

FIG. 1

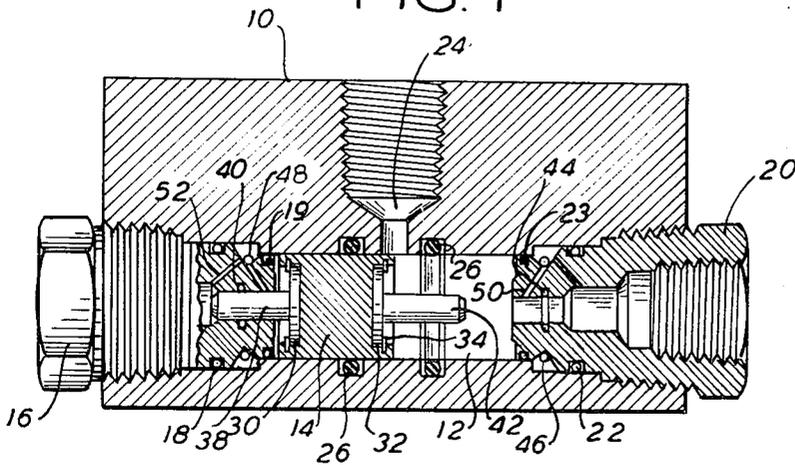


FIG. 2

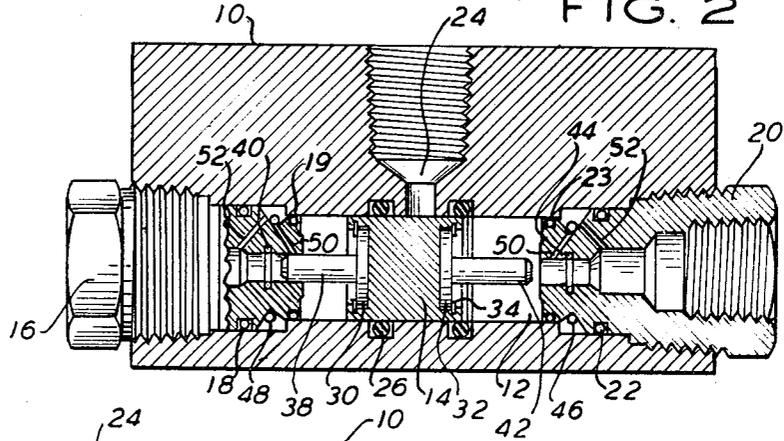


FIG. 3

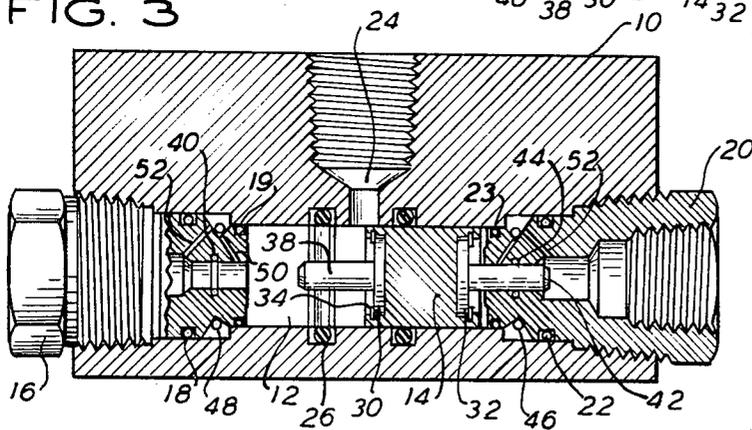


FIG. 4

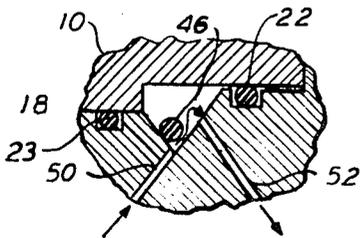
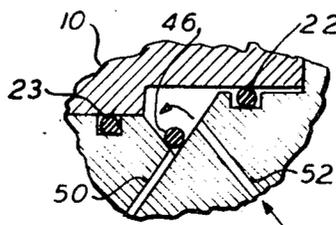


