

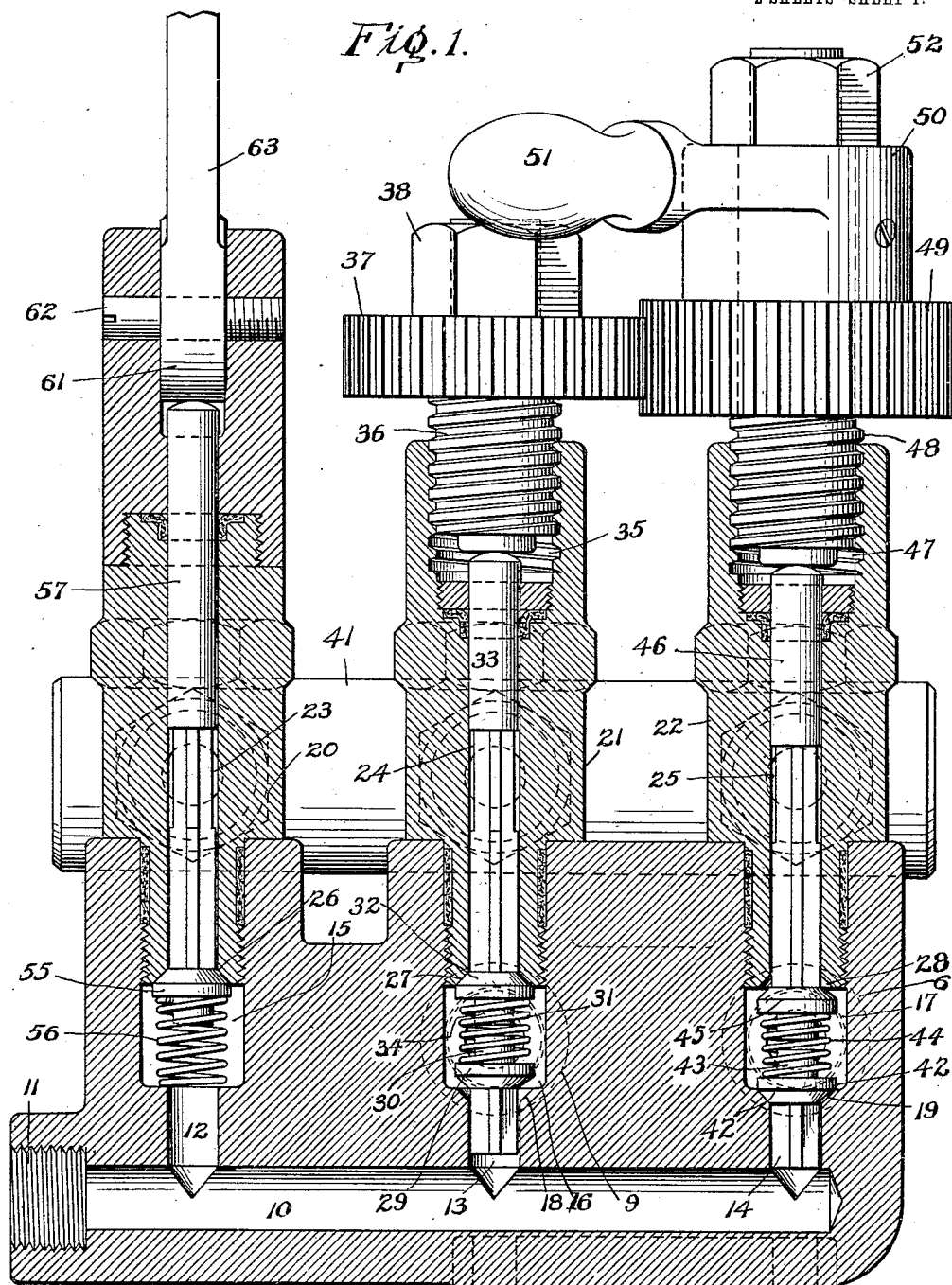
No. 869,755.

