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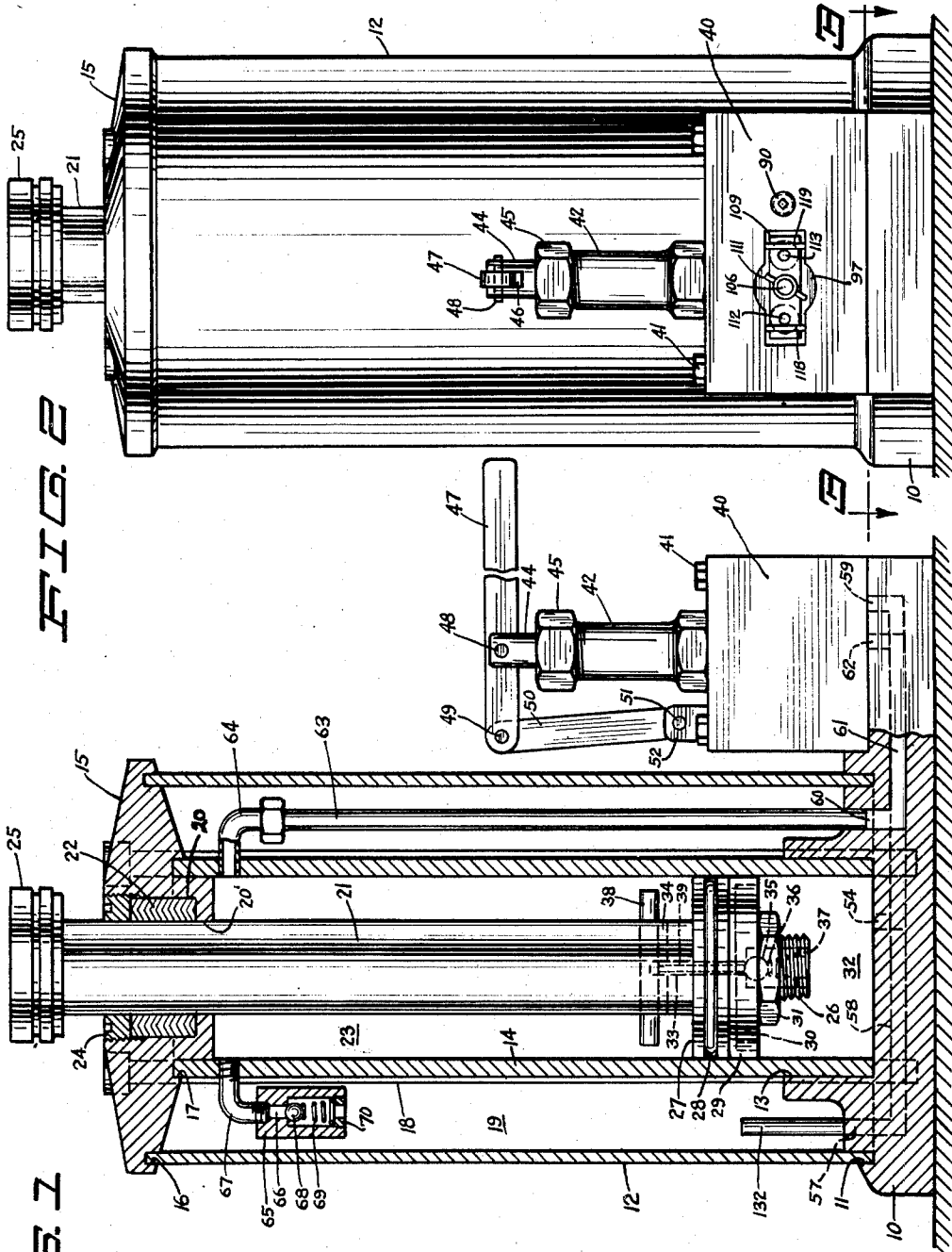
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2,863,285

HYDRAULIC JACK

Filed Feb. 15, 1957

5 Sheets-Sheet 1



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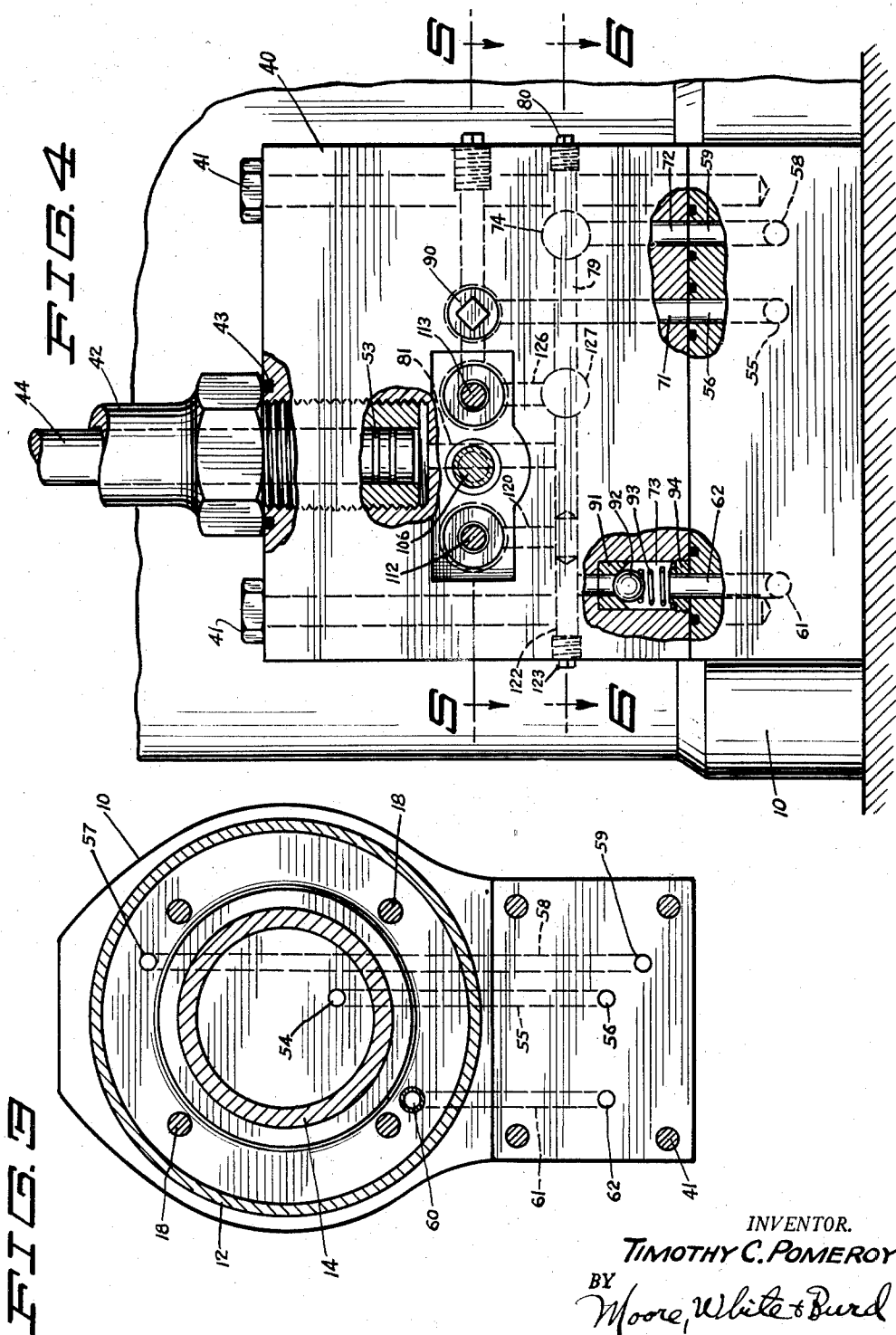
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FIG. 7

