(No Model.) 5 Sheets—Sheet 1.

# H. S. MAXIM.

## AUTOMATIC GUN.

No. 430,210. Patented June 17, 1890.

Fig. 1

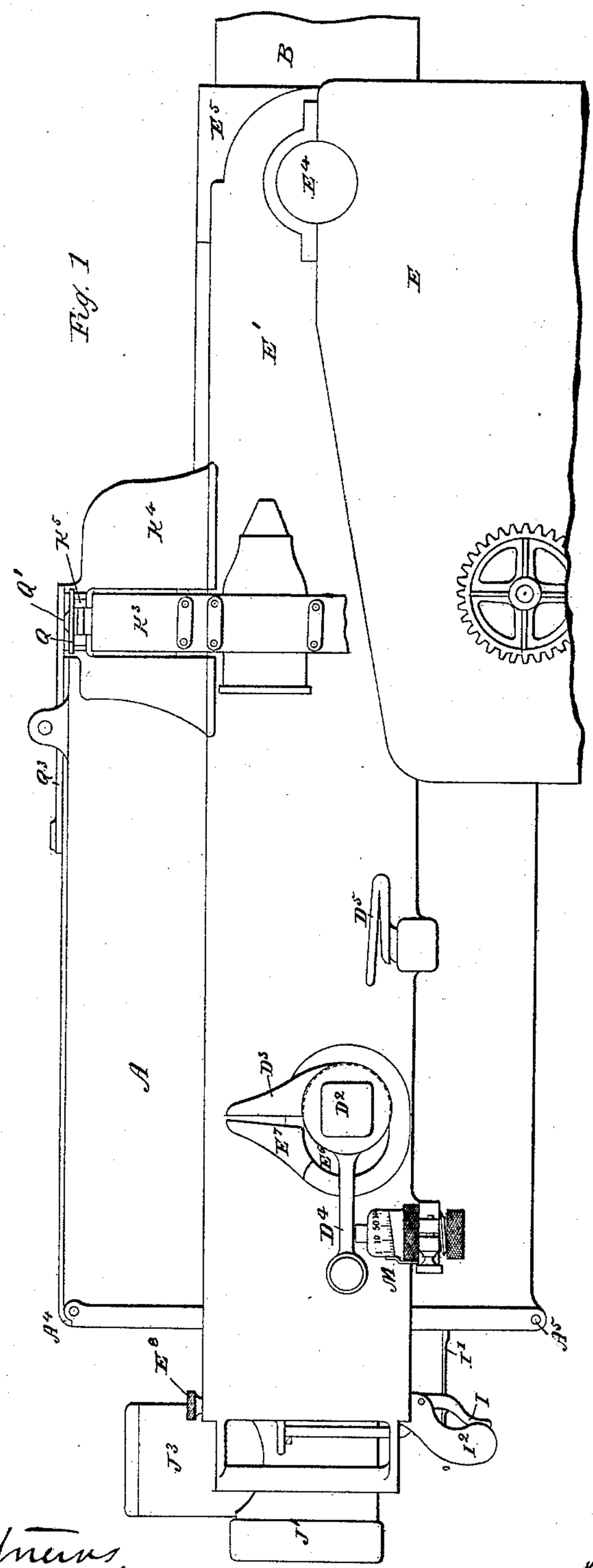



Fig. 3

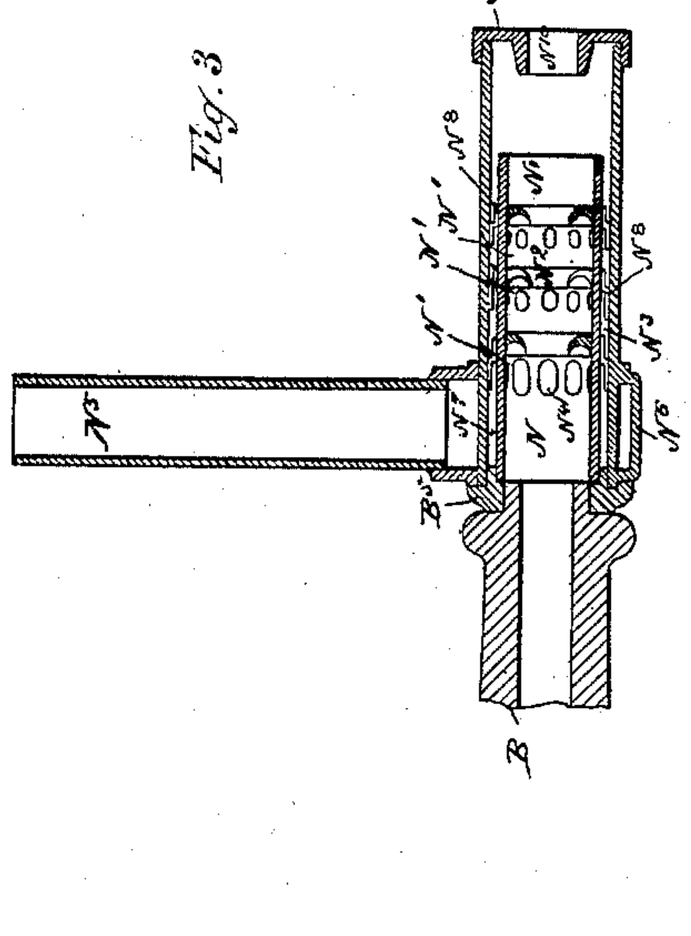
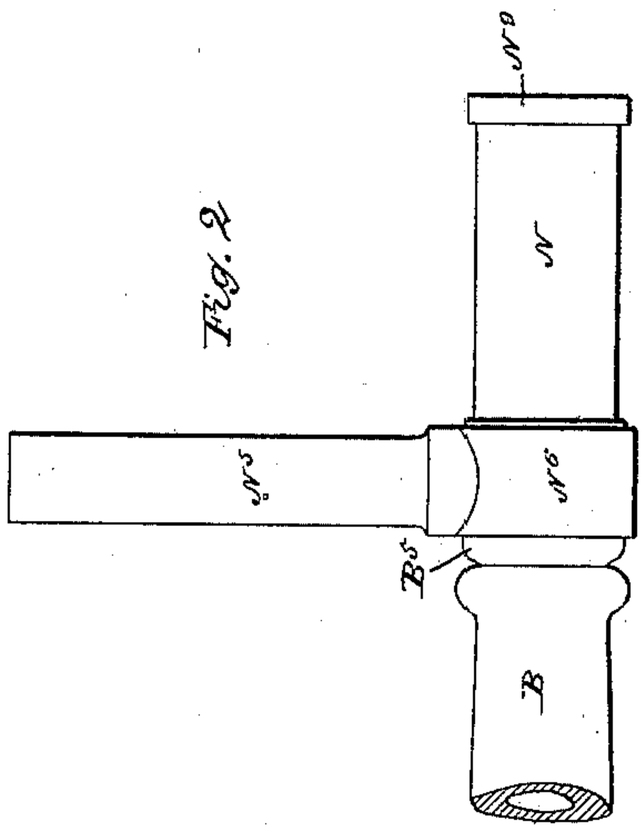



