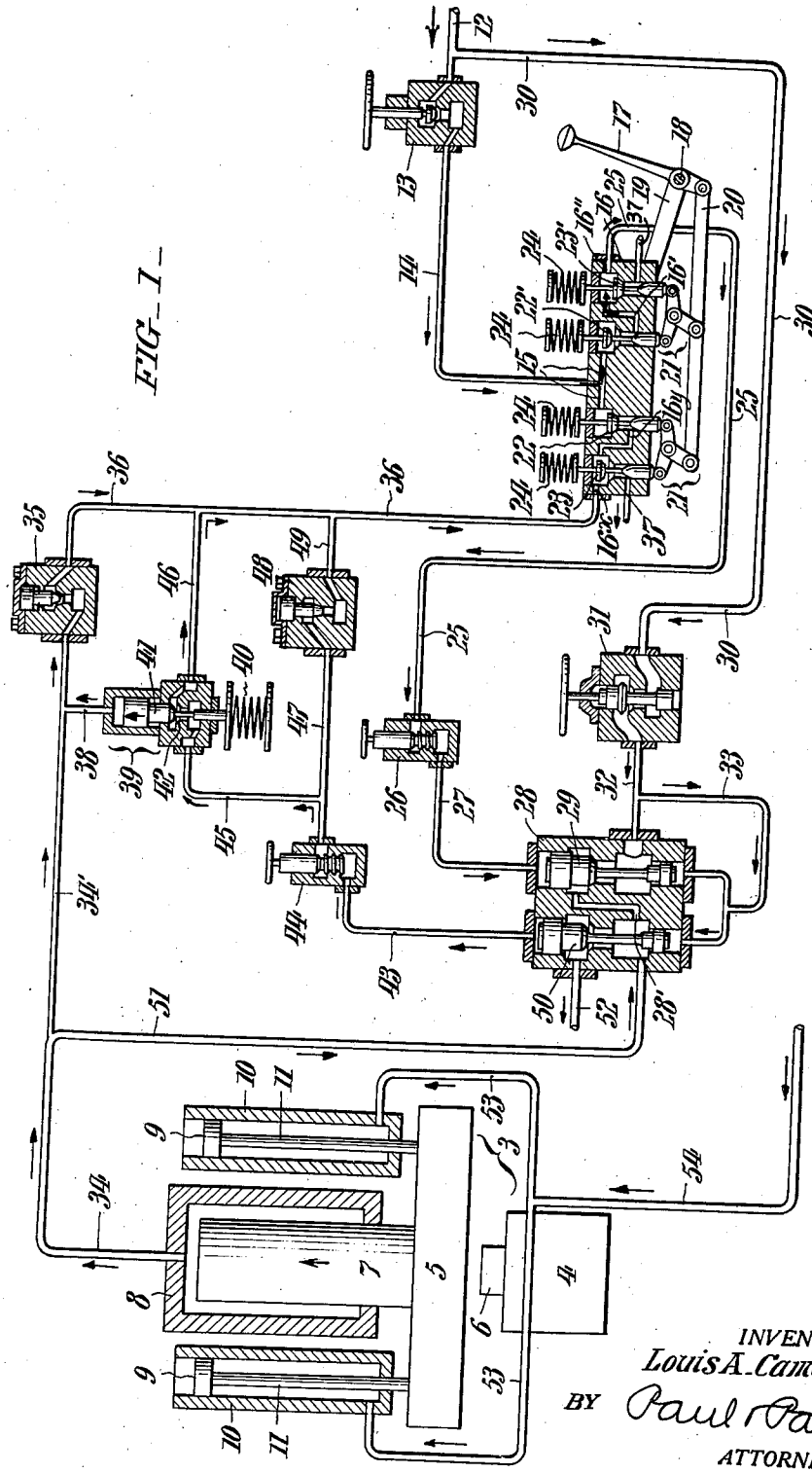
June 13, 1944. L. A. CAMEROTA 2,351,317

HYDRAULIC PRESS SYSTEM

Filed Aug. 17, 1942 2 Sheets-Sheet 1

FIG. 1.



