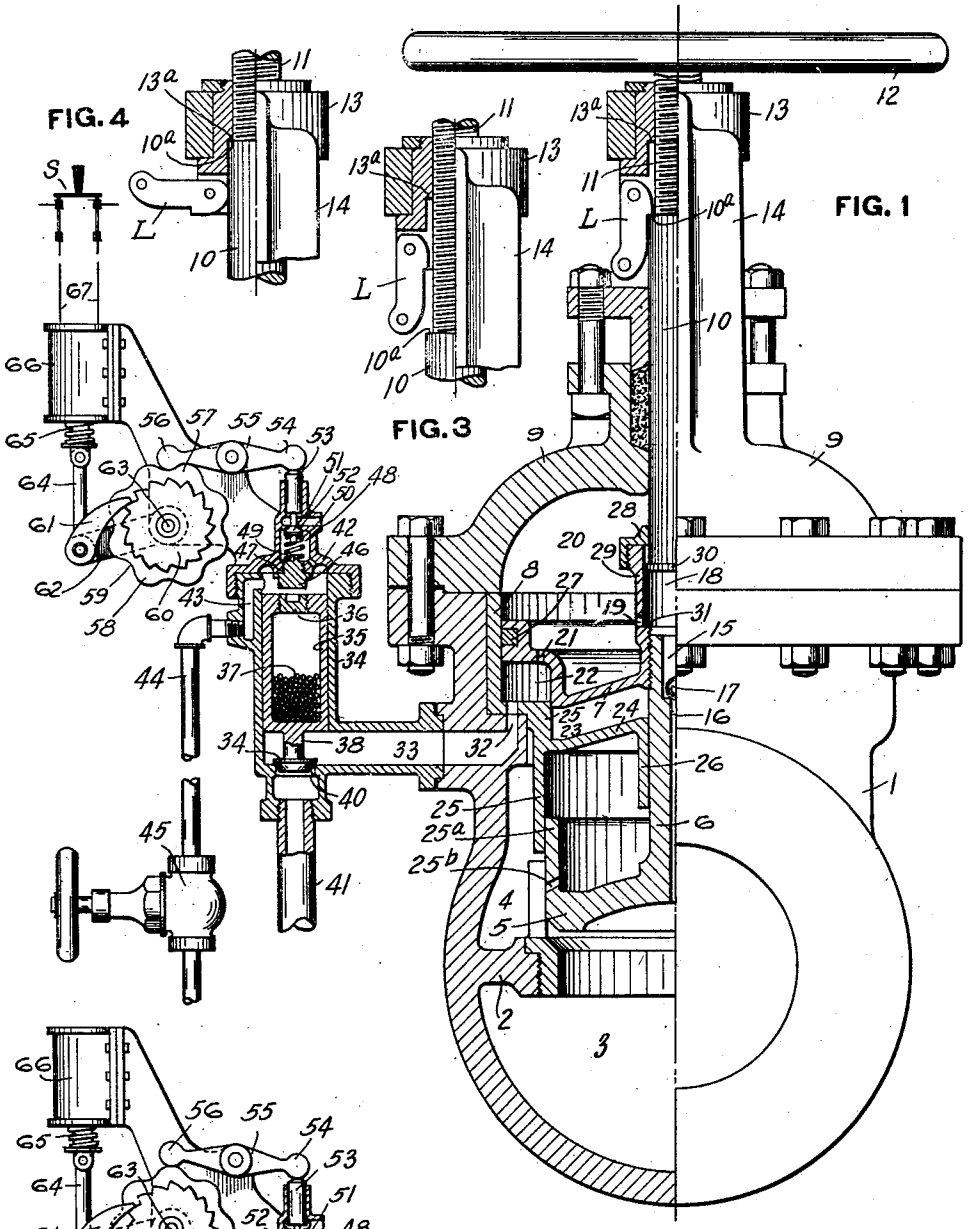
E. V. ANDERSON.

