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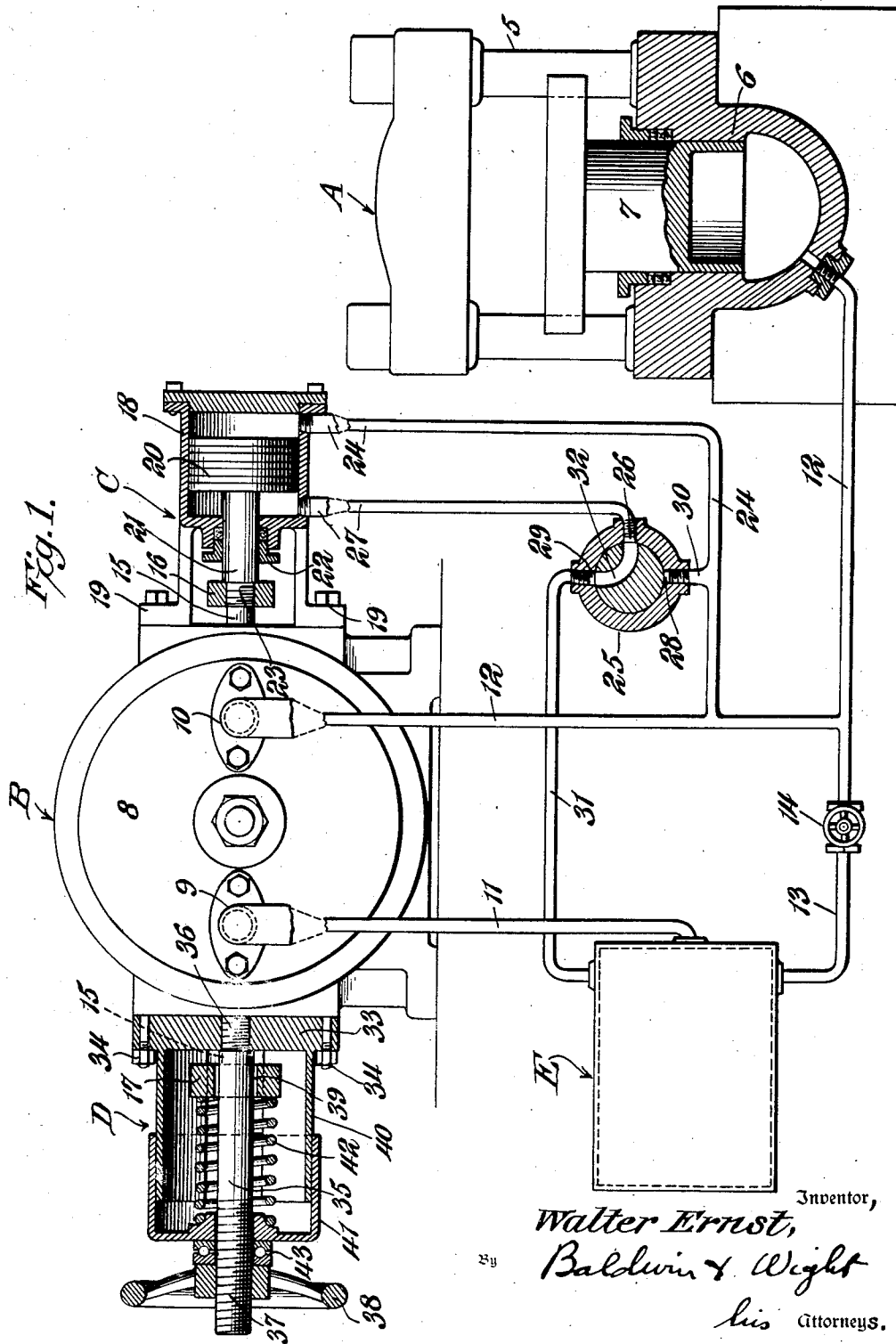
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PLURAL PRESSURE PUMP CONTROL FOR HYDRAULIC PRESSES

