Aug. 6, 1940. P. N. OBERHOLTZER 2,210,427

HYDRAULIC CONTROL MECHANISM

Filed Dec. 7, 1938 2 Sheets-Sheet 1

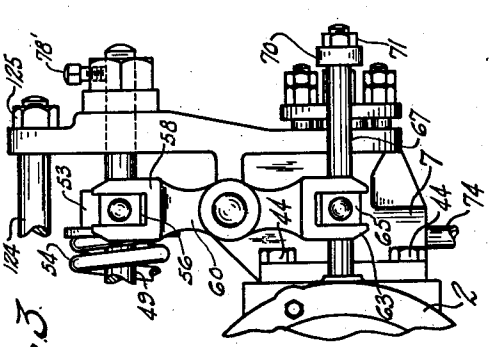


Fig. 3.

Fig. 1.

Inventor
Paul N. Oberholtzer
By Carl K. Libbe
Attorney

Aug. 6, 1940. P. N. OBERHOLTZER 2,210,427

HYDRAULIC CONTROL MECHANISM

Filed Dec. 7, 1938 2 Sheets-Sheet 2

Fig. 2

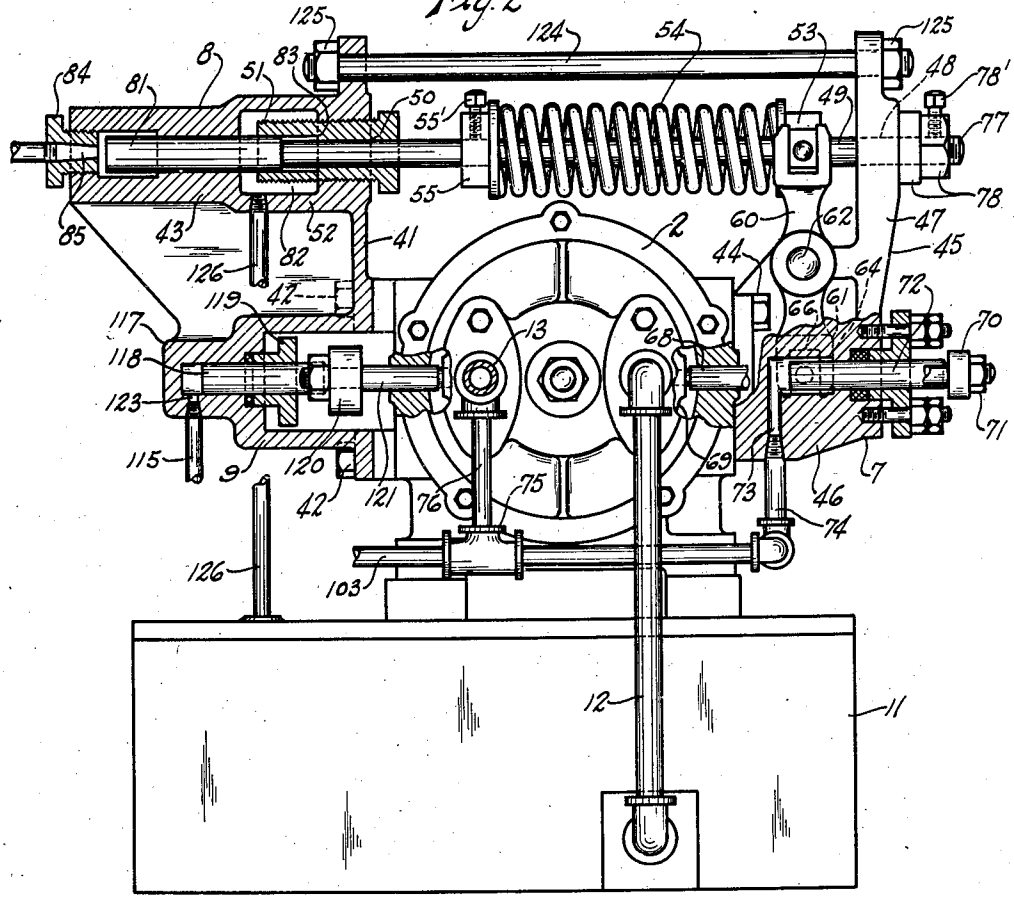


Fig. 4

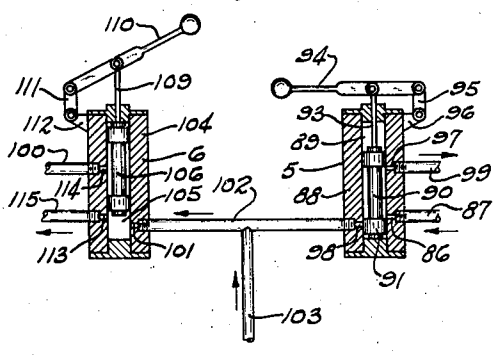
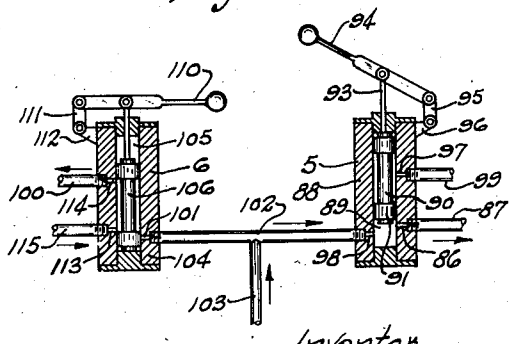


Fig. 5



Inventor
Paul N. Oberholtzer
By Carl W. Libbe
Attorney

Patented Aug. 6, 1940 2,210,427

UNITED STATES PATENT OFFICE

2,210,427

HYDRAULIC CONTROL MECHANISM

Paul N. Oberholtzer, Philadelphia, Pa., assignor to American Engineering Company, Philadelphia, Pa., a corporation of Pennsylvania

Application December 7, 1938, Serial No. 244,343

3 Claims. (Cl. 103—38)

This invention relates to hydraulic control devices, and more particularly to devices for controlling the pressures developed by pumps.

One object of the present invention is to provide in a fluid system including a variable stroke pump, control means which enables operation of the pump at any one of a number of predetermined pressures.

A further object is to provide in a fluid system of the stated character adjustable means for conditioning a pump for operation at any one of a wide range of pressures, and additional means operable upon said pump whereby the pressures developed thereby may be changed at will and maintained constant for any desired period of time.

Other and further objects will become apparent as the description of the invention progresses.

Of the drawings:

Fig. 1 is a general assembly view, diagrammatic in part, of the fluid control device comprising the present invention, several of the elements thereof being shown in section.

Fig. 2 is a side elevational view partly in section of the pump and the control means therefor, certain of the parts being broken away to show certain of the elements thereof,

Fig. 3 is a fragmentary view of one end of the pump, and certain of the control elements associated therewith; and

Figs. 4 and 5 are sectional views of the control valves shown in different positions of adjustment.

Referring to the drawings, the numeral 1 designates generally the fluid system, which in the present instance comprises a pump 2, a hydraulic press 3, press control valve 4, pump control valves 5 and 6, and fluid motors 7, 8 and 9.