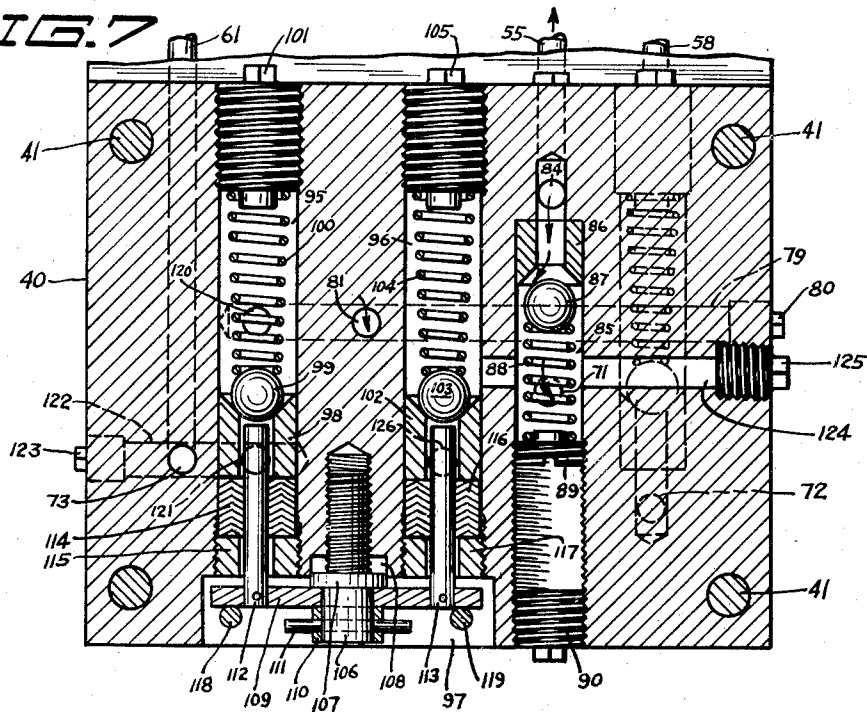
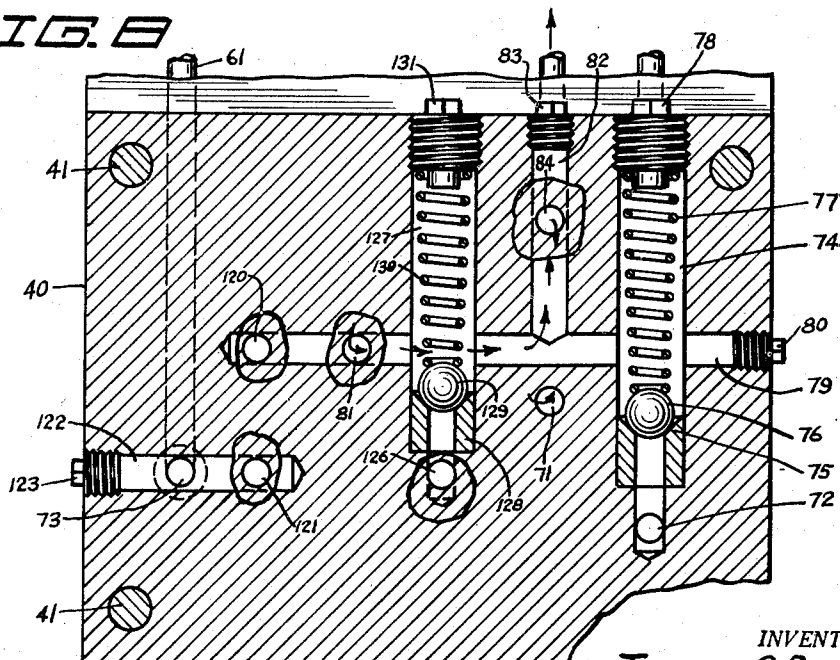