FIG. 5



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AUTOMATIC CHANGEOVER VALVE

Fluids such as compressed gases are often supplied in separate containers or cylinders. It is common practice to place one cylinder or bank of cylinders in service and maintain another full cylinder or bank of cylinders in reserve. Both are connected to the load and suitable valves provided to allow them to be discharged in sequence; i.e., putting the reserve full cylinder in service when the other has been depleted. This can be done manually by operating valves, but it is desirable to provide a changeover responsive to pressure loss in the depleted cylinder to turn off the depleted supply and turn on the full pressure fluid supply.

According to the present invention, the valve comprises a casing having a bore with a discharge outlet, separate high-pressure gas inlets laterally spaced from said outlet, a piston laterally movable in said bore past said outlet and alternately closing one of said high-pressure gas inlets, and means venting the respective ends of said bore when said corresponding high-pressure inlet is closed by said piston.

Preferably the piston has oppositely extending pins insertable within the respective inlets to seal off the same, and the pins are floating members movably retained in the faces of the piston to accommodate minor misalignment.

Preferably said venting means comprise a passage forming a bypass around said closed high-pressure inlet and connecting the trapped portion of the bore with the upstream side of the closed inlet, and an O-ring sealing device which alternately opens and closes the bypass.

Preferably the high-pressure gas inlets are nozzles in the opposite ends of said bore, the bore has grooves on each side of the discharge outlet receiving O-rings for sealing the piston, and said nozzles have O-rings receiving and sealing said pins when inserted.

FIG. 1 is a longitudinal section through a valve according to the preferred embodiment of the present invention, showing the piston on the left side and the flow being from the right;

FIG. 2 is a similar view showing the piston in transit from one operating position to the other;

FIG. 3 is a similar view showing the piston moved to seal off the right side inlet;

FIG. 4 is an enlarged detail view showing the right bypass relief valve O-ring being lifted as the piston nears the right-hand end; and

FIG. 5 is a similar view showing the same O-ring returned as the piston comes to rest at the right hand side.

The preferred embodiment of the present invention comprises a casing 10 having a bore 12 with a piston 14 slidable therein, a first inlet nozzle 16 screwed into one end of the bore 12 and sealed by an outer peripheral O-ring 18 and an inner peripheral O-ring 19, and a second inlet nozzle 20 screwed into the other end of the bore 12 and sealed by an outer peripheral O-ring 22 and inner peripheral O-ring 23. The casing 10 is provided with a lateral delivery port 24, and grooves on each side thereof for O-rings 26.

The piston 14 is slidable in the bore 12 between the nozzles 16 and 20, and has recesses in each end thereof receiving valve heads 20 and 32 retained by snap rings 34 for floating action. The valve head 30 has a stem 38 adapted to enter the first inlet nozzle 16 and be sealed therein by an internal O-ring 40. The valve head 32 has a stem 42 adapted to enter the second inlet nozzle 20 and be sealed therein by an internal O-ring 44.

FIG. 1 shows the piston 14 on the left side closing the first inlet nozzle 16 and permitting fluid to flow from the right inlet nozzle 20 to the delivery port 24. If both cylinders are at full pressure this piston position is accomplished by opening the cylinder valve for the cylinder connected to the right inlet nozzle 20 before that on the left. However, if the valve for the cylinder attached to the nozzle 18 were opened first, the piston would move to the right, and the flow would be just the reverse of the following discussion. With the piston in this left-hand position the valve for the cylinder connected to the nozzle 16 can be opened without causing the piston to move. In

this position the forces acting on the respective ends of the piston 14 are different. As shown in FIG. 1, the inlet pressure from nozzle 16 is acting on the exposed area of the valve stem 38 which, for example, may be a quarter of an inch diameter, and the inlet pressure from nozzle 20 is acting on the full piston area having a diameter of, for example, three quarters of an inch. When the in-use pressure from the nozzle 20 drops to the point where the force acting to keep the piston to the left toward the nozzle is less than the force due to the full cylinder pressure acting on the small diameter valve stem 38, the piston 14 starts to move to the right.

