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COMPLETE SPECIFICATION.

[Communicated from abroad by BERGMANN'S INDUSTRIEWERKE of Gaggenau Grand Duchy of Baden in the German Empire].

Improvements in Automatic Small-arms.

I, ERNST ZAPPERT, of 25 Bartlett's Buildings, in the City of London, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

5 This invention relates to improvements in fire-arms actuated by the recoil and consists mainly in a novel locking and releasing device applicable to sporting-guns, fowling-pieces, pistols or the like, and also to military rifles.

The present improvements are such as to enable weapons intended for use in the army or navy to be operated semi-automatically as well as partly by hand, 10 while, where quick-firing is a desideratum, the automatic mechanism may be set in operation by a single movement of the hand.

Another feature of the invention is that all the apertures are covered over, or concealed and in addition to this, the removal of the breech-plug or breech-bolt as well as the taking to pieces and setting up of the firing-mechanism, may be 15 effected by hand, without the employment of any tool and by a manipulation which may almost be described as more simple even than that by which these operations are accomplished in the latest types of fire-arms employed in modern warfare. Any parts that are difficult of manufacture are dispensed with, so that, whilst the construction is improved, the cost thereof is kept down within 20 the same limits as heretofore, and lastly as regards convenience of shape and lightness of weight, the improved arms will compare favourably with any that have been previously devised.

The invention will be more readily understood by reference to the accompanying drawings, in which

25 Figure 1 is a plan or top view of the improved rifle.

Figure 2 is a vertical longitudinal central section of the same.

Figure 3 shows, in horizontal section, a portion of the casing with the barrel moved rearwardly.

Figure 4 is a horizontal section showing the weapon with the breech closed.

30 Figure 5 shows the locking notch of the barrel.

Figure 6 is a cross section of the casing with its cover or roof shown in the position where its foot 11 rests within the casing;

Figure 7 is a cross section of the barrel taken in the rear of the chamber, showing also the locking surface.

35 Figure 8 represents, by a broken horizontal section, the casing with the breech-bolt and parts of the firing-mechanism moved rearwardly,

Figure 9 shows the central portion of the rifle, viewed from the right hand side;

Figure 10 is a rear elevation of the breech-bolt the position of the operating

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lever or knob when the main spring is disengaged, being indicated in dotted lines;

Figure 11 is a section of the rear-end of the breech-bolt, with the lever 8 arranged to secure the operating-lever in either of two positions;

Figure 12 is a horizontal section of a modified form of breech-bolt head; 5

Figure 13 is a horizontal section of the breech-bolt, barrel and casing of a pistol;

Figure 14 is a side elevation of a complete pistol.

Figure 15 is a cross section of the breech-bolt and surrounding parts showing the cross-piece of the breech in front elevation. 10

Figure 16 is a horizontal section of the breech-bolt holder or catch;

Figure 17 is a plan of the same with the breech-bolt taken out.

Figure 18 is a vertical section of the casing, breech-bolt and firing-mechanism, with the firing-pin cocked;

Figure 19 is a vertical section of the breech-bolt and extractor; 15

Figure 20 is a cross sectional rear view of the breech-bolt;

Figure 21 is a cross sectional front view of the same;

Figure 22 is a cross section of the breech-bolt with the transverse pin 18 showing also the locking projection of the breech-bolt.

Figure 23 is a cross section of the rifle taken at the point where the lock-carrier 20 engages in its terminal position;

Figure 24 is a plan or top-view of the breech-bolt lock and cover-plate.

Figure 25 is a vertical section of the same.

Figure 26 is a sectional plan or top view of another modification of the breech-bolt and casing; and 25

Figure 27 is a cross section through the front end of the same.

The construction is as follows:—

The barrel B is arranged within the casing A, Figures 1, 2, 3, 4 and 8, in such a manner that it may, by a rectilinear movement, be drawn back, but cannot revolve, and is held in place in the rear by the casing A, or by an equivalent 30 ring or ferrule. The spring 1, Figures 3, 4 and 8, constantly tends to drive it forward by means of the slide 28, which is located within a guide 30 dovetailed at its rear end. The slide 28 itself is likewise dovetailed at its front end. When therefore, the guide 30, together with the slide 28 behind which 35 the spring 1 is situated, is inserted into the casing, the front surfaces of the spring case and slide are pressed against the walls of the casing A of corresponding shape, so that these three parts are firmly secured in position without any additional joining contrivance. The barrel, at its rear end, on the right hand side, is provided with a slot 31, Figure 7, wherein the flat portion of the slide 28 40 is supported; while on the left it has a recess or notch 17, Figures 3, 7 and 8, in which the breech-bolt is adapted to be locked. Now inasmuch as the slide 28 rests within the casing A with one half of its flat portion, and within the barrel B with the other half thereof, the barrel is precluded from any rotary motion while the slide cannot move out of the way in any other than the rearward direction, in which direction it exercises its compressing action as illustrated in 45 Figure 3, and the said slide 28 furthermore serves as a bridge or support whereon the transverse pin 18 is adapted to slide over the slot or opening provided in the rear portion of the casing.

