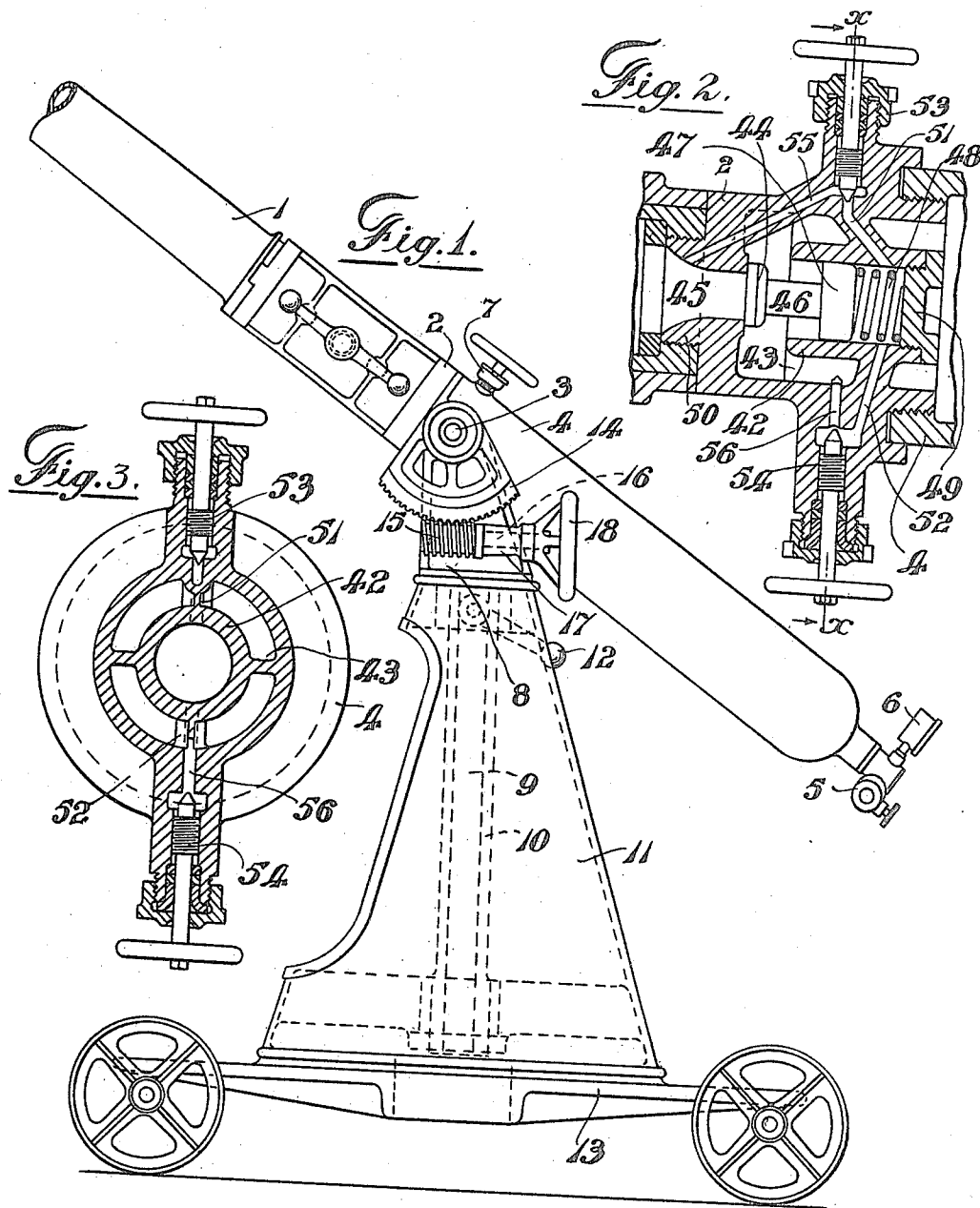


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 APPARATUS FOR FIRING OR DISCHARGING EXPLOSIVE PROJECTILES.
 1,234,603.

APPLICATION FILED APR. 6, 1916.

