

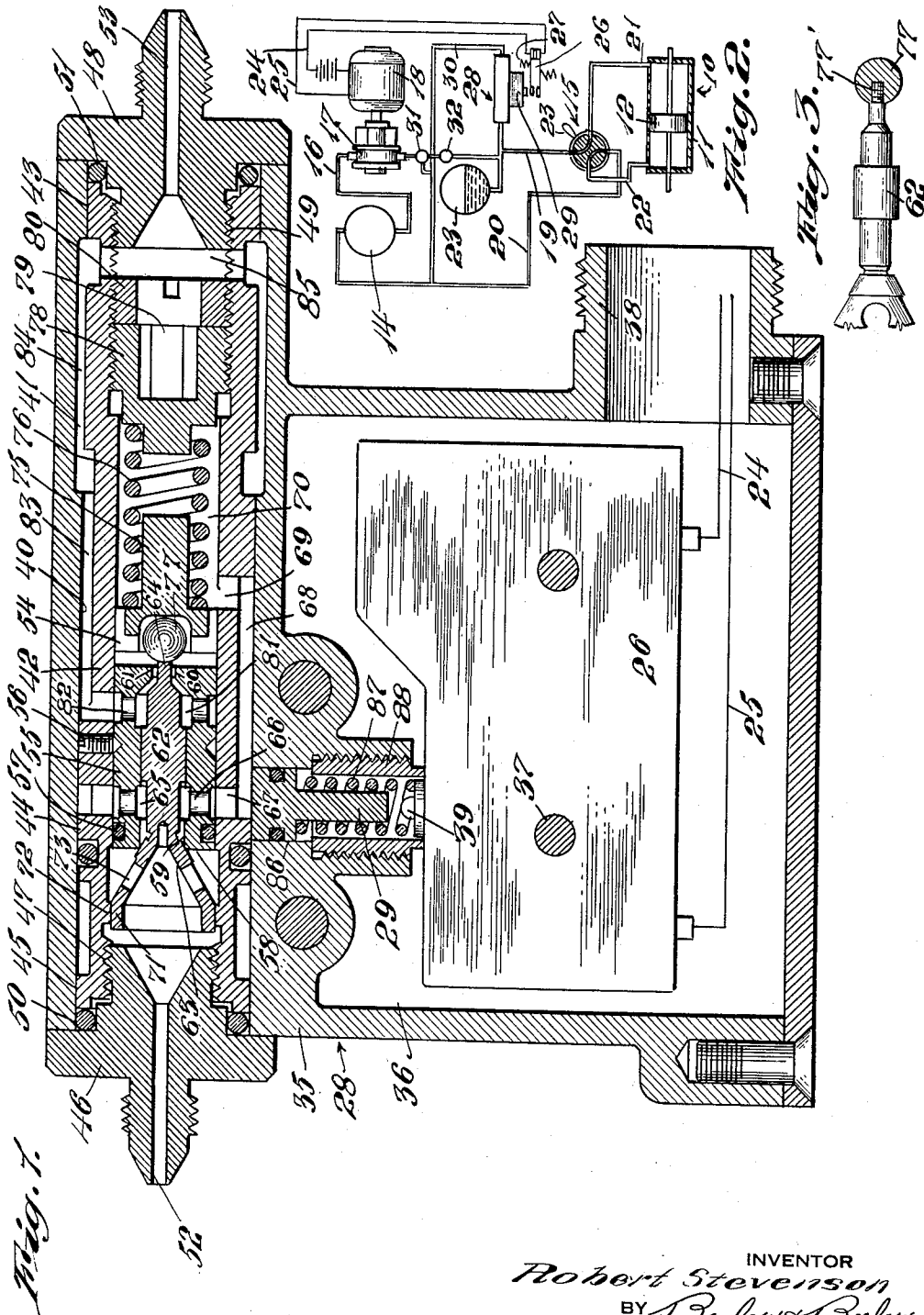
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HYDRAULIC REGULATOR

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HYDRAULIC REGULATOR

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5 Claims. (Cl. 137-102)

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This invention is a continuation of my application Serial No. 553,198 filed September 8, 1944, now abandoned, and relates to the regulation of a hydraulic system wherein it is desired to maintain a substantial pressure in the system for doing work whenever occasion for utilizing that pressure may arise.

