No. 817,197. PATENTED APR. 10, 1906.

M. F. SMITH.

GAS OPERATED MACHINE GUN.

APPLICATION FILED FEB. 21, 1903.

5 SHEETS—SHEET 1.

Fig. 1.

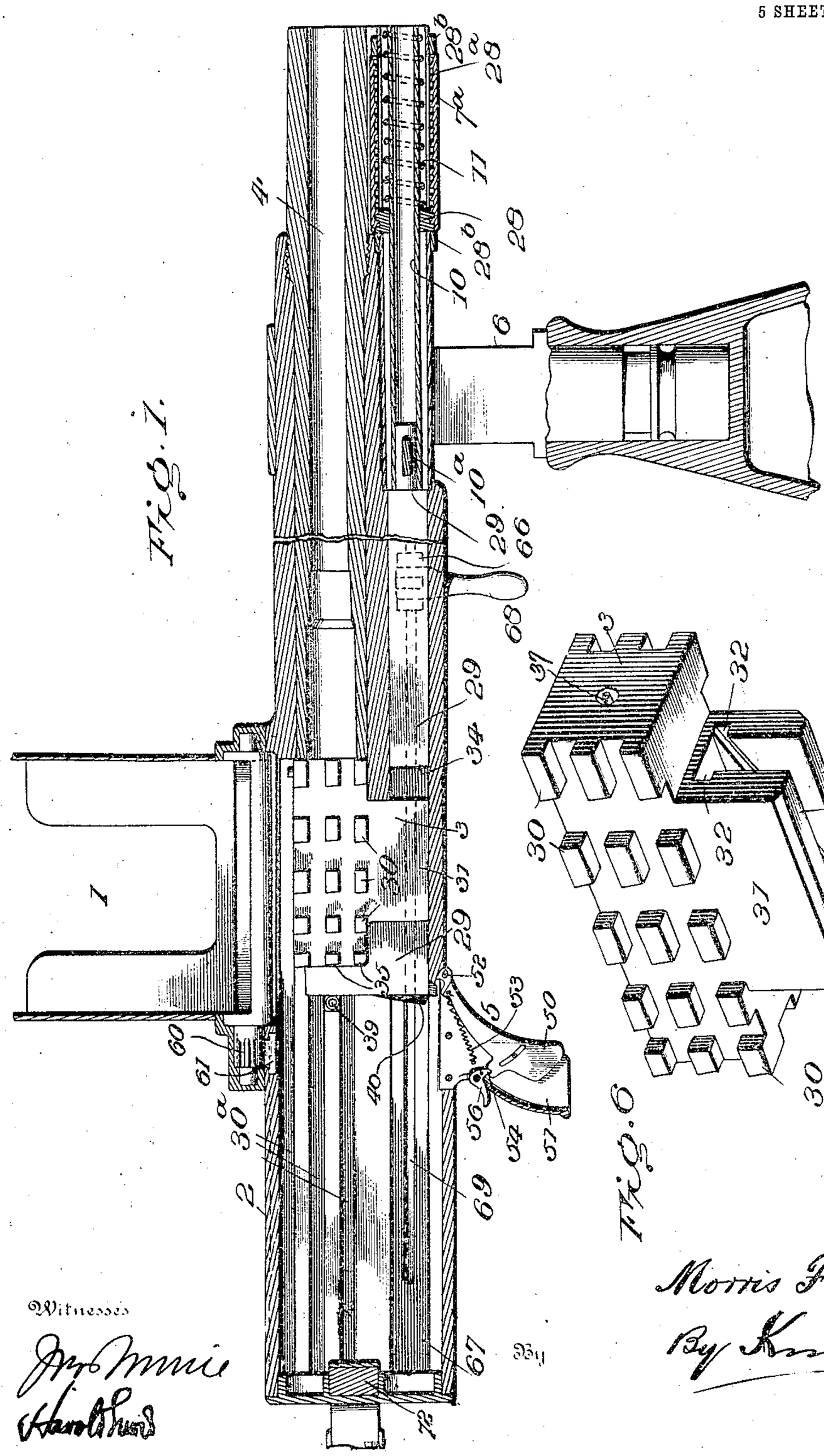

Fig. 6.

Witnesses

Inventor

Morris F. Smith

By Knight Bros

Attorneys

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5 SHEETS—SHEET 2.

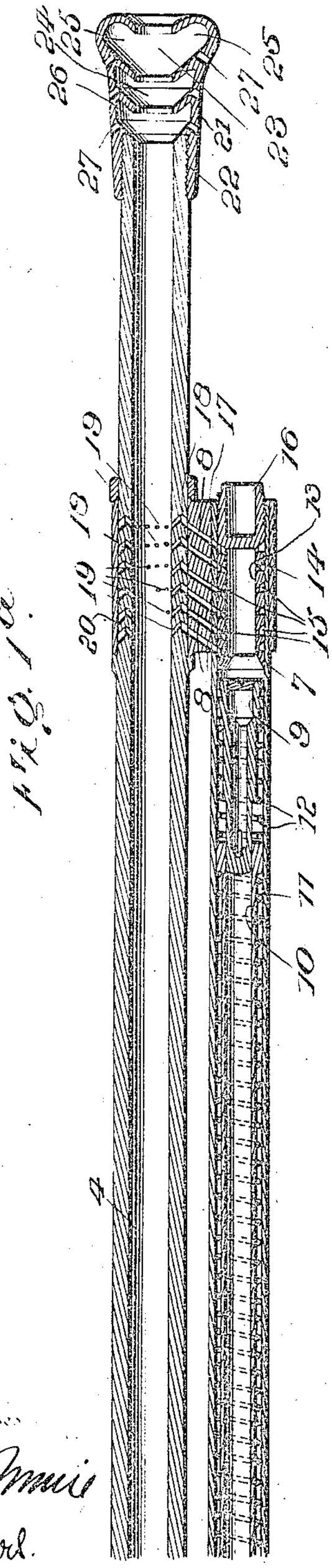

Fig. 1.

