(No Model.) 3 Sheets—Sheet 1.

A. ODKOLEK.

RECOIL OPERATED MACHINE GUN.

No. 454,403. Patented June 16, 1891.

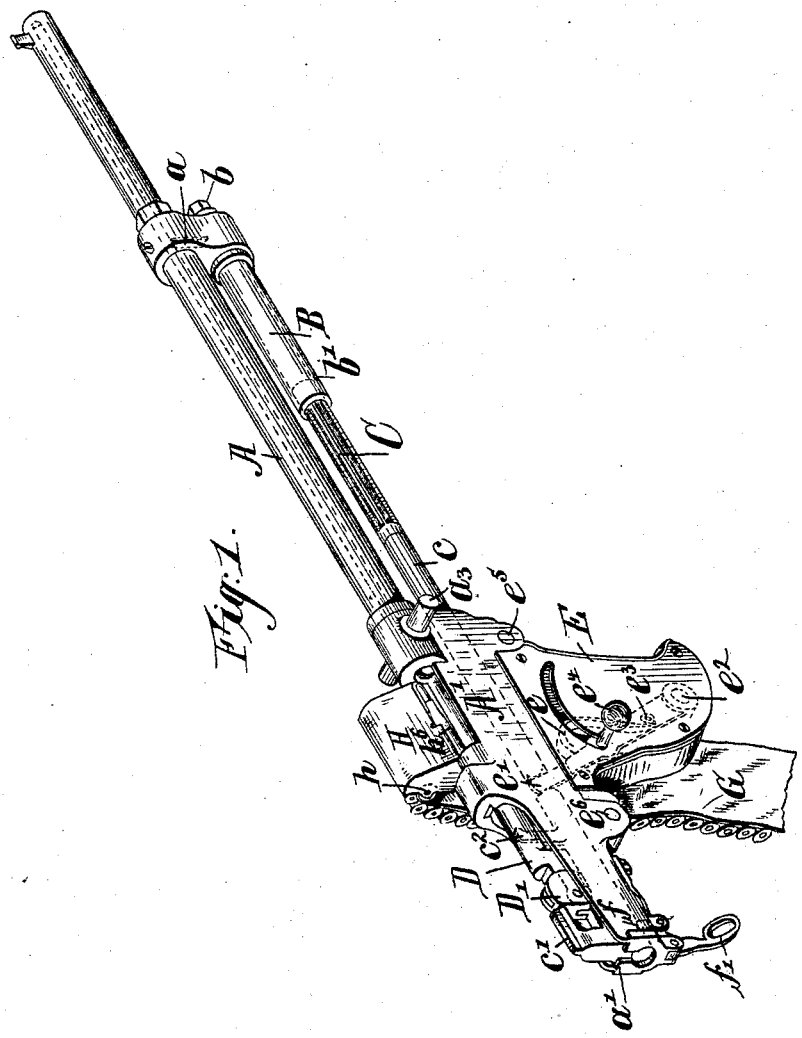

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