No. 645,932. Patented Mar. 27, 1900.

M. BECK & E. FERRANT.

AUTOMATIC MAGAZINE GUN.

(Application filed May 5, 1899.)

(No Model.) 3 Sheets—Sheet 1.

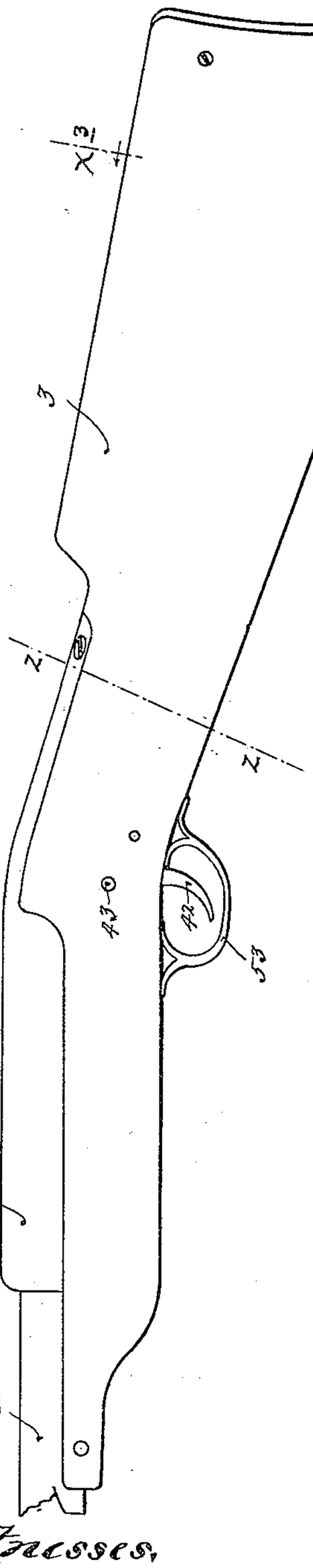

Fig. 1.

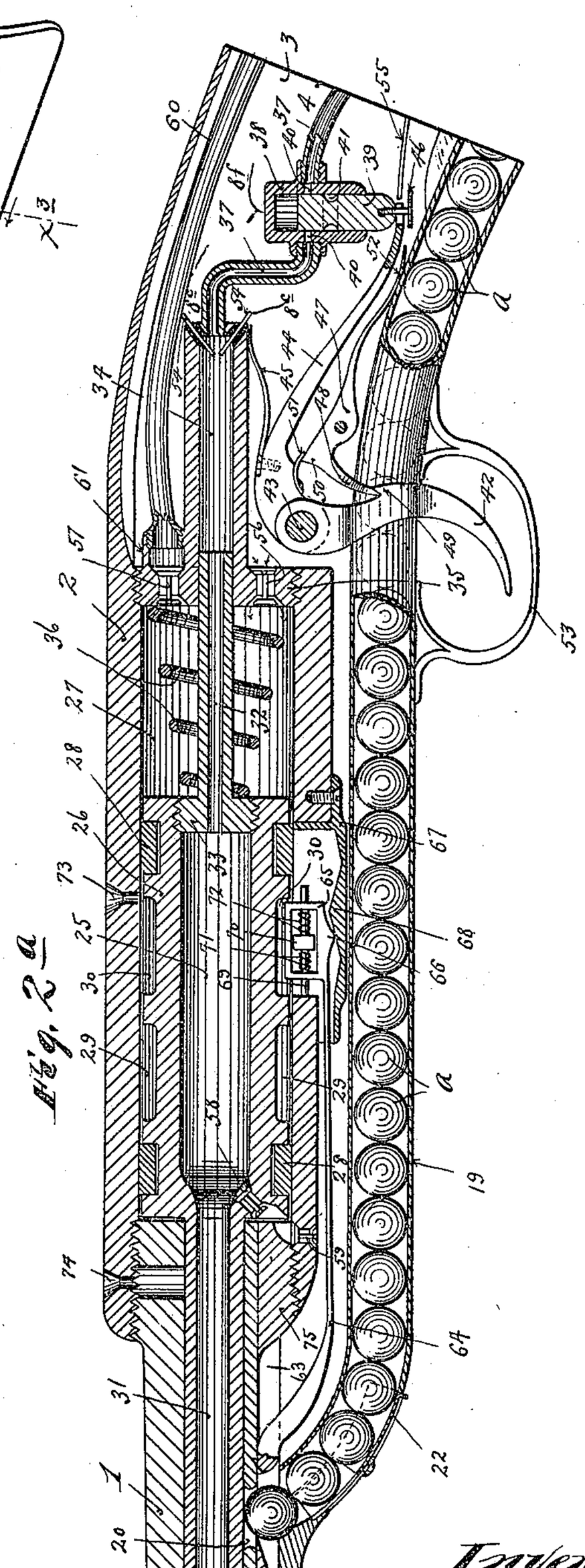

Fig. 2.

