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The invention described herein may be manufactured by or for the Government for governmental purposes without payment of any royalty thereon.

This invention relates to a new and useful improvement in breech blocks and firing mechanisms therein, and is designed particularly for 37 mm. guns. The improved gun has a breech ring containing a sliding breech block and in which is mounted the improved firing mechanism, comprising the firing pin assembly, the cocking lever, and sear. There is also provided an operating lever for the breech block, and cartridge case extractors.

The particularly valuable features of the improved gun are the roll rear co-acting with a sleeve for the firing pin, the cocking plunger for the cocking lever, the structure, mounting and operation of the lever for sliding the breech block, the structure of the case extractors, and the cylindrical contour of the breech ring, devoid of protrusions, which greatly facilitates its fabrication.

While there has been illustrated in the drawings filed herewith, and hereinafter fully described, one specific embodiment of the invention, it is to be distinctly understood that the invention is not considered to be limited to said specific embodiment, its scope being defined by the claims appended hereto.

In the drawings:
Figure 1 is a fragmentary top plan of a gun provided with the improved breech mechanism, a portion being broken away;
Figure 2 is a fragmentary side elevation of the breech mechanism, from the right side, a portion being broken away;
Figure 3 is a view similar to Figure 2, from the left side;
Figure 4 is a rear end elevation of the breech mechanism;
Figure 5 is a fragmentary bottom plan of the breech mechanism;
Figure 6 is a side elevation of the breech block in closed position, a portion of the breech ring being broken away;
Figure 7 is a fragmentary side elevation of the breech block in cocking position;
Figure 8 is a view similar to Figure 6, the breech block being in loading position;
Figure 9 is an enlarged vertical section on the line 9—9 of Figure 1, in the direction of the arrows;
Figure 10 is a fragmentary vertical section of the firing mechanism shown in Figure 9, the parts being in cocked position;
Figure 11 is a view similar to Figure 10, the parts being in firing position;
Figure 12 is a detail perspective of the bracket for mounting the operating crank;
Figure 13 is a fragmentary vertical section on the line 13—13 of Figure 11, showing the round chambered against the extractor lips;
Figure 14 is a view similar to Figure 13 showing the extractor tripped;
Figure 15 is a perspective of one of the extractors;
Figure 16 is a vertical section on the line 16—16 of Figure 9, in the direction of the arrows;
Figure 17 is a vertical section on the line 17—17 of Figure 9, in the direction of the arrows;
Figure 18 is an exploded view of the firing mechanism;
Figure 19 is a perspective of the breech block.

As illustrated in the drawings the improved gun comprises the tube T, breech ring R, breech block B, operating lever L (Fig. 1), and firing mechanism M (Fig. 19). The tube T and ring R are connected in a threadless joint as disclosed and claimed in my Patent 2,445,339, dated July 20, 1948. The breech block B is slid able in a cylindrical transverse bore in the ring R from open loading position (Figs. 8 and 14) to closed firing position (Figs. 6 and 9), by the operating lever L journaled in a removable bracket 11 (Fig. 12) carried by the ring R. The firing mechanism M comprises a cocking lever operated by reciprocation of the block B, a striker and a trigger-actuated rockable sear.

The breech ring R has a cylindrical socket 1 in which is seated the rear end 2 of whose rear T, the tube face 3 is extended into the transverse bore 4 of ring R, provided for the sliding block B. The rear apron 5 of ring R has the load hole 6 and throat 7 thereabove (Fig. 9). The ring R is provided in its bottom face forwardly of bore 4 with a plane surface portion 8, a dove-tail socket 9 above and at the rear end of portion 8, and a concave key-way 10 at the forward end of portion 8. A bracket 11 is seated on portion 8, its upstanding dove-tail key 12 being received in socket 9 and its convex key 13 being received in key-way 10. Bracket 11 has a pair of depending bearings 14 to journal the operating lever L and a socket 15 to receive a lock pin 16 passed through portion 8 of ring R to removably affix bracket 11 to ring R. A bore
concentric with socket 15, opens through bracket 11 for insertion of a tool to remove pin 18 to permit separation of the bracket from the ring.