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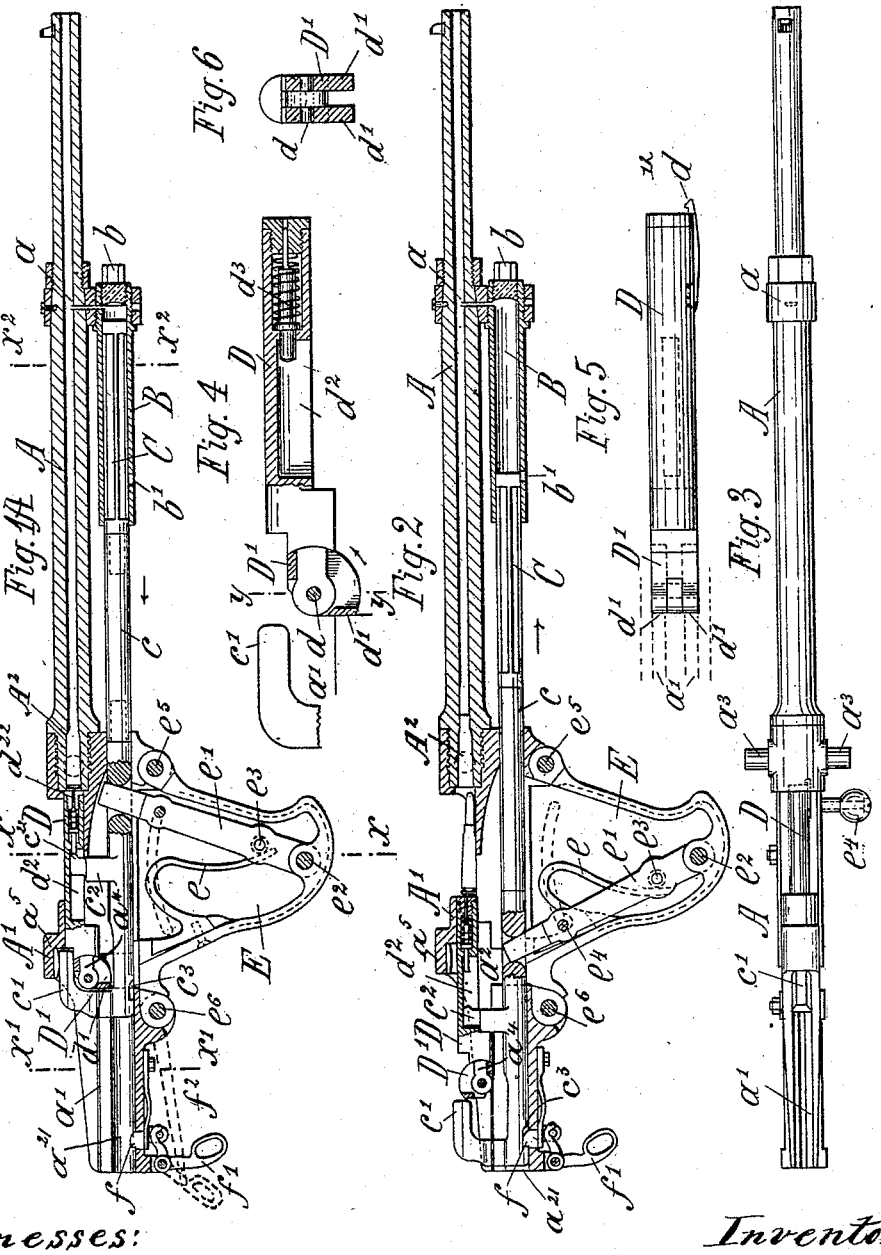

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(No Model.) 3 Sheets—Sheet 3.

