No. 780,216. PATENTED JAN. 17, 1905.

S. N. McCLEAN.

GUN.

APPLICATION FILED JULY 14, 1900.

4 SHEETS—SHEET 1.

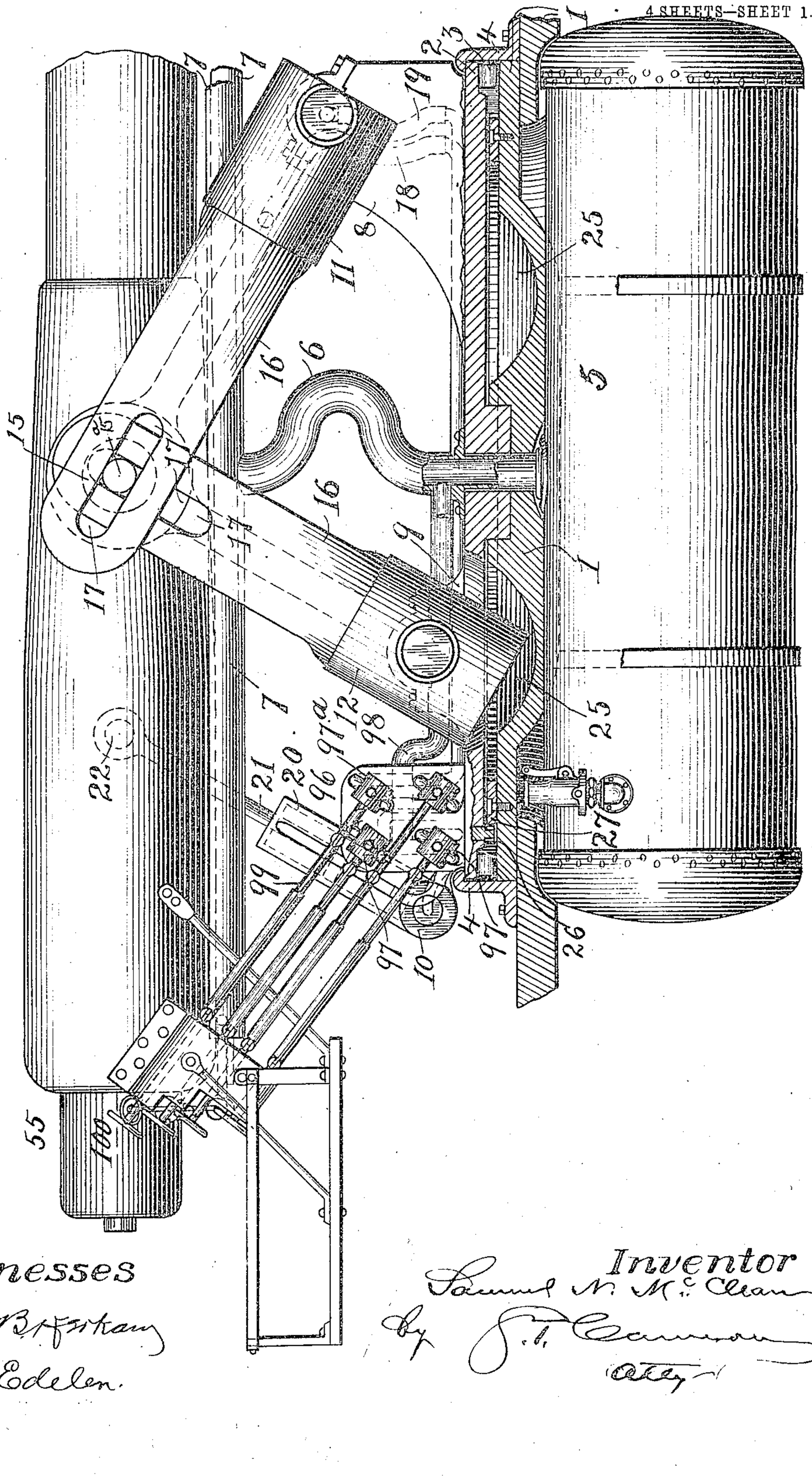


Fig. 1.

Witnesses

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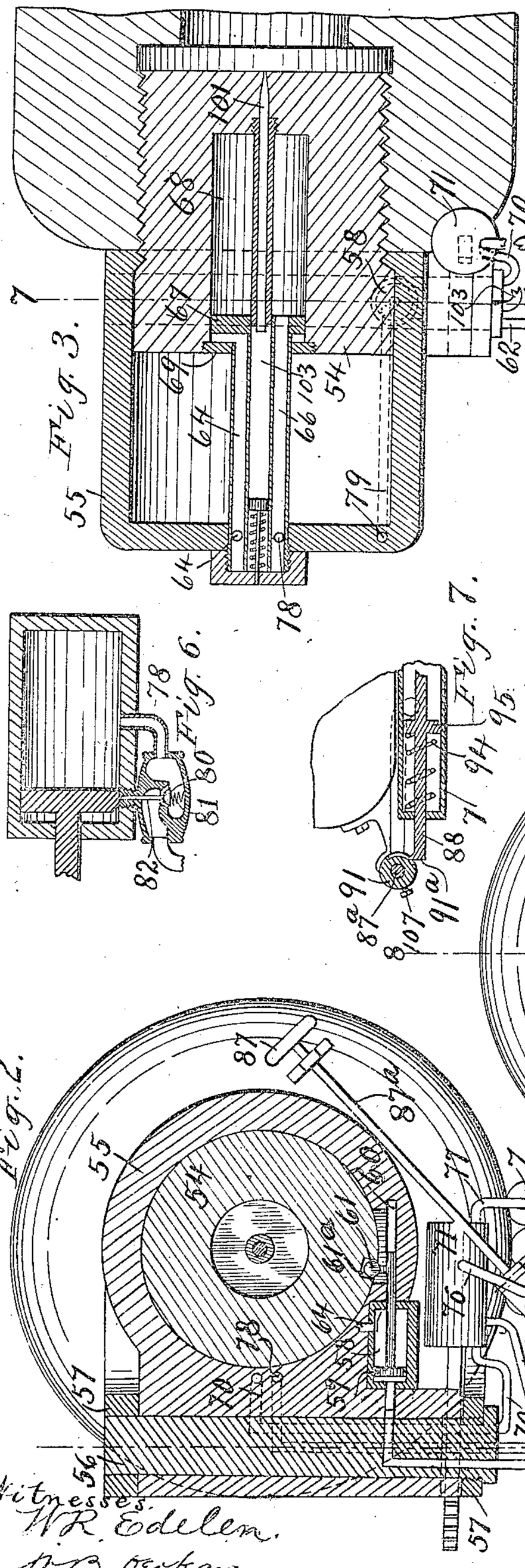
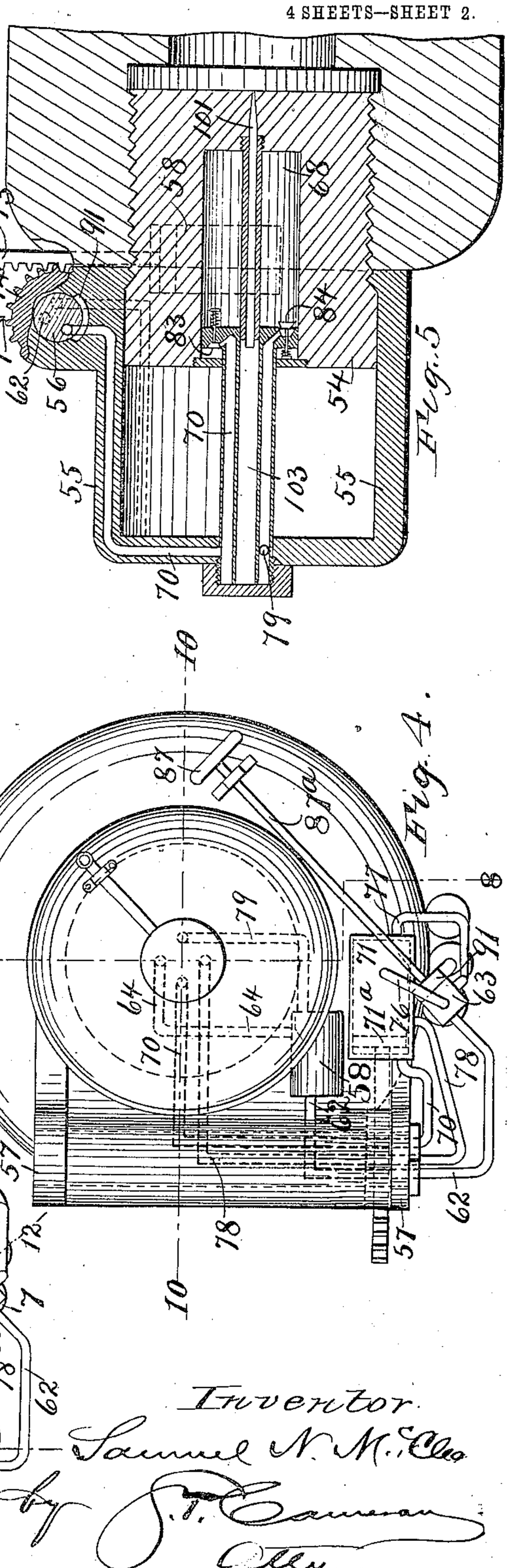
4 SHEETS—SHEET 2.













