

Oct. 8, 1940.

J. A. MULLER

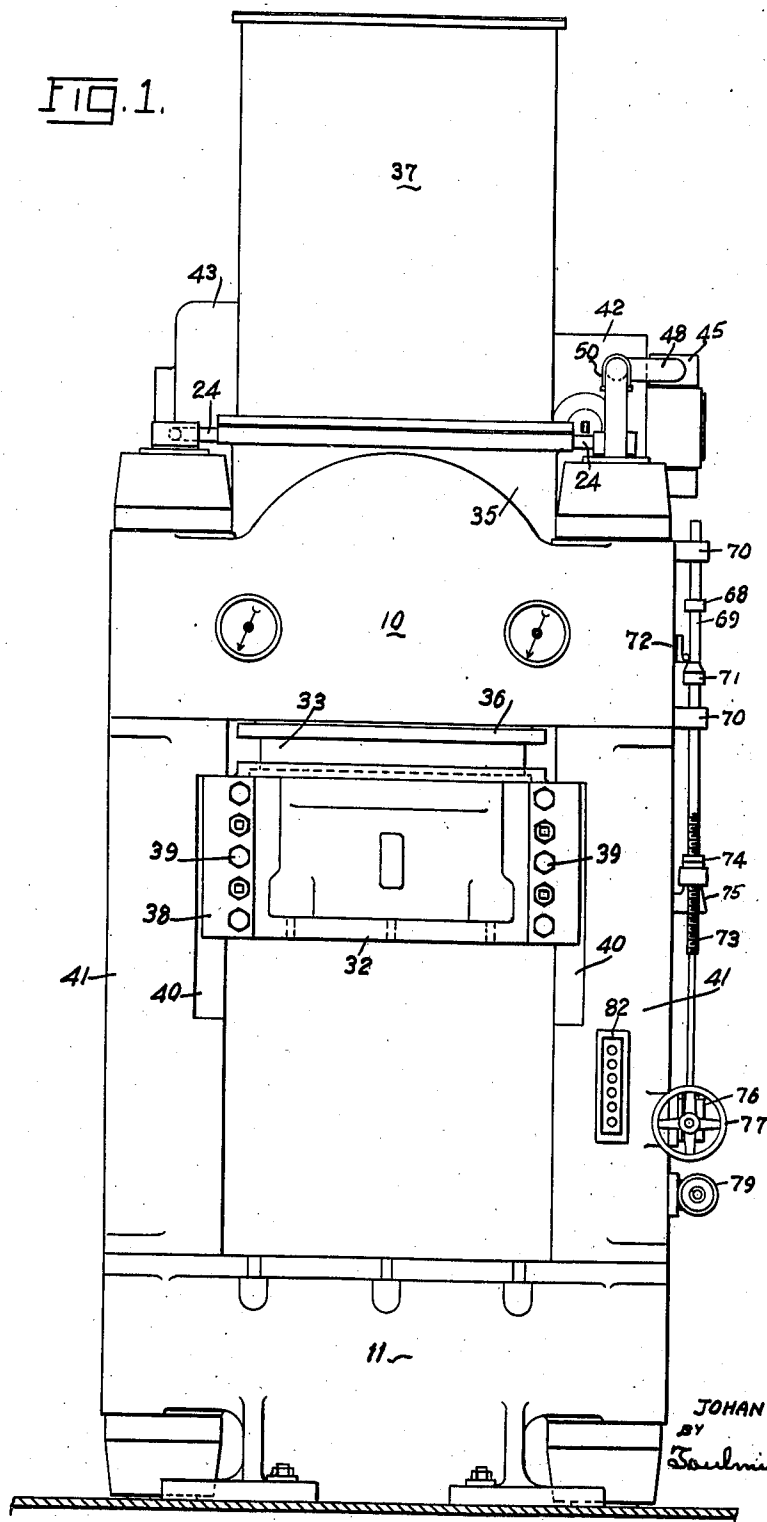
2,217,025

PRESS WITH FLUID-CONDUCTING STRAIN ROD

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4 Sheets-Sheet 1

FIG. 1.