A. ODKOLEK.

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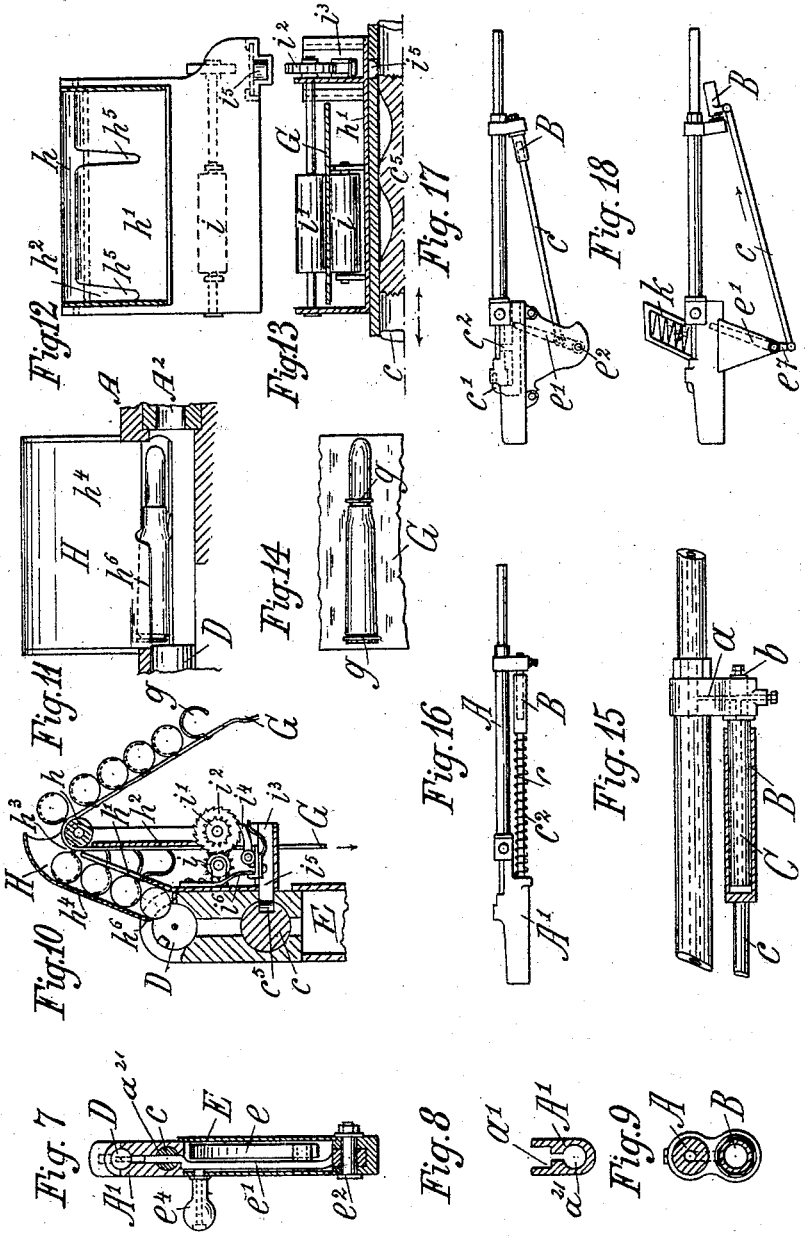

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UNITED STATES PATENT OFFICE.

ADOLF ODKOLEK, OF VIENNA, AUSTRIA-HUNGARY.

RECOIL-OPERATED MACHINE-GUN.

SPECIFICATION forming part of Letters Patent No. 454,403, dated June 16, 1891.

Application filed November 26, 1890. Serial No. 372,676. (No model.)

To all whom it may concern:

Be it known that I, ADOLF ODKOLEK, freiherr von Augezd, captain of horse, a subject of the Emperor of Austria, residing at Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Quick-Fire 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The invention relates to rapid-firing breech-loading or machine guns, and has for its object to control the movements of the loading and firing mechanisms by the expansive power of the gases developed during the combustion of the explosive and to combine therewith means whereby such guns may be loaded and fired by hand.

To these ends the invention consists in the combination, with the breech and the cartridge-feeding mechanisms, of an actuating device operated by the gases resulting from the combustion of the explosive charge and a power-storing device or accumulator controlled by the actuating device and co-operating to impart the necessary movements to the breech and cartridge-feeding mechanisms to effect the rapid loading and firing of the gun.

The invention further consists in the construction of the breech and cartridge-feeding mechanisms and in the combination of co-operative elements, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of the gun. Fig. 1ª is a longitudinal sectional elevation of a gun constructed according to this invention, illustrating the breech mechanism in the position it assumes immediately after firing, and Fig. 2 is a like view illustrating the said mechanism in its position ready for loading, the cartridge-feeding mechanism in both figures being removed. Fig. 3 is a top plan view of the gun without the cartridge-feeding mechanism. Fig. 4 is a section of the breech bolt or block; Fig. 5, a top plan view of said bolt, and Fig. 6 a section taken on line $y\,y$ of Fig. 4. Figs. 7, 8, and 9 are sections taken, respectively, on lines $x\,x$, $x'\,x'$, and $x^2\,x^2$ of Fig. 1. Fig. 10 is a section about on line $x\,x$ of Fig. 1, showing the cartridge-feeding mechanism. Fig. 11 is a left-hand side view of the cartridge-feed hopper, a portion of the breech-bolt and the receiver being shown, the last-named in section. Fig. 12 is a right-hand side view of the cartridge-feed hopper; and Figs. 13 and 14 are detail views, the former of the cartridge-carrier-actuating devices and the latter of the means for securing the cartridges to the carrier. Figs. 15, 16, 17, and 18 are side elevations illustrating modifications in the means for actuating the breech-bolt.