Fig. 2




Witnesses.
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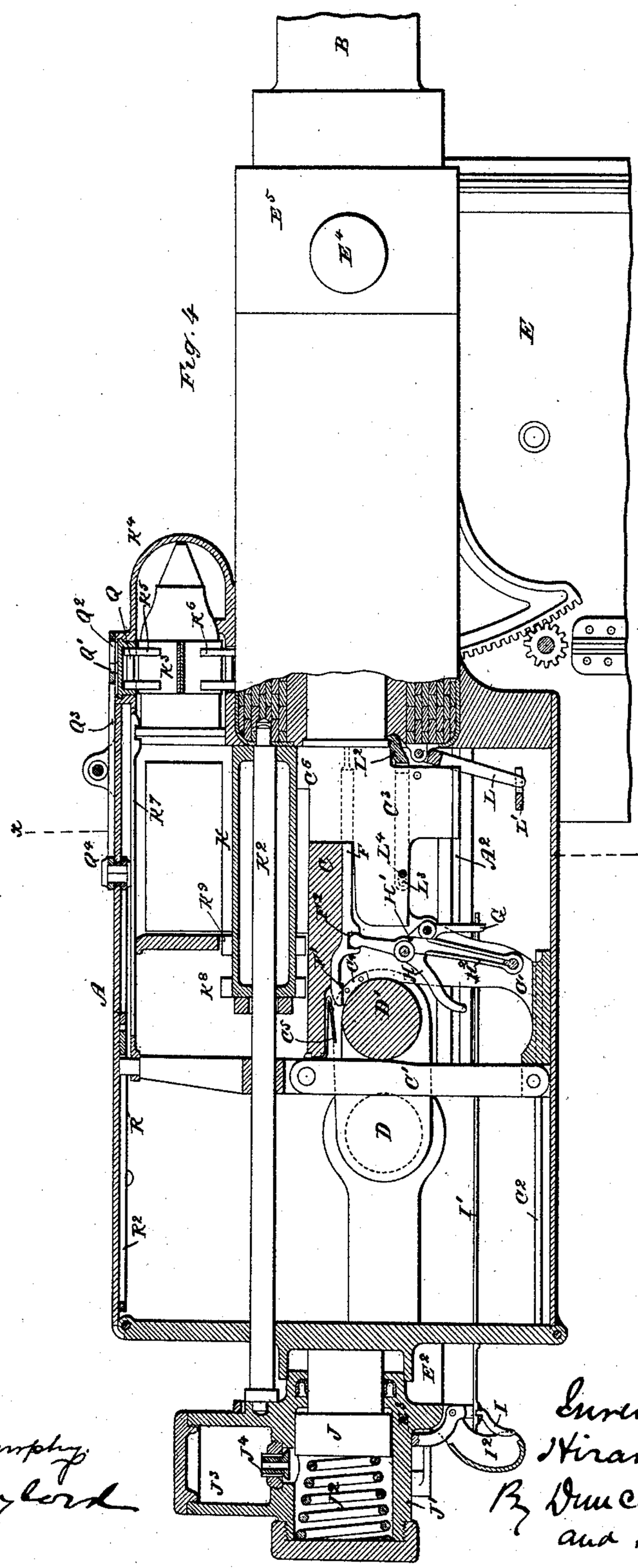
(No Model.) 5 Sheets—Sheet 2.

# H. S. MAXIM.

## AUTOMATIC GUN.

No. 430,210. Patented June 17, 1890.

Fig. 4.

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## AUTOMATIC GUN.

No. 430,210. Patented June 17, 1890.

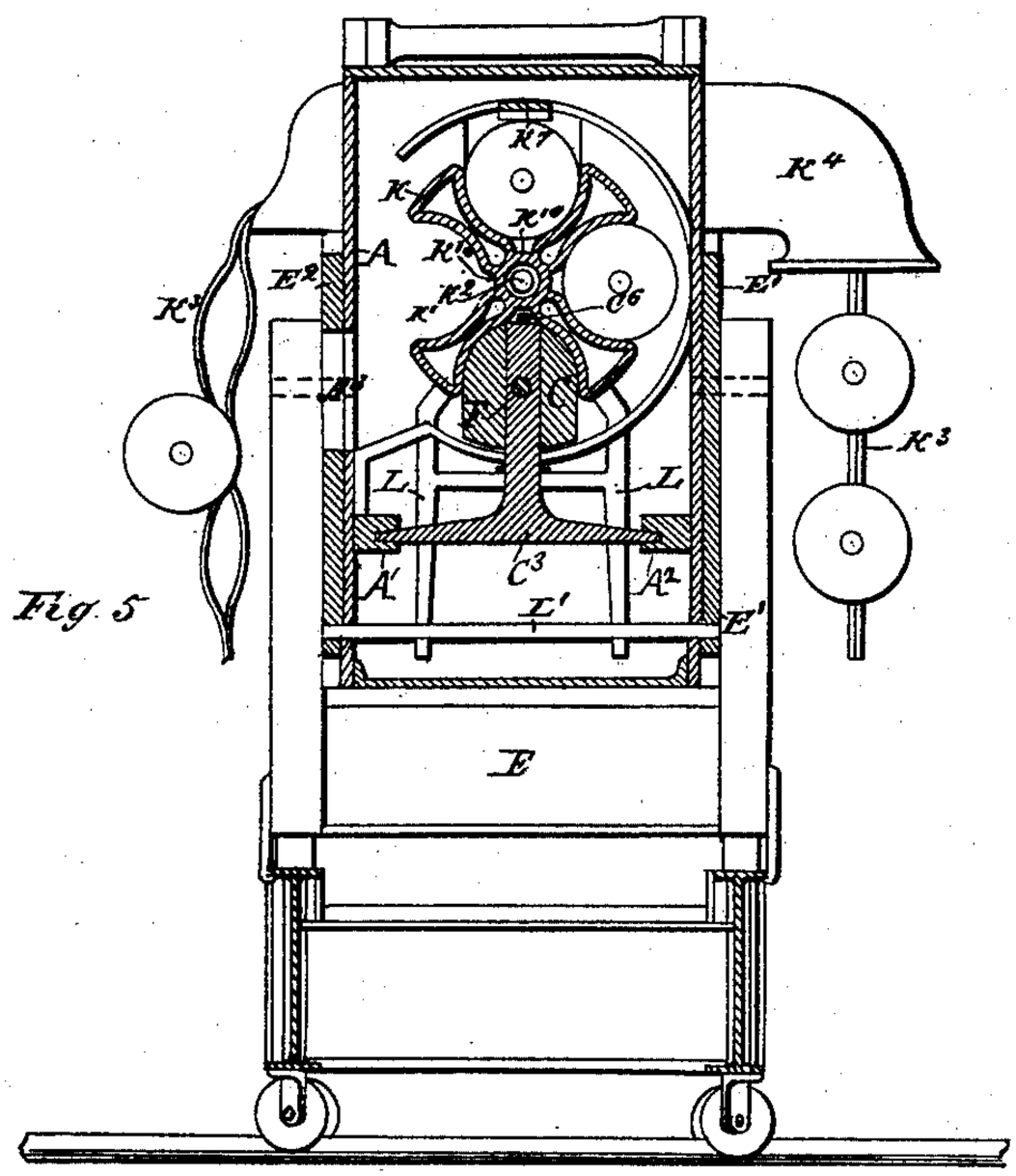


Fig. 5

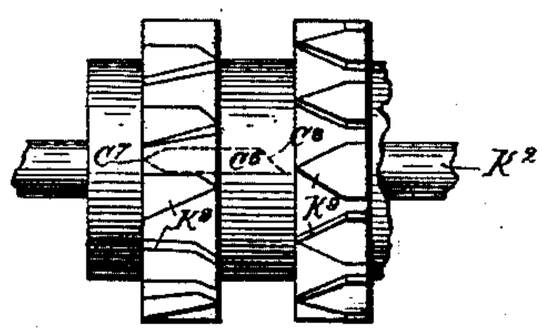


Fig. 6

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(No Model.)

