is screwed into the forward end of the bolt after the plunger is inserted to secure the plunger. The plunger when in its forward position, as shown in Fig. 4, projects beyond the end of the bushing 30 into the cylindrical recess in the head 31 of the cartridge and rests against the primer 32. The invention is not limited to the use of a cartridge of the particular form shown. In the form shown between Figs. 4 and 54 in the drawings the head 31 is formed with a recess 151 to receive the primer 32 and of sufficient depth for the plunger 27 to enter said recess. The rear end of the plunger is seated in a slot 34 in the nose of the weight 21. The plunger may be detachably secured to the nose 33 of the weight, as by means of a C-shaped spring 35, (see Fig. 22,) which partially encircles the nose 33 and has a lug 36, which passes through a hole 37 in the nose (see Fig. 21) and enters a slot or an annular groove 38 in the plunger. A groove is preferable to a slot in the plunger, so that it will fit if the plunger is slightly turned on its axis. The weight extends rearwardly through the bolt and through the spring 19 and bushing 17. Its rear end is provided with a tubular extension piece or collar 39, which is screwed onto it or otherwise made fast to it, thus making it a part of the weight. The rear portion 40 of this collar is made of greater external diameter than the threaded portion, which screws onto the weight and forms a shoulder 41. (See Figs. 29 and 31.) Formed on the side of the extension 40 is a boss 155, Fig. 28, which slides in a guide-groove 15 in the side of the air-cylinder 4 and prevents the weight from turning on its axis. (See Fig. 4.) Formed in the outside of this thickened rear portion 40 and extending rearward from the said shoulder 41 are cam-slots 42 43 opposite to each other, both having inclined sides. (See Figs 29 to 31.)

Formed on the bushing 17 back of the threaded portion is an annular flange 44, and extending rearwardly therefrom are two segmental cam-fingers 45 46, diametrically opposite each other, one of which, 45, has two inclined faces of unequal length and a squared end which corresponds with the inclined faces and the end of the slot 42 in the collar 39, and the other finger, 46, has a squared end 47 and one inclined face corresponding with the slot 43 in the said collar, so that when the said fingers are brought into alinement with said slots and they are brought together the fingers will fit into the said slots. When they are turned with relation to each other, so that the squared ends of the said fingers butt against the shoulder 41 on the collar, the fingers cannot enter the said slots and the telescoping action cannot be completed.

The firing-pin 48 is formed with an enlarged rear portion 49, which is bored to receive the spring 50, which actuates the firing-pin to discharge the cartridge. The engagement of said enlarged portion 49 with the forward end of the chamber 55 limits the forward movement of the firing-pin relatively to the weight. Projecting downward from the said enlarged butt or rear end 49 at right angles thereto is a lug 51, which is engaged by the sear, as will be hereinafter described. (See Figs. 10 and 11.) This lug 51 is formed with the lower part 52 of its front face at right angles with the firing-pin to prevent the sear from becoming disengaged until the trigger is pulled. The firing-pin passes lengthwise through a central hole in the weight and is central with the plunger 27. Preferably the forward part of the firing-pin is reduced in diameter and passes through a central hole 54 in the plunger to engage the primer of the cartridge. The hole in the rear part of the weight is enlarged to form a chamber 55 large enough to receive the butt-end 49 of the firing-pin. Also the collar 39 has a hole 62 through it to receive the butt-end of the firing-pin and a slot 64 through the side of the said collar for passage of the lug 51 on the firing-pin. (See Figs. 28 to 30.)

The rear end of the collar 39 is covered by a disk 56, having a pin 57, which projects at right angles to the face of the disk and is eccentric thereto. It enters a hole 58 in the side wall of said collar 39 and passes through into a recess 156 in the threaded end of the weight 21. (See Figs. 4 and 19.) The said pin is keyed in the slot in the following manner: Projecting from the upper side of the pin 57 is a lug 59. The hole 58 is formed with a longitudinal groove 60 on the left-hand side looking to the front. (See Fig. 28.) This groove extends in far enough to allow the pin 57 to be pushed in its full length. Extending at right angles to the groove 60 is an annular groove 61, so that by turning the disk after the pin has been pushed in its full length the lug 59 will enter the annular groove 61, and thus prevent the withdrawal of the pin. The groove 60 is formed in the left side of the hole 58, so that to insert the pin it has to be started with the lug in alinement with said groove 60, and when the disk is turned to bring the lug into the annular groove 61 it will then come down into its correct position, with the lug 59 on the upper side.

The rear end of the firing-pin spring 50 is seated in a socket 63 in the front face of the

disk 56. In order to allow for the turning of the disk to bring the lug into the annular groove 61, the socket 63 is made curved, as shown in Figs. 32 and 34.

A dust-plate 65 (see Figs. 35 and 36) is dovetailed in the slot 66 in the side of the collar 39 (see Figs. 28 and 29) and extends alongside of said collar to form a cover to protect the slotted camway 42. Said dust-plate projects slightly from the side of the collar and moves in a groove 157 in the side of the air-cylinder 4 and aids in preventing rotary movement of the weight. (See Fig. 7.) Groove 157 in the air-cylinder is in alinement with groove 12 in the frame.

