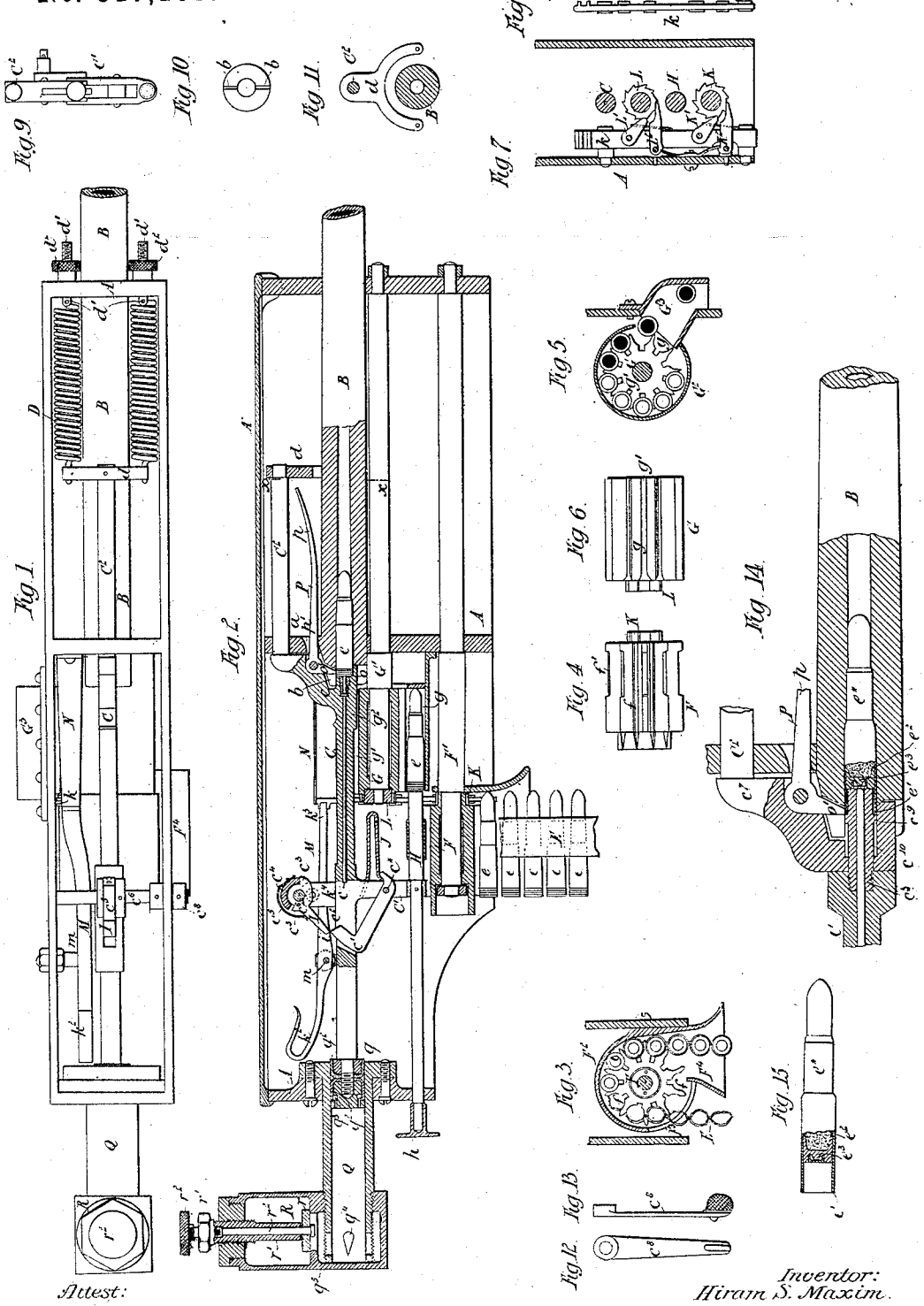
(No Model.)

H. S. MAXIM.

MACHINE GUN.

No. 317,161. Patented May 5, 1885.



