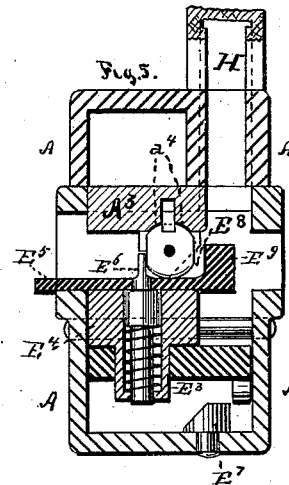
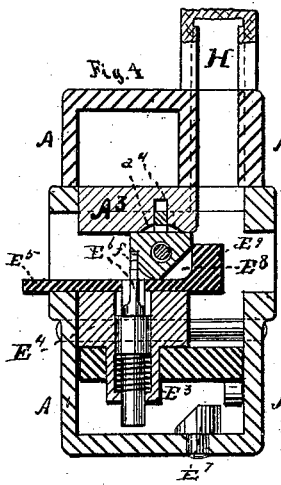
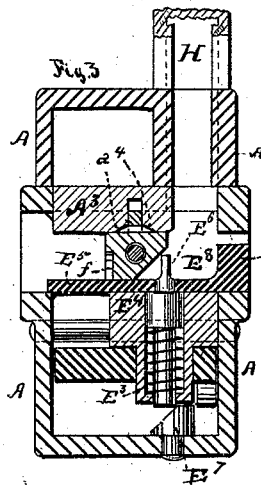
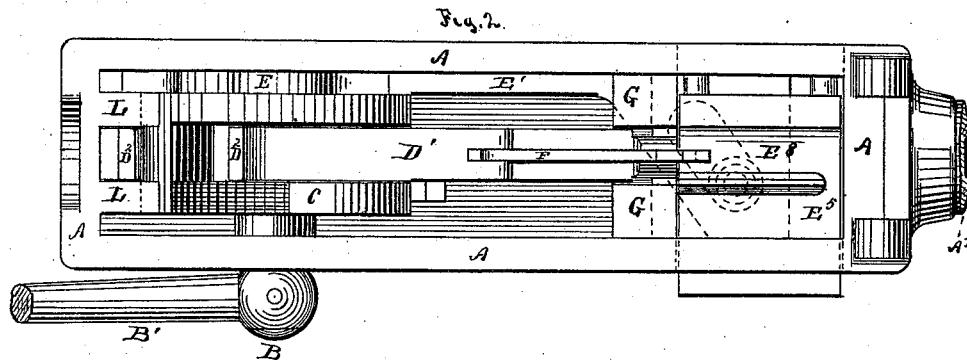
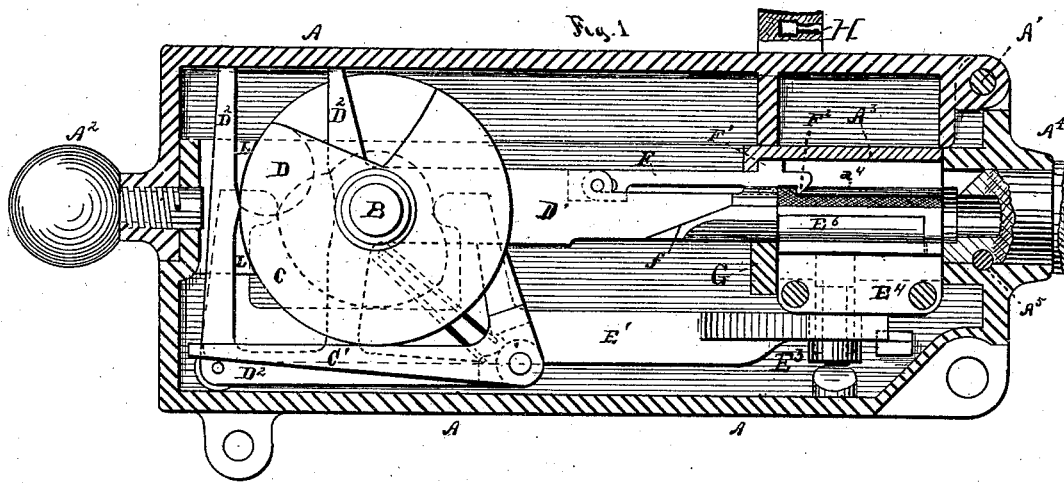


W. GARDNER.  
Machine-Gun.

No. 216,266.