In order to prevent the bushing 17 from working off or turning on the bolt, it is keyed to the bolt in the following manner, (see Figs. 7, 25, 27, and 37:) Formed in the inside of the threaded end of the bolt is a groove or splineway 69, and formed in the side of the bushing 17 is a similar groove or splineway 70, said groove being on the outside of the threaded end of said bushing, thence extending through a hole in the flange 44, and thence in the form of a groove on the inside of the finger 46. Inserted into said keyway is a key 71, consisting of a plate-spring formed with a hook 72 at the rear end, which when the weight and bolt are telescoped together, as in Fig. 7, engages in the grooved camway 73 in the collar 39 on the same side as the slot 43. A portion of said camway 73 extends diagonally crosswise of the bottom of said slot 43 (see Fig. 31) and suddenly deepens at its rear end to receive the hook 22, and thus prevent the camway from retraversing the hook, which might otherwise be occasioned by the compression of the firing-pin spring. The hole 74 through the finger 46, (see Figs. 7 and 27,) which in Fig. 7 is just over the back of the hook 72, is in part for convenience of inserting a tool or the point of a bullet in assembling or separating the parts, also to form an abutment for the back end of the spring to limit the longitudinal movement of the key 71 relatively to the bushing 17 and finger 46, said finger 46 being a part of bushing 17. The camway 73 has beveled walls, as shown in Figs. 7 and 31, so that when there is force exerted in a direction to move the collar 39 of the weight away from the bushing 17 of the bolt the beveled edge will permit the hook to draw out of the camway; but the spring-latch key 71 will serve to hold them together, except when considerable force is applied to separate them, as will be the case during a certain part of the operation. The entrance to the camway 73 is circumferential, as shown in Fig. 31. When in the operation of the gun the weight and bolt after having been separated are brought together again, such movement will occur when they are turned in the position that they occupy when the bolt is unlocked, and the hook of the key will first engage the beveled edge 75 on the end of the collar 39, as shown in Fig. 31, at a point near the under side as the said collar is shown in said Fig. 31. Said beveled edge will allow the hook to ride up onto the side of the collar until it comes opposite the entrance to said camway 73. This will be the position it will occupy until in the forward movement of the bolt the lever 7 reaches the diagonal portion of the notch 8. When the lever 7 moves down through the diagonal portion of the notch, it will turn the bolt enough for the hook 72 to pass through the circumferential portion of the camway 73, and when the bolt turns still farther, carrying the lever 7 down into the bottom of the notch 8, the hook 72 will travel through the diagonal portion of the camway 73. When the weight is forced rearward from the bolt, the beveled edge of the camway 73 throws up the hooked end of the spring out of the camgroove 73 and throws the back of the hook higher up in the hole 74 and allows the weight free motion straight rearward. During this operation the hook has a tendency to revolve the bolt by reason of the camway; but there is much more resistance to the bolt being turned, owing to the backward pressure of the explosion on the forward end of it, than there is power to turn it, due to the stiffness of the spring-key 71 and the angle of the camway 73.

For detail views of the trigger see Figs. 39, 40, 41, 42, and 52. The head of the trigger comprises two cheek-pieces 76 77, united by a cross-piece 78. The finger-piece 79 extends downwardly from the cheek-piece 77 (that being the left-hand cheek-piece looking toward the barrel of the gun) and is formed with an offset 80, thus bringing the finger-hook 81 in a line central with the two cheek-pieces and in proper position for conveniently working the trigger. The trigger is pivoted by a pivot 83 (see Fig. 4) to a block 82, which extends between the rear ends of the cheek-pieces 76 77, said block fitting a rectangular recess in the frame.

Secured to the under side of the frame 2 is a bracket 84, between which and the under side of the cross-piece 78 of the trigger-head is the trigger-spring 85, held in position by a boss 86 on the said bracket and a boss 87 on said cross-piece 78. Secured to the upper side of the trigger-plate 100 by a screw 154 is a twisted spring-plate 101, having at the forward end a lug 102, which enters a hole 103 in the magazine-cover 104 to help retain said cover in position. Toward its rear part it is formed with an inclined shoulder 105, which the trigger engages when it is pulled back to the semi-automatic position and which permits the trigger to be pulled farther back into the automatic position to be more fully described hereinafter. On the forward end of the cheek-piece 77 of the trigger there is formed a shoulder 164, which when the trig-

ger is pushed forward by placing the thumb back of the finger-hook engages a lug 165 on the under side of the frame. (See Fig. 2.) Said lug forms a pivoting-point for the trigger, so that the trigger will be pulled down at the rear end, thus pulling down the block 82 and further compressing the trigger-spring 85. (See Fig. 13[A].) When the said block is pulled down, the air-cylinder 4 can be slid rearward and removed from the frame. It first slides rearwardly far enough for the forward end of the air-cylinder 4 to be clear of the frame. This motion will also disengage the hook 166 on the lower side of the air-cylinder from the notch 167. The air-cylinder can then be lifted straight off. Then the bolt and weight can be removed from the frame straight rearward. When the frame 2 is removed from the stock, the bracket 84 can be swung left-handed, thus partially unscrewing it, causing it to drop the spring 85, and then the trigger and tumbler can be removed from the frame.

Mounted on a pivot 88 between the forward branches of the cheek-pieces 76 77 is a tumbler 89, having a hook 90, which engages the sear, as will be hereinafter described. A spring 91 holds the hook of the tumbler in engagement with the sear, as shown in Fig. 4 and other similar sectional views, said spring being coiled around a hub 92, one end of the spring being engaged in a hole 93 in the face of the tumbler and the other end being secured in a hole 94 in the cheek-piece 76. A hook projection 95 on the tumbler engages a pin 96, which extends between cheek-pieces 76 and 77 and prevents the tumbler from turning rearwardly under pressure of the spring beyond the vertical position shown in Fig. 4 when the sear is moved out of engagement with the hook 90 of the tumbler. The said hook 90 is formed with a beveled upper edge 97, as shown in Fig. 43, the purpose of which will be explained hereinafter. The said hook 90 has also a beveled or inclined face 98 on the inner side, which acts as a cam when it engages and passes over a beveled or cam-face 130 on the sear to throw the sear to one side when the trigger is pulled entirely back into the position for automatic firing, as will be hereinafter explained.