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UNITED STATES PATENT OFFICE.

HIRAM STEVENS MAXIM, OF LONDON, ENGLAND, ASSIGNOR TO ALBERT VICKERS AND ROBERT R. SYMON, BOTH OF SAME PLACE.

MACHINE-GUN.

SPECIFICATION forming part of Letters Patent No. 317,161, dated May 5, 1885.

Application filed May 27, 1884. (No model.) Patented in England June 26, 1883, No. 3,178, and July 16, 1883, No. 3,493; in France July 2, 1883, No. 156,344, and in Belgium July 4, 1883, No. 62,519.

To all whom it may concern:

Be it known that I, HIRAM STEVENS MAXIM, a citizen of the United States of America, and residing at London, England, have invented new and useful Improvements in Fire-Arms, (for which I have obtained patents in Great Britain, No. 3,178, dated 26th June, 1883, and No. 3,493, dated 16th July, 1883; France, patent of addition, No. 156,344, dated 2d July, 1883; Belgium, patent of addition, No. 62,519, dated 4th July, 1883,) of which the following is a specification, reference being had to the accompanying drawings.

In the specification accompanying my petition for United States Letters Patent filed May 2, 1884, No. 130,166, I have described an automatic machine or battery gun—that is to say, a gun wherein the operations of feeding, loading, firing, extracting, and ejecting are automatically performed by the explosion of a cartridge.

My present invention comprises improvements in the construction and mode of operation of the gun referred to, the said improvements relating to the mechanism for effecting the operations of feeding, firing, extracting, and ejecting the shells, the objects of the improvements being to simplify the construction of the parts, and to render their action or operation more certain and effective.

In the accompanying drawings, Figure 1 is a plan of a machine-gun constructed according to the present invention, showing the same with the cover or top plate removed. Fig. 2 is a central longitudinal section of the same, with some of the parts shown in elevation. Fig. 3 is a sectional elevation showing part of the feeding mechanism. Fig. 4 is a plan of one of the feed-wheels, hereinafter described. Fig. 5 is a sectional elevation showing another part of the feeding mechanism, which also serves for ejecting the cartridges. Fig. 6 is a plan of another feed-wheel hereinafter described. Fig. 7 is a sectional elevation showing the mechanism for rotating the said feed-wheels, and Fig. 8 is an edge view of a part of the said mechanism. Fig. 9 is a front end view of the breech-block or plunger detached. Fig. 10 is an elevation of the breech end of the barrel. Fig. 11 is a section on the line *x x*, Fig. 2. Fig. 12 is a front elevation, and Fig. 13 an edge view, of a lever for firing the gun by hand. Fig. 14 is a sectional elevation, drawn to an enlarged scale, showing part of a gun in which is inserted a cartridge made according to my invention. Fig. 15 is a sectional elevation of the said cartridge, drawn to an enlarged scale.

The remaining figures are hereinafter described.

A indicates a strong metal frame, which is provided with a lid or cover, A′, and which may be mounted on any suitable stand or carriage. The barrel B is fixed in the frame A, and does not participate in the recoil. At the rear of the barrel is the breech-block or plunger C, which slides longitudinally in suitable guides, as hereinafter described, and carries the firing-pin *c* and the cock or hammer *c′*. This plunger on its front upper side has a projection carrying a rod, C^2, passing through the guide *a*, and having at its front end a bridge-piece, *d*, to which are connected the spiral springs D. These springs tend always to draw or keep the plunger up to the barrel, but yield to the force of the explosion, so that the said breech-block or plunger is thereby forced backward, taking with it the empty cartridge-case far enough to allow the latter to be ejected from the gun, and to permit a fresh cartridge to be deposited by the feed mechanism in front of the breech-block or plunger. The spiral springs D are also connected with screw-threaded rods *d′*, which pass through the frame A, and have on the outer side thereof nuts d^2, whereby the tension of the said springs can be regulated.

E is a continuous belt or chain into which the cartridges are inserted, so that they may be fed uninterruptedly from a box or magazine placed in any convenient position. I prefer to form this belt of a double web of any suitable fibrous material in which the cartridges are held transversely to the web and parallel to each other at equal distances apart.