Filed July 14, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

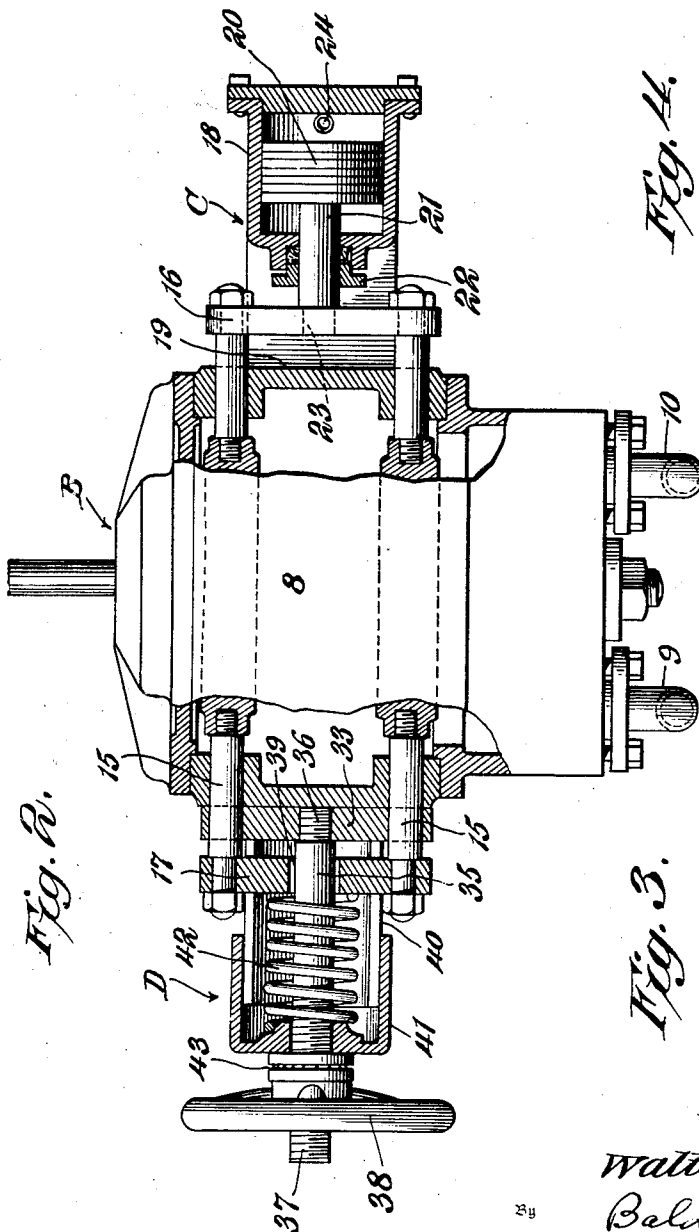
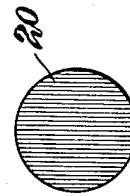
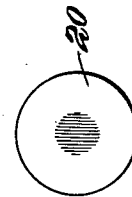


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE

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PLURAL PRESSURE PUMP CONTROL FOR HYDRAULIC PRESSES

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This invention relates generally to hydraulic presses of the type wherein is provided a travelling ram and a pump capable of having its output varied and which supplies the pressure fluid utilized for imparting travel to the press ram, and the invention primarily has for an object to provide novel means for so controlling the output of the pump as to subject the press ram, at any given interval, to a selected one of a plurality of selective, predetermined and fixed operating pressures.

Another object of the invention is to provide means by the employment of which it is possible to vary the pressure values of the selective, predetermined and fixed operating pressures. This inventive feature also provides for adjustment of the pressure values without disturbing the relation which the selective operating pressures bear one to another.

My present invention is adaptable to use in connection with various types of variable output pumps and in this disclosure I have chosen to illustrate my improved control devices in combination with a form of this type of pump which is well known in the art. Pumps of this type are exemplified by the pump disclosed in United States Letters Patent 1,250,170, granted to Hele-Shaw et al., December 18, 1917. Briefly stated, such pumps include a plurality of radially arranged cylinders and pistons, the rate of discharge effected by which depends upon the eccentricity of the cylinder and piston assembly relatively to a drive shaft. The cylinders are usually carried by a floating ring or the like, which, by means of a cross head or other control element, may be shifted to vary the eccentricity of the cylinders and thereby effect control of the pump output.

In its more detailed nature the invention resides in the provision of means tending to hold the pump control element or cross head at the maximum output effecting position,

means responsive to operating pressure being applied to the press ram and effective upon attainment of one or another of a plurality of selective, fixed and predetermined operating pressures to resist the holding tendency and cooperate with the holding means in maintaining the selected operating pressure, and means to select the operating pressure desired to be maintained.

Another object of the invention is to provide means to vary the holding tendency of the holding means so as to vary the values of the selective operating pressures without varying the relation which the individual operating pressures bear one to another.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends, the invention still further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description, then be particularly pointed out in the appended claim, reference being had to the accompanying drawings, in which:—

Figure 1 is a somewhat diagrammatic side elevation illustrating a hydraulic press embodying my invention, the press cylinder and the control devices associated with the pump being shown in section.

Figure 2 is a plan view of the pump, the attached control devices being shown in horizontal section.