FIG. 8



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FIG. 9

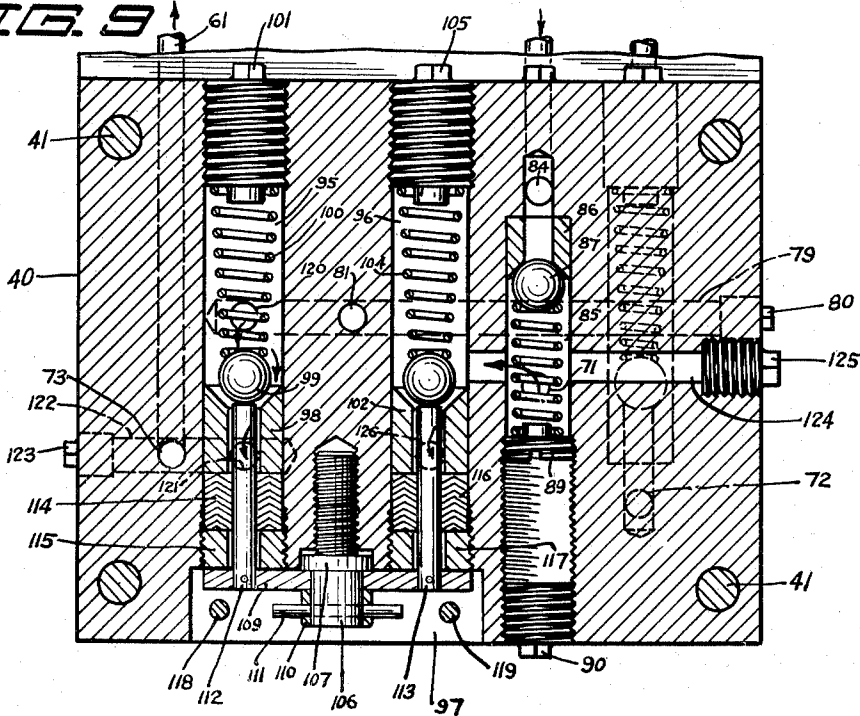
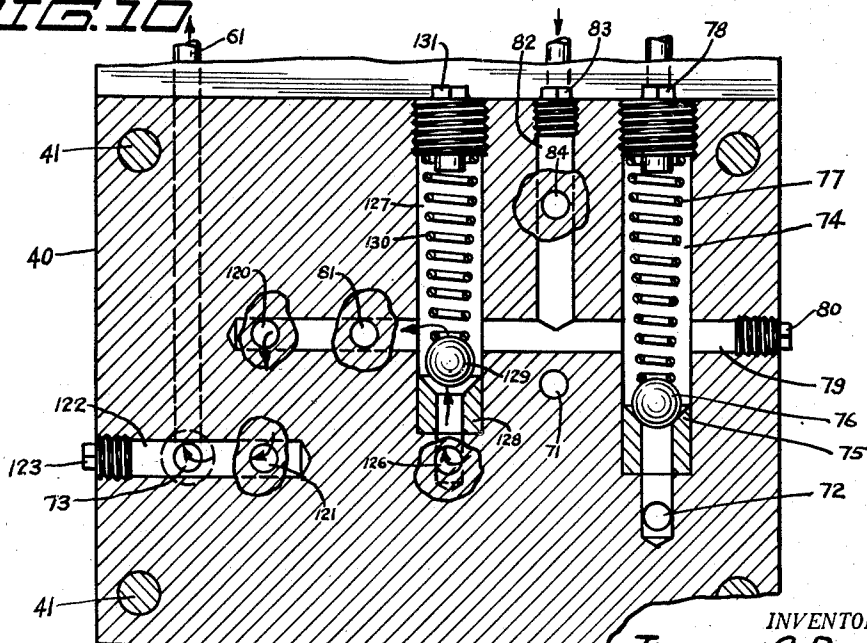


FIG. 10



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HYDRAULIC JACK

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9 Claims. (Cl. 60—52)

This invention relates to new and useful improvements in hydraulic jacks. More particularly this invention relates to a manually operable single pump hydraulic jack which is operable in any position from vertical to horizontal to inverted.

A principal object of this invention is to provide a hand operated hydraulic jack which will permit a jack ram or plunger to be pumped up and pumped down utilizing but a single pump and a single release.

It is a further object of this invention to provide a hydraulic jack wherein the pressure chamber is completely filled with hydraulic fluid both above and below the piston at all times making it impossible for air to enter the hydraulic system.

A further object of the invention is to provide hydraulic jack construction wherein upon the downward stroke of the jack plunger the hydraulic fluid is sucked from under the plunger piston rather than from the oil reservoir so as to insure against entry of any air into the hydraulic system when the jack is operated in a horizontal or inverted position.

Another object of this invention is to provide a hydraulic jack construction wherein the valve block is removable from the base and replaceable in the event of valve failure or breakage.

Still another object of this invention is to provide a hydraulic jack construction having a pressure escape valve between the hydraulic fluid chamber above the plunger piston and the hydraulic fluid reservoir to make possible the maintenance of hydraulic fluid both above and below the piston at all times, the operation of the jack plunger up or down with only one pump and one release, as well as the elimination of the expansion tank.

Other objects of the invention will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated by the drawings in which the same numerals refer to corresponding parts and in which:

Figure 1 is a side elevation, partly in section, showing the details of construction of the jack cylinder, plunger and hydraulic fluid reservoir, as well as the pump and valve block;

Figure 2 is another side elevation of the hydraulic jack of this invention;

Figure 3 is a horizontal sectional view taken generally on the line 3—3 of Figure 2 and in the direction of the arrows;

Figure 4 is an enlarged side elevation of the valve block comprising part of the hydraulic jack of this invention,

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shown partly broken away to illustrate details of construction of the valve block;

Figure 5 is a horizontal sectional view through the valve block taken on the line 5—5 of Figure 4 and in the direction of the arrows and showing the positions of the valving elements during the intake stroke;

Figure 6 is a horizontal sectional view taken on the line 6—6 of Figure 4 and in the direction of the arrows and showing the positions of the valving elements during the intake stroke;

Figure 7 is a horizontal sectional view corresponding to that of Figure 5 but showing the positions of the valving elements during the pressure stroke;

Figure 8 is a horizontal sectional view corresponding to Figure 6 but showing the positions of the valving elements during the pressure stroke;

Figure 9 is a horizontal sectional view corresponding to Figures 5 and 7 but showing the positions of the valving element during the pressure releasing cycle; and

Figure 10 is a horizontal sectional view corresponding to Figures 6 and 8 and showing the positions of the valving elements during the pressure releasing cycle.

