May 2, 1933. J. C. WHITE 1,907,163

AUTOMATIC GUN

Filed Nov. 23, 1931 7 Sheets-Sheet 1

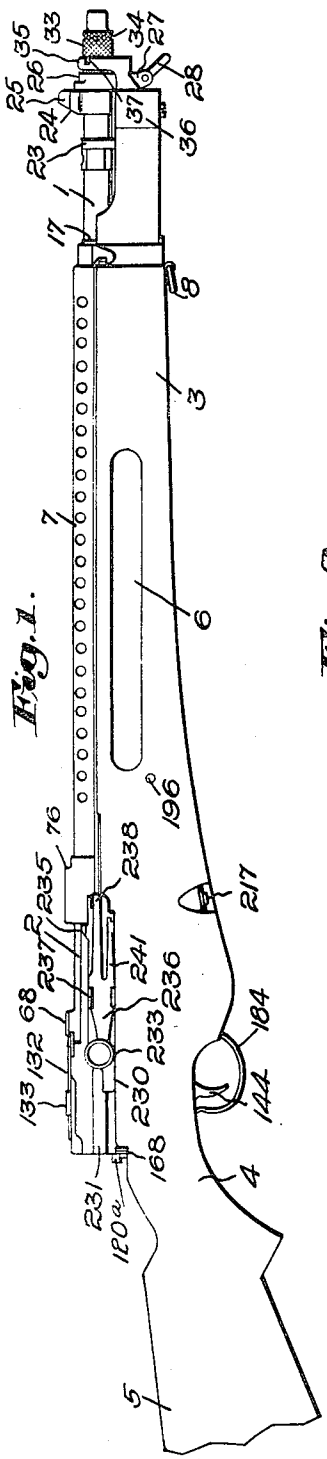

Fig. 1.

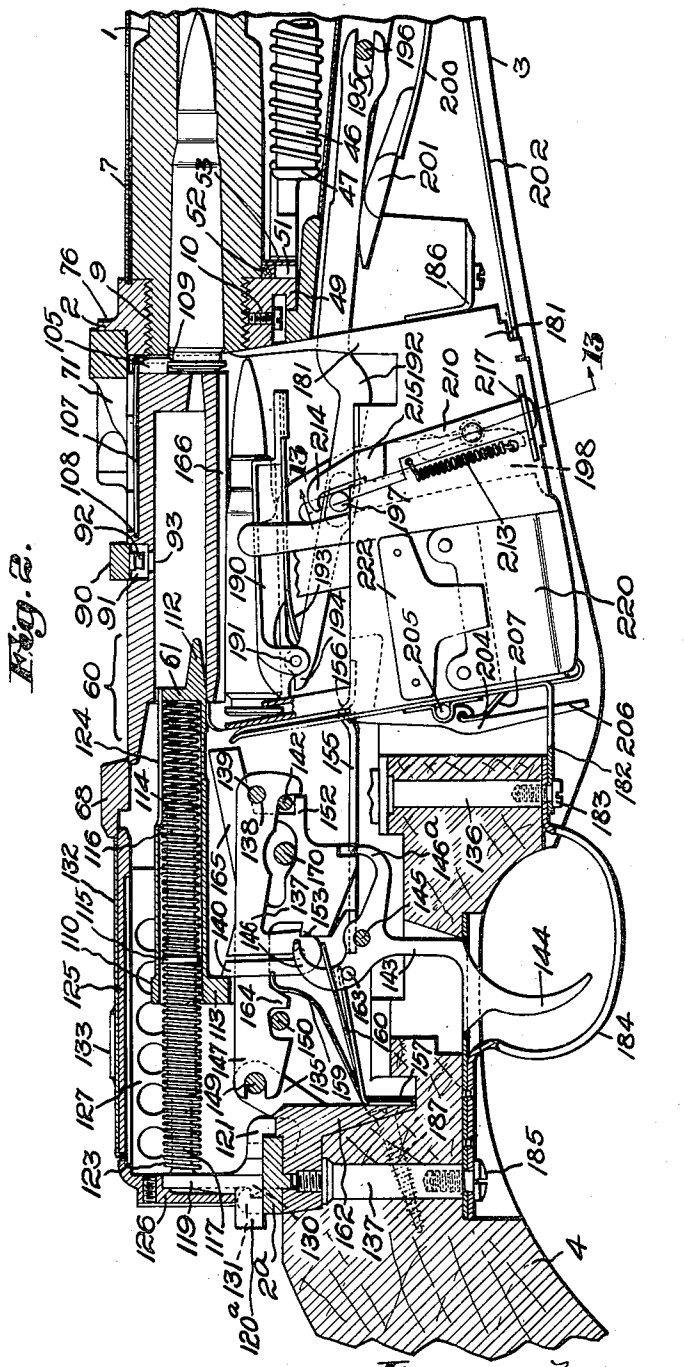

Fig. 2.

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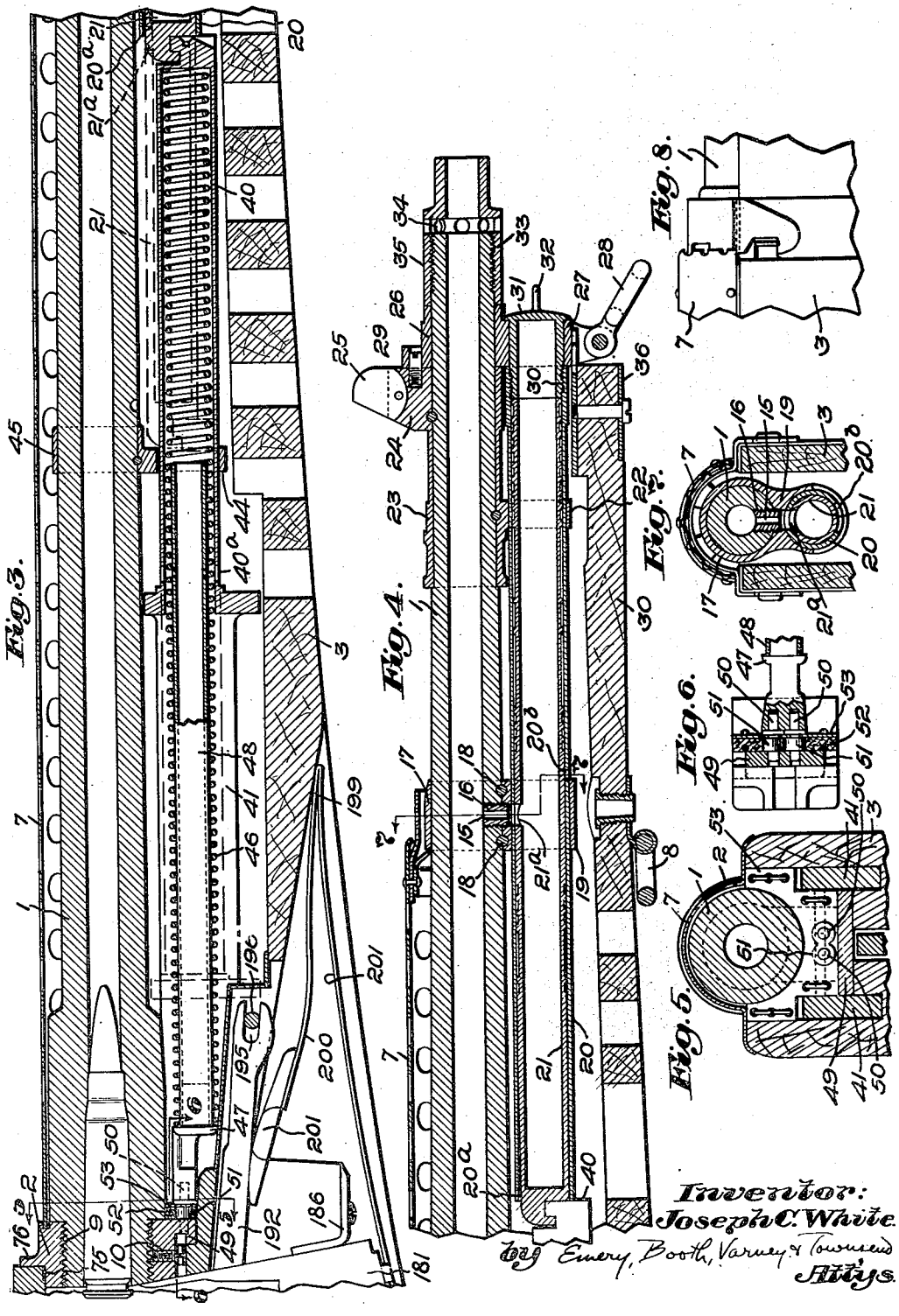

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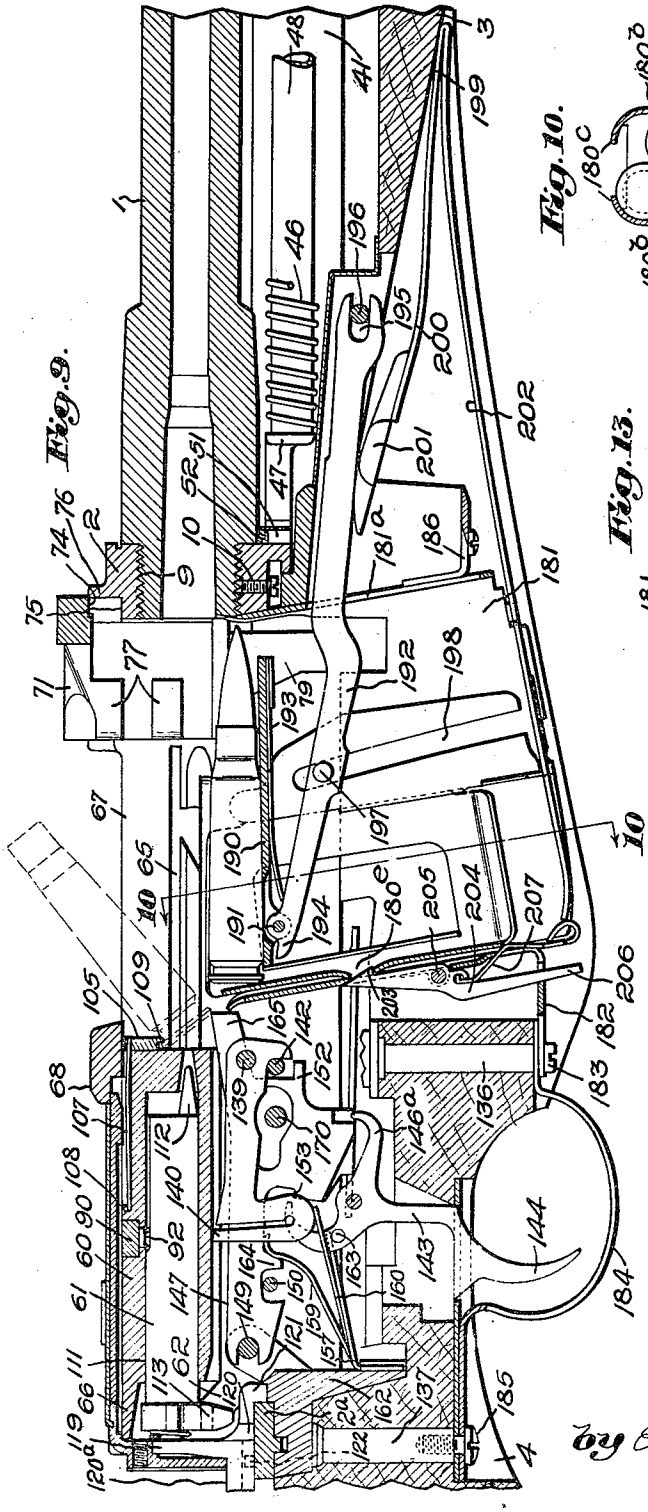

Fig. 9.

