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PILOT CONTROLLED MULTIPLE VALVE ASSEMBLY

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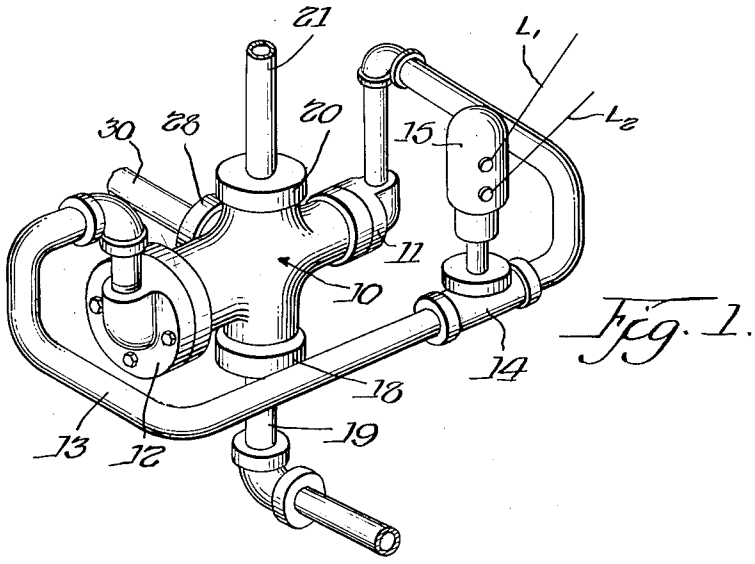


Fig. 1.

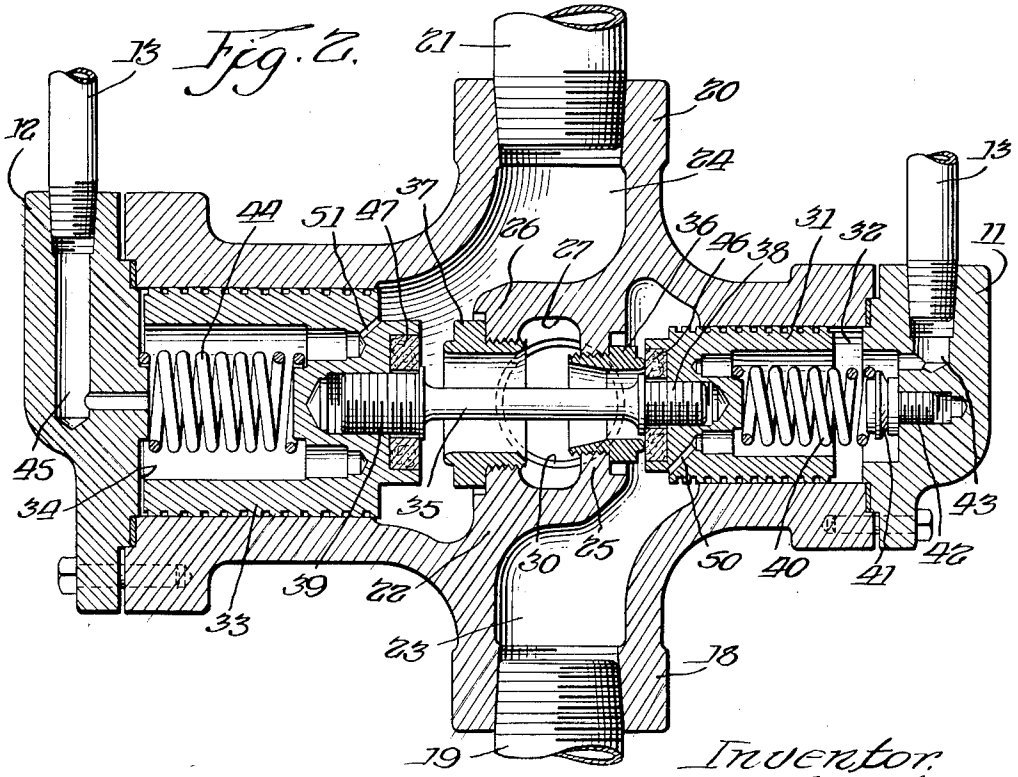


Fig. 2.