Pump 2 may be of the radial piston type shown and described in Patent No. 1,077,979, and may be operated by an electric motor 10, or by any other suitable power means. Pump 2 and motor 10 are suitably mounted upon a supply tank 11, from which fluid is drawn into the pump 2 through a pipe 12. The fluid so drawn into pump 2 is discharged therefrom through a pipe 13. Pipe 13 is connected at one end thereof to the inlet port 14 of press control valve 4. Valve 4 comprises a casing 15, having a cylindrical chamber 16 provided therein, which at all times is in communication with inlet port 14. Chamber 16 also communicates with a pair of spaced ports 17 and 18 to which are respectively connected one end of a pair of pipes 19 and 20. The other ends of pipes 19 and 20 are connected to the lower and upper ends respectively, of the cylinder 21 of a fluid motor 22 secured in any suitable manner to the frame 23 of hydraulic press 3. The opposite ends of chamber 16 are connected by a passage 24 provided in casing 15, which in turn communicates with a discharge port 25. Discharge port 25 is connected to supply tank 11 by means of a pipe 26. Operating in chamber 16 of valve 4 is a valve element 27 comprising a pair of spaced, interconnected valve heads 28 and 29. A valve stem 30 is connected to valve head 29 and extends through the lower end of casing 15. The free end of valve stem 30 is pivotally connected to a lever 31 intermediate the ends of the latter. Lever 31 is pivoted at one end thereof to the lower end of a link 32, the other end of said link being pivotally mounted on an ear 33, secured to and extending laterally from the lower end of casing 15. When lever 31 is in the full line position shown in Fig. 1, the fluid from pump 2 flows to the lower end of cylinder 21 through pipe 13, port 14 of valve 4, chamber 16, port 17 and pipe 19. The piston 34 operating in cylinder 21 is therefore moved upwardly. The fluid at the upper end of cylinder 21 now discharges to exhaust through pipe 20, port 18, the lower end of chamber 16, passage 24, and pipe 26. When lever 30 is moved to the dotted line position shown in Fig. 1, the fluid entering chamber 16 of valve 4 flows through port 18 and is conducted to the upper end of cylinder 21 by pipe 20, thereby causing the piston 34 to descend. The fluid at the lower end of cylinder 21 now flows to supply tank 11 through pipe 19, port 17, the upper end of chamber 16, passage 24 and pipe 26. Piston 34 has secured thereto a piston rod 35, to the upper end of which is secured a platen 36. Consequently when piston 34 is moved upwardly platen 36 is actuated toward the work which may be attached to the head 37 of press 3. The head 37, as shown in Fig. 1, is secured to the upper end of the frame 23 and extends laterally therefrom.

