

[54] **HYDRAULIC VALVE WITH LEAKAGE CONTROL**

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[56]

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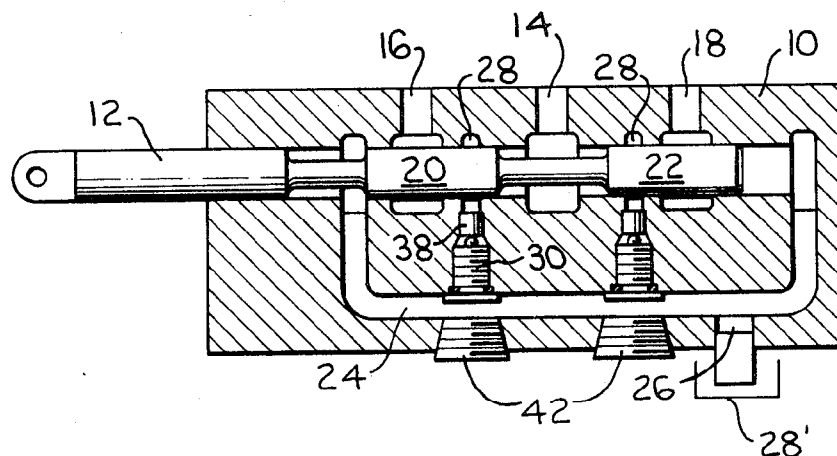
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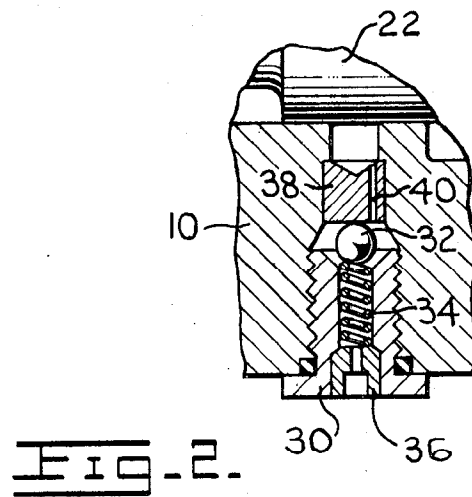
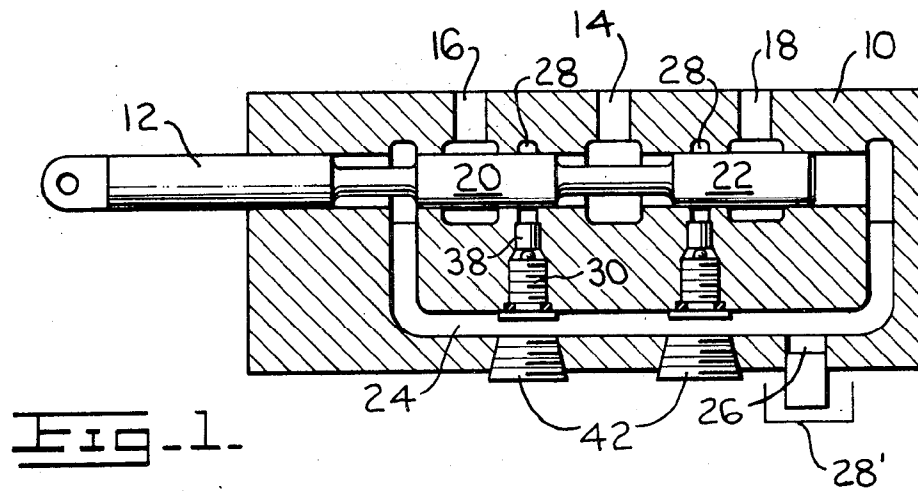
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ABSTRACT

A hydraulic valve of the spool type with means to trap hydraulic fluid which tends to leak between the spool and the bore of the valve in which it slides and to bypass said fluid to atmosphere or a tank in order to prevent it from flowing past the spool to actuate a hydraulic motor causing it to move or creep when it should be at rest.

7 Claims, 2 Drawing Figures





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HYDRAULIC VALVE WITH LEAKAGE CONTROL

This is a continuation, of Ser. No. 873,172, filed Nov. 3, 1969 and since abandoned.

Hydraulic systems on some machines now employ pressures as high as 5,000 psi and it is difficult to contain hydraulic fluid at such pressures with a spool type valve which is used extensively in such systems. It is found that despite very close machining tolerances, some leakage persists and causes a build-up of pressure in a hydraulic motor employed for actuating or adjusting a machine component so that the component will move slowly or creep even though the valve is in its closed position.

The present invention overcomes this difficulty by providing a spool valve in which leakage tending to pass a spool in its closed position is trapped and bled away from the valve before it enters the lines leading to the hydraulic motor. Check valve means are provided in the passage through which the leaking fluid is bled and the check valves are automatically closed when the spool valve is opened for the purpose of directing pressure to a machine component to be actuated.

The invention is more fully disclosed in the following specification wherein reference is made to the accompanying drawing.

In the drawing:

FIG. 1 is a schematic view in section of a spool valve embodying the present invention and

FIG. 2 is an enlarged fragmentary section of a part of the valve shown in FIG. 1.