The breech-bolt C containing the firing-pin 5 is turned eccentrically at its front part, so that projections or lugs 2 and 3, Figures 4, 8, 12 and 13, extend laterally 50 from its head; the front lug or projection 3 being adapted to engage with the notch 17 of the barrel, while the rear one serves for unlocking or releasing in the manner hereinafter described. The perforation for the point of the firing-pin is also situated eccentrically, and the breech-bolt is so formed that it gradually tapers off from its rear end in the forward direction, forming an oval which permits 55 of the front-part of the bolt, within the casing A, taking up its position on one side, as illustrated in Figure 4; the front projection 3, which acts as a locking

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pin, engaging with the barrel and thus serving to connect the parts together into one rigid body.

The breech-bolt C is screw-threaded at its rear end, and upon this threaded portion the cap 4, Figures 4 and 8, is screwed; such cap carrying the operating lever or handle K of the said bolt.

The extent of rearward motion of the breech-bolt, thus connected with part of the lock and with the said protecting cap, is limited by a cross-piece 6, located within the casing A and having a perforation for the firing-pin to pass through. On this cross-piece the slotted breech-bolt is guided in its rectilinear motion. Now, in some instances, to enable the breech-bolt to be drawn out of, or pushed into, the casing, without the necessity of taking to pieces the parts connected therewith, there is provided, as a substitute for the cross-piece 6, a breech-bolt holder or catch E, such as is shown in Figures 1, 16 and 17, which, by means of the prongs or pins provided at its forward end, engages with the casing and breech-bolt; such bolt being adapted to impinge upon it on completing its rearward stroke.

This breech-bolt holder or catch consists of two parts turning about a pivot and between which a helical spring is interposed; the lower resilient part 16, acting as a spring upon the rear portion of the breech-bolt, thus imparting to the same a tendency to move its forward end to the left and to assist the breech-bolt head, when the breech-bolt is moved forward, in catching, with its projection or lug 3, in the notch 17 of the barrel. The release of the breech-bolt is effected in the well-known manner by pressing upon the rearward end of the breech-bolt holder or catch E.

The firing-pin 5 is provided with a flange 5^a terminating downwardly in locking pins or prongs 5^b, as shown in Figures 2 and 18.

No cartridge can be ignited so long as the breech-bolt head has not entered the locking notch on the left inasmuch as the point of the firing-pin, being situated on the right of the centre, cannot strike the priming-cap where it is to be fired. The transverse pin 18, Figures 4 and 18, is provided with a tapering recess, whereby the said firing-pin is enabled to produce the requisite locking effect.

The point of such firing-pin cannot, therefore, reach the priming-cap until after the transverse pin 18 has taken up its position on the right, and the breech-bolt head has moved to the left, both having thus assumed their closed or locked position as illustrated in Figure 4. And at one end of the said pin 18 is a helical spring 19 which forces the breech-bolt into the closed or locked position.

Within the breech-bolt C is also located the extractor 21, Figures 19 and 21, which is guided by the upper cover or wall of the casing A, its operation being perfectly reliable owing to its length and its loose arrangement, and its insertion and removal alike being easy.

The firing-mechanism may be enclosed in the breech-bolt and if desired, a firing-hammer or cock may be employed. In the rifle shown the firing-pin is driven forward directly by the spring 7 and no hammer or cock is employed, while the pistol shown in Figures 13 and 14 is provided with a hammer or cock.

In putting together the parts of the gun-lock, the breech-bolt C is first inserted into the casing A, and then the cross-piece 6 is introduced. After this the firing-pin, with the main spring 7 wound on its rear end, is inserted in its turn, and lastly the cap 4 is screwed on, which involves the compression of the said spring 7. Now in order to prevent the cap 4, together with the operating lever K of the breech-bolt from becoming accidentally unscrewed, there is provided a lever 8, Figures 4 and 8, the forward end 10 of which is caused by the spring 9 to enter a recess in the breech-bolt. In screwing on the cap 4, this lever is pressed inward at its rear end, until the said cap is brought to its proper position.