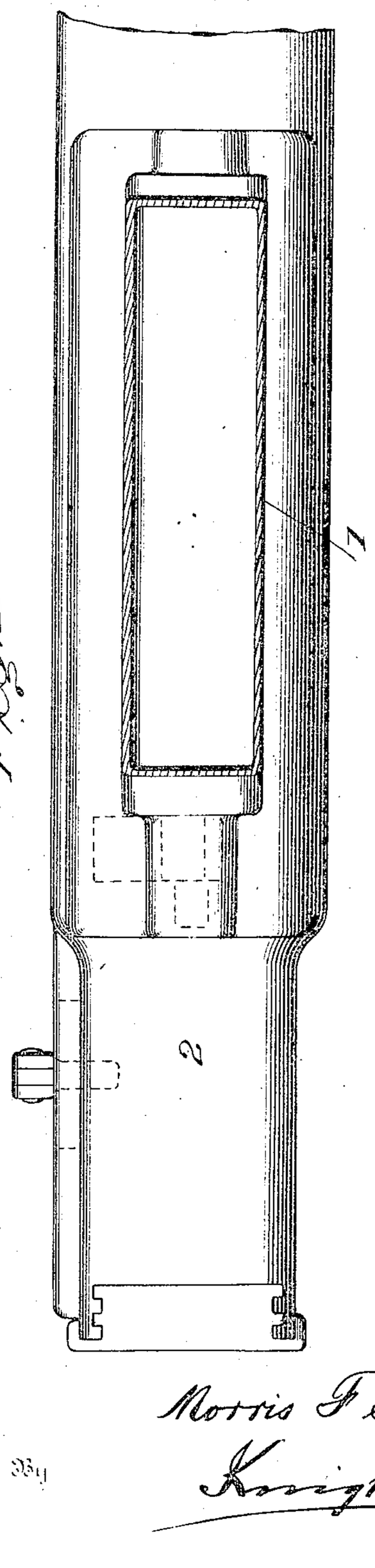

Fig. 2.

Witnesses

Geo. Innis

Harold Ward.

Inventor

Morris F. Smith

By Knight Bros

Attorneys

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5 SHEETS—SHEET 3.

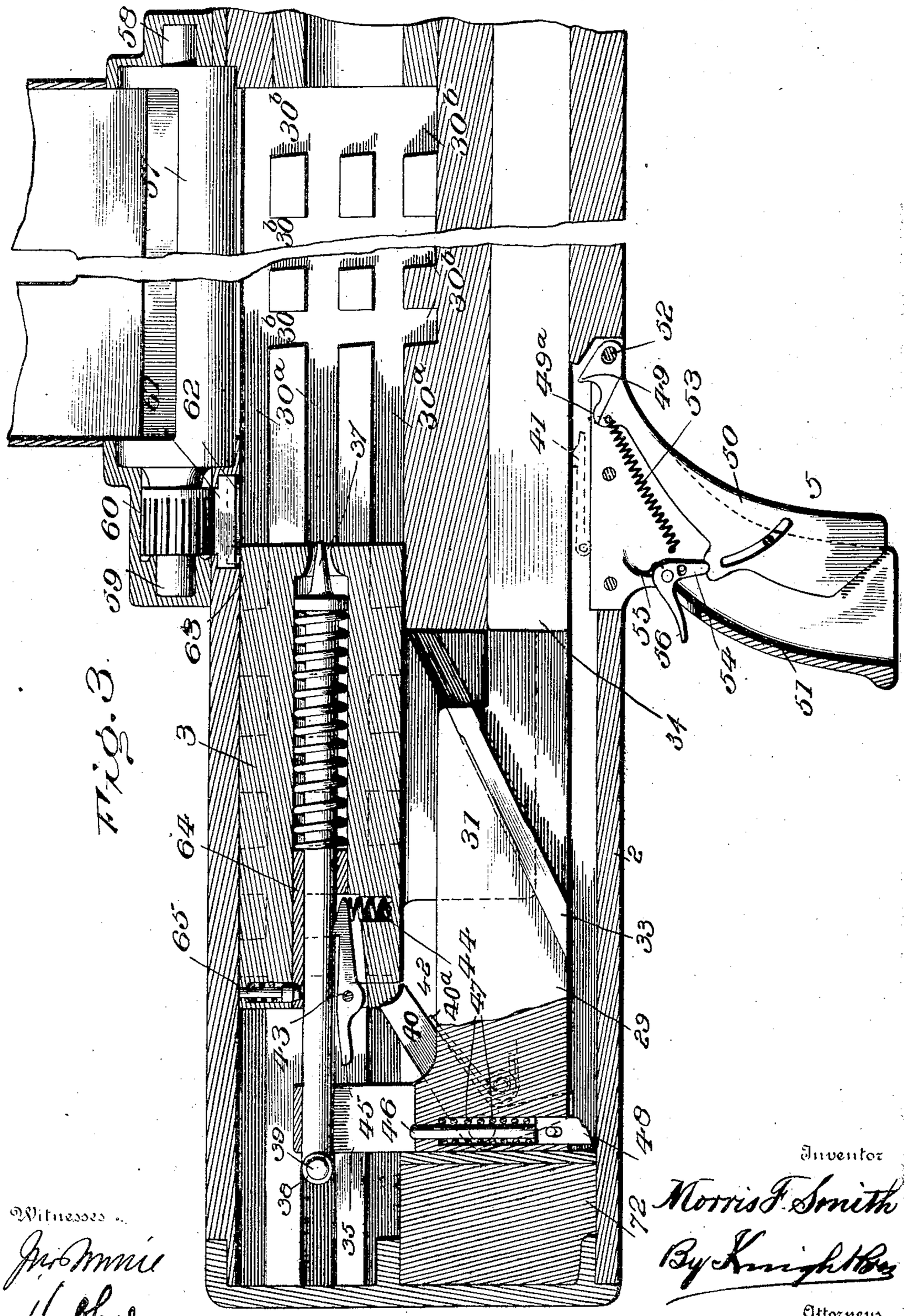

Fig. 3.

Witnesses:

Jno. Arnie

Harold Smith

Inventor

Morris F. Smith

By Knight Bros

Attorneys

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5 SHEETS—SHEET 4.

Fig. 5.