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(No Model.) 3 Sheets—Sheet 2.

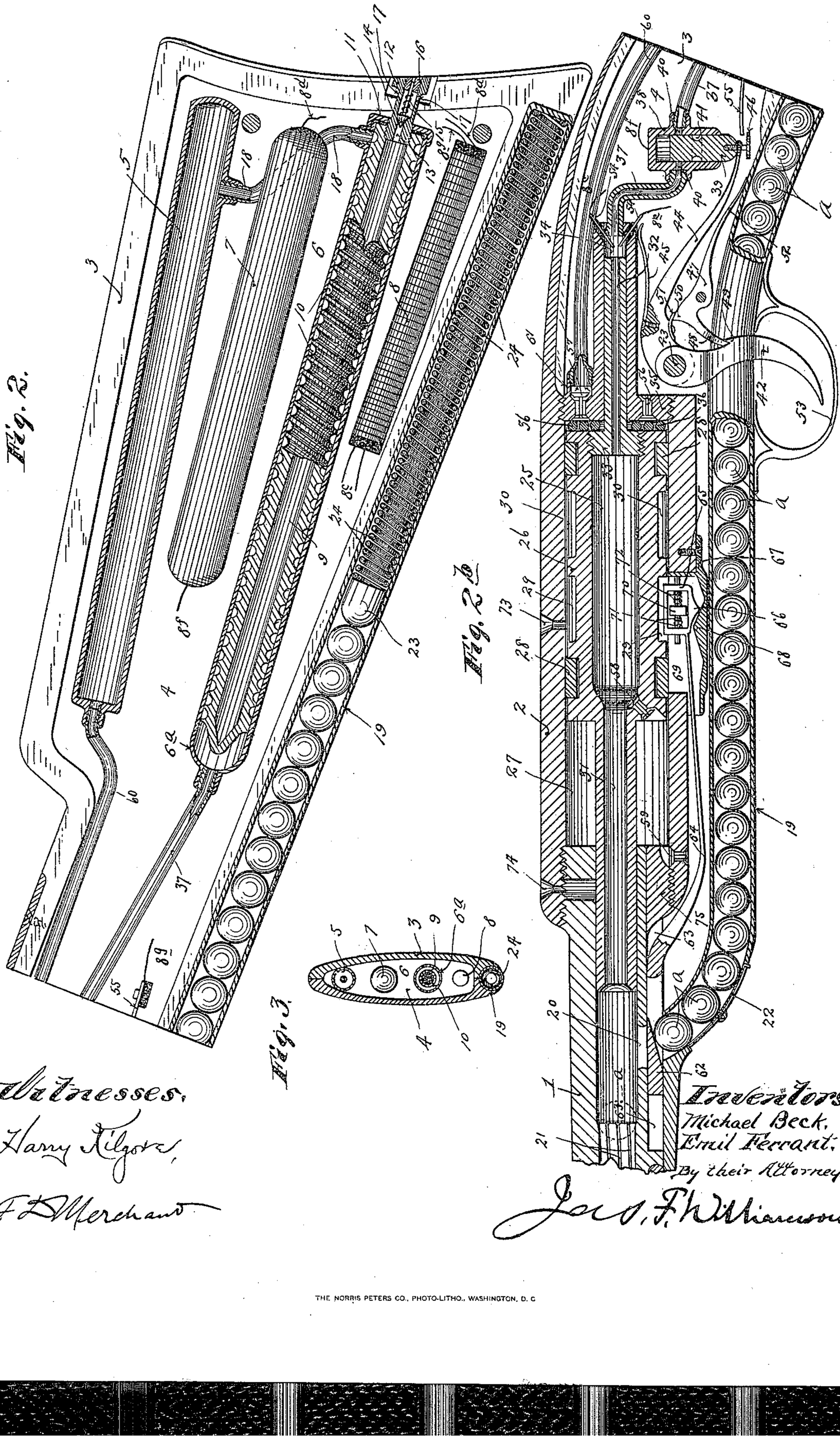

Fig. 2.

Fig. 3.

Fig. 2b.