As the movement continues to the point where the valve stem 38 breaks its seal on the O-ring 40, full pressure is then applied to the full piston area from the left. The difference in the supply pressures now acting on equal areas causes the piston to move over to the right toward the nozzle 20.

FIGS. 2 and 3 show the sequence of this motion. FIG. 2 shows the piston 14 making a seal on the O-ring 26. FIG. 3 shows the valve stem 42 making a seal on O-ring 44. Now at this point there is a volume of gas trapped between O-rings 25, 44, and 23, and if no relief valve arrangement were provided and the piston continued movement, the compression of the trapped gas would be increased, and be acting on the piston diameter. Then when the pressure on the full-cylinder side dropped to this pressure plus the pressure in the right cylinder, switchover to the right cylinder would occur. This might be of the order of twice the initial switchover pressure, thereby causing a premature switchover before the left cylinder is fully exhausted.

To compensate for this, O-ring type relief valves 46 and 48 have been provided, in respective bypasses around the stem O-ring 44 and 40. These relief valves are respectively one way in their action.

These relief O-rings are received in triangular or V-notch grooves in the nozzle blocks, and the bypasses each comprise an entrance passage 50 and an exit passage 52. The entrance passage 50 leads from the inside portion of the nozzle bore ahead of its O-ring 44, to the bottom of the relief O-ring groove. The exit passage 52 leads from a point above the bottom of the groove beyond the top of the O-ring, to the nozzle bore beyond the O-ring 44.

Referring to FIGS. 4 and 5, and with the piston 14 moving to the right, as the pressure between O-rings 26 and 44 builds up through the bypass entrance passage 50, it lifts O-ring 46 (FIG. 4) and allows the increased pressure to bleed back to the low pressure cylinder. When a full cylinder is connected to the right side, the high pressure in the exit passage 52 tends to squeeze the O-ring relief valve 46 into its groove (FIG. 5), sealing off the entrance passage 50 and preventing high-pressure gas from acting on the full-piston area. In this way, any number of switchover cycles can take place and maintain a relatively constant switchover pressure.

The three-piece piston assembly allows the sealing valve stem on each end to float, to compensate for any misalignment of the nozzle bores and the bore for the piston 14.

Having thus described our invention what we claim as new and desire to acquire by Letters Patent of the United States is as follows.

We claim:

1. An automatic switchover valve for changing from a depleted to a full pressure supply, comprising a casing having a bore, said bore having a discharge outlet, separate high-pressure fluid inlets laterally disposed with respect to said discharge outlet, a piston laterally movable in said bore past said outlet and alternately closing one of said high-pressure fluid inlet, seal means adapted to seal the periphery of said piston within said bore whereby fluid is prevented from leaking along the periphery of said piston, said piston having oppositely extending pins insertable within the respective high-pressure inlets to seal off the respective inlets, and

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means venting the respective ends of said bore to each corresponding high-pressure inlet when said corresponding high pressure inlet is closed by said piston,

each venting means comprising a passage communicating with the respective high-pressure inlet to allow fluid to be released from within said bore and an O-ring blocking said passage, said O-ring being responsive to an increase in pressure within said bore to displace said O-ring whereby fluid is allowed to flow past said O-ring.

2. An automatic switchover valve as defined in claim 1

wherein said seal means comprises at least one O-ring surrounding the periphery of said piston.

3. An automatic switchover valve as defined in claim 1 wherein said seal means comprises a pair of O-rings.

4. An automatic switchover valve as defined in claim 1 wherein said bore has at least two grooves oppositely spaced with respect to said discharge outlet, and said seal means comprises an O-ring disposed within each of said grooves.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,633,606 Dated January 11, 1972

Inventor(s) W. W. Hay and C. S. Thompson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 59, "20" should read -- 30 --.

Col. 2, line 21, "25" should read -- 26 --;

line 69, "inlet" should read -- inlets --.

Signed and sealed this 15th day of August 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents