J. DAVIDSON.

FLUID PRESSURE VALVE.

APPLICATION FILED FEB. 24, 1916.

1,350,438.

Patented Aug. 24, 1920.

FIG. 2.

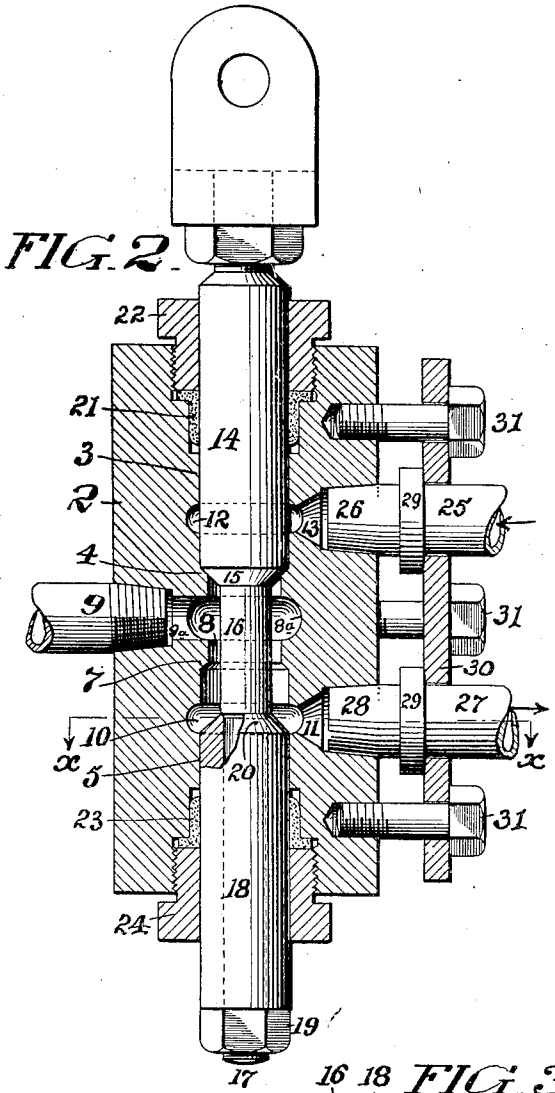


FIG. 1.

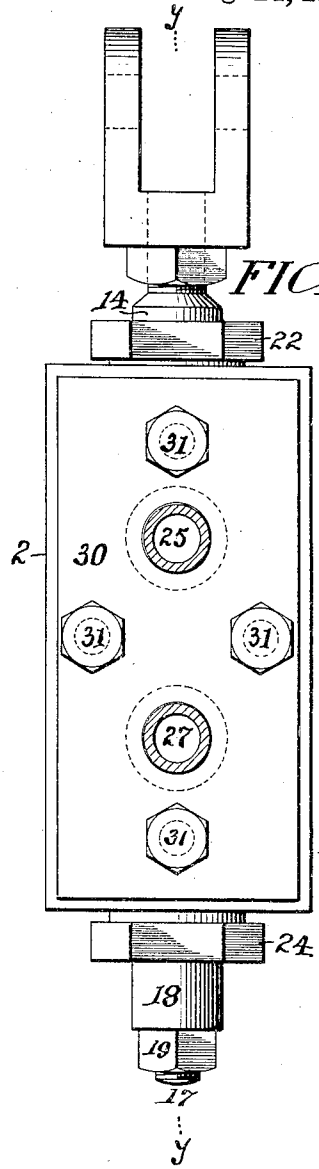
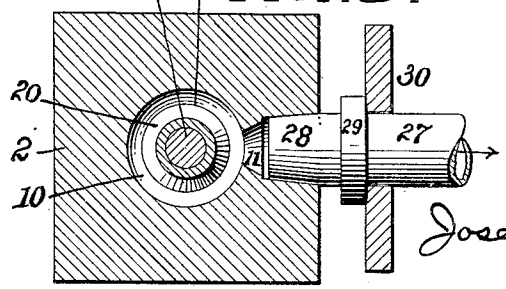


FIG. 3.