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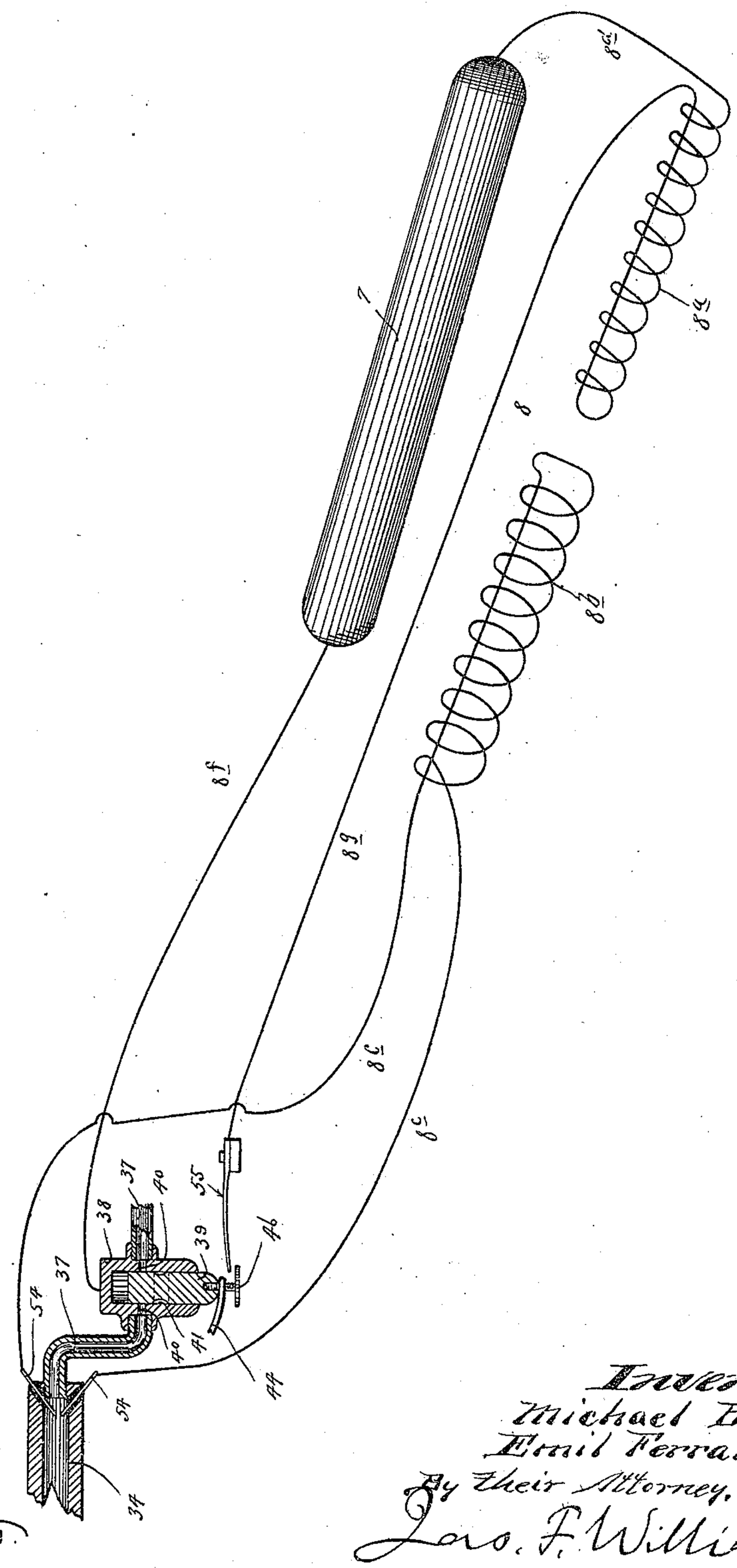
3 Sheets—Sheet 3.

Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

MICHAEL BECK AND EMIL FERRANT, OF MINNEAPOLIS, MINNESOTA.

AUTOMATIC MAGAZINE-GUN.

SPECIFICATION forming part of Letters Patent No. 645,932, dated March 27, 1900.

Application filed May 5, 1899. Serial No. 715,648. (No model.)

To all whom it may concern:

Be it known that we, MICHAEL BECK and EMIL FERRANT, citizens of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Repeating Rifles; and we 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.

Our invention relates to firearms, and has for its especial object to provide an improved repeating rifle capable of very rapid firing and having a large capacity for holding the projectiles.

To these ends and to others which will hereinafter appear our invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

Our invention is a radical deviation both in construction and principles of operation from repeating rifles hitherto constructed and involves the use of an explosive fluid which is automatically generated and exploded, in connection with means for automatically delivering the projectiles into the barrel of the gun and into position to be discharged by the explosion of the fluid, as will be hereinafter described.

The invention in its preferred form is illustrated in the accompanying drawings, and we will first consider this preferred construction, which serves to illustrate the broader features of our invention.