PATENTED OCT. 29, 1907.

W. J. TRETCH.  
HYDRAULIC FOUR WAY VALVE AND BY PASS.

APPLICATION FILED FEB. 12, 1907.

2 SHEETS—SHEET 1.



Witnesses  
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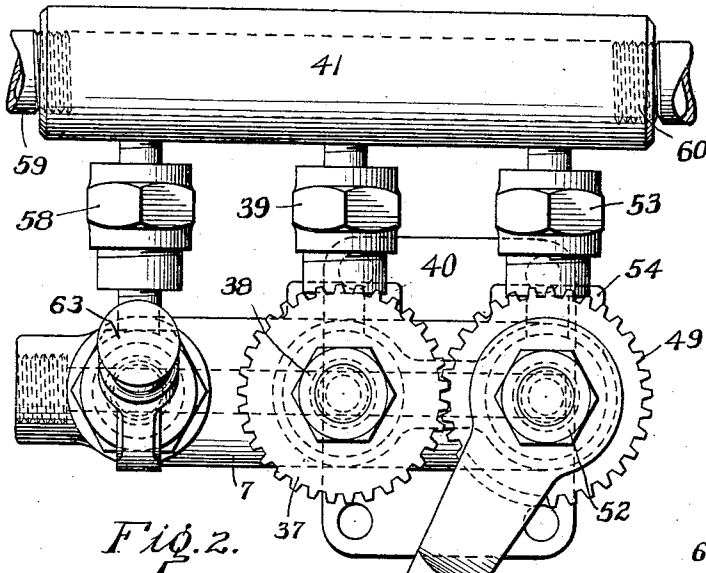


Fig. 2.

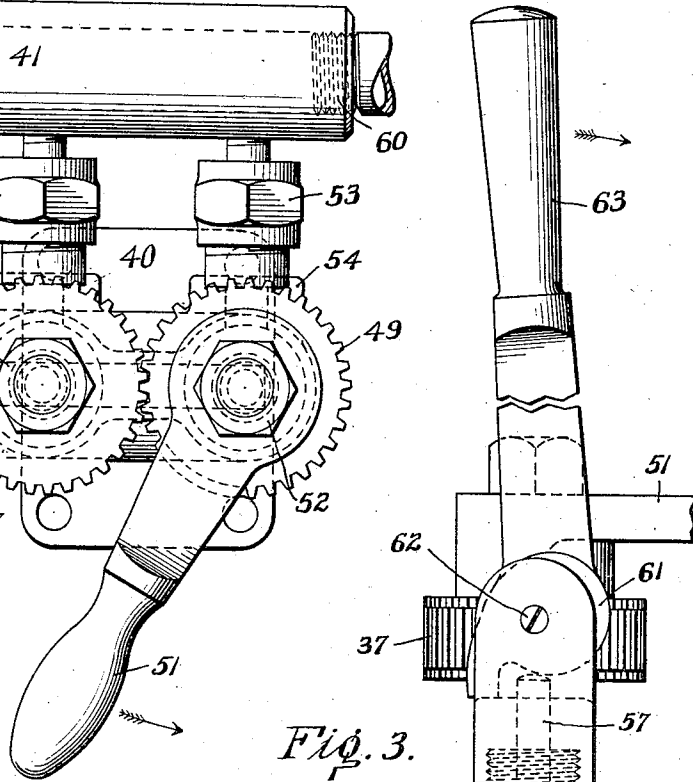


Fig. 3.

