

(No Model.)

5 Sheets—Sheet 2.

H. S. MAXIM.
MACHINE GUN.

No. 439,248.

Patented Oct. 28, 1890.

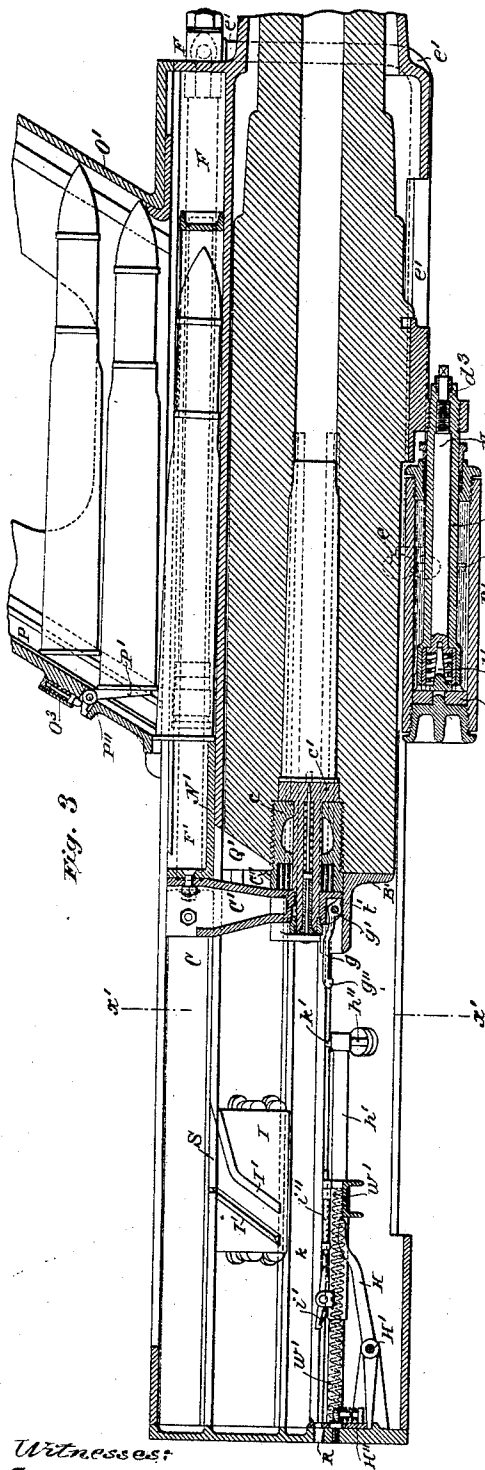


Fig. 3

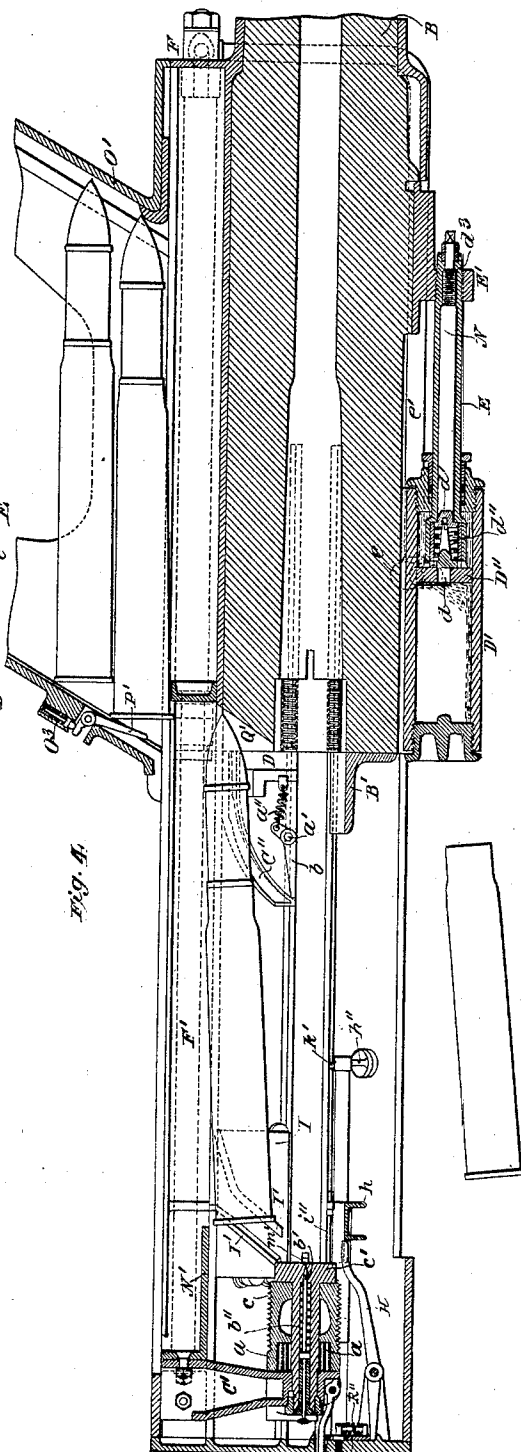


Fig. 4

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