Figures 3 and 4 are diagrammatic face views of the pressure face of the control piston and respectively illustrate, by shaded areas, the areas effective during low and high pressure operation adjustments.

In the drawings, in which like reference characters indicate like parts in all of the figures, A generally designates the hydraulic press which in this particular disclosure is of the fluid pressure propelled gravity return type; B generally designates the variable

output pump by which the pressure fluid utilized in the operation of the press is delivered; C generally designates the pressure responsive plural pressure control mechanism; D, the plural pressure control adjustment mechanism and E the fluid tank which forms a part of the closed hydraulic circuit which includes the operating pump.

The press A includes the usual frame 5, a pressure cylinder 6, and the travelling ram 7 which is of the pressure projected gravity return type as above outlined.

The pump B includes the housing 8, and inlet and outlet ports designated 9 and 10 respectively. The inlet port 9 is connected by a suction pipe line 11 with the tank E, and the outlet port 10 is connected by a pressure pipe 12 with the cylinder 6 beneath the ram 7. A return line 13 provides communication between the cylinder 6 and the tank E, and a cut-off valve 14 is provided in the line 13 for a purpose that will become apparent as the description progresses.

The pump B in this particular disclosure is of the Hele-Shaw type disclosed in United States Letters Patent 1,250,170 hereinbefore referred to, and includes the usual shiftable control rods or elements 15. The rods project in the usual manner at opposite sides of the pump, those projecting at the right-hand side being connected by a cross-head 16 and those at the left-hand side being connected by a cross-head 17. As will be evident by reference to Figure 2, the shiftable control elements comprising the cross-heads 16 and 17 and the control rods 15 are connected to the pump rings so that when these devices are shifted to the right they will serve to bring about the maximum output of which the pump is capable and when shifted to the left the output of the pump will be accordingly diminished in a manner well understood in the art.

The control mechanism C includes the pressure cylinder 15 which is secured as at 19 to the right-hand side of the pump housing and the piston plunger 20 is operable in the cylinder 18, being mounted upon a reduced diameter stem 21 which projects through a suitable packing gland 22 and is attached as at 23 to the cross-head 16. By reason of the provision of the stem at one side only of the piston plunger this plunger is provided with a large area pressure face at its right-hand side and with a smaller area pressure face at its left-hand side. The purpose for this multi-area or differential area pressure face provision will become apparent as the description progresses.

A three-way pressure selection valve 25 is provided, the casing of which is equipped with a common port 26 which is connected by a duct 27 with the left-hand end of the cylinder 18 for communication with the smaller area pressure face of the piston plunger, and

the casing of this valve is also provided with selective ports 28 and 29, the former of which is connected by a pipe line or duct 30 with the pressure pipe line 24, and the latter of which is connected by a duct or pipe line 31 with the tank E. The rotatable core of the valve is provided with an elbow duct 32, and, by rotation of this core, it is possible to bring about communication between the common port 26 and a selected one of the selective ports 28 and 29 in a well-known manner.

Thus it will be seen that, when the valve is positioned as illustrated in Figure 1, it will serve to open communication between the left-hand end of the cylinder 18 and the tank E through the pipe line or duct 27, the port 26, the duct 32, the port 29, and the duct or pipe line 31. In this adjustment of the valve, and at all times, the right-hand end of the cylinder 18 is in communication with the pressure pipe line 12 through the pipe line or duct 24. When the valve core is turned so that the duct 32 connects the ports 26 and 28, both sides or pressure faces of the piston plunger 20 will be subjected to the pressure in the pipe line 12, in one instance directly through the pipe line connection 24 and in the other instance through a portion of the pipe line 24, the duct 30, port 28, duct 32, port 26 and pipe line or duct 27.

The pressure control adjustment mechanism D includes a bracket 33 which is secured as at 34 to the left-hand side of the pump housing and a rod 35, which is secured at one end as at 36 to the bracket 33, has its free end projected from the bracket and threaded as at 37 to receive the adjuster hand-wheel 38. The cross-head 17 is apertured as at 39 to receive the rod 35 and permit movement of the cross-head relatively to this stationary rod.

An open-ended casing flange 40 projects from the bracket 33 and a cup-like casing end or cap 41 is telescopically mounted on the extended end thereof and forms an end abutment for the compression spring 42 which is coiled about the rod 35 between the end cap 41 and the cross-head 17.

An anti-friction thrust bearing 43 equipment is interposed between the hand wheel 38 and the end cap 41 so that the hand wheel may be rotated without imparting rotation to the end cap. By rotating the hand wheel 38 in one direction or another on the threaded end of the rod 35, it is possible to suitably increase or diminish the compression of the spring 42 and thus increase or diminish the tendency of this spring to force the shiftable pump output controlling devices 17, 16, 15 toward the maximum output effecting position.