In hydraulic systems of this character it is quite common that the pump which supplies pressure to the system shall constantly operate in order that the pressure may be obtained. In my Patent No. 2,545,712 I have provided an arrangement so that when the pressure desired has been obtained fluid from the supply may bypass the working part of the system that the load may be to some extent relieved thereby requiring less power for the operation of the pump or other pressure applying means.

One of the objects of this invention is to provide a pressure supply with the working means idle or at rest after the pressure which is desired in the system has been attained.

Another object of this invention is to provide an automatic control so that when the pressure in the system has attained a certain desired value the means for supplying that pressure will stop operating and when the pressure in the system has dropped below a certain range the pressure applying means will again be brought into operation.

Another object of this invention is to provide a hydraulically operated control which will automatically move in one direction upon certain pressure being applied to it and automatically move in the other direction when a certain minimum pressure exists in the conduit to which it is exposed.

Another object of this invention is to provide a quick operating valve and consequently one in which the control of the system may be closely obtained.

Another object of this invention is to provide a valve the working parts of which may be in the form of a cartridge which may be completely removed from the bore of the housing in which it is located and repositioned therein after being set for the desired range of operation.

Another object of the invention is to provide a valve plug which when it moves will move positively in one direction and not flutter or vibrate between opposite ends of its stroke.

Another object of the invention is to subtract an effective amount of counteracting pressure when the valve plug closes to prevent chattering as closing occurs.

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A more specific object of the invention is the actuation of an electric switch and to provide a hydraulic means for controlling this switch that it may in turn by its movement operate an electric motor in the system.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a sectional view of my hydraulic control unit illustrating the various operating parts;

Figure 2 is a diagrammatic view of the system in which the control unit is located for operation;

Figure 3 is a section of a modified form of connection.

The system in which this valve is used consists essentially of a work unit designated 10 which comprises a cylinder 11 with a piston 12 therein to be moved in one direction or the other by hydraulic pressure. The supply reservoir is designated 14 from which pressure is supplied to and a return is provided for the fluid to be supplied to the work or returned therefrom. A four-way control valve designated generally 15 is utilized for this purpose. The pressure line or conduit 16 has a pump 17 therein which is driven by a motor 18 and extends to the valve 15 through conduit 19. The low pressure or return line from the valve 15 is conduit 20 which extends back to the reservoir. The valve 15 may be operated so as to connect the pressure conduit 19 to the conduit 21 to supply one end of the cylinder or to the conduit 22 to supply the other end of the cylinder as the handle 23 is selectively moved. When one end of the cylinder is connected to the pressure conduit the other end is connected to the return line to the reservoir. An accumulator 23 is connected in the supply line or pressure line 19 that a more even and constant pressure may be maintained.

The electric motor 18 is energized through a pair of leads 24 and 25 and the control of energy is had through a switch 26 which is opened by a spring 27. The hydraulic regulator is designated 28 and is equipped with a plunger 29 to press upon and close the switch 26 and energize the electric motor 18. The regulator 28 is controlled by the pressure in the conduit 19 at one end to expose the same to the pressure supply while its other end is connected by a return line 30 to the reservoir 14 or the low pressure side of the system. The system may be equipped with

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a relief valve 31 and a check valve 32 both in the pressure supply line 19.

The control unit designated generally 28 comprises a body casing 35 which has a hollow compartment 36 for the reception of an electric switch designated generally 26 and held in this compartment by pins 37. An outlet 38 is provided for the lead in wires to the switch which normally has its contacts spaced by reason of spring 27. A button 39 when pressed upon will cause a closure of the contacts against the spring action.

Another compartment in this body 35 is provided by a bore 40 which extends completely through the body with an enlarged annular recess 41 along one part of the bore.

A sleeve 42 is insertable in this body bore and engages this bore as at 43, 44 and 45 with a sliding fit so as to position the same therein. The sleeve is held in position in the bore by cap 46 threadingly engaging the central opening through the sleeve as at 47 and the cap 48 also threadingly engaging the sleeve as at 49. Packing 50 provides a seal between the sleeve, the bore and the cap while packing 51 provides a seal between the opposite end of the sleeve, the bore, and the cap. When one of these caps is removed the other cap may be utilized for withdrawing the entire sleeve from the bore. The cap 46 is provided with a conduit 52 which is connected to the pressure supply line 19, while cap 48 is provided with a conduit 53 which is connected to the conduit 30 returning to the low pressure side of the reservoir 14.