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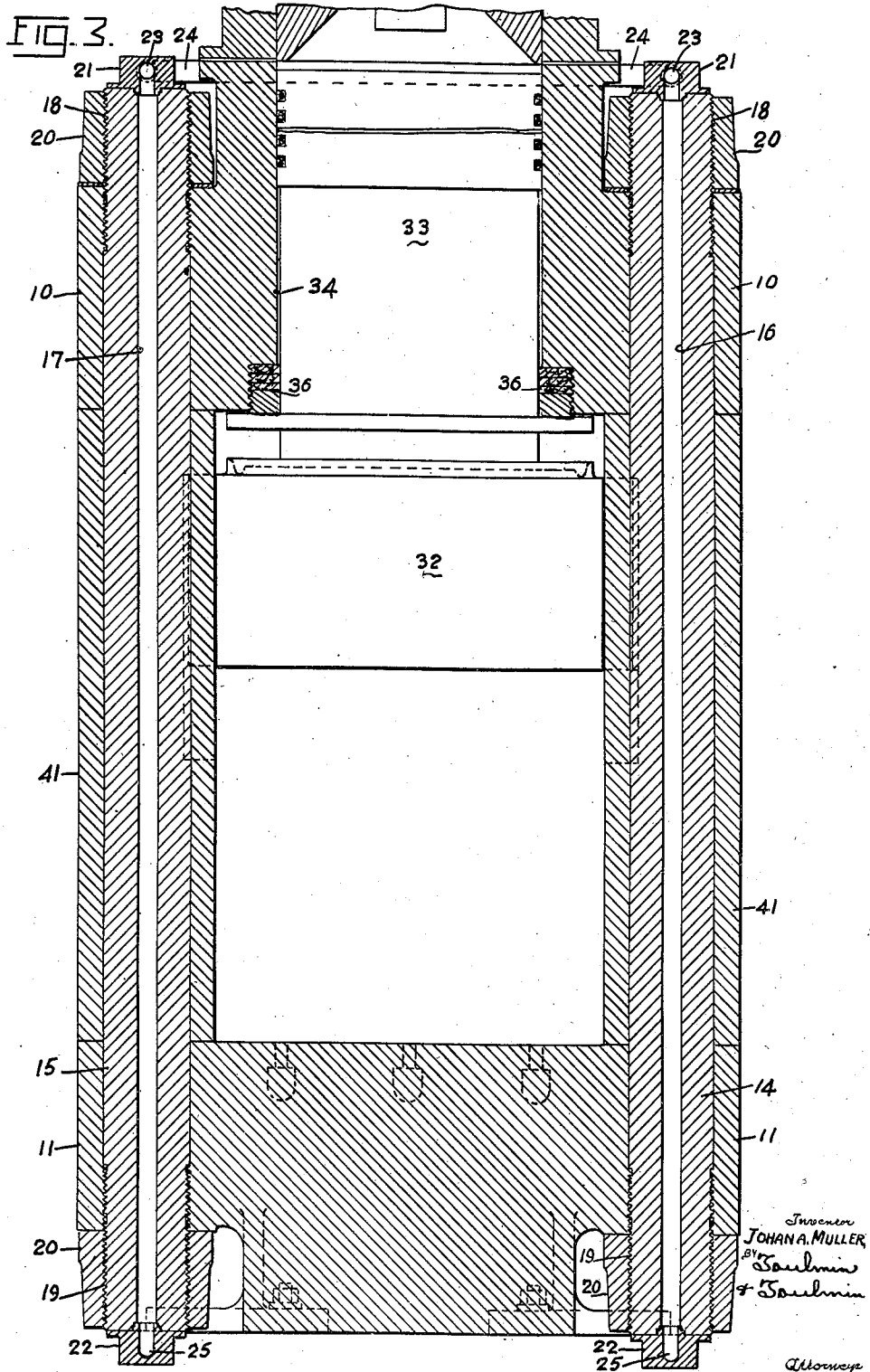
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FIG. 4.