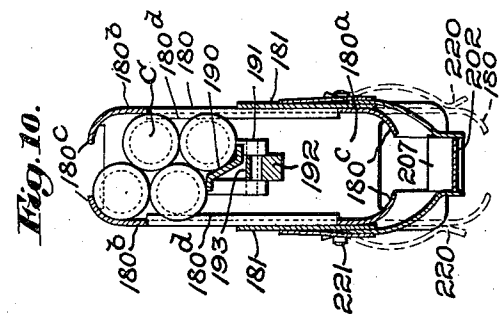

Fig. 10.

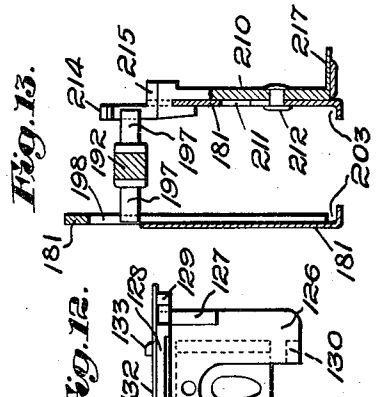

Fig. 13.

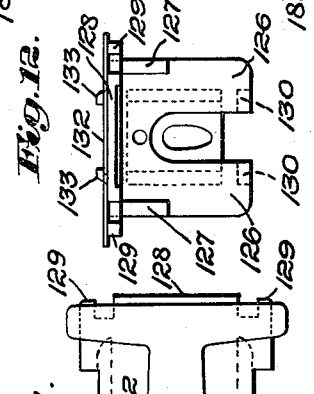

Fig. 12.

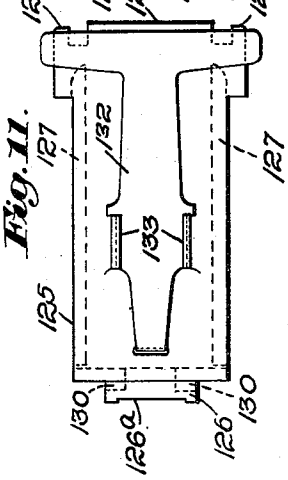

Fig. 11.

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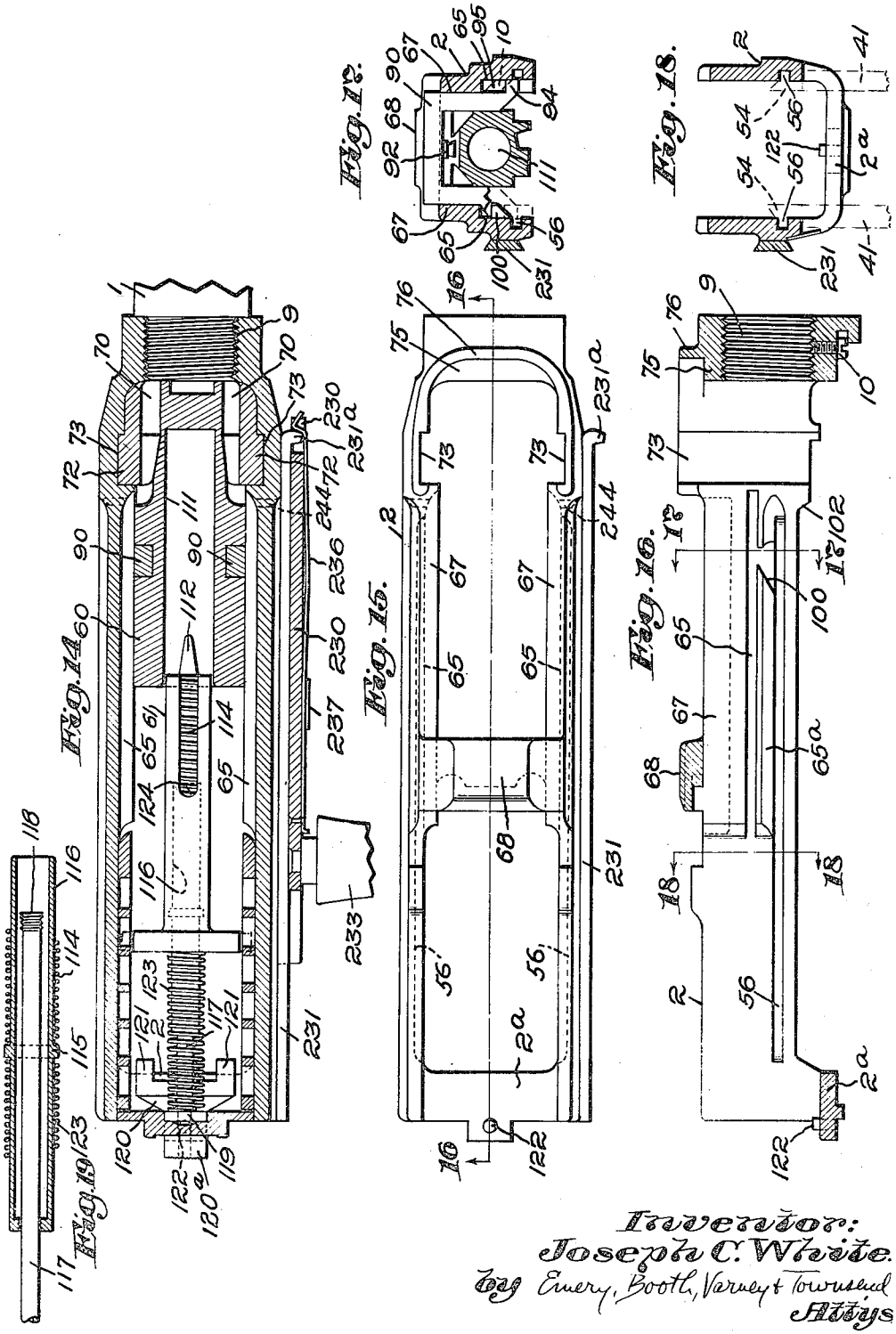

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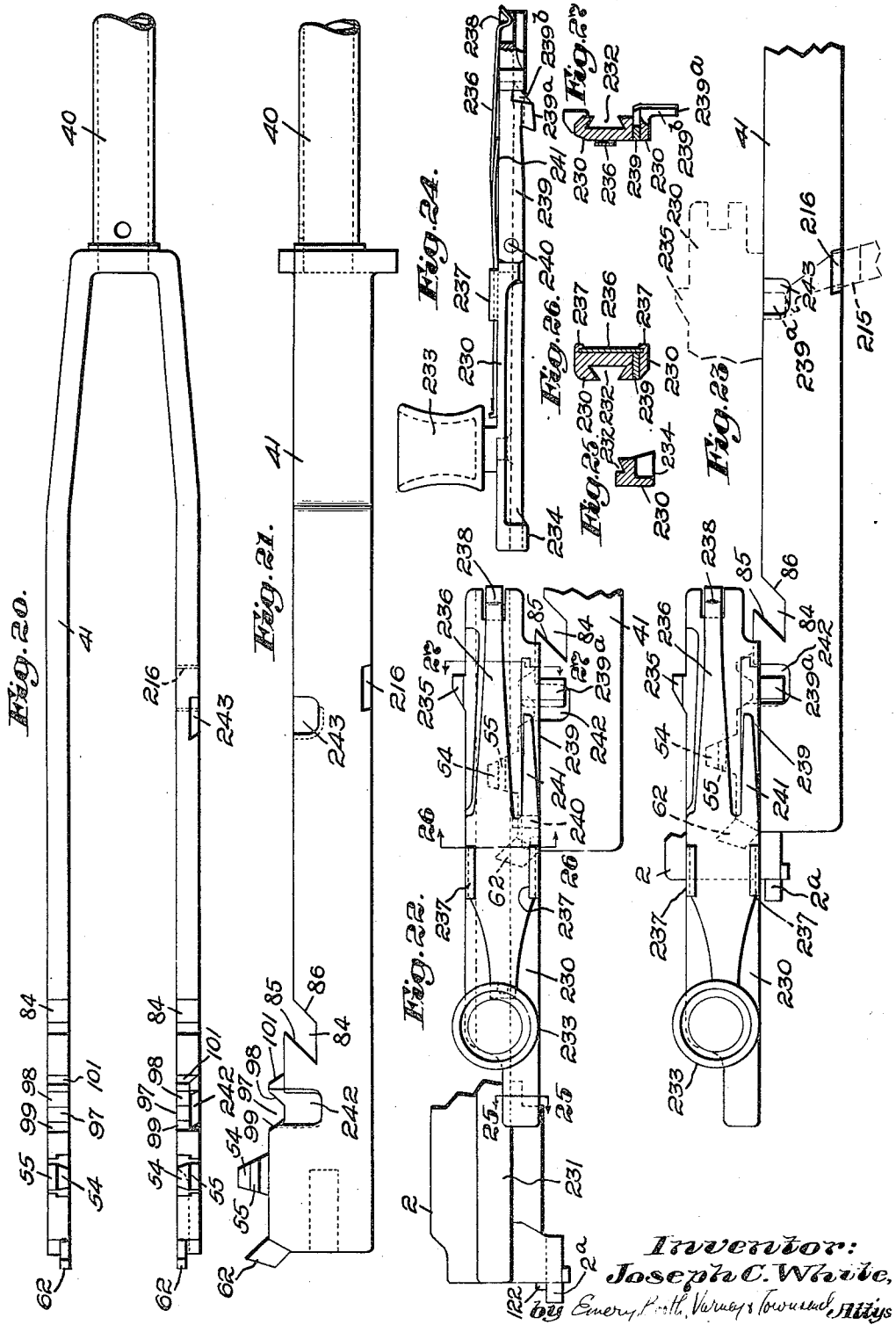

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AUTOMATIC GUN

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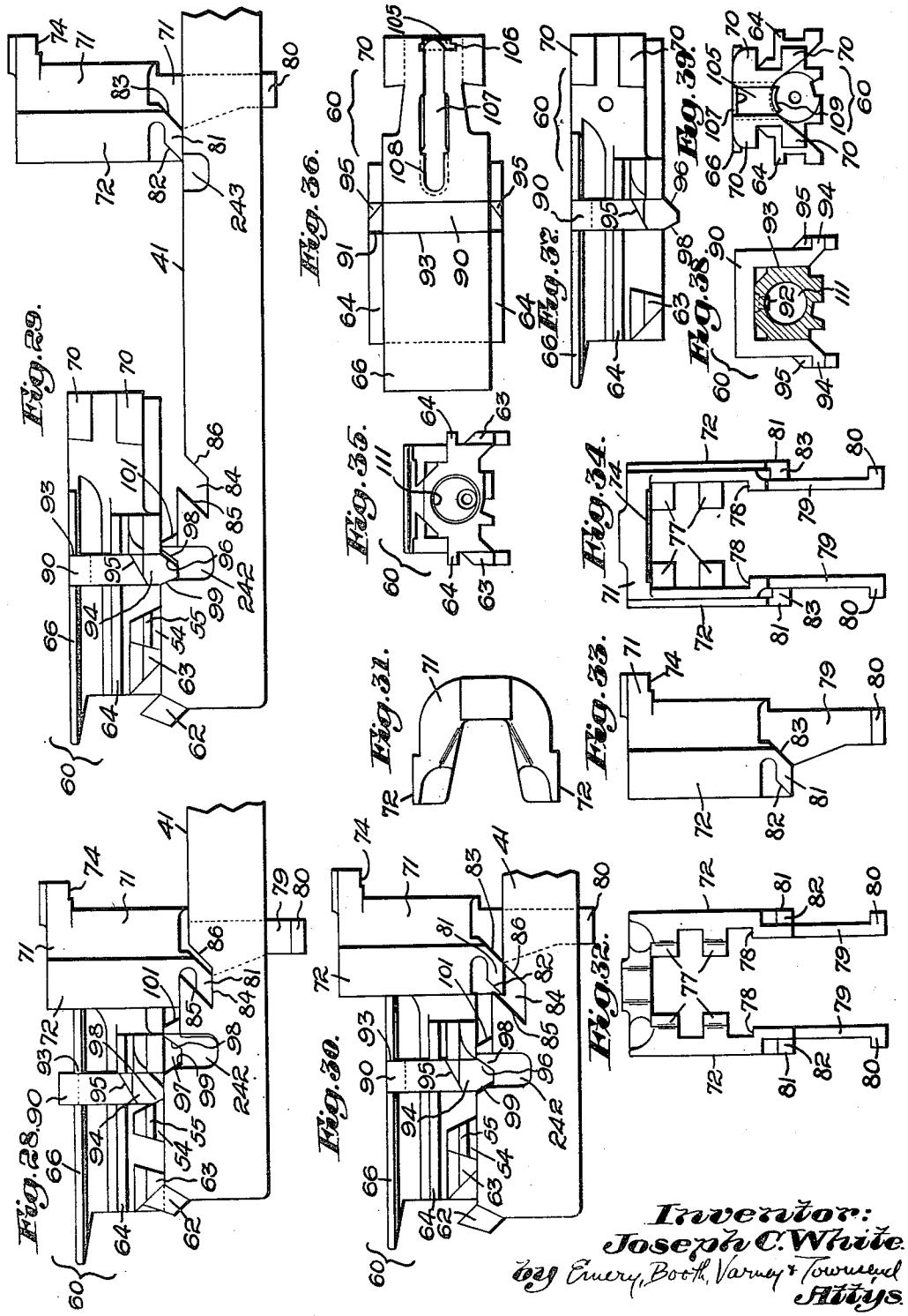