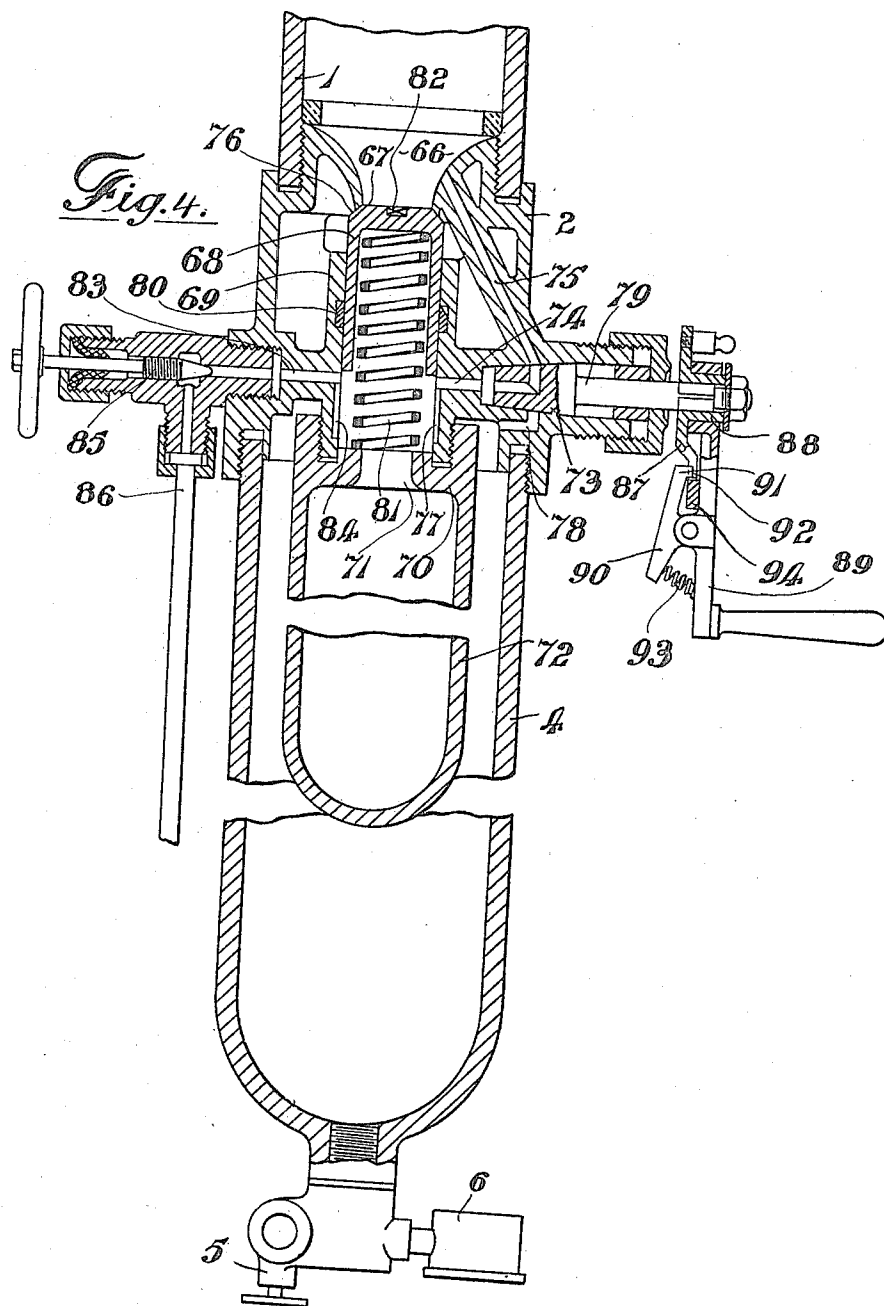
Patented July 24, 1917.
 3 SHEETS—SHEET 1.



Inventor:-
 Francis Percival Aylwin,
 By: B. Singer, Atty.

