April 5, 1949. A. CORTE 2,466,577

BOLT MECHANISM FOR GUNS

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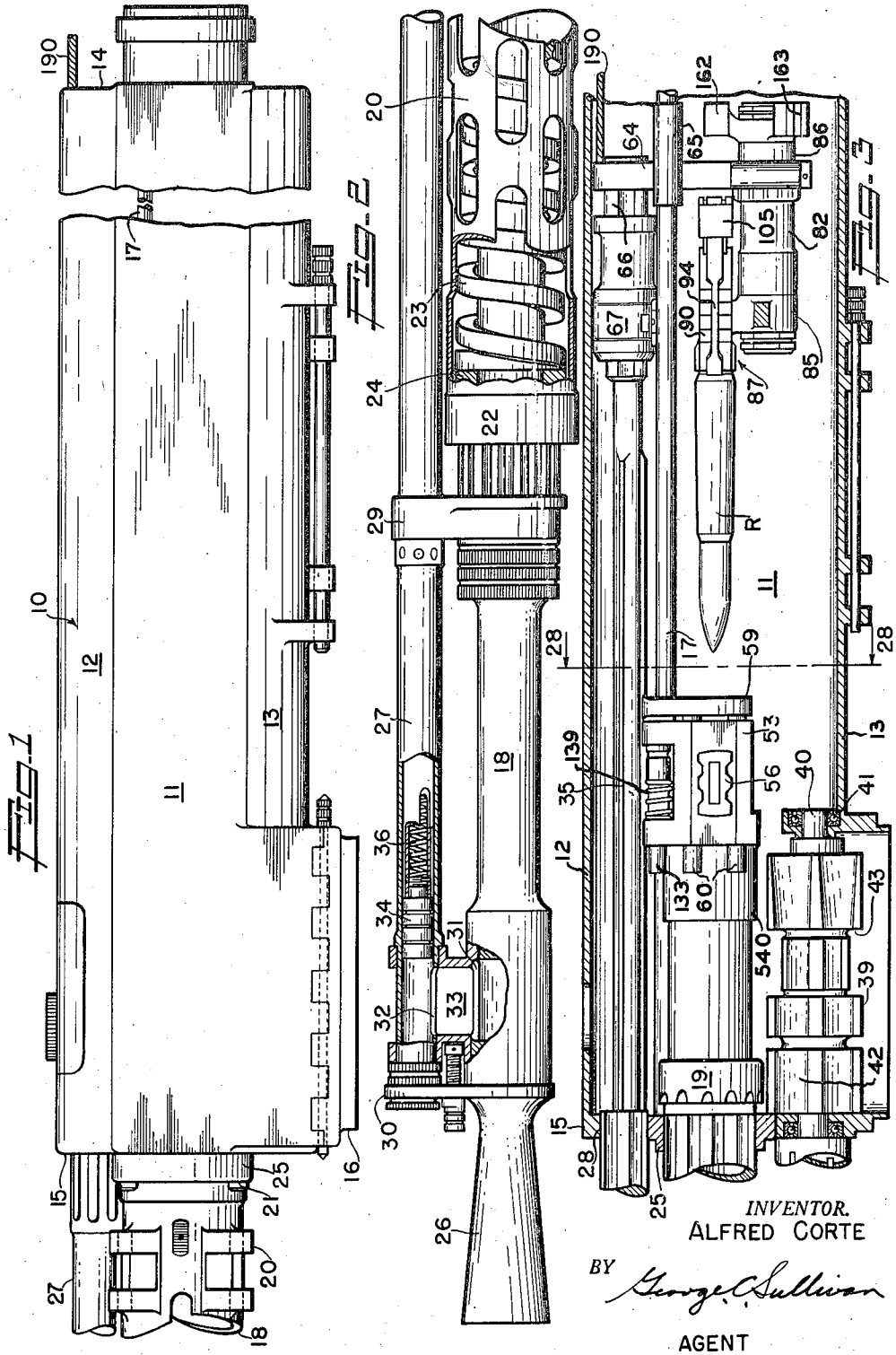

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BOLT MECHANISM FOR GUNS

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Fig. 4

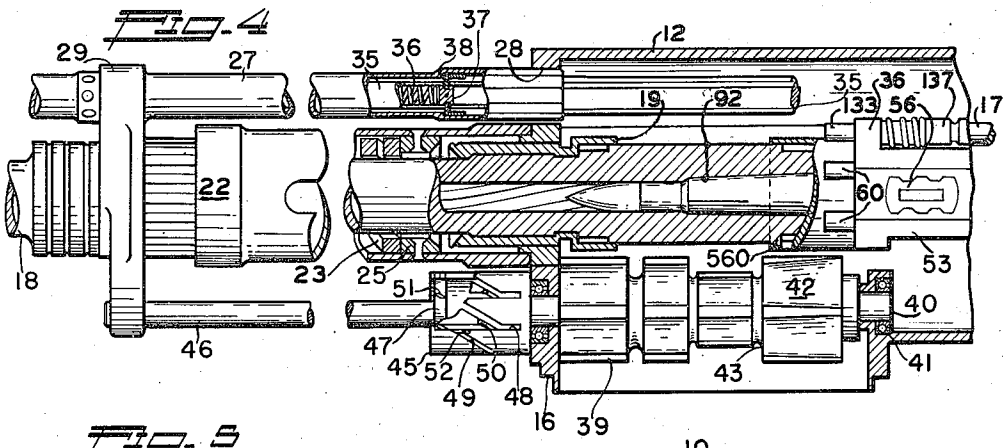


Fig. 5

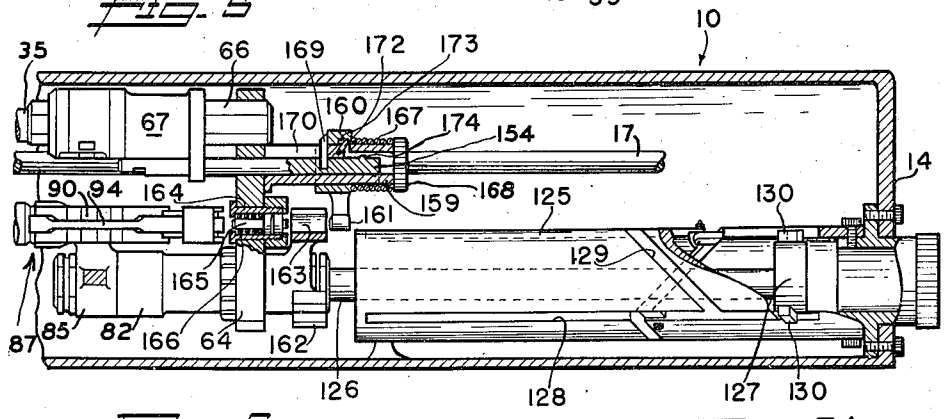


Fig. 6

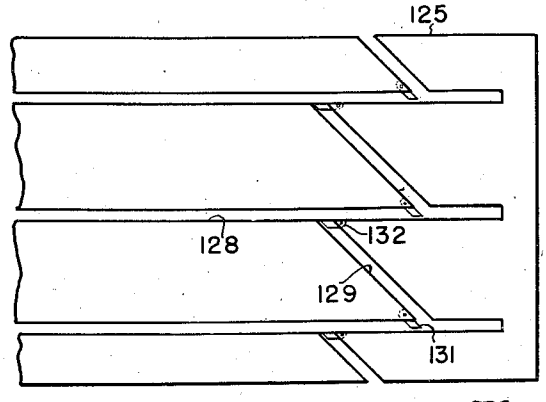


Fig. 6A

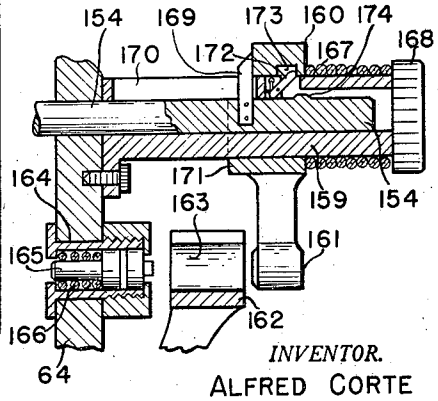
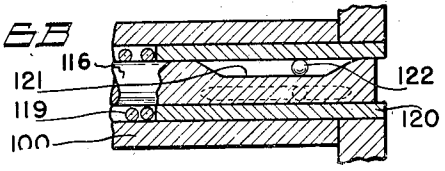


Fig. 6B



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April 5, 1949. A. CORTE 2,466,577

BOLT MECHANISM FOR GUNS

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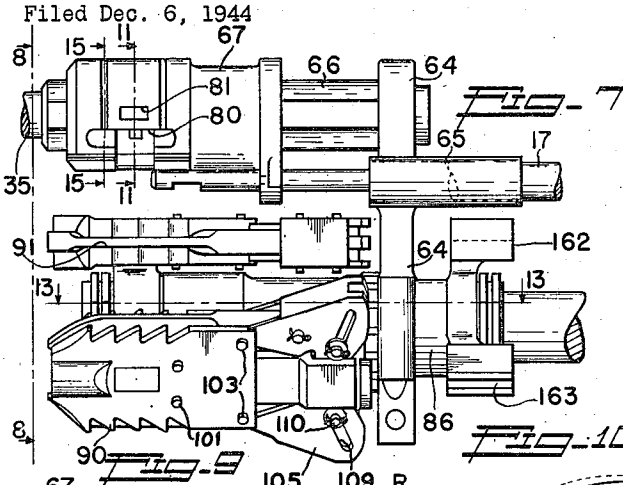