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## AUTOMATIC GUN.

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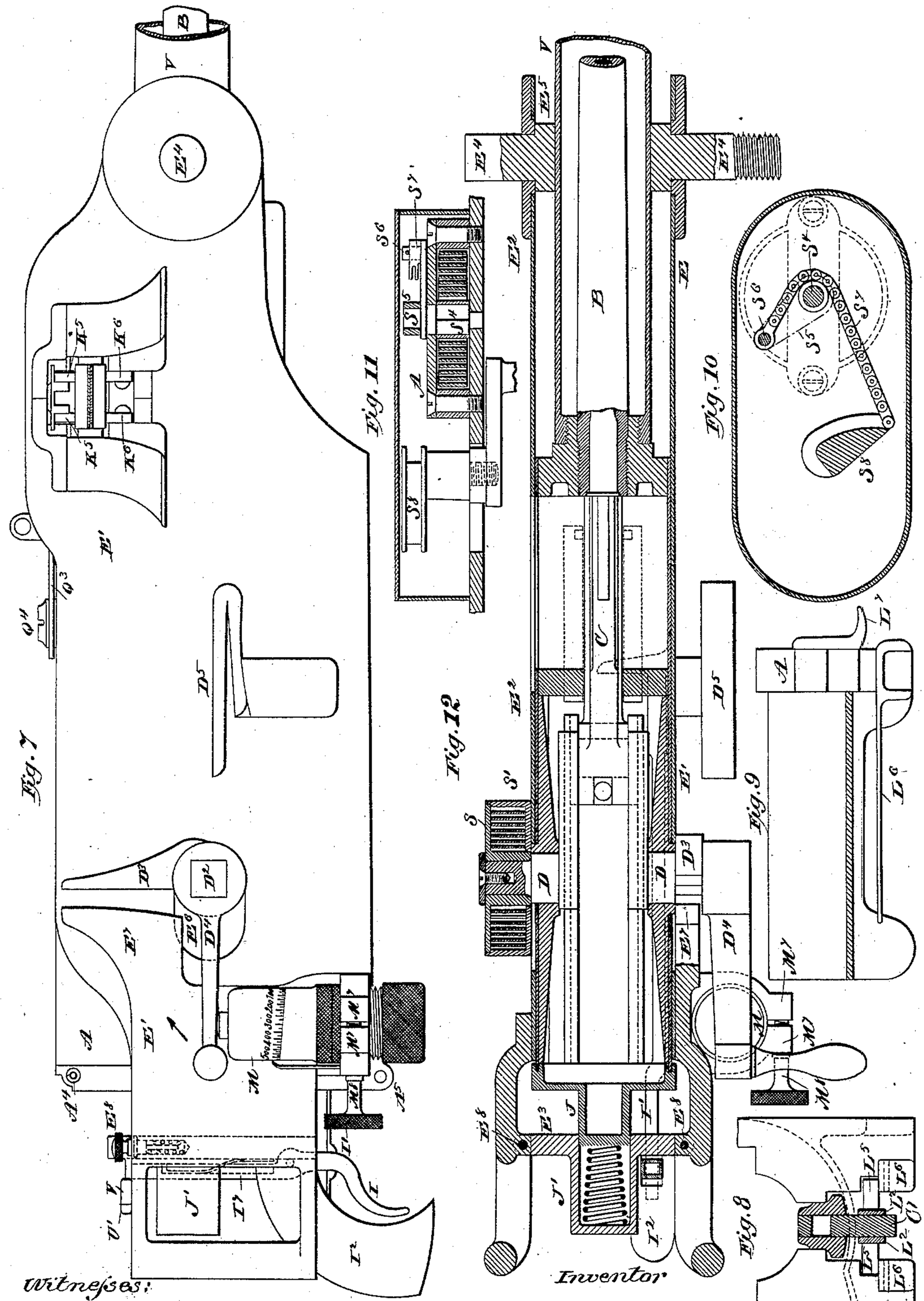


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(No Model.) 5 Sheets—Sheet 5.

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## AUTOMATIC GUN.

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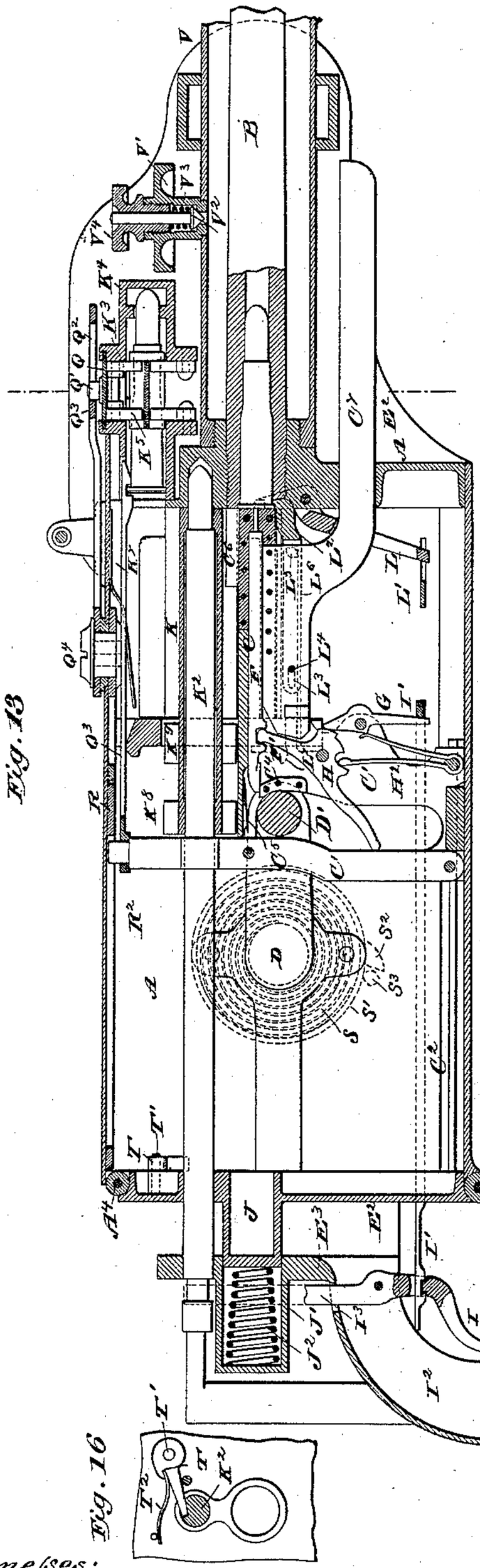