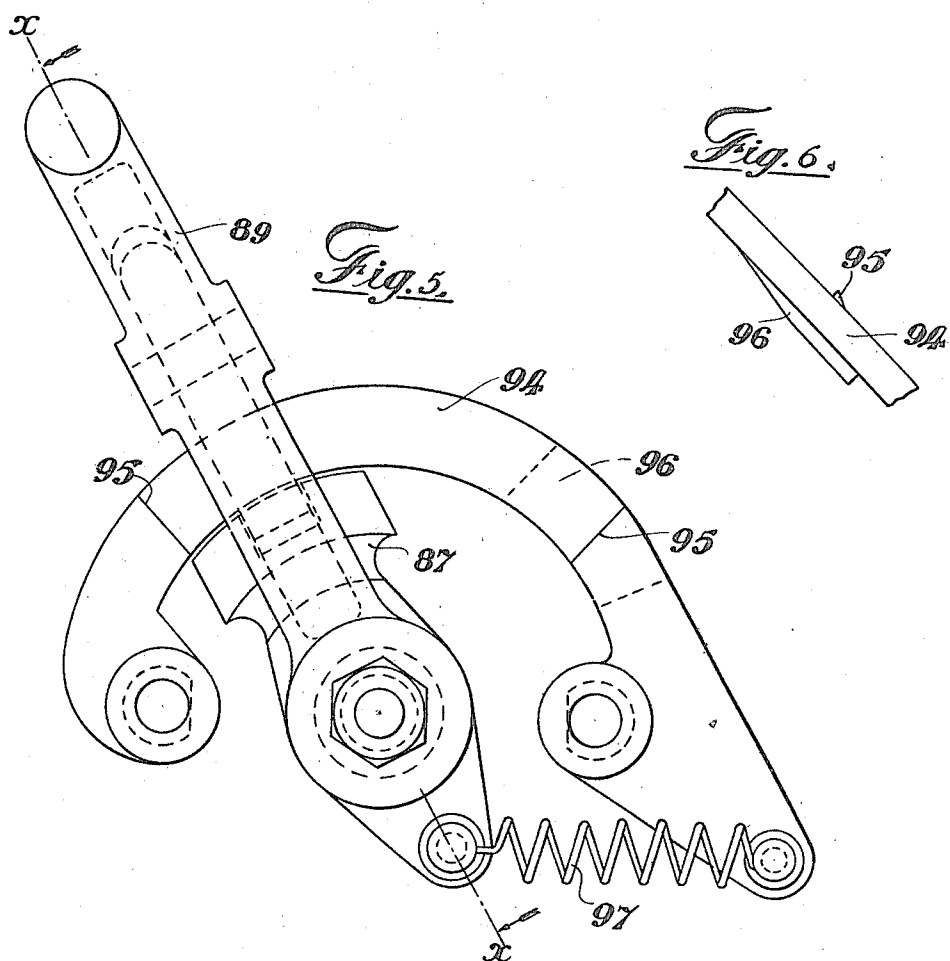
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UNITED STATES PATENT OFFICE.

FRANCIS P. AYLWIN, OF LONDON, ENGLAND.

APPARATUS FOR FIRING OR DISCHARGING EXPLOSIVE PROJECTILES.

1,234,603.

Specification of Letters Patent.

Patented July 24, 1917.

Application filed April 6, 1916. Serial No. 89,494.

To all whom it may concern:

Be it known that I, FRANCIS PERCIVAL AYLWIN, residing at 11 Haymarket, London, W., England, have invented certain new and useful Improvements in and Relating to Apparatus for Firing or Discharging Explosive Projectiles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for discharging projectiles by means of a pressure fluid such as compressed air.

The invention has for one of its objects the provision of an improved form of valve and operating means therefor for admitting the pressure fluid from a reservoir into the cylinder whereby the projectile is given a relatively small initial movement prior to the admission of the full propulsive charge.

Among other objects of the invention are the provision of an improved mounting for fluid operated guns and the provision of a fluid pressure operated elevating gear.

Further features of the invention will be apparent as the description proceeds and are set out in the appended claims.

In the accompanying drawings:—

Figure 1 shows in side elevation one form of the apparatus.

Fig. 2 is a sectional elevation showing one form of valve connection between the pressure reservoir and the discharge barrel.

Fig. 3 is a section taken on the line $x-x$ of Fig. 2 looking in the direction of the arrows.

Fig. 4 is a sectional elevation of a modified form of valve and means for operating the same.

Fig. 5 is a plan of the trigger mechanism shown in Fig. 4.

Fig. 6 is a side view of a detail shown in Fig. 5.