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AUTOMATIC GUN

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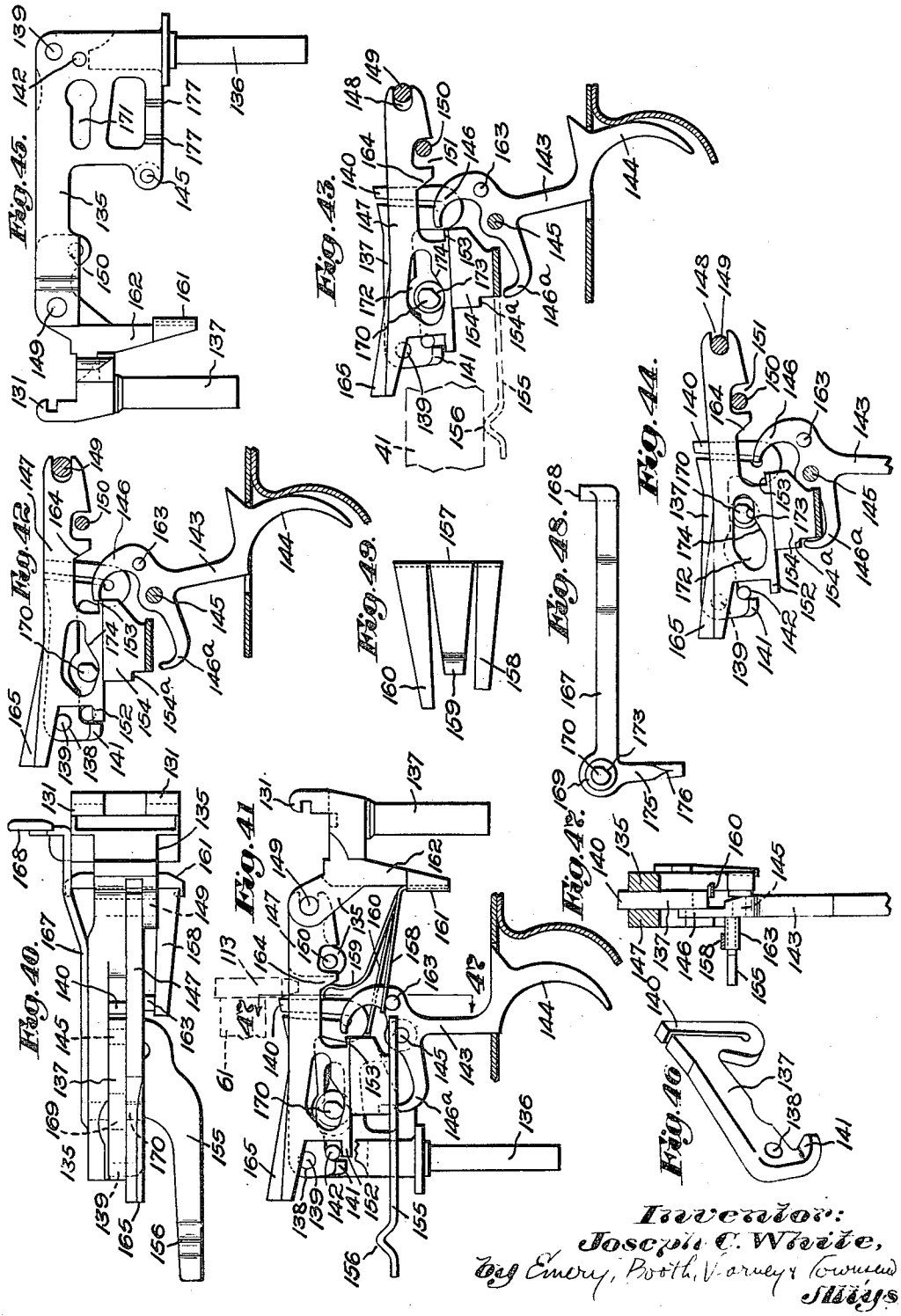

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Patented May 2, 1933 1,907,163

UNITED STATES PATENT OFFICE

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AUTOMATIC GUN

Application filed November 23, 1931. Serial No. 576,666.

My present invention relates to guns, and more particularly to military rifles adapted for firing from the shoulder, and aims to provide an improved service weapon, illustrated as of the semi-automatic, gas-operated type, but various features of the invention may be useful in other guns. In some respects the invention of this application presents improvements over that of my co-pending application Serial No. 419,318, filed January 8, 1930 as a refiling, as to certain subject matter, of previous applications therein named, and in other respects it is generic to that of said application Serial No. 419,318.

Referring to the drawings showing one illustrative embodiment of the invention, by way of example,

Figure 1 is a right side elevation of the assembled rifle substantially in its entirety;

Fig. 2 is a vertical, longitudinal section through the receiver and associated parts, the breech being closed and the firing pin cocked;

Fig. 3 is a vertical section substantially in prolongation of Fig. 2 but also including the cartridge chamber;

Fig. 4 is a section corresponding to Figs. 2 and 3 through the forward portion of the barrel and the gas mechanism;

Fig. 5 is a vertical transverse section on the line 5—5 of Fig. 3;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 3 showing details of the rear support for the action spring guide;

Fig. 7 is a vertical transverse section on the line 7—7 of Fig. 4 showing the barrel, gas piston and ports;

Fig. 8 is a detail view of right side elevation and upon a larger scale of the front fastening of the hand guide as in Fig. 1;

Fig. 9 is a vertical longitudinal section corresponding generally to Fig. 2 but with the parts in fired position and the breech open;

Fig. 10 is a substantially vertical cross section on the line 10—10 of Fig. 9;

Fig. 11 is a plan of the breech cap;

Fig. 12 is a front elevation of the same, viewed from the front;

Fig. 13 is a substantially vertical cross section on the line 13—13 of Fig. 2 showing the breech catch and associated parts;

Fig. 14 is a horizontal cross section substantially in the plane of the axis of the bore, taken through the receiver and breech block, the latter in closed and locked position, and the firing pin being cocked;

Fig. 15 is a plan view of the receiver alone;

Fig. 16 is a vertical longitudinal section through the receiver, on the line 16—16 of Fig. 15;

Fig. 17 is a cross section through the receiver, substantially on the line 17—17 of Fig. 16 but with the breech block assembled with it;

Fig. 18 is a cross section through the rear portion of the receiver, substantially on the line 18—18 of Fig. 16, a portion of the action slide being shown in dotted lines;

Fig. 19 is a detail horizontal sectional view on an enlarged scale through the firing pin spring mounting;

Fig. 20 is a plan view of the gas fork or action slide;

Fig. 21 is a right side elevation corresponding to Fig. 20;

Figs. 22 and 23 are right side elevations of the action slide and associating means for operating the same manually, showing the parts respectively in normal forward position and in position as retracted manually;

Fig. 24 is a bottom plan view of the hand-pull or manual operating means;

Figs. 25, 26 and 27 are respectively vertical cross sections on the lines 25—25, 26—26 and 27—27 of Fig. 22;

Figs. 28, 29 and 30 are right elevations of the breech block, lock and rear portion of the action slide, including also the vertically movable saddle or connector between the breech block and the action slide, showing the parts respectively in forward closed and locked position in readiness for firing (Fig. 28), in full open or retracted position (Fig. 29), and in an intermediate position wherein the block is forward and closed, but is unlocked, the lock being out of locking position (Fig. 30), the latter fig-

ure representing the parts either just prior to locking of the breech, near the end of the return action, or just after unlocking of the breech following firing, at the start of the rearward action;

Fig. 31 is a plan of the breech lock;

Figs. 32, 33 and 34 are respectively a front elevation, a right side elevation and a rear elevation of the breech lock of Fig. 31;

Figs. 35, 36 and 37 are respectively a rear elevation, a top plan and a right side elevation of the breech block and the sliding connector carried thereby;

Fig. 38 is a vertical cross section through the block on the line 38—38 of Fig. 37, looking forwardly;

Fig. 39 is a front elevation of the breech lock;

Figs. 40 and 41 are respectively a plan view and a left side elevation of the firing mechanism assembly, the parts being in the same relative positions in Fig. 41 as in Fig. 2;

Figs. 42, 43 and 44 are corresponding views of the trigger, sear, connector and safety showing these parts respectively in fired position but with the trigger still pulled and the breech block yet closed, Fig. 43 showing the parts of Fig. 42 after the breech block has opened, the trigger still being pulled, and Fig. 44 showing the same parts with the safety "on";

Fig. 45 is a right side elevation of the firing mechanism frame;

Fig. 46 is a perspective of the sear;

Fig. 47 is a vertical cross section of the firing mechanism assembly, on the line 47—47 of Fig. 41;

Fig. 48 is a left side elevation of the safety; and

Fig. 49 is a plan of the single triple-action spring of the firing mechanism.

Referring to the drawings and first to Fig. 1, the barrel is indicated at 1, the receiver or frame at 2, and the stock, as a whole, by the numeral 3, the latter including a pistol grip 4 and a butt 5. Finger channels 6 may be conveniently provided in the forestock. Above the forestock, the major portion of the barrel is preferably covered by a ventilated guard 7. A ring for attaching one end of the usual sling is seen at 8.

The barrel desirably has removable threaded connection with the receiver, as indicated at 9, Figs. 2, 3, 14 and 16, being locked therein as by the set screw 10. The barrel and receiver are readily removable from the stock, as will be apparent from the further description.

Muzzle structure and gas mechanism

While various features of the invention are applicable to other types of firearms or ordnance than gas-operated, the invention includes novel gas-operating mechanism.

Referring now to Figs. 3 and 4, which are slightly overlapping views in prolongation of each other, the barrel has a gas-port 15 in its fore portion and desirably at about three-quarters the distance from the cartridge chamber to the muzzle. The port proper is herein formed in a replaceable bushing 16 tapped into the barrel and adapted to be replaced by similar members, which may have ports of different diameters, for the purposes of adjustment to various conditions. Other factors being the same, the size of the gas port is inversely proportional to its distance from the muzzle. The gas port 15—16 is in registry with a collar or port-housing 17 surrounding and pinned or otherwise secured to the barrel, as indicated at 18. Said port-housing includes a depending portion 19 serving as one support for the gas tube 20 within which the hollow sliding piston 21 operates.