PILOT VALVE.

APPLICATION FILED JULY 6, 1917.

1,370,260. Patented Mar. 1, 1921.



WITNESSES

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UNITED STATES PATENT OFFICE.

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PILOT-VALVE.

1,370,260. Specification of Letters Patent. Patented Mar. 1, 1921.

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To all whom it may concern:

Be it known that I, EDWARD V. ANDERSON, a resident of Monessen, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Pilot-Valves, of which the following is a specification.

This invention relates to actuating mechanism adapted to be used in combination with a pilot valve for controlling a main valve in a pilot pressure line.

Particularly the invention has for its object the provision of a relief valve for controlling the pressure above a weighted pilot valve, and electrical means for controlling the relief valve, whereby the pilot valve may be caused to open, by reason of exhaust through the relief valve, by an electrical control, operable at any distance from the valve mechanism.

Referring to the drawings, Figure 1 shows a partial central vertical section, and partial side elevation of the main valve, and the pilot hereinafter described for operating it; Fig. 2 is a sectional view of the pilot valve similar to that of Fig. 1, but showing the pilot valve in open position; Fig. 3 is a partial vertical section showing portions of the hand-operating means when the valve is locked in closed position so that it cannot be automatically operated; and Fig. 4 is a view similar to Fig. 3, but showing the valve locked in open position, so that it cannot be automatically operated,—the manually operative parts for locking the valve in position to be automatically operated by the pilot valve, being shown in Fig. 1.

Referring to the drawings, the main casing 1 has a valve seat partition 2 separating the fluid inlet chamber 3 and the outlet chamber 4. The opening is closed by a main valve 5 supported on a vertical moving stem 6 which also carries a double piston 7 reciprocating in a cylinder 8 fixed in the main casing. This casing is covered by hood 9 through which projects a screw stem 10 having a threaded portion 11, and a terminal hand wheel 12, the threaded portion engaging a threaded member 13 carried on rigid extensions 14 of the casing hood 9. This hand wheel is adapted to open and close the main valve manually, in a manner more fully described below. The valve stem 6 which is threaded into the piston member 7, to make rigid connection therewith, has a central bore 15 at the top, and a smaller central bore 16 extending from the bore 15 to the bottom of the stem, forming a continuous passage therethrough, and in the larger bore is a ball check 17, adapted to prevent the passage of fluid downward through the stem, but to allow it to pass freely upward, in a manner which is obvious and well known in such construction. By this means pressure can readily pass from the chamber 3 through the stem 6 into a chamber 18 formed by a bore in an upward central extension of the piston member 7, and from that chamber through port 19 into a chamber 20, bounded by the piston member 7, the cylinder 8, and the hood 9. From this chamber 20 pressure can pass by means of small port 21 to the lower side of piston 7, into chamber 22, and thence by leakage into chamber 23, formed by the lower side of piston member 7, and partition wall 24, extending inward from a cylindrical portion 25 of the casting forming the cylinder 8, above referred to. This member 24 has a central extension 26, having a central bore forming a guide bearing for the valve stem 6. A suitable packing 27 is provided for the reciprocating piston 7 so that the only escape of pressure from the chamber 20 to the chamber 22 is by port 21. A screw cap 28 engages the exterior of extension 29 of piston member 7, and this cap extends inwardly beyond the central bore of said extension 29, having a central bore through which the screw stem 10 passes, but forming a shoulder adapted to engage a collar 30 at the lower end of the screw stem 10, and to limit the free upward travel of said screw stem by such abutment. The collar 30 engages at the lower end of the chamber 18 another shoulder 31, on the extension 29. This construction allows the collar 30 to be moved up and down the length of the chamber 18 without effect on the main valve, but after such idle travel, further movement will operate to either open or close the main valve, as the stem may be moving up or down, in obvious manner.

