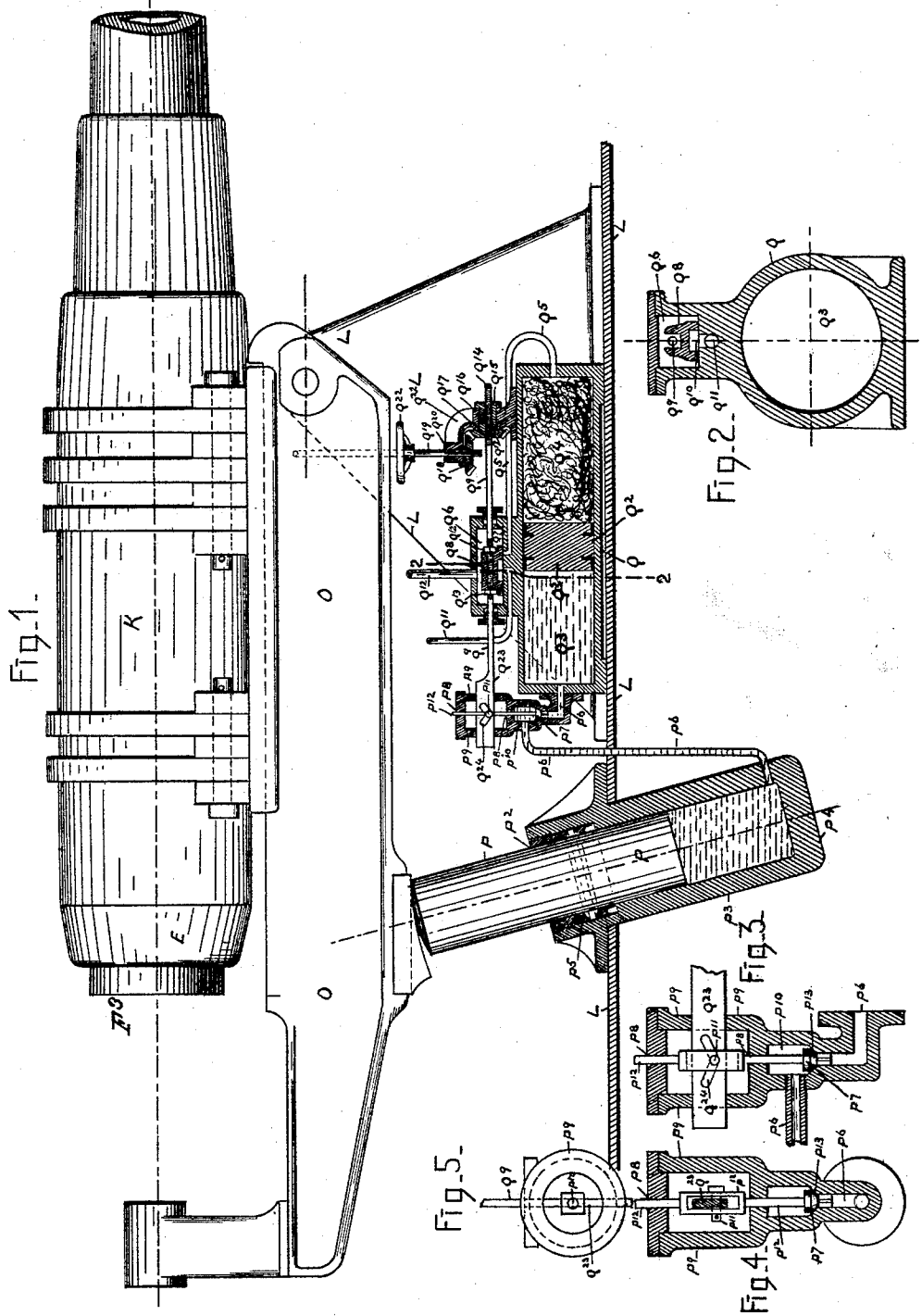
(No Model.)

H. A. SPILLER.

HYDROPNEUMATIC OPERATING MECHANISM FOR GUNS.

No. 458,345. Patented Aug. 25, 1891.