Referring to the drawings, and particularly Figures 1 and 2, the hydraulic jack herein disclosed includes a base 10, which is preferably provided with an annular channel 11 adapted to receive one end of a cylindrical housing 12. The base 10 is also preferably provided with a counterbore 13, concentric with annular channel 11, adapted to receive one end of a cylindrical pressure cylinder 14.

An annular housing cover 15 is provided with an annular channel 16 on its inner side for receiving the opposite or top end of cylindrical housing 12, and an inner concentric annular channel 17 for receiving the opposite end of pressure cylinder 14. Base 10, cover 15, housing 12, and cylinder 14 are secured together to provide a rigid fluid-tight structure by suitable means as, for example, tie bolts 18 which extend from the cover 15 down to the base 10. An annular chamber 19 is provided between the wall of housing 12 and the wall of cylinder 14, as best illustrated in Figure 1.

Housing cover 15 is provided with a central bore 20 adapted to receive a plunger 21 comprising part of the jack ram. The bottom of bore 20 is defined by an interned flange 20' which, in addition to providing a support for a suitable packing 22, also serves as a guide for the upper end of plunger 21. Packing 22 provides a fluid-tight seal for the fluid pressure chamber 23 in pressure cylinder 14 above the piston. The packing 22 is compressed in bore 20 by an annular packing gland 24, received in threaded engagement with the upper wall portion of bore 20, as is well known in the art. The upper end of plunger 21 is provided with a load-engaging element or head 25.

The lower end 26 of plunger 21 is of reduced diameter and is threaded. This lower end 26 is provided with a piston disk 27 having an annular peripheral channel for receiving an O-ring 28. A cup shaped packing 29 is seated against the bottom face of the piston disk 27. The piston disk 27 and cup shaped packing 29 are held in place by means of a washer 30 and a nut 31 threaded onto the lower end 26 of the plunger. The combination of the O-ring 28 and the packing 29 insures a fluid-tight seal between the upper pressure chamber 23 and the lower pressure chamber 32 which lies below the piston or plunger head.

The lower end of plunger 21 is provided with a suitable relief valve including a central axial channel 33, extending from the end of the plunger to a transverse channel 34 through the plunger above the plunger head. The lower end of the central axial channel 33 is some-

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what enlarged to receive a ball check valving element 35 which is normally urged in the closed position by means of a suitable coil spring 36 which is held in place in the channel by means of a collar 37.

An actuating bar 38 is received in the transverse channel 34. The actuating bar 38 is of a length greater than the diameter of plunger 21 so that the ends of the actuating bar extend outward from the ends of the transverse channel. The actuating bar is of smaller diameter than transverse channel 34 so as to be freely movable in the axial direction of the plunger. The actuating bar rests on the upper end of a pin 39 in the central axial channel 33. The lower end of pin 39 engages the relief valving member 35. The spring means 36 for yieldably holding the ball check element 35 on its seat has sufficient tension to overcome the weight of the actuating bar 38 and pin 39 so as to normally hold the valving element 35 on its seat.

The circulation of hydraulic fluid to and from the pressure chambers and fluid reservoir is controlled from a pump and valve housing 40 which is fitted to and secured to the base 10 of the jack by suitable attachment means, such as bolts 41. The pump comprises a cylinder 42 fitted to the housing 40, as best shown in Figure 4. The pump cylinder 42 may desirably be fitted by being screwed into a threaded channel in the top of housing 40, as shown. Fluid-tight construction is assured by an O-ring 43 interposed between the pump cylinder and the top of the housing 40. The pump cylinder 42 has a piston 44 mounted for reciprocal movement therein. The upper end of the cylinder, as indicated at 45, is provided with a suitable gland and packing as is conventional in this art to prevent leakage around the upper end of the cylinder which projects from the cylinder.

The upper end of the pump piston 44 is provided with a transverse slot in which to receive a handle 47 which is pivotally secured in the slot by means of a pin 48. To enable the pump piston to be reciprocated within the pump cylinder by means of handle 47 the short end of the handle which extends beyond the slot in the piston is pivotally mounted by means of a pin 49 to a link 50 which in turn is pivotally mounted at 51 to a lug 52 on the top of the housing 40. The lower end of pump piston 44 is provided with one or more O-rings in peripheral annular channels near the end of the piston.

As best shown in Figure 3 the base 10 is provided with a plurality of ports communicating with the valve housing, a corresponding number of ports communicating with the cylindrical jack housing and interconnecting channels. The portion of the base which underlies the pressure chamber 32 within the pressure cylinder 14 is provided with a port 54 which communicates through a channel 55 with a port 56 underlying the valve housing block 40. The portion of the base which underlies the hydraulic fluid reservoir 19 is provided with an outlet port 57 which communicates by means of channel 58 with port 59 in the base underlying the valve housing 40.

The portion of base 10 underlying the reservoir 19 is also provided with a second port 60 which is connected by means of channel 61 with port 62 underlying the valve housing. Port 60 is connected by means of pipe 63 and elbow 64 (Figure 1) with the pressure chamber 23 above the plunger head. Elbow 64 is fitted into pressure cylinder 14 adjacent to the inner side of the housing cover 15. Thus, port 60 serves as an inlet port for introducing fluid to the upper pressure chamber 23.

A valve is provided for relieving pressure in the upper pressure chamber 23 and returning hydraulic fluid to the reservoir 19. The valve comprises a body 65 having a central axial channel 66 which communicates through an elbow 67 with the pressure chamber 23. Elbow 67 extends through the wall of pressure cylinder

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14 at its upper end adjacent the inner side of housing cover 15. Axial channel 66 is enlarged somewhat to accommodate a ball check valving member 68. The ball valving member is normally seated so as to close the channel 66 and is urged into this closed seated position by spring tension applied by a coiled spring 69 which is retained in the axial channel 66 by means of a collar 70. As will be pointed out in detail hereinafter the pressure relief valve is vital to the functioning of the hydraulic valve of this invention.