In the view shown in Fig. 1, the main valve is open, the hand wheel and stem 10 being raised so as to permit the main valve to be opened and closed automatically by the pilot valve, as below described. In other words, the main valve is in position to be automatically operated. If the hand wheel

be moved upward still farther, it will carry the main valve, and hold it there without possibility of its being closed by a pilot valve, or any other automatic means, until the hand wheel is run down. If it be turned down the main valve will be locked in closed position.

In Figs. 1, 3 and 4, details are shown of devices to determine the proper travel of the valve stem for the various positions described. A latch member L is pivoted to the frame and normally hangs as shown in Fig. 1, with a shoulder across the path of travel of the unthreaded stem 10, which forms a shoulder 10^a at the junction with threaded portion 11. When the stem is moved up by the hand wheel 12, the shoulder 10^a will be caught by the latch, as shown in Fig. 1, and further upward travel of the stem prevented. The valve is then free to be operated to open or close automatically. By releasing the latch as shown in Fig. 4, the stem may be turned on up to the position shown in Fig. 4, where the shoulder 10^a will be stopped by shoulder 13^a on collar 13, and the valve will be locked in open position, so that it cannot be closed by automatic means.

With this explanation of the operation of the hand wheel for opening and closing the main valve, it will be understood that the remainder of the description refers particularly to the operation of that valve by means of a pilot valve.

The operation of valves of this type is well known, and no extended description is considered necessary. High pressure fluid underneath the valve, tends to open it, and so to permit the fluid to pass through the main casing. This pressure passes through the hollow stem by passage 16, above the piston 7, but is equalized on the two sides thereof by passage through the port 21 and leakage into cylinder 23, so normally the valve stays open by reason of pressure of fluid beneath the main valve.

For reasons of safety, it has been heretofore the practice to connect the chamber 22 to the service side of the valve, so that should pressure in the service line be suddenly reduced materially below the boiler pressure, the main valve would be closed by the high pressure fluid source, and prevent further escape therefrom to the broken service line, etc. In the present case this principle is used to automatically operate the main valve, by providing means operable from a distance for suddenly relieving the pressure in the chamber 22, to cause the main valve to close.

From the chamber 22 a port 32 leads by suitable connecting passage 33 to a supplementary valve casing 34, in which is mounted a hollow cylinder or piston 35 having an opening at the top normally closed by a threaded member 36, and being partly filled with an adjustable weight, such as shot 37 therein, the bottom of this hollow cylinder carrying a central valve stem 38, and a valve 39 adapted to seat to close a port 40 from the casing 34 to a pipe 41, leading to free air, or to the fluid supply line beyond the main valve.

The casing 34 is closed by a threaded hood member 42 at the top, and has a lateral passage 43 leading to a pipe 44, having a hand valve 45 therein, the pipe leading beyond the valve to free air. This opening is above the upper limit of travel of the hollow piston member 35, and by opening the valve 45 by hand, pressure above the piston member may be exhausted, to test the operation of the pilot valve, in obvious manner.

A plug 46 is screwed into a perforated dividing wall 47 of the hood 42, and this plug is adapted to limit the upward travel of the piston member 35. This dividing wall 47 forms a supplementary chamber 48 in said hood member, and the upper part of the plug 46 has an extension 49 adapted to retain coil spring 50 which bears against a valve member 51, adapted to close a passage 52 from the supplementary chamber 48 to the atmosphere. This valve 51 has a stem 53 extending upward through a bore in the casing. Against this extending stem one end 54 of a lever member 55, pivoted at its middle point, and having its other end 56 bearing against a corrugated wheel 57, having alternate lugs 58 and depressions 59, and having attached thereto a ratchet wheel 60, the teeth of which are engaged by a pawl 61, pivoted on a lever 62, which in turn is loosely attached to the axle 63 of the wheel 57, the free end of which is attached by a link 64 to the core 65 of a solenoid 66, the winding of which is connected by suitable wires 67 to a switch S at any desired point.