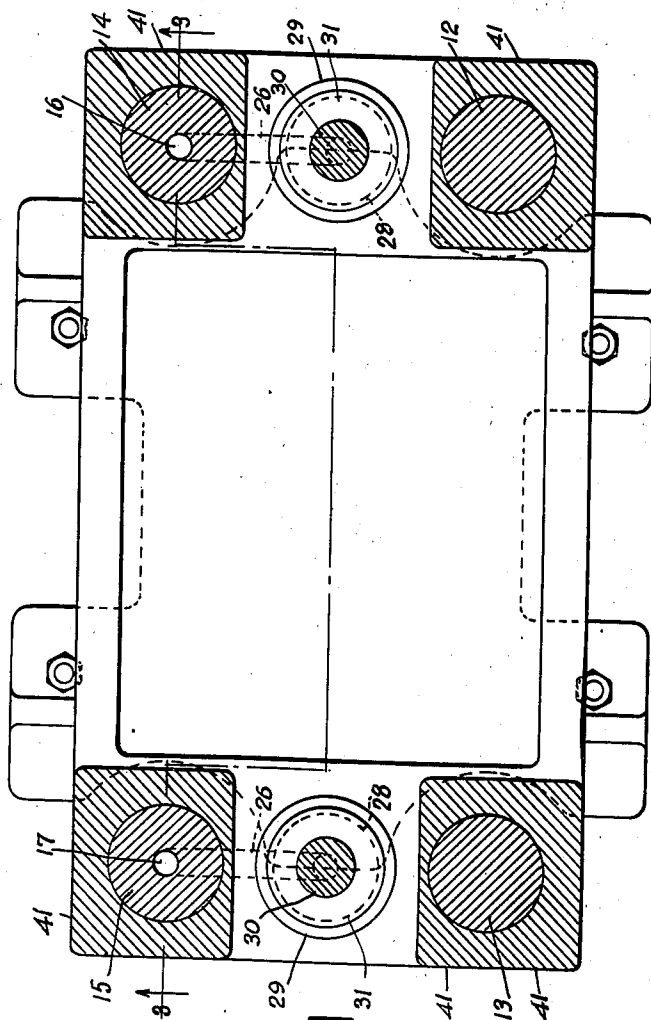
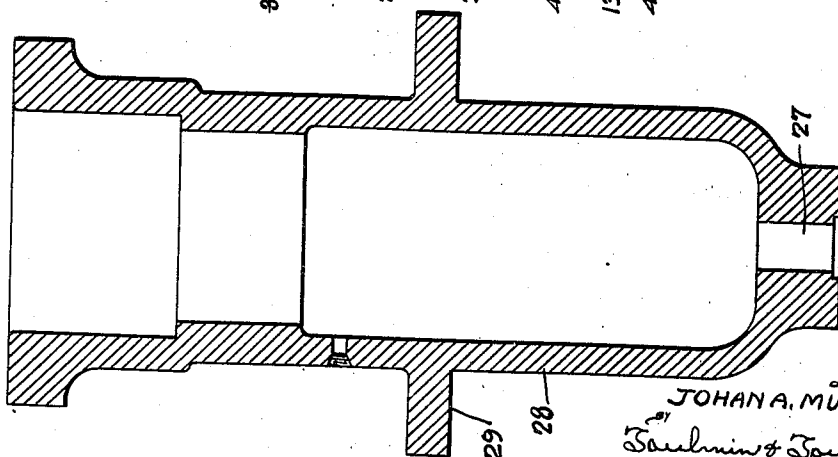


FIG. 5.



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UNITED STATES PATENT OFFICE

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PRESS WITH FLUID-CONDUCTING STRAIN ROD

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Application November 26, 1937, Serial No. 176,503

9 Claims. (Cl. 100—71)

This invention relates to hydraulic machinery, and in particular to hydraulic presses.

One object of this invention is to provide a hydraulic press, wherein at least one of the strain rods interconnecting the top and bottom members of the press is hollow for the purpose of conducting fluid.

Another object is to provide a hydraulic press having hollow strain rods for conducting fluid from the pump to hydraulic devices mounted at a remote portion of the press, thereby eliminating the necessity of running pipes to that portion of the press.

Another object is to provide a hydraulic press having top and bottom members interconnected by strain rods, at least one of which is hollow for the purpose of conducting fluid, thereby eliminating the pipes ordinarily required for this purpose, and simplifying the construction of the machine.

In the drawings:

Figure 1 is a front elevation of one embodiment of the press of this invention.

Figure 2 is a side elevation of the press shown in Figure 1.

Figure 3 is a vertical section along the line 3—3 in Figure 4.

Figure 4 is a horizontal section along the line 4—4 in Figure 2.

Figure 5 is an axial section through one of the push-back cylinders of the press.

