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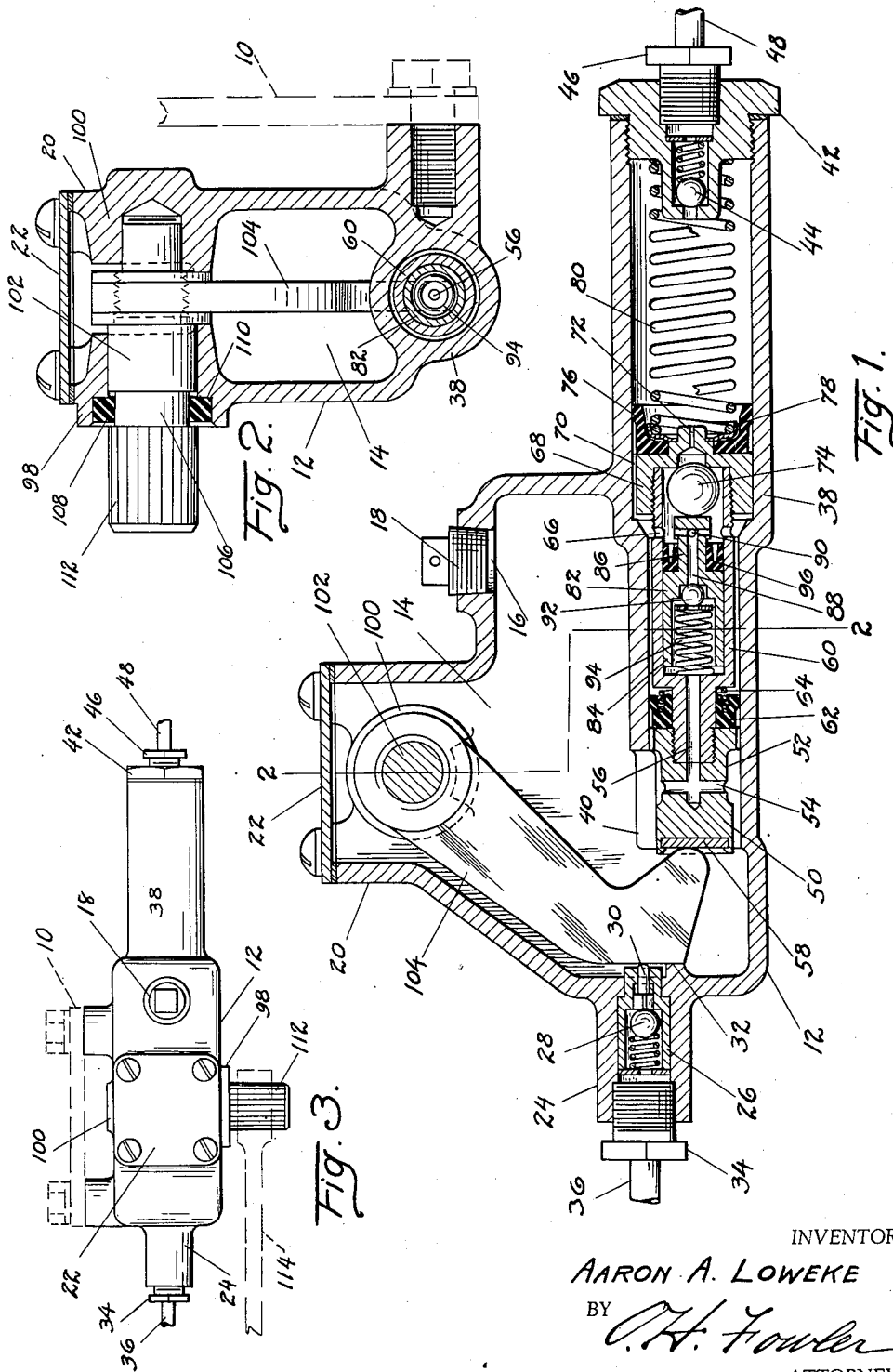
A. A. LOWEKE