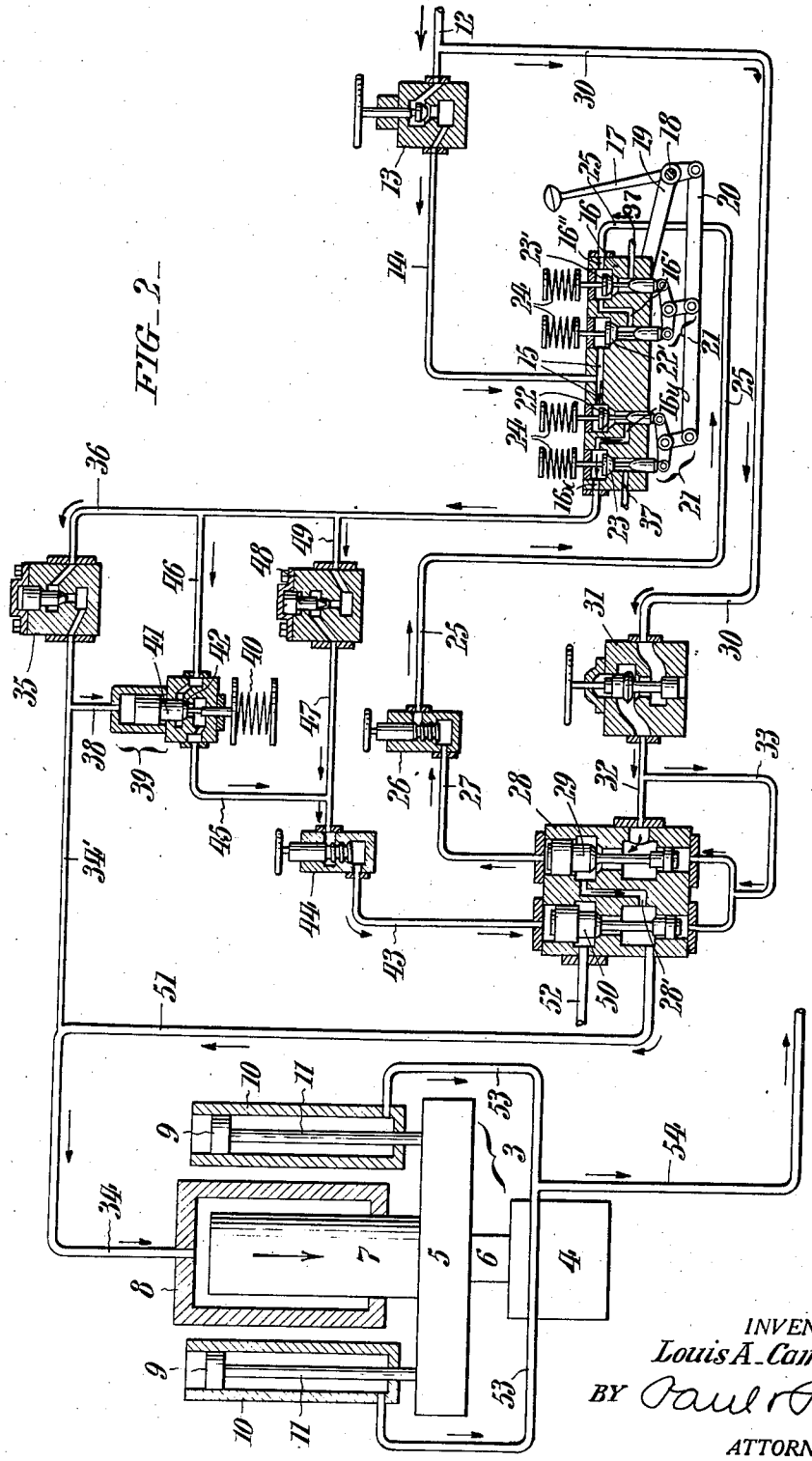
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FIG. 2.