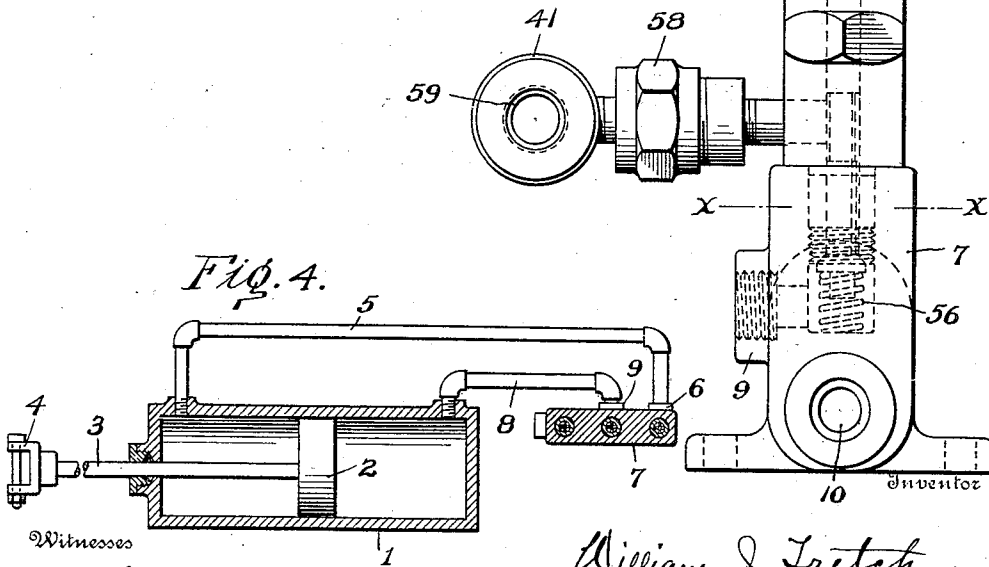


Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## HYDRAULIC FOUR-WAY VALVE AND BY-PASS.

No. 869,755.

Specification of Letters Patent.

Patented Oct. 29, 1907.

Application filed February 12, 1907. Serial No. 357,009.

*To all whom it may concern:*

Be it known that I, WILLIAM J. TRETCH, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Hydraulic Four-Way Valve and By-Pass, of which the following is a specification.

My invention relates to a new and useful hydraulic 4-way valve and by-pass and consists in providing means whereby the power can be directed upon either side of the piston, as desired, and the opposite side of the piston therefrom can be exhausted.

It further consists in providing a by-pass whereby the pressure can be taken care of without affecting the piston and without stopping the pump.

It further consists of other novel details of construction, all as will be fully hereinafter set forth.

Figure 1 represents a vertical sectional view of a hydraulic 4-way valve and by-pass embodying my invention. Fig. 2 represents a plan view thereof. Fig. 3 represents an end view thereof. Fig. 4 represents a diagrammatic sectional view showing the pressure cylinder and the valve in connection therewith, the section of which latter is taken on line *x-x*, Fig. 3.

In practice I have found that in the construction of valves now upon the market for hydraulic cylinders that it is extremely difficult to operate the same, owing to the pressure in the cylinder and I have provided a valve which will control the exhaust and intake in such a manner that when the pressure is applied to one side of the piston, the other side will be exhausted and I also provide a means for taking care of the pressure, so that the piston will not be affected and will be held at any desired point. The valve herein described is more especially adapted for use in hydraulic testing machines, although, of course, it will be understood that the same can be used for any desired purpose and I will describe the same as applied to the said testing machines. It will be evident that in work of this character, it is desirable that the power can be changed from one side of the piston to the other very quickly and also when the desired amount of load has been applied to the specimen that the same can be held stationary at that point. My device is designed to accomplish this purpose and it will be seen that as the valve is situated directly at the place where the test takes place, I can apply the load as desired and remove the same or hold the load at a determined point without reference to the pump, which can operate continuously and as the pump is situated some distance from the point of the test it is not necessary to signal the operator thereof which sometimes, owing to the time it takes, will spoil the test, but in my device it will be seen that no time is lost in accomplishing the results desired.