To move the belt E uniformly and intermittently, and to bring the cartridges successively in front of the breech-block or plunger, I employ the following mechanism—that is to say, I arrange below the breech mech-

anism two feed-wheels, F G, which are formed with equidistant longitudinal grooves or channels *f g* to receive the cartridges. Over the feed-wheel F, which is arranged upon a shaft, F′, below the barrel, I pass the belt or chain E, so that as the said wheel is intermittently rotated it brings the cartridges from the said box or receptacle into position to be thrust successively into the grooves in the feed-wheel G, as hereinafter described. The feed-wheel G is arranged in front of the wheel F on a shaft, G′, which is below the barrel B, but above the shaft F′. The position of the wheel G relatively to the barrel B, the breech-block or plunger C, and the wheel F is such that the lowermost groove or channel, *g*, in the wheel G is in line with the uppermost groove, *f*, in the wheel F, and the uppermost groove in the wheel G is in line with the barrel. In combination with and parallel to the breech-block or plunger I provide an auxiliary plunger or pusher, H, carried by a cross bar or arm, C′, extending downward from the breech-block or plunger. This pusher is arranged, as shown in Fig. 2, so that when a groove, *f*, in the wheel F coincides with a groove, *g*, in the wheel G the said pusher is in line with the said grooves, and as the breech-block moves forward will force a cartridge from the groove *f* into the groove *g*, thus freeing the said cartridge from the belt or band E. The feed-wheels are then partially rotated, as hereinafter described, and another cartridge is forced from the wheel F into the wheel G, and so on, and the cartridges are successively carried by the rotation of the wheel G into line with the barrel, and in front of the breech-block or plunger C.

To prevent the band E from being pushed forward with a cartridge when the latter is forced from one of the grooves *f*, the wheel F is provided with a circumferential recess, *f′*, which receives the said band, so that it is held against displacement.

The pusher H extends through the rear end of the frame A, and is provided with a knob or handle, *h*, whereby the breech mechanism can be operated by hand.

To insure the accurate alignment of each cartridge with the barrel as it is brought up to the same by the wheel G, I form at the bottom of each groove *g* a slot, *g′*, and I form on the forward end of the breech-block or plunger C a pin or feather, g^2, adapted to enter and slide in this slot, the end of the said slot at the rear side of the wheel being widened and inclined, as shown in Fig. 6, so that the said feather cannot fail to enter the same as the breech-block or plunger moves forward. Similar means may, if desired be employed to insure accuracy in the working of the wheel F and pusher H.

Each of the said feed-wheels is suitably inclosed in a casing to prevent the slipping of the cartridge from the said grooves or channels. The casing F^2, which surrounds the wheel F, is provided with two openings, F^3 F^4. The opening F^4, through which the cartridges pass to the feed-wheel, is bell-shaped, as shown in Figs. 2 and 3, for the purpose of guiding the cartridges. After the cartridges have been pushed from the web E into the grooves of the wheel G the empty web passes through the opening F^3. The casing G^2, surrounding the wheel G, has only one opening, G^3, through which the empty cartridge-shells pass as the grooves or divisions of the wheel come successively opposite the said opening.

The manner in which the breech-block or plunger C in its longitudinal to-and-fro movement is caused to impart the required intermittent rotary motion to the feed-wheels is as follows—that is to say, the said wheels F G have ratchet-pinions K L formed or fixed thereon. In combination with these ratchet-pinions I arrange pawls K′ L′, carried by a vertical bar, *k*, arranged to slide in bearings or guides fixed on the side of the frame A. A lever, M, is pivoted at *m*, and has its end k^2 curved, as shown. The other end, k^3, engages with the upper end of the vertical bar *k*. A roller, k^4, on the breech-block or plunger C acts on the curved end k^2 of the lever M at each movement of the said plunger. At the commencement of each forward movement of the plunger C it imparts, through the medium of the lever M, a downward movement to the vertical bar *k*, and in the downward movement the pawls K′ L′ turn the feed-wheels on their axes so as to move each cartridge a distance equal to the width of one groove. At the end of each backward movement of the plunger C the said roller k^4 acts upon the curved end k^2 of the lever M, and moves the vertical bar *k* and pawls K′ L′ upward without operating the feed-wheels. To prevent the accidental backward movement of the said wheels, I provide stop-pawls K^2 L^2, to engage with the ratchet-teeth thereon. A spring, N, is arranged to bear on the upper end of the vertical bar *k* to assist or facilitate its downward movement.