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HYDROPNEUMATIC OPERATING MECHANISM FOR GUNS.

SPECIFICATION forming part of Letters Patent No. 458,345, dated August 25, 1891.

Application filed October 3, 1889. Serial No. 325,863. (No model.)

To all whom it may concern:

Be it known that I, HARRY A. SPILLER, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Hydropneumatic Elevating-Gear for Guns, of which the following is a full, clear and exact description.

This invention relates to hydropneumatic gun-carriages.

The object of the invention is to produce a gun-carriage whereby a gun may be raised and lowered rapidly and at will, and retained at any desired elevation, and whereby the recoil of a gun may be taken up without undue shaking or jarring.

With this object in view the invention consists in the combination, with a pivoted gun, of an obliquely-arranged piston or ram attached to the gun, a water-cylinder receiving the piston or ram, and a cylinder containing water under pressure communicating with the cylinder receiving the piston or ram, and having its piston-head operated by compressed air.

Furthermore, the invention resides in the combination, with a pivoted gun having a piston or ram attached thereto, of a water-cylinder receiving the piston or ram and a supplemental cylinder containing water and communicating with the cylinder receiving the piston or ram, a piston-head, and a compressed-air inlet whereby the piston-head may be moved to impose pressure on the water in the cylinder.

Furthermore, the invention resides in the combination, with a pivoted gun, of a piston-rod or ram attached to the gun, a water-cylinder receiving the piston or ram, a supplemental cylinder containing water on one side of its piston-head and having an opening for the admission of compressed air on the other side, a connection between the portion containing water and the water-cylinder, and valves operated by a common rod and governing the passage of water to the water-cylinder and the admission of compressed air to the supplemental cylinder.

Furthermore, the invention resides in various novel details of construction, whereby the object of the invention is attained.

I have illustrated the invention in the accompanying drawings, in which—

Figure 1 is a side elevation of the gun, a beam supporting the gun, a support having the beam pivoted thereon, and a section of the mechanism to raise, depress, and support the gun. Fig. 2 is an enlarged transverse section in detail, the section being taken on line 2 2 of Fig. 1. Figs. 3 and 4 are enlarged vertical sections of the check-valve and mechanism to open and close it, the sections in the figures being taken in planes at right angles to each other, and Fig. 5 is an interior plan view of the valve.

In the drawings, K represents the gun. The gun lies lengthwise of and is supported on a beam O, which is journaled at the forward end, or toward the muzzle of the gun, on a support L, shown as stationary, but which may be a rotating gun-carriage or other suitable support for the gun. The beam O preferably extends to the rear of the breech F^3 of the gun.

P is a solid (preferably cylindrical) ram or piston entering the upper open end P^2 of a cylinder P^3. The cylinder P^3 is fixed on the gun-support L, and its axis and that of the ram are coincident and in an oblique line of direction to the axis of the gun, so as to present the upper end, preferably rounded off, of the ram in position for the rest of the gun-carrying beam O. The axes of ram and cylinder are in the line of the arc of a circle described from the axis of the journal of said beam as a center and in intersection of the axis of the gun at the breech of the gun. The ram P is free to move up and down in the cylinder P^3, and is suitably packed at P^5 against leakage of a column of water held under pressure in the cylinder below the ram to support the ram and through it and beam O the gun in position and to raise and lower the muzzle of the gun and to resist the recoil of the gun when fired.

P^6 is a pipe leading from the lower end of the cylinder P^3 and upward to one end of a

horizontal supplemental cylinder Q, and making water communication between said two cylinders. The cylinder Q is immovably held on the gun-support L.

Q^2 is a piston-head, suitably packed and free to move forward and backward in and separating the cylinder into two compartments Q^3 Q^4, one on each of the opposite sides of the piston-head. The compartment Q^3 is in communication with the water-chamber of the cylinder P^3, as has been explained, and the compartment Q^4 has a pipe or passage Q^5 opening into it at the head of the cylinder. This pipe Q^5 is for the purpose of admitting air under pressure into the compartment Q^4 of the cylinder Q, and for that purpose it is to be connected with any suitable compressed-air supply. In the present instance this air-passage Q^5 leads into a horizontal air-chest Q^6, held on the upper side of the cylinder Q, and having a horizontal valve-stem Q^9 extending, suitably packed through and projected from the opposite ends of the valve-chest, in position to be used to move the slide-valve forward and backward on its seat Q^7. This valve-stem is also preferably connected to a valve P^7 of the water-pipe P^6, in order that the valves may be operated simultaneously.