A indicates the gun-barrel, A′ the receiver, and D the breech-bolt. The barrel A is provided with a suitable bearing for the forward end of a piston-cylinder B, that is in communication with the bore of the gun through a duct or port a, formed in the gun, the bearing, and the cylinder, respectively, as shown in Figs. 1 and 2. The outer end of the cylinder B is closed by a screw valve or plug b, of such length as to cover the port or duct a to a greater or less extent or entirely, as the case may be, thus providing means for regulating the flow of gas from the gun to the cylinder B or for cutting off such flow when it is desired to load and fire by hand-power, as well as means for gaining access to the interior of the cylinder for the purpose of cleaning the same. The location of the duct a will in a measure depend upon the power required to operate the breech mechanism and the amount of power to be stored up for the same purpose, as well as upon the diameter of the bore of the gun, as it is obvious that the duration and degree of pressure of the gas upon the piston will increase in proportion to the distance of the port a from the muzzle of the gun.

The cylinder B has near its rear end an exhaust-port b', and contains a piston C, whose rod c extends some distance into the receiver A′, which is provided with a suitable bearing a^{21}, Figs. 1, 2, 7, and 8, in which said rod has free motion, and above said bearing are formed two ledges or guide-ribs a', for purposes presently explained. The piston-rod c has a slot into which takes the upper end of

a lever e', that is pivoted at e^2 in a housing or casing E, secured to the receiver A', and to the rear wall of said housing is secured a leaf-spring e, which constitutes the power accumulator or storing device. The lever e' has a stud or pin e^3, that has bearing on the free end of the spring e, and in order to compress a comparatively strong spring with as little flexure as possible the pin or stud e^3 is secured to the lever near its fulcrum, and the spring is bent accordingly, so that a comparatively small spring capable of exerting the necessary power can be used. When the charge in the gun is exploded and the piston and its rod are driven back by the gases entering the cylinder B, the lever e' is also moved backward, thereby compressing the spring e, which drives the piston-rod and piston forward again as soon as the piston reaches a point to uncover the port b' in the cylinder B, at which time the projectile also leaves the bore of the gun, thereby relieving the piston of all pressure. The piston-rod also actuates the breech-bolt and cartridge-feeding mechanism; but inasmuch as the projectile has some distance to travel before leaving the gun after the piston and piston-rod commence to move back under the pressure of the gases in the cylinder B, and to prevent the uncovering of the breech of the gun before the projectile has left the latter, I provide the following means: The breech-bolt D contains in its forward end a short firing-pin d^{22}, the spring of which is so arranged as to hold the said pin retracted within the bolt, and in rear of said pin the receiver is slotted longitudinally, as shown at d^2, and into said slot projects a radial arm c^2 on the piston-rod c, which arm has a nose or striker c^{22}, adapted to strike upon the firing-pin d^{22}, thereby driving the pin forward against the stress of its spring to fire the charge. The slot d^2 is of such length that the arm c^2 will reach the rear end thereof at the same time the projectile leaves the gun.

To prevent back fire, the breech-bolt is securely locked to the breech through the medium of the following instrumentalities: At its rear end the bolt has an extension or arm a^4, to which is pivoted a sector-shaped locking dog or tumbler D', whose faces d' abut against the front face of the guide-ribs a', above referred to, which ribs are arranged below the pivot of the tumbler when said breech-bolt is in a position to close the breech, as shown in Fig. 1. When, however, the breech-bolt is moved back by the piston-rod, the tumbler is tilted, the front face of the ribs acting as a tripping device, a half-revolution being imparted to the tumbler D, which will then slide along the guide-ribs a' as the bolt is moving rearwardly. The tumbler is held against rotation when in the position shown in Fig. 1 by an overhanging heel-piece or arm c' at the rear end of the piston-rod c, which lies in a plane above the pivot of the tumbler, upon which the arm c' impinges during the forward movement of the piston-rod, thereby carrying the breech-bolt along, and as the bolt reaches the limit of its forward motion the tumbler is tilted by the arm c', which then passes over the tumbler and between it and an overhanging ledge or shoulder a^5 on the receiver, as shown in Fig. 1. It will be seen that the breech-bolt cannot move rearwardly until the piston-rod c has moved back sufficiently to move the arm c' clear of the tumbler D', and this occurs when the arm c^2 strikes the rear end of the slot d^2 in the breech-bolt D, or a moment before, and as soon as the breech-bolt has moved back sufficiently to bring the empty cartridge-shell clear of the breech A^2 the spring-extractor d^{12}, Fig. 5, ejects the shell from the receiver, which is slotted for this purpose. As the piston-rod and breech-bolt reach the limit of their rearward movement, the gases are exhausted through port b' and the bore of the gun, and the spring e at once moves the parts forward again. During this forward movement the breech-bolt is not propelled by the arm c^2 on the piston-rod, but by the heel-piece c' impinging on the tumbler D', as shown in Fig. 2, and as above set forth, and during this forward movement a fresh cartridge is also fed to the receiver, as follows.