In operation the compression of the spring 42 is adjusted to impose a predetermined load on the cross-head 17 tending to shift this cross-head and the remaining output control elements 16, 15 toward the right and thereby

bring about a maximum output condition of the pump. As hereinbefore stated the spring 42 constantly tends to force the control devices to or hold the control devices at a position for bringing about a maximum output of the pump, and this forcing or holding tendency of the spring 42 may be adjusted at will.

In the operation of the press it is desired to maintain a constant predetermined operating pressure. At times it is desirable to operate the press at a predetermined high pressure and at other times at a predetermined low pressure. In this disclosure, I have illustrated means for maintaining the desired high or low operating pressure determined by the particular setting of the pressure selection valve 25.

When the valve 25 is in one position and a high pressure value is caused to act in opposition to the spring 42 which overcomes the tendency of that spring to move the pump control devices to the maximum discharge effecting position when a relatively low operating pressure has been built up in the press cylinder 6, and when the valve is shifted to its other position, a relatively low pressure value will be presented in opposition to the spring 42 so that the effect of this spring will be overcome only after attainment of a relatively high operating pressure in the press cylinder 6.

Thus, it is possible to operate the press at one or another of a plurality of selective, fixed, and predetermined operating pressures, which may be selected by manipulation of the valve 25. It should also be understood that, by adjusting the compression of the spring 42, it is possible to vary the selective operating pressure values without disturbing or varying the relation which the selective operating pressures bear one to another.

With parts adjusted as illustrated in Figure 1, the fluid discharged by the pump through the pressure line 12 will enter the cylinder 6 and force the ram 7 upwardly. The spring 42 will force the pump output control devices toward the maximum output position until the predetermined low operating pressure desired has been attained in the cylinder 6 and pipe line 12, when this pressure will act through the pipe line or duct 24 against the large area pressure face of the piston plunger 20, resisting the effort of the spring 42 and, if necessary, forcing the control devices 16, 15, 17 toward the left in order to reduce the output of the pump and thus maintain operation of the press at the desired operating pressure. With the parts thus set for press operation at low pressure, the whole area at the right-hand face of the piston plunger 20 is effective in resisting the function of the spring 42 (see shade lines in Figure 3) in view of the fact that the

opposite end of the cylinder 18 is opened to free communication with the tank E through connections 27, 26, 32, 29, and 31.

When the valve is shifted so that the duct 32 connects the ports 26 and 28 the control devices are set for press operation at a fixed and predetermined high pressure. In this setting of the valve, both faces of the piston plunger 20 are subjected to the pressure in the press cylinder and pipe line 12 with the net result that the small area indicated by shade lines in Figure 4 alone reacts against the action of the spring and cooperates therewith in holding the pump output at the selected fixed and predetermined high operating pressure.

As previously described, the press disclosed herein is of the type wherein the platen is pressure-projected and gravity-returned. During the working stroke of the press ram the valve 14 is, of course, closed, and on the return stroke, as the ram is descending by gravity, this valve is opened to permit the pressure fluid to return to the tank E through the return line 13.

From the foregoing description, taken in connection with the accompanying drawings, it is thought the novel details of construction, the manner of use, and the advantages of my invention will be readily apparent to those skilled in the art to which it relates.

I claim:

A control mechanism to actuate a ram or the like, in combination with a variable output pump having a housing, control means therein provided with shiftable control rods at diametrically opposite sides slidable through and projecting beyond the housing, spring mechanism exteriorly of the pump having a cross head connected to the control rod at one side of the housing, a plural pressure control mechanism including a cylinder member, a pair of spaced apart supporting members extending from the cylinder member and attached to the said housing and offsetting the cylinder member therefrom, a piston operable in the cylinder member having a stem extending through the end of the cylinder member facing the pump and provided with a cross head located between said supporting members and attached to the other control rod, the said mechanisms by their location substantially symmetrically on opposite sides of the pump serving to balance the entire structure, said cylinder being located in a closed hydraulic circuit comprising a fluid tank, a suction pipe line extending from said tank and attachable to the inlet of the pump, a pressure pipe line attachable to the outlet of the pump and to the ram and communicating with the cylinder on the larger area side of the piston, a valved return line from the pressure pipe line to the tank, a three way

valve member, a casing for the valve member having three ports controlled by the valve, said pressure pipe line being connected to one of said ports, a pipe communicating with another of said ports and with said tank, and a duct leading from the other port to the cylinder at the smaller area side of the piston.

In testimony whereof, I have hereunto
10 subscribed my name.

WALTER ERNST.

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