Fig. 7

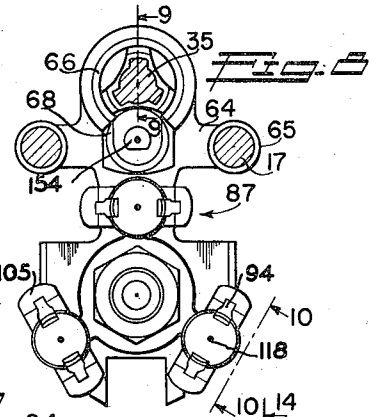


Fig. 8

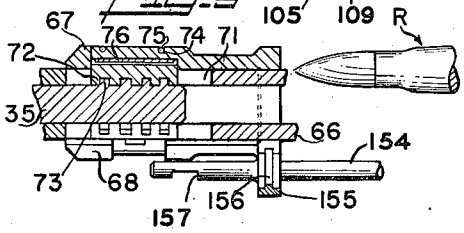


Fig. 9

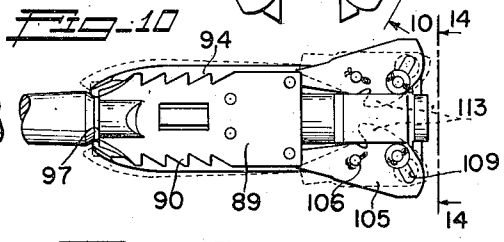


Fig. 10

Fig. 11

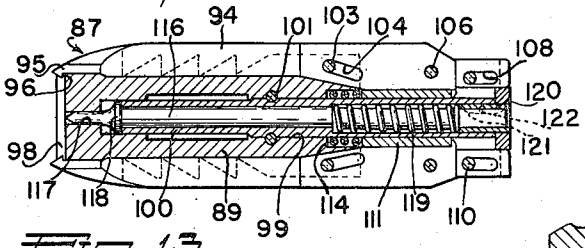


Fig. 12

Fig. 13

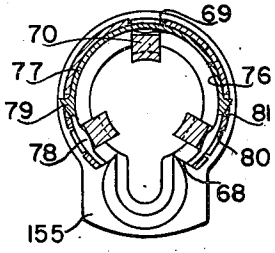


Fig. 15

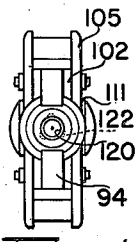


Fig. 14

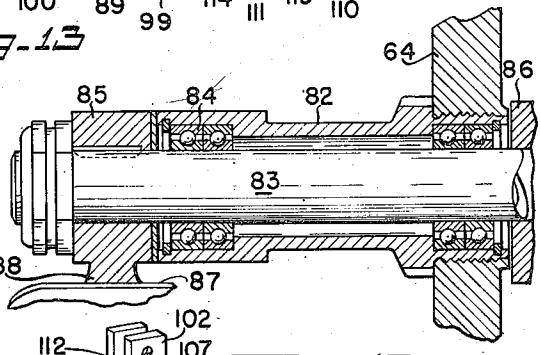


Fig. 17

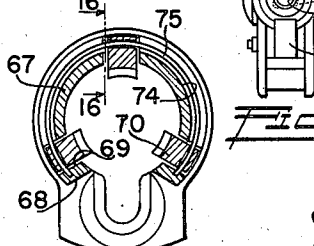


Fig. 16

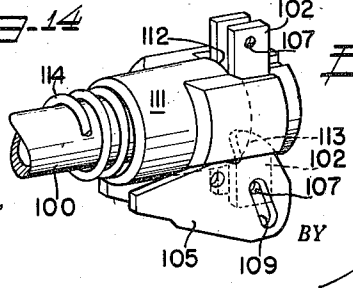
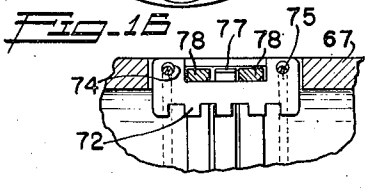


Fig. 18



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BOLT MECHANISM FOR GUNS

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Fig. 18

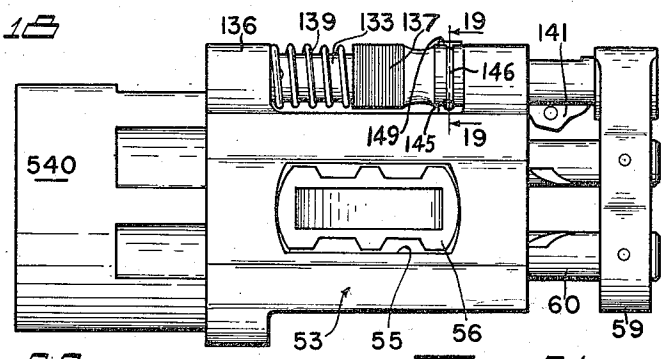


Fig. 19

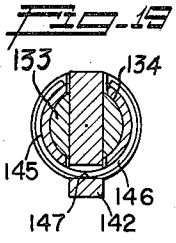


Fig. 20

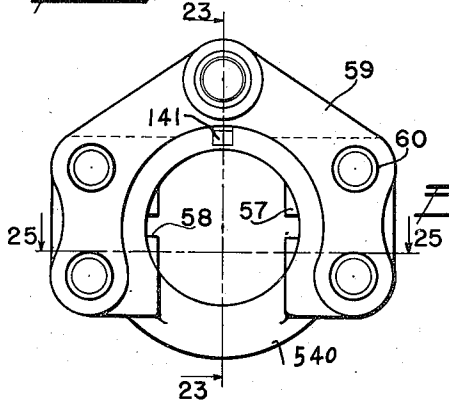


Fig. 21

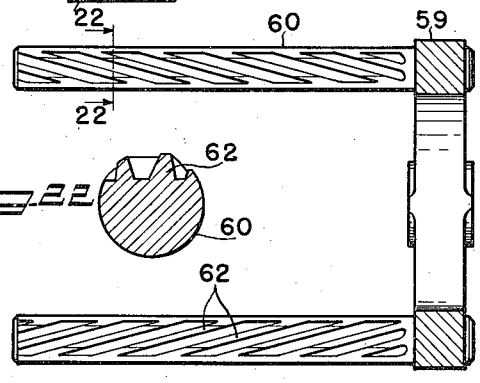


Fig. 22

Fig. 23

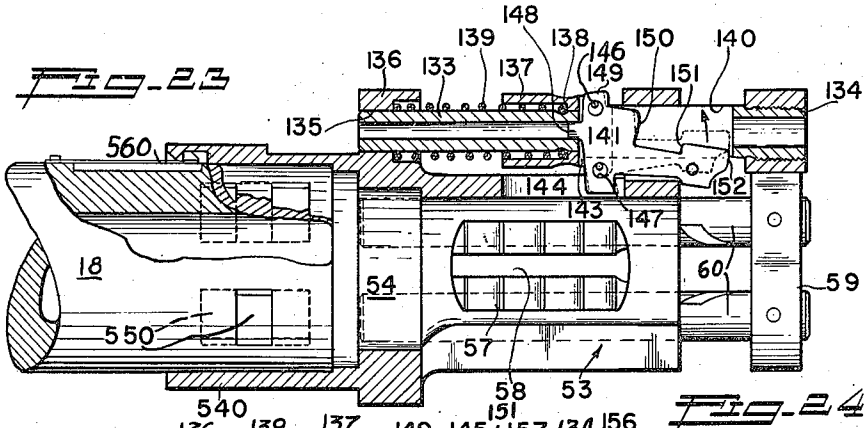
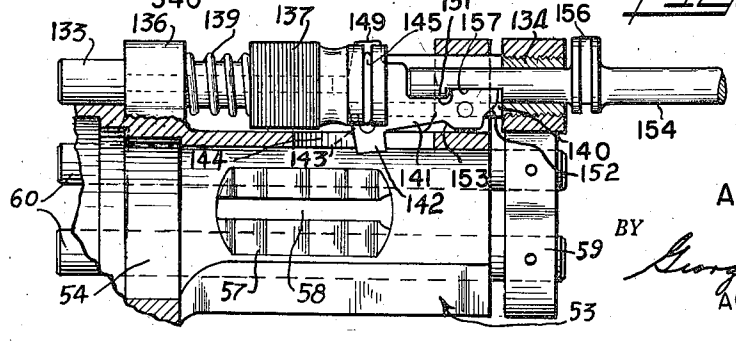