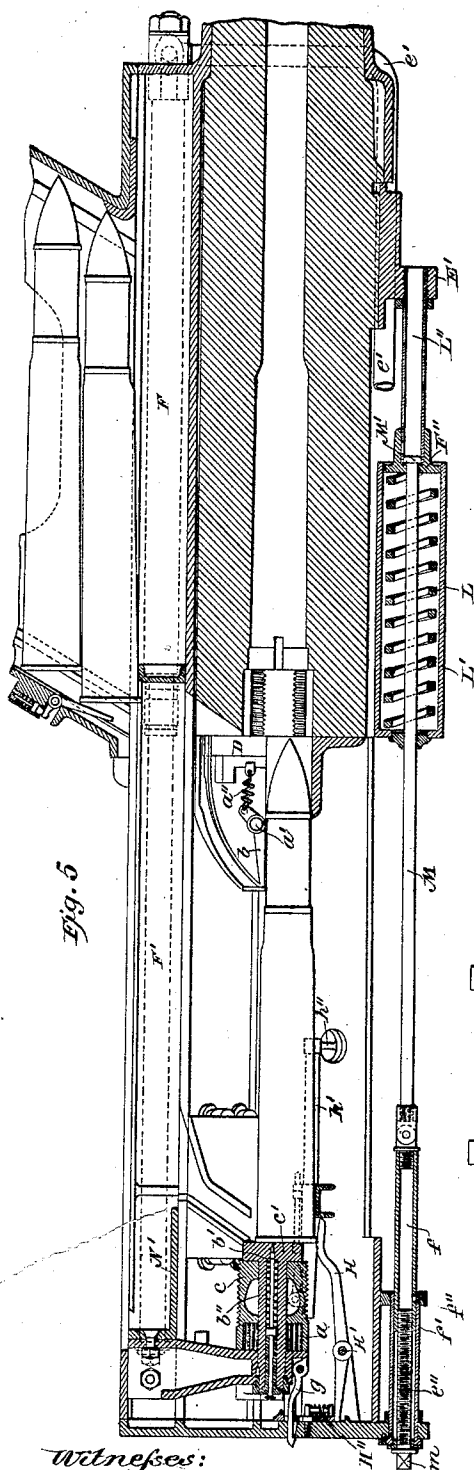


Fig. 5

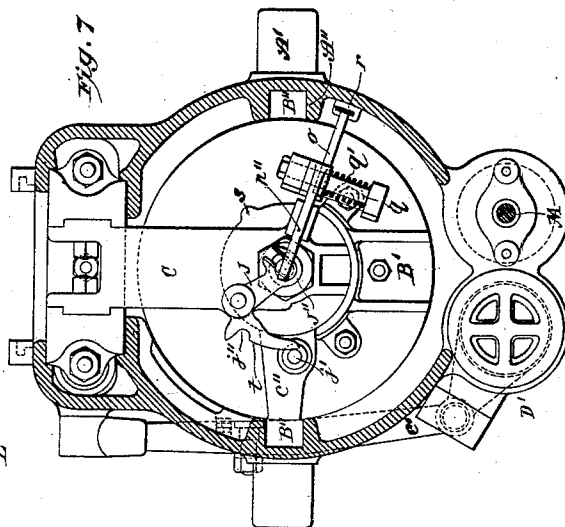


Fig. 7

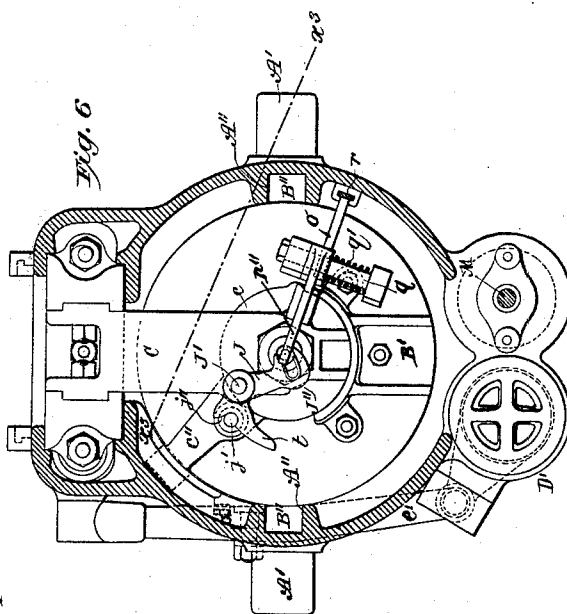


Fig. 6

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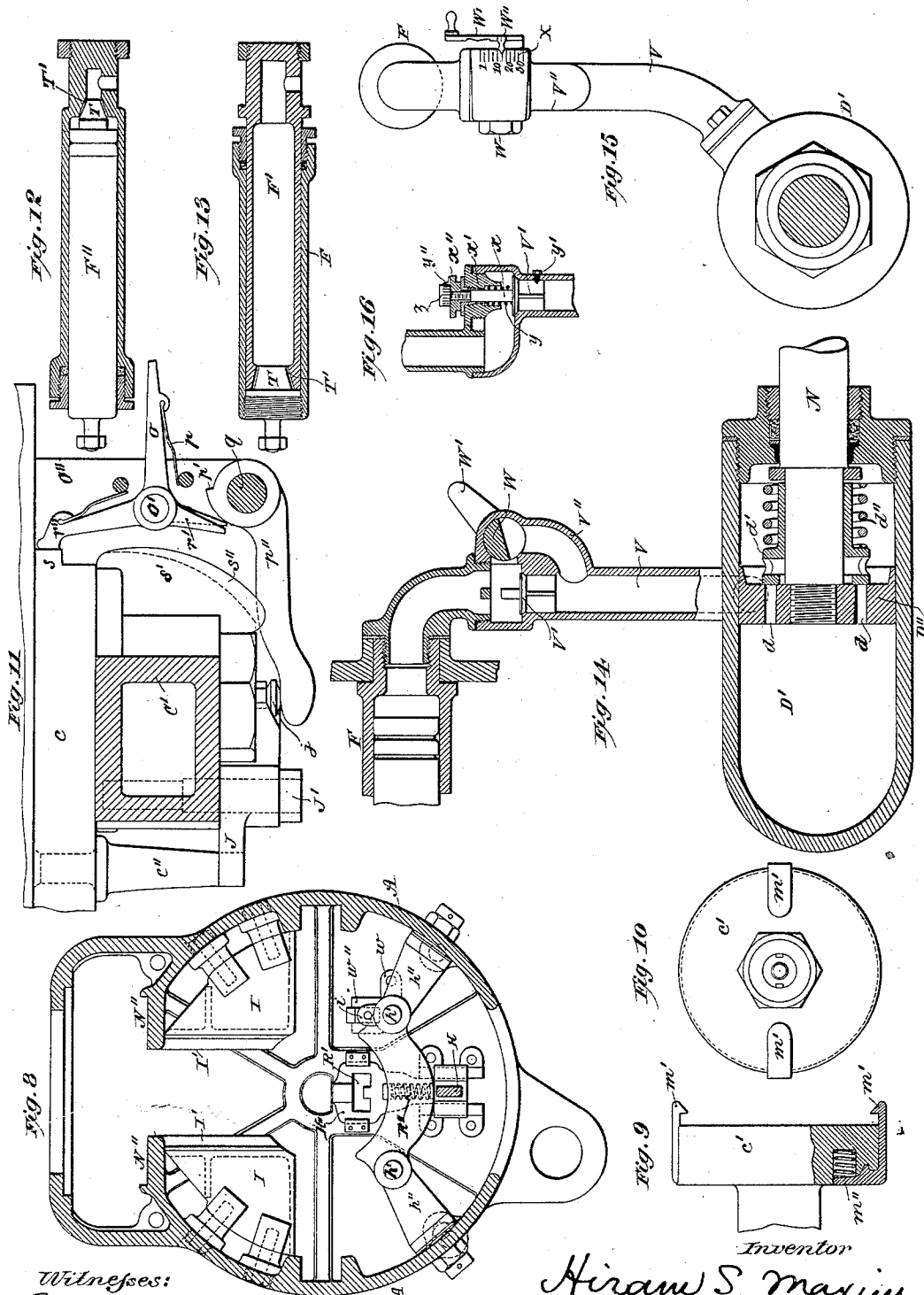
(No Model.)