The compound sear is composed of two members 106 and 107, pivoted together by a vertical pivot 108, the rear arm or tongue 109 of the forward member 106 being inserted in the slot 110 between the lips 111 and 112 of the rear member 107 and the pivot 108 passing through the holes 113 in the lips and through the elongated hole 119 in the tongue 109, there being sufficient play between the end of the tongue and the rear of the slot 110 to allow the member 107 to turn in a horizontal direction on said pivot with relation to the forward member 106. The hole 119 in the tongue 109 is elongated, allowing the rear member 107 to be moved slightly rearward with relation to the forward member and to the lug on the firing-pin, as will be hereinafter explained. (See Fig. 5.) The length of the elongated slot 119 limits the forward and rearward movement of said rear member 107. The forward member 106 is mounted on a horizontal pivot 114, having bearings in the frame. As the vertical pivot 108 is not fixed, the entire compound sear may be rocked vertically on the horizontal pivot 114; but only the rear member 107 can turn in the horizontal direction on the vertical pivot. The under side of the frame is slotted to prevent the members of the sear to project upward. The forward arm 115 of the forward member of the sear is inclined upward with relation to the rear arm, so that when the sear as a whole is in a horizontal position, as in Fig. 4, the arm 115 will project upward. There is a notch 117 in the side of the flange 44 of the bushing 17, (see Figs. 4, 24, and 26,) into which the end of said arm 115 may project while the bolt is locked to permit rocking of the sear to carry the rear member down out of engagement with the lug on the firing-pin, as will be hereinafter described. Except for said slot the sear could not be rocked, and therefore the trigger could not be pulled. There is also another notch, 118, in said flange 44 to receive the end of said arm 115 and permit the sear to be rocked when the bolt is turned into its unlocked position, at which time the notch 118 will be on the under side. The sear-spring 120 is set in a diagonal position, (see Fig. 4,) one end resting against an inclined face in the recessed stock and the other end pressing against the inclined face 122 of the rear member of the sear, (see Fig. 53,) thus pressing the sear both upwardly and rearwardly and tending to keep the rear member as far back as the elongated slot will permit when it is not pressed forward by a greater force and tending to keep it up in position for engaging the lug on the firing-pin. The bosses 121 and 124 hold the spring in place. The rear member 107 of the sear lies at the side of the tumbler 89 between the cheeks of the trigger, the rear part being cut up back of the shoulder 125, so as to clear the tumbler-pivot 88. (See Fig. 53.) Projecting laterally from the side of the member 107 is a lug 126, (see Fig. 53,) which is engaged on its upper side by the hook 90 on the tumbler. (See Fig. 4.) By pulling the trigger back the tumbler is pulled down, and if the hook 90 is engaged with the said lug 126 the rear arm of the sear also will be pulled down out of engagement with the lug 51 of the firing-pin, leaving the firing-pin free to be thrown forward by its spring 50. When the firing-pin is thrown forward, the sear-spring 120 will throw the rear member 107 of the sear backward, as allowed by the elongated slot 119, and upward, as allowed by the rocking of the entire sear on the horizontal

pivot 114. The rear member 107 of the sear has a beveled front face 127 at its upper end, which is engaged by the lug 51 of the firing-pin in its backward movement to turn the sear down again. The upper rear edge 97 of the hook 90 is beveled, and the lower front edge 129 of the lug 126 is beveled, so that when the trigger is released after being pulled back the trigger-spring is strong enough to overcome the spring 91 and make the beveled edge 97 of the hook to ride up over the beveled edge 129 of the sear-lug 126, the tumbler turning on its pivot sufficiently for that purpose, and then the spring 91 will snap the hook 90 back into the upper side of the lug 126.

Projecting laterally toward the sear from the upper end or hook part of the tumbler 89 is a bevel or cam faced lug 98, and projecting laterally from the adjacent side of the sear member 107 is a bevel or cam faced lug 130, lower down on the sear than is the lug 126. After the sear has become disengaged from the firing-pin by the downward pull of the hook (which is accomplished by the half back pull of the trigger) and the sear has also become disengaged from the hook by the backward thrust of the spring 91, if the trigger be pulled still farther back the cam-face 98 on the hook will ride down on the cam-face 130 on the sear and turn the sear member 107 on its vertical pivot 108. This lateral movement of the sear member 107 is not sufficient to carry it entirely out of the path of the lug 51 on the firing-pin; but it will be also in the path of an inclined cam-face 134 in the weight extension-collar 39 for a purpose to be hereinafter described. The upper side of the forward part of cheek 77 of the trigger has a beveled inner edge 132, and the lower edge 131 on the adjacent side of the sear member 107 is also beveled off to avoid obstruction when the sear 107 is pushed to one side, as described, and also to return the sear into the semi-automatic position when the trigger is released. (See Figs. 39, 49, 53, and 54.)

The slot 64 in the under side of the weight extension-collar 39, through which the firing-pin lug 51 projects, is broadened out in the lower part thereof on the left-hand side facing the front (see Figs. 28 to 31) and extends from the front end rearwardly as far as the deeper portion of the slot in which the firing-pin lug moves. The upper side of this broadened and extended portion 133 of the slot has a downward slope 134 toward the rear. When the sear member 107 is turned to one side by the full back pull of the trigger, as described, it will be in line with this slot 133, and if they are in this position when the weight 21 and bolt 3 are thrown forward the square end 52 of the firing-pin lug will first engage the sear and stop the firing-pin without stopping the weight or bolt. The continued onward movement of the weight causes the inclined upper face 134 of said slot to engage the said sear, and as it rides over it will push the sear down out of engagement with the firing-pin lug. The onward movement of the weight while the firing-pin is at rest will compress the firing-pin spring 50, so that by the time the sear is depressed sufficiently to release the firing-pin the spring 50 will be sufficiently compressed to throw the firing-pin forward with full force to ignite the primer.

The cartridges 136 are placed in the magazine 6 by means of a clip (not shown) in the manner well known. The spring 137 brings one cartridge at a time into the position shown in Fig. 16, where its head will be engaged by the bolt in its forward movement and pushed into the explosion-chamber. The bottom of the inside of the frame 2 is formed with an inclined way 138, leading from the magazine, so that when the cartridge is pushed forward by the bolt the rounded end of the projectile in the cartridge will engage the incline and ride up into the chamber. The passage is made tapering, as shown in Fig. 5, so that but one cartridge at a time can be taken from the magazine.

The extractor is mounted on the side of the lever 7 in such manner as to be in position to engage in the circumferential groove 139 in the shell whatever may be the position of the lever 7. (See Figs. 38, 38^{A}, and 38^{B}.) The extractor consists of a bent plate or blade 140, having a curved edge 141 to fit in the groove 139 of the shell and having a shank 142, which extends up alongside of the lever 7. A lug 143 projects from the shank 142 through an elongated slot 144 in the side of the lever. The lever 7 is hollow and contains a spring 145, which is seated on said lug and exerts a yielding downward pressure on the extractor. When the cartridge is shoved into the chamber, the extractor engages with yielding pressure in the groove 139 on the shell. (See Figs. 7 and 12.) In order to prevent the extractor from being lifted out of the circumferential groove 162 near the front end of the bolt, a pin 163 passes down through the spiral spring 145 and through the lug 143. It is formed with a shoulder sufficiently far above the lug to limit the sliding movement of the extractor.