Fig. 13

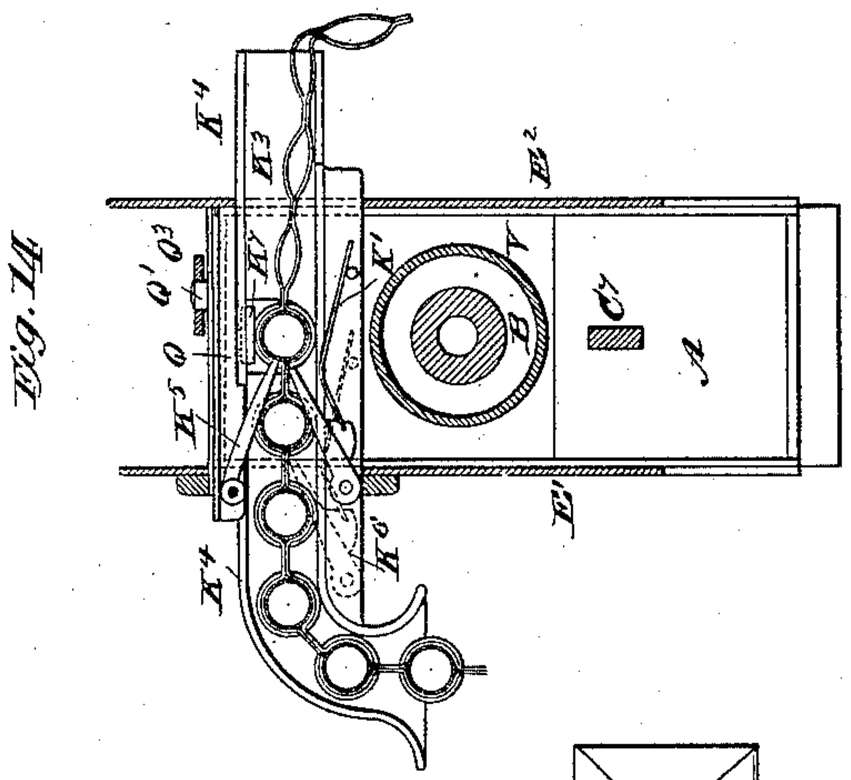

Fig. 14

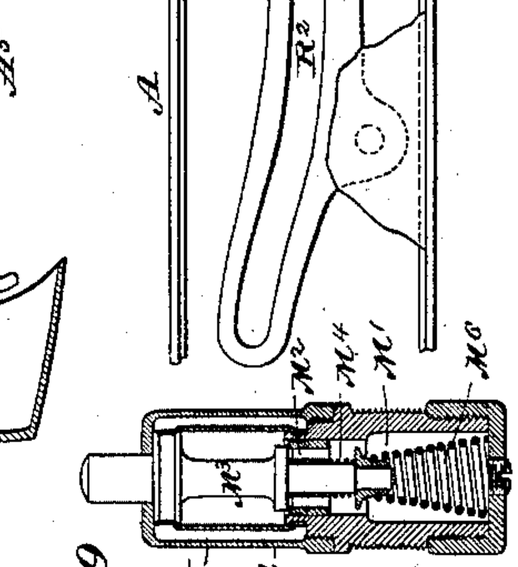

Fig. 15

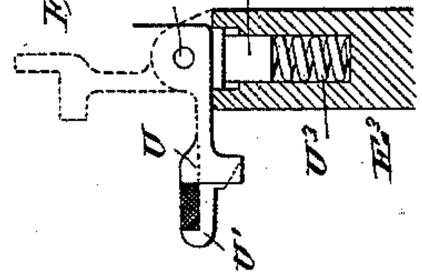

Fig. 18

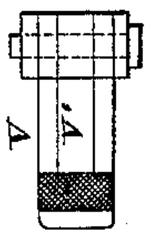

Fig. 17



Fig. 16



Fig. 19

Witnesses:
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M. G. Tracy.

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# UNITED STATES PATENT OFFICE.

HIRAM STEVENS MAXIM, OF LONDON, ENGLAND.

## AUTOMATIC GUN.

SPECIFICATION forming part of Letters Patent No. 430,210, dated June 17, 1890.

Application filed July 9, 1885. Serial No. 171,049. (No model.) Patented in England May 23, 1884, Nos. 8,153 and 9,407, October 17, 1884, No. 13,762, January 8, 1885, No. 288, January 29, 1885, No. 1,307, February 14, 1885, No. 2,090, March 7, 1885, No. 3,019, and April 27, 1885, No. 5,199, and in France June 13, 1884, No. 162,735.

*To all whom it may concern:*

Be it known that I, HIRAM STEVENS MAXIM, mechanical engineer, a citizen of the United States of America, and a resident of London, England, have invented new and useful Improvements in Automatic Guns, (for which I have obtained patents in Great Britain, No. 8,153, dated May 23, 1884; No. 9,407, dated May 23, 1884; No. 13,762, dated October 17, 1884; No. 288, dated January 8, 1885; No. 1,307, dated January 29, 1885; No. 2,090, dated February 14, 1885; No. 3,019, dated March 7, 1885, and No. 5,199, dated April 27, 1885, and in France, No. 162,735, dated June 13, 1884,) of which the following is a specification, reference being had to the accompanying drawings.

My invention pertains to machine-guns, and involves certain improvements in ordnance and fire-arms by means of which their action or operation is rendered automatic.

The details of the construction of the devices which I have selected in illustration of my invention will be described by reference to the accompanying drawings. The features of novelty which distinguish the same will be pointed out more specifically in the subjoined claims.

Figure 1 is a view in side elevation of a gun constructed in accordance with my present invention, such portions as are not included directly in the invention being omitted. Fig. 2 is a side elevation of the end of the barrel with an attachment thereto, the nature of which will be hereinafter described. Fig. 3 is a central vertical section of Fig. 2. Fig. 4 is a central longitudinal section of the working portions of Fig. 1. Fig. 5 is a vertical cross-section on the line $x\,x$ of Fig. 4, but on a reduced scale. Fig. 6 is an enlarged view in elevation of a detail of the cartridge-feed mechanism. Fig. 7 is a view in side elevation of an automatic gun constructed on the same principle, but adapted for firing cartridges such as are ordinarily used in rifles. Fig. 8 is a cross-section of the extractor mechanism of Fig. 7. Fig. 9 is a side elevation of the same. Fig. 10 is a view of one form of a spring for storing the energy of the recoil, the top of the box or casing therefor being removed. Fig. 11 is a central longitudinal section through the case of Fig. 10. Fig. 12 is a sectional plan of Fig. 7, taken longitudinally through the center of the barrel. Fig. 13 is a central vertical longitudinal section of Fig. 7. Fig. 14 is a cross-section of Fig. 13, taken on the line $x'\,x'$. Fig. 15 is a top plan view of the breech-case of Fig. 13. Fig. 16 is a detail of a mechanism used in the gun shown in Fig. 13. Figs. 17, 18, and 19 are views, partly in section, of mechanical details.

Referring to Figs. 1 to 6, inclusive, A indicates a strong frame, which is firmly attached to the rear end of the barrel B, and which carries the breech mechanism. The breech-block C is connected with a crank-shaft D by means of a slotted head C′, formed integrally with or rigidly attached to the breech-block C to receive the crank-pin D′. The gun, complete in itself so far as its action is concerned, is mounted on a suitable carriage or support E. I prefer to arrange it to slide to and fro between two bars or rods E′ $E^2$, which are connected at their rear ends by a cross-bar $E^3$, and the front ends of which are fitted upon trunnions $E^4$, formed on a ring or block $E^5$, which I will hereinafter term the "trunnion-ring," and in which the barrel B is fitted to slide. The trunnions are held in bearings in the carriage E. If desired, however, they may be held in a rigid support or in a swivel, so that they are free to rotate therein. In order that when the gun is fired it shall recoil a short distance independently of the side bars E′ $E^2$, these bars are slotted, as shown at $E^6$, to permit the backward movement of the crank-shaft.