The slide-valve Q^8, at its under and seating face and intermediately of the length of said face, has an exhaust-chamber Q^{10} open to the valve-seat Q^7, and the valve-seat has an air-passage Q^{11} leading from it and this air-passage Q^{11}, which is the exhaust. The valve and the exhaust-chamber Q^{10} of valve, as also the air-passage Q^5 leading from valve-seat to air-compartment Q^4 of chambered cylinder, are relatively constructed and arranged so that with the slide-valve moved to open the air-passage Q^5 of chambered cylinder Q to the air-chest Q^6 the exhaust air-passage Q^{11}, while opened to the exhaust-chamber Q^{10} of the valve, is closed to said air-passage Q^5, and so that with the slide-valve moved to close the air-passage Q^5 of chambered cylinder Q to the air-chest Q^6, said air-passage will then be opened to the exhaust-chamber Q^{10} of the valve, and it in turn opened to the exhaust air-passage Q^{11}.

Q^{12} is a pipe leading into upper side of air-chest Q^6, and to be connected (the connection not shown) in any suitable and well-known manner to a suitable and any well-known air-supply under pressure, (not shown,) and all so that air under pressure may be admitted into the air-chest, to be from it entered into or shut off from the air-compartment Q^4 of the chambered cylinder Q by a proper adjustment of the slide-valve Q^8, as has been explained. The slide-valve Q^8 is rigidly attached to its valve-stem Q^9, which passes lengthwise through it and is confined on the stem by screw-nuts Q^{13}, so that by suitably turning and setting up the screw-nuts the valve may be adjusted lengthwise on the stem. The valve-stem at one end Q^{14} is screw-threaded and receives a screw-threaded nut Q^{15}, which is held against longitudinal movement, but free to turn in a bearing Q^{16}, rigidly held on the upper side of chambered cylinder Q and formed at one end with a vertical bevel gear-wheel Q^{17}, meshing a corresponding bevel gear-wheel Q^{18} held on the lower end of a vertical spindle Q^{19}, turning in, but suitably held against movement through, a bearing-block Q^{20} of a standard Q^{21}, held on the chambered cylinder Q and supporting also the bearing-block Q^{16} for the screw-threaded nut Q^{15} and its vertical bevel gear-wheel Q^{17}, before referred to.

Q^{22} is a wheel-handle held on gear-wheel spindle Q^{19}, for convenience in turning it. By suitably turning the wheel-handle Q^{22} through the gear and other connections between it and the slide-valve Q^8, all as described, the slide-valve is moved forward or backward, as the case may be, on its seat in the air-chest Q^6. The opposite end Q^{23} of the slide-valve stem Q^9 to that end Q^{14}, carrying the screw-threaded nut Q^{15}, is vertically flat-sided and introduced through a vertical and corresponding guideway P^8, extending from side to side of a vertical shell or casing P^9 in upward extension of the water-chamber P^{10} for the valve P^7, hereinbefore referred to, and in the water-passage P^6, leading between the ram-cylinder P and the water-compartment Q^3 of the chambered cylinder Q. The flattened portion of the slide-valve stem Q^9 has a V-shaped slot or camway Q^{24}, which receives a horizontal pin P^{11}, held on the vertical stem P^{12} of the valve P^7 of the water-passage P^6. The valve-stem P^{12} passes through suitable vertical guideways of the shell or casing P^9 and water-chamber P^{10}, containing the valve P^7, and the valve P^7 has a suitable seat P^{13} in the water-chamber P^{10} of the water-way P^9, so that with the valve on its seat to close and with the valve raised from its seat to open the communication by the water-passage P^6 between the ram-cylinder P and the water-compartment Q^3 of the chambered cylinder Q. The cam-and-pin connection Q^{24} P^{11}, between water-valve stem P^{12} and slide-valve stem Q^9, secures the opening and closing of the water-valve on a movement of the slide-valve in opposite directions, and this connection is arranged, for purposes hereinafter described, relatively to the opening of the slide-valve either to allow air to enter or to exhaust air from the air-compartment Q^4 of the chambered cylinder Q, as described, to open and relatively to the closing of the slide-valve, as has been explained, to close the water-valve.