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4 SHEETS—SHEET 3.

Fig. 11

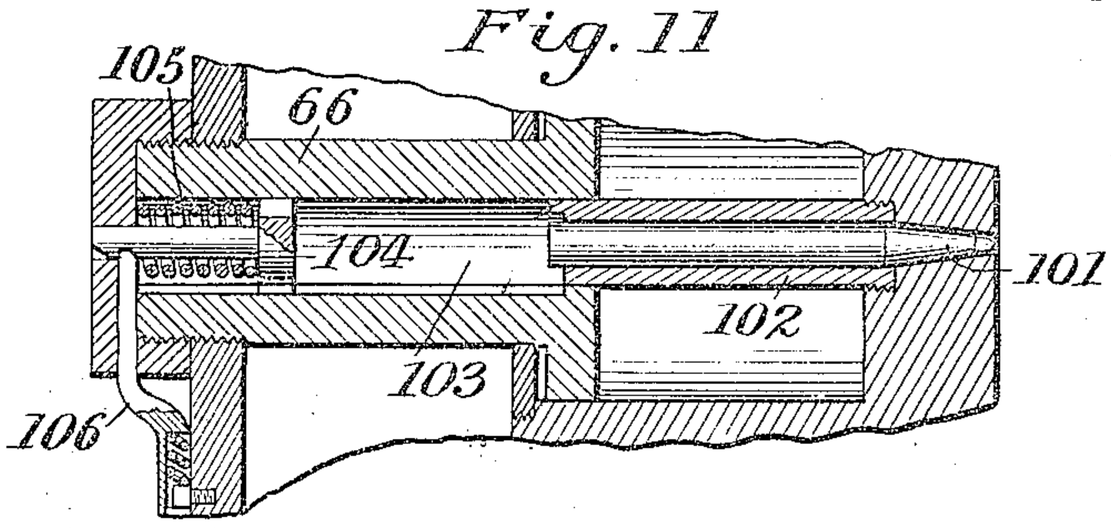



Fig. 8.

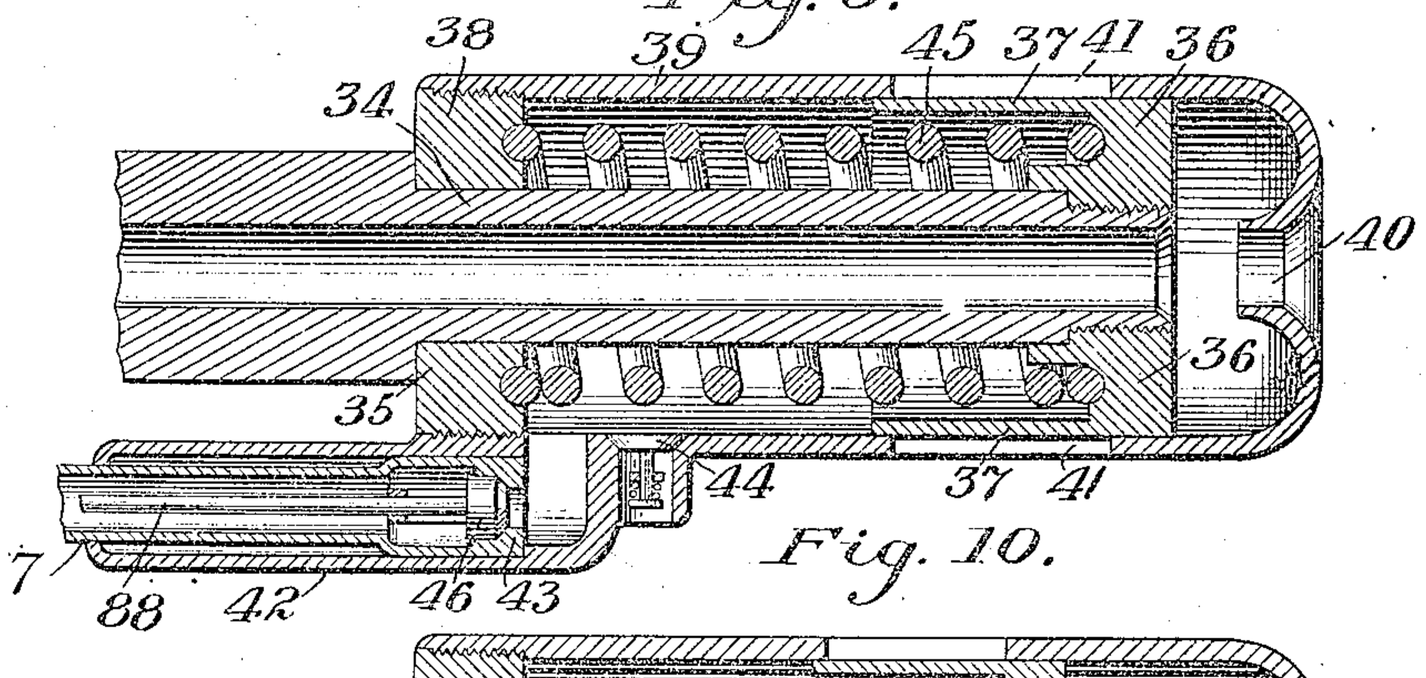



Fig. 10.