Patented June 10, 1879.



Witnesses.

*J. M. Tilton*  
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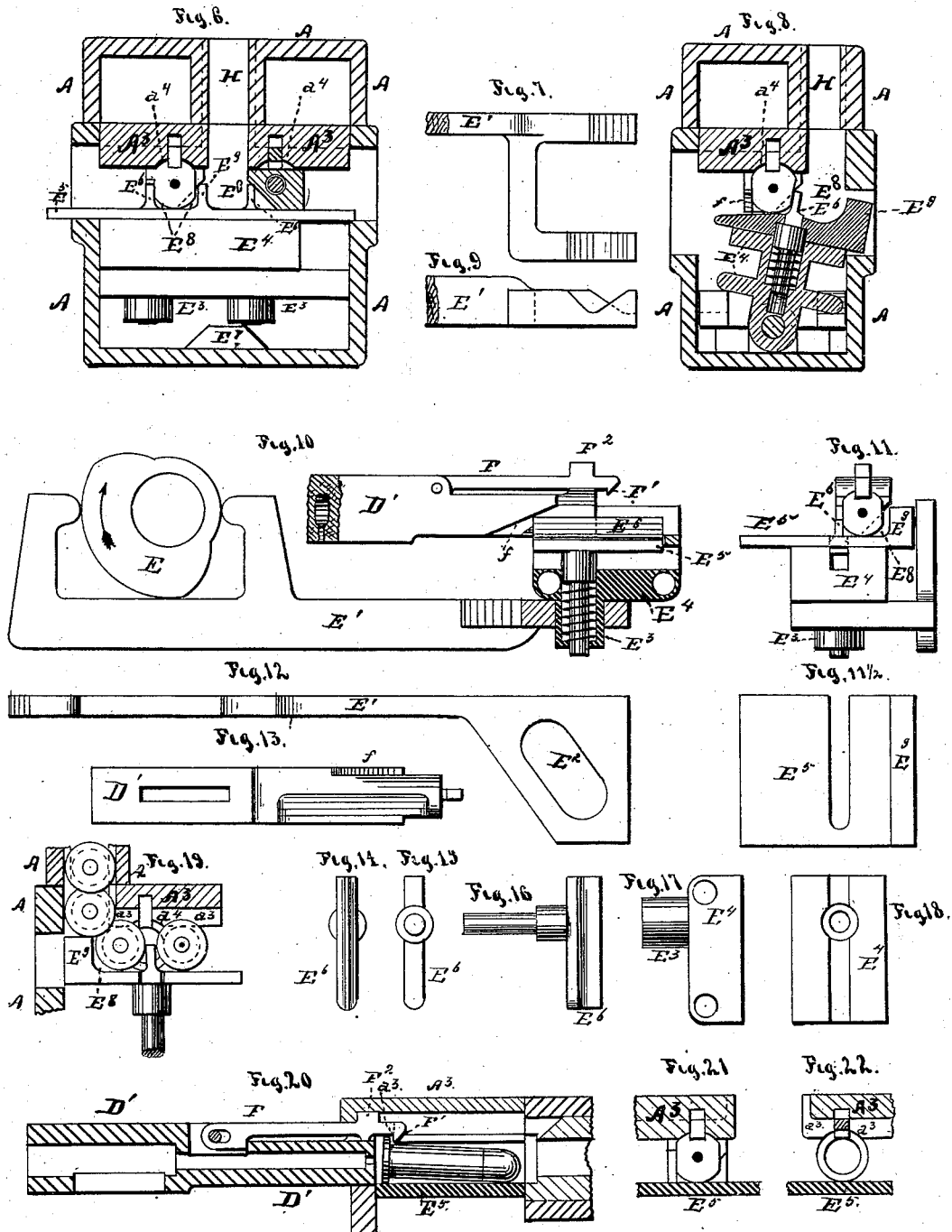
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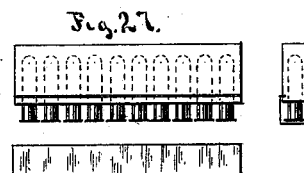