The gas tube 20 is further supported in advance of the port-housing 17 in a ring 22 extending downwardly from a sleeve 23 fitted over the barrel and affording a base 24 for the front sight 25. In advance of the sleeve 23 is a supplemental removable front sleeve 26 having an upper annular portion surrounding the barrel and a depending collar 27 to which is pivoted the stacking swivel 28. Said front sleeve 26 is held in proper angular relation with the sleeve 23 as by means of the lock screw 29.

The fore end of the gas tube 20 abuts the inner face of said depending collar portion 27 of the front sleeve, and is threaded as at 30 to receive the front cap 31 which is thereby adjustably related to the gas tube and forms the front closure therefor. Said cap 31 may readily be turned for the purposes of adjustment or removal, as by the wing 32 thereon.

The muzzle of the barrel is desirably furnished with a muzzle nut 33 having a series of substantially radial ports 34, open to atmosphere. These ports are preferably so arranged that a somewhat greater proportion of gas is liberated upwardly, the muzzle nut thus serving as an anti-climb device, as well as to lessen the recoil. It may be locked in place as by means of a finger 35, Fig. 1, formed as a forwardly and upwardly projecting portion of the U-shaped strap 36 at the fore end of the stock and having an inwardly projecting detent 37 adapted to engage in a slot in the muzzle nut, in the completely assembled position of the latter.

Referring again to Fig. 4, the port-housing 17 is apertured in registry with the barrel port 15, as is also the gas tube 20. The piston 21 within the latter is an elongated tubular member, hollow throughout substantially its entire length and having a rel-

atively thin wall, so that there is provided within the piston a gas chamber of substantial capacity. The bore of the gas tube cap 31 is preferably the same or approximately the same diameter as that of the gas chamber in the piston, forming in effect a forward extension thereof. In Fig. 4, the piston is seen in its normal or forward position, prior to firing. In this position a gas port 21*a* in the piston registers with the barrel port 15 and the communicating apertures in the port housing 17 and gas tube 20.

As seen in both Figs. 3 and 4, the piston 21 is positively but disconnectably coupled to the fore end of the action spring housing 40 which in turn is secured to and constitutes the fore part of the breech-actuator, action slide or gas fork 41; see also Figs. 20 and 21. Interengageable hook-lugs 42 and 43 on the piston and the fore part of the action slide or spring housing 40, respectively, serve to couple said members but may be disconnected when desired by a slight relative tilting and turning.

The piston and action slide have a reciprocating movement in the course of a firing cycle from their forward full line position as in Figs. 3 and 4 to the rearward or fired position as shown in dotted lines in Fig. 3, and return. In the fully retracted position the gas port 21*a* of the piston comes opposite and is exposed by an aperture 20*a* at the rear of the gas tube 20 and the piston interior is then also opened to atmosphere by a slot 20*b* in the gas tube which is just uncovered by the open front end of the retracted piston. It will be noted that at the beginning of the back stroke the piston port 21*a* is immediately closed by the gas tube. It remains so covered until near the end of the back stroke and until exposed by said recess 20*a*, at which latter time the major portion of all gas in the piston is exhausted to atmosphere, a quick exhaust being further aided by said slot 20*b* which is uncovered by the piston front end substantially simultaneously or an instant before the port 21*a* is uncovered. On the forward stroke a reverse operation takes place, the piston port remaining closed substantially until the piston again reaches its full forward position of Fig. 4, while the gas tube slot 20*b* remains covered by the piston itself. Thus a quantity of air with perhaps a small portion of spent gas is trapped within the piston and compressed, serving to cushion the return movement of the piston and associated mechanism. This compressed air is released through the piston port and the barrel port when these again come into registry, producing a scavenging and cooling effect at the muzzle.

In operation, when a bullet has passed the barrel-port 15, high-pressure live gas enters the piston 21 through this port and the then registering port 21*a* in the piston. As the gas in the piston reaches a pressure sufficient to overcome the resistance of the action-spring 46 and the reciprocating parts, the piston moves rearwardly, closing the barrel-port. The gas is thus trapped in the piston and the gas tube, where it expands, actively, causing a continued smooth rearward movement of the piston. This steady expansive action of the gas continues throughout the major portion of the action stroke of the piston and connected parts. Before the full travel of the piston has taken place, however, the slot 20*b* in the gas tube is uncovered by the front end of the piston and the piston port 21*a* comes into registry with the aperture 20*a* at the rear of the gas tube, and is uncovered. A large and sudden drop of gas pressure therefore occurs, with resultant slowing down of the piston.

On the reaction or forward stroke of the piston, effected by the expansion of the action spring which was compressed during rearward travel of the piston, the air and any remaining gas in the gas-tube are compressed, thus cushioning the rapid reaction stroke of the parts, until the piston port 21*a* again registers with the barrel-port 15, when the compressed air and spent gas in the tube escape into the barrel, serving to cool the bore and to drive out any residue.

The described gas-mechanism affords a safe and positive means for operating the breech-closure, particularly one of the extreme lightness as herein disclosed. The gas is utilized expansively rather than by way of a violent initial impulse or hammer-like blow characteristic of known gas systems employing a free or continuously open port. The parts are caused to move back under control rather than to be blown back by the initial gas impulse. By the described means I trap in the piston or expansion chamber a quantity of live, expanding gas sufficient, at its initial pressure, to over-balance the variable resistance to the breech opening effort, and at its final pressure adequate to have completed the rearward stroke of the piston and other reciprocating parts. By thus controlling the admission of gas from the barrel, automatically taking a load-compensating quantity, irrespective of variations in such load or resistance to breech-opening effort, I avoid the chief objections of the usual open-port system, the violent and premature breech-opening effort or the necessity of heavy reciprocating parts to store enough energy from a violent initial gas impulse to complete the full stroke after the pressure has dropped.

It will be understood that the described piston, in functioning to drive the breech mechanism, controls the inflow and outflow of gas, on the rearward stroke, and acts as

a reducing valve to check the piston speed as it approaches the limit of its rearward travel. On the return or forward stroke it traps and compresses air, checking the forward speed and affording adequate time for cartridge feed, reducing the likelihood of jamming and of abrasions on the shoulder of the cartridge case. The compressed air charge, being released only through the barrel port, serves to scavenge and cool the bore.

The compensating action of the described gas mechanism provides for proper, uniform breech action despite variations not only in the resistance to breech-opening effort but also in explosion-chamber pressures. If greater opening effort is needed, more gas is automatically taken. If abnormally high gas pressures are developed, the inflow of gas is automatically more quickly cut off and less gas is taken. Full functioning of the mechanism may be obtained with chamber pressure varying as widely as between 20,000 pounds below and 20,000 pounds above that of standard army ammunition.

The smoothness of operation of the gas mechanism and its freedom from violence is largely dependent upon the described compensating action of the hollow piston and the relatively large capacity of the gas chamber in the piston and housing cap. This chamber is particularly proportioned with respect to the cubic content of the barrel bore. I have determined that it should be at least 35% and desirably between 50% and 100%, or more of the bore volume, and in the illustrated example is approximately 70% of the latter. The described results are further contributed to by reason of the described position of the gas port with respect to the muzzle, the ratio between the size of the gas port and its distance from the muzzle, and by the shortness of the gas passage between the barrel and the piston.

Action-slide and breech-closure

The action-slide or gas fork 41 is shown separately, in plan and in right elevation respectively, in Figs. 20 and 21. Its tubular fore part or spring housing 40 is guided in its movement by a bearing 44 depending from and mounted on the barrel by means of a band 45. Rearwardly of the spring housing is the slide or fork proper, which is of an elongated saddle-like form, comprising the two slide or fork portions spaced to straddle the feed and firing mechanisms; see also Fig. 18.

The action spring 46, referring again to Fig. 3, is received within the spring housing 40, being confined between the front wall of the latter and a shoulder 47 at the rear of the tubular spring guide-rod 48. The rearward pressure on said shoulder 47 is taken by a depending lug 49 at the fore part of the receiver 2. The guide-rod 48 is removably held in position as by a pair of pins 50 having enlarged intermediate portions 51 and the opposite ends of which, as best seen in Fig. 6, are received in recesses provided respectively in said receiver lug 49 and in the rear end of the guide-rod. These pins are anchored in a removable lubricating and dirt-excluding pad 52 as by means of a clip 53, the pad being shaped to conform to the overlying portion of the barrel.

It will be seen that the action spring 46 and its guide-rod 48 may be demounted merely by forcing the guide-rod forwardly sufficiently to disengage its rear end from the pins 50. For convenience in disassembling, a pin or heavy wire of suitable size may be inserted through the registering apertures 40*a* in the spring housing, through corresponding apertures in the guide-rod, and between adjacent coils of the spring, thus confining the spring between the inserted pin and the shoulder 47 at the rear of the guide-rod and retaining it in position on the latter.

The action slide has formed near the rear end of each fork portion an upstanding lug 54, Figs. 20 and 21, each having a longitudinal rib 55 slidably received and guided in corresponding grooves 56 in the side walls of the receiver; see Figs. 16 and 18.

The breech block, and its lock, to be described, and their relation to the action slide in different positions of the latter are illustrated in Figs. 28 to 39. Referring to said figures, the breech block is indicated as a whole by the numeral 60. It is a substantially symmetrical, elongated, rectangular element having an approximately axial bore for the reception of a firing pin 61. The breech block is actuated by the action slide, and is so associated with the latter that at certain times it travels with the slide while at other times the slide is permitted to move relatively to the block.

In addition to the previously mentioned upstanding lugs 54 on the slide forks the latter also have, rearwardly thereof, a second pair of upstanding lugs 62. On the opposite side faces of the block at their lower rear portions, are projections 63, respectively received between the lugs 62 and 54 on the corresponding fork of the action slide. The spacing of the lugs 62 and 54 is greater than the extent of the block projections 63 lengthwise the gun, said excess spacing representing the relative longitudinal movement between the block and the action slide which occurs during locking and unlocking of the block.

In Fig. 28 the block and slide are shown in forward and locked position. In Fig. 30 they are seen in the same forward position, but with the block unlocked from the receiv-

er. By comparison of said figures it will be noted that in Fig. 30 the action slide has moved rearwardly with respect to the block to the full extent of the relative movement permitted between them, carrying the rear lugs 62 out of contact with the block projections 63, from the previously contacting position shown in Fig. 28, into a position wherein the forward lugs 54 of the action slide engage said block projections, in readiness to carry the block to the rear, to open the breech. In said initial rearward movement of the action slide, the rear faces of said lugs 62 engage corresponding portions of the head 113 of the firing-pin 61 and thereby retract the firing-pin within and relatively to the block, into the relative position with respect to the block corresponding to that shown in Fig. 9.

The breech block 60 is guided in its movements in the receiver, in addition to the guiding contributed by the ribs 55 already mentioned, by the longer ribs 64, one at each side, slidable in ways 65 in the opposite inner faces of the receiver, see Figs. 16 and 17, and also by means of its flanged top portion 66 which moves upon the inwardly extending ribs 67 on the upper side walls of the receiver, see Fig. 15, and below the cross portion 68 of the receiver. The firing-pin head 113 also has lateral guide portions, see Fig. 9, in alignment with the ribs 64 of the block and the ways 65 of the receiver.

At the forward end of the block are a plurality of locking lugs 70, herein four, substantially symmetrically disposed about its axis, there being upper and lower lugs at each side, whereby the block is positively held in closed position for firing.