5 Sheets—Sheet 4.

H. S. MAXIM.
MACHINE GUN.

No. 439,248.

Patented Oct. 28, 1890.



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UNITED STATES PATENT OFFICE.

HIRAM STEVENS MAXIM, OF LONDON, ENGLAND.

MACHINE-GUN.

SPECIFICATION forming part of Letters Patent No. 439,248, dated October 28, 1890.

Application filed April 4, 1890. Serial No. 346,607. (No model.) Patented in England December 1, 1886, No. 15,734; in Belgium November 15, 1887, No. 79,005; in Italy November 26, 1887, XXI, 22,500; in France December 14, 1887, No. 185,641; in Austria-Hungary April 21, 1888, No. 34,166; in Germany August 24, 1888, No. 44,208, and in Spain January 25, 1889, No. 8,895.

To all whom it may concern:

Be it known that I, HIRAM STEVENS MAXIM, a citizen of the United States, residing at London, England, have invented certain new and useful Improvements in Automatic or Machine Guns, (for which I have obtained patents as follows: in England, No. 15,734, dated December 1, 1886; in France, No. 185,641, dated December 14, 1887; in Germany, No. 44,208, dated August 24, 1888; in Austria-Hungary, No. 34,166, dated April 21, 1888; in Italy, No. 22,500, dated November 26, 1887; in Spain, No. 8,895, dated January 25, 1889, and in Belgium, No. 79,005, dated November 15, 1887,) of which the following is a specification.

My invention relates chiefly to automatic guns of that kind or class wherein the barrel and breech mechanism are arranged to slide longitudinally in a stationary frame or support, and wherein the breech-block is locked to the barrel during the earlier part of the recoil, and is then released and moved backward away from the barrel to extract the empty cartridge-shell and permit the introduction of a fresh cartridge between the breech-block and the rear end of the barrel. I have hitherto constructed such guns with mechanical devices whereby the breech-block will during the recoil be unlocked from the barrel and driven backward therefrom, and with one or more springs for storing up energy during the recoil and utilizing such energy for effecting the forward or return movement of the barrel and performing the various operations necessary in loading and firing the gun or preparing it for the next discharge.

One object of my present invention is to substitute for such mechanical devices hydraulic apparatus, whereby I am enabled to insure the proper movement of the breech-block without at any time imparting a high velocity to the said block, and also to insure the closing of the breech without jar or shock. In large and heavy guns this feature is especially advantageous, because by reason of the great weight of the moving parts a high velocity thereof would be liable to cause injury to the gun by concussion. Moreover, by the

employment of such hydraulic apparatus I am enabled to provide in a very simple and efficient manner for regulating or controlling the velocity of the moving parts, as hereinafter described, notwithstanding differences in the weight and explosive force of the charges used in the gun, and I am also enabled to provide in a very simple manner for regulating the speed of firing, as hereinafter set forth.

An important feature of my said invention is the construction and arrangement of the parts in such manner that at the termination of the recoil or backward movement of the barrel the breech-block will be unlocked therefrom, and will then be caused to continue its backward movement by force applied to the said block by the barrel in its forward or return movement either by means of hydraulic apparatus or otherwise. It is evident that under these conditions the extraction of the empty cartridge-shell will be effected partly by the withdrawal of the same from the barrel by the breech-block in its rearward movement and partly by the removal of the barrel from the said shell. It is, moreover, evident that in order to permit the introduction of a fresh cartridge between the barrel and the breech-block the said block will only require to move back through a distance equal to or slightly greater than the length of a cartridge minus the length of the forward movement of the barrel, or, in other words, minus the distance through which the barrel recoils.

My said invention, moreover, comprises various other improvements hereinafter set forth.

Certain of my present improvements are applicable to other kinds of automatic guns, such as are described in the specifications of Letters Patent already granted to me, and also to guns designed to be worked by hand. Moreover, my said improvements are applicable to machine-guns and to military rifles and other small-arms, and also to large and heavy guns or ordnance.

In the accompanying drawings, Figure 1 is a plan, and Fig. 2 a vertical longitudinal section, of my improved automatic gun, showing

the parts in the positions which they occupy at the instant of firing. Fig. 3 is a vertical longitudinal section showing the parts in the positions which they occupy after the gun has been fired and the barrel has terminated its recoil. Fig. 4 is a similar view showing the parts in the positions which they occupy after the barrel has returned to its firing position and the breech-block has reached the rear end of its stroke or movement, and showing the empty cartridge-shell falling from the gun. Fig. 5 is a similar view showing the parts in the positions which they occupy after a fresh cartridge has fallen from the magazine into position in front of the breech-block and has liberated the said block, as hereinafter specified. Fig. 6 is a transverse section on the line $x x$, Fig. 2, showing the parts in the positions which they occupy at the instant of discharge. Fig. 7 is a transverse section on the line $x' x'$, Fig. 3, showing the parts in the positions which they occupy when the barrel has terminated the recoil and the breech-block is unlocked from the barrel. Fig. 8 is a transverse section on the line $x'' x''$, Fig. 2, looking in the direction indicated by the arrow y in this figure. Fig. 9 is a plan, partly in horizontal section, and Fig. 10 an end elevation, of a part of the breech-block, illustrating the arrangement of the extractors. Fig. 11 is a section on the line $x^3 x^3$, Fig. 6, showing details of construction. Figs. 12 and 13 are longitudinal sections illustrating modifications of my said invention hereinafter described. Fig. 14 is a vertical longitudinal section, and Fig. 15 is a front elevation, of means for regulating the speed of firing. Fig. 16 is a vertical longitudinal section showing another form of the regulating devices. Fig. 17 is a horizontal section showing mechanism for opening communication between the two ends of the hydraulic cylinder hereinafter specified. Fig. 18 is a vertical section on line $z z$, Fig. 17.