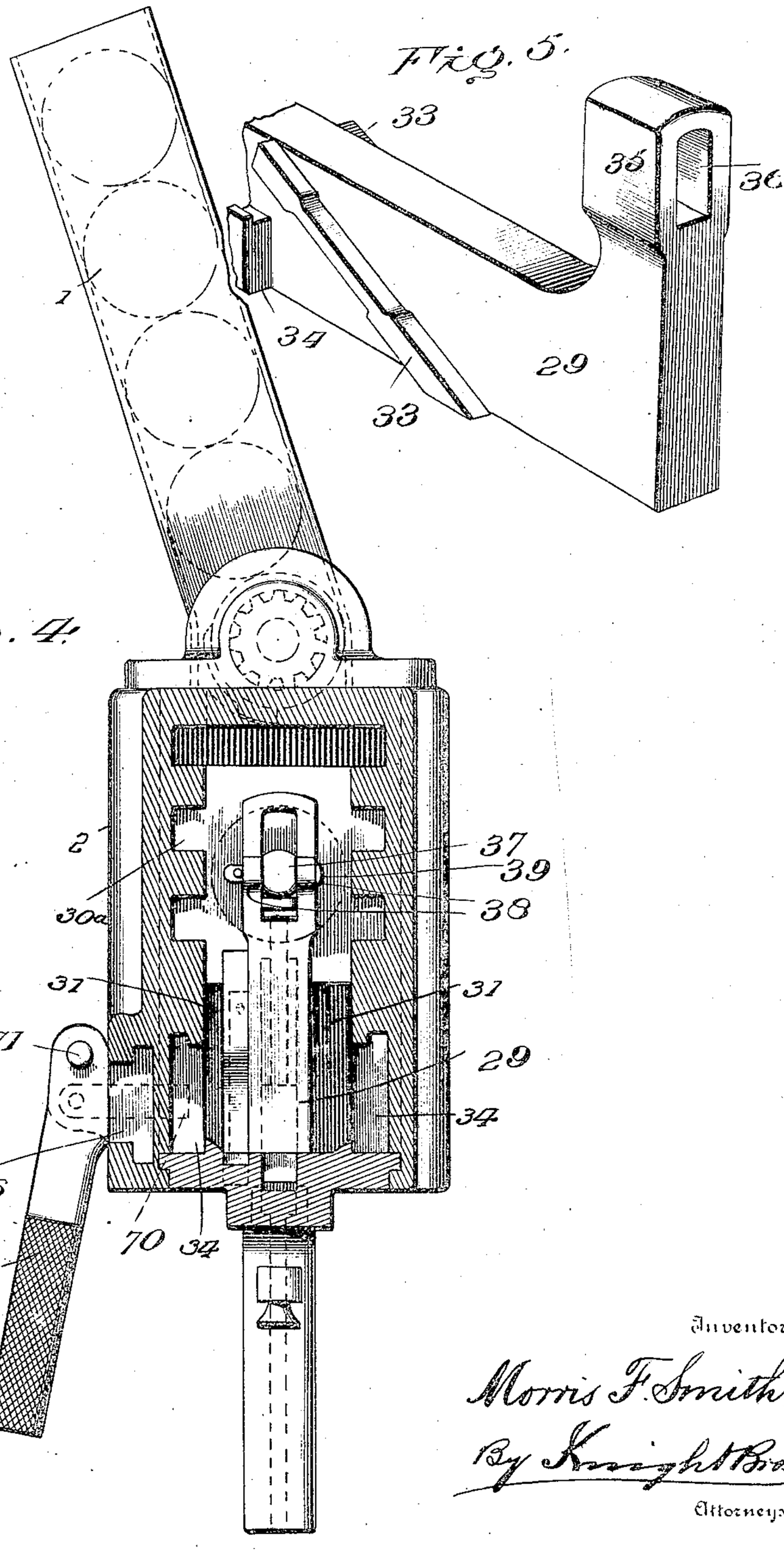

Fig. 4.

Witnesses

Jno. Munn

Harold Hind.

Inventor

Morris F. Smith

By Knight Bros

Attorneys

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5 SHEETS—SHEET 5.

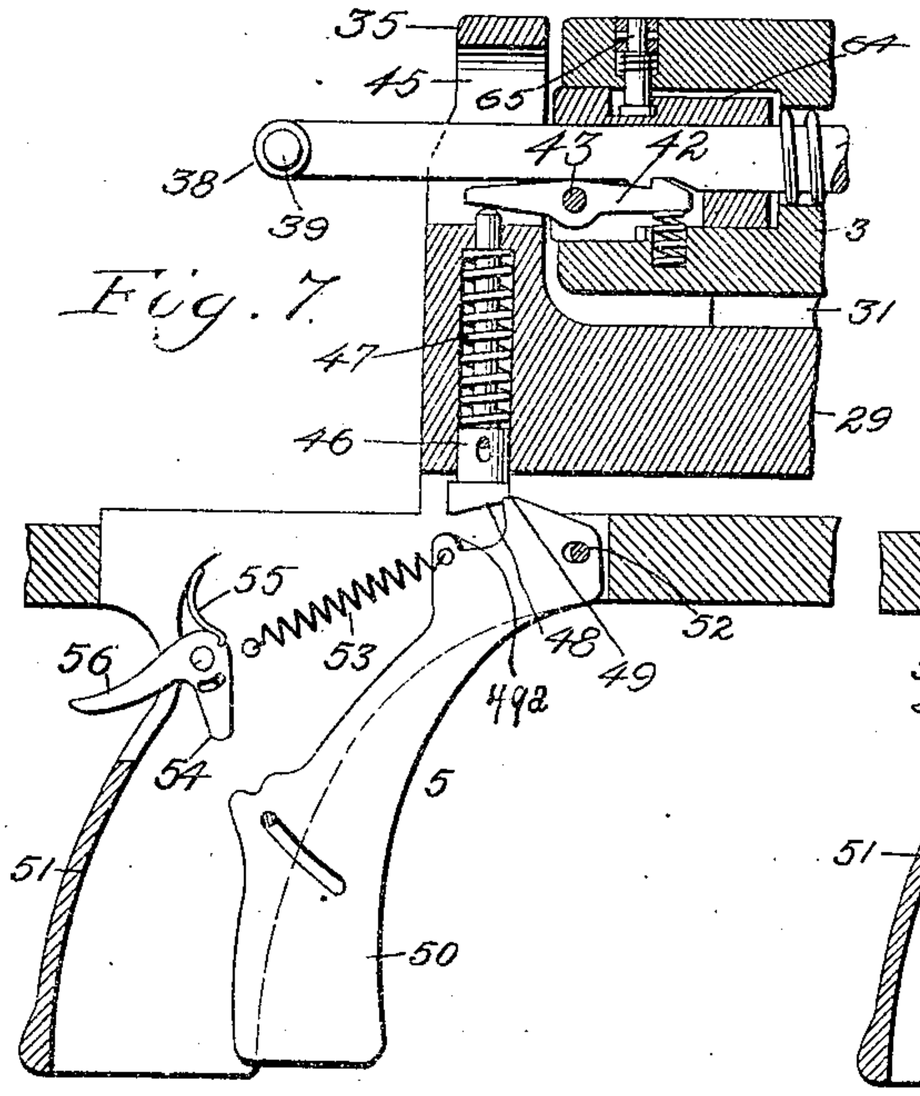

Fig. 7.