2,081,056

COMPOUND CYLINDER

Filed May 27, 1933

2 Sheets-Sheet 1



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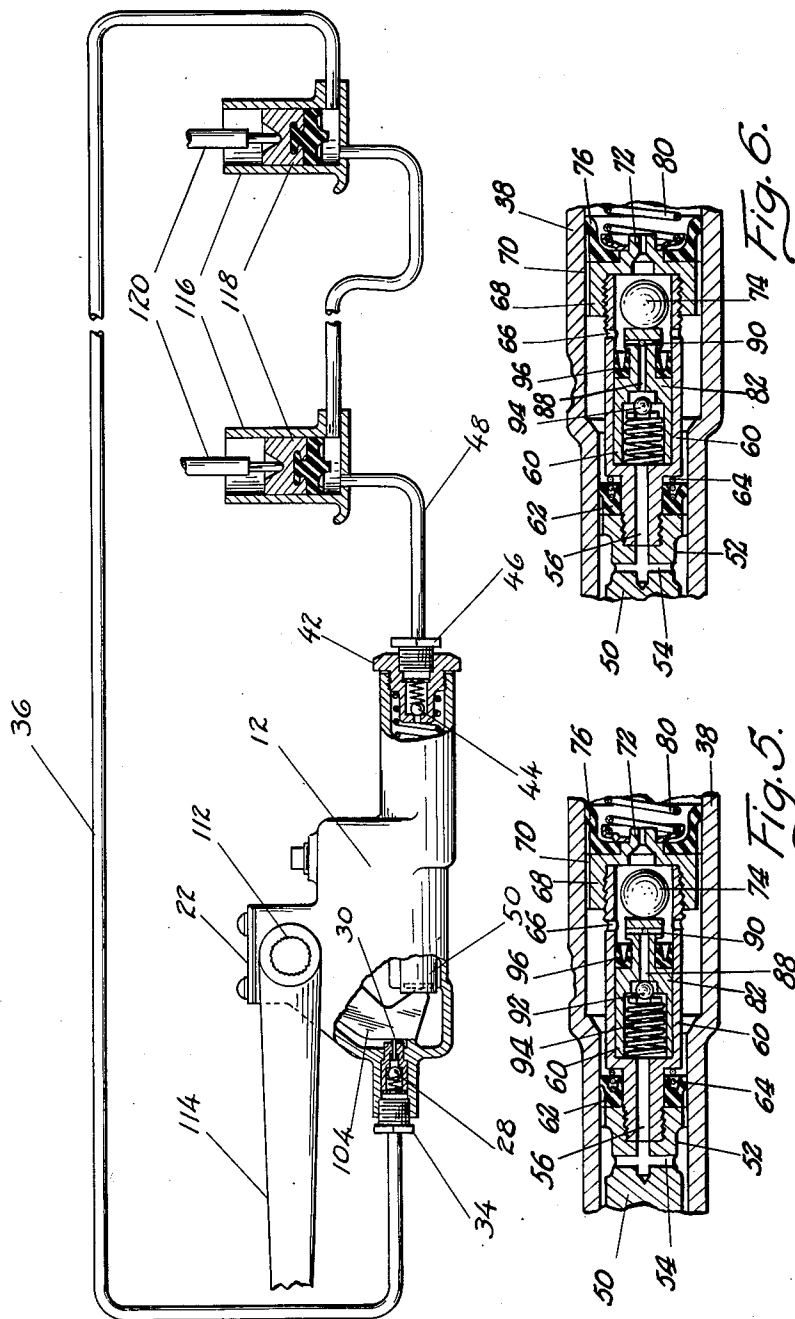
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2 Sheets-Sheet 2

Fig. 4.



UNITED STATES PATENT OFFICE

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COMPOUND CYLINDER

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10 Claims. (Cl. 60—54.6)

This invention relates to pressure devices.