A is the stationary frame or support, which is provided with trunnions A' , whereby it may be mounted in a suitable carriage or mounting.

B is the barrel; C, the breech-block or breech-plug.

The barrel B is provided at its rear end with an extension or frame B' , whereby the breech-block when in the firing position will be supported and lateral displacement thereof prevented. The barrel is, moreover, provided with ribs or projections B'' , fitted to slide in guideways A'' in the frame A for the purpose of guiding the barrel in its to-and-fro movement.

The breech-block or breech-plug C comprises an outer tubular piece c and a central or core piece c' . The outer part c is provided on its circumference with an intermittent or divided screw-thread adapted to fit a corresponding screw-thread in the breech end of the barrel. The said outer part c is arranged to rotate upon the central or core piece c' , which is firmly secured to a vertical block or

piece C' . To the rear end of the piece c is secured an arm c'' , the free extremity of which works in an inclined or spiral groove or guideway C'' in the frame A, so that when the barrel has nearly terminated its rearward movement the said arm c'' will be moved downward and the breech-block thus unlocked or unscrewed from the barrel. The part c of the breech-block is provided with a coiled spring a , which is wound up or compressed in the unlocking of the breech-block, and subsequently reacts to effect the locking of the said block to the barrel.

A switch b is pivoted at a' to the frame A, and is acted upon by a spring a'' , which bends to hold the said switch in the position shown in Fig. 2, so that in the forward or return movement of the barrel the arm c'' will be held down, thus permitting the insertion of the breech-block in the barrel before the part c is acted upon by its spring a to lock the said block therein.

b' is the firing-pin, and b'' its spring, both of which are arranged within the core-piece c' of the breech-block.

A vertical groove or guideway D, Figs. 4 and 5, is formed in the frame A, so that when the breech-block has been driven home the free end of the arm c'' may slide in the said groove or guideway and the breech-block be locked to the barrel under the action of the spring a .

D' is a hydraulic cylinder, which is firmly secured to the frame A, and in which works a piston D'' , provided with a hollow piston-rod E. This rod is firmly connected to a bracket E' , formed on or rigidly attached to the barrel B, and works in a stuffing-box in the forward end of the cylinder D' . The said piston D'' is provided with a central aperture or port d and with a valve d' , acted upon by a spring d'' , which presses the said valve against its seat and thus closes the said aperture or port d . When the barrel recoils, the liquid in the rear part of the cylinder D' is forced through the opening or port d into the forward end of said cylinder. In the forward or return movement of the barrel the spring d'' closes the valve d' , thus preventing the return of the liquid to the opposite side of the piston D'' . It is therefore forced through an aperture in the cylinder, for the purpose hereinafter described.

e is a port or passage in the side of the cylinder D' and communicating by means of a pipe e' with a cylinder F, secured to the outer frame A. In this cylinder is fitted to slide another cylinder or tubular ram F' , firmly connected with the part C' of the breech-block C. The transverse sectional area of the hollow piston-rod E is equal to that of the stationary tube F, or to the collective area of the stationary tubes when more than one are used. Therefore in the recoil of the barrel and breech-block the liquid displaced from the cylinder D' by the progressive immersion of the piston-rod E will fill the empty space

left in the front end of the cylinder F by the rearward movement of the ram F'. When the barrel has terminated its recoil, the liquid in the cylinder D' will have been forced from the rear to the front of the piston D''. In the forward or return movement of the barrel the aperture or port *d* will be closed by the spring *d''*, as above described. The liquid in the cylinder D' will therefore be forced from the said cylinder into the cylinders or tubes F, and, acting upon the ram F', will cause the breech-block C to continue its backward movement while the barrel is moving forward. The return movement of the piston D'' creates a partial vacuum in the rear of the cylinder D'. The velocity of the backward movement of the breech-block will depend partly upon the relative areas of the hydraulic cylinders D' and F and partly upon the velocity of the barrel in its forward or return movement.

For effecting the return movement of the barrel I provide a spring L, inclosed in a cylinder L', firmly secured to the under side of the frame A. The cylinder L' is fitted with a piston F'', arranged to bear on one end of the said spring. The other end thereof bears against the end of the cylinder L'. The piston F'' is secured to a hollow piston-rod L'', the forward end of which is attached to the lug or projection E' on the under side of the barrel. It will be seen that when the barrel recoils the spring L will be compressed and energy will be stored therein to effect the return movement of the barrel. To provide for opening the breech by hand, a rod M is fitted to slide through the piston F''. This rod has a solid end M', loosely fitting the hollow piston-rod L''. The rear end of the rod M is connected to a hollow piston-rod *f*, arranged to slide in a cylinder or tube *f'*, secured to the frame A. A pin *f'''* fits in a groove in the hollow piston-rod *f* and prevents rotation thereof. A screw-threaded rod *e''* fits a corresponding internal screw-threaded portion in the end of the hollow piston-rod *f*. This rod is fitted in a bush in the end of the cylinder or tube *f'* and is provided with a square end *m*. By these means the barrel may be drawn backward and the breech opened by hand.

The port or passage *e*, through which the liquid is forced from the larger cylinder, is preferably tapered at its forward end, so that when the barrel has nearly terminated its forward stroke or movement it will be gradually cushioned by the liquid in the said cylinder. The barrel will therefore be brought to rest without jar or shock.