The crank-shaft D is so arranged that when the breech is closed the crank-pin D′ is slightly above its forward "dead-center." The breech-block is therefore firmly held against the breech end of the barrel, and cannot recoil or move backward independently of the body and barrel of the gun until the crank-shaft D is partially rotated, as hereinafter described. I provide suitable means whereby this rotation of the crank-shaft will

be automatically effected by the recoil of the gun. For this purpose I prefer to construct the crank-shaft and other parts as follows, viz: I make the crank-shaft of such length that it extends at one end through a hole in the frame A and through the slot $E^6$, as shown at $D^2$. This end of the crank-shaft is square and is provided with an arm $D^3$, which, when the gun recoils, comes in contact with a stationary point of resistance, such as a shoulder or projection $E^7$ on the side bar E'. By these means the crank-shaft is rotated through an angle of about one hundred and eighty degrees by the momentum of the whole gun in its recoil, and thereby causes the extraction of the empty cartridge-shell from the barrel and the cocking of the hammer or firing-pin and stores energy in one or more springs hereinafter described, whose reaction effects the loading and firing of the gun. It also causes a fresh cartridge to be drawn out of a belt into a feed-wheel, all as hereinafter described.

The slotted head C' is fitted to slide to and fro between guides $C^2$ at the lower part of the frame A. A piece $C^3$, of steel or other suitable metal of an inverted-T shape in transverse section, is fitted in the forward end of the breech-block C. This piece is fitted to slide between guides A' $A^2$, secured to the sides of the frame A.

I provide the gun with two devices which serve as sears. The release or disengagement of one of these devices is effected by the crank-pin and that of the other device either by hand or automatically. The device operated by the crank-pin serves for the automatic firing of the gun, and also as a safety device to prevent the firing of the gun before the crank is in its proper position to resist the force of the explosion—that is to say, before the crank-pin is at its forward dead-center. This device is constructed as follows, viz: A shoulder or projection $C^4$ is provided on the head C', and the striker or firing-pin F has a shoulder F' near its rear end to engage with the projection $C^4$. When the firing-pin is cocked, as hereinafter described, it is acted upon by a spring $C^5$, which holds it in engagement with the said projection, so that it cannot be released to fire the gun until it is disengaged from the said projection by the raising of its rear end by the crank-pin D'. The other device, which serves as a sear, comprises a lever G, carried by and pivoted to the head C' and arranged to engage with a shoulder H' on the hammer H. The said hammer is also carried by and pivoted to the head C'. Its upper end enters a notch $F^2$ in the firing-pin F, and its lower end extends downward into the path of the crank-pin D'. The mainspring $H^2$ acts upon the hammer H to drive the firing-pin forward. The said spring also acts upon the lever G to cause the same to engage with the hammer when cocked.

A trigger I and sliding bar or rod I' are arranged in combination with the lever G. This trigger is preferably combined with a pistol butt or grip $I^2$.

After the explosion has caused the recoil of the gun and brought the projecting arm $D^3$ on the crank-shaft D against the stationary point of resistance $E^7$ the said shaft is, as above explained, partially rotated. A suitable spring is provided for moving the said shaft, the breech-block, and parts connected therewith back into their firing positions relatively to the barrel and body of the gun. A spiral spring or a coiled spring—such as that shown in Figs. 12 and 13—is preferably employed for this purpose. When a spiral spring is used, it is attached at one end to a stationary part of the carriage or support. Its other end is coupled to a chain, which is attached to a cam on the crank-shaft, so that when the said shaft is rotated by the recoil of the gun, as above described, the chain is wound upon the cam and the spring is then extended. The spring then reacts to rotate the said crank in the opposite direction. The said spring in this case also tends to move the whole gun back to its firing position.

I usually fix on the crank-shaft D a crank-handle $D^4$ for operating the gun by hand. If desired, the projecting arm $D^3$ is formed solidly with this crank-handle. Moreover, a spring stop or buffer $D^5$ is secured to the side bar E', which stop or buffer will be more or less compressed by the handle $D^4$ when the crank is in its firing position, and will therefore prevent the too sudden or violent impact of the breech-block against the breech end of the barrel.

The two side bars E' $E^2$, instead of being secured at their ends to the trunnions, may be attached to any stationary part of the carriage or support.

The cross-bar $E^3$ is furnished with a buffer or cushion to partially absorb or diminish the shock resulting from the recoil of the gun and react to move or assist in moving the gun back to its firing position. For this purpose I prefer to make the gun with a piston or plunger J, fitting into a cylinder J', which is carried by the said cross-bar, and in which the buffer or spring $J^2$ is placed. By this combination of parts the gun is held in position in the frame or side bars E' $E^2$.

Above the cylinder J' is arranged a chamber $J^3$, closed at its upper end and connected at its lower end with the said cylinder by a passage which is partially closed by a valve $J^4$. This valve has a central hole, as shown, and two or more grooves are formed in its periphery and extend in the same direction as its axis. The said cylinder and chamber are to be partially filled with glycerine or other liquid, so that when the gun recoils between the side bars E' $E^2$ the said liquid will be forced through the central hole in the valve $J^4$ into the chamber $J^3$, the valve being at the same time lifted, so that the liquid will be prevented from passing through the grooves

in its periphery. The air in the chamber $J^3$ will thus be compressed, and its reaction and that of the spring will move or assist in moving the gun back to its original position. It is evident, however, that there will be a larger passage for the egress of the liquid from the chamber $J^3$ than for its ingress, because in its egress it will pass through the grooves in the valve as well as through the central hole therein. The device thus constructed will therefore materially assist in effecting the return movement of the crank-shaft and other parts.

The device which I prefer to employ in this gun for feeding cartridges into position to be thrust into the barrel and removing the empty shells is constructed as follows—that is to say: K is a feed-wheel formed with longitudinal grooves or channels K′. This wheel is fitted upon the shaft $K^2$, which is carried in suitable bearings. It is arranged to operate in combination with a band or belt $K^3$, which contains cartridges, and which is intermittently moved forward through a casing $K^4$ in front of the feed-wheel by means of the pawls $K^5$ $K^6$, as hereinafter set forth. An extractor or hooked rod $K^7$ is connected at its rear end with the slotted head C′, and its forward end or hook is adapted to engage with the flanges of the cartridges in the belt $K^3$, in order to draw a cartridge out of the said belt and leave it in the uppermost groove of the feed-wheel K each time the gun recoils and the breech-block moves away from the breech.

The following means are provided for intermittently rotating the feed-wheel K, viz: A projection $C^6$, having two inclined faces $C^7$ $C^8$, as shown in dotted lines in Fig. 6, is formed or fixed on the breech-block C. The feed-wheel K is provided with two series of teeth $K^8$ $K^9$, having inclined faces corresponding with those on the projection $C^6$. During the latter part of the rearward movement of the breech-block the inclined face $C^7$ of the projection $C^6$ acts upon one of the teeth $K^8$ and partially rotates the feed-wheel K—say, for instance, one-third of the distance requisite to bring a fresh cartridge in line with the barrel. During the first part of the forward movement of the breech-block the inclined face $C^8$ of the projection $C^6$ acts upon one of the teeth $K^9$ and partially rotates the said feed-wheel, so as to bring the said cartridge in line with the barrel. The said projection then enters and slides in one of the grooves or channels $K^{10}$ in the feed-wheel, and thus retains the latter in position until the said cartridge is pushed in the barrel.

The empty cartridge-shells, after they have been withdrawn from the barrel by the extractor, hereinafter described, are carried around by the feed-wheel K until they are ejected or fall therefrom through openings at $A^3$ in the frame A and side bar $E^2$.

The pawls $K^5$ $K^6$ operate on the belt $K^3$, containing the cartridges, in the manner hereinafter set forth, so that in each recoil or backward movement of the breech-block, after the hooked rod pulls one cartridge out of the belt, the pawls push another cartridge into the proper position to be drawn out of the belt into the feed-wheel by the said hooked rod in the next recoil or backward movement of the breech-block.

In the form of gun above described I prefer to arrange the feed-wheel above the center of the barrel and to fill the said wheel from the belt at its upper side.