Broadly the invention comprehends a compound cylinder and a piston therefor having two heads operable in sequence to build up pressure, and means between the piston heads automatically operable to transfer the load without loss from one piston head to the other piston head after a predetermined pressure has been obtained.

In the illustrated embodiment of the invention, a reservoir has formed in the bottom thereof a double diametral cylinder with that portion of the cylinder having the larger diameter extending from the reservoir and provided with a removable head. A compound piston is movable in the cylinder and may be readily extracted through the extended portion of the cylinder.

The piston has a plurality of heads of different diameters fitted into portions of the cylinder having corresponding diameters. Arranged between the piston heads are valves and control means therefor including a spring-pressed piston operable upon predetermined pressure to render the piston heads ineffective.

A control means is operable first upon a predetermined pressure to release a valve in the piston head having the larger diameter to render this head ineffective, and, secondly, upon a higher predetermined pressure to release a valve controlling a passage through the piston head having the smaller diameter to return the fluid to the reservoir.

An object of the invention is to provide a fluid pressure device which may be used for various purposes, and particularly where it is desired to build up high pressures.

Another object of the invention is to provide a fluid pressure device including a compound cylinder constructed to attain high pressure without an increase in the applied force.

A feature of the invention is a compound piston and means arranged therein operable upon predetermined pressures for rendering the piston ineffective.

With these and other objects in view which may be incident to the improvements, the invention consists in the parts and combination to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising the invention may be varied in construction, proportion and arrangement, without departing from the spirit and scope of the appended claims.

In order to make the invention more clearly understood, I have shown in the accompanying drawings means for carrying the same into prac-

tical effect without limiting the invention in its useful applications to the particular constructions which, for the purpose of explanation, have been made a subject of illustration.

In the drawings forming a part of this specification:—

Figure 1 is a sectional view of a compound cylinder embodying the invention.

Figure 2 is a sectional view substantially on line 2—2, Figure 1,

Figure 3 is a top plan view,

Figure 4 is a diagrammatical illustration of a fluid pressure operated system embodying the invention,

Figure 5 is a detail view of the piston illustrating the fluid pressure actuating valve mechanism in one position, and

Figure 6 is a detail view illustrating the valve mechanism in another position.

Referring to the drawings for more specific details of the invention, 10 represents a support having bolted or otherwise secured thereto a housing 12 including a reservoir 14 having a filling opening 16 fitted with a plug 18. The housing has an extended top portion 20 provided with an opening having a cover 22.

Formed integral with the housing and communicating with the reservoir 14 is a sleeve 24 having fitted therein a valve cage 26 containing a spring-pressed ball valve 28 controlling the passage or communication between the sleeve and the reservoir. As shown, the passage has therein a pin 30 fitted with sufficient clearance to permit free passage of fluid or liquid. The pin extends into the reservoir and is adapted to open the valve, movement of the pin in opening the valve being limited by a stop 32 for arresting the actuator, to be hereinafter described. The sleeve also has threaded therein a coupling 34 for connecting a return pipe 36.

The housing 12 has formed integral therewith in the bottom of the reservoir a cylinder 38 having a portion extending from the wall of the housing. The cylinder has a double diametral bore. The inner end of this cylinder is slotted as indicated at 40, and threaded in the outer end of the cylinder is a plug 42. As shown, the plug is axially bored for the reception of a spring-pressed valve 44 and a coupling 46 for the attachment of a pipe line 48.

Positioned for reciprocation in the cylinder is a compound piston including a small piston 50 fitted with small clearance in that portion of the cylinder having the smaller diameter. This piston has a circumferential groove 52 communi-

5 cating with the reservoir, a radial bore 54 communicating with the groove, and an axial bore 56 communicating with the radial bore and with the sleeve. The force supplying end of this piston has suitably secured therein a case-hardened insert 58 providing a suitable bearing surface for the actuator. The head of the piston has threaded axially therein a double diametral sleeve 60 and positioned on the head of the piston is a collapsible leak-proof cup 62 held in position by a spring 64 interposed between the cup and that portion of the sleeve having the larger diameter.