At the termination of the forward movement of the barrel the piston D'' uncovers the rear end of the port or passage *e*. The plunger F' then acts upon the liquid in the cylinder F and forces it through the said port or passage into the rear of the cylinder D'. This movement of the plunger F' is effected partly by the pressure exerted by the atmosphere upon the rear end of said plunger and

partly by a spring G, Fig. 1, attached at its rear end to a projection on the side of the breech-block and secured at its forward end to the front end of the casing A, so that the said spring will be extended during the recoil and will by its reaction assist in effecting the forward or return movement of the breech-block and parts carried thereby.

To prevent or diminish concussion on the closing of the breech, I sometimes provide the plunger F' with a conical or plug shaped end T, Fig. 12, which will enter a neck or contracted part T' at the rear end of the cylinder F when the breech-block has nearly terminated its forward movement, and will thus close or contract the space for the passage of liquid from the said cylinder, and thereby gradually diminish the velocity of the breech-block.

In the apparatus shown in Fig. 13 the cylinder F is designed to be connected with the breech-block and the tubular plunger F' with the barrel. In this case the said cylinder is provided with a plug T, adapted to enter a contracted part T' of the said plunger, for the purpose above mentioned.

To provide for regulating or controlling the velocity of the moving parts, I employ means for adjusting the tension or compression of the spring *d''* to increase or diminish the force required to open the valve *d'* during the recoil.

N is a rod fitted to rotate in the hollow piston-rod E. Said rod is provided with a screw-threaded portion *d''*, fitted into a corresponding screw-threaded portion in the hollow piston-rod E. The said rod N is, moreover, provided with a square end, by means of which it may be turned in one or the other direction, thereby extending or compressing the spring *d''* and regulating the speed of the return movement of the barrel. It will thus be seen that by these means the resistance to the recoil can be adjusted according to the weight and explosive force of the charge employed.

The core-piece *c'* of the breech-block carries the extractors *m'*, Figs. 9 and 10, which are so constructed and arranged that when the breech-block is driven home the outer edges of the said extractors will fit into recesses in the breech end of the barrel, and will thus be caused to engage with the flange of the cartridge in the barrel. Each extractor *m'* is formed with a stud or projection which fits into a recess in the piece *c'* and is acted upon by a spring *m''*, which, while allowing the extractor to pass freely over the flange of a cartridge, tends to keep the said extractor in engagement with the flange of the said cartridge. In the extraction of the empty cartridge-shell, which is effected by the movement of the barrel and breech-block in opposite directions after the barrel has terminated its recoil, the extractors, by reason of the peculiar construction and arrangement of the same, are held tightly in engagement

with the flange of the said shell, and the stronger the pull upon the said extractors the more tightly they will be held in engagement with the said flange. The breech-block C has firmly connected with the part C' thereof a frame N', fitted to slide to and fro in grooves or guideways N'' in the frame A. The said frame N' is formed with an aperture O, into which the lowermost cartridge in the vertical hopper or magazine O' will fall when the breech-block is driven home. The frame N' in the recoil or backward movement of the breech-block will transfer the said cartridge from the magazine into such a position that it will fall in front of the breech-block at the termination of the rearward movement thereof.

To prevent the backward movement of the cartridge by the frame N' before the breech-block is unlocked from the barrel, the said frame is made of such length that its forward end will not come in contact with the point of the projectile until the barrel has terminated its recoil. The said frame is, moreover, made with a solid bottom extending forward a short distance from its rear end. While the flange of the cartridge rests on the said solid part the said cartridge cannot pass under the rear end of the magazine. The said frame N' is provided near its forward end with springs O'', so arranged that as soon as the flange of the cartridge drops over the solid portion of the frame the said springs will grip the bullet end of the cartridge.

The magazine O' is formed with guideways P, in which the flanges of the cartridges slide. The said magazine is also provided with a lever P', pivoted thereto at P''. The short arm of the said lever is acted upon by a spring O³, which tends to keep the said lever in such a position that the column of cartridges in the magazine will be held up therein until the lowermost cartridge is transferred from the magazine by the frame N'.

A slot or groove Q' is formed in the breech end of the barrel, through which the bullet end of a cartridge will pass when the said cartridge falls into position in front of the breech-block. The rearward movement of the barrel may by these means be shortened. A sear o is pivoted at o' to a bracket o'', firmly secured to the breech end of the barrel, and is acted upon by a spring p, whereby it is caused to engage with the bent p' of the hammer p'', said hammer being carried by a rod q, supported between the brackets o'' and actuated by a spring q on said rod. The sear o is connected by means of a rod r to the trigger. The safety-sear r', also pivoted at o', is provided with an extension r'', adapted to engage with a lug or projection s on the breech-block, which lug or projection is so arranged that when the breech-block is locked to the barrel the said lug will hold the safety-sear out of engagement with the bent p', and thus allow the said bent to be operated by means of the sear o to fire the gun.

A projection s' on the breech-block is provided with a recess or groove s'', into which the hammer p'' is arranged to slide. In the rearward movement of the breech-block the projection s' acts upon the hammer p'' and pushes it into its cocked position, where it is held by the sear o until the gun is fired. At the same time the projection s releases the safety-sear and allows it to come into operative position with the bent p'.

It will be seen from the foregoing description that the hammer cannot be operated until the breech-block is driven home and locked to the barrel.

I provide an additional safety device by which the accidental firing of the gun is prevented—that is to say, J is a lever pivoted at J' to the breech-block and provided with a forked end J''. The ends of said fork are made tapered or wedge-shaped, as at j, Fig. 11, so that when the lever J is caused to rotate upon its pivot J' the said forked end thereof will engage with the firing-pin b' and hold the same out of reach of the cartridge in the barrel. A pin j', secured to the arm c'' of the breech-block, is adapted to engage with a recess j'' in the arm t of the lever J. It will thus be seen that as soon as the arm c'' is rotated to unlock the breech-block from the barrel the pin j' will cause the lever J to be rotated on its pivot J', and the fork J'', engaging with the firing-pin, will hold said pin out of reach of the cartridge until the breech-block has completed its backward and forward movement and is again locked to the barrel. Therefore should the hammer p'' by any chance be released from the sears and strike the firing-pin no explosion will take place.