Referring first to Fig. 4, I have shown the pressure cylinder 1 having a piston 2 therein, connected with

the rod 3, which has connected therewith or carries the test piece holder 4. The latter can be of any desired construction, it being understood that the specimen or material to be tested is suitably connected therewith and that the other end of the material is suitably connected with an anchor or other stationary point to hold the specimen as the load is applied.

Leading from one side of the pressure cylinder is a pipe 5 which is connected with one of the threaded bosses 6, or other suitable means, of the hydraulic valve 7, while a pipe 8 leads from the cylinder upon the opposite side of the piston and is connected with the threaded boss 9, or other means, on the said valve 7. It will be seen that in this manner the valve is in suitable communication and connection with both ends of the pressure cylinder 1. At a suitable point in the valve 7, I form the inlet manifold or passage 10 which is adapted to be placed in suitable connection with the pump or accumulator, the end 11 of the manifold serving as the intake. Leading from the manifold are the passages or ports 12, 13 and 14 which communicate with the chambers 15, 16 and 17, the passage 16 having a suitable communication with the bore of the boss or lug 9 and the chamber 17 having a suitable communication with the bore of the lug or boss 6, a suitable portion of the passage 13 having the valve seat 18 and a suitable portion of the bore 14 having the valve seat 19. In the present instance, in threaded connection with the body of the valve 7 are the plugs 20, 21 and 22, the lower walls of the plugs serving as the upper walls of the chambers 15, 16 and 17 and through said plugs are the passages or ports 23, 24 and 25, at the entrance of which are the valve seats 26, 27 and 28.

29 designates a valve seated in the bore 13, which can be of any desired construction, which is adapted to seat upon the valve seat 18. In the present instance said valve is provided with the lug 30 and having a spring 31 bearing against the upper face thereof, the other portion of said spring 31 bearing against a valve 32 which is adapted to seat on the valve seat 27 and which is connected in any suitable manner with the stem 33, which is movable in the port 24 in the plug 21, it being noted that the spring 31 normally tends to hold the valve 29 and the valve 32 upon their respective seats and that said valve 32 is also provided with a lug 34. The upper portion of the plug 21 is provided on the interior with the threads 35 which are adapted to be engaged by the threaded pin 36, upon which is mounted a gear 37, a nut 38 in suitable engagement with the pin 36 holding the parts in proper position.

39 designates a coupling which is connected with a boss or projection 40 carried by the valve 7, the bore of said boss and coupling communicating with the passage 24 in the plug 21 at one side and communicating with the bore of an exhaust muffler 41.

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42 designates a valve movable in the port or passage 14, said valve being adapted to seat upon the valve seat 14 and having a lug 43 thereon, a spring 44 contacting with the upper face of said valve and also with the lower face of the valve 45, which is adapted to seat upon the valve seat 28, said valve 45 being in suitable connection with the stem 46 which moves in the passage 25 in the plug 22. The upper portion of the plug 22 is provided with threads 47 which are adapted to engage with a threaded pin 48 carrying a gear 49 which is in mesh with the gear 37 carried on the pin 36. A collar 50 is mounted on said pin 48 having a handle 51 and a nut 52 serving to hold the parts in proper assembled position, it being understood that said pin 48 bears upon the stem 46 and that the threaded pin 36 bears upon the stem 33.

53 designates a coupling which is in suitable engagement with the boss 54 or other means of connection, on the valve 7, the bore of the boss and of the coupling 53 communicating with the passage 25 in the plug 22 at one side and with the exhaust muffler 41 upon the opposite side and it being further understood that the spring 44 serves to normally hold the valve 42 and valve 45 upon their respective seats.

55 designates a valve which is adapted to seat upon the valve seat 26 and has a spring 56 bearing against its lower face tending to normally seat the same, said valve 55 being carried by a stem 57, which is movable in the passage 23 in the plug 20 and communicating with said passage 23 is the bore of the coupling 58 in suitable connection with the valve 7, the opposite end of said coupling serving to communicate with the interior of the exhaust muffler 41.