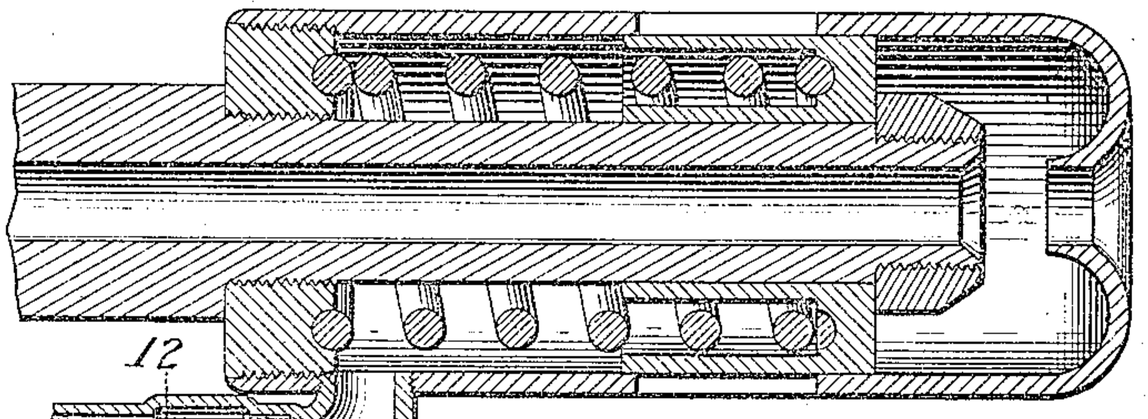
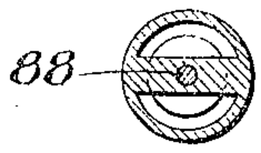
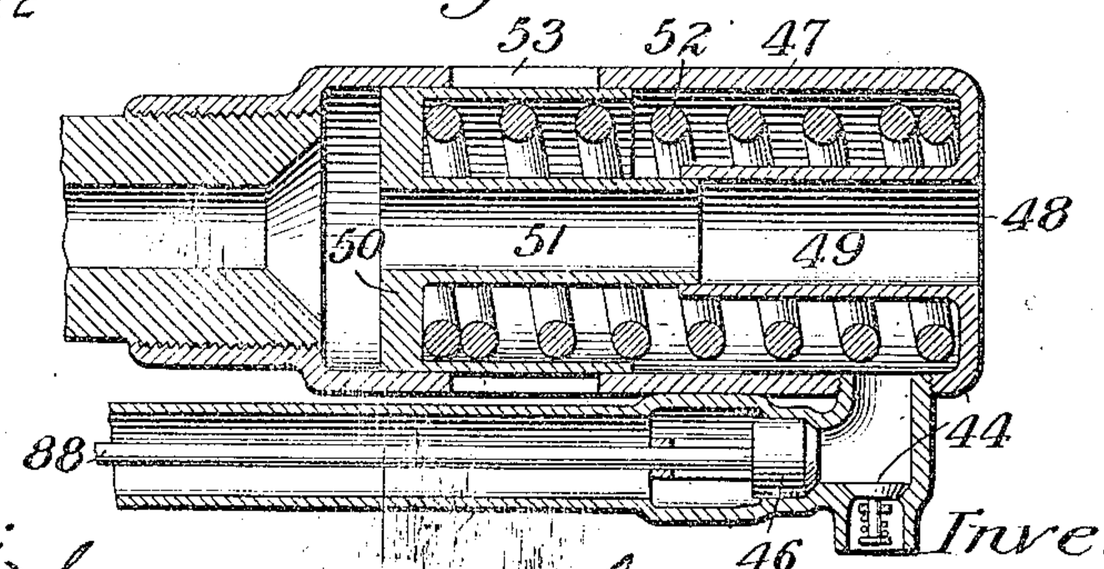



Fig. 9.

Fig. 12.

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No. 780,216. PATENTED JAN. 17, 1905.

S. N. McCLEAN.

GUN.

APPLICATION FILED JULY 14, 1900.

4 SHEETS—SHEET 4.

Fig. 13.