For positively locking the breech block 60 in breech-closing position I have provided, in cooperation with its locking lugs 70, a transversely, and herein vertically, movable lock 71. As best seen in Figs. 28 to 34, this lock is a solid metal element of general U form as viewed in plan; see particularly Fig. 31. The forward portion of the receiver 2, see particularly Figs. 14 and 15, is formed to receive this lock and support it for transverse or vertical movement while retaining it against movement lengthwise the receiver. Said lock 71 has on its opposite outer rear portions the heavy locking ribs 72, 72 slidably received in correspondingly shaped and proportioned locking grooves 73 in the side walls of the receiver. At the upper fore portion of the lock, at the base of the U, is a forwardly projecting shoulder 74, the under face of which constitutes a stop to determine the lowermost or locking position of the lock, in which position said shoulder 74 seats on a correspondingly shaped ledge 75 at the front of the receiver; again see Fig. 15. In the form illustrated the top fore portion of the receiver is provided with an upstanding wall or rim 76 which encloses the upper portion of the lock, excluding dirt and protecting the parts.

The lock 71 is provided internally with locking members 77, 77 etc., see Figs. 32 and 34, in like number and similarly disposed as the locking lugs 70 of the block 60. The upper pair of lugs 77 of the lock are spaced above the lower pair sufficiently to permit the corresponding lugs of the block to move forwardly between them, while the lower lugs 77 of the lock are likewise spaced above the ledges 78 at the opposite inner faces of the lower main portion of the lock adequately to receive the lower lugs 70 of the block 60. In the closing movement of the breech block 70 it is carried forward by the action slide 41 until its locking lugs are in advance of the corresponding lugs 77 of the lock 71. The latter is then caused to move transversely, herein downwardly, bringing the respective lugs into longitudinal alignment, thus securely and symmetrically locking the block ahead of the lock and through it to the receiver, as in Fig. 28. The lock 71 includes a pair of downwardly projecting legs 79 receivable between the two side members of the fork action slide, and having outturned toes 80 at their lower portions adapted to serve as stops to limit the upward movement of the lock.

For effecting the transverse, vertical locking and unlocking movements of the lock 71, suitable cam connections with the action slide are provided. Referring particularly to Figs. 28 to 34, in the present instance the lock has integrally formed at its outer lower side portions the cam lugs 81, 81 each having an inclined rear or locking face 82 and a similarly inclined forward or unlocking face 83. These lugs cooperate with similarly formed cam formations or recesses 84 in the outer faces of the respective fork portions of the action slide.

By reference to Fig. 29 it will be seen that the intermediate and forward parts of the action slide forks have a height corresponding to the distance between the underfaces of the cam lugs 81 of the lock and the toes 80 at the lower portion of the latter. During opening and closing movements of the breech mechanism by the action slide, the lock 71 is elevated as seen in Fig. 29 also in Fig. 30, during which times the lock seats on the upper edges of the fork sides. The locking cam faces 85 of the cam formations 84 of the action slide project upwardly beyond the intermediate height of the action slide forks. Assuming now that the breech mechanism is moving from its open position of Fig. 29 to its intermediate or prelocking but full forward position as in Fig. 30, it will be seen by reference to said Fig. 30 that the upper portion of the locking cam faces 85 of the slide take against the rear

locking faces 82 of the cam lugs 81 of the lock, and that continued forward movement of the slide will cause the lock 71 to be drawn down into locking position, as in Fig. 28, since the lock is restrained from longitudinal movement.

Reversely, in unlocking subsequent to firing, starting from the full closed and locked position of Fig. 28, the lower forward unlocking cams 86 of the action slide cam formation 84 abut the unlocking cam faces 83 of the cam lugs 81 of the lock, whereby rearward movement of the slide lifts and frees the lock from the block 60.

To effect the described locking and unlocking movements of the lock, it will be understood that a relative movement takes place between the action slide and the block proper at the beginning of the rearward or recoil action and again at the close of the return forward or counter-recoil action. As previously noted, the extent of this relative movement is indicated by the excess spacing of the lugs 62 and 53 of the action slide above the length of the side lugs 63 on the block.

To permit this relative movement, and to cause it to occur at the desired times, I have provided a releasable operative connection between the slide and the block. For this purpose I herein employ a latch or action connecting element or action plate 90 of general yoke shape which straddles and seats on the block and is guided in recesses therein for transverse vertical movement relative to the block. In its down position, as in Figs. 29 and 30, the top or cross portion of said latch is received in a cross recess 91 in the upper face of the block; see Fig. 2. The latch may be further positioned by a pin 92 projecting downwardly from its cross portion, and, in the down position of the latch, extending through a corresponding aperture 93 into the bore of the block, where it cooperates with the firing pin in a manner to be explained.

The arms of the latch 90 have at their lower portions lateral projections 94 each formed with an upper cam surface 95, for positively drawing down the latch, and a lower front-facing cam surface 96 for lifting it, at the proper times. The two forks of the action slide have notches 97 in their upper portions, (see also Fig. 21) to the rear of the lock-operating cam formations 85, 86, said notches having front cam walls 98, see Fig. 37, similarly inclined as and cooperating with the lifting cam faces 96 of the latch. The rear walls 99 of said slide notches 97 are adapted to abut the lower rear faces of the latch projections 94, as in Fig. 29.

When the latch 90 is in down position as in Figs. 29 and 30, the action slide and block are operatively connected for movement together; when the latch is elevated as in Fig. 28, being lifted out from the notches 97 of the slide, the block is disconnected from the slide, permitting the latter to move relatively to it. It should be noted, however, that in opening the block the action slide transmits the opening effort directly to the block, through the direct engagement of the lugs 54 on the slide with the lugs 63 on the block, in which position said parts are shown in Fig. 30, in readiness for retraction of the block.

Assuming now that the breech mechanism is closed and locked, as in Fig. 28, the latch being elevated and seating upon the underlying top surfaces of the action slide, the latter first moves rearwardly relative to the block, which is held by the lock. During said relative movement the unlocking cam faces 86 of the action slide engage the unlocking or forward faces 83 of the lock cam 81, thus lifting and unlocking the lock. The block is now free to move rearwardly. During the immediately following first portion of the rearward movement of the block the upper cam surfaces 95 of the latch, which latter is still elevated, engage beneath correspondingly inclined forwardly facing cams 100 on the receiver, see Figs. 15, 16 and 17 and particularly Fig. 16, formed at the adjacent fore portions of the bottom walls 65*a* of the receiver ways 65. This cooperative engagement of the surfaces 95 and 100 causes the latch to be positively depressed into the notches 97 on the action slide forks. The lateral projections 94 of the latch 90 are then received and guided below said bottom walls 65*a* of the ways 65 in the receiver; again see Figs. 16 and 17. In this manner the latch 90 is held in its depressed position, to be ready to connect the action slide and block, during their subsequent return movement, until the return of the parts to a position generally corresponding to that of Fig. 30.

In the full open position of the breech closure, as in Fig. 29, the operating lugs 63 of the action slide remain in engagement with the side lugs 54 of the block, similarly as in Fig. 30, representing the start of the opening action, after the unlocking. Referring again to Fig. 29, it will be understood that, were it not for the latch 90 connecting the block and action slide, the latter, on starting its return or counter-recoil stroke, would immediately move forward relative to the block, leaving no room for subsequent relative movement to effect the locking of the block at the end of the closing action. The desired relative movement between the slide and block, at the end of the return stroke and for the purpose of effecting locking, is thus in effect delayed by the latch 90 until the proper time, namely, when the block has been carried fully forward. The forward or closing movement of the block is

transmitted to it from the action slide through the latch, by the engagement of the rear walls 99 of the slide notches 97 with the lower rear portions of the latch. Thus it is only during the spring-closing of the block that the latch is called upon to perform any work. At the extreme end of the closing travel of the block the lateral projections 94 of the latch ride out from under the receiver portions 65*a*, permitting the latch to rise under the cooperative camming action between the front or cam walls 98 of the slide notches 97 and the cam faces 96 on the latch. Thus the action slide is then free to move forward relative to the block, and in doing so simultaneously draws down the lock to its locking position of Fig. 28, in readiness for firing.

The forward or return movement of the action slide, under the influence of its return spring, is limited by the stops 101, one on each fork of the slide, see particularly Figs. 20 and 21, which bring up against corresponding abutments 102 at the lower fore part of the receiver.

Extractor; firing pin; breech cap

Suitable extracting means is provided, herein carried by the breech block. Referring to Figs. 2, 9, 36 and 39 the extractor 105 as illustrated comprises a substantially rectangular piece vertically movable in guides 106 in the front face of the block. It is normally held down by the overlying front end of the extractor spring 107 seated in a longitudinal recess in the top of the block and having its rear end releasably anchored beneath a U-shaped flange 108 overhanging the rear part of said recess. The extractor spring may readily be removed by sliding it forwardly sufficiently to disengage its rear portion from beneath said flange 108. The extractor is desirably offset slightly to one side of the axis of the block, herein toward the right side of the gun, as seen in Fig. 39, whereby, in cooperation with the ejector, to be described, the empty shell is thrown out upwardly and to one side. The lower part of the extractor is formed with an arcuate lip 109 having a beveled front edge, adapted to engage over the head of a cartridge and in the channelure thereof.

In the present instance I have provided a firing member in the form of a pin receivable within the breech block and adapted for longitudinal movement relative thereto. Referring particularly to Figs. 2, 9, 14 and 15, the pin 61 is an elongated hollow member receivable in the correspondingly formed bore 111 of the breech block and having a nose 112 for detonating the cartridge primer. At the rear of the firing pin is a substantially rectangular head, seen in plan in Fig. 14. The lower portion of said head 113 is engageable behind the sear, to be described, in the manner shown in Fig. 2, to hold the firing pin cocked.

The spring means for advancing the firing pin to fire the gun, as best seen in Figs. 2 and 14, herein comprises a two-part coil spring, the forward spring 114 bearing between the front wall of the firing pin and a collar 115 on a floating sleeve 116 received by an elongated stationary stud 117 in the manner best seen in Fig. 19. The front end of said stud is threaded as at 118 for passage through the rear wall of the sleeve 116, which threaded means retains these two parts against longitudinal separation without intentional unscrewing of the sleeve from the pin. The stud 117 projects forwardly from an arm 119 rising from a plate 120 which seats on the rear cross portion 2*a* of the receiver 2 and has at its front portion a pair of depending hooks 121 which engage over the front edge of said receiver portion 2*a*, releasably anchoring the plate in position thereon, assisted by a pin 122 projecting up from the receiver portion 2*a*, see Figs. 15 and 16, and seating in a recess in the under face of the plate.

The second or rear portion 123 of the firing pin spring surrounds the horizontal stud 117 and the rear part of the sleeve 116, bearing between the collar 115 of the latter and the arm 119 of the plate 120. The described firing pin assembly is readily dismounted, after removal of the breech cap, to be described, merely by tilting and moving forwardly the plate 120 by its thumb piece 120*a* to disengage it from the receiver portion 2*a*, whereupon the entire pin assembly may be withdrawn from the gun. In such dismounted condition, the two springs normally remain upon the sleeve 116, and the latter is retained in engagement with the pin 117 by reason of the threads 118 thereof, but these parts may readily be completely disengaged when desired.

The firing pin 61 has a slot 124 in its top wall, into which the pin 92 of the yoke-like latch 90 on the block, previously described, is received; see Fig. 9. This pin and slot arrangement, in addition to aiding to guide and center the pin and prevent turning thereof serves as a safety feature to prevent premature firing of a cartridge if for any reason the breech block should not be completely closed and locked, under which conditions the latch 90 would be down, as in Fig. 9, its pin 92 then preventing full advance of the firing pin, by engagement with the rear end of the slot 124.

The rear of the receiver is completely closed in by a removable receiver cap 125, seen in Figs. 2, 9, 11, 12 and 14. As seen separately in Figs. 11 and 12, the receiver cap is a substantially flat plate-like member having a down turned rear wall 126

herein affording a rear sight base 126*a*, and also having side walls 127. At its front end is a lip 128 receivable beneath the rear edge of the breech portion 68 of the receiver, as in Figs. 2 and 9. Ears 129 at the cap front co-operate with adjacent upright portions of the receiver walls to position the cap transversely.