As above stated, the breech-block or plunger C carries the cock or hammer *c′*. The said cock or hammer is arranged upon a pivot or fulcrum, *c**, in the proper position to act on the firing-pin *c*, which pin or a rod connected therewith, extends centrally through the breech-block or plunger C, as shown in Fig. 2.

In combination with the hammer *c′* I provide a device which, during the forward movement of the breech-block, will cock the said hammer, and will release the same so that it will be actuated by the mainspring J at the proper moment to discharge the gun. This device consists of an arm, I, pivoted to the frame A, and arranged in such a position that it projects into the path of the hammer *c′* as the latter moves with the breech-block or plunger. The said arm has at its end a beveled surface, *i*, which, as the breech-block or plunger moves forward, engages with the nose c^2 of the hammer and forces the same back against the pressure of the mainspring J,

thereby cocking the said hammer. The arm I will hold the hammer until the breech-block has completed its forward movement and the cartridge is pushed home and properly supported in the barrel. The inclined surface of the arm I then permits the hammer to slip therefrom and strike the rear end of the firing-pin *c*, which is thus driven forward and explodes the cartridge.

I provide the arm I with means whereby it may be adjusted on its pivot or axis so that it can be set either in the position above specified or in such a position that it will not cock the hammer during the movement of the breech-block or plunger, or will cock it but not release it. This object is accomplished by forming shoulders c^3 on the boss or hub of the said arm, and arranging in combination therewith a shoulder or piece, c^4, fixed to the axis or spindle c^6, and provided with a spring, c^5, which limits the adjustment of the said arm and holds it when adjusted. Moreover, I provide the axis or spindle c^6, of the said arm with a lever or handle c^8, outside the frame so that it can be adjusted or the gun fired by hand.

As the cartridges which I prefer to use in my improved gun, and which are hereinafter described, are made without any head or flange, I provide the means hereinafter set forth for extracting the empty shells or cases from the barrel. The shell is started or forced a slight distance outward by the pressure existing in the barrel from the moment of explosion until the bullet leaves the barrel; but without provision for its temporary connection with the breech-block or plunger the latter, when moving back under the effect of the momentum imparted to it by the explosion, would leave the cartridge shell or case in the barrel. I therefore provide the plunger with a clutch or gripping device, which grasps and holds the said shell or case tightly during the recoil of the plunger, and then releases it and permits it to be carried away from the breech by the feed-wheel G, and ejected through the opening G^3. This clutch device or extractor is constructed as follows —that is to say, the fixed jaw *o* is formed on the end of the breech-block or plunger C, and the movable jaw *o'* forms the short arm of a lever, P, pivoted to the said breech-block. This jaw *o'* is so arranged that it grips the cartridge-shell at the moment of the explosion, and is tightened thereon by the backward movement of the breech-block. The long arm *p* of the lever P extends through an aperture, *p'*, in the guide *a*, and is so formed and arranged that as the breech-block C approaches the end of its backward movement the said arm comes in contact with the guide *a*, and the short arm or jaw *o'* is thereby raised so as to release the cartridge-shell. The breech end of the barrel is formed with a transverse slot or groove, *b*, as shown in Figs. 2 and 10, to permit the extractor to take hold of the tube or shell of the cartridge. The jaws of the extractor are preferably provided with teeth or notches to insure their taking a firm hold of the cartridge-shell.