A central opening 54 extends through the sleeve 42 and is equipped with a block 55 held in the bore by a set screw 56 and provided with a packing 57 so as to prevent passage of fluid between the surface of the block and the central opening 54. The block has an axial bore 59 and at one end is formed a valve seat 58. This bore is restricted as at 60 and another valve seat is provided at 61. A plunger 62 has a valve head 63 enlarged at one end for engaging the seat 58 while it is provided with a reduced end 64 to pass through the restricted opening 60 in the block. The plunger is reduced between these seats and near the head 63 to provide an annular chamber 65 between itself and the block. Conduits 66 through the block register with conduit 67 in the sleeve, which communicates with conduit 68 axially along the sleeve and conduit 69 radial of the sleeve for conveying fluid into the chamber 70 on the other side of the block 55. The valve head 63 has a portion 71 engaging the cylindrical surface 72 for guiding the plunger in its movement while openings 73 provide for communication of the fluid through the valve and past the seat into the chamber 65, then through the passages 67, 68, 69 to the chamber 70.

A reciprocating member 75 is slidable in the opening 54 and is pressed toward the seat 61 by spring 76. The plunger 75 loosely houses a ball 77 in its upper end which seats upon the valve seat 61 or is moved from the seat by the reduced portion 64 of the plunger 62. The spring 76 is adjusted by the threaded plug 78 which threadingly engages the threads 49 in the sleeve and may be adjusted by the Allen head or angular socket 79 thereof. A check nut 80 serves to hold this plug in adjusted position. This plug also closes the chamber 70 in the sleeve. The ball valve 77 may be fixed to the plunger 62 as shown at 77' in Figure 3.

When the ball valve 77 is removed from its

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seat as in the position illustrated in the drawing, fluid in the chamber 70 may pass through the restricted opening 60 into an annular chamber 81 formed by a reduction in the size of the plunger 62 at its lower end and an enlargement of the bore 69. From this chamber 81 fluid may pass radially outwardly as at 82 and then through the longitudinally extending conduit 83 to the annular chamber 84 formed by the recess 41 in the bore 40. Fluid may then pass to the conduit 53 by the radial bores 85 through the sleeve.

At some point having convenient communication with the channel 68 I provide a bore 86 for movement of the plunger 29 therealong. The plunger is moved toward the conduit 68 by the spring 87 and is limited in its opposite movement against the spring by a bushing 88 with which the head of the plunger 86 engages. The abutment for one end of this spring 87 is the casing of the switch 26.

In operation the valve head 63 will be on its seat as shown in the drawings when the pressure in the conduit 13 has reached a predetermined maximum amount and in this case the plunger 29 will be forced in the direction shown so that it is free from the button 39 and the switch 26 will be opened so that the motor 18 will be at rest. Should the pressure in the conduit 19 drop below a predetermined minimum amount for which the spring 76 is set by its adjustment 78, then the plunger 62 through the ball 77 will be forced from its seat while the ball valve 77 will be seated on its seat 61. Thereby pressure in the conduit 19 will enter about the valve seat 58 and will fill the conduits 66, 67, 68, 69 and chamber 70 so as to exert a pressure on the top of the plunger 29 forcing it downwardly against the spring 87 to press upon the button 39 and close the switch 26, thereby energizing the motor 18 which will start the pump to again supply pressure and build up this pressure in the supply line 19 to a predetermined value. Whereupon because of the areas of the valve head 63 and the ball, the valve head will cause movement of the plunger 62 to press the spring 76 and close thereby opening the valve 77 and permitting any fluid in the chamber 70, also the conduits 66, 67, 68, 69 to be relieved of any pressure and thereby permitting the plunger 29 to move from the button and permit the spring 27 to open the contacts of the switch 26, thereby stopping the motor until the cycle is again repeated, thus providing an automatic operation for the maintenance of fluid under a certain predetermined range of pressure.

When the plunger 62 moves to the right upon a predetermined pressure being reached and seat 58 is engaged by the head 63 the ball 77 will be forced off of its seat thus subtracting the pressure represented by the area of opening 60 from a counterpressure or pressure tending to open the plunger. This immediate subtraction of pressure prevents fluctuation, chattering or fluttering of the plunger and provides a snap action of the valve.