In general, the press of this invention consists of top and bottom members, interconnected by strain rods. At least one of these strain rods is hollow and is provided with fluid connections whereby the hollow strain rod serves as a fluid-conducting conduit for conducting fluid to and from hydraulic devices located in a remote portion of the press. In particular, the hollow strain rods may be used to conduct fluid from a pump mounted on the top member of the press to the push-back cylinders, hydraulic cushions, or other hydraulic devices mounted in the bottom member of the press. Fluid connections made between such devices and the hollow strain rod avoid the necessity for the use of the piping ordinarily required in such presses, simplify the construction of the press, improve the appearance and strengthen the hydraulic circuit. The hollow strain rods being of considerably greater strength than ordinary pipes, are substantially without the possibility of leakage or breakage.

Referring to the drawings in detail, Figures 1 and 2 show one embodiment of a press em-

ploying the fluid-conducting hollow strain rods according to this invention. This press consists of a top member 10 and a bottom member 11, interconnected by strain rods 12, 13, 14 and 15 (Figure 4). It is immaterial which or how many of the strain rods are hollow as the choice will depend upon the particular installation. For purposes of illustration, however, in the present embodiment the press is shown as having two rearwardly disposed strain rods 14 and 15 provided with bores 16 and 17 for fluid-conduction purposes. The upper ends of the strain rods 12 to 15 are threaded, as at 18, and the lower portions thereof threaded, as at 19, for the reception of nuts 20.

Secured to the upper and lower ends of the bores 16 and 17 in the strain rods 14 and 15 are the fluid connection caps 21 and 22, respectively. The upper caps 21 are provided with fluid passages 23 interconnected by the conduit 24, whereas the lower caps 22 are provided with fluid passages 25, not interconnected but leading by way of pipes 26 (Figure 2) to the ports 27 (Figure 5) in the lower ends of the push-back cylinders 28. The push-back cylinders 28 are mounted upon the press bottom member or base 11, and are supported thereon by flanged portions 29.

Reciprocating within the push-back cylinders 28 are the push-back plungers 30, the upper ends of the push-back cylinders 28 being closed by the glands 31 encircling the push-back plungers 30. The upper ends of the push-back plungers 30 are secured to the press platen 32 (Figure 2). The latter moves downwardly under the influence of the main plunger 33 secured thereto, and reciprocating in the main cylinder bore 34 of the main cylinder 35 mounted in the press top member 10. A gland 36, threaded into the space surrounding the main plunger 33, prevents leakage from the main cylinder bore 34. Surmounting the main cylinder 35 is a surge tank 37 for the purpose of supplying fluid to the various hydraulic devices. The platen 32 is provided with plates 38 bolted thereto, as at 39, and reciprocating in the guideways 40 (Figure 1) provided in the press side members 41. The latter are arranged between the top and base members 10 and 11 and extend around the strain rods 12 to 15, previously described.

Pressure fluid for operating the press is provided by a reversible variable delivery pump 42, operated by an electric motor 43 (Figure 1). Any suitable form of pump may be used, the reversible variable delivery type shown being merely for

purposes of illustration and not by way of limitation. The pump 42 is provided with a forward connection 44 and a return connection 45, the former being the pressure connection when the pump is in its forward delivery position, and the latter the pressure connection when the pump is in its reversed position. Obviously, when one of the connections 44 or 45 is a pressure connection, under these circumstances the other is a suction connection. From the forward connection 44 the line 48 runs to the connection 47 leading to the main cylinder 35. From the return connection 45 the line 48 leads to the surge tank connection 49. From the T-connection 50 the line 51 leads to the right-hand fluid connection cap 21, which is connected to the left-hand cap 21 by means of the pipe 24, previously described.

The pump 42 is provided with a safety centering device 52 on one side and a servomotor unit 53 on the opposite side. These details of pump construction form no part of the present invention, and a disclosure thereof will be found in the copending application Ser. No. 170,250, filed October 21, 1937, of Walter Ernst. This application has become Patent No. 2,184,665, issued December 26, 1939. The servomotor unit 53 is operative to move the shift ring or flow-control member of the reversible variable delivery pump 42, this pump being of the radial piston type wherein the delivery is regulated by varying the eccentricity of the secondary rotor or piston actuator relatively to the primary rotor or cylinder barrel, in a manner known to those skilled in the hydraulic pump art.