Fig. 24



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BOLT MECHANISM FOR GUNS

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Fig. 25

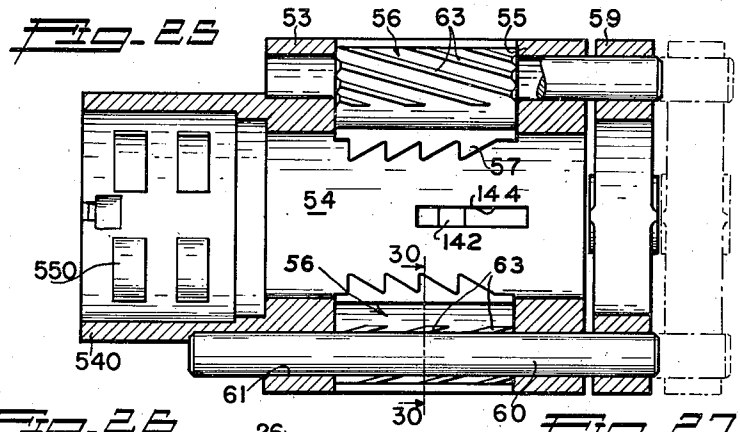


Fig. 26

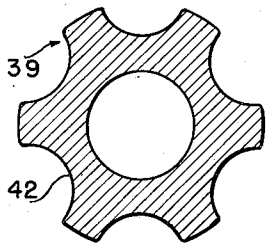


Fig. 27

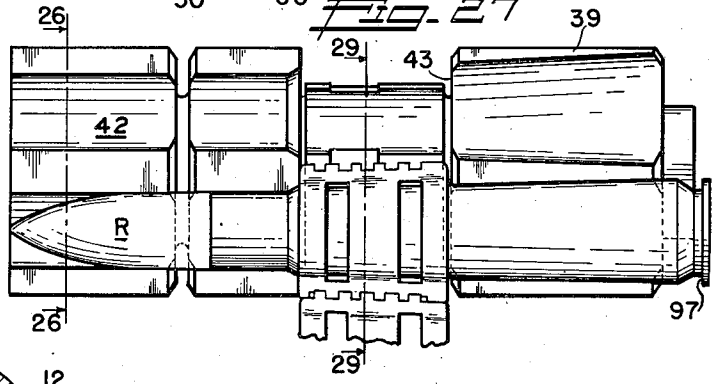


Fig. 28

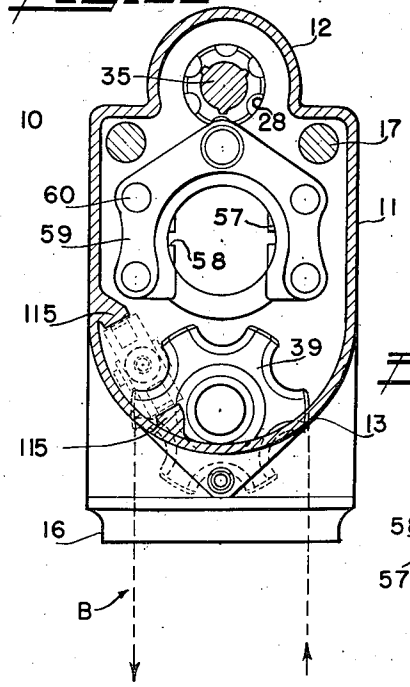


Fig. 29

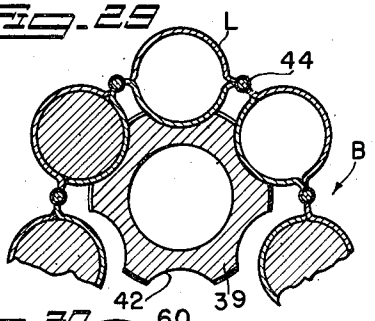
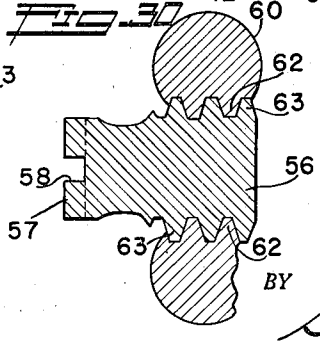


Fig. 30



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Patented Apr. 5, 1949 2,466,577

UNITED STATES PATENT OFFICE

2,466,577

BOLT MECHANISM FOR GUNS

Alfred Corte, Glendale, Calif., assignor to Lockheed Aircraft Corporation, Burbank, Calif.

Application December 6, 1944, Serial No. 566,806

15 Claims. (Cl. 89—159)

1

This invention relates to ordnance, and relates more particularly to automatic or machine guns. A general object of the invention is to provide a machine gun or cannon mechanism embodying a practical and particularly effective breech block and breech bolt assembly.

The mechanism of the present invention is intended for use in a machine gun wherein a live round is withdrawn from the ammunition belt, then introduced into the cartridge chamber for firing, and following the firing of the round, the empty cartridge case is withdrawn from the chamber and replaced in the ammunition belt. When this sequence is performed in connection with the firing of successive rounds, the ammunition belt is partially emptied and then rebuilt or refilled as it passes through the gun. The re-insertion of the empty cartridge cases in the ammunition belt completely avoids the necessity for providing means to handle the empty cases, and where disintegrating belts are employed, the re-insertion of the empty cases prevents disintegration of the belt so that the continuous belt carrying the empty cases may be readily directed into an appropriate receiver or storage space. If desired, the belt may be re-used without the necessity of re-assembling its individual links. In order to successively withdraw a round from the belt, fire the round and then replace the empty case in the belt, the gun mechanism requires a plurality of bolts for cooperating with a single breech block, with round extracting means associated with the bolts. The present invention is concerned primarily with the barrel extension and multiple bolt assembly and the associated elements.

It is an object of the invention to provide a barrel extension and multi-bolt combination of the character above referred to that is positive, dependable and rapid in operation.

Another object of the invention is to provide a sturdy, effective means for successively locking the individual bolts in the barrel extension for the firing of the successive rounds.

Another object of the invention is to provide a simple, rapid-action means for actuating and releasing the breech locks. The mechanism embodies jaws or locks adapted to be simultaneously operated upon the insertion and withdrawal of the bolts, and a positive quick-action rack mechanism for projecting and retracting the locks.

A further object of the invention is to provide a mechanism of the character referred to embodying a simple latch means which serves to positively hold the breech locks retracted to

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permit free insertion of the bolts and which further serves to prevent premature release of the breech locks.

It is a further object of the invention to provide an effective extractor mechanism for the breech bolts, which automatically operates to withdraw the live rounds from the ammunition belt and later insert the empty cases into the belt.

A still further object of the invention is to provide a gun mechanism of the character referred to in which a firing pin device is associated with each individual bolt, and embodies a safety unit for preventing inadvertent and premature actuation of the firing pin.

Other objects and features of the invention will be readily understood from the following detailed description of a typical preferred form of the invention wherein reference will be made to the accompanying drawings in which:

Figure 1 is an elevation of the rear portion of a gun embodying the invention;

Figure 2 is an elevation of the forward portion of the gun with certain parts broken away to appear in longitudinal cross section;

Figure 3 is a longitudinal detailed sectional view through the forward portion of the gun receiver showing the internal parts in elevation;

Figure 4 is a fragmentary longitudinal sectional view of a portion of the gun illustrating the ammunition sprocket and its operating mechanism, and showing portions of the barrel and gas cylinder mechanism in elevation;

Figure 5 is a longitudinal sectional view of the rear portion of the gun with the bolt assembly and a portion of the mechanism for turning the same appearing in elevation;

Figure 6 is a stretch-out view of the drum cam for rotating the bolts;

Figure 6A is an enlarged fragmentary sectional view illustrating the cocking mechanism;

Figure 6B is an enlarged fragmentary sectional view of the firing pin safety means;

Figure 7 is a side elevation of the bolt assembly and its associated actuator;

Figure 8 is a front elevation of the bolt assembly taken substantially as indicated by line 8—8 on Figure 7;

Figure 9 is a fragmentary longitudinal sectional view of the actuator assembly taken as indicated by line 9—9 on Figure 8;

Figure 10 is a face elevation of one of the bolts carrying a round and showing the two positions of the extractors, being a view taken substantially as indicated by line 10—10 on Figure 8;

Figure 11 is an enlarged transverse sectional view of the actuator taken substantially as indicated by line 11—11 on Figure 7;

Figure 12 is a longitudinal sectional view of one of the bolt units;

Figure 13 is an enlarged fragmentary longitudinal section taken substantially as indicated by line 13—13 on Figure 7;

Figure 14 is a front view of one of the bolts;

Figure 15 is an enlarged transverse sectional view of the actuator, taken as indicated by line 15—15 on Figure 7;

Figure 16 is an enlarged fragmentary sectional view taken as indicated by line 16—16 on Figure 15;

Figure 17 is a fragmentary perspective view of a portion of a bolt assembly;

Figure 18 is an enlarged side elevation of the barrel extension assembly;

Figure 19 is an enlarged vertical section taken as indicated by line 19—19 on Figure 18;

Figure 20 is an end view of the barrel extension assembly taken as indicated by line 20—20 on Figure 18;

Figure 21 is a horizontal sectional view of the rack unit showing the two racks in elevation;

Figure 22 is an enlarged transverse section taken as indicated by line 22—22 on Figure 21;

Figure 23 is a longitudinal detailed sectional view of the barrel extension assembly taken as indicated by line 23—23 on Figure 20;

Figure 24 is a fragmentary view illustrating the breech latch mechanism;

Figure 25 is a horizontal detailed sectional view of the block assembly taken as indicated by line 25—25 on Figure 20;

Figure 26 is a transverse cross section of the sprocket taken as indicated by line 26—26 on Figure 27;

Figure 27 is a side elevation of the sprocket and ammunition belt assembly;

Figure 28 is a vertical detailed sectional view taken as indicated by line 28—28 on Figure 3;

Figure 29 is a fragmentary vertical sectional view taken as indicated by line 29—29 on Figure 27; and

Figure 30 is a transverse section of one of the racks and its jaws as indicated by line 30—30 on Figure 25.

The features of the present invention may be embodied in ordnance varying considerably in caliber and construction. In the drawings the invention is disclosed in association with a substantially complete gun structure, it being understood that the invention is not to be construed as limited to the particular details illustrated and described below.

The gun illustrated includes a housing or receiver 10, which is a relatively stationary component being adapted for support by either a stationary or flexible gun mount. The receiver 10 serves as a support for the various other elements and contains the principal operating parts. As the present invention is not primarily concerned with the construction of the receiver 10, it will suffice to describe it as an elongate hollow member having generally vertical side walls 11, a top wall having a longitudinally extending partially cylindrical crown 12, a bottom wall 13 presenting a cylindrically concave internal surface, and end walls 14 and 15. The forward portion of the bottom wall 13 has a rectangular downwardly opening magazine frame 16 for detachably mounting a suitable magazine, not shown. Horizontally spaced guide rods 17 extend longitudinally through the receiver 10 to carry the bolt assembly for axial movement as will be subsequently described. While I have referred to the receiver 10 as having side walls and top and bottom walls, it is to be understood that the gun may be mounted and employed in any position; for example, it may be supported so that the parallel walls 11 form the upper and lower walls of the receiver.