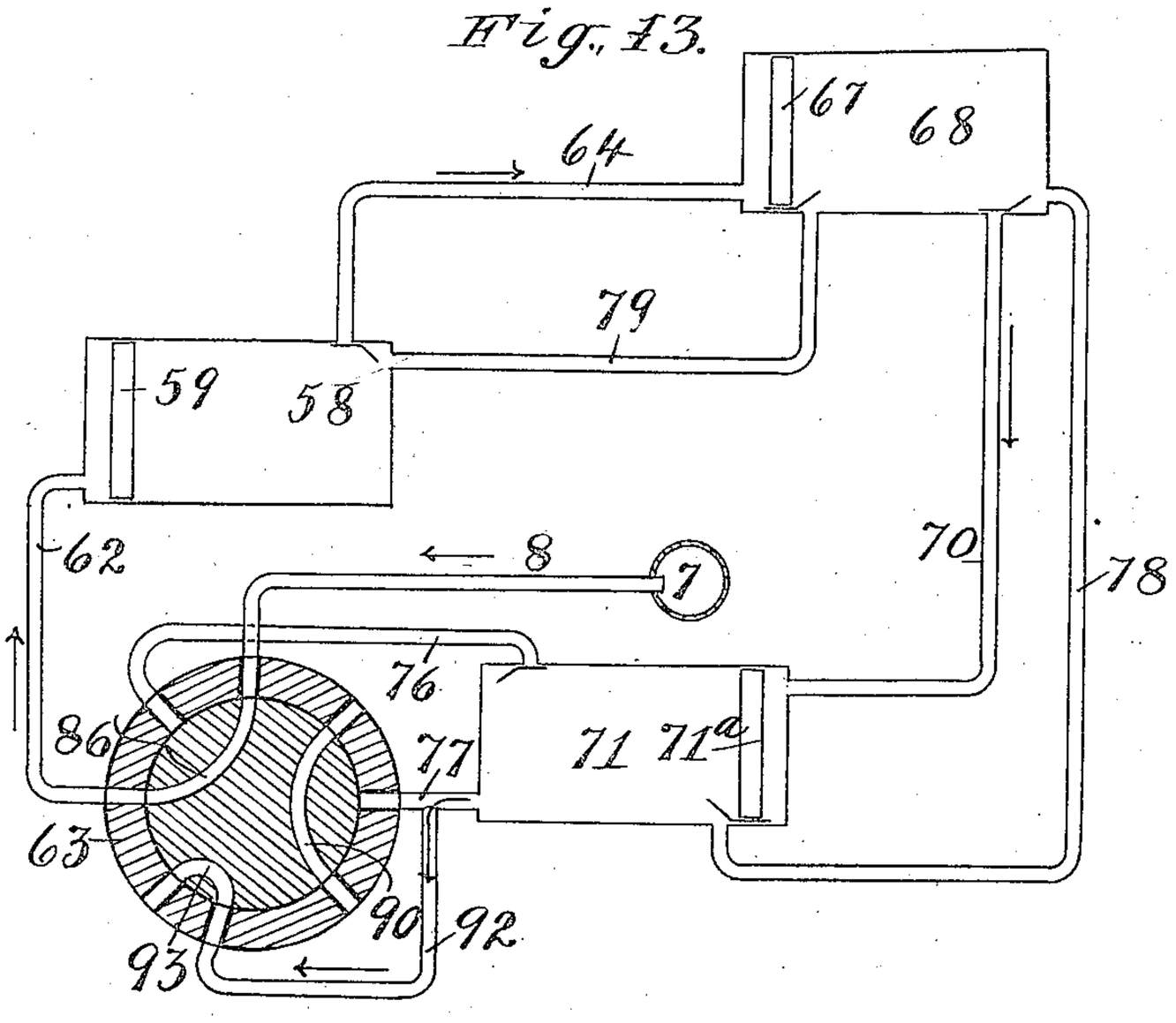
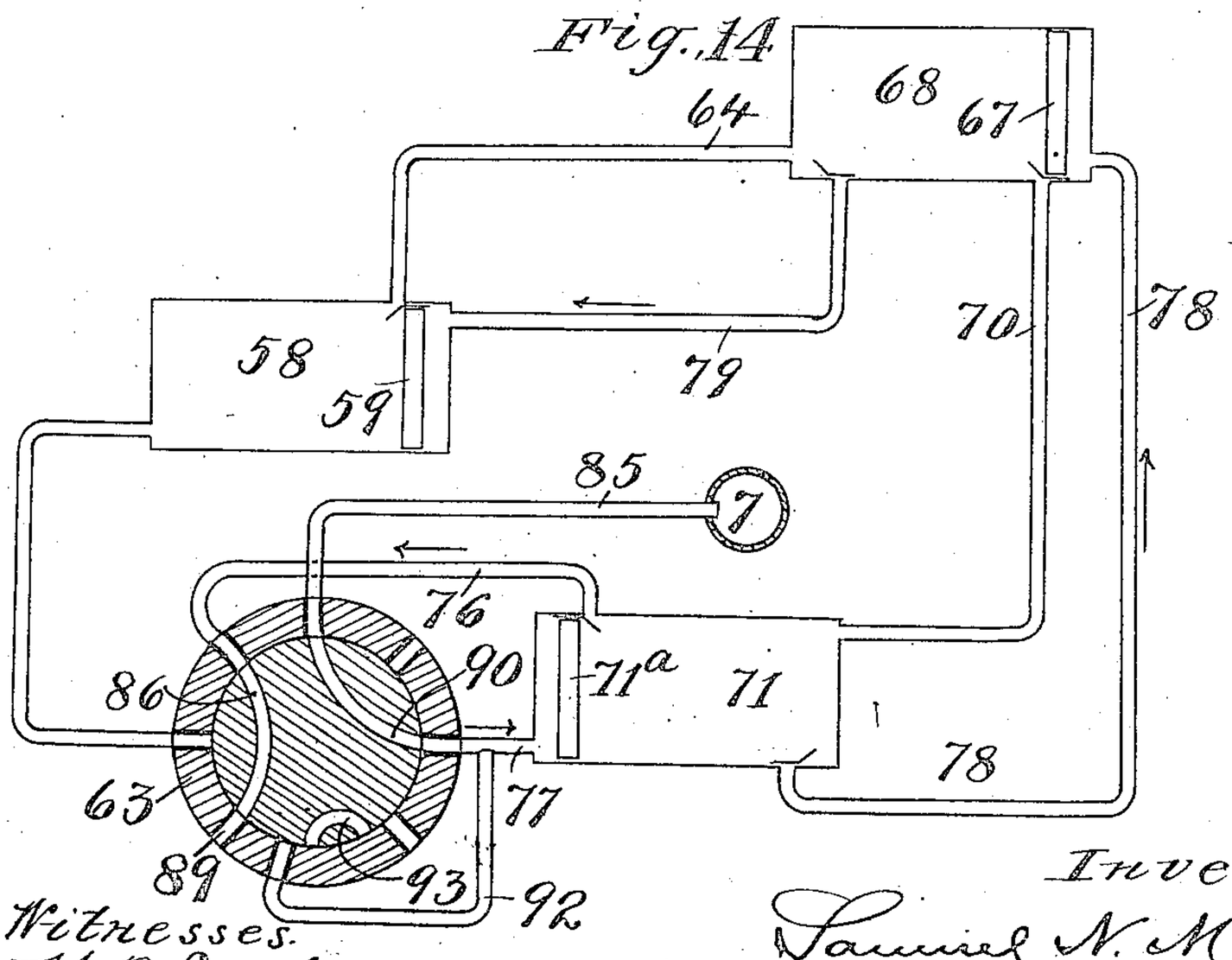



Fig. 14.




Witnesses.
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No. 780,216. Patented January 17, 1905.

# UNITED STATES PATENT OFFICE.

SAMUEL N. McCLEAN, OF CLEVELAND, OHIO.

## GUN.

SPECIFICATION forming part of Letters Patent No. 780,216, dated January 17, 1905

Application filed July 14, 1900. Serial No. 23,616.

*To all whom it may concern:*

Be it known that I, SAMUEL N. McCLEAN, a citizen of the United States, and a resident of Cleveland, Ohio, have invented a new and useful Improvement in Guns, which is fully set forth in the following specification.

My invention relates to heavy ordnance and to power-actuated devices for manipulating the breech mechanism and to means for controlling the recoil and utilizing the force of the gases of discharge for storing up the energy required in the various operations to be performed in manipulating the gun. In guns of this class, which often throw projectiles nearly half a ton in weight, the discharge has heretofore resulted in the recoil of the gun with such enormous force as to impose upon the gun-carriage most severe and destructive strains and has necessitated the construction of very heavy and exceedingly-expensive gun-carriages, which were unwieldy, difficult to operate, and easily disarranged. Furthermore, in guns of large caliber the breech-block, which is usually of the interrupted-screw type, is exceedingly heavy and difficult to operate rapidly in opening and closing the breech.