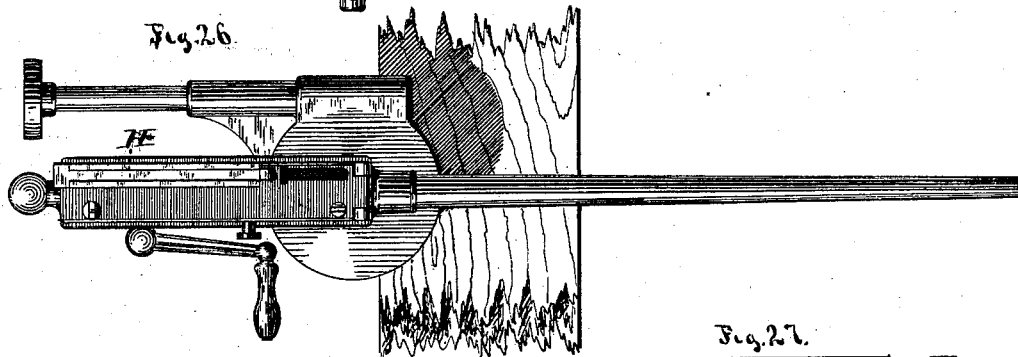
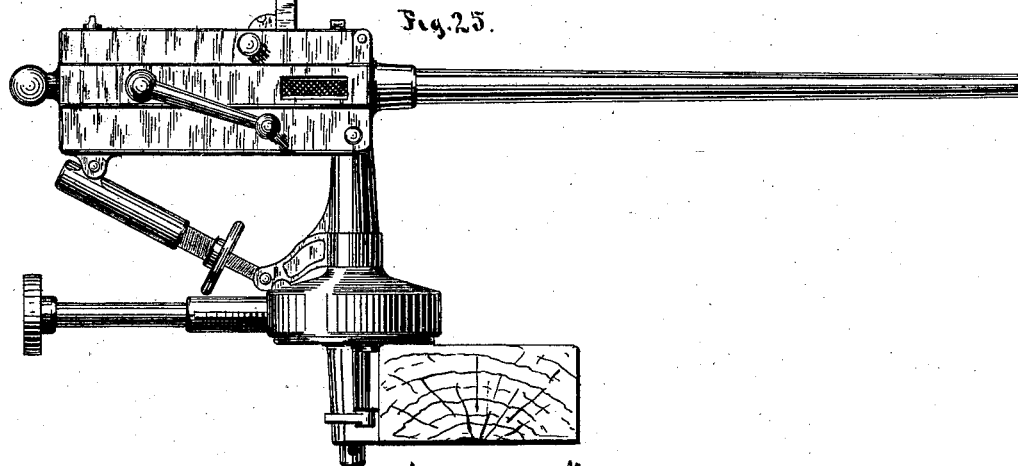
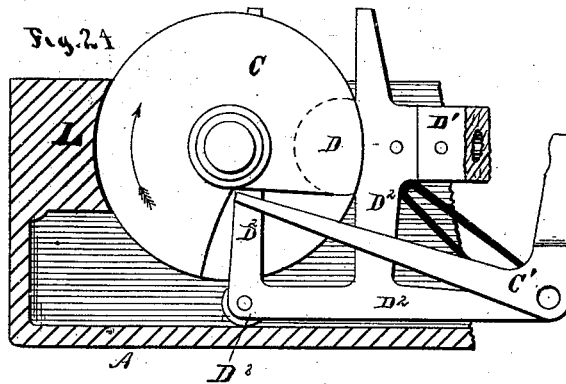
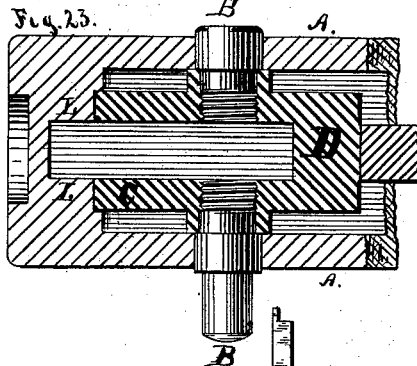
Witnesses.  
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# UNITED STATES PATENT OFFICE.