The operating lever L has a rock shaft 18, journaled in bearings 14 of bracket 11, transverse to the longitudinal axis of ring R. Shaft 18 has a radial crank arm 19 upon its outer end, an extension 20 normal to arm 19, and provided upon its upper end with handle 21 having a spring-pressed pivoted latch 22 co-acting with catch 23 keyed into ring R and having an abutment 24 to limit movement of shaft 18 in one direction. Shaft 18 has a radial finger 25 co-acting with socket 26 in ring R (see Fig. 8) to limit the movement of shaft 18 in the opposite direction, that is, the direction of movement in which the breechblock is lowered to open position. Shaft 18 has, on its end on the left side of ring R, a removable locking collar 27, Figs. 16 and 17, with spring retainer ring 28, to removably retain shaft 18 in bearings 14.

The breech block B is cylindrical for sliding movement within bore 4 of ring R, recessed on its lower right side to provide spaced abutments 29 and 30, Figs. 6 to 9, with which co-acts off-set lug 31 on the end of arm 32 normal to crank arm 33 radial to and integral with shaft 18. See Fig. 16. Rocking of shaft 18 causes lug 31 to bear against abutments 29 and 30 to lower and raise block B, respectively. Block B has an arcuate surface 34 extended upwardly and forwardly from abutment 30, to receive thereon the correspondingly curved face 33 of the block in fully raised or closed position. The corresponding arc of surfaces 34 and 35 are concentric with shaft 18. It will be noted (Fig. 6) that when block B is raised, and latch 22 is engaged with catch 23, the arm 32 is vertical, lug 31 bearing on surface 34. Movement of lug 31 along abutment 30 raises block B to closed position and lug 31 moves along surface 34 without further movement of block B, until arm 32 is vertical, thus providing a mechanical lock for block B.

The retaining mechanism M (Fig. 18) is mounted in breech block B. Block B has a diametrical bore comprising four co-axial portions of progressively reduced diameters. The portion 36 situated at the rear of block B has the largest diameter. Portion 37, situated in the middle of block B, has a reduced diameter, forming shoulder 38. Portion 39, extending forwardly from portion 37 has a reduced diameter, forming shoulder 40. Portion 41 extending forwardly from portion 39, has a reduced diameter forming shoulder 42 (Fig. 9). A cylindrical sleeve 43 has a smooth sliding fit in portion 38. Sleeve 43 has a peripheral flange 44, the outside diameter of which is slightly less than that of portion 37 so that flange 44 slides therein. The sleeve 43 has formed on its forward end a barrel 45 provided with a threaded axial bore 46. The barrel 45 is provided on diametrical opposite sides on its barrel bore 46 with cut-away portions 47 forming plane chondral faces 48 with the inner periphery of sleeve 43, forming two segmental passages between the plane surfaces 45 of barrel 45 and the interior of sleeve 43. A bolt 49, disposed in barrel 45, has its forward end threaded in bore 46 of barrel 45. A lock pin 50 passed through barrel 45 and bolt 49 fixes bolt 49 against axial movement relative to barrel 45. On the forward end of bolt 49, projecting from barrel 45, there is a suitable firing pin 51 to project through hole 41 of the bore of block B which opens through the forward face of block B as indicated at 52. A collar 53 has its inwardly-flanged rear end loosely fitting bolt 49 rearwardly of barrel 45. The collar is provided with two forward projections 54 passed through the said passages between sleeve 43 and barrel 45, and having abutment 46 facing the plane faces 45 of barrel 45 and arcuate faces 55 corresponding to the curvature of sleeve 43. An expansion spring 57 is confined between head 56 of bolt 49 and collar 53 to urge collar 53 against rear end of barrel 45, that is, the position shown in Figures 21 and 22.

A retainer cap 59 is removably mounted in portion 36 of the bore of block B by a bayonet-joint provided by socketed lugs 60 in the portion 36 in which are seated lugs 61 on the cap 59. Cap 59 has seated therein the firing spring 62 passing through sleeve 43 and about bolt 49, and bearing against collar 53.