In the drawing, the valve is shown as having a body 10 suitably bored for the reception of a spool 12 which is slidably mounted in the bore. Actuating linkage is connected to the extending end of the spool in a conventional manner.

In the position in which the spool is illustrated, fluid under pressure entering through a port 14 is prevented from flowing out either of ports 16 or 18 by lands 20 and 22 respectively of the spool. For purpose of this description, the ports 16 and 18 may be considered as connected with opposite ends of a motor such as a hydraulic jack so that when one port is opened to admit fluid to one end of the jack, the other port will be opened for return of fluid to tank from the opposite end. When the spool is moved toward the right as shown in FIG. 1, land 22 admits fluid under pressure from port 14 to port 18 communicating with one end of the jack cylinder. At the same time land 20 uncovers port 16 for return of fluid from the opposite end of the cylinder. The returned fluid enters a passage 24 and is returned through a port 26 to a tank illustrated at 28'. Upon adjustment of the spool in the opposite direction or toward the left, pressure is communicated through port 16 to one end of the jack cylinder and returned from the opposite end through port 18 into the other end of passage 24 for discharge through port 26.

If with the valve in its closed position, as shown in FIG. 1, fluid leaks past either of the lands 20 or 22, it will increase pressure at the corresponding end of the jack cylinder imparting motion thereto and moving or creeping of the component actuated thereby.

The present invention provides annular chambers 28, one of which is disposed in the wall of the valve bore intermediate the inlet port 14 and each of the ports 16 or 18 which communicate with the motor. Leakage fluid is intercepted by these annular chambers

and communicated to the discharge passage 24 by means best illustrated in FIG. 2. In this figure, a threaded plug 30 is contained in a passage which extends between the main valve bore and the discharge passage 24. This plug contains a check valve which includes a ball 32 urged toward an open position by a spring 34 which seats against an orificed spring seat 36 pressed into the plug 30. The ball is urged into contact with a piston 38 slidable in the bore above the ball and having a small orifice 40 through which leaking fluid is discharged. Plugs 42 in the main valve housing are shown in FIG. 1 for closing openings through which the check valve and cylinder means may be inserted and removed.

In operation, any small quantity of hydraulic fluid tending to leak past the lands 20 or 22 will be bled through the orifice 40 of the piston 38 and through the open check valve. During operation of the spool valve for directing high pressure fluid to either of the outlets 16 or 18, the corresponding leakage port is uncovered and, since the pressure and volume of fluid is too great to pass through the small orifice 40, the piston 38 moves downwardly forcing the ball 32 onto its seat against pressure of the spring 34. Consequently, with the valve spool open, the leakage passage is closed.

What is claimed is:

1. In a spool valve having a bore and spaced inlet and outlet ports communicating with said bore, a spool reciprocable in said bore and having land means forming a closure between the inlet and outlet ports when the valve is closed, the improvement which comprises: means to prevent leakage of fluid under pressure to said outlet ports when the valve is closed including drain passage means communicating with said bore in intermediate said inlet and outlet ports for directing leaked fluid to a low pressure area, and check valve means in said drain passage means, said check valve means being responsive to pressure at the area of communication of said drain passage means with said bore to close said drain passage means when said valve is open and open said drain passage means when said valve is closed.

2. The invention of claim 1 wherein said check valve means includes a valve element which is biased to an open position by spring means, and piston means reciprocably mounted in said drain passage means and having a port therethrough to permit escape of leaking fluid, said port being dimensioned so as to be too small to pass full fluid flow when the valve is open, and said piston being subject to said full flow and arranged to engage and close the valve element when the valve is open and the piston is subjected to such flow.

3. The invention of claim 1 wherein said spaced inlet and outlet ports comprise an inlet port and a pair of outlet ports located on opposite sides of said inlet port, said land means comprising a pair of lands on said spool each one of said lands operating to close one of said outlet ports, and wherein said drain passage means comprise a pair of drain passages, each one of said drain passages communicating with said bore and having check valve means in each drain passage.

4. The invention of claim 3 further including annular chamber means in the wall of said bore to entrap fluid cooperating with each drain passage so as to entrap leaked fluid around the circumference of the bore.

5. The invention of claim 1 wherein said drain passage means comprise a drain passage and wherein said check valve means comprises a valve element in the form of a ball adapted to sealingly close against a seat and which is urged to the open position by a spring, and further including a piston reciprocally mounted in said drain passage and having means therein for passing leaked fluid when the valve is closed, said means in said piston operating to not pass the full flow of fluid when said valve is open whereby said piston is shifted by the pressure of said full fluid flow to motivate and thereby close said valve element against said seat.

6. The invention of claim 5 wherein said means in said piston comprise a port extending therethrough.

7. In a spool valve having a bore with spaced inlet

and outlet passages communicating therewith, a spool reciprocable in the bore and having a land forming a closure between the inlet and outlet passages when the valve is closed, the improvement which comprises means to prevent leakage of fluid under pressure to the outlet passage when the valve is closed including an annular chamber in the wall of the bore between the inlet and outlet passages to entrap fluid before it enters the outlet passage, a drain passage to direct such fluid to a low pressure area, and check valve means which is responsive to inlet pressure within the annular chamber to close said drain passage when said valve is open and open said drain passage when said valve is closed.

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