In the drawings, like characters indicating like parts throughout the several views, Figure 1 is a view in side elevation, with some parts broken away, showing a rifle or gun constructed in accordance with our invention. Figs. 2, 2^a, and 2^b are vertical longitudinal sections taken centrally through the rifle shown in Fig. 1, the said Figs. 2^a and 2^b being supplemental to Fig. 2, the line of division being made on the line $z\ z$ of Fig. 1. Fig. 3 is a transverse section taken on the line $x^3\ x^3$ of Fig. 1, and Fig. 4 is a diagram view illustrating the electric connections and devices which make up the igniter or spark-producing device.

The barrel 1 of the gun is provided at its butt or breech end with a cylindrical breech or tubular block 2, into which it is shown as screwed, although it might be otherwise secured. The breech or tubular block 2, as well as the barrel 1, are rigidly secured in a suitable manner and by suitable means to the gun-stock 3, which stock is preferably formed by two hollow sections, one of which may be readily removed to give access to the interior chamber 4, as best illustrated in Fig. 3, but also in Fig. 2.

Within the chamber 4, formed within the gun-stock, are positioned and secured an air-storage tank or tube 5, a carbureter 6, an electric battery 7, and an induction-coil 8. The carbureter 6 is made up of an exterior tube 6^a and a hollow interior tube 9, which latter is constructed of unglazed porcelain or similar porous material, and it is preferably provided on its outer surface with spiral threads or channels 10. At one end the outer tube 6^a is provided with a removable cap 11, which normally closes the tube with an air-tight joint, but which when removed permits the porcelain tube 9 also to be removed. The rear end of the porcelain tube 9 is normally closed by a screw-threaded valve seat or plug 12, which is provided with a vent or escape passage 13, that is normally closed by a safety-valve 14, which is subject to a spring 15, the tension of which may be varied by means of a screw-threaded nut or plug 16, working in the said valve-seat 12. Outward of the valve 14 the valve-seat 12 is provided with lateral escape-passages 17, which permit the escape of the air or gas when the said safety-valve 14 has been forced open by extreme pressure thereon.

When the valve-seat 12 is removed from working position, the porcelain or porous tube 9 is filled with oil—gasolene, for example—or other suitable liquid, which will serve to carburet air brought into contact therewith. In the construction illustrated air under considerable pressure is supplied to the carbureter from the air-storage tube 5 through a small branch pipe 18, which communicates with the said tubes 5 and 6^a. The air forced into the carbureter will be caused to take a winding course around the porous oil-containing tube 9, and a part of this air will work its way through into the interior of said tube 9, while,

on the other hand, a portion of the oil will slowly work its way through the porous tube to the exterior of the same, so that the air and gasolene or other oil will be commingled and the air carbureted. While at this point it may be noted that if at any time the pressure of the air in the storage tube or tank 5, and hence also in the carbureter, is increased beyond a predetermined point of safety as regulated by the tension of the spring 15 the safety-valve 14 will be opened, and this excessive pressure will thus be relieved.

The magazine for containing the projectiles or bullets *a* is in the form of a long tube 19, which is contained within but runs along the lower edge of the gun-stock and terminates at its forward end in position to deliver the bullets or projectiles into the barrel 1 through a perforation 20, formed in the under side of the same just to the rear of the inner extremities of the rifle grooves or channels 21. The bullets or projectiles are, as shown, of spherical form and are adapted to be placed within the magazine through an opening which is normally closed by a sliding gate 22. In the rear end of the magazine-tube 19 is a plunger or follower 23, which is under spring tension to move forward from a long coiled spring 24. This spring-pressed follower 23 keeps the bullets pressed together and forced forward, and thus delivers them as they are required into the barrel 1.

The explosion-chamber 25 is formed within what we term a "recoil" or "reaction" plunger and which, as will be presently noted, serves as a pump-plunger for several purposes. This reaction-plunger (indicated by the numeral 26) is mounted to reciprocate in the cylindrical seat or bore 27 of the breech 2, and it is shown as provided at its ends with packing-rings 28, which form gas-tight joints between the said parts. Between the packing-rings 28 the plunger 26 is provided with peripheral grooves or channels 29 30, for a purpose which will presently appear. At its front end the plunger 25 is provided with a contracted tubular extension or neck 31, which closely fits the smooth bore of the rifle-barrel 1, back of the rifle channels or grooves 21. The outer end of this tubular neck or extension 31 is preferably hollowed out to make it closely fit the bullet *a*, which is in position for firing, as shown in Fig. 2ª. At its rear end said plunger 26 is provided with a smaller tubular neck or extension 32, which, as shown, is formed integral with a plug 33, that is screw-threaded into the rear end of said plunger. The neck 32 works closely but freely within a rearwardly-extended cylindrical seat or tube 34, which, as shown, is formed integral with a plug 35, that is screw-threaded into the rear end of the breech 2. The coiled spring 36, compressed between the screw-threaded plugs 33 and 35 just noted, puts the reaction or pump plunger 26 under a yielding pressure to move forward and to remain in its normal position. (Indicated in Fig. 2ª.)