L is a lever pivoted to the breech end of the barrel B at its rear end for starting the empty cartridge-cases from the barrel. The two arms of this lever are forked, as shown. The two jaws or prongs of the upper arm of the said lever are arranged to form portions of the seating for the flange of a cartridge in the barrel. The two jaws or prongs of the lower arm of the said lever extend downward, so that during the recoil of the gun they will come in contact with a rod or bar L′, extending through slots in the frame A and fixed in the side bars E′ $E^2$, and the lever L will be thereby turned on its pivot and will act very advantageously to start the cartridge-case from the barrel.

$L^2$ is the extractor, which is a hooked rod or bar carried by the breech-block. By using the lever L in combination with the extractor $L^2$, I am enabled to provide for the avoidance of any undue strain upon the latter, as follows, viz: I make the said extractor with a slot $L^3$, through which is passed a pin or bolt $L^4$ in the breech-block C, so that when the said breech-block moves away from the barrel the pin or bolt $L^4$ will travel freely in the slot $L^3$, and the extractor will not be moved with the breech-block until the lever L has started the cartridge-case from the barrel.

M indicates a device designed to operate in combination with the crank-handle $D^4$ to regulate the speed of firing. This device is constructed as hereinafter described.

When my improvements are applied to a rifle, I prefer to arrange the said rifle to slide upon or between two side bars firmly connected to a shoulder-plate and to provide suitable means for partially rotating the crank-shaft at the proper time.

I provide for arresting and conducting away the smoke which issues from the muzzle of the gun in order to have the atmosphere around the gun clear or unobscured after each discharge. I thus obtain among other advantages that of permitting the pointing or aiming of the gun during an action to be effected without inconvenience or impediment from the smoke. This advantage is of great importance in naval actions, as it obviates or removes the danger arising from the facility with which torpedo-boats can attack a ship under cover of the smoke. I accomplish this object as hereinafter described—that is to say, I combine with the gun apparatus comprising a chamber or casing fixed upon or around the muzzle end of the barrel,

which chamber or casing extends beyond the muzzle and is provided with baffle-plates or deflecting-plates for arresting the smoke and with a pipe for conducting the same away from the said chamber or casing. In Figs. 2 and 3, N indicates the said chamber or casing, which is formed of brass or other suitable material, and which is fixed upon the barrel B by screwing it onto a metal piece $B^5$, firmly attached to the end of the barrel. The chamber or casing N is provided with the baffle-plates or deflecting-plates N′, which are fixed within the said chamber at suitable intervals. These plates are made with central holes $N^2$, which permit the passage of a projectile through the said plates. $N^3$ is a second chamber or casing, which surrounds the chamber N. The chamber N is formed with holes $N^4$ behind each plate N′ to permit the passage of the smoke from the chamber N to the chamber $N^3$.

$N^5$ is a pipe which is secured to an annular piece $N^6$, fixed on the chamber $N^3$ and inclosing a space around the same. The chamber $N^3$ is formed with apertures $N^7$, through which the smoke will pass therefrom into the said space and into the pipe $N^5$, whence it is conducted away, as hereinafter explained. A deflecting-plate $N^8$ is fixed on the chamber N around each of the series of apertures $N^4$ to direct the smoke which passes through the said apertures toward the pipe $N^5$. The chamber $N^3$ is provided with a screw-cap $N^9$, having a central hole $N^{10}$ for the passage of the projectile.

When the gun is discharged, the projectile passes through the holes $N^2$ in the plates N′ and through the hole $N^{10}$ in the screw-cap $N^9$; but, by reason of the expansion of the smoke or gaseous products of combustion on leaving the gun, the greater portion of the smoke or gaseous products is arrested by the first or rearmost plate N′ and passes with considerable velocity through the chamber $N^3$ and the annular space around the same into the pipe $N^5$. A partial vacuum is thus formed in the chamber $N^3$. If any of the smoke passes through the hole $N^2$ in the first plate N′, it is arrested by the succeeding plate or plates and passes through the apertures $N^4$ in the chamber $N^3$, the partial vacuum formed in this chamber assisting or facilitating the passage of the smoke through the said holes. If any of the smoke passes through the hole $N^2$ in the last or foremost plate N′, it is arrested by the screw-cap $N^9$ and passes back through the chamber $N^3$ into the pipe $N^5$. The whole or very nearly the whole of the smoke which issues from the muzzle of the gun is thus arrested and conducted away through the pipe $N^5$. This pipe is arranged to conduct the smoke upward for a short distance and permit it to escape into the atmosphere, or the said pipe is made with a movable portion, which can be adjusted so as to conduct the smoke for a short distance to the leeward side of the gun, or it is connected with a boiler-furnace tube beneath the fire-grate, and a blower or the like is provided for forcing the smoke through the incandescent fuel, so that it will be rendered transparent or deprived of its visible particles. It is then allowed to escape through the chimney or funnel of the boiler into the atmosphere.

Figs. 7 to 19 illustrate an automatic gun adapted to fire cartridges of the size ordinarily used in rifles. The construction of this gun is in principle substantially the same as that previously described; but the gun, in lieu of being mounted on a carriage, has trunnions $E^4$, which are adapted to receive a forked piece fitted upon a pivot-pin of the special form of carriage. The breech-block is, moreover, provided with a guide-bar $C^7$, fitted to slide in a hole in the frame A instead of into the projecting piece $C^3$, arranged to slide in the guides A′ $A^2$.

The extractor $L^2$ is slotted, as hereinbefore described, to receive the pin or stud $L^4$, for the purpose specified. The said extractor is, moreover, provided with projections $L^5$, Figs. 8 and 13, against which bear springs $L^6$, whereby it is supported with a capability of yielding to permit its hook to pass the flange of a cartridge. These projections $L^5$ also serve another purpose, viz: When the breech-block has recoiled or moved backward, they strike against fixed inclined surfaces $L^7$, whereby the extractor is depressed to disengage it from the flange of an empty cartridge-case. It will be seen that the two extractors or hooked rods $K^7$ and $L^2$ will both be moved backward with the breech-block, and will thus simultaneously effect the extraction of the empty cartridge-case from the barrel and the transfer of a cartridge from the belt $K^3$ to the feed-wheel K. I sometimes use another feed-wheel for feeding cartridges from a suitable box or magazine or for feeding the aforesaid belt through the gun. In either of these cases the hooked rod or extractor $K^7$ serves for drawing the cartridges from this feed-wheel into the feed-wheel K, and the two wheels are suitably geared with each other.

The mechanism for feeding the belt $K^3$ through the casing $K^4$ is constructed as follows—that is to say, the pawls $K^5$ are carried by and pivoted to a bar Q, fitted to slide to and fro in the said casing transversely to the axis of the barrel. A pin or stud Q′ extends upward from this bar and enters a slot $Q^2$ in the long arm of a double-armed lever $Q^3$, which is pivoted at $Q^4$ to the frame A. The short arm of the said lever extends beneath the top plate of the frame A. It is forked at its extremity and engages with a slotted lever R, pivoted at R′ to the frame A. The upper end of the slotted head C′ is arranged to move to and fro in the slot $R^2$ of the lever R, so that in the to-and-fro movement of the breech-block and the head C′ the said lever is caused to oscillate about its pivot R′ and impart the necessary reciprocating motion to the slide-bar Q and pawls $K^5$ through the lever $Q^3$.