The present invention contemplates control means which enables operation of the device at any one of a number of pressures. The means for accomplishing these results will now be described in detail.

Referring more particularly to Fig. 2, it will be observed that a bracket 41 is secured to the left hand side of pump 2 by any suitable means, such as by bolts 42. The upper end of bracket 41 has provided therein the cylinder 43 of fluid motor 8. Secured to the opposite side of pump 2 by bolts 44 is a second bracket 45. The lower

end of this bracket has formed therein the cylinder 46 of the fluid motor 7. The vertical extension 47 of bracket 45 has provided therein a horizontally disposed aperture 48 through which extends a rod 49. The left hand end of rod 49 extends through the central bore 50 of a nut 51 which makes threaded engagement with the enlarged portion 52 of cylinder 43. Rod 49 has slidably mounted thereon a crosshead 53 against which one end of a coil spring 54 abuts. Spaced from crosshead 53 and secured to rod 49 by any suitable means, such as a screw 55', is an adjustable spring seat 55 against which the other end of spring 54 abuts. Crosshead 53 has provided at the opposite ends thereof a pair of rectangular guide blocks 56 and 57, which respectively receive the upper bifurcated ends 58 and 59 of a pair of levers 60 and 61. Levers 60 and 61 are pivoted intermediate their ends on a rod 62, mounted in any suitable manner in bracket 45. The lower bifurcated ends 63 and 64 of lever 60 and 61 engage a pair of substantially rectangular bearing blocks 65 and 66 pivotally mounted on guide rods 67 and 68, respectively. The left hand ends of guide rods 67 and 68 are secured to the sliding blocks 69 of pump 2, while the right hand ends thereof are secured in any suitable manner to a crosshead 70, such as by nuts 71, engaging the outer threaded ends of said guide rods. Cylinder 46 of fluid motor 7 has operating therein a piston 72, the right hand end (Fig. 2) of which engages the inner side of crosshead 70, at a point substantially midway between guide rods 67 and 68. The left hand end of cylinder 46 communicates with a substantially vertical port 73 provided in the lower end of bracket 45, and to which one end of a pipe 74 is connected. The other end of pipe 74 is connected to pipe 13 by means of a T coupling 75, and a short pipe 76.

The portion of rod 49 extending beyond the right hand side of bracket 45 is provided with screw threads 77, for receiving a pair of correspondingly threaded nuts 78. It therefore is apparent that to adjust the tension of spring 54 it is only necessary to adjust the nuts 78, which causes an axial movement of rod 49. After proper adjustment of spring 54, the nuts 78 may be held against accidental movement by a set screw 78', or by any other suitable means. If the nuts 78 are so adjusted as to cause rod 49 to move to the right, spring seat 55 will tend to compress spring 54. The pressure thus created in spring 54 tends to slide crosshead 53 to the right, which in turn swings levers 60 and 61 in a clockwise direction about their pivot 62. This action of levers 60 and 61 causes the sliding blocks 69 of pump 2 to move to the left by virtue of the connection thereof with guide rods 67 and 68.