A small delivery gas pipe or tube 37 leads from the outer shell or tube 6ª of the carbureter to the rear end of the cylindrical seat or tubular extension 34. The delivery-pipe 37 has a valve-seat 38 interposed between its sections, as shown in Figs. 2ª and 2ᵇ. A plunger-valve 39 is mounted to work in the said valve-seat 38, said valve-seat having ports 40, which coöperate with ports 41 in the said valve. Normally the valve 39 is held downward, and the ports 40, and hence the gas-supply pipe 37, are closed. When the valve 39 is raised, its port 41 will register with the ports 40 of the valve-seat 38, and thus open communication with said supply-pipe 37. When the supply-pipe 37 is opened, the carbureted air or gas under pressure from the air-storage tank 5 will rush first into the tubular seat 34 and thence through the neck 32 into the explosion-chamber 25 of the reaction-plunger 26. The gas thus introduced into the explosion-chamber will be ignited and exploded by an electric igniter, which will be described after having first described the trigger device which operates the valve 39.

The depending finger-piece 42 of the trigger is mounted on a pivot 43, on which pivot the trigger-arm 44 is also pivoted. This arm 44 is held under tension to move downward by a leaf-spring 45, and its free end is connected to the lower end of the valve 39 by a large-headed screw or pin 46. 47 indicates a pivoted detent or trip lever, which has a finger 48, that engages a shoulder 49 on the finger-piece 42, and has the shoulder or corner 50, which normally engages a spring-finger 51 on the lever 44. Said detent is further provided with a spring extension 52, which puts the finger end 48 of the same under tension to move downward and keep engagement with the shoulder 49 of said finger-piece. A guard 53, secured to the under edge of the gun-stock, protects the finger-piece 42 against accidental engagement in the ordinary manner.

The igniter involves, in addition to the battery 7 and induction-coil 8 previously noted, suitable electric connections and a pair of electrodes 54, which are projected through the rear end of the tubular seat 34, being suitably insulated therefrom. The induction-coil 8 (see diagram view Fig. 4) involves a primary coil 8ª and a secondary coil 8ᵇ. The secondary coil 8ᵇ has extended conductors 8ᶜ, which extend one to each of the electrodes 54, so that the secondary circuit is broken only between the points of the electrodes. The primary coil 8ª has extended conductors 8ᵈ, 8ᶠ, and 8ᵍ, the first noted of which extends to the battery 7, the second noted of which extends from the battery to the valve-seat 38, and the last noted of which extends from said primary coil to a spring contact-finger 55. In the normal position of the parts (indicated in Figs. 2ª and 4) the free end of this spring-finger 55 is out of engagement with the head of the screw or pin 46, which is carried at the lower end of the valve 39, and hence this pri-

mary circuit is normally broken. The action of this igniter or spark-producing device, as well as of the trigger device, will be specifically brought out in the description of the operation. The following check-valves may be here noted: In the screw-threaded plug 35 at the rear end of the breech tube or seat 2 is a pair of reversely-acting check-valves 56 and 57, the former of which permits the inflow of air to the plunger-seat 27, but closes to prevent the outflow of air, while the latter opens to permit the outflow of air from said seat, but closes to prevent the inflow of air through the passage which it controls. In the forward end of the reaction-plunger 26 is a small check-valve 58, which opens to permit air to flow into the explosion-chamber 25, but closes to prevent the escape of air or gas therefrom. Controlling a passage through the breech-tube 2, which opens just forward of or into the extreme forward end of the seat 27, is a check-valve 59, that freely opens to permit air to be drawn into the forward end of said seat 27, but closes to prevent the escape of air through the passage which it controls. It is important to here note that the air-storage tube or tank 5 is in communication with the plunger-seat 27 through an air-delivery pipe 60, the forward end of which is connected to a nipple or sleeve 61, that surrounds the check-valve 57 and forms an extension of the passage which it controls.

The escapement device for controlling the delivery of the bullets or projectiles to the barrel one at a time will now be described. A sharp-edged escapement or cut-off blade 62 is mounted to work in suitable guide channels or runways 63 and to be reciprocated, so as to open and close the perforation 20, through which the bullets or projectiles are passed from the magazine-tube into the gun-barrel. Normally this cut-off blade 62 will stand approximately as indicated in Fig. 2[a], although it is at one time adapted to be moved slightly farther outward or toward the left with respect to the drawings, while at another time it will stand as indicated in Fig. 2[b], in which position it will close the perforation 20.