Referring to Fig. 1, 1 indicates the discharge tube or barrel which may be rifled if required, and has a bore equal to the diameter of the projectile to be discharged from it. This tube or barrel is connected and attached by a valve casing or head 2 to a somewhat larger tube 4 which acts as a reservoir for air or other fluid compressed to a very high pressure, which is forced in beforehand by means of a pump, air compressor or any other convenient means. Between the reservoir 4 and the barrel 1 is fitted a suitable

balanced or equilibrium valve 7 hereinafter more fully described.

The reservoir is provided at its outer end with a valve 5 to which the cylinder of compressed air is attached for charging the reservoir, and a pressure gage 6 is also provided for ascertaining the pressure in the reservoir. By operating the valve 7 a given quantity of compressed air or the like is allowed to escape from the reservoir 4 into the barrel 1 sufficient to discharge the projectile. The capacity of this reservoir can be considerably augmented by coupling up several more reservoirs separately or collectively by means of suitable connections, valves, pressure indicators and the necessary fittings required for the purpose, and arranged so that the pressure can be drawn off from one or more reservoirs at once if it be so desired. In addition to this it can also be arranged that the exhausted reservoirs can be replenished from other charged reservoirs even when they are partially or wholly exhausted; the operation of further charging exhausted reservoirs can be carried out even when the apparatus is discharging projectiles. It will thus be seen that in this manner two or more air reservoirs of the apparatus can be effectually worked off while other pairs are being charged up with compressed air or other fluid.

The reservoir is preferably provided with laterally extending trunnions 3 which are carried by cheeks 8 attached to a pillar 9 rotatably mounted in a tubular bearing 10 in a pedestal 11, a suitable locking device 12 being provided to secure the pillar 9 in position during the discharge of a projectile. The pedestal 11 may rest upon the ground as shown in Fig. 2 or may be secured upon a wheeled carriage 13 Fig. 1.

For altering the angle of elevation of the gun one of the trunnions 3 is provided with a toothed quadrant 14 which meshes with a worm 15 mounted on a spindle 16 carried in bearings 17 formed upon one of the cheeks 8, and provided with an operating hand wheel 18.

The apparatus can be used either as a muzzle or breech loader, in the first case by dropping or pushing the projectile from the barrel against a soft india rubber or like material pad and permitting the air in the barrel to escape by a vent hole, or, in the case of a breech-loader, the bottom of the long tube or barrel being provided

with a breech and suitable means for opening and closing the same.

To obviate the danger of premature explosion of the projectile in the apparatus before ejection use is made of the valve illustrated in Figs. 2, and 3 or 4.

The valve casing or head 2 of the reservoir 4 is cylindrical in form and is provided internally with a smaller cylinder 42 spaced from the outer cylinder 2 by ribs 43. Within the head 2 is an equilibrium valve 44 which closes an outlet 45 and is connected by a stem 46 to a piston 47 working in the cylinder 42. A spring 48 is interposed between the piston 47 and a cover 49 which closes the rear end of the cylinder 42, said spring serving when there is no pressure of air to maintain the valve 44 closed against its seating formed upon the end 50 of the cylinder 2, and around the outlet 45 which is in communication with the barrel 1. Between the inner and outer cylinders 42 and 2 are ports 51 and 52 respectively leading to valves 53 and 54 mounted in the wall of the cylinder 2, the said ports communicating with the rear face of the valve piston 47. In the outer cylinder 2 is a port 55 which communicates between the valve 53 and the outlet 45 and another port 56 which communicates between the valve 54 and the interior of the cylinder 2.

In operation the projectile is inserted in the barrel 1 and the breech closed, the main air valve 54 being open in order that compressed air from the reservoir 4 may maintain an equal pressure on both sides of the valve piston 47 and keep the valve 44 closed by the pressure of the spring 48. To discharge the projectile the operator first closes the valve 54 and opens the valve 53 thus admitting air from the cylinder 42 through the ports 51 and 55 to the rear of the projectile which thereby receives its initial movement. This operation results in that the air in the cylinder 42 becomes reduced in pressure, while the full pressure of the air in the reservoir 4 is being exerted on the outer side of the valve piston 47 which is thereby moved inward (that is toward the right Fig. 4) taking with it the valve 44 so that the full force of the pressure fluid in the reservoir rapidly expels the projectile from the barrel 1. The operator then closes the valve 53 immediately and opens the valve 54 to restore the valve 44 to its closed position.