WILLIAM GARDNER, OF CLEVELAND, OHIO.

## IMPROVEMENT IN MACHINE-GUNS.

Specification forming part of Letters Patent No. **216,266**, dated June 10, 1879; application filed May 24, 1878.

*To all whom it may concern:*

Be it known that I, WILLIAM GARDNER, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Machine-Guns; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to certain improvements in machine-guns; and consists, first, in the combination, with a cartridge bed or carrier having an intermittent reciprocating movement transversely to the barrel, and provided with a vertically-yielding diaphragm, of a plunger which has an intermittent reciprocating movement longitudinally with the axis of the barrel; second, in the combination, with a cartridge-extracting device, of an upper bearing-surface for holding said extractor down into a given position, and a bottom bearing or support for the cartridge that shall hold said cartridge securely within the grasp of the extractor, whereby the escape of said cartridge from its extractor is rendered impossible; third, in a combination, with the bed or carrier aforesaid, of a groove placed above said bed, and in such relation with the hook of the extractor that one side of said groove shall partly consist of the inside face of the extractor-hook, whereby it is impossible that a cartridge shall be presented to the breech of the barrel without its shell being in proper relation and connection with its extractor, so that its retraction after discharge shall be insured; fourth, in the peculiar supporting device, hereinafter to be specified; fifth, in an improvement, as hereinafter described, of the casing or frame, whereby a rear support and abutment are provided that shall receive the recoil incident to the discharge, to the relief of the trunnions.

In the drawings, Figure 1 is a longitudinal vertical section through the center of the case, showing mechanism in side elevation. Fig. 2 is a plan view of my device with the top of the case removed. Fig. 3 is a view, in cross-section, of my device, showing the parts as in position at the moment of firing; Fig. 4, a

similar section, showing the parts of my device as they appear just before firing, and before the bed or carrier has been returned to receive the cartridge, and just after the diaphragm has been driven down by the plunger; Fig. 5, a similar section, showing the parts as they appear in position when the cartridge has been carried and presented to the breech of the barrel ready to be introduced therein, the plunger being at the extreme back end of the stroke. Fig. 6 illustrates a modified form of my device, wherein the bed or carrier is constructed and adapted for a two-barreled gun. Figs. 7, 8, and 9 represent a modified form of my device, wherein the bed or carrier has a lateral reciprocating swinging, instead of a lateral reciprocating sliding, motion. Fig. 10 is a detached view, showing in detail the driving-cam, sliding bar operating the bed or carrier, the bed or carrier, the diaphragm, partly depressed by the bevel of the plunger impinging thereon; also the plunger and the extractor. Fig. 11 is a front-end elevation of the parts shown in Fig. 10. Fig. 12 is a detached plan view of the sliding bar with its diagonal cam, whereby a transverse reciprocating sliding motion is imparted to the bed or carrier. Fig. 11½ is a plan view of the top or surface plate of the bed or carrier, showing the slot through which the diaphragm protrudes. Fig. 13 is a detached bottom view of the plunger. Figs. 14, 15, and 16 are top, bottom, and side views, respectively, of the diaphragm. Figs. 17 and 18 show, respectively, the side and plan views of the base upon which the bed or carrier is placed, and to which it is attached. Fig. 19 is a view showing the operation of my device in the following particulars—to wit, the carrier has just taken the bottom cartridge from the reservoir or supply, and, while preventing the superincumbent cartridges from dropping or following, is carrying its cartridge transversely for presentation at the breech of the barrel, while at the same time an exploded shell is being ejected by the action of the diaphragm, which diaphragm also forms one wall of a groove, in which the loaded cartridge securely rests while being carried for presentation. Fig. 20 is a longitudinal vertical section of a portion of my device, showing the