The sliding blocks 69 of pump 2 will remain in adjusted position until the pressure imposed upon the left hand end of piston 72 exceeds the pressure of spring 54. When this occurs piston 72 will move to the right, thereby actuating crosshead 70, guide rods 67 and 68, and consequently the sliding blocks 69 to leakage stroke position.

The cylinder 43 of fluid motor 8 also has operating therein a piston 81. The right hand end of piston 81 extends into the enlarged bore 82 at the left hand end (Fig. 2), of nut 51, and is adapted to engage the left hand end of rod 49. It will be noted that the diameter of piston 81 is greater than that of rod 49, and that the movement of piston 81 to the right is limited by the annular shoulder 83 at the right hand end of bore 82. It therefore is seen that when piston 81 is subjected to pressure it tends to move to the right, thereby compressing spring 54. By adjusting nut 51 the extent of movement of piston 81, and consequently the degree of compression of spring 54, may be varied. Motor 8 is also connected to the pressure side of pump 2, by means of a series of connections which will now be described in detail.

Cylinder 43 of motor 8 has secured to the left hand end thereof a plug 84 having a central port 85 provided therein. The outer end of port 25 is connected to the port 86 of valve 5 by a pipe 87.

Valve 5 is provided to control the operation of fluid motor 8, and comprises a casing 88 having a cylindrical chamber 89 provided centrally thereof. Operating in chamber 89 is a valve element 90 comprising a pair of spaced interconnected valve heads 91 and 92. A stem 93 is connected to valve element 90, and extends through an aperture provided in the end wall of casing 88. The free end of valve stem 93 is pivotally connected to a lever 94 intermediate the ends of the latter. Lever 94 is pivotally connected to the upper end of a link 95, pivoted at the lower end thereof to a laterally extending ear 96 secured to casing 88. The casing 88 of valve 5 has also provided therein ports 97 and 98, the former of which has connected thereto one end of a pipe 99, the other end of which being connected to a pipe 100, which in turn is connected to makeup tank 11. Port 98 is connected to a port 101 of valve 6, by means of a pipe 102, the pipe 102 being connected intermediate the ends thereof to a branch pipe 103, which in turn is connected to the pressure pipe 13 leading from pump 2.

Valve 6 is provided to control the operation of fluid motor 9 and is similar in construction to valve 5, it also comprising a casing 104 having a cylindrical chamber 105 provided centrally thereof. Operating in chamber 105 is a valve element 106 comprising a pair of spaced valve heads 107 and 108. A stem 109 is connected to valve element 105 and extends through an aperture provided at the upper end of casing 104 and is pivotally attached to a lever 110 intemediate the ends thereof. The left hand end of lever 110 is pivoted to the upper end of a link 111 pivoted at the lower end thereof to a laterally extending ear 112 secured to casing 104. Valve casing 104 has also provided therein ports 113 and 114, the former of which is connected to the port 123 (Fig. 2) of motor 9 by a pipe 115, while the latter is connected to pipe 100.

Referring to Fig. 2, it will be observed that the motor 9 comprises a cylinder 117 formed at the lower end of bracket 41, in which operates a piston 118. The right hand end (Fig. 2) of piston 118 extends through a gland 119 and engages a crosshead 120 intermediate the ends of the latter. Crosshead 120 has secured to the opposite ends thereof a pair of guide rods 121 which extend through suitable apertures provided in the left hand side of the casing of pump 2 and are secured in any suitable manner to sliding blocks 69 of said pump.

To prevent movement of brackets 41 and 46 away from each other under the higher pressure conditions of the system, a tie rod 124 is provided. This tie rod extends through apertures provided in the upper ends of brackets 41 and 45 and is secured thereto by nuts 125, as shown in Figs. 1 and 2. It will also be observed that any leakage of fluid past piston 81 of motor 8 drains to supply tank 11 through a pipe 126.

From the foregoing description it is thought that the operation of my improved hydraulic control device is apparent. However, to correlate the elements thereof a brief résumé of the operation of the apparatus as a whole will now be given.

Fig. 1 shows the parts in normal position, wherein the piston 34 and platen 36 are in their lower position of adjustment.