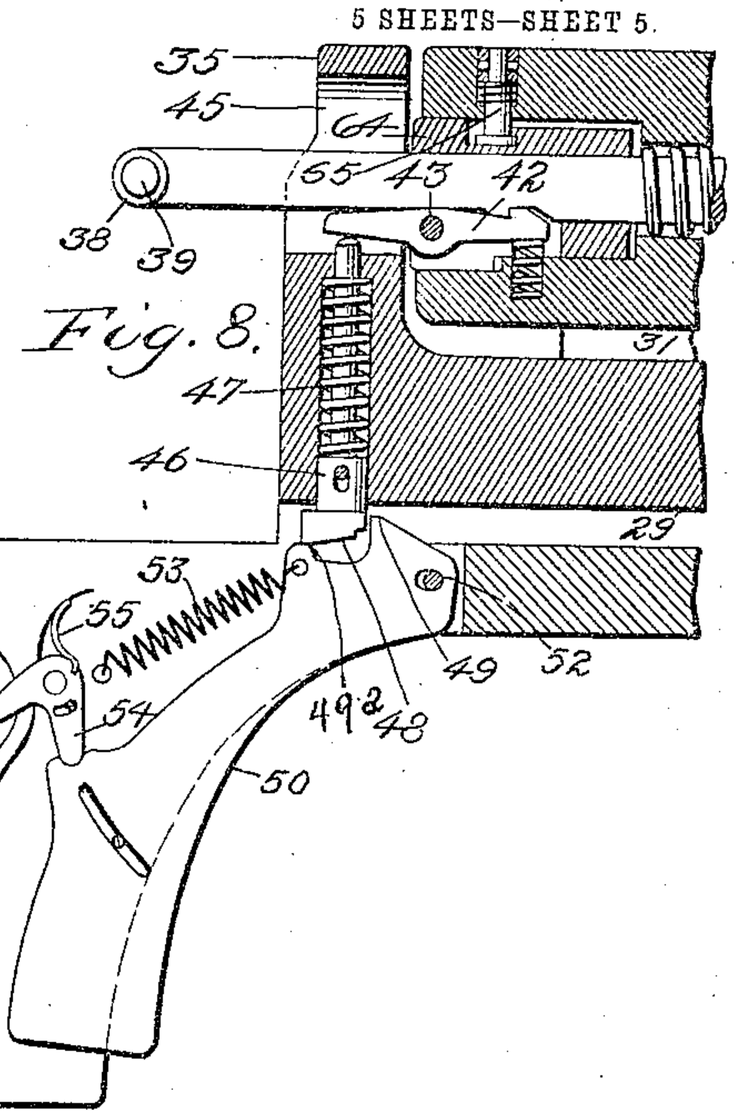

Fig. 8.

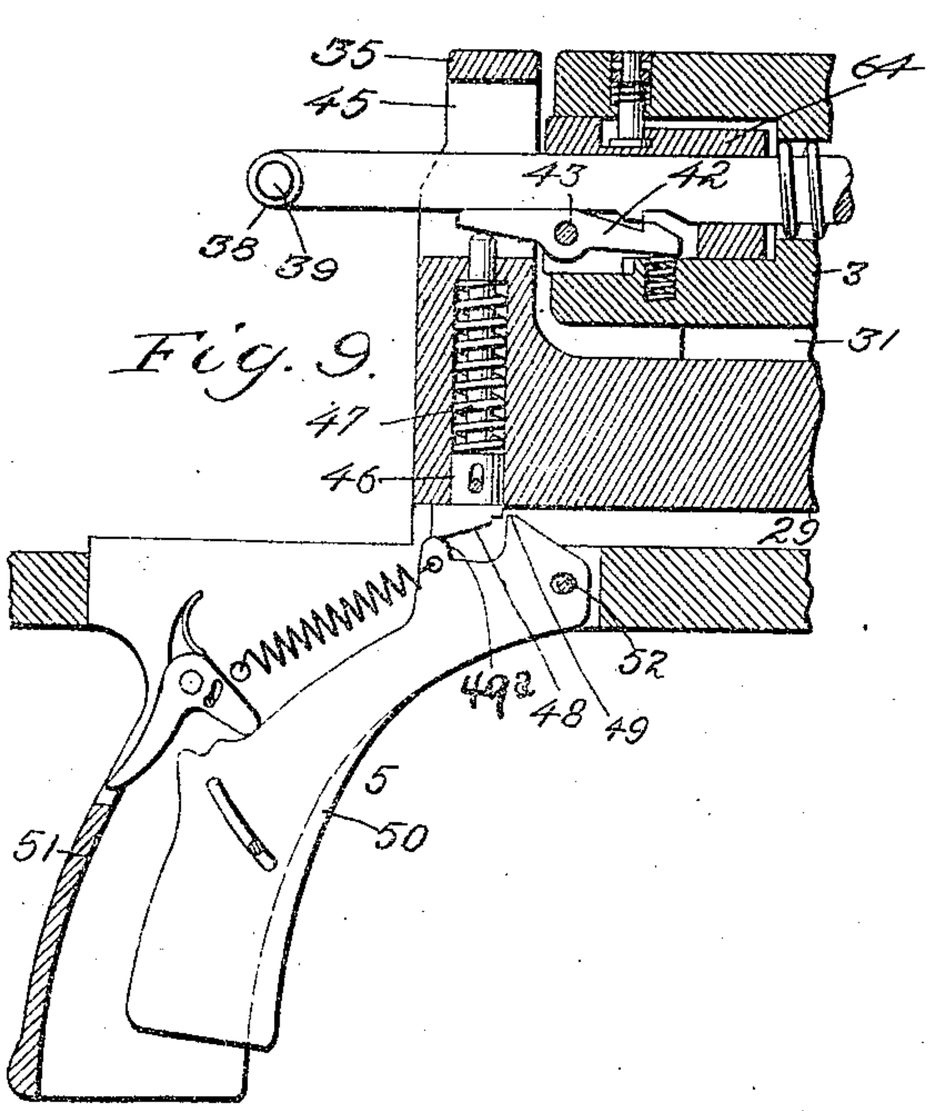

Fig. 9.