The retaining-pawls $K^6$ are pivoted to the interior of the casing and are acted upon by springs $K^{11}$, which tend to hold them in engagement with the belt of cartridges. The parts are shown in position for the hooked rod $K^7$ to draw a cartridge out of the belt $K^3$ in the next rearward movement of the breech-block. During the latter part of this rearward movement the slide-bar Q is moved in one direction, so that the pawls $K^5$ slide over the succeeding cartridge and engage therewith. During the forward movement of the breech-block the said slide-bar will be moved in the opposite direction, and the pawls $K^5$ will push forward the belt of cartridges, so as to bring a fresh cartridge into position for the hooked rod $K^7$ to engage therewith. I do not, however, limit myself to the employment of this mechanism for supplying cartridges to the feed-wheel K, as I may use any means suitable for the purpose. For instance, in some cases I place a few cartridges in a box or chamber directly over the said feed-wheel, so that they will drop therein by gravity. This arrangement answers well for the large forms of guns—say of a caliber of one inch or more.

S indicates a coiled spring for returning the parts to their firing positions after the recoil. This spring is secured at one end to the crank-shaft D and at the other end to a casing S′, which is free to rotate upon or about the said shaft. This casing is formed or provided with a projection $S^2$, which bears against a pin or stud $S^3$, fixed in the side bar $E^2$. When the gun recoils between the side bars E′ $E^2$, the projection $S^2$ is prevented from backward movement by the pin or stud $S^3$. The casing S′ is therefore caused to partially rotate on the shaft D and slightly wind up the spring S, which will subsequently react to move or assist in moving the gun back to its firing position. When the crank-shaft D is partially rotated by the recoil or backward movement of the breech-block, the pin or stud $S^3$ serves as a stop for the spring S, which is consequently wound up during such backward movement and will subsequently react to return the breech-block and parts connected therewith to their firing positions.

It is evident that with the arrangement above described the force exerted by the spring S to drive the breech-block home will decrease as the said breech-block is moved forward and the spring is unwound. As it is preferable that the spring should exert great force during the latter portion of the forward movement of the breech-block, in order that it shall efficiently perform the operations of thrusting a cartridge into the barrel, cocking the hammer, and releasing the firing-pin from the shoulder $C^4$, I sometimes arrange in combination with the crank-shaft the devices shown in Figs. 10 and 11—that is to say, the spring S and casing S′ are mounted on a short shaft $S^4$, which is carried in bearings in the frame A and plate $A^6$. An arm $S^5$ is fixed or formed on this shaft, and is provided with a pin or stud $S^6$, to which is attached one end of a chain $S^7$. The other end of this chain is attached to the extremity of an arm $S^8$, fixed on the crank-shaft D. The arms $S^5$ $S^8$ and chain $S^7$ are arranged relatively to each other as shown, so that when the breech-block commences its backward movement, the leverage between it and the spring S is very great, and as the breech-block recoils or moves backward the said leverage decreases or diminishes, and when the spring S reacts, the leverage between it and the breech-block is small; but the said leverage increases as the said block moves forward, so that it is greatest at the time of closing the breech, as will be readily understood.

A gun constructed as above described can be made very light and of great strength, and may, if desired, be made so that it can be very readily taken to pieces and put together again. For this purpose I sometimes so construct the gun that it is only necessary to remove a few pins or rods to permit the parts to be quickly taken apart.

In the modification of my gun shown in Figs. 7 to 16 the cross-bar $E^3$ is secured in the side bars E′ $E^2$ by two pins $E^8$, so that when these pins are withdrawn the cross-bar can be removed. The rear end and top of the case or frame A are made with hinges $A^4$ $A^5$, so that they can be opened to remove parts of the mechanism. The rod or shaft $K^2$ is, moreover, so made and fitted that it can be easily withdrawn and the feed-wheel lifted out. This rod or shaft is in some cases attached to the cross-bar $E^3$, so that it will be removed simultaneously therewith.

I provide a catch T, which is pivoted at T′ to the interior of the case or frame A, as shown in Fig. 16, and is acted upon by a spring $T^2$. This spring tends to hold the said catch in engagement with a notch in the rod or shaft $K^2$ when the latter is in place, so that before the said rod or shaft can be withdrawn it must be partially rotated in the direction indicated by the arrow to lift the catch out of engagement with its notch.

The shaft $K^2$ is pointed at its forward extremity to facilitate its insertion.

I provide the means hereinafter described for holding the trigger I and sliding bar I′ either in such a position that they will be prevented from acting upon the lever G and the gun cannot be fired by pulling the trigger or in such a position that they will keep the said lever out of engagement with the hammer H, and thus permit the gun to operate automatically so long as the supply of ammunition is maintained, the crank-pin D′, every time it reaches its firing position, releasing the firing-pin F from the shoulder $C^4$—that is to say, the trigger I has an extension $I^3$, which projects upward to near the top of the cross-bar $E^3$, and a locking device carried by the said cross-bar is arranged in combina-

tion with the said extension. This locking device comprises two catch-levers U U′, Figs. 17 and 18, both of which are pivoted at $U^2$ and are acted upon, through the medium of the pin or rod $U^4$, by a spring $U^3$, fitted in a recess or cavity in the cross-bar $E^3$. The said spring tends to hold the said catch-levers in either a horizontal or vertical position.

If it is desired that the sliding bar I′ should be prevented from acting upon the lever G, both catch-levers are turned down into the horizontal position while the extension $I^3$ is in its rearmost position so that the hook of the catch-lever U will be in front of the said extension. If the parts are to be adjusted so that the gun will operate automatically, the catch-lever U is turned up into its vertical position, and when the trigger is pulled by hand to start the gun the catch-lever U′ will be slightly raised by the extension $I^3$ and will then fall so that its hook lies at the back of the said extension. When the parts are in this position, the lever G will come in contact with the hooked extremity of the sliding bar I′ every time the breech-block moves forward and closes the breech, and will thus be disengaged from the shoulder of the hammer H.

By mounting the hammer H and the lever G upon the slotted head C′ so that they move to and fro with the breech-block and arranging the sliding bar I′ as shown I provide for preventing the firing of the gun before the breech is closed.

When both the catch-levers U U′ are moved out of their engagement with the extension $I^3$, the trigger must be pulled by hand to effect each discharge of the gun.

The device M, for regulating or controlling the speed of firing, is constructed as shown in Fig. 19—that is to say, M′ is a cylinder or chamber containing glycerine and water or other liquid, in which chamber is fitted a perforated piston $M^2$. The holes through this piston are closed (when the gun is ready for firing) by a collar or flange on the piston-rod $M^3$, the piston being mounted loosely upon the said rod and held against the said collar by a light spring $M^4$. The chamber M′ is connected with the piston-rod by a flexible tube $M^5$ and is made slightly conical at the part which surrounds the piston $M^2$, as shown. A spring $M^6$ is arranged within the chamber M′ and tends to push the piston $M^3$ upward therein.

When the parts of the gun are in position for firing, the piston-rod and piston are more or less depressed by the handle $D^4$, and the spring $M^6$ is compressed to a corresponding extent. When the breech-block recoils or moves backward and the shaft D and handle $D^4$ are partially rotated in the direction indicated by the arrow in Fig. 7, the spring $M^6$ reacts and slightly compresses the spring $M^4$ and moves the piston-rod $M^3$ upward, thereby uncovering the holes in the piston $M^2$. The piston is then moved upward by the springs, the liquid passing freely through it. During the latter portion of the forward movement of the breech-block the handle $D^4$ acts upon the piston-rod $M^3$ and depresses the same, thereby first closing the holes in the piston and then moving the said piston downward in the chamber M′; but this movement of the said piston will be more or less retarded, according to the space which exists between the piston and the cylinder or chamber. To permit this space to be increased or diminished at will, the chamber M′ is screw-threaded externally and is fitted between the jaws $M^7$ of a bracket secured to the side bar E′, which is correspondingly screw-threaded internally and provided with a set-screw $M^8$, whereby the jaws can be drawn together to grip the chamber M′ and firmly hold the same in any position to which it may be adjusted. When this set-screw is slackened, the said chamber can be turned in either direction to raise or lower the same, so that the space between the piston $M^2$ and the cylinder or chamber M′ will be increased or diminished as required. In this manner the movement of the breech-block during the latter portion of its forward stroke can be more or less retarded, and as the firing cannot take place until the breech is closed the speed of firing can be regulated or controlled at will.