manner in which the cartridge is seized and retained between the extractor and the floor upon which the cartridge rests; also how the extractor in this position is prevented from upward displacement; also the manner of imparting longitudinal play to the extractor. This drawing illustrates the provision whereby the flange of the cartridge-shell is always compelled to take a position back of the extractor-hook. Fig. 21 is a vertical cross-section taken through the middle portion of the bed or carrier, looking toward the rear. Fig. 22 is a similar section taken through the flange-groove just back of the extractor-hook, looking toward the breech of the barrel. This drawing shows how the extractor-hook forms a part of one wall of the flange-groove. Fig. 23 is a longitudinal horizontal section of the rear end of my device, showing the supporting arrangements and neighboring parts. Fig. 24 is a longitudinal vertical section of the same, showing, in side elevation, the main cam and neighboring parts; also showing the rear abutment for relieving the said supports from the shock of recoil. Fig. 25 is a side elevation of my entire device as mounted for marine service, and Fig. 26 a plan view of the same. Fig. 27 is a view, in side and end elevation, of a cartridge-package adapted for use with my device.

A is any suitable casing or frame, so constructed as to be adapted to hold and accommodate the various elements and functions of my device. I prefer that the material composing the frame should be of metal sufficiently durable to withstand the rough external usage to which implements of this class are often subjected. The case is constructed in two longitudinal sections, adapted to be opened or swung apart, in the manner and for the purposes hereinafter specified. A<sup>1</sup> is a pivot or hinge, upon which the movable section of the casing A is swung. A<sup>2</sup> is a locking device for securing the casing in its closed position. This locking device may be of any suitable construction; and I therefore do not in any degree limit myself to the specific device herein shown, which consists in a screw-bolt with a knob, (familiarily known in artillery as a "cascabel-knob.") A<sup>3</sup> is that part of the casing which forms an upper bearing or resisting-surface to the cartridge-extractor. It also forms a part of the flange-groove, which constitutes a very important feature of my invention. Other features and functions of this element will be hereinafter set forth. A<sup>4</sup> is the barrel, which may be attached to the casing A in any suitable manner. I prefer attaching the barrel to the casing in the manner shown in Fig. 1 of the drawings, which consists of a slip-joint instead of a screw, and a pin or key, A<sup>5</sup>, piercing partially the barrel and partially the casing, thereby preventing either longitudinal or lateral displacement. By this means these arms may be more easily constructed on the interchangeable plan.

B is the main shaft, which is turned by its hand-crank B'. To this shaft are rigidly attached, first, the discharging-cam C, which governs the function of cocking and firing; second, the plunger-crank D, which imparts to the plunger and its attached parts a longitudinal reciprocating motion; third, the bed or carrier cam E, which governs and controls the transverse reciprocating motion of the bed or carrier. The cams and plunger-crank, just mentioned as attached to the main shaft B, are so shaped and adjusted as that a definite and exact concert of action, hereinafter specified, shall be had between the various parts of my device.