15 The sleeve 60 has a plurality of ports 66 providing communications between the sleeve and the cylinder and a piston head 68 on the sleeve is positioned for reciprocation in that portion of the cylinder having the larger diameter. This head is fitted in the cylinder with small clearance, or it may have channels 70 providing passageways for fluid or liquid. The head has an axial orifice 72 controlled as by a ball valve 74 and a collapsible leak-proof cup 76 and a disc 78 on the head are held against displacement by a spring 80 interposed between the disc 78 and the plug 42 in the outer end of the cylinder.

25 Positioned for reciprocation in the sleeve 60 is a piston 82 having a skirt 84 and a concentric portion 86 of smaller diameter than the piston and extending beyond the head of the piston. This extended portion controls the ball valve 74. As shown, the extended portion 86 has an axial bore 88 and a plurality of ports 90 providing a passage through the piston controlled by a ball valve 92 urged to close the bore 88 by a spring 94 which also urges the piston 82 to actuate the ball valve 74 to close the port 72. The head of the piston 82 has thereon a leak-proof cup 96 sleeved on the extended portion 86.

40 The extended top portion 20 of the housing has oppositely disposed bosses 98 and 100 bored for the reception of an operating shaft 102. The shaft has a double diameter and that portion of the shaft having the smaller diameter is threaded for the reception of a lever or actuator 104 arranged to actuate the piston and the valve 28. When in normal position the actuator retains the valve 28 in open position so that excess fluid may be returned to the reservoir. The shaft has a circumferential groove 106 in which is positioned a leak-proof washer 108 seated on an annular shoulder 110 in the boss 98. The shaft also has a knurled portion 112 to which may be secured an operating lever 114.

55 Assuming that the device is properly connected in a system and that the reservoir 14 and the cylinder 38 are filled with suitable liquid or fluid, by applying force to the operating shaft, the actuator 104 is moved from the stop 32 resulting in releasing the valve 28 whereupon the valve moves to closed position. This movement of the actuator applies force to the piston. During the initial movement of the piston, pressure is received on the piston head 68 movable in that portion of the cylinder having the larger diameter and fluid is drawn past the piston 50 and the collapsible leak-proof cup 62 into the cylinder forward of the piston 50, and upon attaining a predetermined pressure by this movement of the piston the ball 74 is urged by pressure from its seat to open the port 72. This relieves pressure on the cup 76 and equalizes the pressure on both sides of the piston head 68.

70 The pressure is then received by the cup 62 on the piston 50, also by the cup 96 on the piston

82 and by the ball valve 92. This transfer of the pressure is effected without losses. Upon further movement of the piston and attaining a second predetermined pressure, the ball valve 92 is opened by the pressure to permit the fluid to flow through the ports 90, the passages 88 and 56, the axial bore 54, the groove 52, and past the body of the piston 50 to the reservoir.

10 As the piston moves to its retracted position, the valve 44 closes and retains the fluid in the system under pressure. This pressure is released when the actuator is moved to trip the valve 28 so that excess fluid in the system may be returned to the reservoir. As the piston moves to its retracted position, the cups 62 and 76 collapse and fluid is drawn from the reservoir past the cups into the cylinder, thus filling the cylinder for subsequent discharge stroke.

20 A fluid pressure system including the compression cylinder is illustrated in Figure 4. In this installation the pipe line or conduit 48 controlled by the valve 44 has connected therein a plurality of motor cylinders 116. Each of the motor cylinders has a reciprocating piston 118 connected by a rod 120 to any suitable type of mechanism it may be desired to actuate. In this particular installation the bleed conduit 36 controlled by the valve 28 leads back from one of the motor cylinders 116 to the reservoir 14. In normal operation the valve 28 is closed so that fluid surges back and forth through the pipe line 48 between the compression cylinder and the motor cylinders. When the actuator is moved to its retracted position the valve 44 is closed, and the valve 28 is tripped so that excess fluid in the system may be returned to the reservoir.