Referring to Figs. 10 to 14, inclusive, the cartridges to be fed to the gun are secured to a belt G by means of two soft or flexible wire loops g, Fig. 14, and said belt travels over a guide-roll h, mounted in the upper portion of a feed hopper or chute H, thence between two feed or drawing rolls i and i', having their nip in the plane of the periphery of the guide-roll and mounted in suitable bearings provided on the outside of the chute below the feed-roll. The journal of the roller i' carries a ratchet-wheel i^2, and a spring-pawl i^4, in engagement with the ratchet-wheel, is pivoted to a support i^3, that has motion in a suitable guideway projecting from the lower end of the chute or hopper H, the said support or carriage i^3 having an extension i^5, that projects into a slot formed in that portion of the receiver A' in which the piston-rod c has its bearings, and said piston-rod is provided with two curvilinear notches c^5, into which the carriage-extension i^5 enters whenever they are brought opposite thereto during the reciprocations of the piston-rod, the carriage being continually urged in the direction of the piston-rod by a spring i^6. It will thus be seen that the carriage has a reciprocating motion imparted thereto by the piston-rod, so that at each outward motion of the carriage the pawl will move the ratchet-wheel a given distance, thereby moving the cartridge-belt also.

The feed hopper or chute H is constructed with the vertical wall h^2 and the two parallel inclined walls h' and h^4, and the drawing-rolls i and i' are so arranged as to draw the belt down along the vertical wall h^2. The inner inclined wall extends to the guide-roll h, there being just enough space between them to al-

low the cartridge-belt free passage, and said inner inclined wall h' has two vertical slots h^5, so arranged relatively to the cartridge-belt as that the soft or flexible wire fastening-loops will pass along the slots. As the cartridges cannot follow the belt after they reach the point where said belt passes between the roller h and inner inclined wall h', the belt as it moves down will draw upon the wire loops and open the same, thus releasing the cartridges, as clearly shown in Fig. 10. At the delivery end the feed-hopper A is provided with a more or less elastic lip h^6, that contracts a portion of the mouth of the hopper and prevents a cartridge from falling out, the opening being, however, sufficiently large to allow a portion of the cartridge to project therethrough into the path of the breech-bolt. As the breech-bolt is thrown forward under the stress of the spring e, it will impinge on the butt of the cartridge and carry the same along until its rear end has moved clear of the lips h^6, when it will drop out, at which time, however, the bullet end of the cartridge will already have penetrated into the breech. In fact, the hopper H is so arranged on the receiver A′ that the cartridge will have to move but a very short distance before the bullet enters the breech A^2, by which it is thus guided. Before the piston-rod and breech-bolt reach the limit of their forward motion the overhanging arm c' on the rod will tilt the locking-tumbler forward and slide over the same and between it and the overhanging ledge a^5 on the receiver A′, and simultaneously therewith the striker or hammer-nose c^{22} of the arm c^2 on the piston-rod c will strike the firing-pin and fire the charge.