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PILOT CONTROLLED MULTIPLE VALVE ASSEMBLY

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Original application November 12, 1948, Serial No. 59,693, now Patent No. 2,589,859, dated March, 18, 1952. Divided and this application November 12, 1948, Serial No. 59,694

1 Claim. (Cl. 137—657)

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The invention relates to valves and has reference in particular to a three-way valve for controlling flow of a pressure fluid to and from a member such as a container which is alternately connected by the valve to an inlet and outlet.

An object of the invention is to provide a three-way valve having an opposed piston arrangement providing high and low pressure pistons for the inlet and outlet respectively and wherein the pistons are caused to reciprocate by variations in the pressure of the fluid admitted to chambers behind the pistons.

A feature of the present valve resides in a by-pass conduit connecting chambers at the rear of the high and low pressure pistons and which conducts an intermediate pressure fluid, such as may leak past the high pressure piston, to the chamber behind the low pressure piston whereby to unbalance the piston structure and cause movement thereof to close the suction outlet. A solenoid operated valve can be interposed in the by-pass conduit so that the closing and opening of this solenoid valve will thus control the reciprocation of the piston structure.

Therefore another object of the invention is to provide a three-way valve having electrically actuated means in a by-pass conduit for controlling movement of the piston structure of said valve.

Another object of the invention resides in the provision of a multiple control valve having high and low pressure pistons connected to move simultaneously and which are so tensioned by resilient means that movement of the pistons can be effected by relatively minor pressures applied to the pistons in a manner to unbalance said spring tensioning.

A more specific object of the invention is to provide a multiple control valve having an opposed piston arrangement including high and low pressure pistons of different diameters, with springs tensioning the pistons in directions toward each other to cause the pistons to close, and wherein the pistons are so connected in spaced relation that only one piston may be closed or open at a time.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claim appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

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Figure 1 is a perspective view of the three-way valve of the invention showing the by-pass conduit connecting with the respective ends of the valve housing; and

Figure 2 is a longitudinal sectional view illustrating the internal construction of the present valve.

Referring to the drawings and particularly Figure 1, the embodiment of the present valve selected for illustration in the drawings includes a housing identified by numeral 10 having suitably secured thereto the end members 11 and 12. The end members are connected by the by-pass conduit 13 having the valve 14 interposed therein and which is electrically operated by the solenoid 15 suitably connecting with the terminals L_1 and L_2 of the electric supply circuit.

The valve housing 10 is suitably provided with a depending extension generally indicated by numeral 18 which forms an inlet opening for the valve, the same having the pipe 19 threaded thereto which functions as the supply line for delivering the pressure fluid to the valve. The housing 10 is similarly provided with an upstanding extension 20 forming an outlet for the valve and which has threadedly secured thereto the pipe 21. Said pipe 21 may lead to the atmosphere or more particularly to a source of low pressure such as the suction return line of the conventional refrigerating system. Within the valve the housing 10 includes the integral partition 22 extending transversely of the housing separating the high pressure inlet chamber 23 from the suction outlet chamber 24. The partition 22 centrally of the valve includes the separated walls 25 and 26 forming the chamber 27 therebetween and which chamber communicates with the third outlet provided by the lateral extension 28. Said extension has threaded connection with the pipe 30 which may be defined as a fluid delivery pipe, the same having connection in an alternate manner with the pressure fluid inlet 19 and the suction outlet 21 by means of the opposed piston arrangement which will now be described.