The cut-off blade 62 is provided with a long rearwardly-projected spring-arm 64, at the free end of which is an approximately-rectangular cam bracket or head 65, that is provided on its under edge with a depending V-shaped cam-surface 66. Secured to the breech-tube 2 and extending longitudinally of and below the cam bracket or head 65 is a plate or casting 67, which is provided on its upper surface with a raised or approximately-V-shaped cam-surface 68. Mounted for reciprocating movement longitudinally of and through the end walls of the bracket or head 65 is a plunger 69, which, as shown, has a central enlargement 70 and is put under strain to remain in an intermediate position by a pair of springs 71 and 72. It is sufficient at this point to state that the spring-arm 64 keeps the bracket or head 65 pressed down or lowered as far as permitted by the engagements of the cam-surfaces 66 and 68, that the dimensions of the said head or bracket 65 are such that when forced to its extreme lowermost position its upper edge will stand below the lower surface of the plunger 26, but when raised above this extreme lowermost position its upper edge will be forced more or less into one or the other of the peripheral grooves or channels 29 30 of the said plunger 26, and finally the said springs 71 and 72, acting on the plunger 69, will normally move the head or bracket 65 and parts connected thereto longitudinally, thereby by the engagement of the cams 66 and 68 throwing the head or bracket 65 upward into one or the other of the said grooves 29 30.

73 and 74 indicate oil-holes through which oil may be delivered, respectively, to the plunger 26 and its stem 31. 75 indicates a detachable plug-section which constitutes a portion of the inner end of the barrel 1 and which when removed permits the cut-off blade 62 to be readily slipped into its guides 63.

It will be understood that even if a spark should be produced between the electrode 54 of the igniter upon the closing of the circuit an explosion cannot take place at this time for the reason that the ports 40, controlling the supply of the gas in the explosion-chamber, will not at such time have been opened.

The operation of the mechanism above described will be substantially as follows: The initial air-pressure within the air-storage tube or tank 5 may be produced by giving the plunger 26 several reciprocations, and this may be very readily accomplished by running a ramrod or other long and slender instrument through the barrel 1 and into engagement with the neck 31 or other part of said plunger. This statement should be accepted at this point without question, for it will very soon appear that the said plunger when reciprocated acts as a pump-plunger to force air through the air-supply pipe 60 into the tank or tube 5. Hence we may assume that a gas or carbureted air is contained within the carbureter ready to be forced into the explosion-chamber 25 upon opening the valve 39. As already indicated, the parts normally stand as shown in Fig. 2[a], and the outer end of the sleeve extension 31 of the plunger 26 engages the ball *a*, which is properly located at the inner extremities of the rifle-grooves 21 and cuts off or closes the perforation 20, through which the balls in the magazine are passed into the barrel. When the parts are as shown in Fig. 2[a] and the conditions are as just assumed, the rifle is ready to be fired simply by pulling on the trigger or finger-piece 42. In pulling on the finger-piece 42 the valve 39 will be raised by the arm 44 until the port 41 registers with the ports 40, and thus admits the gas under pressure to rush into and fill the tubular seat 34, neck 32, and explosion-chamber 25, as previously described. This upward movement of the valve also serves to bring the head of the screw 46

into engagement with the spring-contact 55, and thus closes the circuit through the primary electric circuit and induces a current through the secondary circuit. Now as the arm 44 and its spring-finger 51 move on one arc or in one direction and as the shoulder or projection 50 of the detent 47 moves on another arc and in another direction the said shoulder and spring-finger will pass out of engagement as the said valve 39 is forced slightly above a position in which its port 41 registers with the ports 40, and when this takes place the spring 45 will instantly throw the said arm 44 and valve 39 downward to their normal positions, at the limit of which movement the head of the screw 46 will be carried out of engagement with the contact-spring 55, thereby breaking the primary circuit and likewise breaking the secondary current and producing a spark between the electrodes 54, which spark will serve to ignite the gas in the bearing sleeve or tube 34, and consequently also the gas contained in the explosion-chamber of the reaction-plunger 26. It may be here noted that the spring 51, carried by the trigger-arm 44, will yield downward to permit the detent 47 and other parts of the trigger device to assume their normal positions. The force of the explosion of the gas within the explosion-chamber 25 will of course shoot the ball or projectile *a*, which is acted upon, out through the barrel, and the reaction or reacting force of the explosion will kick or force the plunger 26 backward against the tension of the spring 36 and into the position indicated in Fig. 2[b]. Of course it is impossible to positively determine whether or not the reaction-plunger 26 will be forced to its rearmost position before the ball is started through the rifle-section of the barrel; but, nevertheless, it will be forced to its rearmost position some time before the ball leaves the barrel. This rearward or reacting movement of the plunger 26 also serves to carry the cut-off blade 62 from its normal position indicated in Fig. 2[a] into the position indicated in Fig. 2[b], in which position the said blade holds the balls in the magazine backward against the tension of the plunger-spring 24. This movement of the blade is accomplished as follows: The initial part of the rearward movement of the plunger 26 brings the forward wall of its channel 30 into engagement with the forward upper portion of the bracket or head 65 and carries the said head or bracket rearward to its extreme position or slightly farther toward the rear than is shown in Fig. 2[b], in which position the spring 71 is compressed and the cam portion 66 is carried beyond the fixed cam portion 68, so that the said head 65 is under the action of the spring-arm 64 forced downward to its lowest position below and out of engagement with the flange or wall of the plunger 26. At the time when this head or bracket 65 is in its lowermost position toward the rear the said plunger 26 is permitted to complete its movement toward the rear, leaving the said head or bracket standing still until the peripheral groove or channel 29 is brought into line with the said head 65, whereupon the said head becoming free is by the action of the spring 71 forced again slightly forward and by the cam action of the parts 66 and 68 is forced slightly upward into such position that it will be engaged by the rear wall of the groove or channel 29 under the succeeding forward movement of the plunger 26. Two other actions take place under the rearward movement of the plunger 26, which plunger in these actions serves as a pump-plunger. The said rearward movement of the plunger causes the valve 56 to close and the valve 57 to open, thereby forcing the air previously contained in the rear end of the plunger-seat 27 through the pipe 60 and into the air-storage tube or tank 5. Now with this additional statement that the forward movement of the plunger 26 will close or permit to be closed the check-valve 57 and will open the check-valve 56 and draw in air to again fill the rear end of the plunger-seat 27 it will be understood that under successive explosions the air tube or tank 5 will be kept charged with air under pressure. Again, the said rearward movement of the plunger 26 opens the check-valve 59 and draws in air to fill the space left in the forward end of the plunger-seat 27, which space is indicated in Fig. 2[b]. The next forward movement of the plunger 26 will force fresh air into the explosion-chamber 25, and thus displace or discharge the products of the previous combustion, or, in other words, the dead gases left from the last previous explosion.

It will be noted that there is nothing to hold the plunger 26 in its rearmost position, into which it is kicked or forced by the reaction of the explosion. Hence it will of course be understood that the coiled spring 36 will immediately force the said plunger forward to its normal position. Under this forward movement of the plunger the check-valve 58 will freely open, so that the fresh air pumped into the outer end of the seat 27 will then be forced into the explosion-chamber 25 and caused to displace the dead or exploded gases which were left therein after the preceding explosion. These dead or foul gases which are thus displaced will find ready escape through the outer end of the sleeve 31 while the said plunger and sleeve are making their outward movements.

Under the outward movement of the plunger 26 just indicated the rearward wall of the peripheral groove 29 will be engaged with the upper and rear corner of the head or bracket 65 and will thereby move the said head or bracket until its cam portion 66 has passed over the cam 68 and has been forced outward somewhat farther than shown in Fig. 2[a], in which position the spring 72 will be compressed and the said head 65 will under the action of its spring-arm 64 be lowered

so that the intermediate flange or rib between the grooves 29 and 30 may freely pass over the said head 65 and said plunger 26 be permitted to complete its outer movement. These outward movements of the plunger 26 and head 65 and parts carried thereby first cause the cut-off blade 62 to move and open the perforation 20, so that one of the bullets or projectiles may be forced from the magazine through said perforation 20 into the smooth inner extremity of the rifle-barrel, and almost instantly after the said ball has been introduced into the bore of the rifle-barrel the outer end of the tubular neck portion 31 will engage the said ball and force it into engagement with the inner extremities of the rifle-grooves 21, and thereby again cut off or close the passage 20.

When the plunger 26 has been returned to its normal position, its peripheral groove 30 will stand in line with the head or bracket 65, and the spring 72, which was compressed by the extreme movement of the said head 65 backward, will now be permitted to force the said head and cut-off blade 62 again slightly rearward, in which position the said head 65 will be again slightly raised by the cam 68 and will stand in position to be engaged by the outer wall of the plunger-groove 30 when the next explosion takes place.

In Figs. 2, 2^a, and 2^b the electric connections are not completely shown, but portions of the different wires are simply shown, the proper wiring being illustrated in Fig. 4.