At the base of the back wall 126 of the receiver cap is a rearwardly disposed shoulder or ledge 130 adapted to seat beneath the upstanding hook members 131 rising from the frame 135 of the trigger mechanism, to be described; see Figs. 40, 41 and 42, in addition to Fig. 2. On the top face of the receiver cap is a T-shaped spring metal member 132 removably held thereon beneath opposed overhanging ribs 133.

In assembling, the front edge of the receiver cap is hooked beneath the receiver bridge 68, and the cap is swung down in a pivotal manner, while pressing it forwardly against the firing pin springs, thus moving the firing pin spring seat or plate 120 slightly forwardly, until the shoulder 130 of the cap is brought below the stationary hooks 131. Release of the forward pressure on the cap then permits the spring seat or plate 120 to return rearwardly and engage the shoulder 130 of the cap beneath said hooks. At the same time the T-shaped spring member 132 at the top of the cap rides down off the receiver bridge 68, by which it has previously been held elevated, into abutting position behind the latter, thus preventing forward movement of the cap and securely anchoring it in closed position. Removal of the receiver cap is readily effected by a reverse procedure, first lifting the front of the T-member 132 from behind the receiver bridge 68. With the cap opened or removed the breech-closure unit is bodily removable from the receiver, the receiver and barrel being then wholly exposed at the rear in direct prolongation of the axis of the bore.

Firing and safety mechanism.

Suitable means is provided for controlling the firing of the piece, herein arranged for semi-automatic or single-shot operation, as generally desirable for infantry purposes, my present invention being particularly useful as a military weapon. It will be understood, however, that features of the present invention are applicable to other than semi-automatic rifles and that the gun as herein described may readily be adapted for full-automatic or other firing.

The firing mechanism is seen in cocked position, in its relation with the gun as a whole, in Fig. 2, and in fired position in Fig. 9. Detail and assembly views appear in Figs. 40 to 49 inclusive.

Referring to said figures, and first to Fig. 45, the trigger assembly or firing mechanism as a whole constitutes a unit structurally independent of other parts. It is self-contained upon a frame 135 adapted to be removably anchored in the gun stock by means of a front post 136 and a rear post 137. The sear 138 is pivoted at the front part of the frame, as at 139. As seen separately in Fig. 46, it has at its rear end a U-shaped spring nose 140 adapted to engage in front of the firing pin head to cock the same, as in Fig. 2. At the front part of the sear, beneath its pivot point, is a lateral lug 141, the rear face of which is engaged by the means to be described, to swing the sear downwardly to draw down its nose 140 and release the firing pin. Downward movement of the sear is limited by a pin 142.

The trigger 143 having a finger piece 144 is pivoted on the frame as at 145. It includes an upwardly and forwardly extending dog 146, to the rear of its pivot, and a front finger 146*a*.

Intermediate the trigger and the sear is a connector 147 adapted operatively to connect or disconnect said parts. It herein comprises an elongated member having an open bearing 148 at its rear whereby it is fulcrumed upon a stud 149 at the rear of the frame 135. The connector also rests upon a second cross stud 150 in the frame and has a notch 151 seating over said stud and of a length to permit the desired longitudinal movement of the connector.

At its lower front end the connector is formed with a forward projection 152 adapted to engage behind the lug 141 of the sear, when the parts are in position for firing, as in Figs. 2 and 41. The connector also has a rearwardly disposed shoulder 153 which, at the time last mentioned, lies immediately in advance of the trigger dog 146. Accordingly, with the parts positioned as in Fig. 41, a rearward pull upon the trigger causes its dog 146 to engage the shoulder 153 of the connector 147, moving the latter bodily forward. The front projection 152 of the connector presses forward the lug 141 of the sear, drawing down the latter and releasing the firing pin.

Means is preferably included to prevent a "repeat" action, even though the trigger be held "pulled", and which makes it necessary first to release the trigger before the gun can again be fired, as well as preventing operation of the trigger mechanism to fire the gun while the breech is open. As seen in Figs. 42, 43, 44 and particularly in Fig. 43, the connector 147 has a depending step-like portion 154 from which a spring metal arm 155 extends forwardly. On this arm is a cam 156 which is engaged and depressed by the action slide 41 as the latter comes back during opening of the breech. This causes

the connector 147 to be lowered, substantially into the position shown in Fig. 43, in which its front projection 152 is out of line with the sear lug 141 and its rear shoulder 153 cannot be operatively engaged by the trigger dog 146. The relation between the cam 156 and the action slide is such that the connector is thus held depressed at all times when the breech is open or partly open.

Upon release of the finger pressure upon the trigger, the latter, and the connector 147 are returned to their normal position, assuming the breech is closed. In the present instance, the entire spring means of the firing mechanism is comprised in a single spring element, seen separately in Fig. 49 as a triple spring member 157. One outer leaf of this spring, at the bottom in Fig. 49, forms the trigger spring 158, the center leaf 159 acts on the connector, while the opposite outer leaf 160 constitutes the sear spring. The spring as a whole includes a down turned rear portion received in a seat 161 in a foot 162 depending from the frame 135; see Figs. 41 and 45, also Figs. 2 and 9. The trigger spring 158 bears downwardly at its forward end upon a pin 163 projecting laterally from the trigger, thus tending to move the trigger dog 146 downwardly and rearwardly and to swing its operating or finger piece 144 forwardly to its position as in Fig. 41. The sear spring 160 bears upwardly beneath the sear nose 140, as well seen in Figs. 2, 9 and 41. The connector spring 159 presses upwardly and rearwardly against the front face of a downwardly extending shoulder 164 on the connector, thus tending both to elevate it and to move it rearwardly, as does also the trigger spring 158, through engagement of the front finger 146*a* of the trigger with a notch 154*a* in the depending portion 164 of the connector.

The ejector 165, as herein illustrated, is formed as a part of the connector; see Figs. 41, 43 and 44, and also Figs. 2 and 9. It consists of an integral upwardly projection or nose at the fore end of the connector. A correspondingly shaped slot 166 is formed in the bottom of the breech block to permit the latter to ride over the ejector. As the breech block comes back after firing the extractor 105 draws out the empty shell from the firing chamber, carrying it rearwardly until it strikes the ejector 165, which causes the shell to be kicked out upwardly and sidewise substantially as shown by the dotted lines in Fig. 9. This ejecting action also affords a positive rearward or return movement for the connector 147.

In conjunction with the described firing mechanism positive safety means is desirably employed, by which the operative relation between the trigger and sear may be interrupted, and so held, herein in a similar manner as it is automatically done by the engagement of the action slide 41 with the cam 156 on the connector. Said safety means herein also positively locks the sear in cocking position, allowing the gun to be safely carried in such condition, even with a cartridge in the firing chamber.

Referring still to Figs. 40 to 48, this safety means comprises a one-piece member 167, seen separately in Fig. 48. At one end, the right in Fig. 48, said safety member 167 is formed with a lateral finger-piece 168 projecting externally of the gun sufficiently to be engaged by the operator's finger to move the safety member lengthwise, thereby to apply or release the safety. At its opposite end is an inwardly extending boss 169 centrally of which is a reduced portion or cam 170 extending inwardly through a key-hole slot 171 in the firing mechanism frame 135, see Fig. 45, across beneath the sear 137 and into a cam and locking recess 172 in the connector 147. By reference to Fig. 40 it will be noted that the outer part of the boss 169 of the safety, adjacent the body of the latter, is also of reduced diameter, corresponding to that of the cam 170, thus permitting the safety to be entered through the larger portion of the slot 171 in the frame 135, Fig. 45, and subsequently to be moved lengthwise along the frame.

The cam member 170 of the safety is formed with a rearwardly facing cam surface 173, see Fig. 48, and the lower wall of the recess 172 in the connector is provided with a cooperable cam 174, Figs. 42, 43 and 44. In Fig. 44 the parts are shown in "safe" position, that is with the safety "on". By comparison with Fig. 43 it will be seen that the safety member 167 has been drawn rearwardly, causing the cam face 173 of the safety cam 170 to engage the cam 174 of the connector, depressing the latter into the position of Fig. 44, wherein the safety cam 170 lies in the reduced rear portion of the connector slot 172, thus positively locking the connector in down or inoperative position. It will also be seen in Fig. 44 that the boss 169 of the safety directly underlies and is in contact with the sear 137, thus also positively locking this member up in cocking position, preventing discharge of the gun by jarring or the like.

Means may be provided for releasably holding the safety 167 in "off" or "on" position. Referring to Fig. 48, such means herein comprises a depending finger 175 at the front of the safety, having a detent 176 adapted to snap into one or the other of a pair of adjacent grooves 177 in the firing mechanism frame 135; see Fig. 45. Seating of the detent 176 in the forward groove 177, that at the right in Fig. 45, locates and holds the safety in "off" position, while the

rear or left hand groove 177 in said figure serves similarly for the "on" position.

Feed mechanism

As clearly seen in Fig. 15, the receiver 2 is open below the position occupied by the closed breech block and, referring to Figs. 2; 3 and 9, the stock is formed at this point to afford a magazine or cartridge chamber which in the present instance is adapted for the reception of a cartridge clip or packet 180, see Fig. 10, holding a plurality of stacked cartridges.

The magazine assembly, which is a separate unitary mechanism in and of itself, comprises a sheet metal housing or magazine chamber 181, Figs. 2, 3 and 9, of a length and width to receive the cartridges and packet, and of a generally box-like form including front, rear and side walls. This magazine housing 181 is secured in position as by a rearwardly extending foot 182 on its back wall, underlying the front post 136 of the trigger frame 135 and the adjacent solid portion of the stock, where it is secured as by the machine screw 183 tapped into the post 136. This rear foot 182 of the magazine housing also assists to hold in place the trigger guard 184, the front end of which is clamped between it and the post 146. The rear end of the trigger guard is secured to the stock and trigger frame as by a second screw 185 tapped into the rear trigger frame post 137; Figs. 2 and 9. A front foot 186 on the magazine housing underlies a solid portion of the stock and is fastened to it as by a screw. It will be noted that said two machine screws 183 and 185, the screw for the front foot 186 of the magazine, and a wood screw 187, Fig. 2, which holds a metal seat for the firing mechanism frame in place in the stock, are the only screws in the entire gun, aside from the barrel set-screw 10 and the front collar screw 29, Fig. 4, neither of which latter need ever be removed during any ordinary use of the gun, which is also true of the other screw members. That is, it is rarely required to remove either the firing mechanism frame or the magazine housing, and the gun may otherwise be completely dismantled without touching any of said screws.

A packet 180 containing a stack of cartridges, herein ten, in double-row staggered relation, see Fig. 10, is adapted to be introduced from above downwardly through the receiver and into the magazine wherein it is releasably held and from which it is adapted subsequently to be ejected, when empty. In this connection means is desirably provided for holding the breech open after the last cartridge has been fed out of a packet.

Referring now to Figs. 2, 3 and 9, the lowermost cartridges in a packet seat on a follower 190 shaped to conform to the staggered arrangement of the cartridges, see Fig. 10, and adapted to be moved vertically upward through the magazine and through a contained packet 180 therein, to successively feed the cartridges into position for movement into the cartridge chamber by the advancing breech block. As seen in Figs. 2 and 9 said follower is pivotally connected at its rear end as at 191 to the back part of a lifter 192. A spring 193 intermediate the follower and lifter tends to separate them and to hold the follower in substantially horizontal position, the extent of separation being limited by a dog 194 at the extreme rear of the lifter.