The breech block B is provided on its upper right side with a recess 63 at the lower end of which there is a transverse bore 64, below which there is a bore 65 which is recesed on its lower right side to provide spaced abutments 64 and of greater depth than the recess 65. At the bottom of recess 65, there is an aracuate slot 66, Figs. 6, 7 and 8, communicating with portion 37 of the axial bore of the block B. A cocking lever 67 (Fig. 17) has its hub 68 journaled in the bore 64, its upper arm 69 received in recess 63 and its lower crank arm 70 received in recess 65. Arm 70 has an off-set firing pin 71 (see also Fig. 18) extending through slot 66 into the portion 37 of the axial bore of the block B. Lever 67 has a lug 72 projecting from the junction of hub 68 and arm 69 with which co-acts a spring-pressed plunger 73 slidably mounted in block B to urge arm 69 into counterclockwise rotation as viewed in Fig. 6. Arm 69 has an off-set lug 74 on its upper end. As above mentioned, the cocking lever 67 is automatically actuated by reciprocation of block B. As shown in Figs. 1 and 6, when the block B is raised to closed position, arm 53 of lever 67 is against the rear wall of recess 65, urged thereto by spring-pressed plunger 73, and extends rearwardly over the rear apron 5 of breech ring R. Ssuitably disposed in ring R below arm 69, when it is thus positioned, there is an inclined cam surface 75 with which lug 74 co-acts to rock arm 69 forwardly or clockwise as block B is lowered. At the forward end of surface 75, the ring R has a cut-away portion providing a plane vertical dwell surface 76 over which lug 74 travels, holding arm 69 forwardly as the block descends. Ring R is provided with an inclined bore 77 disposed at an acute angle to surface 76. Slidable in this bore 77, there is a spring-pressed cocking plunger 78 bearing against an abutment 79 partially closing the lower end of bore 77. The remainder of bore 77 opens through surface 76, permitting the lower end of plunger 78 to protrude beyond surface 76. It will be noted (Figs. 6, 7 and 8) that the peripheral cylindrical wall 80 of plunger 78 is disposed as to form a cam surface for lug 74 to further project arm 69 forwardly (Fig. 7), and that lug 74 riding off of plunger 78 permits arm 69 to move rearwardly to engage lug 74 with surface 76 (Fig. 8). When block B is raised to closed position, it is obvious that lug 74 of the end wall 81 of plunger 78 will retract plunger 78 against its spring, lug 74 riding on surface 76. The breech block B (Fig. 19) is provided on its left side with a channel or recess 82 extending
from the top of block B to a point below the bottom of the above described axial bore in block B. At the bottom of recess 35, there is an abutment 83. A recess 84 extends forwardly in block B, and from recess 84, a recess 85 extends transversely of block B. From the inner side of recess 35, a transverse bore 86 extends into block B to a point somewhat beyond the axis of block B. It will be noted (Fig. 16) that the transverse bore 86 communicates with portion 31 of the axial bore of block B. Block B has a bore 87 extending from the bottom upwardly to a point above transverse bore 86, and communicating therewith. A transverse bore 88 extends from the left face of block B into the bore 87 somewhat above bore 85. The ear 89 (Fig. 18) comprises a rock shaft 90 which is journaled in bore 88 and a crank arm 91 on the left end of shaft 89 and received in recess 85. The arm 91 has on its outer end an off-set lug 92 received in recess 84. The shaft 90 is cut away on its right end to provide a plane face 93, and is notched in its portion disposed across the bore 87 to provide a plane face 94. A plunger 95 disposed in bore 97 bears against one end of face 94 eccentric to axis of shaft 90, so that shaft 90 is biased by spring 96 disposed between plunger 95 and end of bore 97. Plunger 95 has an annular groove 98.

The breech ring R has a slot 98 (Fig. 1) from its left side extending into its bore 1. Suits pivoted in this slot 98, there is a trigger 99 having an operating ring 100 on its outer end extending outwardly from ring R, and a finger 101 on its inner end and extending into bore 5 and received in recess 92 of breech block B. This finger 101 co-acts with lug 93 of the ear 91, and when trigger 99 is rocked to project finger 101 forwardly from recess 92 into recess 95 causing lug 92 to rotate clockwise as seen in Figure 18 and, through crank arm 91, rock shaft 90. A spring-pressed plunger 102 mounted in ring R bears against a lug 103 to press trigger 99 against abutment 104 at the forward end of slot 98. It will be noted (Fig. 1) that when trigger 99 is seated against abutment 104, the finger 101 is disposed in recess 92 of block B, and that consequently it serves as a stop pin for abutment 93 at the lower end of recess 92 to limit the movement of block B upwardly into closed position.

As clearly shown in Fig. 9, the peripheral flange 44 of sleeve 63 in the axial bore of block B has a forward end face 44c lying in a plane normal to sleeve 63 and provided with an outer peripheral convex fillet 44b. The rear end face 44d of collar 41 tapers rearwardly to form a cam surface to co-act with plane face 93 of rear 89. As clearly shown in Fig. 16, the off-set finger 71 of cocking lever 67 is disposed to bear against radial face 44d to retract sleeve 63 when lever 67 is rocked. It will be noted (Fig. 16) that the plane faces 93 and 94 of sleeve 89 are angularly disposed, so that bolt 55 bearing on face 94 tends to bias rear 89 to position face 93 to receive cam face 44c when sleeve 44c is retracted by lever 67, and that when collar 41 has moved rearwardly over the rear edge of face 58, the rear 89, rocked by bolt 55 pressing on face 94 moves into the position shown at Figure 10 and locks sleeve 43 in cocked position. It is obvious, that when rear 89 is rocked by trigger 99, as above described, its arcuate portion is withdrawn from fillet 44b, and its plane face 94 being disposed on the periphery of portion 31 of the axial bore of block B, sleeve 43 is released.

It will be noted (Fig. 18) that rear 89 has a notch 89a disposed in the rear edge of face 93.

A pair of extractors 105, one of which is shown in Figure 15, are provided in ring R, and are automatically operated by reciprocation of block B. Each extractor 105 comprises a trunnion 106, an upstanding lever arm 107 carrying an off-set finger 108, and a depending crank arm 109 with a rearwardly turned toe 110. The trunnions 106 are journaled in bores 111 suitably positioned in the ring R, and the extractors 105 are disposed in channels formed by recesses 112 on the forward sides of block B, their fingers 108 seated in sockets 113 symmetrically disposed, in tube 4 on diametrically opposite sides of its axis. Block B is provided with suitable cams 114, at a rear of recesses 112, co-acting with toes 110 of the extractors 105 to actuate same.

Block B is provided in its top with a concave channel 115 corresponding in curvature with a load hole 6 of ring R. At the forward edge of channel 115, block B has a bevelled edge 116 sloping downwardly to the upper edge of an arcuate cam surface 117 on the upper edge of the forward face 118 of the block B. At the bottom of face 118, there is a flange 119 having a flared convex face 120 curved with bore 4 of ring R and received against the rear concave face 121 of bracket 11, when block B is raised. Cam surface 117, bearing against head 122, Chambers the round when the block B is raised to operating position.

In firing a round, assuming the gun to have an empty shell therein, and the breechblock in upper, or closed position, lever L is grasped, released by pressure on latch 22 to free it from catch 23, and swung counterclockwise as viewed in Figure 2. This pivotal movement first causes lug 31 to traverse arcuate surface, Figure 6, to unlock the breechblock. Thereafter, the lug engages abutment 25 and positively lowers the block in timed relation with pivoting of the lever.

As the breechblock descends, cam surfaces 114 thereon engage the toes 110 of the respective extractors 105 and pivot the extractors counterclockwise, from the position shown in Figure 13 to that shown in Figure 14. This movement, causes fingers 108 to force the empty shell out of the breech chamber with momentum sufficient to throw it clear of the breech as the block moves to fully open position.

As the breechblock begins to lower, lug 74 of cocking lever 67, first rides on inclined cam surface 76 and is thereby pivoted clockwise from the position seen in Figure 6 to that shown in Figure 7. This pivotal movement includes a small additional increment as lug 74 rides over the projecting end 81 of plunger 78. The total movement is sufficient to cause lug 71 (Figures 16 and 18), of cocking lever 57 to engage face 44a of flange 44, and force sleeve 43 rearwardly and against the action of spring 62. As the sleeve moves rearwardly in bore 37, the rearward cam face 44c of flange 44 engages the flat surface 93 of rear 89, which is in the approximate inclined position shown at Figure 9, and pivots the sear shaft 90 counterclockwise as seen in that figure, against the yielding action of plunger 55 and spring 65, until, as the flange clears shaft 90 in the continued rearward motion of sleeve 43, the shaft is released and, under the urge of spring 66 and plunger 55, pivots clockwise to the position shown in Figure 10, thereby locking the sleeve and firing pin assembly in cocked position. The breechblock is in fully lowered or opened position.
A round of ammunition is now chambered in the usual manner until its rim engages the fingers 108 of extractors 105, which are in the position shown at Figure 14. Lever 21 is next rotated from the position of Figure 8 to that of Figure 6, to close the breechblock. At the beginning of closure lug 74 of cocking lever 67, cams plunger 80 inwardly and, as the block closes, returns to the pivotal position of Figure 6 under the urge of plunger 73. When the block B is fully closed, it is locked in this position by the mating surfaces 34 and 35 as is clear from Figure 6. Lever L is at this time latched in position by parts 22, 22, as seen in Figure 2. Also, at this time, finger 101 of trigger 99, is within recess 85 of block B (see Figure 19), and is thus freed for firing movement.