The objects of the present invention are to provide means whereby the enormous and destructive strains due to recoil may be partially or entirely eliminated to the end that a simple, light, and inexpensive carriage may be used in connection with the heaviest guns and in this connection to provide means actuated by the stored energy of the gases of discharge for opening and closing the breech mechanism.

With these objects in view the invention consists of a gun having at or near its muzzle end a combined recoil-check and air-compressor, said check being in the form of a gas-nozzle which catches any required portion of the gases of discharge and directs or applies them in such a way that their action opposes that of the recoil and at the same time actuates an air-compressor whereby power is stored to be utilized in the manipulation of the breech-block.

More specifically stated, the invention consists of a gun having at or near its muzzle end a gas-nozzle in the form of an expansion-chamber combined with an air-compressor, which gas-nozzle is provided with automatically-controlled vent-ports whereby the force of the gas-current may be regulated and the application thereof be secured at any required pressure, said gas-nozzle and compressor being combined with a power device for automatically unlocking, withdrawing, and swinging the breech-block to one side, means being controlled by the compressor for automatically admitting compressed air from a suitable reservoir to said power device upon the discharge of the gun; and the invention further consists in a series of connected cylinders for unlocking, withdrawing, and swinging the breech-block to one side to open the breech and to return, reënter, and relock the block to close the breech, combined with automatically-tripped valves admitting the pressure from one cylinder to the other in succession as required.

My invention is not limited to any particular construction of mechanical details, since the inventive idea involved may be embodied in a variety of mechanical structures. I have, however, for the purpose of illustration shown in the accompanying drawings one form which the invention may assume.

In the drawings, Figure 1 is a side elevation of the rear portion of a gun having my invention applied thereto, the gun-platform being shown in vertical section. Fig. 2 is a transverse vertical section through the breech-block and its pintle on the line 7 7, Fig. 3. Fig. 3 is a vertical longitudinal section of the breech end of the gun on the line 8 8, Fig. 4, with the breech-block in locked position. Fig. 4 is a rear elevation of the gun. Fig. 5 is a central horizontal section of the same on line 10 10, Fig. 4. Fig. 6 is a section through the cylinder for swinging the block and tray open, showing a form of automatic valve that may be employed. Fig. 7 is a broken section on the line 12, Fig. 2. Fig. 8 is a central vertical section of the muzzle of the gun and the combined gas-nozzle and air-compressor. Figs. 9 and 10 are like views of modified forms of the same. Fig. 11 is a fragmentary view of the firing mechanism. Fig. 12 is a section of the compressor-tube on line 17 17, Fig. 10; and Figs. 13 and 14 are diagrammatic views

illustrating the three cylinders for opening and closing the breech mechanism, together with the lines of communication between them and the valve for controlling the flow of pressure thereto.

Referring to the drawings, 1 is a stationary support for a revolving platform 2, turning on antifrictional bearings 3 and retained in position on the support 1 in any suitable manner, here shown as by a clip-ring 4. Suspended under the support 1 is a compressed-air reservoir 5, having a pipe 6 connected thereto and passing centrally through the support 1 and platform 2, said pipe 6 being preferably flexible throughout the whole or a portion of its length and communicating with a pipe or pipes 7, extending longitudinally under the gun from the breech to the muzzle end thereof.

Attached to the muzzle end of the gun is my combined gas-nozzle and air-compressor, by the use of which I am enabled to utilize the gases of discharge to neutralize or minimize the recoil when the gun is fired and also operate an air-compressor for storing up energy to be used in manipulating the gun and its breech mechanism.

Referring to Fig. 8, 34 is the muzzle end of the barrel, here shown as reduced in its outer diameter so as to leave a shoulder 35, and 36 is a piston secured on the extreme end of the barrel and provided with a rearwardly-extending cylindrical flange 37. A ring 38 is mounted to slide on the reduced portion 34 of the barrel between the shoulder 35 and the rear end of the flange 37, and secured to this ring is a cylinder 39, which cylinder fits snugly over the piston 36, extends beyond or forward of the muzzle end of the gun, and is closed at its forward end with the exception of a perforation 40, in line with the bore of the gun, said perforation 40 being surrounded by the inwardly-turned wall or flange of the front end of the cylinder, whereby the interior line of the cylinder at its front end leads forwardly along said flange and then on a reverse curve rearwardly. The cylinder is also provided with one or more vent-ports 41, normally closed by the flange 37 on the piston 36. A stout coiled spring 45 is interposed between the ring 38 and the piston 36 and tends to hold the cylinder in its rearward position with the vent-ports 41 over the flange 37. The cylinder is provided with a tubular extension 42, within which fits the enlarged piston-like head 43 of the pipe 7, which thus is brought into communication with the cylinder 39. The cylinder is also provided with an inwardly-opening valve 44, which permits air to pass therethrough to enter the cylinder, but closes under the influence of internal pressure, assisted, if necessary, by a spring. The operation of this portion of the device is as follows: When the gun is fired, the gases of discharge expand into the forward end of the cylinder 39 the instant the projectile passes the muzzle of the gun and exert a forward pull upon the cylinder—that is, the energy of the gases of discharge is exerted in the opposite direction to that of the recoil. This forward pull of the gases of discharge upon the cylinder is transmitted to the gun-barrel through the spring 45, which yields, however, and allows the cylinder to travel forward over the piston 36, thereby forcing the air out of the cylinder, past a valve 46, and into the pipe 7, leading to the reservoir 5. The cylinder in advancing under the tension of the gases opens the vent-ports 41, and thereby permits the gases to escape, whereupon the spring 45 returns the parts to the position shown in Fig. 8, the valve 44 opening to permit a fresh supply of air to enter the cylinder.

In the modification shown in Fig. 9 the cylinder 47 is fixedly secured to the muzzle end of the gun and has a perforation 48 concentric with the bore of the gun, and from this perforation a second cylinder 49 projects inwardly a short distance concentric with the cylinder 47. Snugly fitting within the cylinder 47 is a perforated piston 50, having a hollow piston-rod 51 extending into the cylinder 49, while a stiff spring 52 reacts between the piston and the forward end of the cylinder 47. Forward of the piston the cylinder is provided with vent-ports 53, which are normally covered by the flange on the piston, and the cylinder is connected with the pipe 7 at the forward end thereof, the tubular sleeve 42 of Fig. 8 being omitted. The operation of this form of combined gas-nozzle and air-compressor will be understood from the description given of the operation of Fig. 8.