40 Although this invention has been described in connection with certain specific embodiments, the principles involved are susceptible of numerous other applications that may readily occur to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

45 Having thus described the various features of the invention, what I claim as new and desire to secure by Letters Patent is:—

1. A fluid pressure device comprising means for producing pressure including spaced piston heads each having an orifice, a sleeve connecting the piston heads, and means in the sleeve for controlling the orifices operable at a predetermined pressure to open the orifices in one of the heads and at a greater pressure to open the orifices in the other head.

2. A fluid pressure device comprising means for producing pressure including spaced piston heads each having an orifice, a sleeve connecting the heads, a valve controlling the orifice in one of the heads, a piston movable in the sleeve controlling the valve, said piston having a passage, a valve controlling the passage, and means in the sleeve urging the valves to close the orifice and the passage.

3. A fluid pressure device comprising a double diametral cylinder, a piston movable therein having spaced heads each provided with an orifice, one movable in that portion of the cylinder having the smaller diameter and the other movable in that portion of the cylinder having the larger diameter, a sleeve connecting the head and communicating with the orifices and pressure actuated means in the sleeve for controlling the orifices operable at a prede-

terminated pressure to open one of the orifices and at a greater pressure to open the other orifice.

4. A fluid pressure device comprising a piston having an orifice, a sleeve on the piston communicating with the orifice, a piston head on the sleeve having an orifice communicating with the sleeve, valves in the sleeve for controlling the orifices, and means urging the valves to closed position and yieldable at a predetermined pressure to permit the valves to open successively.

5. A fluid pressure device comprising a piston having an axial orifice, a double diametral sleeve supported concentrically on the head of the piston, a head on the sleeve having an orifice, a valve controlling the orifice in the second-mentioned head, a piston movable in the sleeve having a passage, a valve controlling the passage, and a tension member in the sleeve urging the valves to close the orifice and the passage.

6. A fluid pressure device comprising a piston having an orifice, a double diametral sleeve in the head of the piston communicating with the orifice, a cup on the head of the piston, a head secured to the sleeve having an orifice communicating with the sleeve, a cup on the head secured to the sleeve, a valve controlling the orifice in the head secured to the sleeve, an orificed piston movable in the sleeve engaging the valve, a valve in the piston in the sleeve controlling the orifice in the piston, and a tension member urging both valves to closed position and yieldable at predetermined pressures to permit the valves to open successively.

7. A fluid pressure device comprising a reservoir having a double diametral cylinder formed integral therewith, that portion of the cylinder having the smaller diameter extending into the reservoir and that portion having the larger diameter extending from the wall of the reservoir, a piston movable in the cylinder having heads corresponding respectively to the different diameters of the cylinder, the piston being removable through that portion of the cylinder having the larger diameter.

8. A pressure device comprising a piston, a double diametral sleeve threaded in the head thereof, a cup on the head of the piston, and a spring between the cup and that portion of the sleeve having the larger diameter.

9. A pressure device comprising a double diametral cylinder, a head on one end thereof, a piston movable in the cylinder, a double diametral sleeve on the head of the piston, a cup on the head of the piston, a spring between the cup and that portion of the sleeve having the larger diameter, a head secured to the sleeve, a cup on the head secured to the sleeve, and a spring between the head on the sleeve and the head of the piston.

10. A pressure device comprising spaced piston heads each having an orifice, a sleeve arranged concentrically to and connecting the heads, a piston movable in the sleeve having an opening in its head, a valve controlling one of the orifices, a valve controlling the opening, and means urging the valves toward their seats.

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