The operation of the servomotor unit 53 is controlled by a servomotor control valve rod 54, connected to a lever 55 pivotally mounted upon a pivoted link 56. The opposite end of the lever 55 is pivotally connected to a link 57 leading to a rocking lever 58 pivotally mounted, as at 59, upon the pump-supporting bracket 60 (Figure 2), which in turn, is mounted upon the press top member 10. Pivotaly connected to the lower end of the rocking lever 58 is a link 61, which is in turn, connected to an arm 62 mounted upon the pivot shaft 63 and serving to rock the lever 64. To one end of the lever 64 the armature 65 of a solenoid 66 is pivotally connected, whereas the opposite end terminates in a yoke 67 engaging a collar 68 upon the press control rod 69, which reciprocates vertically in bearings 70 projecting from the frame top member 10. The control rod 69 is also provided with a collar 71 serving to actuate a limit switch 72 (Figure 1), included in the electrohydraulic control circuit of the pump.

The intermediate portion of the press control rod 69 is threaded, as at 73, to receive a threaded nut 74 engaged by the platen arm 75, which is secured at its opposite end (Figure 2) to the platen 32. The control rod 69 is mounted so as to be rotatable as well as reciprocable, mechanism for this purpose being provided within the gear casing 76 and operated by the hand wheel 77. By turning the hand wheel 77 the control rod 69 may be rotated, thereby varying the position at which the platen arm 75 becomes operative to cause the threaded nut 74 to lift the control rod 69 and shift the pump 42 to its neutral delivery position at the top of the return stroke of the main platen 32. The limit switch 72 is connected in circuit with the solenoid 66, the latter likewise serving to shift the servomotor control valve rod 54 through the various links and levers arranged therebetween.

The pressure which the platen 32 exerts is regulated by the tonnage control device 78, operated by the hand wheel 79 and connected by the line 80 to one of the push-back cylinders 28. The press is also provided with an emergency stop 81 (Figure 2) serving to engage the platen 32 in the event that the other control features accidentally become inoperative to halt the platen 32. The electrohydraulic control circuit for controlling the press is regulated from the push-button control station 82 (Figure 1). The particular circuit employed forms no part of the present invention.

In the operation of the press of this invention, for executing a forward stroke, the pump 42 is regulated by shifting the servomotor control valve rod 54 to cause it to deliver pressure fluid through the connection 44, the connection 45 temporarily becoming a suction connection. Under these conditions, pressure fluid flows from the pump 42, along the line 48 to the main cylinder connection 47, where it enters the main cylinder 35 and causes the main plunger 33 and platen 32 to move downwardly.

Meanwhile, the suction connection 45 takes in pressure fluid along the line 48 from the surge tank 37 by way of the surge tank connection 49. Fluid is also withdrawn from the push-back cylinders 28 by way of the ports 27, the pipes 26, the lower connection caps 22, the strain rod bores 16 and 17, the upper connection caps 21, the pipe 24 and passages 23 and the pipe 51 connected to the pipe 48 leading to the suction connection or return connection 45. The platen proceeds downwardly until its electrohydraulic control system operates to actuate the solenoid 66, as by operating a pressure-responsive switch (not shown).

When this occurs the servomotor control valve rod 54 of the servomotor 53 is shifted through the links and levers connecting it with the solenoid armature 65, thereby causing the forward connection 44 and return connection 45 to become respectively the suction and pressure connections. Fluid is now withdrawn from the main cylinder 35 by way of the main cylinder connection 47, the pipe 48 and the forward connection 44 of the pump 42. Pressure fluid at the same time is supplied from the return connection 45, through the line 48 to the pipes 51 and 24 leading through the top connection caps 21, to the bores 16 and 17 in the hollow strain rods 14 and 15.

The pressure fluid flows downwardly through these hollow strain rods 14 and 15, thence through the lower connection caps 22 and pipes 26, to the push-back cylinders 28. Under the influence of this pressure fluid the push-back plungers 30 rise, lifting the main platen 32 until the platen arm 75 and nut 74 raise the press control rod 69 to shift the servomotor control valve rod 54 to a position wherein the shift ring or flow-control member of the reversible variable delivery pump 42 will be placed in its neutral or zero delivery position. The platen 32 is then held in its raised or return position until the operator presses the push-button switches at the push-button control station 82 to cause the press to execute another pressing stroke. If the electrohydraulic press control system, however, is set for full automatic rather than semi-automatic operation, the platen 32 on reaching the top of its return stroke immediately executes another pressing stroke, and continues to do so until halted by the operator, in a manner depending upon the particular arrangement of the con-

trol system. The particular electrohydraulic control system employed in the press forms no part of the present invention.