In Fig. 10 I have illustrated a construction like that of Fig. 8, except that in this case the cylinder is fixedly secured to the muzzle of the gun and the piston moves rearward under the pressure exerted by the gases of discharge. In this construction the tubular extension 42 around the pipe 7 is also dispensed with. As herein shown, the breech-block 54 is of the interrupted-screw-thread type and is capable of being turned to unlock it, withdrawn longitudinally into a tray 55, here shown as a cylindrical housing, which tray may be swung to one side around a stationary pintle 56, fixed in lugs 57, secured to and projecting from the rear end of the gun. Supported on the under side of the tray 55 is a cylinder 58, extending transversely to the gun and having a piston 59, whose rod moves in a slot 60, formed in the tray under the breech-block, and is provided with a tooth or lug 61, engaging in a longitudinal slot $61^a$, formed in the breech-block. A pipe 62 extends from the pipe 7 (which is connected by the pipe 6 to the auxiliary reservoir 5) through the pintle 56 to the left-hand end of the cylinder 58, as will be clearly understood from an inspection of

Figs. 2 and 4. A valve 63 is interposed between the pipe 62 and the pipe 7 and controls the admission of fluid to said pipe 62, as well as certain other ports and pipes hereinafter mentioned.

64 is a pipe leading from the cylinder 58 through the walls of the tray 55 and a piston-rod 66, which rod has its rear end secured in the rear wall of the tray 55 and its forward end bearing a piston 67, playing in a cylinder 68, formed in the breech-block, said cylinder being suitably closed at its rear end by a plate 69.

70 is a duct, likewise formed in the walls of the piston-rod 66 and the tray 55, leading from the cylinder 68 through the stationary pintle 56 to the left-hand end of the cylinder 71, supported on the body of the gun and having a piston $71^a$ therein, whose rod 72 extends outward past the pintle of the gun and has formed thereon a rack 73, engaging a toothed segment 74, integral with or secured to the hinge portion of the tray 55, as will be understood by an inspection of Fig. 5. A pipe 76 leads from the cylinder 71 to the valve 63, its point of exit from the cylinder being such that the piston when traversing the cylinder from left to right will move over the mouth of the pipe 76 before coming to rest.

77 is a pipe also leading from the valve 63 to the right-hand end of the cylinder 71 and to the rear of the piston when said piston is at rest in said right-hand end of the cylinder. (See Figs. 2 and 4.)

78 is a pipe leading from the cylinder 71 to the lower end of the pintle 56 and thence in the form of a duct upward through said pintle and the walls of the carrier 55 to the rear end of the piston-rod 66 and thence through said piston-rod into the cylinder 68 in front of the piston 67.

79 is a duct leading from the cylinder 68 on the forward side of its piston through the piston-rod 66 and the walls of the carrier 55 to the right-hand end of the cylinder 58. The ports where the pipes 64, 76, and 78 communicate with their respective cylinders are controlled by suitable valves, which valves are automatically tripped by the piston in the cylinder after the piston has crossed the port and just as it is in the act of coming to rest. Any suitable form of valve may be employed for this purpose. I have illustrated one form in Fig. 6, in which 80 is a valve seated in a casing, as shown, under the influence of a spring 81 and having a stem 82 projecting upward into the path of the piston, which latter is slightly beveled at one corner, as shown. The valve 80 controls the pipe 78 and prevents the exit of fluid through said pipe except at the time when the piston rests over the valve-stem 82 and depresses the valve against the action of its spring. In the drawings and the diagrammatic views shown in Figs. 13 and 14 the valves have been diagrammatically indicated only.

The exit of the fluid from the cylinder 68 through ducts 70 and 79 is also controlled by automatically-tripped valves 83 and 84, closing on valve-seats formed in the body of the piston 67 and having valve-stems projecting in opposite directions through said piston, the stem of the valve 83 being in position to be struck by the right-hand end of the cylinder 68 and the stem of the valve 84 in position to be struck by the left-hand end of such cylinder. The general arrangement and connection of the three cylinders 58, 68, and 71 will best be understood by reference to Figs. 13 and 14, which diagrammatically illustrate the connections between the several cylinders and the valve 63, which controls the admission of fluid to said cylinders from the pipe 7 and the exit of the fluid from the cylinders.

Referring to Fig. 13, when the valve is positioned as shown in said figure fluid passes from the pipe 7 through the pipe 85 and the duct 86, formed in said valve 63, to the pipe 62 and thence into the cylinder 58, whereupon the piston 59 will be moved to the opposite end of the cylinder 58, tripping the valve at the entrance to the pipe 64 and coming to rest with the piston and valve in the position indicated in Fig. 14. Pressure will then flow through pipe 64 to the cylinder 68 and move the piston 67 from the left to the right hand end of said cylinder, closing the valve at the entrance of pipe 79 and passing over the entrance to the pipe 70 and opening the valve in connection with said pipe, the piston coming to rest with the parts in the position shown in Fig. 14; whereupon fluid will flow through the pipe 70 into the cylinder 71, forcing the piston $71^a$ to the left, closing the valve in the pipe 78 by its initial movement and opening the valve in a pipe 76, leading from the cylinder 71 to the valve 63, the valve, however, in the position assumed—that is, the position shown in Fig. 13—preventing the escape of pressure through said pipe 76. Upon shifting the valve 63 from the position shown in Fig. 13 to that shown in Fig. 14 the duct 86 will be shifted so as to register with the pipe 76 and with the port 89, leading to the atmosphere, and pressure will be permitted to pass freely from cylinders 58, 68, and 71, through the pipe 76 and duct 86, to the atmosphere. At the same time that duct 86 is thus placed in communication with pipe 76 a second duct 90, formed in the valve 63, is placed in communication with the pipe 85 and with the pipe 77, leading from the valve to the cylinder 71, whereupon pressure flows from the pipe 7 into the cylinder 71, shifting the piston $71^a$ from the position shown in Fig. 14 to that shown in Fig. 13, thereby closing the valve controlling the pipe 76 and opening the

valve leading into pipe 78, the parts then assuming the position shown in Fig. 13, whereupon fluid passes through pipe 78 into the cylinder 68 and forces the piston 67 from the position shown in Fig. 14 to that shown in Fig. 13, closing the entrance to the pipe 70 and opening the valve leading into the pipe 79, as shown in Fig. 13, thereby permitting fluid to pass from cylinder 68 through pipe 79 to cylinder 58 and forcing the piston 59 in said cylinder from the position shown in Fig. 14 to that shown in Fig. 13, closing the valve at the mouth of pipe 64 in its movement.