In some instances I arrange in combination with the above-described automatic breech mechanism the following apparatus for assisting and controlling the operation of the gun—that is to say, I attach to the rear cross-bar of the frame A a cylinder, Q, which is filled with water or other suitable fluid. The breech-block C is extended rearwardly and provided with a piston, *q*, which is fitted to work in the said cylinder. This piston is fitted with cup-leathers q^2, and has apertures q^3, whereby the liquid has access to the inside of one of the cup-leathers to expand the same, and thus prevent leakage from the said cylinder. The cylinder Q has apertures q^4 at its rear end, through which apertures the water or other fluid is forced (into a space or chamber, q^5, surrounding the cylinder Q) by the piston *q* during the backward movement of the breech-block, these apertures being properly formed and arranged to insure the proper amount of resistance to such movement.

Above the space or chamber q^5 is another chamber, R, separated from the lower chamber, q^5, by a valve, *r*. This valve is provided with screws r' r^2, as shown in Fig. 2, whereby it can be adjusted to open fully or partially, and the passage of the liquid from one compartment or chamber to the other can thus be regulated so as to vary the speed of working of the gun.

I have found that by using cartridges without the customary rim or flange the alignment of the cartridges with the barrel is facilitated, and the construction of the mechanism required for loading and extracting much simplified. Such cartridges, however, require the series of grooves or indentations around the base, as above described, to enable the extractor to take a firm grasp of the shell in withdrawing the same from the barrel. I have found, however, that this construction is better adapted to cartridges of small size, between which and the barrel there is but little friction, than to larger ones. For the latter, therefore, I have devised a modified construction by which their withdrawal from the same is facilitated, and their force in producing the recoil is increased. Such cartridges are shown in Figs. 14 and 15, in which *e* indicates a metallic cartridge-shell the sides of which are parallel from e' to e^2, the remaining portions being tapered. The base e^3 is movable, and is passed into the rear of the shell, which it fits tightly, and so that it will be driven backward to the end of the shell by the explosion of the powder. In using these cartridges the end of the breech-block or plunger of the gun enters the rear part of the shell external to the base, so that the latter, when driven back by the force of the explosion, acts on the moving breech mechanism, and imparts thereto the momentum by virtue of which it operates, as above described, the tube of the shell or case being grasped by

the extractor and drawn out as the breech-block or plunger moves backward. This construction of shell obviates the necessity for starting the shell from the barrel at the moment of the explosion, as hereinbefore described with reference to the form of shell shown in Fig. 2, which has a fixed base, and is moved backward during the burning of the powder. The construction shown in Figs. 14 and 15, moreover, tends to prevent the shell of a cartridge from expanding under the force of an explosion, and thus reduces the power which would otherwise be required to draw the shell from the barrel. When cartridges having this movable portion or base e^3 are used, it is necessary that the construction of the breech-block or plunger should be so modified that it will move back for some distance independently of the extractors. This modification is illustrated in Fig. 14, in which the part c^7, carrying the rod C^2 and the extractors, is not integral with the breech-block or plunger C, as shown in Fig. 2, but slides on a rod, C^3, which is screwed or otherwise fixed to the breech-block or plunger C. This rod is formed with a collar, c^9, which fits into a recess in the part c^7. When a cartridge is fired, the explosion causes the breech-block or plunger C to move back until the collar c^9 impinges against the end of the recess c^{10}, when the part c^7 and the extractors o o' begin to move with the breech-block. The length of the recess c^{10} corresponds to the distance between the face of the movable part or base e^3 of the cartridge and e' of the shell.

It will be seen that the breech-block or plunger is capable of being moved back for some distance independently of the extractor.

Having now described my invention, what I claim is—

1. In a machine-gun, the combination, with the barrel, of a longitudinally-movable breech-block arranged to move or slide in line with the barrel and adapted to be driven backward from the barrel by the explosive force of a discharge, springs connected with the breech-block and the stationary portion of the gun for opposing the backward movement of the breech-block, cartridge-feeding, cartridge-exploding, and shell-extracting mechanism carried by the breech-block and operated by the movement of the same, a wheel with compartments for holding cartridges in position to be removed by the feed mechanism, and mechanism between the breech-block and cartridge-wheel for intermittently rotating the wheel in unison with the movement of the breech-block, all as set forth.