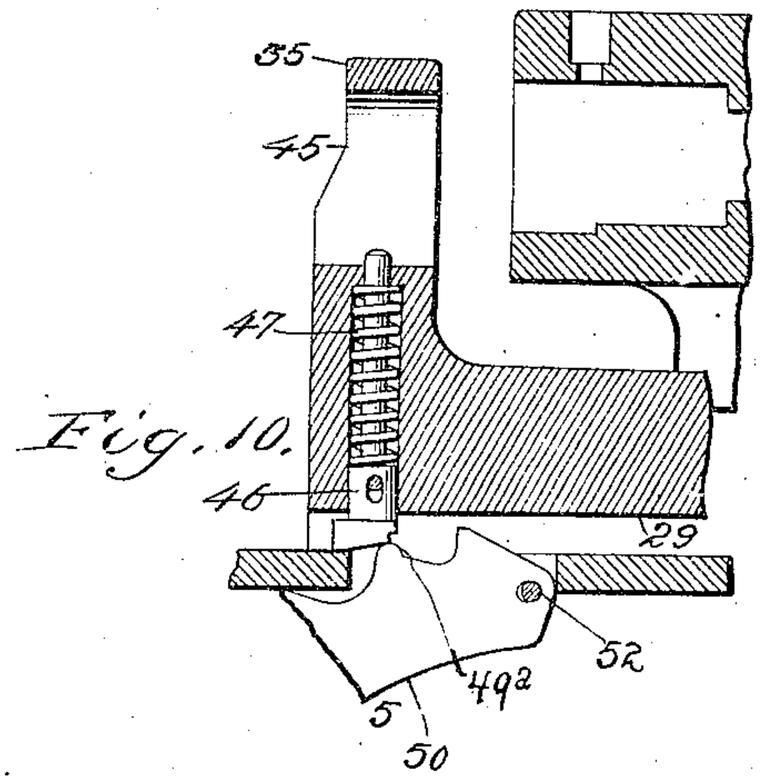

Fig. 10.

Witnesses
Ole Bardeen
H. C. Dennis

Inventor
Morris F. Smith
By Knight Bros
Attorneys

UNITED STATES PATENT OFFICE.

MORRIS F. SMITH, OF PHILADELPHIA, PENNSYLVANIA.

GAS-OPERATED MACHINE-GUN.

No. 817,197. Specification of Letters Patent. Patented April 10, 1906.

Application filed February 21, 1903. Serial No. 144,547.

To all whom it may concern:

Be it known that I, MORRIS F. SMITH, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Gas-Operated Machine-Guns, of which the following is a specification.

This invention relates to automatic or semi-automatic gas-operated machine-guns; and it consists in certain improvements in the construction of several of the working mechanisms employed in such a gun, to wit: The means by which reciprocating motion is developed from the pressure of powder-gases generated in firing the gun and means whereby the powder-gases taken off for this purpose are utilized to partly neutralize recoil, a novel form of muzzle attachment being also employed for completing the neutralization of recoil, the construction of the breech-closing bolt, the means which develops in the bolt vertical locking and unlocking movements, as well as reciprocating opening and closing movements, from the reciprocating movement of the gas-actuated mechanism, and the means whereby firing is controlled, novel mechanism being provided to render the gun semi-automatic or automatic as to firing at will.

My present invention will be fully understood upon reference to the accompanying drawings, in which—

Figures 1 and 1ª are respectively vertical axial sections of the rear and forward portions of the gun. Fig. 2 is a top view of the breech end of the gun. Fig. 3 is a vertical longitudinal section of the receiver and parts working therein on an enlarged scale. Fig. 4 is a vertical transverse section on the line 4 4, Fig. 3. Fig. 5 is a detail perspective view of the reciprocating bar, and Fig. 6 is a perspective view of the breech-bolt. Fig. 7 is a detail view of the firing mechanism, showing the parts in position for single fire before the trigger is pulled. Fig. 8 is a like view showing the position of the parts after the trigger has been pulled for single fire and has not been released. Fig. 9 is a like view showing the position of the parts in continuous firing after the breech-block has returned to firing position and the firing-pin released and about to move forward to strike the firing-cap. Fig. 10 is a detail view showing the position of the parts in continuous firing a short time before the drive-rod reaches its forward position.

1 represents the magazine, which may be of any suitable type constructed to contain and feed fixed charges of ammunition.

2 is the receiver containing the breech-closing mechanism and the firing mechanism and into which charges of ammunition are delivered successively as the breech is opened.

3 is the breech-bolt, which has locking and unlocking, as well as opening and closing, movements in the receiver and which receives a charge in front of it as it moves backward to open the breech.

4 is the barrel suitably joined to the receiver and into which the charge is forced by the forward movement of the breech-bolt.

5 is the trigger mechanism which controls the projection of the firing-pin, and 6 is a mount of a well-known type, which is shown here for purposes of illustration.

I will now proceed to describe the various novel features whereby the several objects of my invention are attained.

For developing a reciprocating motion from the powder-gases a pressure-cylinder 7 is provided having communication with barrel 4 through controllable gas-ports 8, a piston 9 being located in said cylinder in position to receive pressure from said powder-gases at the time of firing and having a piston-rod 10, through which motion is transmitted from the piston to parts to be actuated, and a return-spring 11, surrounding the piston-rod for moving the piston in the opposite direction, a shock absorbing and retarding device being introduced between the piston and its rod—such, for instance, as a compression-spring 12 of suitable strength—for the purpose of taking up the sudden impact of the gas and avoiding the transmission of destructive shocks to the mechanism to be operated and also for retarding the action sufficiently to insure delay in the opening of the breech until after the projectile has left the gun. Control of the ports 8 is accomplished by providing the cylinder 7 with a longitudinally-adjustable lining 13, having ports 14 distant from the ports 8 and connected therewith by circumferential grooves 15 in the periphery of the lining, the lining being moved in or out by its threaded connection 16 to open or close the ports 8 to a greater or less extent and to correspondingly limit the quantity of gas that enters the cylinder during the short interval

of the passage of the projectile. Ports 8 are in the block 17 and communicate with the barrel through annular channels 18, turned in the periphery of the barrel, and apertures 19, bored through the barrel, the channels 18 being closed on the outer side by a sleeve 20. Apertures 19 are multiplied in number in longitudinal series, the circumferential grooves 14 being of like number. This has the important effect of graduating or tempering the admission of gas to the working cylinder, inasmuch as the apertures 19 are uncovered successively by the projectile, and the shock of the gas-pressure in the cylinder is thereby greatly reduced. These apertures 19 may also be multiplied circumferentially and increased in number toward the muzzle, so as to provide a longitudinal series of progressively-increasing circumferential rows of gas-outlets, with the effect of admitting only a small portion of gas for starting the movement of the piston and parts controlled by it and as the inertia of the parts is gradually overcome admitting the full force of the gas to drive the parts to the limit of their movement. This effect is produced in a measure by the longitudinal series of single apertures; but the action may be improved by increasing the number of apertures toward the muzzle, as shown.