To fire the gun, trigger 99 is pivoted counterclockwise from the position of Figure 1. Finger 101 then engages lug 92 of spring 80 and pivots rear shaft 80 counterclockwise from the position shown in Figure 10 until sleeve 43 is released and spring 82 drives the firing pin assembly forwardly. As the assembly moves forwardly, the ends of fingers 54 of collar 53, strike the forward end of bore 39, as seen in Figure 9, and arrest further movement thereof. The momentum of firing pin 49 then carries the pin forwardly, against the thrust of spring 57 until the tip 51 projects through hole 52 (Figure 19), in block B, and disengages the cocking lever from the position shown at Figure 9, within the block B, by the action of spring 57. The block is now ready to be lowered for the next round.

I have thus provided a breechblock and firing mechanism which is positive in action, simple to operate, and easily assembled, disassembled, adjusted and repaired. While I have shown the preferred form of the invention, numerous modifications will occur to those skilled in the art, after a study of the foregoing specification. I therefore desire that the disclosure be taken in an illustrative rather than a limiting sense, and it is my desire and intention to reserve all those modifications falling within the scope of the subjoined claims.

Having described the invention, what I claim is:

1. A firing mechanism for a gun, the combination of a firing pin reciprocable in the gun; a rock shaft transverse to said pin in the gun, said shaft having a cut-out portion forming a plane face and a notched portion forming a second plane face, said faces lying in planes describing chords of the circumference of the shaft, respectively; a spring-pressed plunger bearing on the said face of the notched portion, eccentric to the axis of the shaft, tending to bias the shaft to intrude the said face of the cut-out portion into the path of said pin; means to reciprocate said pin to cocking position; a cam shoulder on said pin co-acting with said intruded face to rock said shaft, when said pin is reciprocated, said plunger rocking said shaft to engage said shoulder when said pin is cocked; a crank-arm on said shaft; a trigger pivoted on the gun for swinging said arm to rock said shaft against the force of said plunger, to release said shoulder and said firing pin; and resilient means in said gun associated with said pin and energized by the reciprocation of the pin, and projecting the pin to firing position when the shoulder is released by the trigger action.

2. In a gun, the combination of a breech block; a firing pin reciprocable in and projectable from said block; a peripheral flange mounted on said pin and having a forward face normal to the axis of the pin and a rear face inclined rearwardly at an acute angle to said axis; a finger pivoted in said block for engagement with said forward face; means in said block for rocking said finger to retract said pin into cocked position; a rear rockably mounted in said block in the path of said flange, said rear face camming said rear on said face on one engagement said forward face after retraction holds pin cocked; manual means for rocking said rear to release said pin; and means to project said pin from the block into firing position when the pin is released.

3. In a gun, the combination of a breech block provided with an axial bore therethrough; a sleeve slidable in said bore; a peripheral flange on said sleeve having a forward face normal to the axis of the bore, and a rear face inclined rearwardly at an acute angle to said axis; a firing pin mountable therewith; an expansion spring confined between said sleeve and said cap; a reciprocable finger in said bore forwardly of said flange; means in said block to reciprocate said finger to engage the forward face of said flange, retracting said sleeve to compress said spring to cock said firing pin; a rear rockably mounted in said block and resiliently intruded into said bore rearwardly of said flange prior to said retraction, the said inclined face camming the said rear on said face on one engagement the said forward face after said retraction; and manual means for rocking said rear to release said sleeve, said spring projecting the firing pin into firing position.

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