Pivoted in the frame at 146 behind the magazine is the ejector 147. (See Figs. 2, 5, and 16.) The rear arm 184 of the ejector is outside of the path of the body of the bolt, but lies in the path of the lug 10. The forward arm 147 is in the path of the body of the bolt and is not engaged by the lug 10. (See Fig. 5.) When the bolt is thrown back after a discharge, it is engaged on its rear arm 184 by the lug 10 on the bolt, thus turning up the front end into the position shown in Figs. 2 and 16 to engage the shell when driven back and to eject it. When the forward end of the ejector is turned up, it enters a slot 187 in the lower side and front end of the bolt, (see Fig. 38,) so as not

to interfere with the movement of the bolt. When the bolt moves forward again, it will engage and ride over the inclined back of the turned-up forward arm of the ejector and turn it down again out of the path of the bolt and hold it down until the bolt is again forced rearward.

In the modification shown in Fig. 54 the plunger 27 is made without any perforation for the passage of the firing-pin. Instead of having the end of the firing-pin come in direct contact with the primer it strikes the rear end of the plunger in the forward movement and drives the plunger forward, the plunger being formed with a reduced end or boss 150, which strikes and explodes the primer.

In Figs. 55 and 56 are shown the preferred form of cartridge, which is somewhat different from that shown in the other figures, and also a somewhat different form of weight and bolt which are adapted for use with the cartridge. The primer 170 is held in a cupped-out plug or piston 171, which is in the recess 172 in the head of the cartridge 173, and which extends back flush with the rear end of the cartridge-head 174 before the ignition and is driven rearwardly by the explosion, so that when it drives the plunger 175 rearward the forward end of the plunger will be driven back inside of the bolt 176 and the piston 171 will follow the plunger and project inside of the bolt, while in the form shown in Figs. 4 and 54 before ignition the primer is in the bottom of the recess 151 in the head of the cartridge and the plunger 27 extends into said recess, and when the cartridge is exploded the rearward movement of the plunger is limited by the lug 28, so that when in its most rearward position, as shown in Fig. 12, the forward end of the plunger is flush with the end of the bolt and the rear end of the primer is flush with the end of the cartridge-shell. In the form shown in Figs. 55 and 56 the plunger 175 is formed with a shoulder 177, which engages with the shoulder 181 on the bolt to limit the rearward movement; but instead of being reduced again at its forward end, as in Fig. 4, so as to enter the recess in the head of the cartridge, the full breadth of the plunger extends to the forward end and covers the end of the recess 172 in the cartridge. The screw-bushing 30 of Figs. 4 and 54 is omitted, and there is no need for the spring-clamp 36 for connecting the plunger with the weight. In order to prevent the plunger from sliding out of the bolt into the chamber when there is no cartridge in the chamber, the plunger is formed with a groove 178, into which extends a pin 179, the groove 178 being of sufficient length to permit the proper movement of the plunger in the operation of the gun. The piston 171 is held in the cartridge by the inner end being crimped, forming a flange 182 against the shoulder 183 at the inner end of the head. When the cartridge is exploded, the force will be sufficient to straighten out the flange 182 and drive the piston rearward.

The operation of the firearm is as follows: Assume that the magazine is empty and the bolt is locked, as shown in Figs. 1 and 4, and no cartridge in the chamber, although one is shown in the chamber in Fig. 4. To fill the magazine, the bolt is unlocked by grasping the handle 13 with the hand and turning the lever 7 up out of the notch 8 and through the inclined portion 16, then pulling the lever back as far as it will go, carrying the bolt, weight, and firing-pin, and compressing the spring 135. The bolt as it slides rearward will engage with and ride over the inclined front face 127 of the sear member 107 and push it down, rocking the entire sear on the horizontal pivot 114. The bolt will be held in this position by the end 185 of the carrier 186 until the clip which holds the cartridges is inserted. Then the clip will hold the bolt back until the clip is pulled out, leaving the cartridges in the magazine. The bolt is then pushed forward and the lever 7 is turned down again into locking position. As the bolt moves forward its front end engages the rear end of the uppermost cartridge in the magazine and shoves it into the chamber of the barrel, the flange of the extractor 140 engaging in the groove of the cartridge, as already described. This will bring the parts into the position shown in Fig. 4, the gun now being ready for firing, the hook 90 of the tumbler resting on the upper side of the lug 126 of the sear 107 and the firing-pin spring 50 compressed. As already stated, one cartridge only may be fired at each pull of the trigger, or all in the magazine may be fired by a single pull, according to the extent it is pulled. For convenience of designation the former is termed the "semi-automatic" and the latter is termed the "automatic" firing. In the semi-automatic operation by pulling the trigger part way back one cartridge is fired, the shell ejected, and another cartridge is pushed into the chamber; but another cartridge will not be fired until the trigger is released and again pulled. In the automatic operation by pulling the trigger full back the firing-pin is automatically released and thrown forward simultaneously with the locking of the bolt, when the bolt moves forward and inserts the second cartridge after the first cartridge has been fired. The semi-automatic operation will be first described. The trigger is pulled back until it encounters the foot of the incline 105 on the spring 101, compressing the trigger-spring 85 and pulling down the tumbler 89, whose hook 90 is already in engagement with the lug 126 of the sear, thereby rocking the sear on its horizontal pivot and pulling the member 107 down out of engagement with the lug 51 of the firing-pin, the forward end of the forward sear member 106 rising into the slot 117. The spring 50 then drives the firing-pin for-