Neutralizing recoil action.—Ports 8 are inclined rearwardly, as are also the walls of channels 18, while apertures 19 are inclined forwardly in the direction of flow of gases. Hence gas escaping from the barrel 4 through forwardly-inclined apertures 19 expands and is deflected by the inclined walls in a manner to exert considerable pressure longitudinally of the barrel and in a measure neutralize the recoil action of the gun. It will thus be seen that the gas which has to be taken from the barrel of the gun is manipulated in such a manner as to perform the very important additional function of opposing recoil action. As a further means of neutralizing the recoil action of the gun I provide a novel construction of muzzle-cap 21, consisting of an outwardly-enlarging body threaded or otherwise secured to the muzzle of the gun at 22 and having the longitudinal bore 23 to permit discharge of the projectile. Intersecting the bore 23 are a series of outwardly and forwardly inclined chambers 24 25 26, having rearwardly-inclined escape-openings 27. The angular disposition of the walls of these chambers is such that gas entering each chamber as the projectile passes through it must be deflected by the walls of the chamber and will escape in a rearward direction, causing a reaction in a forward direction, and thereby tending to overcome the recoil of the gun.

Regulating tension on the return-spring may be accomplished by having the rear end of the spring 11 abut against the collar 28, which protrudes through a slot 7^a in cylinder 7 and is formed with teeth engaging with an internally-threaded sleeve 28^a, confined between nuts 28^b. By turning the sleeve 28^a the position of the collar 28 may be shifted so as to regulate the tension of the spring 11.

Actuating the breech-closure.—The breech-bolt 3 moves transversely to the bore of the gun (I have shown it moving vertically) for locking and unlocking it in a closed position, and it moves longitudinally of the gun to open and close the breech. In order to securely lock the breech-bolt in position and also to guide it in its locking and unlocking as well as its longitudinal reciprocating movements and for the further purpose of affording an ample margin of safety in the resisting power of the breech-bolt and, furthermore, for insuring an accurate sliding movement the breech-bolt is provided with locking means on opposite sides—such, for instance, as lugs 30, engaging in longitudinal grooves 30^a and in vertical grooves 30^b. (See Fig. 3.) These grooves define the movement of the breech-bolt, and when the breech-bolt reaches the forward end of its longitudinal movements its lugs come opposite the vertical grooves 30^b and permit the bolt to move downward to a firm seat in locked position. The lugs 30 are multiplied in transverse as well as longitudinal series in order to better serve the purposes just stated, and the horizontal dimensions of the several lugs increase toward the front end of the bolt, as also do the vertical grooves 30^b, so that as the bolt moves from and to the forward limit of its movement there is no tendency of any of the lugs to enter any of the grooves other than those to which they are fitted. The rear faces of some or all of the lugs and the rear faces of corresponding vertical grooves may be beveled or inclined slightly in order to facilitate entry of the lugs into the grooves and to cause a firm seating by wedging action, the angle of these bevels, however, being too slight to cause any tendency of the bolt to slide vertically under the rearward pressure of the powder-gases in a longitudinal direction. In order to impart these vertical locking and unlocking movements and longitudinal opening and closing movements to the breech-bolt, the rear end of the piston 10 is connected by a key 10^a, Fig. 1, with a reciprocating bar 29, traveling in a suitable guide in the bottom of the receiver 2, and the breech-bolt 3 is provided with a depending yoke 31, having cam-grooves 32 on its opposed inner faces, which receive cams 33 on opposite sides of the bar 29. These cams 33 are preferably coextensive with the grooves 32, and elongated bearings are provided between these parts which will avoid the tendency of the breech-bolt to tip, the yoke 31 being located at an intermediate point on the under side of the breech-bolt to further insure a balanced effect. The result thus ob-

tained by this disposition and construction of these parts is further insured by the symmetrical distribution of the locking-lugs and their coöperating grooves on opposite sides of the breech-bolt, as already referred to.

From the construction and relation of these parts it is obvious that rearward movement of the bar 29 by the action of powder-gases on the piston 9 will be converted by the cams 33 in the grooves 32 into a vertical movement in the breech-bolt 3 so long as vertical movement is permitted by the grooves 30^b, after which continued rearward movement of the bar 29 imparts rearward movement to the breech-bolt in the grooves 30^a. In order to arrest the cam action at the completion of the unlocking movement and prevent undue friction of the lugs in the longitudinal grooves, the bar 29 is provided with shoulders 34, which abut against the forward end of the yoke after the cam action has taken place and thereafter transmit the thrust of the bar against the bolt. During the cam action of the bar 29 in the breech-bolt the bar is necessarily moving rearward relatively to the breech-bolt, and this motion is utilized to cock the gun, for which purpose the bar 29 carries a horn 35 upon its rear end, formed with a longitudinal opening 36, through which the firing-pin 37 protrudes, the firing-pin carrying upon its rear end a suitable enlargement formed by antifriction-rolls 38, mounted upon a pin 39, extending through the end of the firing-pin. Inasmuch as the breech-bolt, with its firing-pin, is moving vertical during this relative rearward movement of the bar 29 and the cocking of the pin, the opening 36 is elongated vertically, and in this vertical movement of the pin relatively to the horn 35 the antifriction-rollers 38 travel upon the rear face of said horn.

As soon as the rearward movement of the breech-bolt is completed the return-spring 11 moves the piston-rod 10 forward. At this time the cam action would again come into play and tend to move the bolt downward, causing undue friction of the lugs in the longitudinal grooves; but to avoid this the bar 29 carries a dog 40, which is tripped up behind the breech-bolt by a spring 40^a immediately after the relative movement between the bar and the breech-bolt, which causes the unlocking of the latter, and is in a position to take the entire thrust of the bar against the breech-bolt in the forward closing movement, this dog 40 being tripped out of engagement with the breech-bolt by a cam 41 as soon as the forward movement is completed, so that the bar 29 is thereafter free to continue its forward movement relatively to the breech-bolt and cause the cam action which forces the breech-bolt to its seat in locked position.