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UNITED STATES PATENT OFFICE

2,351,317

HYDRAULIC PRESS SYSTEM

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Application August 17, 1942, Serial No. 455,057

3 Claims. (Cl. 121—38)

This invention has general reference to fluid pressure systems and, more particularly, relates to the type primarily designed to supply and control the operation of hydraulic presses, or similarly actuated machines, and wherein it is known to employ a pilot-valve for governing the operation or actuation. In such systems, however, one disadvantageous condition prevails, which is mainly due to the fact that the pressure, from the pilot-valve, acts on the main-valve almost instantaneously, with the result a sudden "rush" of high-pressure fluid through the pipes leading to the press, or other machine, takes place with incidental destructive shock. The same "rush" action occurring when the press, or other machine, is reversed, but with greater violence and damaging effect, because the fluid is trapped under high-pressure in the press cylinder, whereby said cylinder and the associated parts are injuriously stretched and expanded. Furthermore, should the main exhaust-valve be opened quickly, which is unavoidable in conventional systems, the pressure-fluid "cannonades" through the exhaust, because the pipe-line and valve areas must be large enough to permit said fluid to pass to discharge at high velocity, when at low pressure.

The fundamental aim of this invention is to overcome the noted disadvantages, in a simple and effective manner, by providing a system and control therefor, whereby a press, or similarly actuated machine, can be operated by fluid under high-pressure without damaging shock either when starting or reversing, regardless of how fast or slow the attendant may shift the operating lever.

Another aim of this invention is the provision of an hydraulic press system, including "in-flow" shock preventing means and exhaust "damping" means; said system being well adapted to the fabrication of shells for projectiles, and containers for explosives.

Further aims, with ancillary advantages, of this invention will appear, as the nature thereof is better understood, from the following description of the typified embodiment illustrated by the accompanying two sheets of drawings, wherein like reference characters are used to designate corresponding parts in both views; while the features of novelty are more particularly defined in the concluding claims.

In the drawings:

Fig. 1 is a general and somewhat diagrammatic view of a hydraulic press system in accordance with, and including, the novel features of this invention; said view illustrating the various valves and cooperative devices during the moving-up or opening cycle of the press; and

Fig. 2 is a similar view but showing the valves and cooperative devices in the position they occupy during the moving-down or "active" cycle of the press.

In describing the typified form of the invention, exemplified by the above captioned views, specific terms will be employed for the sake of clarity, but it is to be understood the scope of said invention is not thereby limited; each such term being intended to embrace all reasonable equivalents which perform the same function for an analogous purpose.

The hydraulic press shown and generally designated 3, in the drawings, is of conventional type including a stationary platen 4 and a co-active or relatively movable-platen 5, by and between which platens the work 6 is operated on. The movable-platen 5 has downward or "active" movement imparted thereto by means of a ram 7 operating in a main cylinder 8; whereas said platen 5 is elevated through the medium of "pull-back" pistons 9, operating in return-cylinders 10 and having the lower ends of the piston rods 11 secured thereto.

Fluid or water, under high-pressure, for operating the press 3 is supplied from any appropriate source, not shown, through a main conduit 12 to a stop-valve 13, and from which it flows, by way of a pipe 14, to aligned inlet ports 15 in the pilot-valve 16. This pilot-valve 16 has an operating lever 17, fulcrumed at 18 to a suitable support 19, and it is also operatively coordinated to a link 20, in turn serviceable through conventional mechanisms 21 to lift, or open small pressure valves 22, 22' when the, respectively, associated exhaust-valves 23, 23' are closed under the action of individual springs 24 in compression, and vice versa.

Referring now more particularly to Fig. 1 which illustrates the parts in position to effect the opening cycle of the press 3 it will be observable that, with the operating lever 17 in the position shown, the pilot pressure valve 22' and exhaust-valve 23 are open; while the respectively associated valves 22 and 23' are closed. High-pressure fluid entering the pilot-valve 16, by way of the stop-valve 13 and pipe 14, passes the inlet port 15, valve 22', duct 16' over closed valve 23', through port 16'' into pipe-line 25 and thence to the throttle-valve 26, wherein the in-rush "shock" is repressed. From the valve 26 the in-flow passes by way of a pipe 27 to the upper end of the main, or three-way, control 28 to thereby

downwardly force or close the pressure-plunger 29 of said control. A branch 30, of determinate larger diameter than that of the pipes 14, 25, also permits concurrent flow of the high-pressure fluid, from supply pipe 12, to a second stop-valve 31, in turn having a pipe connection 32 into the pressure side of the main control 28, with a forked-branch 33 into the lower end of said control.