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UNITED STATES PATENT OFFICE.

JOSEPH DAVIDSON, OF EAST POINT, GEORGIA.

FLUID-PRESSURE VALVE.

1,350,438. Specification of Letters Patent. Patented Aug. 24, 1920.

Application filed February 24, 1916. Serial No. 80,240.

To all whom it may concern:

Be it known that I, JOSEPH DAVIDSON, a citizen of the United States, and resident of East Point, county of Fulton, and State of Georgia, have invented an Improvement in Fluid-Pressure Valves, of which the following is a specification.

The object of my invention is to provide a construction of valve suitable for hydraulic machinery which shall have capacity for acting as a supply and relief valve or for a three-port control with a single movable plunger structure irrespective of the special uses to which it may be put.

One use to which my improved hydraulic valve is well adapted is set out in my application Ser. No. 71,840, filed January 13, 1916, for machine for forming oil-cakes, in which my improved valve construction is employed for controlling the fluid pressure to the hydraulic cylinder of the plunger operating the meal tray, and also in the control of the fluid pressure to and from the operating motor for the head tree.

My improved hydraulic valve embodies in its construction, a body having a straight passage through its length, said passageway having a contracted central portion having oppositely arranged seats at its ends, and further having side openings or ports, one opening into the passage between the seats and the others respectively opening into the passage beyond the seats, said body associated with a plunger valve structure of greater length than the body and filling the larger bores of the passageway, and further having a central smaller cross section of greater length than the distance between the seats and provided with annular valve seating portions adapted to the respective seats, the proportions being such that when one valve seating portion is seated the other valve seating portion is beyond the port beyond the other valve seat and vice versa, and suitable stuffing-boxes on the opposite ends of the body for providing fluid tight packing.

With the above and other objects in view, the nature of which will be more fully understood from the description hereinafter, the inventon consists in the novel construction of hydraulic valve as hereinafter more fully described and defined in the claims.

Referring to the drawings:—Figure 1 is an elevation of my improved hydraulic valve with the supply and relief pipes in section; Fig. 2 is a vertical sectional view of the same taken on line y—y of Fig. 1, but with the plunger structure in elevation; and Fig. 3 is a cross section of same taken on line x—x of Fig. 2.

2 is the body and is preferably made from a solid block of steel suitably bored and drilled and otherwise shaped as shown. This body 2 is provided with a through passage comprising the parts 3, 8 and 5 in alinement and having the smaller diameter of the part 8 opening into the larger diametered portions 3 and 5 through the respective valve seats 4 and 7. Furthermore, the larger bore 3 is formed with an annular grooved portion 12 having a side port 13 by which fluid pressure may be supplied from a pipe 25. Similarly, the larger bore 5 is formed with an annular grooved portion 10 having a side port 11 by which the fluid pressure may be released to the relief pipe 27. Moreover, the smaller bore 8 is preferably provided with an annular grooved portion 8^a having a lateral port 9^a with which a pipe 9 may connect, said pipe adapted to provide communication with a hydraulic or other machine to which fluid pressure is required to be supplied under control. In the preferred construction, the distance between the seat 7 and port 13 is substantially equal to the distance between seat 4 and port 11, but this is not essential.

The plunger structure adapted for operation with the above described body, comprises two plunger portions 14 and 18 connected by the smaller or neck portion 16 with which they connect through the valve seating portions 15 and 20 respectively. These seating portions 15 and 20 are preferably conical and are oppositely directed as shown; and similarly, the seats 4 and 7 are conical and oppositely directed and respectively adapted to receive the seating portions 15 and 20. In the particular construction shown, by way of example, the plunger portion 14 is formed integral with the neck portion 16 and with a shank 17 of still smaller diameter; and upon this latter is fitted the plunger 18, the same being clamped in position by nut 19. In this manner the

plunger structure may be assembled within the body and the seating portions 15 and 20 adapted to the seats 4 and 7, providing a construction of simple and strong design. The upper end of the plunger 14 may be fitted with a yoke or other means for attachment with an operative part for reciprocating the plunger structure within the body.