The operation of the main valve is well known in the art, and need not be here further described, except to point out that an additional cushioning device has been provided in downwardly extending cylinder 25, and the interfitting upwardly extending cylinder 25^a fixed on the valve itself, and having the leakage port 25^b, thus forming an additional dash pot to prevent either the sudden opening or closing of the main valve. This construction provides three separate and distinct dash pot spaces operable to prevent chattering and sudden closing of the valve.

By means of the pilot valve provided the main valve may be either opened or closed at any time by simply throwing the switch S. When the switch has been closed and allowed to remain so for a short time, it is again opened, so that no unnecessary current is used, and the valve will remain in the position resulting from such throwing of the switch, until the switch is again closed,

when it will be automatically moved to the other position, either open or shut.

Referring to Fig. 1, in which the manually operating means are shown adjusted to leave the main valve in position to be operated by the pilot valve here shown open, and the pilot valve closed as would normally be the case when the main valve is open, the operation is as follows:—The pressure on the two sides of piston 7 is equalized through the bore in the valve stem, the port 21 and leakage into chamber 23, and the valve is held in open position by pressure in the chamber 3. The operator desiring to close the valve, closes switch S, whereupon the solenoid is actuated, raising lever 62, and turning the wheel 57, so that the end 56 of lever 55 is raised from a depression to a projection on the wheel 57, assuming the position shown in Fig. 2, and consequently depressing valve stem 53, allowing escape of pressure by the vent 52, whereupon pressure underneath the piston 35 raises that member, opening the passage 40, and so relieving pressure in chamber 22, and allowing pressure from the supply side of the main valve to force piston 7 downward to close the valve. This movement is cushioned by the dash pot chambers 22, 23 and the chamber formed by the interfitting cylinders 25 and 25a.

Having seated, the valve remains closed by high pressure above the piston 7.

By again closing the switch S the solenoid moves the ratchet the space of one tooth, throwing the lever 55 back into the position shown in Fig. 1, allowing valve 51 to seat, whereupon pressure by leakage around the piston member 35, restores the balance on the piston 35 and the weight thereof causes the valve 39 to seat, whereupon pressure on the two sides of piston 7 again equalizes, and the main valve slowly opens.

By this means, the main valve can be readily opened or closed by merely throwing the switch, and obviously this switch can be situated at any part of the power plant, and at any desired distance from the valve. The arrangement of the manually operated opening and closing means with the main valve permits its complete coöperation with the pilot valve opening and closing means, and consequently the valve can be either locked in open position, in closed position, or in position to be automatically actuated only by the pilot valve.

I claim:—

1. In a pilot valve, the combination with a normally closed spring-controlled relief valve having a stem extending through its casing, of means to open said valve, said means comprising a reciprocating electrically controlled device, a member arranged to be actuated step wise thereby, and connections from said member to said valve, said member being arranged on alternate actuations thereof to open the valve and on intermediate actuations thereof to permit the valve to close.

2. In a pilot valve, the combination with a normally closed spring-controlled relief valve having a stem extending through its casing, of means to open said valve, said means comprising a reciprocating electrically controlled device, a notched wheel, ratchet and pawl mechanism actuated by said device and arranged to rotate said wheel step by step, and a lever for actuating said valve and having an end bearing against the periphery of said notched wheel, whereby on alternate actuations of said wheel the valve is opened and on intermediate actuations of said wheel said valve will close.

3. In a pilot valve, the combination with a normally closed spring-controlled relief valve having a stem extending through its casing, of means to open said valve, said means comprising a notched wheel, a lever fulcrumed at its middle point and having one end bearing against the valve stem and the other end against the notched wheel, a solenoid, and ratchet and pawl means operatively connecting said solenoid and notched wheel, whereby each time the solenoid is actuated the notched wheel is turned to raise or lower the valve controlling lever, alternately.

In testimony whereof, I have hereunto set my hand.

EDWARD V. ANDERSON.

Witnesses:

A. N. Shuster,

Rhoda Armstrong.