Single and continuous firing of the gun is attained at will by having a sear 42 pivoted at 43 and tilted to engage with the firing-pin by means of a spring 44, but having a tail 45, which when the parts are in locked position projects above trigger and sear connector or push-pin 46, held normally downward by a spring 47 and having its lower end 48 stopping in position to be controlled by a trigger 49. When the gun is to be operated for single firing—that is to say, fulfilling all of its functions up to the point of projecting the firing-pin to fire the gun, which last step in the single firing is to be accomplished at will of the gunner—the push-pin 46 stands immediately above the trigger-point 49 in such position that upon raising the latter the push-pin 46 will be elevated and the sear 42 will be disengaged from the firing-pin. The trigger 50, which controls the trigger-point 49, is made to conform to the grip 51 and during the rapid action of the gun will not be released promptly enough to bring its point 49, which has passed beyond the path of the push-pin 46, beneath the end 48 of the push-pin, for which reason the trigger has an elongated bearing on its fulcrum-pin 52, so that when the trigger 50 is released the point 49 will readily pass beneath the end 48 of the push-pin under the action of the spring 53 into position for firing the gun.

54 represents a releasable stop which is held normally in the path of the trigger 50 under the action of a spring 55, so that the pull of the trigger 50 is normally limited, so as to cause the action just referred to in connection with the single-fire action. If it is desired to prepare the gun for continuous firing, the stop 54 is removed from the path of the trigger 50 by depressing the thumb-piece 56, after which the trigger 50 may be pressed still closer to the grip 51 to cause a horn 49^a to be brought into the path of the end 48 of the push-pin 46, so that as the bar 29 moves forward to the point where the breech-bolt will have been thoroughly seated in locked position the end 48 rides up upon the horn 49^a and releases the sear 42 automatically. This arrangement for shifting from single to continuous firing will be found very effective and convenient in use, as the action is merely the modification of the gunner's grip, it being obvious that under the more strenuous action of full automatic operation of the gun a mere increase of the hold will come very naturally to the gunner and will require a little thought to produce the effect.

Automatically feeding the ammunition is accomplished through the means of a gate 57, trunnioned at 58 59 in the lower part of the magazine 1 and carrying upon its trunnion 59 a pinion 60, which engages with a correspondingly-toothed upper surface of a transversely-reciprocating block 61, which has a cam-groove 62 in its lower surface engaged by a pin 63 in the upper portion of the breech-

bolt. Each time the breech-bolt moves to open position the gate 57 swings and releases one charge of fixed ammunition, so that the latter drops in front of the bolt in position to be forced into the barrel, the gate being returned to normal position by the forward movement of the breech-bolt.

Other minor details of construction are disclosed in the drawings, which, while not of the essence of my invention, are preferably used in the construction of a gun of this character. The firing-pin 37 is preferably confined with its projecting spring by a lining 64, as shown in Fig. 3, which lining is held in place by a spring-pressed locking-pin 65 entering a recess in the lining. This construction affords a convenient means of removing the firing-pin on short notice.

The object of using the key connection 10^a, already referred to, and which is disclosed in Fig. 1, is to permit ready disconnection between the piston-rod 10 and the bar 29, so that the breech-bolt may be operated and the several functions of loading and firing carried out by hand should the gas-operated mechanism become disabled. To accomplish the hand operation, I provide a block 66, sliding in a groove 67 and having a handle 68, having a connection with said block, which works in a slot 69 in the side of the receiver, said handle also carrying a connecting-pin 70, which by swinging the handle outward upon its pivot 71 and sliding the block 66 to the upper position may be made to engage in a recess in the reciprocating bar 29, after which said bar, and through it the breech-bolt and the other mechanism, may be operated by hand.

72 represents a buffer located in the rear end of the receiver 2, which arrests the rearward movement of the parts through the medium of the reciprocating bar 29.

Having thus described my invention, the following is what I claim as new therein—

1. In a gas-operated machine-gun, a cylinder containing a piston which actuates working mechanism in the gun, and having communication with the barrel through a plurality of gas-transmitting apertures arranged one in advance of another longitudinally of the gun and increasing in number toward the muzzle, whereby the admission of gas is graduated.

2. In a gas-operated machine-gun, a pressure-cylinder into which gas is introduced from the gun to perform work, having communication with the barrel through a plurality of circumferential series of openings or apertures.

3. In a gas-operated machine-gun, a cylinder in which gas is admitted for the performance of work, having communication with the barrel through a plurality of circumferential series of apertures arranged one series in advance of the other, and with the apertures in the several series increasing in number toward the forward end of the gun.

4. In a gas-operated machine-gun, a cylinder communicating with the barrel of the gun, and receiving gas-pressure therefrom to perform work; such communication being effected through a longitudinal series of apertures, and the cylinder being provided with a lining having corresponding apertures but movable longitudinally to regulate the opening of the apertures from the gun.

5. In a gas-operated machine-gun, a cylinder containing a piston having connections for actuating gun mechanism, ports through which the gas is delivered to said cylinder from the barrel of the gun, a lining in said cylinder formed with ports circumferentially distant from the ports leading from the gun-barrel, and circumferential grooves affording communication between the ports in the lining and those leading from the gun-barrel.

6. In a gas-operated machine-gun, a cylinder containing a piston operated by gas-pressure to perform work; said cylinder communicating with the gun-barrel through suitable ports and having arranged therein a longitudinally-adjustable lining formed with circumferential grooves corresponding to the ports, and openings through the lining connecting the grooves with the interior of the cylinder.

7. In a gas-operated machine-gun, a cylinder containing a piston, communicating with the barrel of the gun to receive gas-pressure therefrom to perform work; such communication being through the medium of forwardly-inclined apertures in the gun-barrel, rearwardly-inclined circumferential channels surrounding the gun-barrel, into which said apertures discharge, and ports leading from said channels to the cylinder.

8. In a gas-operated machine-gun, the combination of the gun-barrel, having forwardly-inclined apertures for the escape of gas, rearwardly-inclined circumferential channels with which said apertures communicate, and a surrounding sleeve or jacket closing said channels; a spacing-block having ports communicating with said channels, and a cylinder containing a piston operative under gas-pressure, communicating with said ports.

9. In a machine-gun, the combination with the breech-bolt having a yoke, with cam-grooves therein, and a reciprocating bar having cams working in said grooves; the cams being substantially coextensive with the grooves, whereby the breech-bolt is prevented from tipping relatively to the bar.

10. In a machine-gun, the combination of the reciprocating and transversely-moving breech-bolt having locking means symmetrically disposed on opposite sides thereof, and having a yoke projecting in an intermediate position from said breech-bolt, with cam-

grooves in the yoke, and a reciprocating bar having cams engaging in the cam-grooves and coextensive therewith transversely and longitudinally of the grooves.

11. In a gun, the combination with a breech-bolt, a drive-bar and a cam connection between the bolt and the bar causing them to move toward and from one another transversely to cause a locking of the breech-bolt in closed position, of means carried by the drive-bar and engaging the breech-bolt after their relative movement to unlock the breech-bolt, to form a positive connection between the drive-bar and the breech-bolt upon the return movement of the breech-bolt and prevent a wedging action of said parts in the gun-frame.