The exhaust muffler 41 is provided with a pipe or other means 59 connecting the same with the pump or with any other suitable point and the opposite end of the muffler may be closed or provided with a pipe 60 for connection with a suitable point.

61 designates a cam which is pivotally mounted at 62 upon a suitable portion of the valve, the face of said cam being adapted to contact with the stem 57 and being provided with a handle 63 or other means for operating the same. It will be understood that when the parts are in the position seen in Fig. 3 that the spring 56 tends to hold the valve 55 upon the seat.

The operation is as follows:—Referring first to Fig. 1, it will be understood that the pressure is entering the intake 11 and passes into the manifold or passage 10. The handle 51 has been meanwhile operated to throw the pressure into the desired direction and in the present instance the parts are so operated as to raise the pin 36 and lower the pin 48 and by reason of the position of the pin 36, the stem 33 is elevated by the action of the spring 31, which causes the valve 32 to be seated. The pressure in the manifold 10 will be directed upon the valve 29 and as the tension of the spring has been somewhat released by the raising of the valve 32, the pressure will overcome the tension of the said spring and raise the valve 29 from its seat, so that the pressure will pass through the boss 9 into the pipe 8 and be directed upon the right side of the piston as seen in Fig. 4. At the same time as the pin 48 is lowered, it depresses the stem 46 removing the valve 45 from its seat and closes the valve 42 against its seat 19 holding the

same in this position, so that the pressure from the manifold 10 cannot pass therethrough, but will be caused to pass through the port or passage 13, as before described. As the piston 2 is moved to the left, in Fig. 4, the pressure on the left side thereof will be forced through the pipe 5, through the bore of the boss 6 into the chamber 16 and can pass into the passage 25 and from thence through the boss 54 and coupling 53 into the exhaust muffler 41 and be returned to the pump or other suitable point. When, however, the lever 51 is moved to its other position in the direction indicated by the arrow in Fig. 2, the gears 49 and 37 meshing will cause the pin 36 to be lowered and the pin 48 to be raised or elevated. This will lower the stem 33, opening the valve 32 and closing the valve 29 against its seat, and the stem 46 will be elevated by the action of the spring 44 closing the valve 45 and permit the opening of the valve 42 by the pressure in the manifold, so that the reverse movement of the pressure will occur, that is to say, pressure will in this case pass through the bore of the boss 6 into the pipe 5 and will be directed upon the left of the piston 2, as seen in Fig. 4 and the exhaust from the pressure cylinder on the right of the piston will pass through the pipe 8 from the boss 9 into the passage 24 and thence into the boss 40 and coupling 39 into the muffler 41.

It will be seen by the above explanation that the pressure can be directed, as desired, upon either side of the piston in the pressure cylinder, that is to say, into either end of the cylinder as desired, the opposite end thereof being exhausted at the same time. When it is desired that the piston be held at a desired point, I have provided a by-pass as before stated, so that the pressure will be held in the pressure cylinder 1 and the pressure from the pump or accumulator can be taken care of by said by-pass. It will be noted in the operation before described that the stem 57 has remained in the position seen in Fig. 1, that is to say, that the valve 55 is closed so that no pressure from the manifold 10 can pass therethrough, but is always directed into either of the ports or passages 13 and 14 as desired. When the load on the specimen to be tested has reached the desired amount, or when it is desired to hold the load, I operate the lever 63 in the direction indicated by the arrow in Fig. 3. This causes the cam 61 to contact with the end of the stem 57 depressing the same, overcoming the tension of the spring 56 and opening the valve 55 so that the pressure from the manifold 10 passes through the port or passage 12 into the chamber 15 and from thence into the passage 23 from which it passes through the coupling 58 into the muffler 41 and back through the connection 59 to the pump or other point, it being understood that in this manner the pump or accumulator can run continuously, the pressure circulating from the pump and back thereto and being returned thereto without affecting the valves or the piston, which is held in the position desired.