In order that the mechanism may be entirely concealed from view at the top, a cover or roof D, Figure 1, is provided, the foot 11 with which it is fitted in front, as shown in Figures 2 and 6, being adapted to slide in the slot of the casing and thereby prevent any lateral displacement thereof, while in the rearward direction the said cover extends over the pin 12 of the breech-bolt Figure 2. A

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lever 13 engages with the said pin 12 and thus connects the said roof or cover and breech-bolt, the said lever 13 being resilient and its tappet 14 being adapted to enter a recess in the roof or cover D, whereby the parts are fixed in the closed position. In order to ensure a perfect contact and a close joint between the forward end of the cover or guard-plate D and the breech-bolt without however 5 connecting it with the latter so rigidly as to interfere with its lateral motion, a spring pin 15, Figure 2, is attached to its extreme rear end, so as to press upon the cap 4 and force the rear end of the cover D upwards and the front end downwards. On the right of the casing A there is situated a spring case 33, Figures 1, 4 and 8. In this case 33 there is enclosed the spring 34 wound on the rod 35 the rear part 10 of which is held by the nut 36 and the front end of which is provided with a head 35^a.

The operating lever K of the breech-bolt, as illustrated in Figures 8 and 10, may be brought to the position in which it will engage with the nut 36. Whenever the breech-bolt is drawn back, the spring 34 is compressed as shown in 15 Figure 8, and when the breech-bolt is released, the said spring moves it forward again to the closed position as shown in Figure 4. Thus the fire-arm in this condition operates perfectly independently, that is to say, after firing, the breech-bolt immediately flies back, and is then driven forward again by the compressed spring, taking a fresh cartridge along with it, from the magazine, and conveying 20 it into the barrel. When the operating lever K is moved into the position shown by dotted lines in Figure 10, the spring 34 and rod 35 are disengaged from the breech-bolt and the breech then remains thus open until the breech-bolt is moved forward again by hand.

The operating lever K is adapted to be secured in either of its two positions 25 by the two notches *e*, *e*¹, Figure 11, in which the lever 8 is caused to engage by its spring. In the disengaged position, where the spring 34 is inoperative and therefore the breech-bolt remains in its rearmost position, the magazine may be filled with cartridges from the top; or cartridges may conveniently be introduced into the barrel singly. In this condition, therefore, the arm is what is known as a 30 semi-automatic one; because the empty cartridge-case is ejected automatically, and the opening of the breech is also automatic, whereas the loading operation, whereby the cartridge is driven from the magazine into the barrel, has to be performed by the marksman himself, though the amount of labour involved in the operation is after all less than that required with ordinary repeating rifles. 35

This construction therefore enables the improved rifle to be conveniently utilized also as a repeating rifle with a straight-moving breech-bolt, whenever there is any reason to fear waste of ammunition. Where, however, quick firing is an object, one turn of the hand will in all cases be sufficient to set the automatic mechanism in operation. Again, where a cartridge that has missed fire is to be dealt with, 40 or in other emergencies, this property of the improved rifle, of operating in two different ways, will prove an invaluable advantage.

The operation of the firing-mechanism is as follows:—

The locking prong 5^b of the firing pin, whenever the breech-bolt is drawn back, takes up its position behind the spring sear 37, Figure 2. Now when the 45 breech-bolt has advanced sufficiently for the prong or pin 5^b to come into contact with the sear 37, then, as it completes its forward movement, it will compress the main spring 7, and at the very last moment the breech-bolt will spring to one side, and the projection or lug 3 will engage in the notch 17 of the barrel. The breech-bolt head which, when locked in position, is held in engagement on one or both 50 sides, merely prevents the breech-bolt from receding under the pressure of the mainspring 7. The firing-pin will consequently be retained in its cocked position and the rifle will be ready for firing, a cartridge having at the last stage entered the barrel, while the extractor hook is for the time being arrested.

Now when pressure is applied to the trigger 39, the sear 37, Figure 2 will 55 thereby be drawn downwards, and the firing-pin, being thus set free, will spring forward and fire the charge.

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As upon firing, the barrel recoils, the breech-bolt in its locked position is at the same time thrown back; and as soon as the inclined surface 41 of the breech-bolt head comes up to the surface 42 of the case Figure 4, the projection or lug 3 will leave the notch 17 in the barrel, under pressure, thereby disengaging
 5 the breech-bolt. The barrel and breech-bolt are now disconnected from each other, and the breech-bolt is by the kinetic energy thrown further back to the very limit of its movement, and the cartridge extractor being drawn back too, takes the cartridge-case out of the barrel along with it; the spring 1 compelling the barrel to return to its initial position. The ejector 43 which has in the meantime entered
 10 the breech-bolt head through the groove or slot 43^a, Figure 2, now takes up its position in rear of the base of the cartridge-case, and, by acting upon the same effects the ejection of the cartridge-case.