According to the present invention, therefore, the hollow strain rods 14 and 15 serve to conduct fluid between remotely situated portions of the press, and thereby eliminate the pipes formerly required for this purpose. The simplification and strengthening of the press resulting from this invention effect an improved dependability and freedom from breakdowns which arose in previous presses by reason of leakage in such pipes.

It will also be seen that hydraulic devices other than push-back cylinders may be operated by pressure fluid received through the hollow strain rods. For example, one of the dies may be mounted upon a hydraulic cushion, receiving pressure fluid through a hollow strain rod. Alternatively, the construction of this invention may be employed in a hydraulic metal drawing press wherein one of the plungers, such as the clamping plunger, may be operated by pressure fluid received through a hollow strain rod.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a hydraulic press, a top member, a base member, strain rods interconnecting said members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder, a plunger therein, a source of pressure fluid, and a hydraulic circuit connecting said source with said fluid-conducting passageway near one end of said strain rod, said cylinder being connected to said strain rod passageway near the other end of said strain rod.

2. In a hydraulic press, a top member, a base member, strain rods interconnecting said members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder, a plunger therein, a source of pressure fluid, a hydraulic circuit connecting said source with said cylinder and with said strain rod passageway near one end of said strain rod, and a hydraulically-operated device connected to the fluid-conducting passageway near the other end of said strain rod.

3. In a hydraulic press, oppositely disposed end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder, a plunger therein, a source of pressure fluid, a hydraulic circuit connecting said source with said cylinder and with said strain rod passageway near one end of said strain rod, and a hydraulically-operated device connected to the fluid-conducting passageway near the other end of said strain rod.

4. In a hydraulic press, oppositely disposed end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder and plunger associated with one of said end members and connected to said fluid-conduct-

ing passageway near one end of said strain rod, a source of pressure fluid, and a hydraulic circuit connecting said source with said strain rod passageway near the other end of said strain rod.

5. In a hydraulic press, oppositely disposed end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder and plunger associated with one of said end members, a source of pressure fluid, a hydraulic circuit connecting said source with said cylinder and connected to said strain rod passageway near one end of said strain rod, and a hydraulic motor connected to said fluid-conducting passageway near the other end of said strain rod for receiving pressure fluid therethrough.

6. In a hydraulic press, oppositely disposed end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a main cylinder, a main plunger therein, a source of pressure fluid, a hydraulic circuit connecting said source with said main cylinder, and with said fluid-conducting passageway near one end of said strain rod, a platen connected to said main plunger, a push-back cylinder, a push-back plunger therein connected to said platen, and means hydraulically connecting said push-back cylinder with said fluid-conducting passageway near the other end of said fluid-conducting strain rod.

7. In a hydraulic press, upper and lower end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a main cylinder and main plunger associated with one of said end members, a push-back cylinder and push-back plunger associated with the other of said end members, and connected to said fluid-conducting passageway near one end of said strain rod, a pump, and a hydraulic circuit connecting said pump with said cylinders and with said fluid-conducting passageway near the other end of said fluid-conducting strain rod.

8. In a hydraulic press, oppositely disposed end members, strain rods interconnecting said end members, at least one of said strain rods having a fluid-conducting passageway therein, a cylinder with a plunger therein mounted on one end member, a pump mounted on the other end member, fluid connection terminals secured to said fluid-conducting strain rod near the opposite ends thereof, and a hydraulic circuit connecting said pump with said cylinder by way of said strain rod passageway and said fluid connection terminals.

9. In a hydraulic press, upper and lower end members, strain rods interconnecting said end members, two of said strain rods having fluid-conducting passageways therein, a main cylinder and main plunger connected to one of said end members, a pair of push-back cylinders and push-back plungers, connected to the other of said end members, a platen connected to said plungers, a pump, and a hydraulic circuit connecting said pump with said cylinders by way of said fluid-conducting strain rods.

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