Valve housing block 40 is provided with three ports 71, 72 and 73, which, when the block 40 is fitted in place on the base 10, are in registry with and communicate with ports 56, 59 and 62, respectively. A resilient O-ring is provided around the points of juncture of each of ports 56 and 71, 59 and 72, and 62 and 73 in order to provide a fluid-tight construction. It will be noted that the valve block 40 is easily removable from the base and in case of valve failure or breakage can readily be replaced merely by unfastening of bolts 41 and substitution of a new valve.

Fluid intake stroke and mechanism

The structure of the valve block 40 is best shown in Figures 4 through 10. The means for drawing fluid by the pump is best shown in Figures 4 to 6. Port 72 connects directly within the valve housing with a horizontal channel 74 which is enlarged through part of its length to accommodate a valve seat element 75 against which a ball check valving member 76 is urged by means of coil spring 77. A threaded plug 78 is screwed into the open end of channel 74 in order to close the channel and provide means for adjusting the tension of spring 77. Channel 74 communicates directly with a horizontal cross channel 79 which is closed by means of a screw plug 80. Cross channel 79 is intersected by a vertical channel 81 which communicates with the pump cylinder 42. Thus, when handle 47 is lifted and pump piston 44 is retracted suction is created within the pump cylinder 42 sufficient to overcome the tension of spring 77 holding check valve 76 closed and hydraulic fluid is drawn from the reservoir 19 through port 57, channel 58, port 59, port 72, valve 76 and channel 74, into cross channel 79 to channel 81.

Pressure stroke mechanism

The mechanism for operating the pressure stroke for lifting the jack plunger and position of the valves is shown in Figures 4, 7 and 8. Cross channel 79 is also intersected by a horizontal channel 82 the end of which is closed by screw plug 83. Channel 82 in turn communicates with a vertical channel 84 which leads to a transverse horizontal channel 85 which in turn communicates with vertical port 71. Horizontal channel 85 is enlarged through part of its length to receive a valve seat 86, a ball check valving member 87, which is held in closed position under the influence of coil spring 88. The end of channel 85 is closed and the spring 88 is held in place and under tension by means of the screw plug 89. The plug 89 is sufficient to seal off the end of the channel 85 but because of the length of the channel to avoid using an unusually long plug it is preferred to provide further closing means such as screw plug 90.

Vertical port 71 which communicates with the channel 85 in turn communicates with port 56 in the base 10 and then through channel 55 to port 54 and lower pressure chamber 32 in the pressure cylinder 14 under the plunger head. Thus, when handle 47 is depressed and pump piston 44 is pushed into the pump cylinder 42 the hydraulic fluid in the pump cylinder is forced down through vertical channel 81 into cross channel 79 to cross channel 82 into vertical channel 84 to horizontal channel 85, displaces valve 87 and is forced into vertical port 71 to port 56, through channel 55, up through port 54 and thence into the lower pressure chamber 32 to fill

that chamber with hydraulic fluid and force the plunger 21 upward upon repeated up and down movement of the handle 47.

Pressure relief

Because both pressure chambers of the pressure cylinder 14 are always filled with hydraulic fluid, as the amount of fluid in lower chamber 32 is increased and the plunger 21 moves upwardly pressure is put upon the fluid contained in the upper pressure chamber 23. This pressure is relieved by means of check valve 68 permitting the fluid from the upper pressure chamber 23 to be forced against the pressure of the spring holding the check valve and into the fluid reservoir 19. At the same time a certain amount of pressure is imposed upon the fluid in elbow 64, pipe 63, port 60, channel 61, port 62, and port 73. Vertical port 73 is enlarged to accommodate a valve seat 91, a ball check valving element 92 which is urged against the valve seat by means of a spring 93 which in turn is held within the port 73 by means of a threaded collar 94 screwed into the end of the port 73. By this means fluid from the upper pressure chamber 23 is prevented from backing up into the valve housing beyond check valve 92.

As the plunger 21 is forced upwardly under the influence of increased fluid pressure in the pressure chamber 32 and approaches the limit of its course of travel, actuating bar 38 comes into contact with the inner surface of housing cover 15 and pushes pin 39 downwardly, displacing relief valve 35. Thus, if additional pressure is applied to lower pressure chamber 32 by means of working pump handle 47 after the limits of extension of the plunger ram have been reached, the pressure from the chamber 32 bleeds off through valve 35, channel 33, transverse channel 34 to the now greatly restricted upper pressure chamber 23 and thence out through the check valve 68 and into the fluid reservoir 19.

Load pressure releasing means

A single load pressure releasing mechanism, best shown in Figures 4, 9 and 10, is provided as follows. Two transverse horizontal parallel channels 95 and 96 extend all of the way through the valve block 40 from a control recess 97 in one side of the block. Channel 95 is provided with a valve seat 98 adapted to receive a ball check valving element 99 which is normally held in closed position by the tension applied by a coil spring 100. The end of the channel opposite from recess 97 is closed by means of a screw plug 101 by means of which tension on spring 100 may also be adjusted. Channel 96 is similarly provided with a valve seat 102 in which a ball check valving element 103 is normally urged in the closed position by means of coiled spring 104 which is held in place by the plug 105 screwed into the end of the channel for the purpose of closing off the channel and providing means for adjusting the tension on the spring.

A bolt 106 is aligned parallel between the two channels 95 and 96. Bolt 106 is provided with a shoulder 107 adapted to move in and out in a counterbore recess 108 in the valve housing 40. A horizontal longitudinal release bar 109 is disposed on the outer end of the bolt 106 to rest against the shoulder 107 so as to permit relative rotary movement between the bolt and release bar. The release bar 109 is held in place against the shoulder by means of a collar 110 which is keyed to the bolt by means of a pin 111 which is of a length greater than the diameter of the collar 110 so as to form a handle element for rotating the bolt 106.

