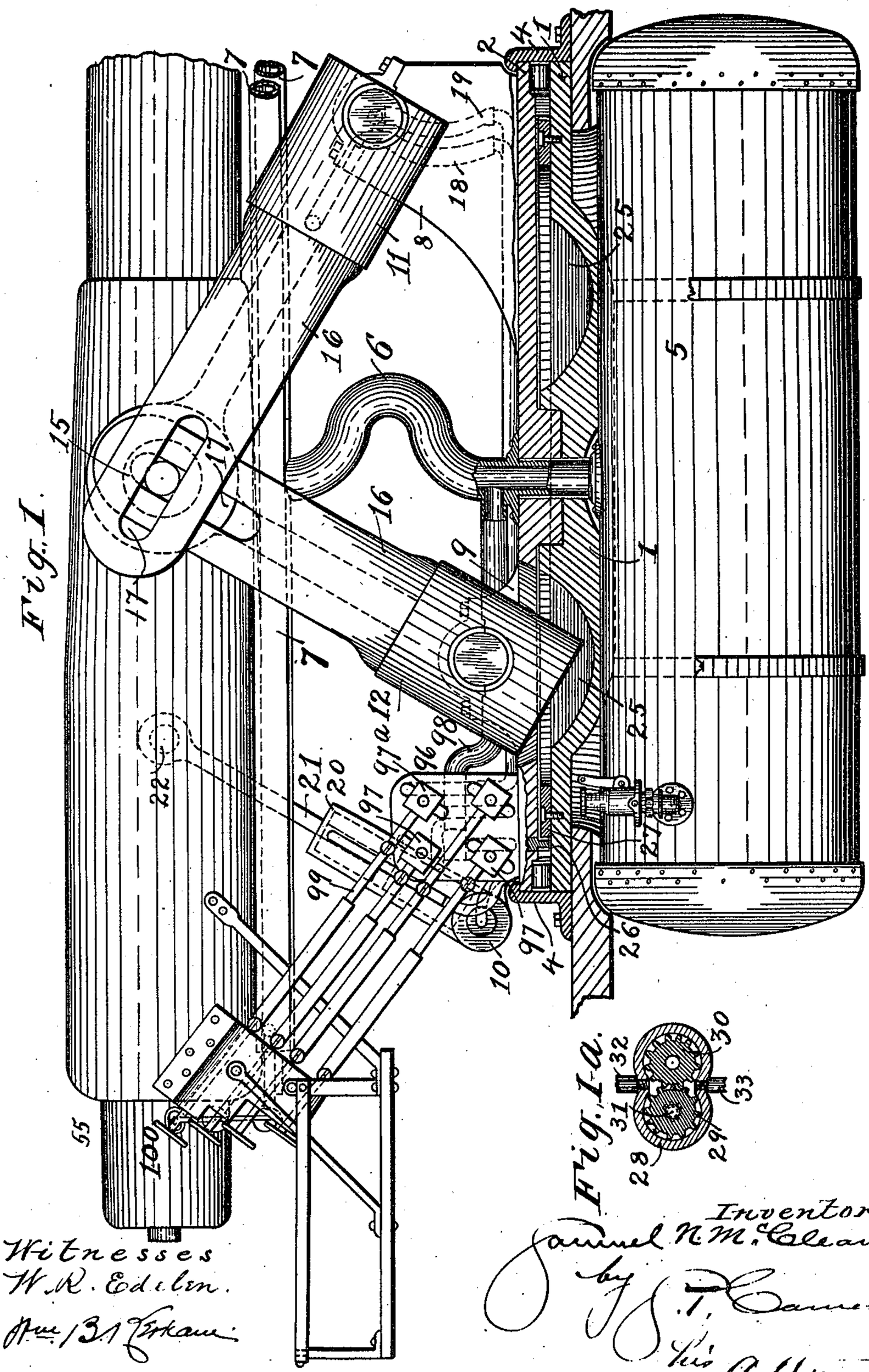
No. 678,969. Patented July 23, 1901.

S. N. McCLEAN.

GUN CARRIAGE FOR HEAVY ORDNANCE.

(Application filed Nov. 26, 1900.)