ward against the primer and the cartridge is exploded. As soon as the sear becomes disengaged from the lug on the firing-pin the spring 120 forces the rear member 107 backward as far as the elongated slot 119 permits, and rocks the entire sear on its horizontal pivot in the reverse direction to the previous rocking bringing the forward end down and the rear end up, as shown in Fig. 12. The sear member 107 is now too far back for the hook 90 to engage the upper side of the lug 126. The explosion forces the primer 32 rearwardly in the chamber 151, which acts as a piston, and thereby also drives violently backward the plunger 27, whose forward end is in contact with the primer. The rearward movement of the plunger carries with it the weight 21. The plunger and primer are brought to a sudden stop by the boss 28 on the plunger coming in contact with the shoulder 152 at the rear end of the chamber 29 in the bolt. The impulse given to the weight by the movement of the plunger causes the disengagement of the spring-clamp 36 from the groove 38 and the weight continues to shoot rearward, carrying with it the firing-pin. The lug 51 on the firing-pin will engage the inclined front face 127 of the sear and ride over it, turning down the sear until the lug has passed. Then the spring 120 will throw it up again. The inclined edge of the slot 43 in the extension-collar 39 of the weight permits the disengagement of the weight from the bolt, the hook 72 being pushed up into the hole 74 as the inclined edge rides under it. The head of the hook engages with the edge of the hole and prevents the key 71 from being pulled out of the bolt-bushing 17 by the weight. There is no movement of the bolt until the weight has moved rearward far enough for the lugs 22 to engage the spiral projections 23 in the interior of the bolt, as shown in Fig. 12. The weight 21 being prevented from rotary movement by the lug 155, which slides in guide-grooves 15 in the air-cylinder 4, and the bolt 3 being rotatable, the continued rearward movement of the weight will cause the lugs 22 to traverse the spiral projections 23 and turn the bolt through an arc equal to that of the spiral projections, which is sufficient to turn the lever 7 up out of the notch 8 as far as the oblique passage 16 out of the notch. This brings the parts into the position shown in Fig. 13, the spring 20 forming a cushion between the weight and bolt, doing away with the destructive effects due to a too solid metal blow. The bushing 17 being fast to the bolt and forming a part of the bolt, also turns with it and brings the segment-fingers 45 and 46 into the positions shown in dotted lines in Fig. 13. The oblique side 25 of the notch in the frame now permits the bolt to move longitudinally, as well as causes it to move rotatably under the impulse given when the lugs 22 of the weight strike the spring 20. The bolt is turned far enough to bring the flanges 9 10 into alinement with the grooves 11, as shown in Fig. 18, the lever 7 being lifted out of the notch 8 into alinement with the longitudinal slot 12 in the frame and the segment-fingers 45 46 are brought around into the position shown in Fig. 14. The bolt will have moved longitudinally a distance equal to the length of the base-line of the oblique side 26, carrying with it the plunger 27 and empty shell. (See Fig. 14.) The bolt is now free to move with the weight, and they continue the rearward movement without change of their relative positions until the disk 56, which forms the rear end of the weight, strikes the spring 135 in the rear end of the air-cylinder, as in Fig. 15. The rearward movement of the weight and bolt compresses the air in the cylinder 4, and the force of the blow of the weight against the spring 135 compresses it, as shown in Fig. 16. As the movement of the weight is checked the bolt telescopes back onto the weight, and the segment-fingers 45 and 46 telescope onto the weight extension-collar 39, as shown in Fig. 16, as far as the shoulder 41; but the bolt has turned on its axis far enough to bring the fingers 45 and 46 entirely out of alinement with the cam-slots 42 43, so that the end of the finger 45 strikes against the shoulder 41 a little above the entrance to the slot 42 as viewed in Fig. 29, and the end of finger 46 strikes the shoulder 41 a little below the entrance to slot 43 as viewed in Fig. 31. The bolt and weight cannot, therefore, fully telescope until the weight is turned slightly in the reverse direction on its axis on the forward movement, as will be hereinafter explained. The loose fit of the threads of the bushing 17 with the threads of the bolt 3, already described, reduces the shock when the ends of the fingers 45 and 46 strike the shoulders 41. While the bolt telescopes onto the weight, as shown in Fig. 16, the hook 72 on the spring-key 71 will ride up on the chambered end of the collar 39, thence back until it drops into the entrance to the diagonal grooved slot 73. In the meantime the empty shell has been brought into engagement with the ejector 147 by the rearward movement of the bolt and been thrown out. The expansion of the spring 135 and the expansion of the air which was compressed by the rearward movement of the weight and bolt drives the weight and bolt forward again. On the rebound movement the bolt and weight will maintain the same relative position, as shown in Fig. 16, until the lever 7 on the bolt reaches the diagonal entrance to the notch 8. When the lever 7 engages the inclined wall 26, it will be guided down the incline, turning the bolt the same distance that it was turned by the incline 25 when moving in the reverse direction. This turning movement is sufficient to bring the hook 72 of the key through the circumferential portion of the slot 73 in the

weight extension-collar 39, (shown in Fig. 31,) and brings the long inclined side of the finger 45 into engagement with the long inclined side of the slot 42 and the inclined side of the finger 46 into engagement with the inclined side of the slot 43. The inclined faces act as cams, and as the bolt has been brought to the end of its forward movement by reason of the lever 7 engaging the forward vertical wall of the notch 8 the continued onward movement of the weight will by reason of the engagement of the cam-faces of the fingers 45 46 with the inclined sides of the slots 42 43 cause the bolt to turn and bring the lever 7 down into the bottom of the notch 8. The wedge portions of the fingers 45 46 will telescope into the slots 42 43 and the hook 72 will ride along the inclined slot 73 and come into the same position as shown in Fig. 4. The wedge or cam ends of the fingers 45 46 therefore do the work in reverse order on the forward movement of the bolt that the spiral projections 23 did on the rearward movement. The weight moves forward until the front end engages the plunger. In the forward movement of the weight just described the lug 51 on the firing-pin engages the rear side of the sear member 107 and pushes it forward to the limit of the elongated slot 119. When the sear member 107 has moved as far as permitted by the slot 119, it will stop the forward movement of the firing-pin, while the weight continues to move and compress the firing-pin spring 120. All this will practically occur so quickly as to be done before the trigger is released after being pulled. When the trigger is released, the hook 90 will snap up onto the lug 126 again, as already described. The forward movement of the bolt will have pushed down the ejector 147 and pushed another cartridge into the chamber, and the gun is now ready for another discharge by pulling the trigger as before. In the automatic operation the trigger is pulled back as far as it will go, engaging the incline 105 on the spring 101 and bending the spring to one side as it is pulled clear back. The inclined face 98 on the side of the hook 90 engages the inclined shoulder 130 on sear member 107 and turns the sear member 107 on its vertical pivot 108 into the path of movement of the inclined top 134 of the slot 133 in the weight extension-collar 39, so that while the firing-pin is intercepted by the sear enough for the firing-pin spring to be fully compressed, yet the sear is in the meantime being gradually pushed down by the inclined face 134, and by the time the bolt is in the locked position the sear will be entirely disengaged from the firing-pin and the now-compressed firing-pin spring 50 will drive the firing-pin forward and ignite the primer in the manner already described. The automatic action will continue until the cartridges are all fired, provided the trigger is held back.