Nuts 78 are now adjusted to compress spring 54 to condition the pump for operation at the desired predetermined initial pressure. This causes actuation of levers 60 and 61 in a clockwise direction, which in turn, through their connection with rods 67 and 68, actuate sliding blocks 69 of the pump to on-stroke position. By actuation of pump 2 by motor 10 fluid from makeup tank 11 will be drawn into pump 2 through pipe 12, and be discharged therefrom through pipe 13. Fluid discharging through pipe 13 now enters the central chamber 16 of valve 4 through port 14, and then flows through port 17 and pipe 19 to the lower end of cylinder 21 of motor 22 causing the piston 34, and consequently plate 36, to move

inder 117 of motor 9. Now, as the pressure in the system builds up due to the engagement of the work by platen 36, pistons 118 and 72 of motors 9 and 7 respectively, will move in unison to the right to actuate the sliding blocks 69 of pump 2 to leakage stroke position. If pistons 118 and 72 have the same cross-sectional area it will be seen that the pressure required to retain pump 2 on leakage stroke position will be one-half of that required to retain it in said position should motor 7 be operating alone.

It therefore is seen that the pressure exerted upon the work may be substantially reduced by simply actuating valve 6. Under some conditions it may be desirable to operate the pump at a higher pressure during the working stroke of piston 34, but to reduce the pressure when the platen reaches its normal position of adjustment, and thereby decrease the load on the parts during waiting periods. Under such conditions lever 110 of valve 6 remains in its lower positions, as shown in Fig. 1, when valve 4 is adjusted, as shown in Fig. 1. However, when

continued operation of the pump piston 81 further compresses the spring, thereby causing the pump to actuate at a still higher pressure. Such a control is highly desirable where the materials to be compressed are of such a nature that it is desirable to first maintain one pressure thereon, and to thereafter increase the pressure to a higher value and to retain that pressure on the work for a predetermined period of time.

When the operation has been completed, the operator simply moves lever 31 to the dotted line position shown in Fig. 1, thereby causing a reversal of the flow of fluid to cylinder 21, whereupon piston 34 again moves downwardly. Lever 94 is now moved to its lower position of adjustment, as shown in Fig. 1, and if desired lever 110 may be moved upwardly, as shown in Fig. 4, so that when piston 34 reaches its lowermost position of adjustment the load imposed upon pump 2 and motor 10 will be reduced to a minimum.

From the foregoing description it is apparent that a simplified, as well as highly efficient control device has been provided. The various adjustable features associated with the device enable operation thereof through a wide range of pressures. The device therefore may be employed for various uses wherein such variable pressures are desired.

While the embodiment herein shown and described is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to limit the invention thereto, since it may be embodied in other forms, all coming within the scope of the claims which follow.

What is claimed is:

1. In a fluid system, the combination of a variable stroke pump, control means for said pump including adjustable resilient means for placing said pump on stroke, fluid pressure means operatively connected to the pressure side of said pump and operating in opposition to said resilient means for actuating said pump toward neutral position, additional fluid pressure means operatively connected to the pressure side of said pump and adapted to operate in unison with said first mentioned fluid pressure means, a valve for connecting or disconnecting said second fluid pressure means from the pressure side of said pump, and power means operable upon said resilient means for changing the initial adjustment thereof.

2. In a fluid system, the combination of a variable stroke pump, means including an adjustable spring for placing said pump on stroke, a fluid motor connected to the pressure side of said pump and operating in opposition to said spring, whereby when the pressure developed by said pump exceeds the compression of said spring said fluid motor actuates said pump towards leakage stroke position, a second fluid motor operable upon said spring to further compress the same, whereby said pump remains on stroke at a higher predetermined pressure, means for predetermining the extent of movement of said second fluid motor, and means for decreasing the pressure developed by said pump, said last mentioned means comprising a third fluid motor adapted to operate in unison with said first mentioned fluid motor.

3. In a fluid system, the combination of a variable stroke pump, a valve for controlling the operation of said motor, means including an adjustable spring for placing said pump on stroke, fluid motor means acting in opposition to said spring and adapted to actuate said pump to leakage stroke position when the pressure developed by said pump exceeds the pressure of said spring, a second fluid motor means adapted to operate in unison with said first mentioned motor means, thereby enabling operation of said pump at a lower pressure, a valve for controlling the operation of said second fluid motor means, a third fluid motor means, said last mentioned motor means being adapted to actuate said spring to different positions of adjustment, means for predetermining the adjustment of said spring by said third fluid motor means, and valve means for controlling the operation of said third fluid motor means.

PAUL N. OBERHOLTZER.