The lifter is an elongated element or lever extending forwardly through a guide slot 181*a* in the front wall of the magazine 181 and fulcrumed at its front end by means of an open bearing 195 straddling a cross pin 196 fixed in the gun stock. Due to the length of the lifter 192 a powerful leverage is obtained for efficiently feeding the cartridges. The lifter is further guided in its movement by a cross pin 197 movable in a slot 198 in the left side wall of the magazine.

The lifter is actuated by a V-shape member 199 of flat spring metal including an upper leaf 200 having at its rear end a foot 201 upnderlying the lifter and urging it upwardly. The lower and longer leaf 202 of this lifter spring 199 is inserted in ways 203 at the base of the magazine housing, see Figs. 9 and 13, being slid into the latter from the front, whereby the spring is removably anchored in position. The under leaf 202 constitutes a bottom closure for the magazine and the fore stock.

Upward movement of the lifter and follower 190 is limited by the top of the slot 181*a* in the front wall of the magazine. When a full packet is loaded into the chamber, from above, it will be understood that the follower and lifter are depressed beneath the lowermost cartridge in the packet. In Fig. 10 they are seen in position as when a portion of the cartridges have been fed out of the packet.

A packet 180 is of general U-shape as seen in horizontal section or in plan, including a rear wall 180*a* and apertured sides 180*b* of approximately half the length of the cartridges. The packet sides have inturned cartridge retaining lips 180*c* at both top and bottom, and inturned vertical flanges 180*d* adapted to seat in the channelures of the contained cartridges C, the packets being desirably stamped or otherwise formed from a single piece of sheet metal. At substantially mid-height of the back wall of the packet is a notch or aperture 180*e* for cooperation with the nose 203 of a packet catch 204 pivoted on the rear wall of the

magazine as at 205, Figs. 2 and 9, and having a finger piece 206. A leaf spring 207 attached at its lower end to the base of the magazine housing tends to throw the nose of this latch forwardly, into its holding position as in Fig. 9. A packet as described, with its load of cartridges, may be inserted either end foremost, the catch aperture 204 being cooperable with the packet catch in either position, and since there is an even number of cartridges, and they are loaded into the packet, at the arsenal or elsewhere, with the stack at the same selected side of the packet uppermost, depending on the formation of the follower 190, the lowermost cartridges accordingly will always seat properly on the follower. In a related application I disclose and claim lifter and follower means operable with packets loaded with the top cartridge either at the left or at the right.

It will be understood that a full packet is loaded into the magazine from above and depressed until the catch 204 snaps into the packet aperture 180*e*. The packet and contents are thus held down in the chamber or magazine, but a full or partly emptied packet map readily be removed by inverting the gun and releasing the catch by manipulation of its finger piece 206, whereupon the packet and any contained cartridges may be dropped out or withdrawn in the reverse manner from which they are inserted.

The described feed mechanism preferably also includes means whereby the breech is held open after the last cartridge has been fed from the packet and fired. Referring to Figs. 2 and 13, I have provided for this purpose a breech catch 210 slidably supported at the outer face of one side wall of the magazine housing 181, as by means of a slot 211, herein in the right hand wall of the latter, and a cooperating stud 212 on the breech catch. A relatively light coil spring 213 secured at its lower end to the magazine and at its upper end to the breech catch tends to hold the latter down, in its position substantially as in said Figs. 2 and 13. At its upper end the breech catch 210 is formed with a rearwardly directed hook 214 which lies above and in the path of the cross pin 197 of the lifter 192.

In Fig. 2 a single cartridge remains to be fed from the packet. When the lifter reaches its uppermost position, attendant upon feeding out of this last cartridge, it rises into contact with the hook 214 of the breech catch and bodily lifts the latter. This causes a shoulder or catch proper 215, Figs. 2 and 13, on the breech catch to be raised into the path of the action slide, where it will engage in the notch 216, see Figs. 21 and 23, in the bottom of one fork, herein the right fork, of the action slide, as the latter comes back into breech opening position. The slide and breech are thus automatically caught and held back by the elevated catch member 215. The breech catch desirably is provided with a lateral operating piece 217, by manual depression of which the slide and block may be released to allow them to close.

In the illustrated construction the empty packet is ejected, through the bottom of the magazine, in the process of inserting a fresh packet. The bottom of the magazine is open below the packet but, as best seen in Figs. 2 and 10, is normally closed by a pair of opposed spring doors or flaps 220. One such flap or packet-ejection door is mounted on each side of the magazine housing, as by the pins 221 projecting from the latter and received in corresponding apertures in the doors. These doors are held in closed position, as shown by the full lines in Fig. 10, by flat spring members 222 fastened upon the outer sides of the magazine and overlying the upper portions of the doors, as clearly seen in Fig. 2. The doors may be bodily removed from the magazine housing merely by turning them outwardly sufficiently to disengage them from the pins 221.

As a fresh packet is thrust down into the magazine, it automatically pushes out and ejects the empty packet, which cams open the ejection doors 220 in the manner indicated by the dotted lines at the bottom of Fig. 10, and is expelled. The doors immediately spring closed, sealing the bottom of the magazine against entrance of dirt and the like. It will be seen by reference to Figs. 9 and 10 that the underleaf 202 of the lifter spring extends rearwardly through substantially the entire length of the magazine and forms in effect a bottom or closure therefor, except for the relatively narrow areas at each of its rear sides necessary for the downward passage of the packet sides, which openings are effectively closed by the spring doors 220.

Hand operating mechanism

The gun as above described is semi-automatic in its operation, automatically opening, loading and closing so long as a cartridge remains in the packet in the magazine, requiring only a pull of the trigger to effect successive shots up to the capacity of the pocket, or, if desired, plus one cartridge carried in the firing chamber. As previously noted, it may be adapted for full automatic operation, including actual firing, if desired. In addition, means is desirably provided whereby the gun may be operated manually, in the manner of the ordinary Springfield rifle, should the gas mechanism for any reason become disabled or if it is desired to dispense with the latter, and also to provide for manual opening of the breech when required.

For this purpose I have provided suitable means including a hand actuator 230 illustrated by way of example in Figs. 22 to 27. Referring to said figures, the receiver 2 has along one side, herein its right side, see also Figs. 14 and 15, a dovetailed rib 231. The hand actuator 230 is mounted on this rib, for sliding movement, by means of a correspondingly formed groove 232, see particularly Figs. 26 and 27, said actuator having a finger piece 233 by which it may be manipulated. The hand actuator is an elongated piece or slide, seen in full side elevation in Figs. 22 and 23. A stop 235, at its upper forward portion is engageable with a fixed part of the receiver to limit its forward position. Along the other face of the actuator is a leaf spring 236 held beneath opposing ears 237 and having at its forward end a latch 238, adapted to snap over a lateral lug 231*a* at the front end of the receiver rib 231, as seen in Fig. 14, releasably to hold the hand actuator in its normal inoperative or forward position.

The actuator is recessed at its under forward portion to accommodate a dog 239 vertically pivoted thereon as at 240; see particularly Fig. 24, a bottom plan view of the actuator. Thus the dog is movable laterally of the gun, toward and away from the adjacent right hand fork of the action slide 41. The spring 236 includes a finger 241 which presses against the outer face of the dog 239, urging it inwardly, toward a hand cocking notch 242 in the adjacent part of the action slide 41; see also Fig. 21.

In the normal position of the parts, and with the breech closed, a lug 239*a* on the dog 239 lies slightly in advance of said cocking notch 242 and is held out of the latter, as shown in Fig. 22. When it is desired to open or operate the gun manually, the operator grasps the finger piece 233 and draws the actuator rearwardly. During its first rearward movement, the lug 239*a* of the dog 239 comes opposite and is forced into the cocking notch 242 by its spring 241, the hand actuator or lever 230 being positively retained in said engaged position during its sliding movement by retention of said dog in the cocking notch through engagement of the rear portion of the dog in an undercut portion of the rear wall of said notch; see Fig. 22 and particularly Fig. 23. Continued rearward movement of the actuator accordingly draws back the action slide, unlocking and opening the breech in the same manner as would be done automatically by the action slide 41 under gas operation. On subsequent release of the hand actuator, it returns forwardly with the action slide and breech mechanism, the dog 239 being automatically cammed out of the cocking notch, by reason of its inclined front face 239*b*. The latch 238 rides over the lug 231*a* on the receiver and thus the parts return to their normal position as in Figs. 14 and 22. Thus it will be seen that while the gun may be operated manually, the hand actuator, under normal gas operation, remains at rest, whereby any projecting portion thereof affords no liability of injuring the operator.

As seen in Fig. 23 a second notch 243 may be provided on the action slide, forwardly of the previously mentioned notch 242, for cooperation with the dog of the hand actuator at certain times. When the last cartridge has been fed and fired the breech is caught and held open by the breech catch 210 described. This catch may be released to close the breech, whether or not a fresh packet is inserted, by depressing its operating piece 217. In accordance with my invention such release of the breech, if a fresh packet is inserted, may optionally also be effected by manipulation of the finger piece 233 of the hand actuator 230, which may be more convenient, distract the operator's attention from the target less, and so make for more rapid fire. It will be understood that when a fresh packet is inserted, the cartridge lifter mechanism is depressed and hence the breech catch is no longer held up in breech-holding position by the lifter mechanism, but remains in said position because of the forward pressure of the breech mechanism against it, under influence of the action spring 46. If this tension is taken off the breech catch, it will drop or be drawn down by its own relatively light spring 213, out of holding position.

The second notch 243 in the action slide, above referred to, is provided for this purpose. In Fig. 23, the hand actuator 230 is shown in dotted line in its normal, forward position, the breech being open. Assume now that the breech catch, shown dotted, is holding the breech open. The lug 239*a* of the dog 239 of the hand actuator then lies in said second notch 243. Assume also that a fresh packet has been inserted. If now the operator grasps the hand actuator and draws it slightly rearwardly, the breech mechanism and action slide 41 are moved rearwardly, by reason of the engagement of the lug 239*a* in said second notch, the breech catch is relieved of the forward tension upon it, and moves down. As the operator releases the hand actuator, the breech accordingly closes. The necessary movement of the hand actuator is but slight and can readily be effected by the forefinger of the operator's hand which has just inserted the packet, so that the gun may be reloaded and the breech closed substantially in a single operation. The same is true if the breech has been opened manually, and is then loaded, rear pull on the hand actuator freeing the breech, for forward movement, but in that instance through engagement of the op-

erator dog in the front cocking notch 242 of the action slide. When the second notch 243 is used in the manner described, the lug 239*a* of the dog 239 is automatically moved back out of said notch, to allow the action slide to move forward to its closed position as in Fig. 22, by engagement of the inclined front face 239*b* of said lug with an appropriate cam 244 on the receiver; Figs. 14 and 15.

My invention is not limited to the particular embodiment thereof herein shown and described, its scope being pointed out in the following claims.

I claim:

1. In an automatic gun having a receiver, a barrel and breech mechanism, in combination therewith, a gas port in the fore part of the barrel, a piston, an enclosing housing in which the piston is reciprocable, and means mechanically connecting the piston and the breech mechanism, said piston having a hollow gas-receiving portion for substantially its entire length and being open at its front end, and having a gas port at approximately mid length registering with the barrel port in the forward or firing position of the parts, said piston port being opened to atmosphere at or near the rear or fired position of the piston, and said housing having a port normally closed but opened to atmosphere by the passage of the piston to the rear thereof, during or just prior to the opening of said piston port, the cubic content of the hollow piston portion being at least one-half that of the bore of the barrel.

2. In an automatic gun, a receiver, a barrel, breech mechanism, and gas-operable actuating means mechanically associated with the breech mechanism, including a hollow elongated piston ported at its mid-length portion to receive gas from the fore part of the barrel and having a cubic content not less than approximately one-half that of the barrel bore.

3. In an automatic gun, a receiver, a barrel, breech mechanism, and gas-operable actuating means mechanically associated with the breech mechanism, including a hollow piston to receive gas from the fore part of the barrel and having a cubic content not less than approximately one-half that of the barrel bore, and provisions for exhausting the gas from the piston substantially simultaneously at longitudinally spaced points as the piston approaches its fired position.