I claim:

1. In a hydraulic regulator, a body having a supply port, a return port and a chamber, a first conduit from said supply port to said chamber, a second conduit from said chamber to said return port, a first valve for controlling said first conduit having an effective area on one side thereof subjected to the pressure from said supply port tending to move the valve to closed position to shut off the fluid to said chamber, a

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second valve for controlling the said second conduit and having when in the closed position an effective area on one side thereof subjected to the pressure of the fluid from said supply port tending to hold the second valve in said closed position to shut off the flow of fluid from said chamber to said return port, said first valve having means engageable with said second valve to move said second valve to open position upon said first valve being moved to closed position, adjustable spring pressure means to supplement the supply of fluid pressure acting on said second valve tending to move the same to closed position so as to equal at a predetermined pressure the pressure acting on said first valve tending to move the first valve to closed position whereby upon the closing of said first valve said second valve will be moved to open position and spring pressure alone will oppose the fluid pressure acting on said first valve tending to maintain said first valve in the closed position.

2. In a hydraulic regulator as set forth in claim 1 wherein said second valve is a ball valve.

3. In a hydraulic regulator, a body having a supply port, a return port and a chamber, a plunger operable upon a predetermined fluid pressure in said chamber for conveying of mechanical movement, a first conduit from said supply port to said chamber, a second conduit from said chamber to said return port, a first valve at one end of said plunger for controlling said first conduit having an effective area on one side thereof subjected to the pressure from said supply port tending to move the same to closed position to shut off the fluid to said chamber, a second valve at the other end of the plunger for controlling the said second conduit and having when in the closed position an effective area on one side thereof subjected to the pressure of the fluid from said supply port tending to hold the second valve in closed position to shut off the flow of fluid from said chamber to said return port, said first valve having an extension therein engaging said second valve on the other side thereof to the said effective area therein to move said second valve to open position upon said first valve being moved to closed position, adjustable spring pressure means to supplement the supply fluid pressure acting on said second valve tending to move the same to closed position so as to equal at a predetermined pressure the pressure acting on said first valve tending to move the first valve to close position whereby upon the closing of said first valve said second valve will be moved to the open position and said spring pressure alone will oppose the fluid pressure acting on said first valve tending to maintain said first valve in the closed position.

4. In a hydraulic regulator, a body having a supply port, a return port and a chamber, a first conduit from said supply port to said chamber, a second conduit from said chamber to said return port, a first valve for controlling said first conduit having an effective area on one side thereof subjected to the pressure from said supply port tending to move the valve to the closed position to shut off the fluid to said cham-

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ber, a second valve for controlling the said second conduit and related to said first valve in a manner to oppose the closing of said first valve and having an effective surface area when in the closed position subjected to the pressure from said supply port tending to move the same to closed position to hold said valve in the closed position to shut off the flow of fluid from said chamber to said return port and oppose the closing movement of said first valve, spring pressure means to supplement the supply pressure acting on said second valve tending to move the same to closed position so as to equal at a predetermined pressure the supply pressure acting on the first valve tending to move the same to close position, and means carried by said first valve engageable with said second valve to move said second valve to open position upon said first valve moving to closed position to drain said chamber whereby to relieve said first valve of the supply pressure acting on said second valve opposing the closing of said first valve to permit a snap action closing of said first valve.

5. In a hydraulic regulator, a body having a supply port, a return port and a chamber, said body having a bore therein with one end portion thereof provided with a first conduit from said supply port to said chamber and the other end portion thereof with a second conduit from said chamber to said return port, valve seats along said conduits, first and second valves for engaging said valve seats and controlling said conduits and provided with a body therebetween slidably mounted in said bore and operatively connecting said valves whereby the closing movement of one of said valves will be transmitted to move the other valve to open position, said first valve controlling said first conduit and having an effective area on one side thereof subjected to the pressure from said supply port tending to move the same to closed position to shut off the fluid to said chamber and to move said second valve to open position, said second valve controlling said second conduit and having an effective area thereon on one side thereof when in the closed position subjected to supply pressure tending to move said second valve to the close position to shut off the flow of fluid from said chamber to said return port and to oppose the closing of said first valve, and spring pressure acting on said second valve tending to move the same to closed position so as to equal at a predetermined pressure the supply pressure acting on said first valve tending to move the first valve to closed position whereby upon movement of said first valve at a predetermined differential pressure across said valves said first valve will be moved to closed position and said second valve will be moved to open position to drain said chamber and relieve said first valve of the said opposing supply pressure acting thereon.

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