Secured to the release bar 109 adjacent to its opposite ends are two valve release pins 112 and 113 which are adapted to move in channels 95 and 96, respectively. Pin 112 is adapted to move in the channel of the valve seat element 98 so as to dislodge valving element 99 upon rotation of bolt 106 and inward movement of the release bar 109. Suitable packing 114 is disposed around the

release pin 112 to provide a fluid-tight seal for the channel 95. Packing 114 is held in place by a threaded collar 115 screwed into the end of the channel 95 adjacent to the recess 97.

Similarly, the release pin 113 is adapted to move simultaneously in the channel of the valve seat element 102 to dislodge the ball check valving member 103 when the pin is moved inwardly. A fluid-tight seal for channel 96 is provided by means of packing 116 which is held in place by means of a threaded collar 117 screwed into the end of the channel. If desired or necessary coil springs may be disposed between the packing and the valve seat element or between the packing and the threaded collars in order to maintain the packing under proper compression at all times, or alternatively, the packing may be displaced by O-ring members for maintaining proper seal against leakage from the channel.

Two vertical stop pins 118 and 119 are provided in recess 97 to restrict the outward movement of the bolt 106 and release bar 109. In normal operating position the bolt 106 is adjusted so that the release bar rests against the stop pins 118 and 119 so as to hold the valve release pins 112 and 113 away from the valving elements 99 and 103 thereby permitting these valves to remain closed under normal spring tension. On the other hand, when it is desired to release the load pressure from the hydraulic jack bolt 106 is rotated by means of the handle pin 111 to move the release bar and its valve release pins inwardly so as to unseat valving elements 99 and 103 by forcing them away from their seats against the tension of their coil springs. This is shown in Figure 9.

Channel 95 is connected to cross channel 79 on one side of valve 99 by means of a vertical channel 120. On the opposite side of valve 99 channel 95 is connected by means of a vertical channel 121 with a short horizontal channel 122 which in turn communicates with vertical port 73 above the ball check valve 92 and thence through port 62, channel 61, port 60, pipe 63 and elbow 64 to the pressure chamber 23 above the plunger head in the pressure cylinder 14. The short channel 122 is closed at its open end by means of a screw plug 123.

Channel 96 is intersected on one side of valve 103 by a cross channel 124 which in turn is intersected by channel 85 and communicates on one side of valve 87 with port 71 and ultimately with the bottom pressure chamber 32 below the plunger head, and on the opposite side of valve 87 with channel 84 and ultimately with the pump cylinder 42. Channel 124 is closed at its opposite end by means of a screw plug 125. Channel 96 on the opposite side of valve 103 is connected by means of vertical channel 126 with a transverse horizontal channel 127 which in turn intersects the horizontal cross channel 79. Channel 127 is enlarged through part of its length to receive a valve seat element 128, a ball check valving element 129 which is held normally in closed position under the influence of spring tension provided by coil spring 130. The end of the channel is closed and adjustment means is provided for the spring by means of screw plug 131.

Load pressure release operation

As best seen in Figures 9 and 10, when the pressure release means is in position to open valves 99 and 103, the pressure of the lifted load upon the plunger 21 pushes the plunger and plunger head downwardly thereby applying pressure on the fluid in the lower pressure chamber 32 and forcing it through port 54, channel 55, port 56 and port 71 to channel 85. Then, because valve 87 is forced closed by spring 88, the fluid is forced through channel 124 into channel 96. Because valve 103 is held open by release pin 113 the fluid is forced past valve 103 into vertical channel 126 and thence into channel 127. The force of the fluid is sufficient to displace valve 129 and permit the fluid to flow into cross channel 79,

Valve 76 is forced closed both under the influence of the fluid in channel 79 and the force of spring 77. Valve 87 is maintained closed by the greater fluid pressure from port 71 than from channels 84 and 82.

Flow through vertical channel 81 is prevented by the pump plunger 44, leaving an unrestricted path of flow through vertical channel 120 to channel 95 and thence past valve 99 which is forced open by valve release pin 112, through vertical channel 121 to channel 122 to port 73. The fluid pressure against valve 92 is sufficient to dislodge the valving member and the fluid flows on to port 62, channel 61, port 60, pipe 63 and elbow 64 to the upper pressure chamber 23 where it occupies the space created by descent of the plunger and insures against entry of air into the hydraulic system above the plunger head.

The function of the hydraulic fluid returning to the upper pressure chamber is not to force the plunger downwardly since that is being accomplished by the weight of the load on the plunger head and the hydraulic fluid is in effect sucked into the upper pressure chamber primarily merely to occupy space. Any excess fluid is released to the reservoir 19 through the check valve 68 which likewise releases any excessive pressures in the upper pressure chamber during this period of pressure release. By means of a single release mechanism oil is transferred from the bottom of the plunger piston to the top of the piston automatically with no other valves to open or close. In transferring the hydraulic fluid the intention is not to create pressure in the upper pressure chamber 23.

Pump pressure release means

At the very instant that the load pressure stops the operator can then pump the jack ram out from under the load and pump the ram back into the jack. To accomplish this the release mechanism is maintained in its open position, that is, with release pins 112 and 113 forcing valves 99 and 103 into their open positions, as shown in Figures 9 and 10. Thus, when the operator works handle 47 the flows are virtually the same as when merely under the influence of load pressure upon the plunger with the following exceptions. When the operator lifts handle 47 to retract the pump piston 44 fluid from the lower pressure chamber 32 is drawn as heretofore described to the cross channel 79 and thence up to vertical channel 81 into the pump cylinder 42. Then, on the downward stroke of handle 47 and pump piston 44, the hydraulic fluid is forced out of the pump cylinder 42 through vertical channel 81 back to cross channel 79 and thence to vertical channel 120, channel 95, past open valve 99, etc. back to the upper pressure chamber 23.

On the downward stroke of the pump piston 44 the check valve 129 closes, stopping the hydraulic fluid from going anywhere but through the vertical channel 120 to channel 95. The spring tension on check valve 129 is just strong enough to hold check valve 129 on its seat. The spring tension on the reservoir intake check valve 76 is just strong enough to overpower the spring in check valve 129. In this way, the intake valve 76 will remain closed even though the check valve 129 will open under the influence of the pump to permit oil to be sucked from under the piston from lower pressure chamber 32.