What I claim is—

1. In a machine-gun, the combination, with stationary supports or guides, of a barrel and breech mechanism fitted to and adapted to slide back and forth in said supports, a crank-shaft and a crank connected with the breech-block, and a fixed point of resistance for engaging with a projection on the crank-shaft for partially turning the same when the barrel recoils, and thereby retracting the breech-block, as and for the purpose set forth.

2. The combination, with the stationary supports or guides, of a gun-barrel and breech mechanism adapted to slide therein, a shaft carried by the breech mechanism, provided with a crank that engages with the breech-block and with a projecting lug or arm, a spring connected to the crank and adapted to be brought under tension by its rotation, and a fixed point of resistance in position to encounter the said lug or arm and turn the crank-shaft when the barrel recoils, as herein set forth.

3. The combination, with a reciprocating gun-barrel and breech mechanism, of a crank-shaft and crank connected with the breech-block, whereby the breech-block is retracted from the breech when the crank-shaft is turned, a lug or arm extending from the crank-shaft, and a fixed or stationary point of resistance secured to the supports of the gun in the path of movement of the said lug, whereby the said crank-shaft will be partially rotated by the recoil of the barrel and breech mechanism and the engagement of its lug or arm with the stationary point of resistance.

4. The combination, with the breech-block and crank for moving the same to and from

the breech, of a hammer carried by the breech-block and two sears associated therewith, one projecting into the path of the crank-pin, whereby it will be encountered and moved to release the hammer at the termination of the forward movement of the breech-block, the other consisting of a pivoted lever, the end of which is adapted to engage with a sliding bar connected to a trigger mounted on the stationary gun-support, these parts being so arranged that the lever or sear may be tripped automatically by its engagement with the sliding bar at the termination of the forward movement of the breech-block or by pulling the trigger and drawing back the sliding bar.

5. The combination, with the breech-block, the slotted head, and the crank and pin working in the slot for the purpose of reciprocating the breech-block, of a firing-pin, a sear, and a spring-actuated hammer pivoted to the breech-block and extending into the path of the crank-pin, whereby it is encountered and cocked thereby on the backward movement of the breech-block, as set forth.

6. The combination, with the reciprocating breech-block, the slotted head, and the crank and crank-pin working in the slot, of the hammer H, pivoted to the breech-block, the firing-pin F, engaging with the hammer and having a shouldered end projecting into the path of the crank-pin, the spring $C^5$, in position to bear down upon the end of the firing-pin, and a projection $C^4$ on the slotted head for engagement with the shoulder of the firing-pin and holding the hammer cocked until the firing-pin is released by the crank-pin, as set forth.

7. The combination, with the reciprocating breech-block, of a firing-pin extending through the same, a hammer H engaging therewith, a sear G, pivoted to the breech-block and adapted to engage with the hammer, a trigger I, pivoted to the stationary gun-support, and a sliding bar I′, connected with the trigger and extending to and formed to engage with the sear G, in substantially the manner herein set forth.

8. The combination, with stationary supports or guides, of a gun-barrel and breech mechanism fitted to slide therein, a crank-shaft and crank-connection with the breech-block which is adapted to be operated or partially turned by the recoil of the barrel, and a cushion or buffer between the movable barrel and breech mechanism and the stationary supports of the gun, as set forth.

9. The combination, with the reciprocating breech mechanism and the crank-shaft adapted to be partially rotated by the recoil of the same, of a handle connected to the crank-shaft and a spring cushion or buffer on the gun-supports, upon which said handle impinges when the crank-shaft is partially rotated, as set forth.

10. The combination, with the stationary supports of a gun-barrel and breech mechanism fitted to slide therein, of the piston J on the breech mechanism, the cylinder J′ on the stationary support of the gun, and the spring $J^2$, contained within the cylinder and forming a buffer or cushion to receive the recoil of the barrel and breech mechanism, as herein set forth.

11. The combination, with the buffer or cushion composed of a cylinder and piston carried one by the stationary supports and the other by the sliding gun-barrel and breech mechanism and containing a spring $J^2$, of the supplemental chamber $J^3$ and intermediate valve parts controlled by a valve $J^4$, as herein set forth.

12. The combination, with the reciprocating breech-block C, of the extractor $L^2$, carried thereby and formed or provided with lugs or projections $L^5$, the springs $L^6$, secured to the breech-block and bearing on the said lugs, and the inclined surfaces $L^7$ on the stationary support of the gun in position to encounter and depress the extractor by engagement with the lugs $L^5$ thereon.

13. The combination, with the slotted head C′ of the breech-block, of the sliding bar Q and intermediate levers operated by the reciprocating head C′ to impart a to-and-fro movement to the bar Q, the retaining-pawls $K^6$, pivoted to the casing through which the feed-belt moves, and the pawls $K^5$, carried by the bar Q and adapted to engage with the cartridge-belt, as set forth.

14. The combination, with the reciprocating breech-block C and the crank-shaft connected therewith, of the rotary casing S′, carried by an extension of the shaft, the spring S, the ends of which are connected to the crank-shaft and the casing, the projection $S^2$ on the casing S′, and the stops $S^3$ on the stationary support or guide E′, as herein set forth.

15. The combination, with the trigger I, formed with an extension $I^3$, of the cross-bar $E^3$, the catch-levers U U′, carried thereby and adapted to engage with the extension $I^3$, and the spring $U^3$, for holding said levers in either a horizontal or vertical position, as set forth.

16. The cylinder M′, secured to the gun-support, the piston $M^2$ and rod $M^3$ working therein, the springs $M^4$ $M^6$, acting upon the piston, and the flexible tube $M^5$, surrounding the rod $M^3$, combined, as set forth, with the crank-shaft D and the arm $D^4$, extending therefrom to operate as a device for regulating and controlling the speed of firing, as set forth.

17. The combination, with the gun-barrel, of a smoke-arrester secured to the muzzle and a pipe or tube leading therefrom to convey the smoke away from the muzzle, as set forth.

18. The combination, with the gun-barrel, of a casing secured to the muzzle and provided on its interior with a series of smoke-deflecting plates with openings to permit the passage of the ball, a tube or pipe secured to the casing for carrying off the smoke, and passages of communication for the smoke in-

tercepted by the plates from the interior of the casing into the said pipe or tube, as set forth.

19. The combination, with the reciprocating barrel and breech mechanism and guides in which they are mounted, of the casing A, inclosing the breech mechanism, provided with hinged sides and detachably secured to the guides, as set forth.

20. In a machine-gun, the combination, with stationary guides or supports, of a barrel and breech mechanism fitted to and adapted to slide back and forth in said supports, the breech-block being capable of independent movement to and from the breech or end of the barrel, of a stationary point of resistance adapted to be encountered by a portion of the breech mechanism during the recoil of the gun and to thereby retract the breech-block, as set forth.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HIRAM STEVENS MAXIM.

Witnesses:
HERBERT E. DALE,
W. J. SKERTEN.