In the form shown in Fig. 4 the valve box 2 is fixed preferably at one end of the air reservoir 4 and in some cases may form the end of the latter entirely, the outlet 66 of the valve 67 being attached to the end of the discharge tube or barrel 1. To raise or open such a valve from its seating under such a heavy air pressure would be extremely

difficult under ordinary conditions, but this objection is entirely removed by connecting the valve 67 to, or making it solid with a piston or plunger 68 or diaphragm of larger diameter than the valve. This piston 68 works in a small cylinder 69 (with an end 70) formed in the body of the valve box, the cylinder being connected by an opening 71 with a reservoir 72 charged with air under pressure from the main reservoir 4 so that the pressure of the air from the reservoir is let in behind the small cylinder piston or plunger 68 so that the same pressure sets on both sides of the piston or plunger and the main valve remains closed and upon its seating in a sealed position.

To open the main valve 67 the small auxiliary valve 73 must first be shut off entirely from the air reservoir 4, and at the same time the small cylinder 69 and back of the piston or plunger 68 is also opened to the barrel by way of the ports 74 and 75 which latter communicate with the barrel 1, thus destroying the equilibrium or balance of pressure and causing the small piston or plunger 68 to move inward by the pressure of the air from the reservoir and at the same time moving the air valve 67 attached to it from its seating 76 which will then remain open until the equilibrium or balance of pressure is restored again to the small cylinder. Closing of the port 74 by the inward movement of the piston 68 is prevented by a small passage 77 extending from said port toward the inner end of the cylinder, or the port 74 can be drilled diagonally toward the inner end of the cylinder. By turning the auxiliary valve 73 into communication by way of a port 78 with the reservoir 4, the piston and valve return at once to the closed position by the air pressure from the reservoir 4 acting directly upon the piston within the cylinder 69 and keeping it sealed. It should be noted that for convenience in illustration the ports 75 and 78 have been shown in Fig. 4 spaced 180° apart, although as shown in Fig. 5 the normal movement of the spindle 79 of the valve 73 is only about 90° and any other convenient angle can be utilized.

The main air valve 67 and piston 68 are preferably formed in one piece, a flexible packing pressure ring 80 being introduced in the cylinder 69 for the purpose of preventing any excess of leakage which might destroy the relief of pressure in the small cylinder. A coiled spring 81 strong enough to overcome the friction is arranged in the small cylinder which spring acts on the piston or plunger and valve for the purpose of keeping it seated in the event of the pressure being exhausted in the air reservoir 4. The valve 67 is also provided on its outer surface with a square recess 82 for the purpose of receiving a tool when it is necessary

to twist the valve around its axis or grind it into its seating.

The cylinder 69 is further provided with a port 83 and passage 84 controlled by a valve 85 having a pipe 86 attached thereto which may be connected up to any suitable source of fluid pressure in the event of the plunger 68 sticking in the cylinder and requiring to be forced back on its seat.

The pipe 86 can also be connected if desired to a source of lubricant, such a supply being necessary owing to the fact that it has been found in practice that lubricant is scavenged from the cylinder after each firing operation.

The spindle 79 of the auxiliary regulating valve 73 has a squared upper end provided with a catch plate 87. This plate has a boss 88 thereon whereon is rotatably mounted the lever 89 having a handle for manual operation. Pivoted beneath the lever 89 is a trigger 90 one end of which is formed with a projection 91 for engaging a notch 98 in the catch plate, while the opposite end of said trigger is controlled by a spring 93 interposed between the trigger and the lever 89. The latter is arranged to work over a quadrant 94 supported upon the valve box having stops 95 formed on its upper face while its under face is provided with a cam 96 adapted to engage and depress the forward end of the trigger 90 when the lever 89 is moved around the quadrant. A spring 97 attached to the quadrant 94 and the catch plate 87 normally retains the latter in the position shown in Fig. 5 in which position the valve is maintaining the pressure on both sides of the main valve plunger 67 in equilibrium and keeping the said valve closed.

When a projectile is to be discharged the valve 73 is turned to the position shown in Fig. 4 so that the pressure fluid passes from the back of the valve plunger 67 through the ports 74 and 75 to the rear of the projectile, thus destroying the equilibrium and causing said valve 67 to open. When the lever 89 by means of which this operation has been performed reaches the stop 95 the cam 96 depresses the trigger 90, thus disengaging the projection 91 thereon from the notch 92 and releasing the catch plate 87. The latter is now free to move back to its original position under the influence of spring 97, restoring communication between the ports 74 and 78 and thereby closing the valve 67. The lever 89 is then moved back to its original position in which the projection 91 can again engage the notch 92 in readiness for the next shot, the edge of the plate 87 being suitably beveled to allow the trigger 90 to pass thereover.