Considering first the discharging apparatus of my device, it is primarily operated as already specified by the cam C. The plunger is hollowed out to receive and accommodate the firing-pin. This pin is actuated by a bell-crank, C', fixed thereto, attached to the plunger-frame, pivoted thereon, and moving therewith. The rear or free arm of the bell-crank C', as shown in Figs. 1 and 24, engages with the cam C. This cam is shaped and placed substantially as shown in the drawings, and operates to depress the free arm of the bell-crank C', and thereby to retract the firing-pin, until the proper moment, when the plunger has driven the cartridge into proper position for discharge. At this instant the plunger and all its attached parts are securely held in position by their abutment against the plunger-crank D. At this moment the bell-crank lever C', through the action of the mainspring, is driven forcibly into the position shown in Fig. 24 of the drawings, thereby driving the firing-pin forward through the end of the plunger, causing it to discharge the cartridge.

It will be observed that I have formed one face of the cam C upon the arc of a circle concentric with the pivot of the bell-crank C', thus permitting an unobstructed movement to said bell-crank. As soon as the cartridge has been discharged the cam C, turning in the direction of the arrow indicated in Fig. 24, rides down the arm of the bell-crank C', and again retracts the firing-pin until the proper moment for the succeeding discharge.

Considering now the plunger and its attached extractor, it will be seen that they are given by the plunger-crank D an intermittent longitudinal reciprocating movement. At both rear and forward extremes of its throw the plunger is held motionless during about one-sixth of a revolution of the main shaft B. The plunger-crank D is so placed in relation to the cams C and E that the following concert of action is secured: Starting from the moment of discharge of a cartridge, the firing-pin is first retracted. Then the plunger begins to move back, drawing with it the exploded shell by means of the extractor. When it has reached the limit of its backward movement, the bed or carrier moves transversely in front of the plunger, carrying away the exploded shell, and bringing a loaded cartridge into position to

be inserted into the breech of the barrel by the forward movement of the plunger, which now takes place.

As shown by the drawings, Figs. 1 and 24, the plunger proper,  $D^1$ , will be seen to be attached to a frame,  $D^2$ , which consists, essentially, of two upright arms, between which is placed and operates the plunger-crank  $D$ , which, by its rotation, is thus made to give the plunger its longitudinal reciprocating motion, already described. This frame I prefer to place upon one or more casters,  $D^3$ , whereby friction is diminished in its travel backward and forward upon the floor of the casing  $A$ . Forming the plunger and its frame  $A$  substantially as herein shown admits of its ready removal by merely lifting the same out of the casing. It can be replaced with equal facility. This constitutes a very important feature of my gun, enabling it to be instantly disabled without injury; also admitting of a free access to all the parts of my device for purposes of inspection, cleaning, oiling, and repairing.

My extracting mechanism is as follows: The bar  $F$  is attached at its rear to the plunger by the slot-and-pin arrangement shown in Figs. 1 and 20. It rests longitudinally upon the plunger, and is provided at its front end with the extracting-hook  $F^1$ , also with the upper stud,  $F^2$ . The upper bearing-face of the stud  $F^2$  impinges against the plate  $A^3$  of the case. The plunger to which the extractor is affixed is placed directly in rear and in line with the bore of the barrel, and its motion corresponds with this position.

An important feature of my invention, as related to the extracting device, consists in an arrangement whereby the flange or head of the cartridge-shell is always and of necessity made to take a proper position behind the hook of the extractor, and held there until the proper time for its ejection from the gun after it is discharged. This function is accomplished by the provision of that which I term the "flange-groove." This flange-groove consists in its front wall partly of the shoulder  $a^3$ , formed upon the plate  $A^3$ , and partly of the inside or grasping face of the extractor-hook  $F^1$ .

The face of the hook and the groove or shoulder  $a^3$ , just mentioned, together form a substantially continuous wall or side of the flange-groove. The opposite wall or side of this groove consists of the front faces of the parts  $G$  and the face of the plunger  $D^1$ .

By this arrangement it will be seen that every cartridge, as it is taken from the reservoir or feed, can only be carried transversely, except that its head or flange enters or travels in this flange-groove. If it were attempted to feed the cartridge in any other way, there would not be room for its passage.

It will also be observed, as shown in Fig. 20 of the drawings, that the plate  $A^3$  effectually prevents any upward displacement of the ex-

tractor-hook  $F^1$ , which is thus held securely in proper relation with the cartridge.