To provide for retaining the breech-block in its rearmost position while a cartridge falls in front thereof and then releasing the said block to permit its forward movement, I sometimes employ the device hereinafter described—that is to say, a bar or catch g is pivoted at g' to the breech-block C and is formed with a hook g'' and with a projection t' to hold it in its horizontal position. At the termination of the backward movement of the breech-block the hooked end of this bar passes through an aperture R in the rear end of the frame A and engages with said frame, thus holding back the breech-block until released, as hereinafter described.

H is a lever, pivoted at H' to a bracket on the frame A. The short arm of this lever is adapted to engage with the lower edge of a vertically-sliding plate H'', which works between guides on the rear end of the frame A. This sliding plate is provided with an opening R', Fig. 8, through which the end or catch g is pushed in the backward movement of the breech-block. The plate H'' is, moreover, provided with a spring R'', which tends to keep said plate in its lowermost position.

I I are two parallel plates firmly secured to the frame A and having guide-pieces I' formed

or fixed thereon. In the backward movement of the frame N' the cartridge is pushed back by means of springs O'', the flange of said cartridge being supported between the lower 5 projecting flanges of the guideway N'' until it is allowed to fall through the extended opening S in said flanges and passes between the guide-pieces I'. The flange of the cartridge then strikes the end of the lever H, 10 which operates the sliding plate H'' to force the rod or catch *g* out of engagement with the aperture R in the rear end of the frame A. The breech-block is then moved forward through the medium of its springs.

15 To prevent the falling of the cartridge from the gun and to retain it in position to be pushed forward into the barrel, I provide a frame or cradle *h*, adapted to slide to and fro on horizontal guide-rods *h'*, which are secured 20 at one end to the rear end of the frame A and are carried at the other end in brackets *h''*, also secured to the frame A. On one side of the frame or cradle *h* is a lug or projection *w*, to which is attached the forward end 25 of a spiral spring *w'*, the other end being firmly secured to the rear end of the frame A. The said frame or cradle is, moreover, provided with an extension *w''*, to which is pivoted a lever *i*, one arm of which is acted upon by a spring *i'*, which tends to keep said 30 lever in the position shown in Fig. 2. The other arm of the lever *i* is arranged to be operated by a rod *i''*, working in guides in the frame or cradle *h* and having a wedge-shaped end *k*. In the forward movement of the 35 breech-block the arm *c''* of said block impinges against the end of the lever *i*, thereby forcing the frame or cradle *h* forward and extending the spring *w*. When the said frame or cradle 40 has moved forward a predetermined distance, the rod *i''* strikes a projection *k'* on the bracket *h''*, thereby forcing the end of the lever *i* downward and releasing it from the arm *c''* of the breech-block. The spring *w* 45 then reacts upon the frame or cradle *h*, causing it to assume its original position. It will thus be seen that the flange of the cartridge is supported in a horizontal position and the cartridge carried forward by the frame or 50 cradle *h* to a sufficient distance to insure the entrance thereof into the barrel before the said frame is withdrawn from the said cartridge.

It is obvious that I may, if desired, employ 55 two or more of the aforesaid hydraulic cylinders and pistons in combination with the barrel communicating with one or more hydraulic rams connected with the breech-block.

Where I use hydraulic apparatus constructed and arranged as above described I 60 am enabled to provide in a very simple and efficient manner for regulating the speed of firing. For this purpose I employ means for controlling the flow of liquid from the cylinder F to the cylinder D'.

In Figs. 14 and 15, V is the pipe or passage between the cylinders D' and F. V' is a valve

arranged in the said pipe in such a manner that although the liquid can flow freely from the cylinder D' into the cylinder F, the said 70 valve will close the passage against the flow of liquid in the reverse direction. V'' is a by-pass or branch passage, which is connected with the pipe V on each side of the said valve and is provided with a cock W. This cock is to 75 be opened more or less to permit the flow of liquid from the cylinder F to the cylinder D'. The handle W' of the said cock is provided with an index or pointer W'', and the exterior of the cock is provided with a graduated 80 scale X, so that the said cock may be readily turned to regulate or control the flow of the liquid through the branch passage V'', according to the speed of firing desired.

I sometimes so arrange the valve V' that it 85 may be adjusted in such a manner as to permit the flow of liquid with greater or less velocity from the cylinder F into the cylinder D'. An arrangement of this kind is shown in Fig. 16, in which the valve V' is made with 90 a screw-threaded stem *x*, which is passed through a stuffing-box *x'*, and on which is screwed a nut *x''*. This nut bears upon the gland of the stuffing-box, so that by turning the said nut in one or the other direction the 95 said valve can be raised or lowered, and its downward movement can be limited, so as to permit the flow of the liquid with greater or less velocity. The said valve is acted upon by a 100 spring *y*, which effects its return or downward movement after it has been raised by the liquid flowing from the cylinder D' to the cylinder F. The rotation of the valve V' is prevented by a set-screw *y'*, fitting into a vertical 105 groove in the said valve, or other suitable means are provided for this purpose. An index or pointer *y''* is attached to the nut *x''*, and a collar or head *z* is fixed on the outer end of the stem *x* and is provided with a graduated scale, so that the speed of firing 110 can be accurately regulated or controlled.

According to another part of my invention I so construct the hydraulic apparatus that 115 when the smallest charge to be used is exploded in the barrel the recoil will only move the piston D'' backward through a distance equal to about two-thirds of the length of the cylinder, and when a heavier charge is used 120 the recoil will move the piston back through a greater distance, and there will be in the cylinder in front of the said piston an excess of liquid above the quantity required to move back the breech-block. It is necessary in this 125 case to provide for opening communication between the two ends of the cylinder as soon as or before the breech-block terminates its backward movement in order to permit the continuance of the forward movement of the barrel until it arrives at the firing position. 130 For this purpose I connect the two ends of the said cylinder by means of a pipe or passage provided with a cock or valve arranged to be operated by a stud or projection on the breech-block, or on one of the sliding cylin-

ders or plungers, or on some part connected therewith, so that when the gun has recoiled and the breech-block has been moved backward to the end of its stroke by the partial forward movement of the barrel the said cock or valve will be opened to permit the free passage of the liquid from the front to the rear of the piston, and the forward movement of the barrel may be completed without affecting the breech-block. A spring or other suitable device is provided for closing the said cock or valve as soon as the breech-block commences to move forward.