The piston 31 having location in the high pressure chamber 32 is relatively small in diameter compared to the larger piston 33 located in the low pressure chamber 34. The chambers are located within the respective ends of the housing 10 and in aligned relation with each other which accordingly lines up the pistons so that they may be connected by rod 35 which extends through central openings in the valve seats 36 and 37. The valve rod at 38 has thread-

ed connection with the front end of piston 31 and said rod at 39 has threaded connection with the front end of piston 33. The pistons are each centrally cored from the rear for receiving a coil spring which applies spring tension to each piston in a direction toward the other for moving the piston against its respective valve seat. Piston 31 is centrally cored for receiving the coil spring 40 which at one end has contact with the piston and at its other end is supported by the adjustable support 41 threaded at 42 in its respective end 11 of the valve housing. This end of the valve housing is provided with the passage 43 to which is connected the by-pass conduit 13. Piston 33 is likewise centrally cored for receiving the coil spring 44 which at one end has contact with the piston and at its other end is backed by the end member 12. Said end member is provided with the passage 45 to which is connected the by-pass conduit 13.

It will be understood that chamber 32 within which the small high pressure piston 31 operates has connecting relation so as to communicate with the passage 43 and thus with the by-pass conduit 13. In a similar manner the chamber 34 within which the large low pressure piston operates has connecting relation so as to communicate with passage 45 and thus with the by-pass conduit 13. It will be observed that the coil springs 40 and 44 oppose each other and in accordance with the invention coil spring 40 tensioning the high pressure piston is a relatively strong spring, whereas the spring 44 tensioning the low pressure piston is considerably weaker so that under normal conditions spring 40 controls and urges piston 31 toward the left, Figure 2, to thus hold the position in contact with the valve seat 36.

The valve seat 36 is in the form of a ring or annulus providing a central opening through which the rod 35 extends and being exteriorly threaded for securement to wall 25. The valve seat 37 is likewise in the form of a ring so that the opening through the ring receives the rod 35 with the threaded periphery being secured to wall 26. The piston 31 may be provided with an insert 46 of steel or other suitable hard material for contact with the valve seat so as to take up wear and insure good sealing contact between the parts for closing the high pressure inlet. The piston 33 is similarly provided with an insert 47 for contact with the valve seat 37. With the coil spring 40 extended to maintain piston 31 in contact with its seat 36 it will be seen that piston 33 is located to the rear of its chamber 34 which places coil spring 44 under compression and locates the insert 47 carried by the piston in spaced relation with its seat 37. Accordingly under normal conditions this low pressure side of the valve is open and the suction outlet 21 has connection with delivery pipe 30.

In accordance with the invention the piston 31 is provided with a bleed or leakage passage 50 connecting the interior of the piston and thus chamber 32 with the pressure inlet chamber 23. Under normal conditions with the solenoid operated valve 14 closed, the high pressure fluid will flow through the bleed passage 50 into the chamber 32 and into the by-pass conduit 13 connecting with this end of the valve housing. This high pressure fluid behind piston 31 assists the coil spring 40 in maintaining the piston closed with the insert 46 in contact with its seat 36. Chamber 34 on the other hand is maintained at a low or sub-atmospheric pressure when the solenoid operated valve is closed since the bleed or leakage passage 51 in piston 33 connects said chamber with the suction outlet chamber 24. The bleed or leakage passages 50 and 51 in the pistons respectively may take other forms, as for example, the pistons may have a loose fit in their respective chambers such as to allow a flow of the fluid past the pistons.