(No Model.) 3 Sheets—Sheet 1.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

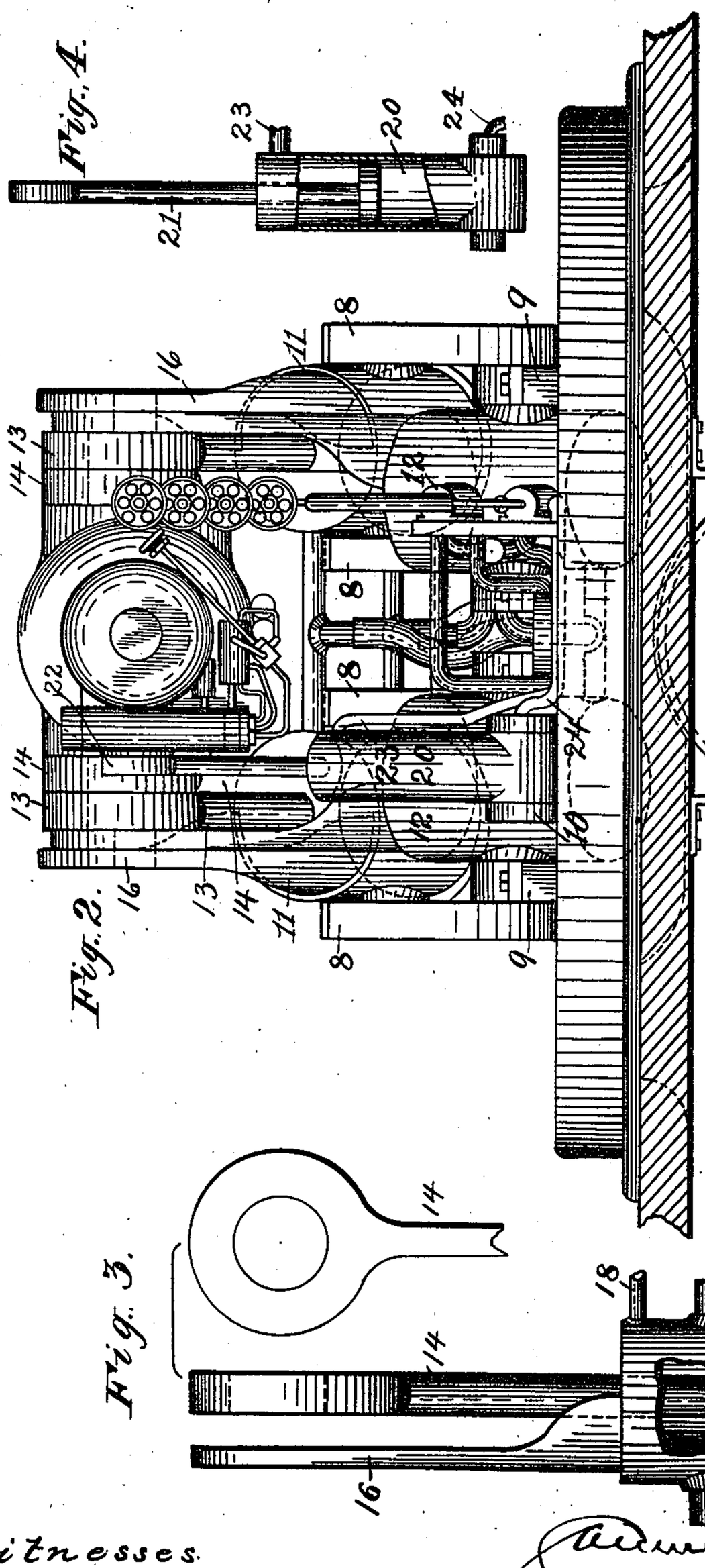

Fig. 2.

Fig. 3.

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Fig. 7.

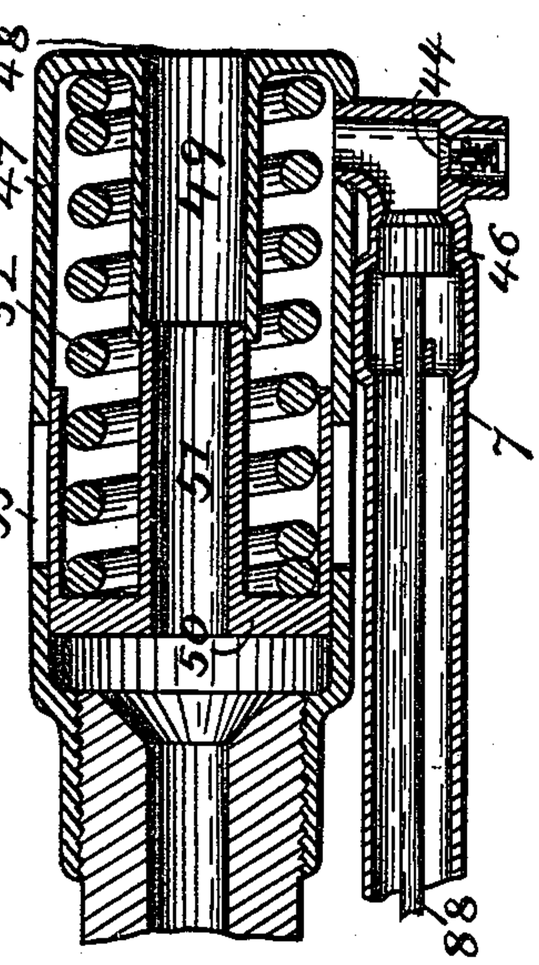


Fig. 9.

Fig. 5.

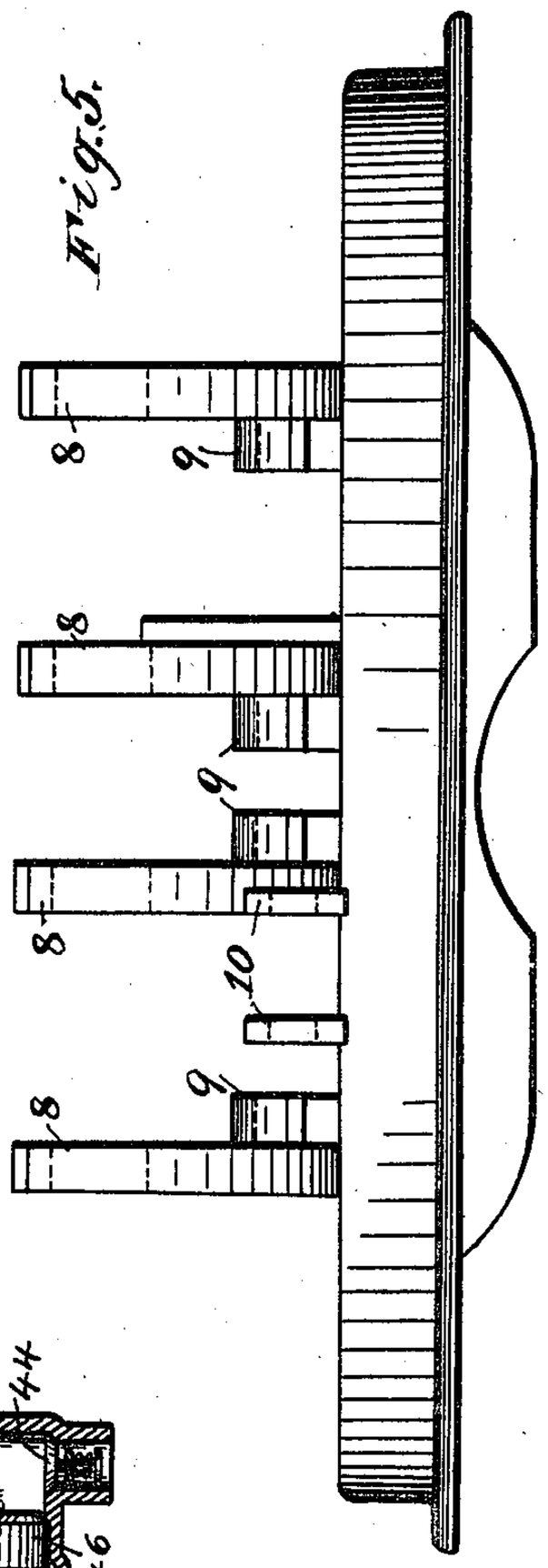


Fig. 6.

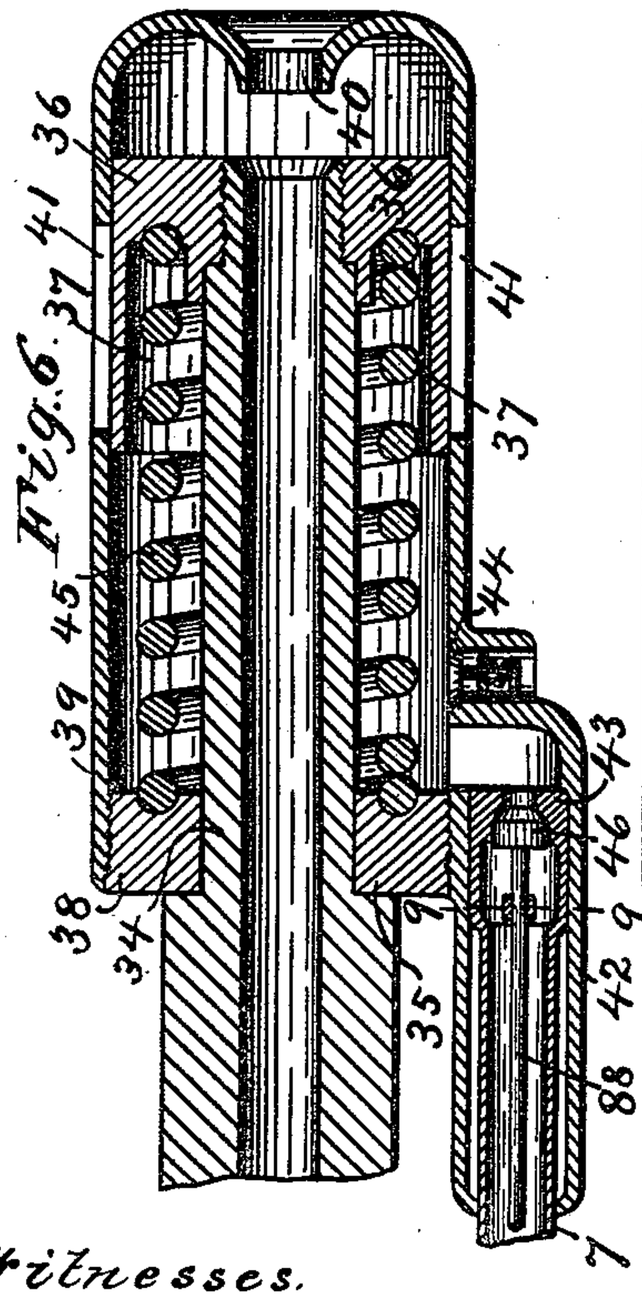
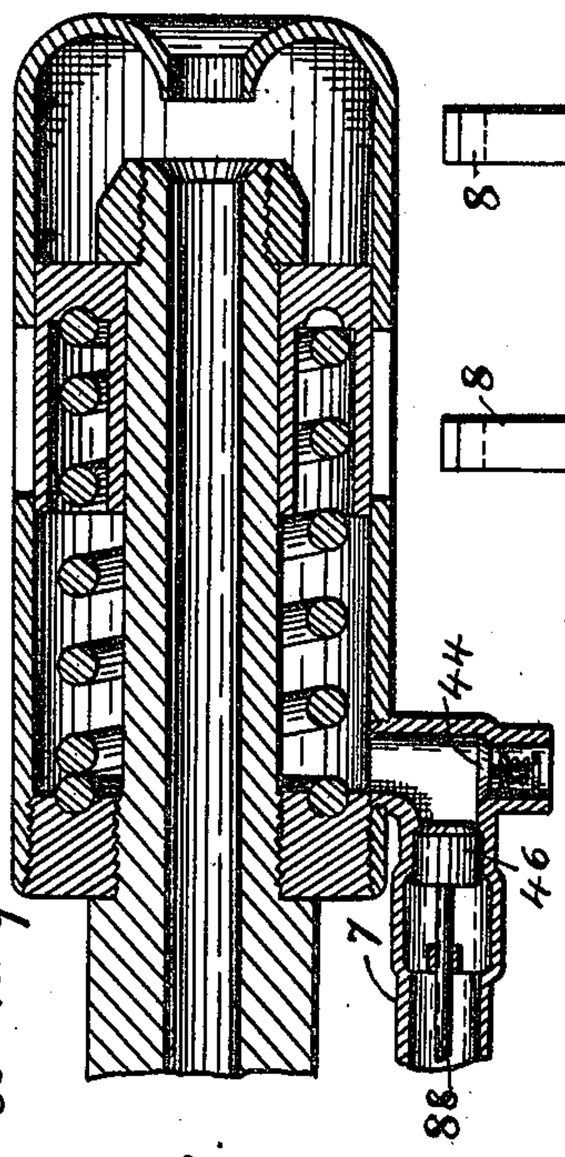


Fig. 8.



Witnesses.
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UNITED STATES PATENT OFFICE.

SAMUEL N. McCLEAN, OF CLEVELAND, OHIO.

GUN-CARRIAGE FOR HEAVY ORDNANCE.

SPECIFICATION forming part of Letters Patent No. 678,969, dated July 23, 1901.

Application filed November 26, 1900. Serial No. 37,817. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL N. MCCLEAN, a resident of Cleveland, Ohio, have invented a new and useful Improvement in Gun-Carriages for Heavy Ordnance, which invention is fully set forth in the following specification.

My invention relates to heavy ordnance and to power-actuated devices for training, elevating, and depressing guns of this class 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 of great 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.

The object of the present invention is to provide means whereby the enormous and destructive strains due to the recoil of heavy ordnance may be partially or entirely eliminated, to the end that a simple, light, and inexpensive gun-carriage may be used in connection with the heaviest guns, and in this connection to provide means for storing the energy of the gases of discharge and utilizing the same to do work in the manipulation of the gun and its carriage, as in training and laying the gun.

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 preferably 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 performing any requisite work in the manipulation of the gun, such as training and laying the gun and locking the same in position to resist the recoil upon the shock of discharge. 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. This compressor discharges into a reservoir in communication with pneumatic cylinders, whereby the gun may be locked against the shock of recoil by pneumatic pressure and the energy of the gases of discharge stored in the compressed air may be employed for training, elevating, and depressing the gun.

My invention may assume various forms, one of which I have illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation, with parts in section, of a gun-carriage embodying my invention. Fig. 1ª is a detail of a form of motor that may be employed to rotate the carriage. Fig. 2 is a rear elevation of the carriage. Fig. 3 is a detail of one of the recoil-cylinders. Fig. 4 is a detail of the cylinder for elevating and depressing the gun. Fig. 5 is a rear elevation of the platform of the carriage. Fig. 6 is a longitudinal vertical section of one form of gas-nozzle and air-compressor that may be employed. Figs. 7 and 8 are like views of modified forms of the same; and Fig. 9 is a detail sectional view on the line 9 9, Fig. 6.

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. The platform 2 has upon its upper surface uprights 8, 9, and 10, Figs. 1 and 5, arranged in pairs, as shown, each pair of uprights affording bearings, as indicated by dotted lines in Fig. 5, for the trunnions of an air-cylinder. There are two pairs of the uprights 8, with an air-cylinder 11, mounted by

means of its trunnions, between each pair, and likewise there are two pairs of uprights 9, having air-cylinders 12 similarly mounted therein. The cylinders 11 and 12 are provided with pistons whose piston-rods 13 and 14, Fig. 2, engage and support the trunnions 15 of the run, and with guide-arms 16, supported on the cylinders and provided with slots 17, within which extensions 15ª of the trunnions play, such slots thus defining the limits of movement for the piston-rods 13 and 14 both in and out. Each of the cylinders 11 and 12 is provided with a pipe 18 above and a pipe 19 below its piston, Fig. 3, which pipes communicate with the reservoir 5, as will be hereinafter described. Mounted in the uprights 10 is the trunnioned cylinder 20, said cylinder being also connected by pipes 23 and 24, Fig. 4, with the reservoir 5. For the purpose of permitting the swing of the cylinders 12 on their trunnions without elevating them too high above the platform 2 the latter is provided with suitable openings between the uprights 9, and the support 1 has a depression 25 formed therein under said openings, so that the cylinders 12 may be mounted close to the surface of the platform without danger of striking any part of the structure when turning about its trunnions.

For the purpose of revolving the platform 2 it is provided on its under side with a pinion 26, engaging the toothed wheel 27, secured to the support 1, said pinion being driven by any suitable motor. I have shown in Fig. 1ª a motor which I prefer to employ for this purpose, consisting of a casing 28, having therein two toothed disks 29 30, engaging each other, one of which is secured to the shaft 31 of the pinion 26. Pipes 32 and 33 enter the casing 28 from opposite sides, and when one of these pipes is connected with pressure the other is open to the atmosphere, so that air may pass through the motor-casing in either direction desired to turn the platform to the right or the left.

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. 6, 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. 6, the valve 44 opening to permit a fresh supply of air to enter the cylinder.

In the modification shown in Fig. 7 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. 6 being omitted. The operation of this form of combined gas-nozzle and air-compressor will be understood from the description of the operation of Fig. 6.

In Fig. 8 I have illustrated a construction like that of Fig. 6, 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.

Pressure within the reservoir 5 may be initially secured by means of a force-pump connected in any appropriate way to the reservoir—as, for example, through the inlet-valve 44 of the air-compressor.