In Figs. 17 and 18, A³ is a pipe or passage connecting the two ends of the cylinder D' and provided with a cock B³. A rod or spindle C³ is fixed on the plug of this cock, and has formed thereon an arm D³, to which a rod E³ is coupled by means of a link F³. The rod E³ is fitted to slide longitudinally in lugs G³, formed on or attached to the frame A, and is coupled at its rear end to a bar H³, fitted to slide between guides I³, formed on the said frame. The bar H³ has pivoted thereto a pawl J³, acted upon by a spring K³, which tends to hold it in the position shown. This pawl extends through an aperture L³ in the side of the frame A, the said frame being rounded on the inner side at the rear end of the said aperture, for the purpose hereinafter specified. The spindle C³ is also provided with an arm M³, to which a bar N³ is coupled by means of a link O³. The said bar N³ is fitted to slide longitudinally between guides P³, formed on or attached to the frame A, and is arranged to be operated by a shoulder or projection on the barrel, (not shown in the drawings,) as and for the purpose hereinafter explained.

The operation of this mechanism is as follows, viz: When the lightest charge to be used is exploded in the barrel of the gun, the barrel in its recoil will move the piston D'' through, say, two-thirds of its stroke. In the forward or return movement of the barrel, the breech-block will be moved backward, and when it has nearly terminated its backward stroke or movement will strike the forward end of the pawl J³, and thus move the rod E³ backward and open the cock B³. In the continued backward movement of the breech-block the short arm of the pawl J³ will strike the rounded edge at the rear end of the aperture L³, and the said pawl will thus be disengaged from the breech-block. On the return of the barrel to the firing position it will push forward the rod N³, and thus close the cock B³. If a heavier charge is used, the barrel in its recoil will move back the piston D'' through more than two-thirds of its stroke, and in the forward movement of the barrel the cock B³ will be opened by the breech-block, as above described, so that any excess of liquid in front of the piston D'' above that required to move back the breech-block to the rear end of its stroke or movement will be forced through the pipe or passage A³ into the rear end of the cylinder D', thus permit-

ting the return of the barrel to the firing position.

By constructing and arranging the parts in the manner above described with reference to Figs. 17 and 18 of the drawings I provide for insuring the proper movement of the barrel and breech-block notwithstanding differences in the weight and explosive force of the charges used in the gun—that is to say, I so proportion the cylinder D' that the smallest charge used in the gun will cause the recoil thereof to such an extent that the liquid in front of the piston at the termination of the recoil will be just sufficient for effecting the backward movement of the breech-block during the forward or return movement of the barrel. If a heavier charge is used, the breech-block will arrive at the rear end of its movement before the barrel has terminated its forward movement, and in the remainder of the forward movement of the barrel the liquid will be forced from the front to the rear end of the piston.

What I claim is—

1. In a magazine gun or fire-arm, the combination of a barrel, a breech-block normally locked thereto and both capable of longitudinal movement due to recoil, means for unlocking the barrel and breech-block at the limit of backward movement of the barrel, and mechanism between the barrel and breech-block brought into operation by the forward movement of the barrel and adapted to continue the backward movement of the breech-block, as herein set forth.

2. In a magazine gun or fire-arm, the combination of a barrel and a breech-block normally locked together, a stationary frame or support in which they are adapted to slide longitudinally, means for unlocking the breech-block at the termination of the recoil of the barrel, and a hydraulic cylinder with a piston connected with the breech-block and adapted to be charged by the barrel in its forward movement and to thereby continue the backward movement of the breech-block.

3. In a magazine gun or fire-arm, the combination of a barrel and a breech-block normally locked together, a stationary frame or support in which they are adapted to slide longitudinally, and a releasing device in the path of the breech-block and adapted to unlock the same from the barrel when encountered by the said breech-block at the limit of backward movement of the barrel, as set forth.

4. In a magazine or machine gun, the combination, with a stationary frame or support, of a barrel capable of a given longitudinal movement in said frame, a breech-block having a longer range or path of longitudinal movement than the barrel, and retractile mechanism connected with the barrel and the breech-block for returning them to the forward position, as set forth.

5. The combination, in a machine-gun, with a longitudinally-sliding barrel and breech-block normally locked together, of means for

unlocking or disengaging the breech-block from the barrel, adapted to be brought into operation by and at the end of the backward movement of said barrel, and a device for applying the force of the return of the barrel to continuing the backward movement of the breech-block, as set forth.

6. In a machine-gun, the combination, with a stationary frame or support, of a barrel and breech-block normally locked together and both adapted to slide longitudinally in said frame, a projection or extension on said breech-block, and a stationary part or point with which said projection by the backward movement of the barrel is brought into engagement and by which the locking portion of the breech-block is turned to disengage the breech-block from the barrel, as set forth.

7. In a machine-gun, the combination, with a barrel capable of longitudinal movement in its frame or supports, of a breech-block, a part of which engages with the barrel and is capable of being rotated relatively to the remaining parts, and a projection or arm extending from the rotary portion and adapted in the backward movement of the barrel to encounter a stationary part of the gun and to thereby turn and disengage the part of the breech-block engaging with the barrel.

8. In a machine-gun, the combination, with a barrel capable of longitudinal movement in its frame, of a breech-block locked thereto, an arm or projection on said breech-block adapted to encounter a stationary part of the gun and to thereby turn and disengage the breech-block, and a spring brought under tension by the turning of the breech-block and adapted to re-engage or lock the same with the barrel, as set forth.

9. The combination, in a machine-gun having a sliding barrel and breech-block, of a hydraulic cylinder secured to the frame, a piston therein and connected with the barrel, a second cylinder communicating with the first and secured to the gun-frame, a piston therein connected with the breech-block, and a spring connected with the barrel and adapted to be compressed by its recoil, as herein set forth.

10. The combination, with the sliding barrel and breech-block, of a hydraulic cylinder attached to the stationary frame or supports of the gun, a piston-connection with the barrel and working in said cylinder, a valve in said piston through which the water passes on the backward movement of the barrel, a cylinder secured to the frame, and a piston connected with the breech-block and working therein, and a passage of communication between the two cylinders whereby the forward movement of the barrel will effect the continued backward movement of the breech-block, substantially as set forth.