If it is desired to set the gun at safety when loaded, the operation is as follows: Turn the lever 7 up by hand far enough to turn the bolt sufficient to cause the hook 72 of the key 71 to traverse the spiral groove 73, Fig. 31, and thus move the weight rearward. When the lever 7 is turned up out of the notch 8, the bolt is of course partially rotated. This turns the slot 117 in the bushing 17 out of position to receive the arm 114 of the sear and brings the slot 118 down into position to admit the sear-arm 114. Otherwise the trigger could not be pulled to set the gun at safety. (See Fig. 26.) As the rearward movement of the weight carries with it the disk 56, which forms the rear abutment for the firing-pin spring 50, the tension of the firing-pin spring will be relaxed. After the lever 7 has turned the bolt far enough to move the slot 117 out of alinement with the forward arm 115 of the sear the trigger should be pulled upon, so that when the slot 118 comes into alinement with said sear-arm 115 the trigger will move far enough to depress the sear out of engagement with the firing-pin and allow the firing-pin to fly forward; but the firing-pin cannot strike the primer, because the weight which limits the travel of the firing-pin is not in its most forward position. As soon as the firing-pin is moved forward the sear will be thrown up and back by its spring. The lever 7 should be turned down into the notch 8 to lock the bolt. To make ready for firing after being placed at safety, the operation is as follows: Without touching the trigger turn the lever 7 by hand, as in setting at safety, causing the hook 72 to traverse the camway 73, thus moving the weight and firing-pin far enough to bring the lug on the firing-pin behind the sear. The sear will be pushed down by the lug on the firing-pin in the rearward movement, and when the lug has passed over the sear the sear will be thrown up by its spring into position to intercept the lug. Now turn down the lever 7, thus causing the hook 72 to retraverse the camway 73, bringing the weight forward. The forward movement will cause the lug on the firing-pin to engage the sear and hold the firing-pin while the weight completes its forward movement, thereby compressing the spring 50, and the gun will now be ready for firing.

What we claim is—

1. In breech mechanism for firearms, a bolt which is both slidable and rotatable, mechanism for locking the bolt, a plunger located and movable within the head of the bolt, a weight which is slidable in relation to the bolt and is actuated by the plunger to unlock the bolt, a firing-pin carried by the weight and movable longitudinally with relation thereto and a firing-pin spring whose ends abut against said weight and firing-pin, substantially as described.

2. In breech mechanism for firearms, a bolt, mechanism for locking the bolt, a longitu-

dinally-apertured plunger located in the head of the bolt, said bolt having a shoulder which forms a rigid stop to limit the rearward movement of the plunger, a slidable weight which is actuated rearwardly by the movement of said plunger, a firing-pin carried by said weight and slidable therein and in its forward movement passing through said plunger, and mechanism actuated by the rearward movement of said weight to disengage the locking mechanism of the bolt, substantially as described.

3. In breech-operating mechanism for firearms, a bolt, a slidable weight, a plunger located and movable within the head of the bolt to actuate the weight when the plunger moves rearwardly, a firing-pin carried by said weight and slidable with relation thereto, and a firing-pin spring one end of which abuts against said firing-pin and the other end of which abuts against said weight, substantially as described.

4. In breech mechanism for firearms, a bolt, mechanism for locking and unlocking the bolt, a longitudinally-apertured plunger movable in the forward end of the bolt, a weight having a sliding movement with relation to said bolt, means for preventing rotation of said weight, a firing-pin which is carried by said weight and is slidable therein and in its forward movement passes through the aperture in said plunger, said weight being actuated by said plunger, and cam connections between the weight and bolt whereby the movement of the weight turns the bolt and unlocks it after an initial movement of the weight, substantially as described.

5. In a breech-operating mechanism for firearms, a bolt, a slidable weight, a firing-pin carried by said weight and slidable with relation thereto, a firing-pin spring carried by said weight, mechanism which throws forward the weight and bolt and held spring, mechanism which raises the tension of the firing-pin spring during the said forward movement, mechanism which prevents forward movement of the firing-pin with relation to the said bolt and weight until the bolt and weight have completed their forward movement, and mechanism for releasing the tension on the firing-pin spring after the completion of said forward movement of the bolt and weight whereby the firing-pin is thrown forward with relation to said bolt and weight, substantially as described.

6. In hand-operatable breech mechanism for automatic firearms, a bolt which is both slidable and rotatable, a hand-lever attached to said bolt by which the bolt can be operated independent of the automatic mechanism, a plunger movable in the head of the bolt, a weight having a slidable movement in said bolt, means for preventing rotation of said weight, a firing-pin which is carried by said weight and is slidable therein, said weight being actuated by the plunger, and said bolt being engaged by said weight and unlocked after an initial movement of the weight and then driven rearward, substantially as described.

7. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which is slidable in said bolt, means for preventing rotation of the weight, cam connections between said weight and bolt whereby the movement of the weight turns the bolt, a firing-pin carried by said weight and slidable therein, a shoulder on said weight which limits the forward movement of the firing-pin, and a longitudinally-apertured plunger located in the head of the bolt through which the firing-pin passes and which actuates the weight, substantially as described.

8. In breech mechanism for firearms, a bolt which is both slidable and rotatable, means for locking said bolt by turning it in one direction, and unlocking it by turning it in the reverse direction, a weight which actuates the bolt and which has a preliminary sliding movement before it actuates the bolt, means for preventing rotation of said weight, cam connections between the weight and bolt whereby the movement of the weight turns the bolt and unlocks it after the preliminary movement of the weight and then drives the bolt rearwardly, a plunger in the bolt-head which actuates the weight rearwardly, an air-cylinder in which air is compressed by the rearward movement of the bolt and weight and which causes them to rebound forward, a detent which prevents the bolt from completing its telescoping movement onto the weight until the end of the forward movement, mechanism which at the end of the forward movement of the bolt turns the bolt and releases said detent and permits the weight to complete its telescoping movement and cam connection which further turns the bolt and locks it, substantially as described.