It will be observed that when the parts are in the position shown in Fig. 13 the cylinder 71 is in communication with the atmosphere by way of pipe 77 and branch pipe 92, which communicates through suitable ports and a duct 93 in the valve 63 with the atmosphere. It will also be observed that when the valve is in the position shown in Fig. 14 communication between the left-hand side of the piston $71^a$ and the atmosphere is cut off, while the right-hand side of the cylinder is open to the atmosphere through pipe 76 and the duct 86, as heretofore described. With this diagrammatic illustration of the manner in which the three cylinders employed in manipulating the breech-block are connected and the means whereby the piston in each cylinder is caused to automatically trip a valve which permits the fluid to pass to the next cylinder in the series the operation of the improved means for opening and closing the breech-block will be readily understood, said operation being as follows:

The valve 63 rests in the position shown in Fig. 14 when the breech-block is closed. Upon shifting the valve from the position shown in Fig. 14 to that shown in Fig. 13 pressure passes from pipe 7 via pipe 85, valve-duct 86, and the pipe 62 up through the pintle 56, and thence into the left-hand end of the cylinder 58, as clearly shown in Fig. 2, thus forcing the piston 59 to the right, whereupon the lug 61, being in engagement with the longitudinal slot in the breech-block, imparts to the breech-block a turning movement sufficient to unlock the interrupted screw-threads on the block from those in the breech of the gun. As the piston reaches the terminus of its movement to the right it trips the valve leading to the pipe 64 and pressure passes via said pipe into the cylinder 68 to the rear of the piston 67. Inasmuch as the piston-rod 66 is secured in the rear wall of the carrier 55 the piston cannot move; but the pressure between the rear face of the piston and the rear end of the cylinder 68, formed by the plate 69, serves to withdraw the breech-block rearward over the piston and into the tray. Just as the breech-block reaches the end of its movement the forward end of the cylinder 68, formed in said block, strikes the stem of the valve 83 and forces said valve open against the tension of its spring, (see Fig. 5,) thereby permitting pressure to flow through the duct 70, formed in the walls of the piston-rod 66, the carrier 55, and the pintle 56 into the left-hand end of cylinder 71, (see Fig. 4,) thereby forcing the piston $71^a$ in said cylinder from the left to the right. The rack 73, formed on the piston-rod 72, engages the toothed segment 74 on the tray 55, causing said tray to revolve around the pintle from right to left and carrying with it the breech-block. When the piston has reached the limit of its movement to the right, the tray will be in position to fully expose the breech of the gun, and the pressure in the cylinder 71 against piston $71^a$ will serve to rigidly hold the parts in this position. The gun having been loaded, the reverse of the movements just described is accomplished by shifting the valve 63 from the position shown in Fig. 13 to that shown in Fig. 14, whereupon the pressure in the cylinders 58, 68, and 71 escapes to the atmosphere through the pipe 76 and the duct 86, as will be understood from inspecting Fig. 14, and pressure flows from the pipe 7 through the pipe 85 and the duct 90 in the valve 63 and pipe 77 into the right-hand end of the cylinder 71, thereby forcing the piston $71^a$ from the right to the left, Fig. 4, whereupon the rack 72, engaging with the toothed segment 74, swings the tray 55 back against the breech end of the gun, which movement is completed just as the piston $71^a$ reaches the position shown in dotted lines in Fig. 4, and the valve controlling the pipe 78 in said cylinder 71 being opened pressure flows through said pipe upward through the pintle 56 and the walls of the tray 55 and the piston-rod 66 into the cylinder 68, as will be understood by an inspection of Figs. 3 and 4. The pressure against the forward end of the cylinder 68 forces the breech-block to reënter the breech of the gun, and just as it is pushed fully home the rear end of the cylinder 68 strikes the stem of the valve 84, as shown in Fig. 5, permitting pressure to pass outward through duct 79, formed in the walls of the piston-rod 66, and the tray 55 to the right-hand end of the cylinder 58, thereby forcing the piston in said cylinder to the left-hand end of said cylinder and imparting to the breech-block a partial turn, which serves to engage the threads on the block with those in the gun. The pressure in the cylinder 58 also serves to firmly maintain the breech-block in this locked position until such time as the cylinder is vented, which venting may be secured by shifting the valve 63 from the position shown in Fig. 14 to that shown in Fig 13, whereupon the pressure passes from cylinder 58 through pipes 79, cylinder 68, pipe 78, cylinder 71, pipes 77 and 92, and duct 93 to the atmosphere. For the purpose of avoiding any break in the continuity of the ducts 62, 70, and 78 at the point where they pass from the pintle of the tray to the main body of the tray during the

turning movement of the latter around the pintle a partially-circular chamber 91 is formed in the hinge of the tray, as will be understood by inspection of Fig. 5. This chamber extends far enough on each side of the duct to maintain uninterrupted communication through said duct during any turning movement of which the tray is capable. The valve 63 may be manipulated manually by a suitable hand-wheel 87, and its connecting-rod is as shown in Figs. 2 and 4. Provision is also made for automatically operating said valve when the gun is fired. For this purpose the valve 46 (shown in Fig. 8) has a rod 88 extending rearward through the pipe 7 and projecting therefrom in immediate proximity to a disk $91^b$, formed on the valve-stem, as shown in Fig. 4. This disk $91^b$ has a shoulder $91^a$ formed thereon, with which the heel of the rod 88 is in engagement. When the gun is fired and the air-compressor acts to force the valve 46 rearward, the rod 88, attached to said valve, also moves rearward, compressing the spring 94 between the shoulder 95 and the rear end of the tube 7. Upon this rearward movement the heel of the rod 88 engages the shoulder $91^a$ on the disk $91^b$, thereby revolving the valve-stem and with it the valve, shifting the latter from the position shown in Fig. 14 to that shown in Fig. 13, thus permitting the current to flow in the direction necessary to automatically open the breech mechanism.

The reservoir 5 is connected by suitable piping with the air-compressor, with the trunnion-supporting cylinders 11 and 12, elevating and depressing cylinder 20, cylinders 58, 68, and 71 for manipulating the breech mechanism and motor 28 for traversing the gun, and the construction is such that the breech mechanism may be operated either automatically at each discharge of the gun or its operation may be controlled by the hand-wheel 87.

Referring to Figs. 3, 5, and 11, 101 is a firing-pin located in a tube 102, secured centrally in the breech-block and extending rearward through the cylinder 68 and communicating with the central bore 103 of the piston-rod 66, said tube 102 reciprocating in the bore 103 of the piston-rod as the breech-block is moved backward and forward in withdrawing it from or replacing it within the breech of the gun. The front end or striking-point of the pin 101 may extend through a conical opening in the block to impinge on the primer of the cartridge, and the rear end of the pin projects from the tube 102 in position to be struck by any suitable striker—as, for example, spring-actuated plunger 104, which is forced back against the tension of its spring 105 when the breech-block is withdrawn and is retained in its rear position by the spring-actuated sear 106.