The same breech-releasing operation takes place whenever the breech is opened by hand, by a pull on the lever K. A cartridge in the barrel may thus be
 15 extracted and ejected in the same way as above stated; and when the lever K is brought into the position shown in full lines in Figures 10 and 4, *i.e.*, when the breech-bolt is engaged with the spring 34, the breech-bolt, which was previously thrown back, is driven forward by the spring 34 through the medium of the rod 35, overcoming the resistance of the main spring 7. If there was a cartridge
 20 in the magazine, it will by this time have entered the barrel, so that the rifle is once more in readiness for firing. But as the marksman's finger, after pressing the trigger, cannot be withdrawn therefrom as quickly as the breech-bolt performs its rearward movement on firing, the sear would not be able to rise again, before the prong 5^b of the firing-pin reaches the point of its engagement with the sear 37,
 25 and would not therefore hold the firing-pin back in its engaged or "firing" position, were it not for the cock 45, Figure 2, which is provided on the trigger 39 and controlled by a spring 44.

Owing to the provision of this additional part, the sear 37 is indeed drawn down when the trigger is pressed; but at the last moment of the disengaging operation
 30 it will fly upwards again, before the prong 5^b of the firing-pin comes up to it. When the trigger is released, its tooth or cock 45 will be pressed back and will pass the nose 46 of the sear 37 and will then be forced by the spring 44 into the position shown in Figure 2 and so prepared for the next shot.

Another kind of breech-closing mechanism, which engages or locks itself on
 35 both sides is the following, *viz.*:—As shown in Figures 25, 26 and 27, the breech-bolt C is split or divided vertically throughout its whole length and is provided at its rear end with a round projection 22, Figures 25 and 26; which bears a segment 22^a at the centre. As shown in Figures 24 and 25, this split breech-bolt C can be connected with the cover so that the connected parts together form
 40 a whole, so that the split breech-bolt will be continually forced asunder by the springs 23, Figure 27, in its head, at the front, and is retained in two crescent-shaped grooves in the barrel by means of its projections or lugs 3 as soon as it comes into the closed position.

The cone of the firing-pin, before firing, presses the two halves C¹ and C² of
 45 the breech-bolt asunder, and so does not reach the percussion cap until the halves of the breech-bolt are forced asunder at the head and the closure is securely made.

The firing spring 7 is here supported at the back by a fly-nut 25 which can also serve at the same time as a catch or safety bolt. In shot guns where the base of the
 50 cartridges is very large and therefore the breech-bolt also must have a larger diameter, a third form or modification of the method of closing must be provided for, which is shown in Figure 12, and in which the breech-bolt does not move to one side but is provided with an inclined piece 26 arranged in the head thereof which inclined piece can move horizontally in the closing head and as shown in
 55 Figure 12, is likewise locked, by means of its lug or projection 3, in the rear end of the barrel. The cone of the firing-pin, as well as the depression at the rearward

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face or end of the inclined piece 26, Figure 12, in a similar manner to the bolt 18, prevent the point of the firing-pin from reaching the percussion cap before the inclined piece 26 is forced to the left.

In order to press the piece 26 to the left into the closing position, the spring lever 19, Figure 13, is employed, and is lengthened so that it presses on the piece 26 in the closed position; moreover a small spring lever can be secured directly to the right side of the piece 26, which presses the said piece to the left into the closing position.

In the pistol the spring 1 lies, in front in the casing beneath the barrel; a projection in the latter presses on the spring 1 and thereby prevents any rotary motion of the barrel. The forward movement of the barrel is controlled by the lever 32 which, in order to enable the barrel to be removed, may be moved to one side. Figure 13 illustrates in section the manner in which this lever takes up its position against the projection or extension of the barrel.

In view of the fact that in a pistol the diameter of the breech-bolt head is generally so small that it scarcely admits of the proper attachment of the transverse pin 18, a spring-controlled lever 19, Figure 13, is in this case employed; the forward end of this lever is adapted to force the breech-bolt into the locked position on the left-hand side, while its rearward extremity takes up its position against the hammer 20 and thereby prevents it from meeting the firing-pin, whenever it happens that the locking operation has not been quite completed.

The magazine may be of any suitable construction, and conveniently chargeable either from the top or from either side; but its construction being generally known, it is omitted from the drawings.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, as communicated to me by my foreign correspondents, I declare that what I claim is:—

First. In small-arms operated by the recoil and having a movable barrel, a breech-bolt adapted, in the engaged or "firing" position of the mechanism, to have its forward end moved to one side by spring pressure, whereby a lug or projection on the said breech-bolt becomes locked in the barrel, while it is disengaged, as the said barrel recedes, by an inclined projection acting on an incline in the casing, substantially as hereinbefore described.

Second. A modification of the fire-arm referred to in the preceding claiming clause, wherein the locking and releasing operations are effected on both sides, the breech-block being for this purpose divided into two halves or sections, Figures 26 and 27, substantially as described.