9. In breech mechanism for firearms, a bolt, a weight which is slidable in the bolt, means for preventing rotation of said weight, mechanism actuated by the explosion to drive the weight rearward, cam connections between the weight and bolt whereby the movement of the weight turns the bolt and unlocks it after an initial movement of the weight, mechanism which prevents the bolt from moving during the initial movement of the weight, mechanism which is actuated by the rearward movement of the weight to release the bolt, a spring-cushion in the bolt for the weight at the end of its rearward movement relative to the bolt, the impulse of the weight causing the bolt when released to also move rearwardly, substantially as described.

10. In breech mechanism for firearms, a bolt, a weight which actuates the bolt, and a cushion one end of which abuts against the bolt and the other end of which receives the impact of the weight in its rearward movement and transmits the impulse to the bolt, substantially as described.

11. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which extends rearwardly farther than said bolt and which is slidable in relation to said bolt and slidable with said bolt, mechanism which prevents said weight from turning, mechanism which locks said bolt by turning the bolt at the end of its forward movement, mechanism which prevents the bolt from moving rearwardly as far as the weight and which prevents the weight from completing its forward movement with relation to the bolt until after the bolt has completed its forward movement, mechanism which partially turns the bolt before it completes its forward movement and releases the detent between the weight and bolt, and cam connection between said weight and bolt whereby the forward movement of the weight after the bolt has completed its forward movement will turn the bolt into the locked position, substantially as described.

12. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which extends rearwardly through said bolt, and which is slidable both together with and relatively to said bolt, mechanism which prevents said weight from turning, mechanism which locks said bolt by turning it at the end of its forward movement, a stop which prevents said bolt from moving rearwardly as far as the weight and which also prevents the weight from completing its forward movement as soon as the bolt, mechanism which partially turns the bolt before the end of the forward movement to disengage said stop, and cam connections between said bolt and weight which are brought into engagement with each other by the said partial turning of the bolt whereby the continued movement of the weight will turn the bolt still farther and lock it, substantially as described.

13. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which extends rearwardly through said bolt and which is slidable both together with and relatively to said bolt, mechanism which prevents said weight from turning, mechanism which drives said weight rearwardly in advance of the bolt, projections on said weight and bolt which engage each other and prevent the rear end of the bolt from moving rearwardly as far as the rear end of the weight and which causes the bolt to complete its forward movement before the weight, cam projections on the bolt and camways on the weight adapted to said cam projections, mechanism which partially turns said bolt during its forward movement and brings said cam projections into engagement with said camways, whereby the continued forward movement of the weight after the bolt has completed its forward movement will turn the bolt, and mechanism which is brought by the turning of the bolt into position to lock it, substantially as described.

14. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a bushing having a limited longitudinal movement in said bolt, means for locking the bolt by turning it in one direction and unlocking it by turning it in the reverse direction, a weight having a sliding movement with relation to said bolt, means for preventing rotation of said weight, cam connection between said bolt and said weight which turns the bolt in one direction on the rearward movement to unlock the bolt, and cam connections between said bushing and said weight to turn the bolt in the reverse direction to lock it on the forward movement, substantially as described.

15. In breech mechanism for firearms, a bolt, a weight which is slidable with relation to the bolt and actuates the bolt, a firing-pin carried by said weight and slidable relatively thereto, a firing-pin spring, means for driving the weight and bolt forward, a sear which engages the firing-pin before the weight completes its forward movement, the firing-pin spring being compressed by the movement of the weight after the firing-pin stops, the sear being movable both vertically and laterally, a sear-spring, an incline on said weight which engages the sear and moves it out of engagement with the firing-pin by the same movement that compresses the firing-pin spring, the sear being normally out of the path of said incline, a trigger and a tumbler pivoted thereto which engages the sear having engaging surfaces which if the trigger be pulled a certain distance will move the sear into the path of said incline so that the said incline will on the forward movement depress the sear out of engagement with the firing-pin lug, substantially as described.

16. In breech mechanism for firearms, a firing-pin, a sliding carrier for the firing-pin, the firing-pin and carrier having a longitudinal movement with relation to each other, a firing-pin spring, means for driving the said carrier forward, a sear which engages the firing-pin before the carrier completes its forward movement, the firing-pin spring being compressed by the continued movement of the carrier, a sear-spring, an incline on said carrier which engages the sear and moves it out of engagement with the firing-pin by the same movement that compresses the firing-pin spring, the sear being normally out of the path of said incline, and a trigger which engages the sear and if the trigger be pulled a certain distance will move the sear into the path of the incline so that the said incline will on the forward movement depress the sear out of engagement with the firing-pin lug, substantially as described.

17. In breech mechanism for firearms, a firing-pin, a trigger, a sear, a tumbler which is pivoted to the trigger and engages with the sear and is actuated by the trigger to pull the sear down out of engagement with the firing-

pin, a firing-pin spring, a sear-spring, mechanism actuated by the explosion to drive the firing-pin rearward past the firing position, a sliding carrier for the firing-pin which has a sliding movement with relation to the firing-pin and compresses the firing-pin spring, and an incline on said carrier which if the trigger is pulled a certain distance will engage the sear and depress it out of engagement with the firing-pin, substantially as described.

18. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a slidable weight within said bolt which turns said bolt and drives it rearwardly after an initial movement of its own and has a sliding movement relatively to said bolt, means for preventing rotation of the weight, a firing-pin carried by said weight and having a sliding movement relatively thereto, a firing-pin spring which abuts against the firing-pin and said weight, projections on said weight and bolt which engage each other and prevent the bolt from moving rearwardly as far as the weight moves, and hold them apart, mechanism which forces the bolt and weight forward again, a sear which engages the firing-pin on its forward bound before the weight stops, mechanism which turns the bolt and releases the weight so that the weight continues to move forward after the firing-pin has stopped and thereby compresses the firing-pin spring, and a trigger which actuates the sear to release the firing-pin, substantially as described.

19. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a slidable weight within said bolt which turns said bolt and drives it rearwardly after an initial movement of its own and has a sliding movement relatively to said bolt, means for preventing rotation of said weight, a firing-pin carried by said weight and having a sliding movement relatively thereto, a firing-pin spring which abuts against the firing-pin and said weight, projections on said weight and bolt which engage each other and prevent the bolt from moving rearwardly as far as the weight moves and hold them in that relative position until the bolt completes its simple forward movement, means for driving the bolt and weight forward, a sear which engages the firing-pin on its forward bound before the weight stops, mechanism which turns the bolt and releases the weight so that the weight continues to move forward after the firing-pin has stopped and thereby compresses the firing-pin spring, the sear being movable both vertically and laterally, a sear-spring, a cam on said weight which is adapted to engage the sear and move it out of engagement with the firing-pin by the same movement that compresses the firing-pin spring, the sear being normally out of the path of said cam, a trigger and a tumbler pivoted thereto which engages the sear and if the trigger be pulled a certain distance will move the sear into the path of said cam, and thereby cause the repeated firing without again releasing or pulling the trigger, substantially as described.

20. In a firearm, a receiving-frame, a slidable bolt, a slidable weight, a firing-pin carried by the weight, a cylinder mounted on the frame into which the weight and bolt telescope in their rearward movement, a bracket secured to said frame, a trigger, a trigger-spring one end of which rests on said bracket and the other end of which bears up against the head of the trigger, a block to which the trigger is pivoted, said block being held in a slot in the frame by the pressure of the trigger-spring on the trigger, a lug on the cylinder which engages with the block to prevent rearward movement of the cylinder, a lug on the frame which forms a pivot-bearing for the trigger when the trigger is turned forward of its normal position, a hook on the under side of the said cylinder, a slot in the frame having a hook with which the hook on the cylinder engages, said trigger and pivot-block being removable by pushing the trigger forward on its pivot, and the cylinder being slidable rearwardly and movable upwardly to disengage the cylinder from the frame, whereby the cylinder, bolt, weight and firing-pin may all be removed and separated without the use of tools, substantially as described.

21. In breech mechanism for firearms, a bolt which is slidable and rotatable, a slidable weight driven rearwardly by the explosion, means for preventing rotation of the weight, cam connections between the weight and the bolt whereby the movement of the weight unlocks the bolt and then drives it rearward, a screw-bushing which is screwed into the rear end of said bolt, the bolt and bushing being so threaded as to allow a slight longitudinal play with relation to each other, the inner end of the bushing forming a shoulder, a spring between the inner end of said bushing and a shoulder on said bolt which forms a seat for said bushing and which also forms a spring-seat for a projection on the said weight when said weight moves rearwardly and actuates the bolt, substantially as described.

22. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which is slidable in said bolt, means for preventing rotation of said weight, cam connections by which the movement of the weight turns the bolt after an initial movement of the weight, a spring-key in said bolt projecting into a cam-groove in said weight, said key having a lug which engages said weight and maintains the weight and bolt in proper connection until they are separated by the explosion, substantially as described.

23. In breech mechanism for firearms, a bolt which is both slidable and rotatable, a weight which is slidable in said bolt and projects rearwardly through said bolt, a bushing in the rear end of said bolt having rearwardly-

extending segmental cam-fingers, a collar on the rear end of said weight having cam-slots in the periphery with which said segmental fingers engage, a spring-key which fits in grooves in said collar and bushing, a lug on said key, and a cam-groove in said collar with which said lug engages to maintain the said bolt and weight in proper connection until they are separated by the explosion, and a hole in one of said segmental fingers to receive the rear end of said spring, substantially as described.

24. In a firearm, a receiver, a bolt which slides in said receiver, a lug on the side of the bolt, an ejector pivoted to the receiver having one arm which projects into the path of the bolt but not into the path of the lug and another arm which projects into the path of said lug but not into the path of the bolt, the rearward movement of the bolt causing the said lug to engage one of said arms and turn the other arm up into position to engage and eject the shell, and the forward movement of the bolt engaging said ejector-arm and depressing it and raising the other arm, substantially as desoribed.

25. In breech mechanism for firearms, a bolt, a hollow arm projecting from said bolt, an extractor carried on the side of said arm and having a lateral projection which projects through a slot in the side of said hollow arm, and a spring which holds the extractor under tension, substantially as described.

26. In breech mechanism for firearms, a bolt, a hollow arm projecting from said bolt, an extractor carried on the side of said arm and having a lateral projection which passes through a slot in the side of said hollow arm, a pin in said hollow arm which engages said lateral projection to limit the movement of said extractor, and a spring in said hollow arm which bears on said projection and holds the extractor under tension, substantially as described.

27. In breech mechanism for firearms, a bolt, a slidable weight which actuates said bolt, means for preventing rotation of said weight, a firing-pin carried by said weight, cam connections between said bolt and weight by which the weight turns the bolt to unlock it on the rearward movement and to lock it at the end of the forward movement of the bolt, means which prevent the weight from completing its forward movement until after the bolt has been turned into its locking position, and a stop which prevents the firing-pin from moving forward far enough to ignite the primer until the weight has completed its forward movement, substantially as described.

28. In breech mechanism for firearms, a bolt, a weight which actuates said bolt and which extends rearwardly thereof, an air-cylinder into which said bolt and weight telescope on the rearward movement, the rear end of said weight forming a piston which in its rearward movement compresses the air in said cylinder and which is driven forward by the expansion of the air in said cylinder, substantially as described.

29. In breech mechanism for firearms, a bolt, a weight, which actuates said bolt and which extends rearwardly thereof, an air-cylinder into which said bolt and weight telescope on the rearward movement, the rear end of said weight forming a piston which in its rearward movement compresses the air in said cylinder, and a spring in said cylinder which in combination with the compressed air drives the weight and bolt forward, substantially as described.

In testimony whereof we have affixed our signatures in presence of two witnesses.

FRANKLIN K. YOUNG.
JAMES E. SHERIFF.

Witnesses:
WILLIAM A. COPELAND,
GEORGE P. DIKE.