It will now be readily apparent that upon high-pressure fluid being admitted as just set forth, the plunger 29 will be forced down and the in-rush of such admitted fluid is repressed in the pipe-lines 25, 27, and 30, 32, 33. At the same time the high-pressure fluid in the press main cylinder 8 is permitted to discharge by way of a comparatively larger diameter pipe 34, with a relatively-smaller continuation 34', to a check-valve 35 and pipe-line 36; the latter communicating into the pilot-valve 16, by way of an aperture 16^{x} and from thence through an outlet 37 to exhaust, or wherever desired. The action just described breaks the force of the pressure accumulated in the main cylinder 8 and, hence, no shock occurs because the valves 22, 22', 23, 23' are made comparatively small. As soon as the pressure in the pipe-line 34' is reduced it correspondingly falls in a branch 38, that connects into the hydraulic-loaded or top portion of a check-valve 39, whereby the latter is released; whereupon, the spring 40 influencing said check-valve 39 reacts to raise or lift its plunger 41, from the seat 42, thereby permitting fluid from the exhaust-line 43 of the control 28, to discharge by way of a throttle-valve 44 and pipe-line 45, through the check-valve 39 and a branch 46 into the pipe-line 36, aforesaid, as well as into a pipe 47 and another check-valve 48, wherein the flow is "blocked". The valve 48 has a connection 49, into the line 36, through which the blocked flow passes to the small exhaust-valve unit 23 of the pilot-valve 16, and a duct 16^{y} to the pressure valve 22 in small or greatly reduced volume. Such action, forthwith, relieves the pressure previously acting on top of the exhaust-valve 50, of the control 28, whereupon high-pressure fluid supplied by way of the axially-aligned portion of the forked-branch 33, causes said valve 50 to rise or open, and thereby permit forced-flow of the high-pressure fluid from the main cylinder 8 through pipe-line 34, hereinbefore referred to, and a pipe-line 51, to the valve 50 to the control exhaust-line 52, in considerable volume. The constant-pressure acting on the "pull-back," or return, cylinders 10 will thereupon function, to elevate the pistons 9, and cause upward-movement of the platen 5, whereby rapid discharge of the pressure fluid in the main or operating cylinder 8 is effected, with a resultant high-speed opening movement for the press 3 without any "shocking" of the associated parts.

Turning now more particularly, to Fig. 2 which shows the parts in the position they assume to effect the closure cycle, of the press 3, or its "active" stroke, the operating lever 17 is first moved to the location illustrated in said figure. High-pressure fluid from the source of supply now entering the system, from the supply line 12, passes through the stop-valve 13 and pipe 14, as before set out, to the inlet port 15, of the pilot-valve 16. Now, in view of the operating lever 17 having previously, through the means 20 and 21, opened or lifted the valves 22, 23' and closed or lowered the valves 23, 22'; it will be evident that the hydraulic, or other, high-pressure fluid flows through the valve 22, duct 16^{y}, over valve 23, through orifice 16^{x} and pipe-line 36, to the valve 35, wherein the in-rush is again "repressed". Some of such in-flow will however, be diverted or pass through the connection 49 and open check-valve 48, pipe-line 47, throttle 44 and line 43, to the top of the control exhaust-valve 50, and thereby close said valve 50 gradually. At the same time the exhaust-valve 23', of the pilot-valve 16, being open, the fluid-pressure previously acting on top of the control plunger 29 will be relieved and exhaust through pipe 27, throttle valve 26, pipe-line 25, port 16'', and past open valve 23' to the exhaust outlet 37. During the just described action release of the exhaust-valve 50 will be temporarily arrested by the fluid pressure on its top, blocked-in by the check-valve 48, and closure of the hydraulic-loaded valve 39 by in-coming high-pressure fluid from pipes 34', 38; whereas the valve 29 will be gradually elevated to the open position, shown in Fig. 2, by high-pressure fluid conducted therebelow through the branch pipe 30, stop-valve 31, pipe connection 32 and axially-aligned part of forked-branch 33; or, in other words, it will be understood that the valve 50 closes, before the valve 29 opens, and vice versa. As a result of the just explained opening of the valve 29, there will now be free flow of fluid under high-pressure, and considerable volume, from the connection 32 by way of the control duct 28' and pipe-line 51 into pipe 34 for direct downward action on the press ram 7, in the cylinder 8, whereby the platen 5 will operate on the work 6 in a positive manner, without any "shocking" of the cylinder 8 and adjoining parts of the press 3.