Third. A modification of the fire-arm above referred to, wherein the inclined piece 26, which is movable within the breech-bolt, is adapted to move on one side and to lock and release the said breech-bolt, substantially as, and for the purposes, hereinbefore described.

Fourth. The employment of an operating lever or handle on the breech-bolt, which, by a corresponding rotary movement, is adapted to be brought into or out of engagement with the rod 35 and spring 34 driving the same, substantially as, and for the purposes, hereinbefore described.

Fifth. The breech-bolt holder or catch, the lower portion of which exercises a spring action upon the rear end of the breech-bolt, thereby bringing the locking-projection on the said breech-bolt into engagement with the notch in the barrel, substantially as described.

Sixth. The provision of the spring-controlled lever 19, the rearward end of which prevents the cock 20 from acting upon the firing-pin before the breech-bolt is locked in position, substantially as described.

Seventh. The provision of the guard-plate or cover D which closes the loading-aperture of the casing C, and which is capable of being attached to the breech-

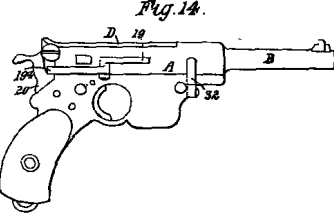
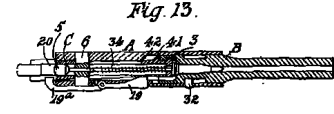
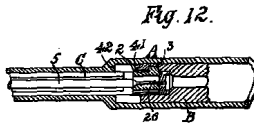
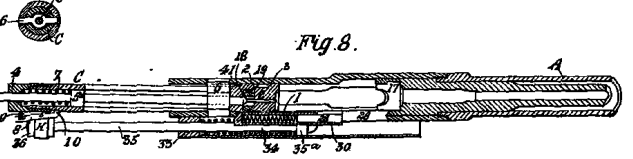
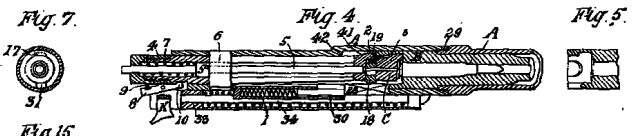
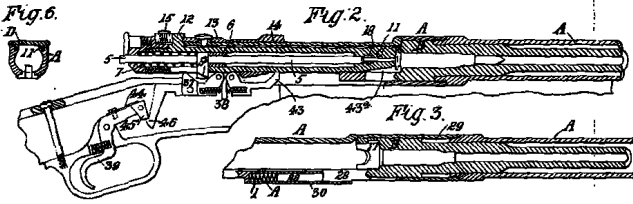
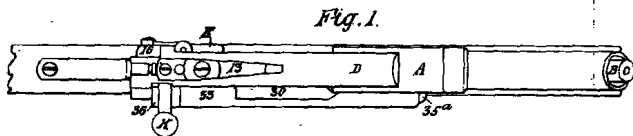
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bolt by hand by means of the lever 13, Figures 1, 2 and 24, substantially as described.