When the valve 14 is opened by energization of the solenoid 15 the pressure fluid in chamber 32 will flow through the by-pass 13 to chamber 34. Eventually the pressures within chamber 32 and within chamber 34 are substantially equalized and the same approximates an intermediate pressure which builds up behind the respective pistons. In other words, assuming that the fluid delivered to the valve by pipe 19 is at a pressure of approximately one hundred pounds per square inch then upon opening of the solenoid operated valve 14 the intermediate pressure existing behind the pistons will approximate fifty pounds per square inch. The result of opening the valve in the by-pass is to reduce the pressure behind piston 31 and to increase the pressure behind piston 33. Although the pressures acting on both pistons are approximately the same, nevertheless said pistons differ in size and accordingly the force acting on piston 33 assists the spring 44 to cause movement of the tandem piston arrangement in a direction toward the right. In other words, insert 47 is caused to close against valve seat 37, whereas valve seat 36 is opened to the pressure inlet chamber 23. The pressure fluid from the supply line 19 is now admitted through valve seat 36 to the intermediate connection defined by the pipe 30. It will be understood that the coil springs are so adjusted that the intermediate pressure above referred to will accomplish movement of the piston arrangement in the direction as stated. It will be found that this intermediate pressure existing in the by-pass conduit when the valve 14 is opened will be approximately one-half the difference between the pressure on the high and low sides of the valve.

The operation of the piston arrangement when the solenoid operated valve 14 is closed is of course the reverse of that taking place when the valve is opened. Upon closing of valve 14 the intermediate pressure behind piston 33 gradually diminishes since the fluid leaks through bleed passage 51 and is drawn off by the suction existing in chamber 24. On the other hand, the pressure behind piston 31 increases as the pressure fluid continues to bleed through passage 50. Eventually a point is reached when the pressure within chamber 32 with the assistance of the coil spring 40 is such as to overbalance the opposing pressure and effect movement of the pistons in a direction toward the left to close valve seat 36.

Opening and closing of valve 14 is preferably electrically controlled by means of solenoid 15 or other suitable mechanism. It is possible to render the valve entirely automatic since the solenoid 15 can be controlled by the fluid supplied by delivery pipe 30. When the valve is open to the supply pipe 19 the pressure fluid is delivered to 30 and upon a predetermined quantity flowing through said pipe 30 it is possible to effect actuation of valve 14 to close the valve seat 36 by movement of the piston

arrangement toward the left. When this takes place delivery pipe **30** is open to the suction outlet **21** and eventually the fluid will be exhausted from the member or container connecting with pipe **30** and upon this eventuality taking place the valve **14** can be again actuated to open the pressure side of the three-way valve and to close the suction side. In operation of the present device it will be understood that the pistons are so connected in spaced relation that only one piston is closed at a time so that the fluid delivery pipe **30** is alternately connected with the fluid supply pipe and the suction outlet.

This is a divisional application of my copending application Serial No. 59,693, filed November 12, 1948, and entitled Suction Line Liquid Return Trap which matured into Patent No. 2,589,859 on March 18, 1952.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claim.

What is claimed is:

In valve structure of the character described, in combination, a valve housing having an inlet chamber for a fluid under pressure, an outlet chamber, and a fluid delivery passage connected to the housing between said inlet and outlet chambers, an inlet valve seat of small diameter located between the inlet chamber and said delivery passage, an outlet valve seat of larger diameter located between the outlet chamber and said delivery passage pipe, piston structure for alternately closing the inlet and outlet valve seats and including a high pressure piston associated with the inlet valve seat and a low pressure piston of greater area than said high pressure piston and associated with the outlet valve seat, a cylinder for each piston and each cylinder providing a piston chamber mounting its piston for reciprocation, means extending through the valve seats and connecting said pistons in opposed relation and spaced a distance greater than the distance between the valve seats, whereby when either valve seat is closed by its respective piston the other is open to communicate the fluid delivery passage with either the inlet or outlet chambers, resilient means tensioning the piston structure to maintain the high pressure piston against its valve seat, a restricted passage connecting the inlet chamber with the piston chamber for the high pressure piston, another restricted passage connecting the outlet chamber with the piston chamber for the low pressure piston, conduit means joining the said piston chambers whereby the fluid pressures in the piston chambers may be substantially equalized to cause an unbalancing of the resilient tensioning means and closing of the low pressure piston with opening of the high pressure piston, and a valve member in the conduit means for closing the same.

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