The gun barrel 18 extends forwardly from the receiver 10 and is supported for axial movement as required during the recoil and counter recoil phases of operation. The forward wall 15 of the receiver 10 carries a suitable slide bearing unit 19 cooperating with a splined or grooved portion of the barrel 18 to support the barrel for the required limited axial movement. The details of the bearing 19 and its mounting form no part of the present invention. The barrel 18 extends rearwardly into the receiver 10 for association with the extension 53 to be subsequently described. A suitable recoil mechanism is provided for the barrel assembly. This includes a tubular jacket 20 secured to the forward end of the receiver 10 by screws 21 and extending outwardly in spaced surrounding relation to the barrel 18. The jacket 20 is perforated or slotted for the ready dissipation of heat and its forward end carries a bearing means 22 which assists in supporting the barrel 18 for axial movement. A helical recoil spring 23 is arranged in the jacket 20 in surrounding relation to the barrel 18. The forward end of the spring 23 is engaged by a part 24 of the bearing means 22 which travels with the barrel 18 and the rear end of the spring 23 bears on a ring 25 which is stationary on the receiver 10; see Figures 2 and 4. With this arrangement of parts, the spring 23 is compressed during recoil movement of the barrel 18 and the energy stored in the spring during recoil serves to move the barrel and associated parts forwardly for the counter recoil stroke. A flaring muzzle member 26 is provided on the forward end of the barrel 18 and may contain a suitable flash tube, not shown. It is to be understood that the barrel 18 is suitably rifled and may be of any selected construction and caliber.

Certain elements of the gun mechanism are gas operated; that is, they are operated by a portion of the gas pressure built up in the bore of the barrel 18 when the projectile leaves its cartridge case. A gas cylinder 27 extends in parallel relation with the barrel 18. The cylinder 27 travels with the barrel and enters an opening 28 in the forward wall of the receiver 10. A yoke member 29 engages about the barrel 18 and the cylinder 27 to secure the cylinder to the barrel; see Figure 2. The yoke member is attached to the barrel 18 adjacent the bearing means 22. The forward end of the gas cylinder 27 is closed and secured to the barrel 18 by a connecting member 30. Aligned ports 31 and 32 are provided in the forward parts of the barrel 18 and cylinder 27 and are connected by a tubular junction member 33 engaged about the cylinder and secured on the barrel 18 adjacent its muzzle 26. The ports 31 and 32 and the tubular junction member 33 serve to conduct gas pressure from the bore of the barrel 18 to the forward portion of the cylinder 27.

A piston 34 is operable in the cylinder 27 and is adapted to be driven rearwardly by the gas pressure conducted to the cylinder from the barrel 18 immediately following the ejection of the projectile from the barrel. The piston 34 is closed

at its forward end but its major portion is tubular. A tubular piston extension 35 continues rearwardly from the piston to project from the rear end of the cylinder into the receiver 10. A spring 36 is arranged under compression between the closed forward end of the piston 34 and a block 37 slidably engaged in the tubular piston extension 35; see Figure 4. Pins 38 pass through axial slots in the extension 35 and anchor the block 37 to the wall of the cylinder 27 so that the block forms an effective abutment for the spring. Upon rearward movement of the piston 34 under the action of the gas pressure, the spring 36 is compressed between the rearwardly moving closed end of the piston and the block 37. When the gas pressure is relieved, the energy stored in the spring 36 drives the piston 34 forwardly. The forward and rearward movements of the piston 34 are utilized to translate the bolt assembly, as will be subsequently described.

The gun mechanism further includes a sprocket 39 arranged in the forward portion of the receiver 10 to handle the ammunition belt B as it moves through the gun. The shape and action of the sprocket 39 will vary somewhat depending upon the nature and caliber of the rounds R. Furthermore, the sprocket 39 may be driven or rotated in various appropriate manners to effect an automatic feed of the ammunition belt B. In the construction illustrated, the counter recoil motion of the barrel 18 is employed to intermittently rotate the sprocket 39, and the sprocket serves to advance the belt B in timed relation to the elements of the mechanism.

The sprocket 39 is positioned adjacent the magazine frame 16, and has its axis of rotation parallel with the barrel. The sprocket 39 is fixed to its shaft 40, and the shaft is carried by suitable bearings 41 at the frame 16; see Figure 4. Equally spaced longitudinal grooves 42 are formed in the periphery of the sprocket 39 to receive the rounds R, and a circumferential groove 43 is formed in the sprocket to receive the links L of the belt B. The axial grooves 42 are of rearwardly increasing depth to properly receive the projectiles and their cases. The particular belt B illustrated is of the non-disintegrating type comprising generally tubular links L interconnected by hinges 44; see Figure 29. As indicated by broken lines in Figure 28, the belt B enters the opening of the frame 16, passes 180° around the sprocket 39, and then passes outwardly through the frame opening. It will be observed that the belt B enters and leaves a single side of the gun, thereby greatly simplifying the mounting of the gun and permitting it to be positioned in confined spaces where only one side is accessible.

The sprocket 39 is rotated substantially 60° during each counter recoil stroke of the barrel 18. The mechanism for producing this intermittent rotation of the sprocket 39 may take various forms and the invention is not primarily concerned with the particular mechanism employed. In the drawings the mechanism for this purpose is illustrated in a more or less diagrammatic manner, and comprises a drum 45 fixed to the forward end of the sprocket shaft 40; see Figure 4. The drum 45 may be positioned in front of the receiver 10 and may have a suitable casing, not shown. The sprocket rotating mechanism further includes a rod 46 fixed to the above described yoke 29 to move with the barrel 18. The rod 46 extends rearwardly to enter the forward end of the drum 45. A flange or collar 47 is fixed to the rod 46 to operate within the drum. The sprocket drum

45 is provided with six equally spaced axial slots 48. Correspondingly pitched helical slots 49 are formed in the wall of the drum 45 to extend between and connect the adjacent axial slots 48. Pivoted spring urged switches 50 are provided at the junction of the slots 48 and 49. The switches 50 occur at the rearward ends of the helical slots 49 and are designed to direct forwardly moving objects in the slots 48 into the helical slots 49. Lugs 51 are provided on the flange 47 to move in the slots 48 and 49, it being preferred to provide a lug 51 for each axial slot. The lugs 51 are diamond shaped to have pairs of parallel sides operable in both the axial slots 48 and pitched slots 49. Pivoted spring urged switches 52 are provided at the forward ends of the helical slots 49 to prevent the lugs 51 from moving into the slots 49 as they travel rearwardly through the straight slots 48.

With the barrel 18 in its forward-most position, the lugs 51 are engaged in the forward ends of the axial slots 48. When the barrel moves rearwardly the lugs 51 move to the rear in the axial slots and move the switches 50 out of their paths as they travel rearwardly. The instant the lugs 51 pass the switches 50, the latter swing back to their active positions under the action of their springs. It is to be noted that the engagement of the lugs 51 in the axial slots 48 holds the sprocket 39 against rotation throughout the recoil stroke of the barrel 18. When the barrel 18 moves forwardly during the counter recoil stroke, the lugs 51 travel forwardly in the axial slots 48 until they encounter the switches 50. The switches 50 direct the lugs 51 into the helical slots 49 and as the forward movement continues, the lugs travel forwardly in the helical slots. The cooperation of the lugs 51 with the walls of the helical slots 49 rotates the drum 45 and sprocket 39. By the time the lugs 51 move out of the slots 49, past the switches 52, into the adjacent axial slots 48, the sprocket 39 will have been turned 60°. The re-entry of the lugs 51 into the axial slots 48 definitely terminates the rotation of the sprocket 39. Thus during each recoil stroke the sprocket 39 is held stationary, and during each counter recoil stroke the sprocket is rotated 60°, and then brought to a stop in a definite angular position.

The invention provides a barrel extension 53 of special construction for receiving and cooperating with the plurality of bolts 87. The extension 53 is secured to the rear end of the barrel 18 to operate axially in the forward portion of the receiver 10. It is preferred to construct the extension 53 as an integral member provided at its forward end with a tubular boss 540 for receiving the rear end of the barrel 18. The barrel and extension are connected by cooperating interrupted splines 550 and a spring latch 560 engages in a notch 561 in the extension to hold the barrel and block against relative angular movement in the relationship where the splines are in cooperation. The body of the barrel extension 53 has a longitudinal opening 54 in axial alignment with the bore of the barrel 18. The major, generally rectangular portion of the extension 53 is cut away at one side, the lower side, as shown in Figures 20 and 23, to provide clearance for the sprocket 39 and other elements. The opening 54 is cylindrical and is proportioned to successively receive the individual bolts.

Effective lock means is associated with the barrel extension 53 to lock the bolts 87 in the opening 54 for the firing of the rounds. The oppos-

ing walls of the extension 53 have aligned generally rectangular windows or openings 55. Lock blocks or jaws 56 are arranged in the openings 55 for movement toward and away from the longitudinal axis of the opening 54. The jaws 56 may be socketed at their outer faces to reduce the weight. Series of teeth or serrations 57 are formed on the inner faces of the jaws. The serrations have abrupt forward faces and inwardly and forwardly sloping rear surfaces. An axial groove 58 extends through each series of serrations 57. The end walls of the openings 55 are preferably concave and the ends of the jaws 56 are correspondingly curved to conform thereto.

The lock means of the barrel extension 53 further includes a rack mechanism for actuating and retracting the jaws 56. This mechanism embodies a substantially U-shaped member 59 arranged at the rear of the extension 53. Two pairs of spaced rods 60 are fixed in openings in the member 59 and extend forwardly therefrom to slidably operate in axial openings 61 in the walls of the extension 53. The openings 61 partially intersect the jaw openings 55, so that the rods 60 may cooperate with the jaws. The rods 60 are in the nature of actuating members or racks having series of pitched or inclined rack teeth 62 formed on their opposing sides. The teeth 62 are parallel but are pitched with respect to the longitudinal axes of the rods 60 to be diagonal relative to said axes. The diagonal rack teeth 62 may be formed by machining angular grooves in the rods. The opposite sides of the jaws 56 have correspondingly pitched diagonal teeth 63 meshing with the teeth 62 of the rack rods; see Figures 25 and 30. The direction of pitch or inclination of the mating rack teeth 62 and 63 is such that upon forward movement of the rods 60 the jaws 56 are moved inwardly relative to the axis of the opening 54 by the cooperating teeth and upon rearward movement of the rods, the cooperation of the teeth moves the jaws outwardly. It is to be observed that both the actuation and retraction of the jaws 56 are positive and rapid and that the movements of the jaws are simultaneous and equal. Simple forward and rearward movement of the rack member 59 with respect to the barrel extension 53 effects actuation and retraction of the two jaws 56. The engagement of the rack rods 60 with the opposite sides of the jaws 56 normally prevents both inward and outward radial movement of the jaws.

The breech bolt assembly is an important component of the mechanism provided by the invention. This assembly is movable axially in the receiver 10 and embodies a multiple bolt unit that is intermittently rotated during each complete cycle of operation of the gun. The bolt assembly includes a traveling carrier or spider 64 having two elongate tubular bosses 65 which receive and ride on the above mentioned guide rods 17; see Figures 7 and 8. The rods 17 support the bolt assembly for free axial movement. The carrier or spider 64 also carries a tube 66 which receives the rear portion of the gas piston extension 35. The piston extension 35 and the tube 66 may have sliding spline engagement to assist in preventing undesirable relative rotation between the parts. The piston extension and the spider tube 66 are related for relative axial movement, and the invention provides a slack or lost motion connection between these two elements.

The lost motion connection between piston extension 35 and the bolt assembly includes what I will term an actuator 67; see Figures 9, 11 and 15. The actuator 67 is a tubular member surrounding the spider tube 66 and related thereto for axial movement. A longitudinal gap or slot 68 is provided in one side of the actuator 67 and the actuator has three circumferentially spaced elongate openings 69 in its wall. Blocks or jaws 70 are arranged in the openings 69 and are received in elongate axial slots 71 in the tube 66; see Figure 9. The jaws 70 are capable of longitudinal movement in the slots 71 whereby the actuator 67 may move longitudinally with respect to the bolt assembly. The jaws 70 may engage the ends of the slots 71 to limit this relative movement and the end of the actuator 67 engages the spider 64 to assist in limiting the rearward travel of the actuator with respect to the bolt assembly. Teeth or serrations 72 are provided on the inner faces of the jaws 70 to mesh with similar serrations 73 on the piston extension 35. The engagement of the serrations 72 and 73 serves to connect the piston extension 35 and the actuator 67. The jaws 70 are movable radially in the openings 69 and means are provided to yieldingly urge the jaws outwardly so that their serrations 72 will not interfere with the insertion of the piston extension 35 into the tube 66. External circumferential grooves 74 are provided in the actuator 67 and intersect the openings 69. Partially circular springs 75 are arranged in the grooves 74 and have their ends anchored to the actuator. The springs 75 pass through openings in the end portions of the jaws 70 to urge the jaws outwardly. In addition to urging the jaws 70 to their outward positions, the springs 75 hold the jaws assembled in the actuator 67.

Cam means is provided to normally hold the jaws 70 in their inward positions where the teeth 72 and 73 cooperate to secure the actuator 67 to the piston extension. An internal circumferential groove 76 in the actuator 67 carries a partially circular cam member 77. The inner surface of the member 77 has spaced cam lifts 78 which are cooperable with the outer sides of the jaws 70. Upon turning of the member 77 in one direction lifts 78 may be brought into cooperation with the jaws 70 to force them inwardly and bring the teeth 72 into engagement with the teeth 73. The cam member 77 is movable between the position illustrated in Figure 11 where the lifts 78 hold the jaws 70 inwardly and a position where the springs 75 may return the jaws to their outward positions. Latch or detent means are provided to releasably hold the member in its two positions. Detents 79 are formed on the exterior of the member 77 and are cooperable with shoulders 80 on the actuator 67. The cam member 77 may be turned to a position where one detent engages the adjacent shoulder 80 to releasably hold the member where the jaws 70 are retracted. Openings 81 in the wall of the actuator 67 are adapted to receive the detents 79 to retain the cam member 77 in the position where the jaws 70 are actuated. The detents 79 have sloping surfaces whereby they may be readily released from the openings 81 to allow the cam member 77 to be moved to the position where the jaws 70 are released. The cam member 77 is slotted circumferentially at each side of the detents 79 to provide the flexibility and resiliency necessary to snap the detents into and out of cooperation with the shoulders 80 and openings 81. It will be seen that upon depressing the detents 79 the cam member 77 may

be turned between its two positions to actuate and release the toothed jaws 70. The releasable slack connection between the bolt assembly and the piston extension 35 afforded by the actuator 67 described above, is such that the bolt assembly is moved rearwardly and forwardly with each full cycle of operation of the piston 34 by the gas pressure and spring 36. The lost motion allowed by the construction described above serves to control the sear and hammer mechanism and to permit other actions to be subsequently described.

The bolt assembly further includes a tube 82 threaded in an opening in the spider 64 to extend forwardly from the spider in parallel relation to the barrel 18; see Figure 13. A shaft 83 extends through the tube 82 and is supported for rotation therein by spaced bearings 84. A ring 85 is keyed or otherwise fixed to the forward portion of the shaft 83 to carry the bolts and a similar ring 86 is fixed to the rear portion of the shaft 83 for a purpose to be later described. The bolts 87 are fixed to the ring 85 to be equally spaced circumferentially and to be in parallel relation to the barrel 18. In the particular gun illustrated there are three bolts 87 spaced 120° apart. Projecting arms 88 on the rotatable ring 85 carry the three bolts 87. The bolt assemblies are identical and I will proceed with a detailed description of one of them, it being understood that this description applies to all of the bolt units.

Each bolt 87 includes an elongate body 89 that is generally rectangular in transverse cross section. The bolt body 89 is proportioned to readily enter the opening 54 of the barrel extension 53 and is provided at its opposite sides with serrations 90 for cooperating with the serrations 57 of the jaws 56. The serrations 90 have abrupt rear faces for locking with the abrupt forward faces of the serrations 57, and have outwardly and rearwardly sloping forward surfaces for engaging the sloping faces of the teeth 57. Longitudinal slots 91 are provided in the bolt body 89 for the purpose which will later become apparent, and extend through the sets of serrations 90 to divide the serrations in spaced series. Upon forward movement of the bolt assembly, the bolt 87, which is aligned with the barrel 18, enters the opening 54 and introduces the new round into the firing chamber 92 of the barrel.

Each bolt 87 is equipped with extractor means for extracting a round R from the ammunition belt B and for retaining the round as the belt moves rearwardly and then forwardly so that the round is introduced into the firing chamber. The extractor means further serves to withdraw the empty case following firing the round and later introduces the empty case into the belt B. The extractor means includes pawls 94 extending through the grooves 91 to be partially contained and guided therein. The above mentioned grooves 58 in the breech jaws 56 receive the protruding portions of the pawls 94 when the bolt is locked in the breech block. The pawls 94 extend beyond the forward ends of the bolt body 89 and their projecting portions have beveled noses 95 provided with internal shoulders 96 for engaging and gripping the flange 97 at the base of the cartridge case. The shoulders 96 are arcuate and abrupt to conform to the flange 97 and the forward internal surfaces of the pawl noses 95 slope away from the shoulders so that the noses may snap over the flange. The forward end of the bolt body 89 has a circular depression 98 for receiving the flange 97 of the cartridge case, and the pawl noses 95 extend into the socket for cooperation with the flange.

The rear portions of the extractor pawls 94 are mounted for movement and a mechanism is provided to impart a combined forward and lateral motion to the pawls to free the noses 95 from the flanges 97 of the empty cartridge case after the latter has been re-inserted in the ammunition belt B. The bolt body 89 has a longitudinal opening 99 and a tube 100 enters the rear end of the opening. The tube 100 is secured in the opening 99 by transverse pins 101 engaged in openings in the bolt body and cooperating with notches in the tube. The tube 100 extends beyond the rear end of the body 89 and has a T-head which is notched at its ends to form split lugs 102; see Figure 17. The pawls 94 have reduced end portions which are slidably received in the lugs 102. Pins 103 are engaged in transverse openings in the rear corner portions of the body 89 and pass through the grooves 91. Forwardly and laterally inclined slots 104 are formed in the pawls 94 and receive the pins 103; see Figure 12. The cooperation of the pins 103 and slots 104 directs the pawls 94 forwardly and outwardly when actuated.

The means for operating the pawls 94 further includes yoke-like actuators 105 which straddle the lugs 102, and the adjacent portions of the pawls. Pivot pins 106 are engaged in openings in the actuators 105 and the pawls 94 to pivotally connect these elements. The split lugs 102 have transverse openings 107 registering with longitudinal slots 108 in the rear portions of the pawls 94. The side walls of the actuators 105 have rearwardly and laterally inclined slots 109 which register with the openings 107. Pins 110 pass through the slots 109, the openings 107 and the longitudinal slots 108. The engagement of the pins 110 in the openings 107 of the rigid lug 102 restrains the pins against bodily movement. When the rear portions of the actuators 105 are pressed inwardly toward the longitudinal axis of the bolt body 89 the cooperation of the inclined slots 109 with the pins 110 cams the actuators forwardly. The intermediate pins 106 being engaged in confining openings in the actuators and pawls 94, transmit this forward movement to the pawls. The engagement of the inclined slots 104 of the forwardly moving pawls 94 with the pins 103 imparts a forward and outward direction of movement to the pawls. This movement disengages the pawl noses 95 from the flange 97 freeing the bolt from the empty case.

Means is provided to normally urge the actuators 105 to positions where the pawls 94 are in active gripping engagement with the round flange 97. This means includes a sleeve 111 slidable on the tube 100 and forked at its rear end to partially straddle the side parts of the actuators 105 and to present rearwardly facing shoulders 112. The actuators 105 have forwardly facing hooks 113 engaging the shoulders 112. A spring 114 surrounds the tube 100 and is engaged under compression between a shoulder on the wall of the opening 99 and the forward end of the sleeve 111. The spring 114 urges the sleeve 111 rearwardly so that the cooperation of the shoulders 112 with the hooks 113 pivots the actuators 105 outwardly or laterally. The spring 114 normally holds the actuators 105 in the positions where the pawls 94 are fully actuated.

Any appropriate means may be provided for actuating the extractor pawls 94 to free their

noses 95 from the cartridge flanges 97. In the simple case illustrated, cam projections 115 are suitably located on the walls of the receiver 10 to be engaged at the proper time by the actuators 105. The outer surfaces of the pawl actuators 105 are inclined rearwardly and laterally, and upon contacting the cams 115, produce inward movement of the actuators toward the longitudinal axis of the bolt assembly. As above described, this movement results in forward and lateral movement of the pawls 94 to open their round-gripping noses 95. It is to be understood that other means may be utilized to operate the pawl actuators 105, and the invention is not to be construed as limited to the use of the cams 115 but is to be considered as contemplating any practical operating means.

Each bolt 87 further includes a firing pin 116 and a novel safety means for the pin. The firing pin 116 is arranged longitudinally within the tube 100 and is capable of limited axial movement. Its forward end portion is pointed and operates in a reduced opening 117 leading to the forward end of the bolt body 89. A flange 118 on the pin 116 is engageable with the forward end of the tube 100 to limit the rearward travel of the pin and may engage a shoulder on the wall of the opening 117 to limit the forward travel of the pin. A spring 119 surrounds the pin 116 and is engaged between a rearwardly facing internal shoulder in the tube 100 and a sleeve 120 surrounding the rear portion of the firing pin. The rear end of the pin 116 is exposed at the end of the tube 110. The above mentioned safety means includes the sleeve 120 surrounding the rear portion of the firing pin 116 and slidable within the tube 100. A series of circumferentially spaced longitudinally extending grooves 121 is provided in the rear part of the firing pin 116 to be within the sleeve 120. The end walls of the grooves 121 curve or slope outwardly to the periphery of the pin 116. A ball 122 operates in each groove 121 and rides on the internal surface of the sleeve 120. The rear end of the sleeve 120 is exposed at the end of the bolt body 89 and may be projected slightly from the end of the firing pin. The spring 119 urges the sleeve 120 to the rear end and the balls 122 engage the end walls of the grooves 121 to limit rearward travel of the sleeve relative to the pin 116 and to transmit the rearward spring pressure to the pin. In the event that the firing pin 116 is moved forwardly independently of the sleeve 120, the balls 122 ride up the sloping end walls of the grooves 121 and bind to prevent actuation of the firing pin. However, when the sleeve 120 is struck first, or when the sleeve and the firing pin are simultaneously moved forwardly, the balls 122 remain in intermediate position and the firing pin is free to operate.

During each reciprocation of the bolt assembly its three bolts 87 are turned as a unit a distance of 120° to provide for the required sequence of round extracting, insertion of the round into the firing chamber 92 and the insertion of the empty cartridge case into the belt B. The present invention is not primarily concerned with the means for effecting this rotation of the bolts 87, except as such means may occur in combination with the elements of the invention, and it is contemplated that the bolts may be rotated by any appropriate means actuated either by the gas cylinder mechanism or by the recoil or counter recoil of the barrel 18.

In the drawings there is illustrated in a more or less schematic manner, one means for producing the required rotation of the bolts 87 during the forward stroke of the gas piston 34. This means includes a tubular drum 125 secured to the rear wall 14 of the receiver 10 and a tube or rod 126 secured to the shaft 83 of the rotatable bolt unit and extending rearwardly into the drum. If desired, the rod 126 may be a simple extension of the shaft. A collar or flange 127 is fixed to the rod 126 and operates in the drum 125. Three axial slots 128 spaced 120° apart are provided in the walls of the drum 125. The slots 128 are connected by pitched or helical slots 129. The slots 128 and 129 are of uniform width and are adapted to slidably receive lugs 130 formed on the periphery of the flange 127. There is a lug 130 for each axial slot 128 and the lugs have pairs of parallel side surfaces adapted to slidably ride along the walls of the axial slots and helical slots. The helical slots 129 join the rear end portions of the axial slots 128. Each helical slot 129 extends from immediately adjacent the rear end of one axial slot to join the next axial slot a relatively short distance from its rear extremity. This leaves the major forward portions of the axial slots 128 entirely uninterrupted. A pivoted switch 131 is provided at the rearmost end of each helical slot 129. The switches 131 are spring urged to the positions illustrated in Figure 6 where they direct the lugs 130 from the axial slots 128 into the helical slots when the lugs are traveling forwardly. The switches 131 are swung out of the way by the lugs as the lugs travel rearwardly in the axial slots 128. Similar switches 132 are provided at the forward ends of the helical slots 129. The switches 132 are pivoted and spring urged to positions where they prevent the lugs 130, traveling rearwardly through the axial slots 128, from entering the helical slots.

Upon rearward movement of the gas piston 34, the lugs 130 travel rearwardly through the axial slots 128 from the forward ends of the slots to their rear ends. This engagement of the lugs 130 in the slots 128 prevents rotation of the bolts 87 and assures true rearward movement of the bolts so that the bolt in the barrel extension 53 moves out of the extension without interference and the bolt that has engaged the new round R in the belt B withdraws the round from the belt without any angular movement. The lugs 130 travel substantially the entire lengths of the slots 128 and are prevented from entering the helical slots 129 by the switches 132. When the bolt assembly begins to move forwardly under the action of the spring 36, the lugs 130 almost immediately encounter the switches 131 and are diverted thereby into the helical slots 129. The lugs 130 travel forwardly through the helical slots 129 and their engagement with the slots of the stationary cam drum 125 produces rotation of the bolt assembly through a distance of 120°. Owing to the pitch of the slots 129, this rotation of the bolt assembly is rather abrupt and the angular movement is completed by the new round carried by the bolt 87, which is being brought into alignment with the breech before the round can interfere with the barrel extension 53 or the parts associated therewith. Upon leaving the helical slots 129, the lugs 130 engage the switches 132 and swing them out of the way. Upon passing out of the slots 129, the lugs 130 move forwardly in the axial slots 128 and remain in the axial slots until the forward stroke of the

gas piston has been completed. The engagement of the lugs 130 in the axial slots 128 definitely maintains the bolts 87 in the angular position where the new round is in alignment with the breech, and where the empty cartridge case is aligned with its empty belt link L for insertion therein. It is to be observed that the bolt assembly is turned in the same direction as the sprocket 39 but is turned 120° with each complete cycle whereas the sprocket is turned only 60°. The cartridge feeding mechanism above described forms the subject of my copending application Serial Number 659,985, filed April 5, 1946.

The above described jaws 56 of the barrel extension 53 and rack mechanism for operating the jaws are dependably latched in positions where the bolt 87 carrying the new round R may freely enter the barrel extension upon forward movement of the bolt assembly without interference by the jaws 56. The latch mechanism for holding the jaws retracted is released or conditioned for release during forward movement of the gas piston 34 by a part associated with the above described actuator 67. The latch means includes a tube 133 fixed in an opening 134 in the intermediate portion of the member 59. The tube 133 projects forwardly to extend along one side of the breech block 53; see Figures 18 and 23. The tube 133 is slidably guided in openings 135 of spaced lugs 136 projecting from the block. The parts are related so that the tube 133 remains in cooperation with the openings 135 throughout the entire range of movement of the rack supporting member 59. A sleeve 137 surrounds the tube 133 and has an internal shoulder 138. The sleeve 137 normally bears rearwardly against the rear lug 136. A spring 139 is arranged under compression between the forward lug 136 and shoulder 138 to urge the tube 133 and sleeve 137 rearwardly. The spring 139 is of sufficient strength to normally hold the member 59 in its rearmost position where the jaws 56 are fully retracted.

The tube 133 has an elongate axial slot 140 receiving a latch 141. The latch has an inwardly projecting ear 142 on its inner edge received in a notch 143 in the sleeve 137 and operating in an axial slot 144 in the wall of the barrel extension 53; see Figures 23 and 24. An annular groove 145 is formed in the exterior of the sleeve 137 and receives a wire ring 146. The ear 142 of the latch has a transverse opening 147 and the ring 146 passes through the opening to retain the latch 141 in the slot 140; see Figure 19. The latch 141 also has a projection 148 on its forward end freely received in the opening of the tube 133. An ear 149 projects from the outer edge of the latch 141 and is engaged by the rear end of the sleeve 137. The spring urged sleeve 137, acting on the forward edge of the latch 141 and its ear 149, normally urges the latch to the full line position of Figure 23. The longitudinal outwardly facing edge of the latch 141 has an abrupt shoulder 150 facing rearwardly. The shoulder 150 is pitched forwardly and inwardly to some degree when the latch 141 is in the normal full line position of Figure 23. The same edge of the latch 141 has a shorter forwardly facing shoulder 151 which is also pitched forwardly and inwardly. The rear end surface 152 of the latch is engageable with the end wall of the slot 140 to normally prevent forward movement of the member 59 and its rack rods 60 relative to the barrel extension 53. This surface of the latch is slightly inclined and rounded away so as to clear the end wall of the slot 140 and enter the tube 133 upon slight swinging movement of the latch 141 in the direction indicated by the arrow in Figure 23. The inner edge of the latch 141 has a sloping shoulder 153 engageable with the rear end of the barrel extension 53. It will be seen that the spring 139 holds the latch 141 in the full line position of Figure 23 where the surface 152 engages the end wall of the slot 140 to positively prevent forward movement of the member 59 and rack rods 60 so that the jaws 56 are retained in their retracted positions.