Although the hydraulic jack of this invention has been illustrated and described with the jack plunger in the vertical position it is to be understood that in its operation it is not so limited. On the contrary, it is adapted to be operable in any position ranging from vertical to horizontal to upside down. Because it operates on a closed hydraulic system the hydraulic jack of this invention is equally well adapted to operation in air or under water.

The pressure release check valve 68 makes possible the functioning of the hydraulic jack of this invention

with only one pump and one pressure release mechanism. In addition this escape valve makes possible the elimination of an expansion tank. When the plunger is raised by introduction of fluid into the lower pressure chamber 32 the fluid from the upper pressure chamber 23, which is maintained filled with hydraulic fluid at all times, is forced through the valve 68 into the fluid reservoir 19. Due to this fact, that almost as much fluid is being replaced into the reservoir through the escape valve 68 as is being taken out to raise the jack plunger, less hydraulic fluid is used than ordinarily would be required. This makes possible leaving a small amount of air space above the fluid in the reservoir to take care of expansion, thereby eliminating the need for an expansion tank. To insure against entry of air into the valving system and pressure cylinder when the jack is inverted, the reservoir port 57 is provided with a short extension 132 which is at all times under the level of the liquid in the reservoir.

Summary of operation

In summary, the operation of the hydraulic jack according to this invention is briefly as follows. To lift a load upon the plunger, regardless of the position of the hydraulic jack, the pump handle 47 is oscillated up and down (or back and forth) upon its pivot point 49. When the pump piston is retracted suction is created within the pump cylinder 42 and hydraulic fluid is drawn from the reservoir 19 through port 57, channel 58, port 59, and port 72 to channel 74, displacing the check valve 76, into cross channel 79 and thence up to vertical channel 81 into the pump cylinder 42. Any other flow is restricted because check valves 99 and 129 are closed, due both to the positive fluid pressure and spring pressure. Check valve 87 is maintained closed both because of spring pressure and the reduced pressure on the opposite side due to the suction created in the pump cylinder.

The fluid drawn into the pump cylinder is then expelled and forced to the lower pressure chamber 32 under the plunger head by forcing the pump piston back into the cylinder thereby forcing the hydraulic fluid back through the vertical channel 81, into the cross channel 79, into the channel 82, the vertical channel 84, thence to channel 85 dislodging the check valve 87, back down through the vertical port 71 to the port 56 in the base, thence through channel 55 to port 54 and into the lower pressure chamber 32. This flow is possible because check valves 99 and 129 remain closed as previously described. The force of the fluid under the action of the pump piston with the assistance of spring pressure maintains check valves 76 and 103 closed.

Repeated reciprocation of the pump piston forces the jack plunger upwardly and at the same time forces the hydraulic fluid from the upper pressure chamber 23 through the check valve 68 back to the fluid reservoir 19. Check valve 92 prevents fluid from chamber 23 being forced back into the valve block. As the plunger approaches the end of its path of travel, pressure in the lower chamber 32 is relieved by actuating bar 38 contacting the inner side of the housing cover 15 and pushing pin 39 so as to dislodge the check valve 35.

Pressure in the jack pressure cylinder is relieved by turning release bolt 106 inwardly by means of the handle 111 thereby moving bar 109 and pins 112 and 113 inwardly to open the check valves 99 and 103. With those check valves opened, under the influence of the load pressure the plunger is forced downwardly forcing the fluid from the pressure chamber 32 through port 54, channel 55, port 56, port 71, channel 85, channel 124, through the channel 96, past the open check valve 103, into vertical channel 126, to channel 127, forcing its way past the check valve 129, into cross channel 79, through vertical channel 120, into channel 95, past open check valve 99, into vertical channel 121, through channel 122, into port 73, dislodging check valve 92, thence into base port 62, channel 61, port 60, pipe 63, and elbow 64, into the

upper pressure chamber 23. This flow is permitted because the pressure of the line in addition to the spring pressure maintains check valves 76 and 87 closed and the pump piston prevents flow through vertical channel 81.

The pressure may also be released by operation of the pump. When this is done fluid is sucked from the lower pressure chamber 32 by action of the pump piston and cylinder. Retracting the pump piston 44 creates a suction in the pump cylinder 42. The fluid is sucked from the chamber 32 into the port 54 through the channel 55 into the port 56, port 71, channel 85, channel 124, channel 96, past open check valve 103, vertical channel 126, channel 127, past check valve 129, into cross channel 79, and thus through vertical channel 81 into the pump cylinder 42. This flow is possible because the spring tension on check valve 76 is greater than that upon check valve 129 so that check valve 76 remains closed even though check valve 129 is open.

On the down stroke of the pump piston 44 the fluid is forced from the pump cylinder 42 down through the vertical channel 81, into the cross channel 79, through vertical channel 120, into channel 95, past open check valve 99, into vertical channel 121, through channel 122 to port 73, dislodging check valve 92, thence into base port 62, channel 61, port 60, pipe 63 and elbow 64 into the chamber above the plunger head. As previously pointed out the jack plunger is lowered not because of pressure imposed upon the upper surface of the plunger piston but rather due to drawing away of the fluid under the plunger piston.

It will be seen that the hydraulic jack of this invention as illustrated and described is characterized by a single operating lever for simultaneously actuating two valves for controlling directional flow of fluid. The reservoir cylinder and all fluid circulating passages are always completely filled with fluid so as to avoid the presence of air pockets which might interfere with the operation of the jack. It has a single pump for pumping fluid under the plunger piston to raise the load or for drawing the fluid from under the piston to force the plunger down by fluid pressure when necessary. It has a fluid escape or pressure release valve in communication with the interior of the upper end of the pressure cylinder to permit fluid in the cylinder to enter the reservoir from the cylinder during the upstroke of the plunger. The valve mechanism and fluid pressure pump are assembled as a complete unit and detachably secured to the jack base to facilitate manufacture, repair and replacement of worn or broken parts.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof. The specific embodiments described are given by way of example only and the invention is limited only by the terms of the appended claims.