The operation of the device as a whole is as follows: Upon the discharge of the gun the gases of discharge act through the gas-catching nozzle at the muzzle of the gun to counteract the recoil either wholly or in part and at the same time actuate the compressor, whereby the air is forced past the valve 46 into the pipe 7. These movements of the valve 46 serve to operate the valve 63, which controls the passage of fluid to the cylinders 58, 68, and 71 for opening the breech mechanism, and the breech mechanism being automatically opened, as hereinbefore described, is retained securely in its open position until the valve 63 is turned from the position shown in Fig. 13 to that shown in Fig. 14, when the passage of the current through the cylinders 58, 68, and 71 is reversed and the breech-block closed. In case it is desired that the breech mechanism should be opened at the will of the gunner rather than automatically the disk $91^b$ on the valve-stem $87^a$ may be arranged so as to turn loosely upon the valve-rod $87^a$ or be rigidly connected thereto, as may be desired. Any suitable means may be employed for thus rigidly connecting the disk $91^b$ to the valve-stem $87^a$ or disconnecting it therefrom. I have shown in dotted lines a set-screw 107, Fig. 7, which may be employed for this purpose. The air-reservoir 5 may be initially charged by a suitable air-pump, which may be connected in any suitable manner with the reservoir—as, for example, through the inlet-valve 44 of the air-compressor.

While I have herein shown and described my invention as an entirety, I have not claimed the means for traversing, elevating, depressing, and locking the gun by the use of the stored energy of the gases of discharge, as the same forms the subject-matter of a separate application, Serial No. 37,817, filed November 26, 1900.

Having thus described my invention, what I claim is—

1. The combination of a gun, an air-compressor supported on the muzzle thereof, a gas-catching nozzle also supported on the muzzle of the gun and operatively connected to said air-compressor.

2. In a gun the combination of the barrel and the combined gas-nozzle and air-compressor supported on the muzzle of the barrel.

3. The combination of the cylinder and piston supported on the muzzle of the gun and having movement relative to each other and a gas-catching chamber of which the piston forms one of the walls.

4. In a gun the combination of a nozzle and piston supported near the muzzle end of the barrel and movable relatively to each other, a spring between the piston and cylinder, an air-reservoir, a conduit connecting said cylinder and reservoir and a check-valve in said conduit.

5. In a gun, the combination of a nozzle for catching the gases of discharge, a power device for operating the breech mechanism,

means controlling the application of power to said device, and operative connections between said nozzle and controlling means.

6. In a gun the combination of a gas-catching nozzle, a power device for operating the breech mechanism, means controlling the application of power to said device, and connections between said nozzle and controlling means whereby the latter are automatically operated to admit power to said device upon discharge of the gun.

7. In a gun, the combination of a gas-nozzle, a fluid-actuated power device for operating the breech mechanism, a valve controlling the passage of fluid to said device, and means extending from the nozzle to said valve and operating it to admit fluid to said power device when the gun is fired, whereby the breech is automatically opened upon the discharge of the gun.

8. In a gun the combination of a nozzle catching the gases of discharge, a fluid-actuated power device for operating the breech mechanism, a valve controlling the passage of motive fluid to said power device, and means actuated by the gases of discharge to operate said valve.

9. In a gun, the combination of a nozzle catching the gases of discharge, an air-compressor connected therewith, a fluid-actuated power device for operating the breech mechanism, a valve controlling the passage of motive fluid to said device, an outlet-valve to said compressor and operative connections between said outlet and controlling valves.

10. The combination of the gun, its breech mechanism, and pneumatic cylinders for operating said mechanism, with an air-compressor actuated by the gases of discharge, an outlet-valve for said compressor, a valve controlling the supply of air to said pneumatic cylinders, and a rod extending from said outlet-valve into operative relation with said controlling-valve.

11. In a gun, the combination of the breech-block, a fluid-actuated power device for operating the same, a valve controlling the passage of motive fluid to said device, and discharge-actuated means operatively connected to said valve.

12. In a gun, the combination of the breech-block, a fluid-actuated power device for operating the same, and discharge-actuated means controlling the passage of motive fluid to said power device.

13. In a gun, the combination of the breech-block, a fluid-actuated power device for operating the same, and means actuated by the gases of discharge and controlling the passage of motive fluid to said power device.

14. In a gun, the combination of a breech-block having interrupted screw-threads, with a series of cylinders for rotating reciprocating and swinging said block, and means automatically operated upon the discharge of the gun and admitting motive fluid to said cylinders one after the other.

15. The combination of a gun and its breech-block having a plurality of movements to open or close the breech, with a series of motor-cylinders in operative relation with said breech-block, and means permitting motive fluid to pass through said cylinders in series.

16. The combination of a gun and its breech-block having a plurality of movements to open or close the breech, with a series of motor-cylinders, one for each opening or closing movement, valved connections between said cylinders, and means automatically and successively opening said valves, whereby motive fluid is admitted to said cylinders in succession and the opening or closing movements of the block are consecutively imparted thereto.

17. The combination of the gun and the breech-block having rotating and reciprocating movements, with a motor-cylinder operatively connected to the block to rotate it, a second cylinder operating to reciprocate the block, a valved connection between said cylinders, means controlling the admission of motive fluid to said first-mentioned cylinder, and means automatically opening the valve in said connections and permitting the motive fluid to pass to the second cylinder.

18. The combination of the gun and its breech-block having rotating, reciprocating and swinging movements with a motor-cylinder to rotate the block, a second cylinder to reciprocate the block and a third cylinder to impart the swinging movement thereto, and means for admitting motive fluid to said cylinders.

19. The combination of the gun and the breech-block having rotating, reciprocating and swinging movements with a motor-cylinder to rotate the block, a second cylinder to reciprocate the block and a third cylinder to impart the swinging movement thereto, and automatically-operated means for admitting motive fluid to said cylinders consecutively.

20. The combination of the gun and a breech-block having rotating, reciprocating and swinging movements, with a carrier-tray hinged to the gun, a motor-cylinder supported on said tray in operative relation with the breech-block to rotate it, a second cylinder in operative relation with said block to reciprocate it, a third cylinder operatively connected to the tray to swing the same around its hinge, and means for supplying said cylinders with motive fluid.

21. The combination of the gun, the breech-block and the air-reservoir, with the gas-nozzle, the air-compressor connected thereto and communicating with the reservoir, motor-cylinders in operative relation with the breech-block, connections between the reservoir and said cylinders, and means for controlling said connections.

22. The combination of a gun, a breech-

block and a gun-carriage, with motor mechanism on the gun for opening the breech-block, a fluid-containing reservoir or receptacle on the carriage, means operating upon the discharge of the gun to place fluid in said reservoir under pressure and connections between said reservoir and motor mechanism, whereby energy due to the discharge of the gun is utilized to open the breech.

23. The combination of a gun, a breech-block, and a gun-carriage, with motor mechanism on the gun for opening the breech-block, a fluid-containing reservoir or receptacle on the carriage, means operated by gases of discharge to place the fluid in said reservoir under pressure, and connections between said reservoir and motor mechanism, whereby energy due to the discharge of the gun is utilized to open the breech.

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

SAMUEL N. McCLEAN.

Witnesses:

L. O. MALLERY,

S. T. CAMERON.