Means is provided for releasing the latch 141 just prior to forward actuation of the rack member 59. This means includes a rod 154 carried by the actuator 67. The actuator has a yoke 155 open to its interior and the rod 154 is provided with a grooved flange 156 seated in the yoke so as to be normally rigid with the actuator. The engagement of the flange 156 in the yoke 155 positively holds the rod 154 against angular movement. The rod 154 extends both forwardly and rearwardly from the yoke 155, and its longitudinal axis is coincident with the axis of the tube 133. During the final portion of forward motion of the gas piston 34 and the actuator 67, the rod 154 enters the tube 133. The above described notch 68 in the actuator freely clears or passes the lugs 136 of the barrel extension during this movement. The advancing end of the rod 154 may be somewhat beveled to readily enter the tube 133. One side of the rod 154 has an inwardly facing notch 157 and is cut away to some extent to clear the rear portion of the latch 141 when entering the tube. The end of the forwardly moving rod 154 is adapted to strike the pitched shoulder 150 to swing the latch 141 to the broken line position of Figure 23. This pivoting of the latch 141 moves the portion of the latch occurring between the shoulder 151 and the surface 152 into the notch 157 of the rod 154. The engagement of the rod 154 with the shoulder 150 may not be sufficient to cause the latch to swing the entire distance, but the cooperation of the rear wall of the slot 140 with the rounded end surface 152 of the latch completes the swinging of the latch. When the latch 141 has been swung to the position of Figure 24, the rack rods 60 are free to move forwardly and actuate the jaws 56 to cooperate with the bolt serrations 90. It is to be observed that during forward movement of the bolt assembly the actuator 67 is in its forward position relative to the spider 64 because the actuator is, in effect, pulling the spider and bolt assembly forward. Accordingly, the latch 141 is released or conditioned for release by the rod 154, on the "leading" actuator, before the yoke 155 engages the member 59 or before the spider 64 of the bolt assembly comes into contact with the yoke 155. When the bolt assembly is drawn forwardly by the actuator 67, the rod 154 first releases or conditions the latch 141 for release and the yoke 155 then engages the member 59. The spider 64 moves up to its final position to introduce the bolt 87 into the block 53, inertia carrying the bolt assembly forward while the actuator lags slightly by reason of its engagement with the latch. The actuator continues to move forwardly after the spider stops, and the actuator strikes the member 59, to drive the rack pins 60 forwardly and actuate the breech block jaws 56.

When the jaws 56 are fully actuated, the latch 141 is in the position illustrated in Figure 24. With the latch in this position its end surface 152

is engaged with the rear wall of the notch 157 to hold the member 59 and the rack rods 60 against rearward movement. Thus the latch 141 effectively locks the breech block jaws 56 in the position where they retain the bolt 87 in the barrel extension. The sudden and violent rearward movement of the rod 154 caused by the action of the gas piston 34 immediately following firing of the round and transmitted by the forward wall of the notch 157 to the pitched or rounded shoulder 151 of the latch releases the latter. Upon release of the latch 141, the spring 139 moves the rack rods 60 to the rear with the result that the jaws 56 are retracted. Retraction of the jaws 56 is immediately followed by rearward withdrawal of the bolt 87 from the barrel extension by the gas piston 34 acting through the medium of the actuator 67.

Immediately following locking of the bolt in the barrel extension, the firing pin 116 of the bolt 87, in the breech, is operated to fire the round R. Each bolt 87 carries it own firing pin 116 to be in a position for actuation by a suitable hammer mechanism. The invention is not primarily concerned with the nature of the hammer mechanism employed except insofar as it occurs in combination with the other elements. In order to complete the disclosure I have illustrated a hammer and cocking mechanism including a tube 159 secured to the spider 64 and arranged to receive the rear portion of the above described rod 154; see Figure 6A. A sleeve 160 is slidable on the tube 159 and carries a laterally projecting hammer 161. The ring 86 on the rear of the shaft 83 carries three spaced projections 162 provided with axial grooves 163. The axial slots 128 of the cam drum 125 position the ring 86 so that the grooves 163 of tis lugs 162 are successively aligned with the hammer 161. A bushing 164 is secured in an opening in the spider 64 and slidably carries a striking pin 165. The parts are related so that the pin 165 is aligned with the hammer 161 and the pin is normally urged to the rear by a light spring 166. The hammer 161, when actuated, moves through a guide groove 163 and strikes the pin 165, which in turn, strikes the sleeve 120 and firing pin 116 of a bolt assembly to fire the round R.

The means for actuating the hammer 161 includes a spring 167 arranged under compression between the sleeve 160 of the hammer and a head 168 on the rear end of the tube 159. The spring 167 surrounds the tube 159 and is adapted to drive the sleeve 160 and the hammer 161 forwardly with considerable force. An arm 169 projects radially from the rod 154 and operates in a slot 170 in the tube 159. The sleeve 160 of the hammer has a stop lug 171 on its forward end engageable with the securing flange of the tube 159 to limit the forward movement of the hammer sleeve 160 and stop it in a position where the arm 169 is directly in front of the sleeve.

When the gas piston 34 begins to move rearwardly, the actuator 67 moves rearwardly with respect to the spider 64 and the rod 154 moves rearwardly in the tube 159. During this relative movement between the rod 154 and the tube 159 the arm 169 moves the sleeve 160 rearwardly along the tube to compress the spring 167. A pivoted spring urged latch 172 is carried in a slot in the tube 159 and engages in a notch 173 in the hammer sleeve 160 to releasably latch the hammer in its cocked position; see Figure 6A. This occurs immediately before the actuator 67 engages the spider 64 to push the spider and bolt assembly rearwardly. The latch 172 holds the hammer 161 cocked during the rearward stroke of the bolt assembly and during the major part of the forward stroke of the assembly. Before the gas piston 34 reaches the end of its forward movement, the rod 154 engages the shoulder 150 of the spring-held latch 141 and this causes the actuator 67 and the rod 154 to lag slightly. The inertia of the spider 64 and the bolt assembly carries the spider forwardly relative to the lagging rod 154 to actuate the rack rods 60 and jaws 56 of the barrel extension as above described. The actuator 67 and the rod 154 continue to move forwardly under the action of the gas piston spring 36 after the spider 64 has stopped its forward movement. This final short forward motion of the rod 154 relative to the tube 159 brings a cam 174 on the rod into cooperation with the latch 172 to release the latch. Upon the release of the latch 172, the spring 167 drives the hammer 161 forwardly to strike the pin 165, which in turn, strikes the firing pin 116 and sleeve 120 to fire the round R. The spring urged latch 172 automatically returns to its active position and the cam 174 moves away from the latch during the subsequent rearward motion of the rod 154 relative to the tube 159.

Any appropriate means may be employed to charge the gun manually and to initiate and terminate gun operation. For example, a cable 190, shown schematically, may be connected with the spider 64 of the bolt assembly and extend to the exterior of the receiver 10 to provide for hand charging of the gun by pulling the bolt assembly rearwardly to thus compress the gas piston spring 35 and rotate the bolts 87 to their new angular positions. A suitable solenoid operated mechanism may control the hammer and cocking means to initiate and terminate operation of the gun. Such solenoid control mechanisms are common in the art, and form no part of the present invention and are therefore considered unnecessary to an understanding of the construction provided by the invention. This invention is concerned with the barrel extension and bolt assembly combination and elements associated therewith, and while a substantially complete gun has been disclosed it is to be understood that this disclosure has been provided for the purpose of assuring a better understanding of the construction and operation of the novel features and is not to be considered as restricting either the scope or the application of the invention.

Operation

Substantially complete operation of the gun will be described below in order to fully disclose the purpose and operation of the barrel extension and bolt assembly. To condition the gun for operation a suitable magazine, not shown, is applied to the frame 16 and the ammunition belt B is trained over the sprocket 39. At least one link L of the belt B is empty so as to pass the barrel extension 53, and a live round is introduced into the recess in the forward end of the bolt 87, which is to be aligned with the breech, so as to be gripped by the pawl noses 95. When the sprocket 39 has been supplied with the belt B, the bolt assembly is manually moved to the rear by the charging cable 190. During the rearward travel of the spider 64 and bolt assembly, the hammer 161 is cocked as above described. The lugs 130 travel rearwardly through the axial slots 138 and the bolts 87 move rearwardly without rotation. The rearward movement of the ac-

tuator 67 with the bolt assembly causes rearward travel of the gas piston 34 and the spring 36 is compressed so that energy is stored therein. Upon completion of rearward travel of the bolt assembly the gun is ready for operation.

The bolt assembly may be released for forward movement under the action of the spring 36 by a suitable control device, either direct or remote. For present purposes it may be considered that the operator merely releases the charging cable to allow the spring 36 to move the bolt assembly forward. During the first phase of forward movement of the spider 64 and bolt assembly, the lugs 130 move through the helical slots 129 to rotate the bolts 120°. This brings the bolt 87, which is carrying the live round, into alignment with the cartridge chamber 92. During the remainder of the forward motion of the bolt assembly, the bolts are held against rotation and the bolt 87, carrying the round, enters the barrel extension and introduces the round into the cartridge chamber. The actuator pawls 94, of an empty bolt 87, cooperate with the next round in the belt B to have their noses 95 grip the flange 97 of the round. As above described, the rod 154 enters the tube 133 and contacts the latch shoulder 150 to release the latch 141 so that the member 59 and the rods 60 may move forwardly to operate the jaws 56. The latch 141 operates to retain the member 59 and the rods 60 in their forward positions where the jaws 56 are actuated so that the bolt 87 is locked in the barrel extension. During the final phase of forward movement of the bolt assembly and actuator 67, the cam 174 releases the latch 172 and the hammer 161 is actuated to fire the round.