What I claim is:

1. In a hydraulic jack, a cylinder; a plunger reciprocable therein; a fluid reservoir; a pump; a first passage connecting the bottom of the reservoir to the pump, a second passage connecting the pump to the bottom of the cylinder, a third passage connecting the pump to the top of the cylinder, a by-pass passage connecting the second and third passages, and a fourth passage connecting the top of the cylinder to the reservoir; an inelastic fluid in said reservoir, cylinder and passages; a check valve in said first passage to permit one-way flow of fluid from the bottom of the reservoir on the suction stroke of the pump, a check valve in said second passage to permit one-way flow of fluid from the pump to the bottom of the cylinder in the pressure stroke of the pump, a check valve in said third passage to prevent back-flow of fluid from the top of said cylinder and a check valve having a manually displaceable valving element in said third passage to normally prevent flow of fluid from the pump to the top of the cylinder, a check valve in said by-pass passage to permit one-way by-pass flow of fluid from said

second passage to said third passage and a check valve having a manually displaceable valving element in said third passage to normally prevent by-pass flow of fluid from said second passage to said third passage, and a check valve in said fourth passage to permit one-way flow of fluid from the top of said cylinder to said reservoir; and a pressure release mechanism to simultaneously manually displace the valving elements in both of said manually displaceable check valves.

2. A hydraulic jack according to claim 1 further characterized in that said cylinder and reservoir are disposed upon a single base, said check valves in the first, second, third and by-pass passages are contained in a single valve block housing on said base and the first, second and third passages interconnecting said cylinder, reservoir and valve block housing are at least partially disposed in said base.

3. A hydraulic jack according to claim 2 further characterized in that one end of each of said passage portions in said base terminates in ports in an upper plane surface of said base, one end of each of the corresponding passage portions in said valve block housing terminates in ports in a lower plane surface of said valve block housing, said ports in said base are in registry with the corresponding ports in said valve block housing, fluid-tight sealing means are disposed around said ports between the base and valve block housing and said valve block housing is removably secured to said base.

4. A hydraulic jack according to claim 2, further characterized in that said manually displaceable check valves are disposed in parallel side-by-side relation in said valve block housing, a rotatable bolt is disposed between said check valves, at least the head of said bolt being exterior of said housing, a transverse bar is secured to said bolt head for in-an-out movement with said bolt as the bolt is rotated, check valve release pins are provided on said bar, whereby movement of said pins on said bar unseats the valving elements of said check valves simultaneously.

5. A hydraulic jack according to claim 1 further characterized in that said reservoir comprises an annular chamber surrounding said jack cylinder and contained within an outer surrounding housing.

6. A hydraulic jack according to claim 1 further characterized in that said plunger includes an axial channel extending from above the plunger head to below said head, a transverse channel above said head communicating with the axial channel, a check valve in said axial channel permitting one-way flow of fluid from the part of the cylinder above said head to the part of the cylinder below said head, a pin in said axial channel above the check valve extending into the transverse channel, and an actuating bar of smaller diameter in said transverse channel and extending beyond the ends thereof, said actuating bar resting upon the end of said pin.

7. In a hydraulic jack, a cylinder; a plunger reciprocable therein; an annular fluid reservoir surrounding said cylinder; a pump; a first passage connecting the bottom of the reservoir to the pump, a second passage connecting the pump to the bottom of the cylinder, a third passage connecting the pump to the top of the cylinder, a by-pass passage connecting the second and third passages, and a fourth passage connecting the top of the cylinder to the reservoir; an inelastic fluid in said reservoir, cylinder and passages; a check valve in said first passage to permit one-way flow of fluid from the bottom of the reservoir on the suction stroke of the pump, a check valve in said second passage to permit one-way flow of fluid from the pump to the bottom of the cylinder on the pressure stroke of the pump, a check valve in said third passage to prevent back-flow of fluid from the top of said cylinder and a check valve having a manually displaceable valving element in said third passage to normally prevent flow of fluid from the pump to the top of the cylinder, a check valve in said by-pass passage to permit one-way by-pass flow of fluid from said second passage to said third pas-

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sage and a check valve having a manually displaceable valving element in said third passage to normally prevent by-pass flow of fluid from said second passage to said third passage, and a check valve in said fourth passage to permit one-way flow of fluid from the top of said cylinder to said reservoir; and a pressure release mechanism to simultaneously manually displace the valving elements in both of said manually displaceable check valves; said cylinder and reservoir being disposed upon a single base, said check valves in the first, second, third and by-pass passages being contained in a single valve block housing on said base, the first, second and third passages interconnecting said cylinder, reservoir and valve block housing being at least partially disposed in said base; one end of each of said passage portions in said base terminating in ports in an upper plane surface of said base, one end of each of the corresponding passage portions in said valve block housing terminating in ports in a lower plane surface of said valve block housing, said ports in said base being in registry with the corresponding ports in said valve block housing, fluid tight sealing means disposed around said ports between the base and valve block housing, said valve block housing being removably secured to said base.

8. A hydraulic jack according to claim 7 further characterized in that said manually displaceable check valves are disposed in parallel side-by-side relation in said valve

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block housing, a rotatable bolt is disposed between said check valves, at least the head of said bolt being exterior of said housing, a transverse bar is secured to said bolt head for in-and-out movement with said bolt as the bolt is rotated, check valve release pins are provided on said bar, whereby movement of said pins on said bar unseats the valving elements of said check valves simultaneously.

9. A hydraulic jack according to claim 7 further characterized in that said plunger includes an axial channel extending from above the plunger head to below said head, a transverse channel above said head communicating with the axial channel, a check valve in said axial channel permitting one-way flow of fluid from the part of the cylinder above said head to the part of the cylinder below said head, a pin in said axial channel above the check valve extending into the transverse channel, and an actuating bar of smaller diameter in said transverse channel and extending beyond the ends thereof, said actuating bar resting upon the end of said pin.

References Cited in the file of this patent

UNITED STATES PATENTS

1,711,549	Stillman	May 7, 1929
2,211,479	Pomeroy	Aug. 13, 1940
2,352,390	Kirkland	June 27, 1944