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

1. In a device of the character described, a valve provided with an inlet manifold, one end of which serves as the intake and having a plurality of passages, a plurality of chambers in direct communication therewith, valves in pairs in said passages controlling the inlet and outlet thereof, the valves in one passage being constructed to

act oppositely to those in the other, resilient means between the valves of each pair, means for actuating said valves, a by-pass and a valve controlling the latter.

2. In a device of the character described, a valve provided with an inlet manifold, one end of which serves as the intake and having a plurality of passages, a plurality of chambers in direct communication therewith, valves in pairs in said passages controlling the inlet and outlet thereof, the valves in one passage being constructed to act oppositely to those in the other, resilient means between the valves of each pair, means for actuating said valves, a by-pass and a valve controlling the latter, combined with a pressure cylinder connected at opposite ends with the casing of said valve.

3. In a device of the character described, a pressure cylinder, an intake manifold having separate connection with opposite ends thereof and having passages, valves in pairs controlling said passages, resilient means between the valves of each pair, an exhaust muffler, a by-pass and a valve controlling said by-pass.

4. In a device of the character described, a pressure cylinder, an intake manifold having separate connection with opposite ends thereof and having passages, valves in pairs controlling said passages, resilient means between the valves of each pair, an exhaust muffler, a by-pass, a normally closed valve controlling the passage of the manifold adjacent the inlet and means for simultaneously actuating the valves in pairs.

5. In a device of the character described, a pressure cylinder, a casing, an inlet passage therein, ports leading to said pressure cylinder, communications between said passage and ports, valves in pairs in each of said communications controlling the same, resilient means between the valves of each pair means for actuating said valves, said valves acting oppositely to each other, a by-pass for one of said valves, and a valve controlling said by-pass.

6. In a device of the character described, a pressure cylinder, pipes leading from opposite ends of said cylinder, a valve casing with which said pipes communicate, an inlet manifold in said casing, ports leading from said manifold, chambers with which said ports communicate, valves in pairs in two of said chambers with a spring between each pair of valves, a valve in the other chamber, and an exhaust muffler in communication with said chambers.

7. In a device of the character described, a pressure cylinder, pipes leading from opposite ends of said cylinder,

a valve casing with which said pipes communicate, an inlet manifold in said casing, ports leading from said manifold, chambers with which said ports communicate, valves in pairs in two of said chambers with a spring between each pair of valves, a valve in the other chamber, an exhaust muffler in communication with said chambers, and means for simultaneously actuating the valves in pairs.

8. In a device of the character described, a casing, an inlet passage therein, ports leading to a pressure cylinder, communications between said passage and said ports, valves in pairs in each of said communications controlling the same, ports communicating with an exhaust muffler and with said ports and pressure cylinder, springs situated between the valves of each pair, means for actuating said valves, a by-pass in said casing and a valve controlling said by-pass.

9. In a device of the character stated, a pressure cylinder, a casing having an inlet passage and ports leading to the pressure cylinder, communications between said passage and ports, an exhaust muffler, ports communicating therewith and with said ports and pressure cylinder, and valves in pairs with resilient means between each pair in each of said communications and controlling the same.

10. In a device of the character stated, a pressure cylinder, a casing having an inlet passage and ports leading to the pressure cylinder, communications between said passage and ports, an exhaust muffler, ports communicating therewith and with said ports and pressure cylinder, and valves in pairs with resilient means between each pair in each of said communications and controlling the same, one of the valves of each pair controlling an exhaust port.

11. In a device of the character stated, a pressure cylinder, a casing having an inlet passage and ports leading to the pressure cylinder, communications between said passage and said ports, an exhaust muffler, ports communicating therewith and with said ports and pressure cylinder, valves in pairs with resilient means between each pair in each of said communications, means for actuating said valves, a by-pass in said casing, and a valve controlled by said by-pass.

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