Upon firing of the round, the gas pressure developed in the bore of the barrel 18 acts on the gas piston 34 to drive it rearwardly. Rearward movement of the gas piston moves the actuator 67 to the rear. This releases the latch 141 as described above so that the spring 139 may move the rack rods 60 to the rear and retract the jaws 56. The initial rearward movement of the actuator 67 also compresses the hammer spring 167 and cocks the hammer 161. Thus by the time the rearward travel of the actuator 67 relative to the spider 64 is completed the jaws 56 are retracted to release the bolt 87 and the hammer 161 is cocked. The actuator 67 then engages the spider 64 to move the bolt assembly to the rear. During rearward movement of the bolt assembly the lugs 130 move through the axial slots 128. The rearward movement of the bolt assembly also results in withdrawal of the empty cartridge case from the chamber 92 and the new round gripped in the pawls 94 of a bolt 87 is pulled out of the belt B. Thus one empty cartridge case and one live round are moved to the rear with the bolt assembly. During the recoil of the barrel 18, accompanying firing of the round, the lugs 51 travel rearwardly through the axial slots 43 and the sprocket 39 remains stationary.

Upon counter recoil of the barrel 18, the lugs 51 move through the helical slots 49 to rotate the sprocket 39 and thus position the sprocket to receive the empty cartridge case and to bring the next round into position for extraction by the pawls of the now empty bolt 87. The spring 36 initiates forward movement of the bolt assembly immediately following rearward travel of the assembly. During the forward stroke of the bolt assembly, the lugs 130 cooperate with the helical slots 129 to turn the bolt assembly to the position where the new round is aligned with the firing chamber 92 and the empty cartridge case is aligned with its emtpy link L of the belt B. The lugs 130 move into the axial slots 128 and during the remainder of the forward motion of the bolt assembly the bolts are held against rotation. During the final phases of forward motion of the bolt assembly, the new round R is introduced into the firing chamber 92 and the bolt 87 enters the barrel extension opening 54. The rod 154 of the actuator assembly releases the latch 141 so that the jaws 56 may be actuated to lock the bolt in the barrel extension. The empty cartridge case is introduced into the empty link L of the bolt during the final forward motion of the bolt assembly, and the actuators 105 of the bolt 87, which carries the empty cartridge case, are operated through engagement with the cams 115 so that the pawls 94 release the empty case. The pawls 94 remain in the released condition until the bolt assembly begins its rearward travel during the next cycle of operation and the released pawls allow the empty case to remain in the belt B. The final phases of forward movement of the actuator 67 release the latch 174 so that the hammer 161 is actuated to fire the round. The above sequence of operations is repeated during successive automatic firing cycles of the gun.

Having described only a typical form of the invention, I do not wish to be limited to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

I claim:

1. A gun mechanism having a barrel and a barrel extension provided with an opening and characterized by a bolt assembly including a series of bolts supported for intermittent rotation as a single unit, each bolt being engageable in the opening of the extension, serrations on the bolts, means supporting said assembly for axial movement toward and away from the extension so that the individual bolts are entered in the opening of the extension, and serrated lock means on the extension for cooperating with the serrations of the bolts to lock the bolts in the block.

2. A gun having a barrel and comprising an extension on the barrel having an axial opening aligned with the barrel and a lateral opening, a bolt to be introduced into said axial opening and having serrations, a lock jaw contained in said lateral opening for movement in a radial direction relative to said axial opening and having serrations for cooperating with the first named serrations, and translatory rack means for moving the jaw in said radial direction, to bring its serrations into cooperation with said first named serrations.

3. A gun having a barrel and comprising an extension on the barrel having an axial opening aligned with the barrel and a lateral opening, a bolt to be introduced into said axial opening and having serrations, a lock jaw contained in said lateral opening for movement radially of said axial opening and having serrations on its inner side for cooperating with the first named serrations, inclined rack teeth on the jaw, and an actuating member movable axially on the extension and having inclined teeth cooperating with the first named teeth to move the jaw radially in said lateral opening for the purpose of engaging and disengaging the serrations.

4. A gun having a barrel and comprising an extension on the barrel having an axial opening aligned with the barrel and a lateral opening, a bolt to be introduced into said axial opening and having serrations, a lock jaw contained in said lateral opening for movement radially of said axial opening and having serrations for cooperating with the first named serrations, diagonal teeth on opposite sides of the jaw, and spaced rack rods movable axially of the extension and having diagonal teeth meshing with the first named teeth to move the jaw between positions retracted from the axial opening and positions where its serrations mesh with the serrations of the bolts.

5. A gun having a barrel and comprising an extension on the barrel having a main axial opening aligned with the barrel, spaced axial bores and radial openings communicating with the main opening, a bolt to be introduced axially into the main opening having serrations, block-like jaws contained in the radial openings and supported therein for radial movement, the jaws having serrations for meshing with the serrations of the bolt, diagonal rack teeth on the jaws, rack rods shiftable in said bores and having teeth cooperating with the teeth of the jaws to move the jaws radially between retracted positions and positions where their serrations engage the serrations of the bolt to retain the bolt in the extension.

6. A gun having a barrel comprising an extension on the barrel having an opening aligned with the barrel, a breech bolt movable axially into and out of the opening, jaws carried in the extension for transverse movement between positions clear of the opening and positions where they lock the bolt in the extension, and a single latch means operable to releasably latch the jaws in both of said positions.

7. In a gun having a barrel the combination of an extension secured to the barrel and having an opening aligned with the barrel, a breech bolt movable axially into and out of the opening, a jaw in the extension movable transversely of the opening between a position clear of the opening to allow the entrance of the bolt therein and an actuated position where it locks the bolt in the extension, means for moving the bolt into and out of the opening including an actuator having a slack connection with the bolt, and latch means for holding the jaw in the retracted position and released by relative movement between the actuator and bolt.

8. In a gun having a barrel the combination of an extension secured to the barrel and having an opening aligned with the barrel, a breech bolt movable axially into and out of the opening, a jaw in the extension movable transversely of the opening between a position clear of the opening to allow entrance of the bolt therein and an actuated position where the jaw locks the bolt in the extension, means for moving the bolt into and out of the opening including an actuator having a slack connection with the bolt, and rack means for moving the jaw between said two positions and controlled by relative movement between the actuator and bolt.

9. In a gun having a barrel extension provided with an opening aligned with the barrel, the combination of a breech bolt movable axially into and out of the opening, a jaw in the barrel extension movable transversely of the opening between a position clear of the opening to allow entrance of the bolt therein and an actuated position where it locks the bolt in the extension, means for moving the bolt into and out of the opening including an actuator having a slack connection with the bolt, rack means for moving the jaw between said two positions controlled by relative movement between the actuator and bolt, and latch means for holding the jaw in the retracted position released by relative movement between the actuator and bolt.

10. In a gun having a barrel extension the combination of, a carrier movable axially relative to the barrel extension, a plurality of breech bolts supported on the carrier for simultaneous intermittent rotation as a unit so as to be individually alignable with the barrel extension, lock means in the extension for locking the bolts therein, a member for moving the carrier axially, a lost motion connection between the member and carrier, and a latch for the lock means controlled by relative movement between the member and carrier.

11. In a gun having a barrel extension the combination of, a carrier movable axially relative to the barrel extension, a plurality of breech bolts supported on the carrier for simultaneous intermittent rotation as a unit so as to be individually alignable with the barrel extension, a member for moving the carrier axially, lock means for locking the bolts in the barrel extension, the carrier being operable to actuate the lock means when the carrier moves toward the barrel extension, and a latch for holding the lock means retracted and released by said member before the carrier actuates the lock means.

12. In a gun having a barrel extension the combination of, a carrier movable axially relative to the barrel extension, a plurality of breech bolts supported on the carrier for simultaneous intermittent rotation as a unit so as to be individually alignable with the barrel extension, a member for moving the carrier axially, lock means for locking the bolts in the barrel extension, the carrier being operable to actuate the lock means when the carrier moves toward the block, latch means for holding the lock means in a retracted position and operable to latch the lock means in its operated position, and a part on said member for releasing the latch means to free the lock means for actuation before the carrier actuates the lock means while traveling toward the barrel extension and operable to release the latch means to allow retraction of the lock means when the member initiates its movement in the direction to move the carrier away from the barrel extension.

13. A gun comprising a barrel, an extension fixed to the barrel and having an axial opening constituting a continuation of the bore of the barrel, a spider at the rear of the extension supported for axial movement toward and away from the extension, a circular series of three equally spaced bolts supported by the spider for rotation as a unit about an axis parallel with the barrel, the bolts being proportioned so as to be individually receivable in said opening of the extension, and means for imparting axial movement to the spider and rotary movement to said series to successively introduce the bolts in said opening and then withdraw them from the same.

14. A gun comprising a barrel, an extension fixed on the barrel and having an opening constituting a continuation of the bore of the barrel, a circular series of three equally spaced bolts supported for axial movement as a unit toward and away from the extension and for rotation as

a unit about an axis parallel with the barrel, each bolt being designed for reception in said opening, and means for imparting reciprocating motion and intermittent rotation to said series so that the bolts are successively entered into and withdrawn from said opening.

15. In a gun having a barrel, the combination of an extension secured to the barrel and having an opening aligned with the barrel, a breech bolt movable axially into and out of the opening, jaws carried in the extension for transverse movement between positions clear of the opening and positions where they lock the bolt in the extension, inclined teeth on the jaws, a pair of shiftable actuating rack members having inclined teeth for cooperating with the first named teeth to operate each jaw between said positions, and latch means associated with the rack members for releasably holding the jaws in their said two positions.

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