It will also be seen that the cartridge flange or head rests firmly upon a bed or carrier beneath it. Thus firmly held, the cartridge cannot become accidentally displaced, nor can it escape the grasp of the extractor until purposely forced out to make room for a succeeding cartridge.

Another provision to secure an accurate movement and position of the cartridge is the bevel or curved faces  $a^4$  on either side of the slot in the plate  $A^3$  in which the extractor-bar moves.

By means of this device a way or support is formed for the reception of the cartridge-head while it is moving longitudinally to and from the breech of the barrel during the time it is not held by the flange-groove. This I find effectually prevents liability to lateral displacement.

Considering now the parts operated by the cam  $E$ , it will be seen that this cam engages with two arms or equivalent parts of the bar  $E^1$ , which terminates in the horizontal diagonal cam-slot  $E^2$ . This slot engages with and operates a pin, stud, or projection,  $E^3$ , which forms a part of the base  $E^4$  of the bed or carrier  $E^5$ .

$E^6$  is the diaphragm, adapted to be driven down to a level with the floor of the carrier  $E^5$ , and when released from pressure to return to its original position through the action of a spring, or its equivalent, and a cam or bevel,  $E^7$ , suitably placed.

The diaphragm  $E^6$  is preferably formed substantially as shown in Figs. 2, 14, 15, and 16, and when projecting up through the bed or carrier  $E^5$ , as shown in Figs. 3, 4, 5, 8, 11, &c., it forms one side or wall of a groove,  $E^8$ , in which rests the cartridge.

As the cam  $E$  revolves in the direction indicated in Fig. 10, the bed or carrier  $E^5$ , through the operation of the cam-slot  $E^2$ , will be given a transverse reciprocating motion to and fro with every revolution of the cam  $E$ .

The operation of the bed or carrier  $E^5$  and its spring-diaphragm  $E^6$  is as follows: When the plunger, as shown in Figs. 3, 4, 5, and 19, is at its extreme backward throw, the groove or bed  $E^8$  is in the position shown in Fig. 3, directly beneath the feed or reservoir  $H$ . While the plunger is held stationary at the end of its backward throw, the bed or carrier is made to move transversely in front thereof until the groove  $E^8$  is in line with the bore of the barrel. The bed or carrier is now held stationary, while the plunger is driven forward, thus forcing the cartridge into the breech of the barrel; and immediately after the explosion of the cartridge, and while the plunger is held stationary in its extreme advanced position, the bed or carrier is given a return transverse movement to its original position, when a succeeding cartridge is received.

In order to permit of this return movement of a bed or carrier, the diaphragm  $E^6$ , during the forward throw of the plunger, is ridden down by the impingement of the cam or bevel  $f$ , formed upon the side of the plunger.

The raised surface  $E^9$  of the carrier  $E^5$  operates as a check and support to the cartridges not received in the bed or carrier, thus preventing more than one cartridge being fed or received at one time.

The main shaft B, I make to serve the purpose of trunnions. This part of my device consists of screw-threaded bolts made to pass through the sides of the case A, and to unite with the hub of the cams C E. By this arrangement it is unnecessary to cut out the casing, or to provide the boxing or journals otherwise required. Moreover, it enables me to construct a device having greater resistance and durability at a point where great strain and wear occur.

If found desirable in heavy guns, I shall provide the abutment L in the rear of the cams C E. This abutment may be suitably attached to or form part of the case A, and is so placed as to receive the force of the recoil incident to the discharge of the gun, instead of requiring this duty of the trunnions.

My invention is susceptible of modifications without departure from its spirit or intent. These modifications might be applied to guns having more than one barrel, such as shown in Fig. 6, which, in view of the previous specifications, is sufficiently indicated by the drawings without the necessity of additional description. Here are shown two grooves,  $E^8$ , with two depressible diaphragms,  $E^6$ , the raised surface  $E^9$  being placed midway between the diaphragms.