2. In a machine-gun, the combination, with the barrel, of a cartridge-delivery wheel and a cartridge-feed wheel having corresponding compartments for holding cartridges, two plungers, one forming a reciprocating breech-block arranged to move or slide in line with the barrel and adapted to force in its forward movement a cartridge from the delivery-wheel into the barrel, the other connected with the first or adapted to move simultaneously therewith and in its backward movement to transfer a cartridge from the feed-wheel to the delivery-wheel, and gearing between the plunger forming the breech-block and the cartridge-wheels by which the said wheels are intermittently rotated in unison with the movements of the plungers, all as set forth.

3. The combination, with the barrel of a machine-gun, of a wheel for presenting the cartridges in line with the barrel, a wheel and belt of cartridges passing over the same, a breech-block for forcing the cartridges from the delivery-wheel into the barrel, and a plunger connected or moving simultaneously therewith for transferring the cartridges from the belt or feed-wheel to the delivery-wheel, as and for the purpose set forth.

4. The combination, with the barrel of a machine-gun, of a delivery-wheel or one for presenting the cartridges in line with the barrel, a feed-wheel, a reciprocating breech-block for forcing the cartridges from the delivery-wheel into the barrel, an extractor pivoted to the breech-block and adapted to bind upon a shell on the recoil of the breech-block, and a plunger connected to or moving simultaneously with the breech-block for transferring the cartridges from the feed to the delivery wheel, all substantially as set forth.

5. In a machine gun, the combination, with the barrel, the two cartridge holding or feed wheels, and reciprocating breech-block or plunger, of the mechanism for causing the intermittent rotation of the feed-wheels by the movement of the breech-block or plunger, and consisting of the curved lever M, pivoted to the frame of the gun in the path of a portion of the breech-block, the sliding bar K, connected with the lever, pawls carried by the sliding bar, and ratchets or pinions on the ends of the feed-wheels, all as set forth.

6. In a machine-gun, the combination, with a longitudinally-movable breech-block and a cock or hammer pivoted thereto, of a spring-controlled adjustable arm, I, pivoted to the frame of the gun and having a beveled end that may be moved into or out of the path of movement of the hammer, whereby the latter may be automatically disengaged or held in check according to the adjustment of the movement of the arm I to or from the line of movement of the hammer, as set forth.

7. In a machine-gun, the combination, with a longitudinally-movable breech-block or plunger, of a fixed jaw, o, formed on its forward end, a movable jaw, o', pivoted to the breech-block in position to rest upon the end of a cartridge when the breech-block is in its extreme forward position, a curved arm, P, connected with the jaw o', and a guide fixed to the frame and in the path of movement of the arm P, whereby the arm is caused to release the jaw o' from its position against the cartridge, where it is held by the backward movement of the breech-block, all as set forth.

8. In a machine-gun, the combination, with a longitudinally-movable breech-block and breech mechanism connected therewith, of a piston secured to the breech-block and working in said cylinder, a chamber communicating with the rear of the cylinder, and intermediate adjustable valves for controlling or varying the channels of communication between the cylinder and the chamber, as and for the purpose specified.

9. The combination, with the longitudinally-movable breech-block C, and breech mechanism connected therewith, of the pistion *q*, extending from the rear end of the same, the cylinder Q, in line with the breech-block, in which said piston works, the chamber R, communicating with the rear portion of the cylinder Q, and the adjustable valve *r*, for controlling or varying the channel of communication between the cylinder Q and the chamber R, as set forth.

10. In a machine-gun, the combination, with the barrel, a longitudinally-movable breech-block, and the breech mechanism connected therewith, of the spiral springs D, connected to the frame, bridge-piece *d*, connected to the opposite ends of said springs, and rods C^2, connecting said bridge-piece with the forward end of the breech-block so that the distention of the springs is caused by the backward movement of the breech-block, as and for the purpose specified.

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

HIRAM STEVENS MAXIM.

Witnesses:
J. WATT,
T. J. OSMAN,
Both of 17 *Gracechurch St., London.*