To provide a fluid tight valve, the opposite ends of the body are respectively furnished with hydraulic annular packing 21 and 23 and bushings 22 and 24 by which the plunger portions 14 and 18 are tightly packed and also supported, said bushings acting as guides for the plunger portions, as will be readily understood by reference to Fig. 2.

While the supply pipe 25 and the relief pipe 27 may be attached to the body in any suitable manner, such as in the case of pipe 9 for example, I have shown a suitable union joint for said pipes for more conveniently coupling them, and especially where it is not convenient to rotate the pipes because of their connection with other parts of the apparatus. In this particular construction, the pipe 25 has a tapered end 26 which fits the tapered port 13, and similarly, the pipe 27 has a tapered end 28 which fits the tapered port 11. Furthermore, both of these pipes 25 and 27 have collars 29. Extending about the pipes 25 and 27 and pressing upon the collars is a plate 30 which may be drawn toward the body 2 by means of the cap screws 31. In this manner the pipes may be clamped tightly into position in the body or may be readily disconnected in case of repairs.

The operation of the valve may be described as follows:—Assuming that the parts are in the position shown in Fig. 2, it is manifest that any fluid pressure which may have existed in the device being operated will be relieved through pipe 9, passage 8, passage 5, port 11, to the relief pipe 27. It will also be observed that the fluid pressure from the accumulator or other source which would be delivered by the pipe 25 is shut off by the valve seating portion 15 of the plunger 14, which tightly rests upon the valve seat 4. It will also be seen that the plunger 14 substantially fills the passage 13 and shuts off the free supply of the fluid from the port 13 and annular grooved portion 12 from finding its way to the valve seat, so that there is a double shutting off of the fluid pressure from the passage 8 and pipe 9. Assuming now that it is desired to supply fluid pressure to the device to be operated, the plunger structure is raised until the seating portion 20 of the plunger 18 seats upon the valve seat 7 of the passage 15, and this effectually closes communication with the relief pipe 27; and the plunger 18 completely fills the passage 5 and shuts off the annular grooved portion or chamber 10 and its port 11 from communication with the valve seat, thereby insuring a more positive sealing of the relief. While this is being done, the plunger 14 has risen sufficiently to carry the valve seating portion 15 above the annular grooved or chamber portion 12 and port 13, so that the fluid pressure may then pass freely through the passage 3, valve seat 4, passage 8, and into the pipe 9 which communicates with the device to be operated. It will be noted that one of the valve seating portions respectively seats upon its valve seat, just as the other valve seating portion has passed to the limit of its movement in opening the supply or relief pipe communication, as the case may be, and it will further be observed that during the shifting of the plunger structure there will be a time when both of the valve seating portions 15 and 20 are off their seats 4 and 7, and it is at this time that the bodies of the plungers 14 and 18 fitting the respective passages 3 and 5 act as cylinder valves to prevent supply or escape of fluid pressure. It will therefore be seen that the valves are double acting. First, as plunger valves, and second, as plunger valves assisted by conical valve seating portions. The reason for the combination of the two parts for controlling the fluid pressure is that the cylindrical or plunger portions need not be so tight as would be required if the conical seating portions were not employed. On account of the valve shifting with reasonable speed, any slight leakage around the plungers would not be harmful provided the valve were tight when fully shifted, and this is insured by the conical seating portions 15 and 20 coöperating with the annular conical seats 4 and 7.

Another feature of the valve is the employment of the annular grooved or chamber portions 10 and 12 which communicate with the lateral ports 11 and 13 respectively. By means of these annular chambers the flow of fluid pressure is supplied more uniformly through the passage, is quicker in action, and provides a thorough balancing of the pressure about the plunger portions which could not otherwise be secured if the lateral ports opened directly against the plungers. In this way the plunger structure is thoroughly balanced and free from undue friction due to the high fluid pressure. As the plungers 14 and 18 are the same in diameter, it is manifest that the valve is a balanced valve, whether in supplying pressure or in relieving it, and as the annular passages 10 and 12 extend wholly about the plungers, it is evident that no variation in pressures can affect the freedom of movement of the plungers themselves.