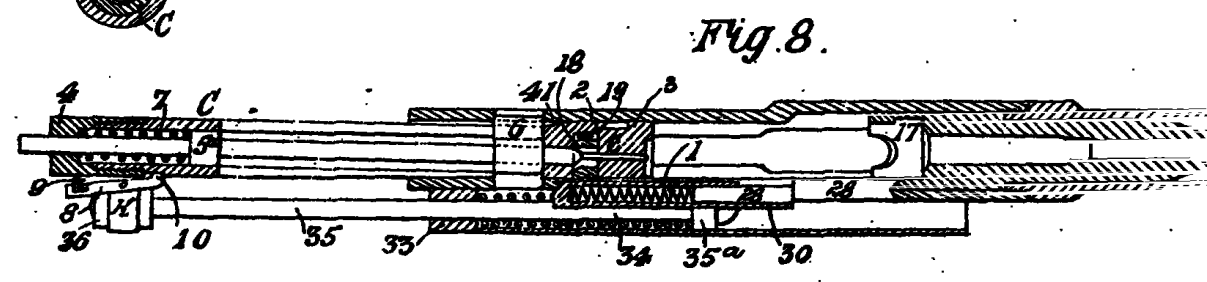
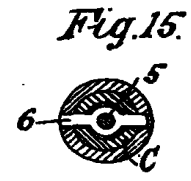
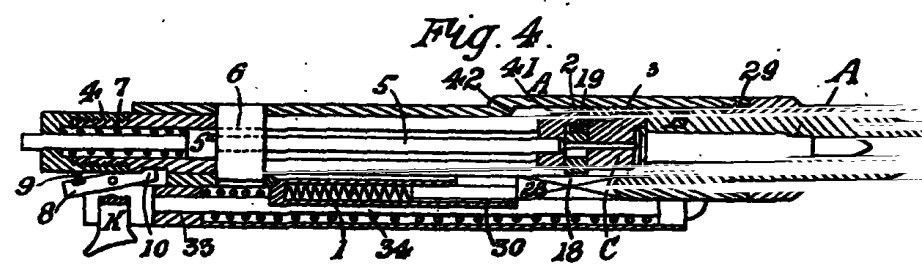
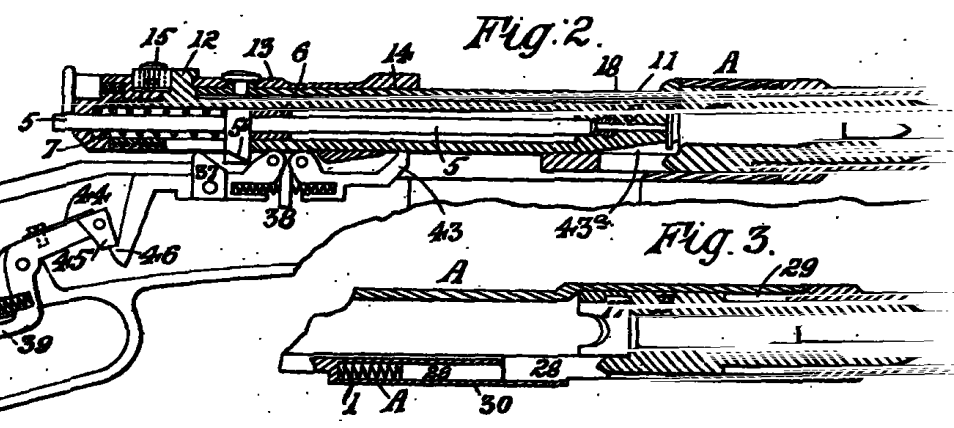
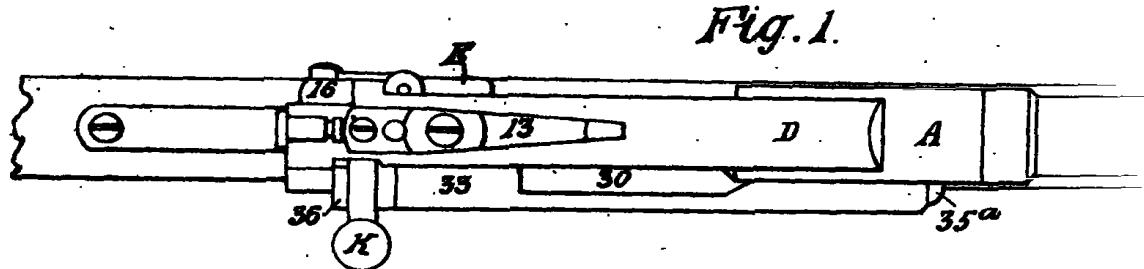
Dated the 21st day of July 1897.

5

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11 and 12 Southampton Buildings, London, W.C.,
Agents for the Applicant.



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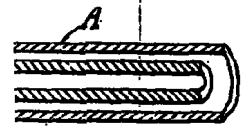
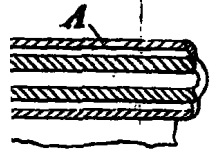


Fig. 12.

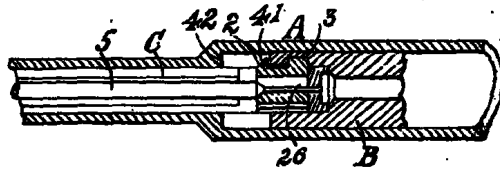


Fig. 13.

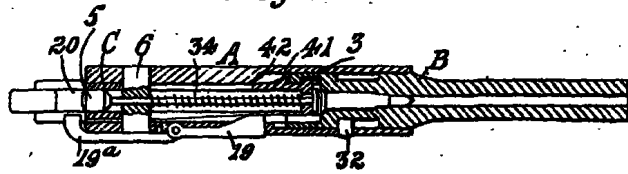


Fig. 14.