12. In a machine-gun, the combination of a breech-bolt having longitudinal movements and transverse movements toward and from the path of the longitudinal movements; a reciprocating bar; a cam connection between said bar and said breech-bolt for imparting transverse movements to and from the same by relative movement of said bar; a shoulder or abutment on said bar for imparting movement to the breech-bolt after completion of transverse movement of the bolt in one direction; and means imparting longitudinal movement to the breech-bolt in the other direction independently of the cam action.

13. In a machine-gun, the combination of the breech-bolt provided with a firing-pin and having longitudinal movements and transverse movements toward and from the path of the longitudinal movements, a reciprocating bar having a horn through which said firing-pin projects for the purpose specified, a cam connection between said bar and the breech-bolt imparting to same transverse movements to and from the bar by opposite movements of the bar relatively to the breech-bolt, a shoulder or abutment carried by said bar adapted to engage said bolt upon completion of its transverse movement in one direction, and a yielding or releasing means imparting movement to the breech-bolt independently of the cam and in a longitudinal direction as the bar moves longitudinally in the opposite direction.

14. In a machine-gun, the combination of the breech-bolt adapted to move longitudinally in opposite directions, a reciprocating bar provided with a cam connection with said breech-bolt for imparting transverse movements thereto, to and from the bar, and a releasable dog carried by said bar for imparting longitudinal movement to the breech-bolt independently of the cam action.

15. In a machine-gun, the combination of the breech-bolt capable of longitudinal movements and transverse movements to and from the path of the longitudinal movements, a reciprocating bar, a cam connection between the bar and the block through which transverse movement is imparted to said breech-bolt, a releasable dog carried by the reciprocating bar for imparting longitudinal movement to the breech-bolt in one direction, and a tripping means for said dog.

16. In a machine-gun of the character described, the combination of the breech-bolt capable of longitudinal and transverse movements and having a firing-pin, a reciprocating bar having connection with said breech-bolt for moving same, and a horn on said bar having an opening through which the firing-pin projects and engaged by said firing-pin for the purpose set forth.

17. In a machine-gun, the combination of the breech-bolt having transverse and longitudinal movements, a reciprocating bar imparting movement to the breech-bolt, and having a horn with an opening therein elongated in the direction of the transverse movement of the breech-bolt and the firing-pin in said breech-bolt projecting through said opening and engaging with the horn.

18. In a machine-gun, the combination of the breech-bolt having the firing-pin and a sear, a reciprocating bar adapted to move said breech-bolt and provided with a horn through which the firing-pin projects for the purpose specified, a push-rod adapted to engage said sear, and means for controlling said push-rod.

19. In a machine-gun, the combination of a breech-bolt, having a firing-pin, and a sear, a reciprocating bar adapted to move said bolt and provided with a horn for engaging said firing-pin as specified, and a push-pin mounted on a part with which the bolt has relative movement and in a position which brings it in controlling relation to the sear, as said breech-bolt arrives in locked position.

20. In a machine-gun, the combination of a breech-bolt having a firing-pin, and a sear mounted thereon, a push-pin also mounted on a moving part and moving into controlling relation with the sear as the parts approach firing position, and means for moving said push-pin brought into controlling relation therewith as the parts reach said firing position.

21. In a machine-gun the combination of a breech-bolt and a firing-pin and a sear, a reciprocating bar for moving said breech-bolt and provided with means for setting the firing-pin, a push-pin for said sear mounted on a moving part and brought into controlling relation therewith as the breech-bolt reaches its dropped position, and a trigger device controlling said push-pin.

22. In a machine-gun, the combination of a breech-bolt reciprocating in the gun, and carrying a firing-pin and a controlling-sear, a push-pin controlling said sear, and also

mounted on a reciprocating part, and a device in the path of said push-pin causing it to release the sear as the breech-bolt reaches its locked position.

23. In a machine-gun, the combination of a reciprocating breech-bolt, a reciprocating bar controlling the movement of said breech-bolt, a firing-pin and sear mounted on the breech-bolt, a push-pin mounted on the reciprocating bar, and brought into controlling relation with the sear by the movement of said bar, and means for causing the push-pin to release the sear.

24. In a gun, the combination with the breech-block and a drive-bar for operating the breech-block movable relatively to the same, of a firing-hammer carried by the breech-bolt, a sear for the hammer carried by the breech-bolt, a trigger mounted on the frame, and means carried by the drive-bar forming a connection between the trigger and the sear.

25. In a gun, the combination with the breech-block and a drive-bar movable relatively to one another to unlock the breech-block, of a firing-hammer carried by the breech-block, a sear also carried by the breech-block, a trigger for the sear, and means carried by the drive-bar forming a connection between the sear and the trigger and moved out of connection with the sear on the relative movement of the drive-bar and the breech-block.

26. In a gun, the combination with the breech-block and an automatically-operated part movable relatively to one another, of a hammer carried by the block, a sear for the hammer carried by the breech-block, a trigger mounted on the frame for operating the sear when the breech-block is in closed position, and means carried by the automatically-operated part for connecting the trigger with the sear, said means being moved with the automatically-moving part out of connection with the trigger when the breech is opened.

27. In a gun, the combination with the breech-block and a drive-bar, movable relatively to one another to unlock the block, of a hammer carried by the breech-block, a sear for the hammer also carried by the breech-block, a trigger mounted on the frame in a position to operate the sear when the breech-block is in closed position, and means carried by the drive-rod acting as a connector between the sear and the trigger when the breech is in closed position and moved with the drive-bar out of connection with the sear and with the trigger when the drive-bar is moved to open the breech.

28. In a gun the combination with the breech-bolt, the firing-hammer, the sear, a sear-tripping means and a reciprocating part setting the firing-hammer and moving the sear-tripping means, of a trigger having two movements, one of which causes the operation of the sear through the tripping means on separate pulls of the trigger only, and the other of which causes the tripping of the sear through the tripping means on every return of the parts to firing position.

29. In a gun, the combination with the firing-hammer, the sear, a trigger, and a sear-tripping means, of a part movable to set the firing-pin and move the sear-tripping means, and a stop for the trigger in one position permitting the trigger to operate the sear through the tripping means on separate pulls of the trigger only and in another position to permit the trigger to move to a position so as to actuate the sear through the tripping means on every return of the parts to firing position.

The foregoing specification signed this 4th day of February, 1903.

MORRIS F. SMITH.

In presence of—
HERVEY S. KNIGHT,
EDWIN S. CLARKSON.