While the annular chambers 10 and 12 are especially important in connection with the

ports 11 and 13, it is not so important that there shall be an annular portion formed in the central passage 8, as this passage is of considerably greater diameter than the neck portions 16 of the plunger structure; but as it is desirable to have as free passage for the fluid pressure as possible to all sides of the plunger structure, I preferably engage the said passage 8 in alinement with the lateral port 8^a, as clearly shown.

It will also be observed that while I prefer to make the plunger structure in two parts secured together by the bolt 19, it is manifest that the same construction shown in connection with the plunger 18 might be employed also in respect to the plunger 14, the manner of assembling the parts permitting the plungers to be entered from opposite ends of the body and coupled for use. In the construction shown, it is also seen that the operative part of the plunger is continuous from one end to the other, and this is desirable on account of the strength. I, however, do not restrict myself in these details.

It will now be apparent that I have devised a novel and useful construction which embodies the features of advantage enumerated as desirable, and while I have in the present instance shown and described the preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that I do not restrict myself to the details, as the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention.

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

1. In a fluid pressure valve, a body part having a through passage comprising two end portions of uniform diameters separated by oppositely directed valve seat portions arranged at a distance apart and also having a port opening from the passage between the valve seats and further having separate additional ports opening from the side walls of the end portions of the passages at a distance from the respective valve seats and respectively terminating in annular chambers surrounding and opening into said passages, combined with a plunger structure of greater length than the body part and comprising two plunger portions of uniform diameters respectively closely fitting the end portions of the passage so as to be surrounded by the annular chambers and connected by a neck portion of less cross sectional area than the passage between the valve seats, and which plungers adjacent to the neck portion are provided with seating portions adapted to the valve seats but arranged at a distance apart greater than the distance between the valve seats and less than the distance between the additional ports entering the sides of the end portions of the passage in which the plungers operated, the ends of the plunger extending beyond the end portions of the passages of the body part, and suitable packing means surrounding each of the end portions of the plunger and fitting the opposite ends of the body part, whereby each end of the plunger structure is exposed beyond the body.

2. In a fluid pressure valve, a body part having a through passage comprising two end portions of uniform diameters separated by oppositely directed valve seat portions arranged at a distance apart and also having a port opening from the passage between the valve seats and further having separate additional ports opening from the side walls of the end portions of the passages at a distance from the respective valve seats, combined with a plunger structure comprising two plunger portions of uniform diameters respectively closely fitting the end portions of the passage and connected by a neck portion of less cross sectional area than the passage between the valve seats, and which plungers adjacent to the neck portion are provided with seating portions adapted to the valve seats but arranged at a distance apart greater than the distance between the valve seats and less than the distance between the additional ports entering the sides of the end portions of the passage in which the plungers operate, said plunger structure having one of its plungers provided with a neck and a shank of smaller diameter extending from said neck upon which the other plunger is sleeved and clamped thereon in fixed spaced relation from the other plunger.

3. In a fluid pressure valve, the combination of a body having a through passage, consisting of two bores in alinement of substantially the same diameter and separated by oppositely directed valve seats, and also having a lateral port from the passage between the valve seats and additional independent lateral ports opening from the sides of the bores of the same diameter at a distance from the respective valve seats, and in which each of said independent lateral ports provides communication with the bore by an annular chamber extending substantially around the bore, a plunger structure comprising two plunger portions of uniform diameters each snugly fitting the respective bores of the same diameter and connected by a neck portion of less cross sectional area than the cross sectional area of the passage through the valve seats and the passage between said seats, said plungers extending beyond each of the bores and provided with oppositely directed seating portions for the valve seats and in which said seating portions are separated a distance greater than the distance between the valve seats and less

than the distance between the independent lateral ports entering the passages occupied by the plungers, and suitable packing means surrounding each of the plungers and fitting the opposite ends of the body whereby each end of the plunger structure is exposed beyond the body.

In testimony of which invention I hereunto set my hand.

JOSEPH DAVIDSON.

Witnesses:
E. W. SMITH,
C. E. KLEINFELDER.