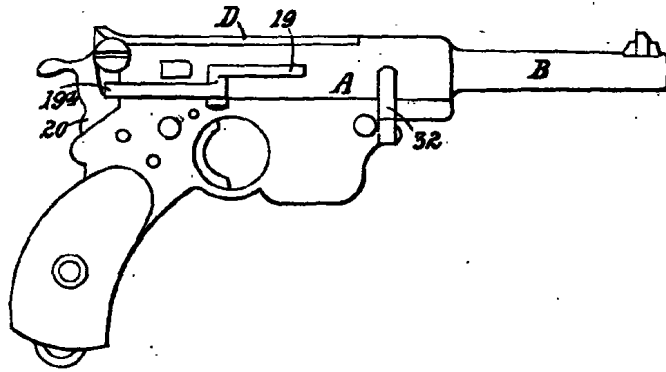
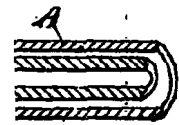
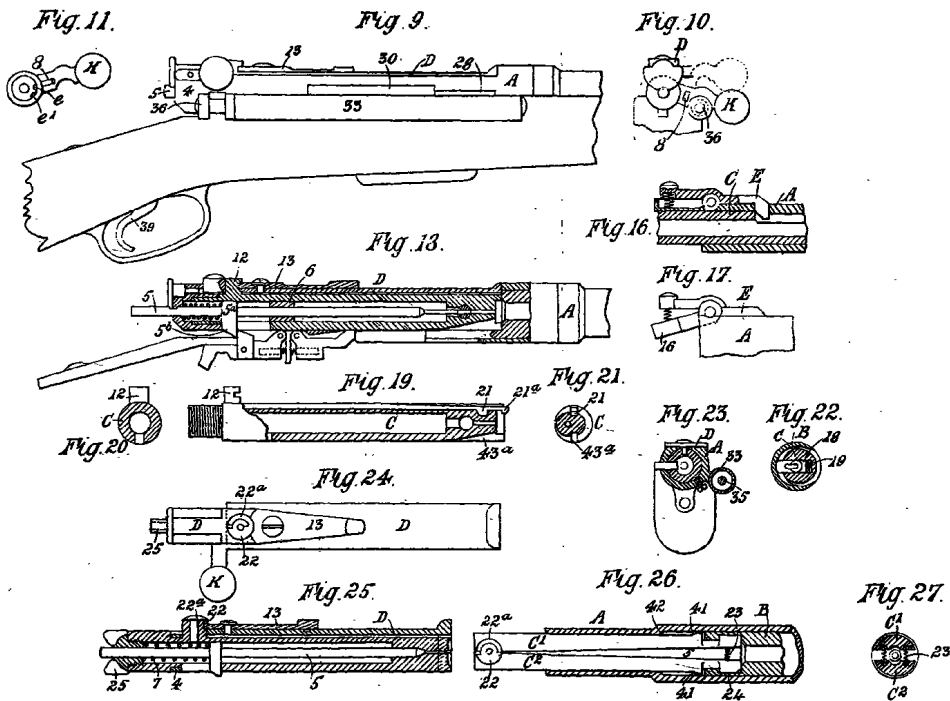


Fig. 5.



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Fig. 11.

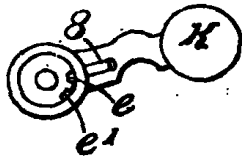


Fig. 9.

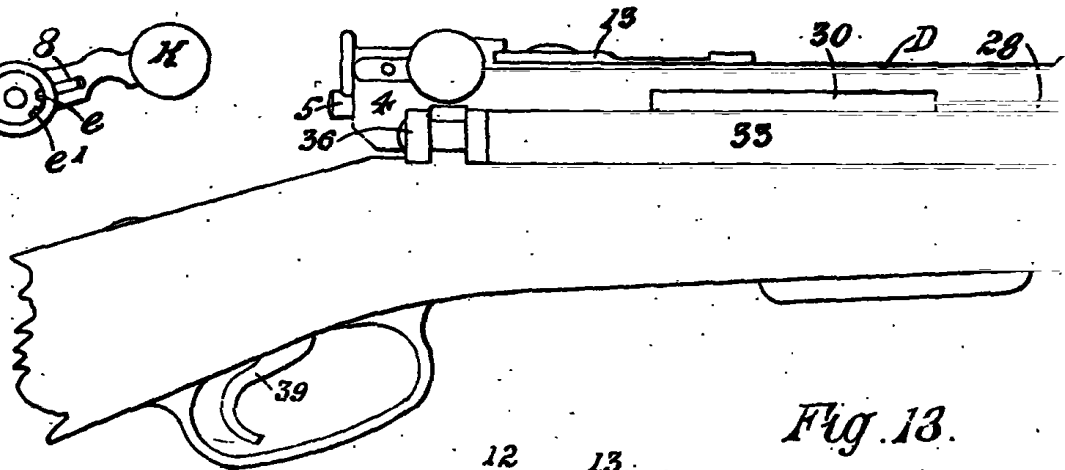


Fig. 13.