Under the arrangement of mechanism described with the slide-valve Q^8 opened for the admission of air to and closed to the exhaust or outlet of air from the air-compartment Q^4 of the cylinder Q and with the water-valve P^7 opened for water communication between the water columns of the cylinder Q and of the ram-cylinder P, all as has

been described, obviously by forcing air into and compressing it in the air-compartment Q^4 of the chambered cylinder Q the water contained in water-compartments of the cylinder Q and ram-cylinder will be placed under pressure and to a degree sufficient not only to support the gun acting on it through the ram P and the gun-carrying bearing O, but also by raising the height of the water column in the ram-cylinder to raise the gun at its breech, depressing its muzzle, and there to support it on a confined column of water in ram-cylinder P^3. With the slide-valve Q^8 opened to the exhaust or outlet of air from the air-compartment Q^4 of the chambered cylinder Q, at the same time opening the water-valve P^7, and so opening communication between the water columns of the ram-cylinder P and the chambered cylinder Q, the air-pressure in the chambered cylinder Q can be thereby reduced, so as to secure a lowering of the height of the water column in the ram-cylinder and through the ram and gun-carrying beam O a lowering of the gun at its breech and a raising of it at its muzzle, as may be desired, on which, by then closing the slide-valve Q^8, so as to shut off the exhaust or outlet of air, as described, at the same time shutting off the water communication between the water columns of ram-cylinder and chambered cylinder the gun can and will be then supported in its position of adjustment by the water column confined in ram-cylinder.

It is thus plain from the description given of the mechanisms of this invention acting in co-operation with a confined column of water under the ram and under pressure the gun is made adjustable, vertically considered, by the rise and fall of a column of water under pressure and is supported in its positions of adjustment on a confined column of water, and again that the rise and fall in the height of said water column is secured from action of a column of air placed either under a greater or less degree of compression, according as it is either in or out of connection with the air-supply under pressure or with the exhaust, and that the recoil of the gun when fired is resisted by a confined column of water, all substantially as has been described.

It is preferable to connect the water-valve P^7 and air-valve Q^8, so as to be operated simultaneously, as has been described; but the connection described or any other suitable connection for the same purpose may be dispensed with and the valves arranged for separate and independent operation. Again, the water-valve P^7 may be simply a check-valve of any of the ordinary or other suitable constructions and arrangements, but such as to open against and to close with the pressure of the water column in ram-cylinder. A water-valve P^7, however, constructed and arranged substantially as described is most preferable.

Preferably the gun, as has been particularly described, is supported on a beam journaled on a suitable support; but obviously the gun may be journaled directly on the support itself.

In conclusion, it will be observed that while air and water are specially mentioned as used for the operations of the mechanisms of this invention and as particularly explained the invention is not to be limited in these regards.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a pivoted gun, of an obliquely-arranged piston or ram adapted to act upon the gun-support, a water-cylinder receiving the piston or ram, a cylinder containing water under pressure communicating with the cylinder receiving the ram and having its piston-head operated by compressed air, and valves operated by a common connection and governing the passage of the piston-actuating liquid and the admission of the compressed air to the piston-head, substantially as described.

2. The combination, with a pivoted gun, of a piston-rod or ram attached to the gun, a water-cylinder receiving the piston or ram, a supplemental cylinder containing water on one side of its piston-head and having an opening for the admission of compressed air on the other side, a connection between the portion containing water and the water-cylinder, and valves operated by a common connection and governing the passage of water to a water-cylinder and the admission of compressed air to the supplemental cylinder, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HARRY A. SPILLER.

Witnesses:
ALBERT W. BROWN,
HENRY F. MCKEEVER.