It will be seen from the above that the valve 73 is so arranged as to allow of a predetermined and automatic shutting of the

main valve 67 and prevent any excess of air being used beyond that actually required for the discharge of the projectile. In accordance with the distance projectiles are required to be thrown the position of the cam 96 can be altered to give the desired cut off and thus regulate the amount of pressure fluid allowed to flow into the discharge tube or barrel.

I claim:—

1. Apparatus for discharging projectiles by fluid pressure, comprising a reservoir provided with a head, a barrel secured to said head, a passage establishing communication between said barrel and reservoir, an equilibrium valve normally closing said passage, a piston connected to the valve stem, a cylinder, formed within said head, adapted to receive the said piston, means for allowing fluid to act upon said piston, whereby to move the same, consequently unseating the valve and allowing the unrestricted flow of fluid from the reservoir to the barrel.

2. Apparatus for discharging projectiles by fluid pressure, comprising a reservoir provided with a head, a barrel, secured to the said head, a passage establishing communication between said barrel and reservoir, an equilibrium valve normally closing said passage, a piston connected to the valve, a cylinder, formed within said head, adapted to receive the said piston, a passage, which allows fluid under pressure to act upon one of the faces of the piston, whereby to normally hold the equilibrium valve in seated position, means being provided for exhausting the fluid acting upon the piston, and conducting the said fluid to the discharge barrel, whereby the piston will be retracted, unseating the equilibrium valve and allowing the unrestricted flow of fluid from the reservoir to the barrel.

3. In apparatus for discharging projectiles by means of fluid pressure comprising a main reservoir, a valve connected directly to a piston working in a cylinder having secured thereto an auxiliary fluid pressure reservoir and an auxiliary valve said valve being adapted to open communication between said cylinder and the discharge barrel or between the former and the main pressure reservoir.

4. Apparatus for discharging projectiles by means of fluid pressure, comprising a main reservoir, a valve formed in one with a piston or diaphragm, said piston to work in a cylinder having secured thereto an auxiliary fluid pressure reservoir, and an auxiliary valve, means for operating said valve comprising a hand lever, a catch plate secured to the valve spindle, and adapted to be automatically released from the said hand lever at a predetermined point in the path of travel of the latter to cut off the

supply of compressed air as the projectile leaves the discharge barrel, so that the maintaining pressure fluid in the reservoir can be reinforced by a further charge and used for the next shot, said valve being adapted to open communication between said cylinder and the discharge barrel or between the former and the main pressure reservoir.

5 5. Apparatus for discharging projectiles by means of fluid pressure, comprising a main reservoir, a valve formed in one with a piston, adapted to work in a cylinder having secured thereto an auxiliary fluid pressure reservoir and an auxiliary valve, means for operating said valve, such means comprising a hand lever, a catch plate secured to the valve spindle and adapted to be automatically released from the said hand lever at a predetermined point in the path of travel of the latter, a trigger mounted upon said hand lever and held by spring pressure in engagement with the catch plate until released therefrom by means of a cam mounted upon a quadrant around which the hand lever moves, such valve being adapted to open communication between said cylinder and the discharge barrel, or between the former and the main pressure reservoir.

6. Apparatus for discharging projectiles by means of fluid pressure comprising a main reservoir, a valve formed in one with a piston, such piston being adapted to work in a cylinder having secured thereto an auxiliary fluid pressure reservoir and an auxiliary valve, means for operating said valve, comprising a hand lever, a catch plate secured to the valve spindle, and adapted to be automatically released from the said hand lever at a predetermined point in the path of travel of the latter, a trigger mounted upon said hand lever and held by spring pressure in engagement with the catch plate until released therefrom to close the valve under the influence of a spring by a cam mounted upon a quadrant around which the hand lever moves, said valve being adapted to open communication between said cylinder and the discharge barrel, or between the former and the main pressure reservoir.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS P. AYLWIN.

Witnesses:

BYR BOSANQUET,
A. R. J. RAMSEY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."