Another modification, as shown in Fig. 8, would consist of an arrangement whereby the bed or carrier  $E^5$ , instead of having the intermittent transverse reciprocating sliding movement, is given an intermittent transverse reciprocating rocking or swinging movement. This modified movement is attainable by the action of the double cams (shown in Figs. 7 and 9) upon the cross-arms. (Shown directly over the pivot of the rocking bed in Fig. 8.)

It is evident that instead of using both a spring and a cam device to return the yielding diaphragm  $E^6$  to its raised position, one only of the same may be employed.

The method of mounting (shown in Figs. 25 and 26) is sufficiently indicated by the drawings, and needs no specific mention.

The reservoir H is shaped to receive and retain the cartridge-shells by their heads, and is preferably constructed so as to be swung and secured in a horizontal position flat with the casing, as shown in Fig. 26, or in the vertical position shown in Fig. 25.

What I claim is—

1. A gun provided with a cartridge bed or carrier adapted to have an intermitting mo-

tion transverse to the axis of the barrel, said bed or carrier provided with a yielding diaphragm,  $E^6$ , substantially as and for the purpose shown.

2. A cartridge bed or carrier adapted to have an intermitting motion transverse to the axis of the barrel of a gun, a yielding diaphragm moving with said bed or carrier, a plunger, or its equivalent, having its motion in line with the axis of said barrel, and mechanism whereby said diaphragm may be depressed to permit of its passage beneath said plunger, combined substantially as shown and described.

3. In a machine-gun, the laterally-reciprocating cartridge bed or carrier, formed with a rigid side support and a vertically-yielding diaphragm, the same being adapted to inclose a cartridge, substantially as shown.

4. In a machine-gun, the combination, with the extractor-hook and the plate secured to the upper casing-section, and formed with shoulders, of the plunger and the two abutments, respectively, on each side thereof, the same forming a flange-groove for the cartridge, substantially as shown.

5. A machine-gun provided with the flange-groove, or its equivalent, one side or wall only of which groove partly consists of the extractor-hook, substantially as shown.

6. The way or groove formed by the curved or beveled surfaces  $a^4$  on the plate secured to the upper section, whereby the cartridge, during its longitudinal motion, is prevented from lateral displacement, substantially as shown.

7. The combination, with the extractor, of the upper bearing-surface,  $A^3$ , and the bed or carrier  $E^5$ , whereby the cartridge is securely held within the grasp of the extractor, and said extractor prevented from upward displacement, substantially as shown.

8. The plunger  $D^1$ , provided with the bevel or cam  $f$ , in combination with a yielding diaphragm,  $E^6$ , substantially as shown.

9. The yielding diaphragm  $E^6$ , in combination with the cam  $E^7$ , or its equivalent, whereby said diaphragm is raised after having been depressed, substantially as shown.

10. The cam E, bar  $E^1$ , and diagonal cam-slot  $E^2$ , for giving the cartridge bed or carrier its motion, substantially as shown.

11. The combination, with the transversely moving or oscillating cartridge bed or carrier, of the diaphragm adapted to be operated either by spring-pressure, cam engagement, or both, whereby said diaphragm is adapted to return to its projected position above the level of said carrier after passing under the plunger, substantially as shown.

12. The combination, with the shaft provided with the discharging and the carrier-actuating cams, of abutments placed in the rear of said cams, and adapted to receive the recoil of the gun therefrom, substantially as shown.

13. The combination, with the barrel, connecting by a slip-joint with the casing, and formed with a recess in its outer side body, of a pin or key adapted to fit partly in said recess and partly in the casing-wall of the barrel-opening, whereby said barrel is readily removable, and is also secured against longitudinal or rotary movement, substantially as shown.

14. In a machine-gun, the combination,

with the reciprocating plunger-frame, of one or more casters, upon which said frame has movement, substantially as shown.

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

WILLIAM GARDNER.

Witnesses:

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F. TOUMEY.