For the purpose of controlling the flow of fluid to and from the cylinders 11, 12, and 20, as well as the motor for revolving the platform 2, I have provided a set of valves, preferably compactly located, so as to be operated by hand-wheels within easy reach of the gunner and connected to jointed telescopic valve-rods. These valves may be of any desired construction which will simultaneously admit fluid to one end of the cylinder and permit it to escape from the other. As an ordinary two-way valve fully answers all the requirements, I have not thought it necessary to illustrate the construction thereof in detail.

Referring to Fig. 1, 96 is a plate mounted on the platform 2 and supporting the valves 97, which control the fluid passing to and from the several cylinders just mentioned. A description of the construction and operation of one of these will be sufficient, as they are all substantially alike. One of these valves—as, for example, 97ª—is in direct connection with the pipe 98, which, as shown, is in connection with pipe 6, leading to the compressed-air reservoir 5. Said valve is also operatively connected with the pipes 18 and 19, leading to the opposite ends of the cylinder 11, and is controlled by a telescopic valve-rod and hand-wheel 100. By properly manipulating the valve fluid may be passed to either side of the piston in the cylinder 11 and permitted to escape from the opposite side thereof, or the valve may be turned to a blank position, whereby the pressure existing on the opposite sides of the piston may be maintained. It will thus be seen that 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, and motor 28 for traversing the gun.

The operation is as follows: The gunner by means of the proper valve operates the motor 28, so as to traverse the gun until the desired position is reached, and elevates or depresses it to the proper degree through the operations of the cylinder 20 and its piston, the admission of pressure to the piston being regulated by the proper valve. The cylinders 11 and 12 having been adjusted and pressure supplied thereto through the manipulation of their respective valves, the latter are turned to blank position, so as to secure and retain pressure both above and below the pistons in said cylinders, and the gun is then in condition to be fired. 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 and thence via pipe 6 to the reservoir 5.

From the foregoing description it will be seen that I have devised means in the shape of a gas-nozzle whereby I am enabled to oppose the energy of the gases of discharge to the energy of recoil, thereby relieving the carriage of the great strain that would otherwise be placed upon it by the recoil of the gun. In addition to the work of overcoming or neutralizing the recoil the gases of discharge also furnish in the form of compressed air the power required to manipulate the gun.

Having thus described my invention, what is claimed is—

1. The combination of the gun, the gas-nozzle, the air-compressor and the reservoir, with the motor-cylinder for elevating and depressing the gun and valved connections between said reservoir and cylinder.

2. The combination of the gun, the gas-nozzle, the air-compressor, and the reservoir, with air-cylinders supporting the trunnions of the gun, and valved connections between said cylinders and reservoir.

3. The combination with the gun and its trunnions with pneumatic cylinders sustaining said trunnions and locking the same against recoil.

4. The combination of the gun and its trunnions with pneumatic cylinders mounted on trunnions, pistons in said cylinders having piston-rods projecting therefrom, and trunnion-bearings supported by said rods within which bearings the gun-trunnions rest, and means for simultaneously applying pneumatic pressure to the opposite sides of said pistons.

5. The combination of the gun and its trunnions, with a pair of pneumatic cylinders on each side of the gun, pistons in said cylinders having piston-rods projecting therefrom, trunnion-bearings formed on each rod, each pair of bearings serving to support the trunnion of the gun on the respective sides thereof, and means for supplying pneumatic pressure to the opposite sides of said pistons.

6. The combination of the gun and its trunnions, with a revolving platform having uprights with bearings therein, cylinders mounted to turn in said bearings, pistons in said cylinders, piston-rods projecting therefrom and supporting trunnion-bearings within which the gun-trunnions rest, and means for supplying pneumatic pressure to the opposite sides of said pistons in said cylinders.

7. The combination with a gun, of pneumatic cylinders, pistons in said cylinders, piston-rods attached thereto and supporting the trunnions of the gun, means admitting fluid pressure to said cylinders and means attached to the cylinders and limiting the movements of the trunnions.

8. The combination with a gun and its trunnions, of a pair of cylinders on each side of the gun, pistons in said cylinders having pis-

ton-rods engaging and supporting the trunnions, means simultaneously supplying pneumatic pressure to the opposite sides of each piston and means limiting the movement of the trunnions by the pistons.

9. The combination of the gun and its trunnions, with a pair of reversely-inclined cylinders on each side of the gun, pistons in said cylinders having piston-rods engaging and supporting said trunnions, and arms secured to said cylinders and having engagement with the trunnions for limiting and guiding the movements of the trunnions by the pistons.

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

SAMUEL N. McCLEAN.

Witnesses:
S. T. CAMERON,
REEVE LEWIS.