Constant-pressure fluid is supplied to, and vented from the "pull-back" or press return-cylinders 10 by way of pipe connections 53 from a pipe line 54, in flow communication with a suitable source, not shown, in accordance with known practice.

Particular attention is, herein, directed to the fact that, what might be termed the service-supply pipes 30, 34 and 51 in addition to the control exhaust line 52 are, preferably, made of determined larger diameter than the various other pipes 14, 25, 27, 32, 33, 36, 38, 43, 45, 46, 47 and 49, as well as the continuation 34', intervening the union of the pipes 34, 51, and the check-valve 35, to facilitate precision actuation of the press 3.

From the foregoing it will be readily seen that the press 3 cannot open unless the pressure in pipe-lines 34 and 51 is reduced, the same only being possible of attainment by joint use of the small valves 22, 22', 23, 23' in the pilot 16; the line 34 with its relatively smaller continuation 34' to check-valve 35; and the corresponding smaller pipe-line 36. It is, also, to be remarked that, the exhaust-valve 50 of the control 28 cannot open until the pressure is relieved from above the plunger 41 of the hydraulic-loaded check-valve 39; and, furthermore, in view of the two just stated important factors, the pipes 34, and 51 will be correspondingly relieved of high-pressure, whereby the press 3 only opens gradually, or without destructive shock occurring, incidental to sudden release of the high-pressure.

From the foregoing it is thought the merits and advantages of this invention need no further elucidation herein; while it will be equally obvious that various changes in the details described may be made by those skilled in the art within the

spirit and scope of said invention, as more concisely expressed in the following claims.

Having thus described my invention, I claim:

1. In systems operated by fluid pressure for energizing a device productive of mechanical work, dual reciprocative means respectively designed to impart effective and ineffective movements to said device; a main control and pipe arrangement governing supply and venting of high-pressure fluid to and from the reciprocative means; associated stop, directive and check means in an in-flow portion of the conduit arrangement, said directive means including relatively small pressure-and-exhaust devices, and the check means serving to prevent "in-flow" shock to the main control; a branch from the supply side of the pipe arrangement aforesaid and stop means in circuit with the main control to impart effective movements to the reciprocative means; and a loop-section in the pipe arrangement including a fluid-pressure loaded check device with reactive means effective to "damp" exhaust flow from the reciprocative means during the ineffective movements of the latter, whereby the system is prevented from destructive operating shocks.

2. In a hydraulic press system the combination, with a movable-platen, of ram and piston means for respectively imparting active and return movements to said platen; a conduit system, including a main control-valve, governing supply and venting of high-pressure operating fluid, to and from the ram means; associated stop, pilot, and throttle valves in an in-flow portion of the conduit system to the top of the control-valve, said pilot-valve including plural pressure-and-exhaust units, all of which are of comparatively small corresponding area, and the throttle-valve serving to repress the in-rush shock of the flow to the main control valve conduit portion of the system; a branch from the high-pressure main supply line to the system, with an interposed stop-valve, for concurrent in-flow of high-pressure fluid to and through the control-valve to effect active movement of the ram and platen; an exhaust-line from the ram means, including a check-valve, to the pilot-valve; a loop in the exhaust-line having connection thereinto to each side of the included check-valve, said loop including a fluid-pressure loaded check-valve with reactive means effective to relieve pressure acting thereon from the control valve as the pressure in the exhaust line reduces; a branch line, from the top of the outlet side of the control-valve into the exhaust-line aforesaid having flow-connection to the pressure-loaded check-valve; and individual throttle and check valves in said branch line, respectively to each side of its flow-connection with the fluid-pressure loaded check-valve, whereby the system is rendered immune from destructive operating shocks.

3. The combination of claim 2, wherein the majority of the pressure in-flow conduits of the hydraulic press system are of pre-determined diameter, and the majority of the exhaust-flow conduits in said system are of relatively smaller diameter to positively facilitate precision operation of the hydraulic press.

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