11. The combination, in a machine-gun, of a barrel capable of sliding longitudinally in its frame or supports, a breech-block movable with said barrel and capable of a backward

movement of greater extent than the barrel, springs connected with the barrel for effecting the return of the same after a recoil, and intermediate mechanism between the barrel and breech-block adapted to be operated by the return or forward movement of the barrel to impart a continued backward movement to the breech-block, as set forth.

12. In a machine-gun, the combination, with the sliding barrel, of a block adapted to slide to and fro from the breech end of the barrel, a breech-plug capable of turning said block and formed with divided or intermittent screw-threads engaging with corresponding screw-threads in the barrel, and means for partially rotating said plug alternately in opposite directions, for the purpose set forth.

13. The combination, with the sliding barrel, of a breech-block composed of a central block or core-piece provided with hooks or extractors, the breech-plug capable of turning on the core and having the divided screw, the arm or projection on the plug by which it is turned and unlocked from the barrel, and a coiled spring between the core and plug adapted to be compressed by the partial rotation of the latter, as set forth.

14. The combination, with the breech-block having a central core-piece or block with a flanged or enlarged head and a sleeve surrounding the core back of the head, of the extractors consisting of L-shaped plates or bars with studs bearing in recesses in the rear of the flanged head of the core, and springs contained in recesses in the rear of said flanged head and upon which the ends of the extractors bear, the extractors being formed with hooked ends for engaging with the flange of a cartridge, as set forth.

15. The combination, with the sliding barrel, of a breech-block having a rotating portion engaging with the barrel, an arm extending from said portion, a stationary cam with which the arm engages during the backward movement of the barrel, whereby it is partially rotated in a direction perpendicularly to the barrel to disengage the breech-block, and a coiled spring between the main and revoluble parts of the breech-block for returning said arm and re-engaging the breech-block and barrel, as set forth.

16. The combination, with a sliding barrel, of a breech-block having a revoluble portion adapted to lock into or engage with the barrel, means for turning the said locking portion during the backward movement of the barrel to disengage it from the barrel, and a pivoted lever or switch with which said arm or projection engages on the return of the breech-block and by which the arm is prevented from turning back until the locking portion of the breech-block has entered the barrel, as herein set forth.

17. The combination of the magazine, the ways or guides therein and set obliquely to the axis of the barrel for holding the cartridges in a vertical row, the sliding breech-

block and frame connected therewith for transferring the cartridges from the magazine to the breech, and a spring-actuated lever pivoted in the lower part of the magazine in position to press against the butt of the lowermost cartridge, whereby the forward end of the same is prevented from dropping down from the magazine first, as and for the purpose set forth.

10 18. The combination, with the breech-block having a revoluble portion that engages or locks with the barrel, of a firing-pin passing through the breech-block and a forked or slotted arm pivoted to the breech-block and normally surrounding the end of the firing-pin, and adapted to be shifted out of engagement or contact with the pin by the engagement with itself of a projection on the revoluble portion of the breech-block when turned into position to lock the breech-block to the barrel, as set forth.

19. The combination, with the sliding breech-block, of a hook carried thereby and adapted to engage with a stationary part of the gun when the breech-block is in its rear-most position, and a tripping device for releasing said catch in position to be encountered by a cartridge dropping into position forward of the breech-block and to be operated thereby to release the breech-block, as set forth.

20. The combination, with the sliding breech-block, of a hooked bar pivoted thereto, a sliding plate on the frame of the gun with which the hooked bar engages when the breech-block has reached the limit of its backward movement, a cradle back of the breech upon which the cartridges fall when transferred from the magazine, and a lever pivoted to the frame, one end being in engagement with the sliding plate and the other in position to be struck by a cartridge dropping onto the cradle, as set forth.

21. The combination, with the stationary frame or support and the gun-barrel movable longitudinally therein, of a cylinder or barrel connected to the frame, a spiral spring inclosed in the cylinder, a hollow piston connected with the gun-barrel, provided with a head for compressing the spring in the cylinder, a rod passing through the spring from the rear of the gun and entering the hollow piston, to which it is secured by a head, and a screw-threaded rod connected therewith and passing through a part of the stationary frame, whereby the gun-barrel may be drawn back by hand, as set forth.

22. The combination, with the sliding

breech-block and barrel, of a frame connected with the breech-block and working under the cartridge-magazine, said frame being formed with a solid bottom extending forward a short distance from its rear and being of such length that the forward portion or end will not encounter on the backward movement of the breech-block the point of a cartridge until the barrel has reached the limit of its recoil, as set forth.

23. The combination, with a stationary frame or support, of a sliding barrel and breech-block separable from and in line with the barrel and a cartridge-feed mechanism adapted to supply cartridges from above between the breech-block and barrel, the said barrel being formed with a slot or groove in the upper side of the breech end thereof for the reception of the bullet end of a cartridge as it falls into line with the bore of the barrel, as set forth.

24. In a machine-gun, the combination, with a sliding barrel and breech-block, of a stationary hydraulic cylinder, a piston working therein and connected with the barrel, a second hydraulic cylinder connected with the first and provided with a neck or contracted part, and a piston therein connected with the breech-block, the said piston or plunger being formed with a conical end to operate in conjunction with the contracted part of the cylinder, as set forth.

25. In a machine-gun, the combination, with a sliding barrel and breech-block, of a stationary hydraulic cylinder, a piston therein connected with the barrel, a second hydraulic cylinder, a piston therein connected with the breech-block, a passage of communication between said cylinders, and a valve or cock therein for regulating the passage of water through the same from one cylinder to the other.

26. In a machine-gun, the combination, with the sliding barrel and breech-block, of two hydraulic cylinders and pistons working therein and connected, respectively, with the barrel and the breech-block, a passage of communication between the ends of the cylinder on opposite sides of the piston connected with the barrel, a valve or cock in said passage, and means for turning the same adapted to be actuated by the movement of the barrel, as set forth.

HIRAM STEVENS MAXIM.

Witnesses:

DAVID YOUNG,
CHAS. B. BURDON.