4. In a firearm, a ported barrel, a gas-tube adjacent the barrel, having a port adapted to connect with the barrel port, a piston mechanically associated with the breech mechanism, and having a gas-port and a relatively large expansion-chamber, said piston adapted to coact with the gas-tube so as to provide, approximately at the end of its rearward stroke, a substantially complete exhaustion of the gas from the piston chamber.

5. In an automatic gun, in combination with a receiver, a barrel and breech mechanism; a gas tube, a hollow piston movable in the gas tube, having a port for the intake of gas from the fore part of the barrel, a removable front cap for the gas tube, an action slide connected with the breech mechanism, and interengageable lugs at the adjacent ends of the action slide and piston disconnectable by relative movement of the slide and the piston, whereby the latter is mechanically engaged with the action slide but may be dismounted upon removal of said gas tube front cap, without disturbing other parts.

6. In an automatic gun, in combination with a receiver, a barrel and breech mechanism; a gas tube, a hollow piston movable in the gas tube, having a port for the intake of gas from the fore part of the barrel, a removable front cap for the gas tube, an action slide connected with the breech mechanism, and interengageable lugs at the adjacent ends of the action slide and piston, whereby the latter is mechanically engaged with the action slide but may be dismounted upon removal of said gas tube front cap, without disturbing other parts, the gas tube also being readily demountable, and the gun being hand-operable in the absence of the piston and/or the gas tube.

7. In a gun, a receiver, a non-rotary breech block longitudinally movable therein, a lock movable transversely but held against longitudinal movement in the receiver, sets of locking lugs operable between the receiver and the lock and between the latter and the block, an action slide, cam connections between the slide and lock to shift the latter to unlocking and to locking position respectively at the beginning of the rear movement and at the end of the forward movement of the slide, and means operatively intermediate the slide and block to effect longitudinal movement of the latter, including a latch movable with the block and also slidable relatively thereto to permit relative longitudinal movement between the slide and block during said shifting of the lock but interconnecting the slide and block for movement in unison at other times.

8. In a gun having a receiver and barrel, a longitudinally movable non-rotary breech block, guides for the block on the receiver and adapted to hold the block against transverse movement, a transversely movable lock held against longitudinal movement in the receiver, an actuating element adapted to move the lock transversely and to move the block longitudinally, a yoke-like element movaby associated with the block, and co-operating means on the receiver for mov-

ing said yoke-like element operatively to connect and disconnect the block and the actuating element for movement in unison or relatively to each other respectively.

9. In a gun having a receiver and barrel, a longitudinally movable non-rotary breech block, guides for the block on the receiver and adapted to hold the block against transverse movement, a transversely movable lock held against longitudinal movement in the receiver, an actuating element adapted to move the lock transversely and to move the block longitudinally, and a transversely shiftable connecting and disconnecting element operatively intermediate the block and the actuating element, the block and said transversely movable lock having a like plurality of substantially rectangular cooperating locking lugs symmetrically disposed thereon and of major dimension and mass lengthwise the barrel, to resist shearing action.

10. In a gun having a receiver and barrel, a longitudinally movable breech block, an actuator therefor, a connecting element on and movable both with and relatively to the breech block operatively to connect and disconnect the block and actuator at certain times, a firing pin longitudinally movable in the block, and interengageable means between said connecting element and the firing pin.

11. In a gun of the class described, in combination, a receiver, a barrel, a reciprocating breech block, an automatically operated actuator element for controlling and operating the breech block, cartridge feeding means, a breech catch to hold open the breech when the last cartridge has been fired, a manual lever having a normal inoperative position but adapted to operate said actuator element, means whereby the breech catch may be released from breech-holding position by manipulation of said manual lever when a fresh cartridge supply has been inserted in the gun, and other means to release the breech catch.

12. In a gun of the class described, firing mechanism including a frame, a sear pivoted thereon, a trigger pivoted on the frame, a connector having connecting and disconnecting positions with respect to the trigger and sear, and cartridge ejector means at the fore part of the connecter.

13. In a gun of the class described, firing mechanism including a frame, a sear pivoted thereon, a trigger pivoted on the frame, and an elongated substantially horizontally disposed connector operatively interposed between the sear and trigger, said connector having rear and intermediate points of support on the frame and having a fore part engageable with the sear to actuate the same when in line therewith, the connector and its support being constructed and arranged to provide for bodily longitudinal movement of the connector for sear-actuating purposes, and vertical movement thereof for disconnecting purposes.

14. In a gun of the class described, in combination with a breech block, actuating means therefor, and a firing pin movable in the breech block, a sear to hold the firing pin cocked, a pivoted trigger, an elongated substantially horizontal connector element intermediate the sear and trigger operatively to connect or disconnect them, said element supported for longitudinal sliding movement by the trigger to effect release of the sear and also for vertical swinging movement, to disconnecting or connecting position, means compelling the trigger to be released to effect operative positioning of the connector and sear after each actuation, and automatic means associated with the breech actuating means to retain the connector element in disconnecting position during opening and closing of the breech.

15. In a gun of the class described, in combination with a breech block, actuating means therefor, and a firing pin movable in the breech block, a sear to hold the firing pin cocked, a pivoted trigger, a connector element intermediate the sear and trigger operatively to connect or disconnect them, said element supported for longitudinal sliding movement by the trigger to effect release of the sear and also for vertical swinging movement, to disconnecting or connecting position, means compelling the trigger to be released to effect operative positioning of the connector and sear after each actuation, automatic means associated with the breech actuating means to retain the connector element in disconnecting position during opening and closing of the breech, and means whereby automatic opening of the breech insures return of the connector to its original position longitudinally of the gun.

16. In an automatic gun, in combination with a receiver and barrel, a magazine adapted to receive a packet holding a plurality of cartridges, feed mechanism to move the cartridges successively from the packet for firing, and a packet ejection formation and closure means therefor arranged normally to close the ejection formation and openable for the passage of an empty packet upon insertion of a fresh packet.

17. In a gun of the class described, in combination with a receiver, a barrel, and breech mechanism, a chamber adapted to receive a plural-cartridge packet from above, a down exit for the emptied packet, and means normally closing said exit but openable by depressing the emptied packet to eject it.

18. In a gun of the class described, in combination with a receiver, a barrel, and breech mechanism, a chamber adapted to receive a

plural-cartridge packet from above, a down exit for the emptied packet, means normally closing said exit but openable by depressing the emptied packet to eject it, and means automatically reclosing said exit.

19. In a gun of the class described, in combination with a receiver, a barrel, a stock and breech mechanism, a chamber adapted to receive a plural-cartridge packet from above, a down exit for the emptied packet, and spring-pressed closure means for said packet exit, said chamber, exit and closure means contained within the stock.

20. In a gun of the class described, in combination with a receiver, a barrel, and breech mechanism, a chamber adapted to receive a plural-cartridge packet from above, a down exit for the emptied packet, and manually operable exit closure means normally spring closed.

21. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a magazine chamber below the fore part of the receiver, a cartridge follower vertically movable in said chamber, an elongated lifter-arm for the follower extending forwardly through the front wall of the magazine chamber and having an open bearing at its fore end, a pin in the stock providing a fixed pivot for said bearing, and spring means for said lifter-arm forwardly of the magazine chamber.

22. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a sheet-metal casing below the fore part of the receiver providing a chamber for a double stack of cartridges, a vertically movable follower in said casing, an elongated lifter pivoted at its rear end to said follower and projecting forwardly through a front opening in said casing, a fixed pivot for the fore end of said lifter substantially forward of the casing, guide means on the casing and a cooperating guide portion on the lifter, and a lifter spring in advance of the casing.

23. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a sheet-metal casing below the fore part of the receiver providing a chamber for a double stack of cartridges, a vertically movable follower in said casing, an elongated lifter pivoted at its rear end to said follower and projecting forwardly through a front opening in said casing, a fixed pivot for the fore end of said lifter substantially forward of the casing, guide means on the casing and a cooperating guide portion on the lifter, and a lifter spring in advance of the casing, said spring being removable and affording access to the fore part of the lifter, and said lifter and follower being demountable as one unit and said casing and supporting parts as a second unit.

24. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a sheet-metal casing below the fore part of the receiver and open at the top for the loading reception of a clip containing a plurality of stacked cartridges, said casing having a bottom opening for the ejection of an emptied clip, laterally yieldable closure means for said bottom opening, and spring means normally holding said means closed.

25. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a sheet-metal casing below the fore part of the receiver and open at the top for the loading reception of a clip containing a plurality of stacked cartridges, said casing having a bottom opening for the ejection of an emptied clip, closure members on the casing movable toward and away from each other to close or to expose said bottom opening, and spring means urging said members into closing position.

26. In a gun of the class described, in combination with a stock, a receiver and breech mechanism, a sheet-metal casing below the fore part of the receiver and open at the top for the loading reception of a clip containing a plurality of stacked cartridges, said casing having a bottom opening for the ejection of an emptied clip, movable closure means for said bottom opening, and spring means normally holding said means closed, said closure means constructed and arranged to be opened by and to release an emptied clip in the operation of inserting a fresh clip.

27. In a firearm, in combination, a receiver, a barrel, a reciprocating breech-bolt for the barrel, an automatically actuated reciprocating member for controlling and operating the breech-bolt, a manual lever wherewith to operate said member, said lever slidably supported on the receiver and being movable into an operatively engaged position or into a normal disengaged position wherein it remains at rest during automatic operation of the firearm, and means positively retaining said lever in engaged position during operative sliding movement thereof.

28. In a firearm, in combination, a barrel, a reciprocating breech-block for the barrel, a reciprocating member for controlling and operating the breech-block, and a manual lever wherewith to operate said member, said lever being guided for reciprocating movement and having an operative position and a normal inoperative position, and means automatically to return it to inoperative position at the end of a breech opening and closing movement thereof.

29. In a gun of the class described, a reciprocable breech closure including a block and operating means therefor, a magazine

below the path of the block, a cartridge loader or packet receivable in the magazine, lifter means to feed cartridges from the loader into the path of the block, a normally inoperative breech catch to hold the closure open, means on said lifter means to position the breech catch for holding engagement with the closure when the last cartridge has been fed out of the loader or packet, said means constructed and arranged to leave the breech catch in said holding engagement after insertion of a fresh loader or packet, and independent manual means to release said catch at the will of the operator.

30. In a gun of the class described, a barrel, a receiver therefor, a breech-closure unit including a reciprocating block carrying a firing-pin, an extractor and extractor spring and an action-connecting element movable relatively to the block, an openable receiver cap adapted to close the rear portion of the receiver, said breech-closure unit being bodily removable from the receiver in the open position of said cap, the receiver and barrel being then wholly exposed at the rear in direct prolongation of the axis of the bore, for cleaning and inspection purposes.

31. In a gun having a receiver and a barrel, a longitudinally reciprocable breech block, actuating means therefor, an element movably carried by the block and having different positions relative to it, as controlled by said actuating means, in closed and non-closed positions of the block, a firing pin longitudinally movable in the block, and a lateral projection on said block-carried element adapted to be engaged with or disengaged from the firing pin in non-closed and closed positions of the block respectively, to prevent fire-effecting advance of the firing pin in a non-closed position of the block.

32. In a gun of the class described, reciprocating breech closure mechanism including a breech block having a firing-pin longitudinally movable therein, a sear engageable with the firing-pin for holding it cocked or releasing it, a trigger, a disconnector element between the sear and trigger for operatively connecting or disconnecting them, and safety means for moving said disconnector element to and holding it in disconnecting position, and for simultaneously locking the sear in cocking position with respect to the firing-pin.

In testimony whereof, I have signed my name to this specification.

JOSEPH C. WHITE.