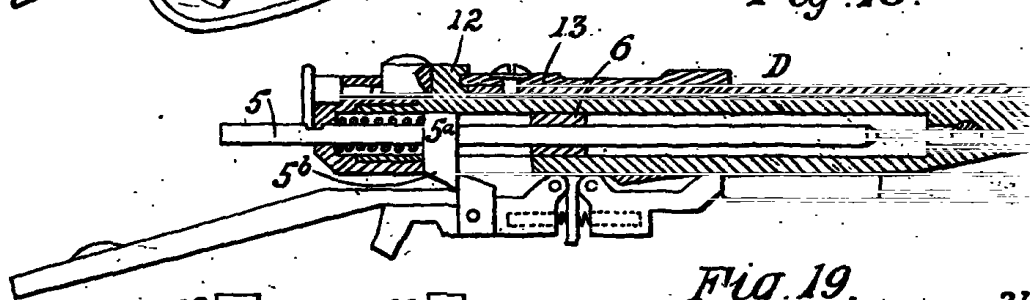


Fig. 19.

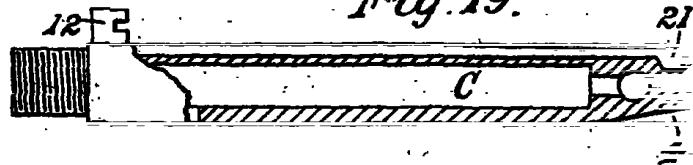


Fig. 20.

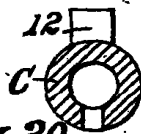


Fig. 24.

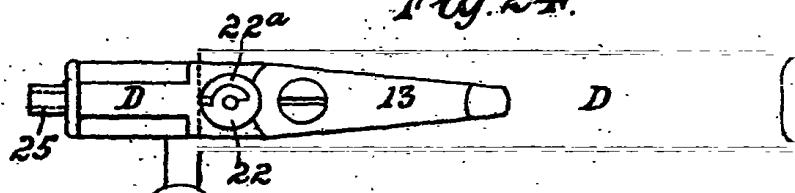


Fig. 25.

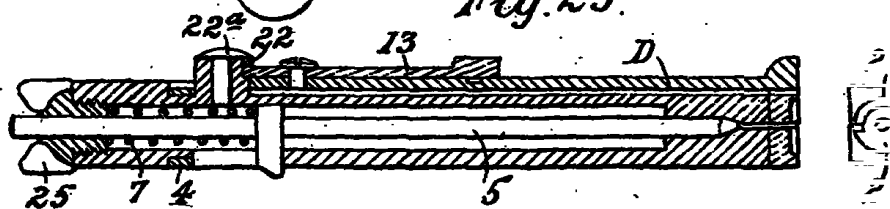


Fig. 10.

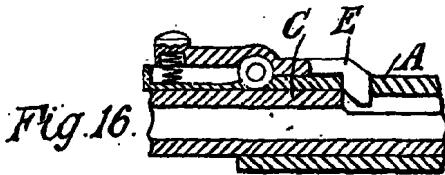
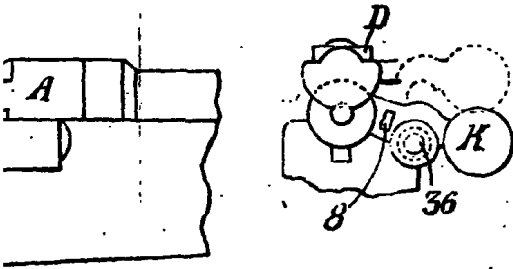


Fig. 17.

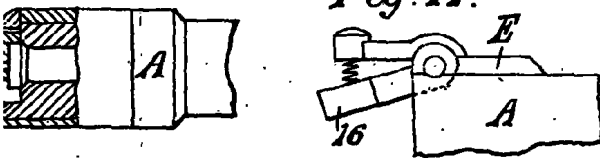


Fig. 21.

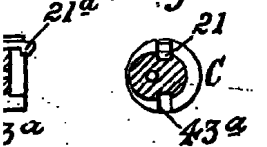


Fig. 23.

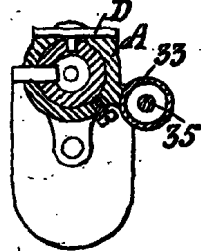


Fig. 22.

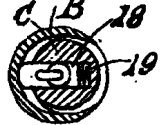


Fig. 26.

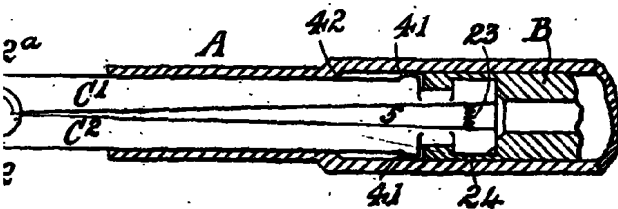
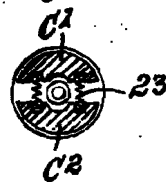


Fig. 27.



[This Drawing is a full-size reproduction of the Original.]