From the illustrations above given it is evident that the gun may be fired with great rapidity, inasmuch as the only movement required to be performed by the manipulator is the simple pulling of the trigger or finger-piece 42, all other actions being automatically performed. It is also evident that a repeating rifle capable of holding a very large number of projectiles is made possible, since only the bullets or projectiles are contained within the magazine, the explosive material being supplied from an entirely different source and by devices requiring but very little room as compared with the force capable of being generated.

It is thought that gasolene will be very efficient as a carbureting medium; but we do not limit ourselves to the use of this or any other carbureting liquid or material. On the contrary, we contemplate the generation and use of acetylene gas from calcium carbid and water, and we have also contemplated the generation and use of nitroglycerin by the proper admixture or commingling of nitric acid and glycerin at the proper point for explosion. It will also be understood that we do not limit ourselves to the mechanism above specifically described, which mechanism is, as is obvious, capable of many modifications within the broad scope of our invention. It will also be understood that the invention is capable of being embodied in various sorts and sizes of guns and will be especially well adapted for embodiment in cannon.

What we claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a gun, the combination with an explosion-chamber opening into the gun-barrel, of a magazine for the projectiles, an escapement device operated by the recoil of the gun for controlling the feed of the projectiles into the gun-barrel, a valve controlling the supply of gas to the explosion-chamber, an electric igniter for exploding the charge of gas, and a trigger device for operating said valve and said igniter, substantially as described.

2. In a gun, the combination with an explosion-chamber opening into the gun-barrel, of a magazine for the projectiles, an escapement actuated by the recoil of the gun for controlling the delivery of the projectiles to the gun-barrel, a carbureter having a delivery connection to said explosion-chamber, a feed-valve in said delivery connections, a trigger for operating said valve, and an air-supplying device or connection leading to said carbureter and involving an air-pump which is actuated by the recoil of the gun, substantially as described.

3. In a gun, the combination with an explosion-chamber opening into the gun-barrel, of a magazine for the projectiles, an escapement actuated by the recoil of the gun and controlling the delivery of the projectiles into the barrel, a carbureter delivering into said explosion-chamber, an air-storage tank or receptacle delivering to said carbureter, an air-pump actuated by the recoil of the gun and delivering to said storage vessel, an electric igniter for exploding the delivered charge of gas, a valve in the passage between said carbureter and said explosion-chamber, and a trigger device for controlling said valve and said electric igniter, substantially as described.

4. In a gun, the combination with a movable recoil-plunger provided with an explosion-chamber opening into the gun-barrel, of a magazine for the projectiles, an escapement device actuated by said recoil-plunger and controlling the delivery of the projectiles, a receptacle containing an explosive fluid or basis thereof, connections for delivering the same to said explosion-chamber involving a feed-valve, an igniter for exploding the delivered charge, and a trigger device for controlling said feed-valve and said igniter, substantially as described.

5. In a gun, the combination with a recoil-plunger and a spring yieldingly holding the same forward, of an explosion-chamber formed within said plunger and opening into the gun-barrel, an escapement actuated by said plunger for controlling the delivery of the projectiles to the gun-barrel, a magazine containing said projectiles and provided with

a spring-pressed follower, a carbureter with connections to said explosion-chamber, a feed-valve in said connection, an air-storage vessel with connections for delivering air to said carbureter, an air-pumping device actuated by said recoil-plunger and delivering to said air-storage vessel, an electric igniter for exploding the delivered charge of gas, and a trigger device controlling said valve and said igniter, substantially as described.

6. In a gun, the combination with a reciprocating recoil-plunger formed with an explosion-chamber opening into the barrel of the gun, of valve devices arranged to cause a fresh charge of air to enter said explosion-chamber when the said plunger is reciprocated, substantially as described.

7. In a gun, the combination with a cylindrical breech or block having the seat 27 provided with the inlet-valve 59, of the reciprocating plunger 26 provided with the explosion-chamber 25 delivery-neck 31, an inlet-valve 58, and a spring yieldingly holding the said plunger forward, the said valves 58 and 59 serving to produce a forced charge of fresh air into the explosion-chamber when the said plunger is reciprocated, substantially as described.

8. In a gun, the combination with the breech-block or cylinder 2 provided with the reversely-operating check-valves 56 and 57, of an air-containing receptacle receiving from said valve 57 through a suitable passage, and the reciprocating plunger 26 formed with an explosion-chamber opening into the gun-barrel, a carbureting device receiving the air pumped through said valve 57 and provided with connections for delivering the carbureted gas or air to said explosion-chamber, a valve in said gas-delivery connection, an igniter for exploding the delivered charge of gas, and a trigger device controlling said feed-valve and said igniter, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

MICHAEL BECK.
EMIL FERRANT.

Witnesses:
M. M. McGRORY,
F. D. MERCHANT.