The gun may be loaded and fired by hand only, to which end the plug b is screwed into the piston-cylinder B to cover the port a. The lever e' is provided with a handle e^4, Fig. 7, that projects through a curved slot (shown in dotted lines in Figs. 1 and 2) formed in the housing E, and to the rear end of the receiver is secured a spring-sear f, adapted to take into a notch c^3, Figs. 1 and 2, in the piston-rod, the sear being operated by a trigger f' in the form of a bell-crank lever. When the gun is to be fired automatically, the sear is held out of the path of the notch in the piston-rod c by means of the lanyard secured to the trigger, or by means of an arm f^2, (shown in dotted lines in Fig. 1,) pivoted on the hinge-pintle e^6, by means of which the housing E is hinged to the receiver at its rear end, it being secured to the receiver at its forward end by means of a pin e^5. By removing the pin e^5 the housing E can be swung back, thereby withdrawing the lever e' from the slot in the piston-rod c, which rod can then be drawn out of the receiver together with the breech-bolt D.

The receiver A′ is provided at its forward end with trunnions a^3 for obvious purposes.

It is not necessary that the piston should be movable. A stationary piston having a passage in communication with the bore of the gun may be used, in which case the actuating-rod will be connected with the movable piston-cylinder, as shown in Fig. 15.

Instead of the arrangement of spring shown in Figs. 1 and 2, a coiled spring c^2 on the connecting-rod and abutting against the receiver and movable piston-cylinder may be used, as shown in Fig. 16.

To obtain a great rapidity in firing with a comparatively limited piston-stroke, the piston or connecting rod may be connected with the lever e' at a point near its fulcrum, either above, as shown in Fig. 17, or below, through the medium of a crank-arm e^7, as shown in Fig. 18, and in both arrangements the lever e' will extend into a slot in the receiver A′. Of course when the rod c is connected to the short arm e^7 of a two-armed lever e', or to a crank on the pivot thereof, it is necessary that the rod should move in the direction of the projectile, in order to move the longer arm of the lever e' backward, in which case the piston-cylinder is also movable on the piston, which is then applied so as to project forward from its bearings, as shown in said Fig. 18. Finally, instead of the cartridge-feeding devices above described, any other well-known devices may be employed without departing from the spirit of my invention.

Having described my invention, what I claim is—

1. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of a piston-cylinder, an inlet-port leading from the forward end of the cylinder to the bore of the gun, a piston contained in the cylinder in rear of the admission-port, and a radial arm on the piston-rod adapted to engage the breech-bolt and impart motion thereto in one direction, for the purpose set forth.

2. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of a piston-cylinder, an inlet-port leading from the forward end of the cylinder to the bore of the gun, a piston contained in the cylinder in rear of the port, a radial arm on the piston-rod adapted to engage the breech-bolt and impart motion thereto in one direction, and a power-accumulator connected with the piston and operating to move the same in reverse direction, for the purpose set forth.

3. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of a piston-cylinder, an inlet-port leading from the forward end of the cylinder to the bore of the gun, an exhaust-port leading from the rear end of the cylinder to the atmosphere, a piston contained in said cylinder between said ports, and a radial arm on the piston-rod adapted to engage the breech-bolt and impart motion thereto in one direction.

4. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of an open-ended cylinder, an inlet-port leading from the forward end of the cylinder to the bore of the gun, a valve for con-

trolling the admission of the gases through said port, a piston contained in the cylinder in rear of the port, and a radial arm on said piston-rod adapted to engage the breech-bolt and impart motion thereto in one direction, for the purpose set forth.

5. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of a motor operated by the gases resulting from the combustion of the explosive charge and operatively connected with the bolt to move the same in one direction, and a power-accumulator in perpetual engagement with the motor and said bolt, for the purpose set forth.

6. In a breech-loading gun, the combination, with the gun, its receiver, and the breech-bolt, of a piston-cylinder, an inlet-port leading from the forward end of said cylinder to the bore of the gun, an exhaust-port opening into the atmosphere in rear of the inlet-port, a valve for controlling the latter port, a piston contained in the cylinder between its inlet and outlet ports, a radial arm on said piston-rod adapted to engage the breech-bolt and impart motion thereto, and a power-accumulator in perpetual engagement with the piston-rod, for the purpose set forth.

7. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a cartridge-feeding device connected with the receiver, and a piston-cylinder in communication with the bore of the gun and provided with an exhaust-port, of a piston having motion in the cylinder, a power-accumulator controlled by the piston in its movements in one direction and adapted to move the piston in a reverse direction, a connection between the piston and breech-bolt, and an actuating mechanism operated by said piston and operating the cartridge-feeding device, for the purpose set forth.

8. In a breech-loading gun, the combination, with the gun, the receiver, the breech-bolt, and a cartridge-feeding device connected with the receiver, of a motor operated by the gases resulting from the combustion of the explosive charge and imparting a rectilinear motion to the breech-bolt in one direction, a power-accumulator operated by said motor and imparting a like motion to said bolt in a reverse direction, and an actuating mechanism operated by both motor and power-accumulator and operating the cartridge-feeding devices, for the purpose set forth.

9. In a breech-loading gun, the combination, with the gun, its receiver, and breech-bolt, of a piston-cylinder in communication with the bore of the gun and a piston contained in the cylinder in rear of said communication and adapted to move the bolt in one direction, and a power-accumulator consisting of a spring and a compressing-lever, said lever being directly connected with the piston-rod, for the purpose set forth.

10. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, and a piston-cylinder in communication with the bore of the gun, of a piston, a housing or casing depending from the receiver, a power-spring contained in said housing, a lever fulcrumed in the housing and extending into a slot in the piston-rod, said lever having bearing on the spring, and a connection between the piston-rod and breech-bolt, for the purpose set forth.

11. In a breech-loading gun, the combination, with the gun and the open-ended piston-cylinder arranged below the same and in communication with the bore of the gun by a vertical passage *a*, of the screw-valve *b*, closing the inlet end of the cylinder and adapted to control the admission of the gases through port *a*, for the purposes set forth.

12. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, and a piston-cylinder open at one end and communicating with the bore of the gun, of a piston, a housing hinged to the receiver below the same, a power-spring secured in said housing, a lever fulcrumed in the housing, said lever having bearing on the spring and extending into a slot of the piston-rod, and a radial arm on said piston-rod extending into a slot of the breech-bolt, for the purposes set forth.

13. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a piston-cylinder in communication with the bore of the gun, a piston contained in the cylinder in rear of said communication and operatively connected with the breech-bolt to move the same in one direction, and a recoil-spring operatively connected with the bolt and piston to move the same in a reverse direction, of an actuating mechanism directly connected with the piston, and a hand-lever for operating said mechanism, for the purpose set forth.

14. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a piston-cylinder in communication with the bore of the gun, and a piston contained in said cylinder in rear of said communication and adapted to impart motion to the breech-bolt in one direction, of a recoil-spring, a compressing-lever for said spring directly connected with the piston, and a handle connected with the lever, for the purpose set forth.

15. In a breech-loading gun, the combination, with the gun, its receiver, and cartridge-feeding devices connected with the receiver, of a reciprocating motor operatively connected with the cartridge-feeding devices and moving the same in one and the same direction, and also connected to and reciprocating the breech-bolt, for the purpose set forth.

16. In a breech-loading gun, the combination, with the gun, its receiver, and cartridge-feeding devices connected with the receiver, of a reciprocating motor operated by the gases resulting from the combustion of the explosive charge and adapted to move the cartridge-feeding devices in one and the same direc-

tion and the breech-bolt in opposite directions, for the purpose set forth.

17. In a breech-loading gun, the combination, with the gun, its receiver, cartridge-feeding devices connected with the receiver, the breech-bolt, a reciprocating piston, a recoil-spring adapted to be brought under tension by the piston, and intermediate connections between the piston, of the cartridge-feeding devices and breech-bolt operating to move said devices in one and the same direction and to move the breech-bolt in opposite directions during the reciprocations of the piston, for the purpose set forth.

18. In a breech-loading gun, the combination, with the receiver, cartridge-feeding devices connected therewith, and a ratchet-wheel connected to the driving-shaft of said cartridge-feeding devices, of a reciprocating driving element, and a pawl in engagement with the ratchet-wheel and moved by the driving element to revolve the ratchet, for the purpose set forth.

19. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, and cartridge-feeding devices connected with the receiver, of a piston-cylinder and a piston operated by the gases resulting from the combustion of the explosive charge, the rod of the piston being provided with peripheral notches and with a radial arm adapted to engage the breech-bolt, a power-accumulator controlled by the motor, a ratchet-wheel on a revoluble element of the cartridge-feeding devices, a pawl, a support therefor having motion in the path of the ratchet and provided with an extension in the path of the notches in the piston-rod, and a spring to hold the support in contact with said rod, for the purposes set forth.

20. In a breech-loading gun, the combination, with the receiver, cartridge-feeding devices connected therewith, a ratchet mechanism for operating said cartridge-feeding devices, and a reciprocating pawl in engagement with the ratchet, of a reciprocating piston driven in one direction by the gases resulting from the combustion of the explosive charge, a recoil-spring brought under tension by the piston and adapted to move the same in a reverse direction, intermediate mechanism operated by the piston to impart motion to the pawl and revolve the ratchet, and a spring operating to move the pawl in a reverse direction, for the purpose set forth.

21. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, cartridge-feeding devices connected with the breech-bolt, a pawl, and a ratchet-wheel on the operating-shaft of said cartridge-feeding devices, of a reciprocating driving element operating to move the breech-bolt and pawl in one direction, and springs operating to move said bolt and pawl in a reverse direction, for the purpose set forth.

22. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a locking-tumbler pivoted to the bolt at its rear end, an abutment below the tumbler-pivot on which said tumbler has bearing, and a piston-cylinder in communication with the bore of the gun, of a piston, the rod of which is provided at its rear end with an arm in a plane above the pivot of the tumbler and adapted to engage the same, a power-accumulator, a connection between the same and the piston-rod, and a connection between the piston-rod and breech-bolt, for the purposes set forth.

23. In a breech-loading gun, the combination, with the gun, its receiver provided at its rear end with guide-ribs a' and an overhanging ledge a^5, the breech-bolt provided with a longitudinal slot, the segmental locking-tumbler D′, pivoted to the rear end of the breech-bolt and adapted to bear against the forward end of the guide-ribs, and a piston-cylinder in communication with the bore of the gun and having an exhaust-port, of a piston whose rod has a slot, and a radial arm extending into the slot of the breech-bolt, and an arm at its rear end in a plane above the pivot of the tumbler, a power-accumulator, and a connection between the same and the piston-rod, for the purposes set forth.

24. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a firing-pin contained in the forward end of said bolt, and a hammer having motion in a slot in the bolt in rear of the firing-pin, of a motor, a connection between the motor and hammer adapted to impart rectilinear motion to said hammer, and a power-accumulator controlled by the motor and adapted to control the same, for the purposes set forth.

25. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a firing-pin contained in the forward end of the bolt, a hammer having motion in a slot in said bolt in rear of the firing-pin, and a lock for locking the bolt to the breech, of a motor operated by the gases resulting from the combustion of the explosive charge and operating the lock, a connection between the motor and hammer adapted to impart rectilinear motion to the latter, a power-accumulator, and a connection between the same and the motor, for the purposes set forth.

26. In a breech-loading gun, the combination, with the gun, its receiver, the breech-bolt, a cartridge-extractor secured thereto, a firing-pin contained in the forward end of the bolt, a hammer having motion in a slot in the bolt in rear of the firing-pin, a lock for locking the bolt to the breech, and a cartridge-feeding device connected with the receiver, of a motor operated by the gases resulting from the combustion of the explosive charge, adapted to operate the lock and cartridge-feeding device, a connection between said motor and the hammer adapted to impart a rectilinear motion to said hammer, a power-accumulator, and a connection between the accumulator and motor, for the purpose set forth.

27. The cartridge-feeding devices consisting of an inclined chute, a guide-roll arranged with its periphery slightly in rear of the upper edge of the inner wall of said chute, said inner wall being provided with two vertical slots, drawing-rolls having their nip in the peripheral plane of the guide-roll below the same, a cartridge-belt, and a flexible metallic fastener for the cartridges arranged to register with the slots in the chute as said belt is drawn over the guide-roll, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ADOLF ODKOLEK.

Witnesses:
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W. B. MURPHY.