June 20, 1944. A. L. PARKER 2,351,872

HYDRAULIC PRESS

Filed March 31, 1941

Fig. 1

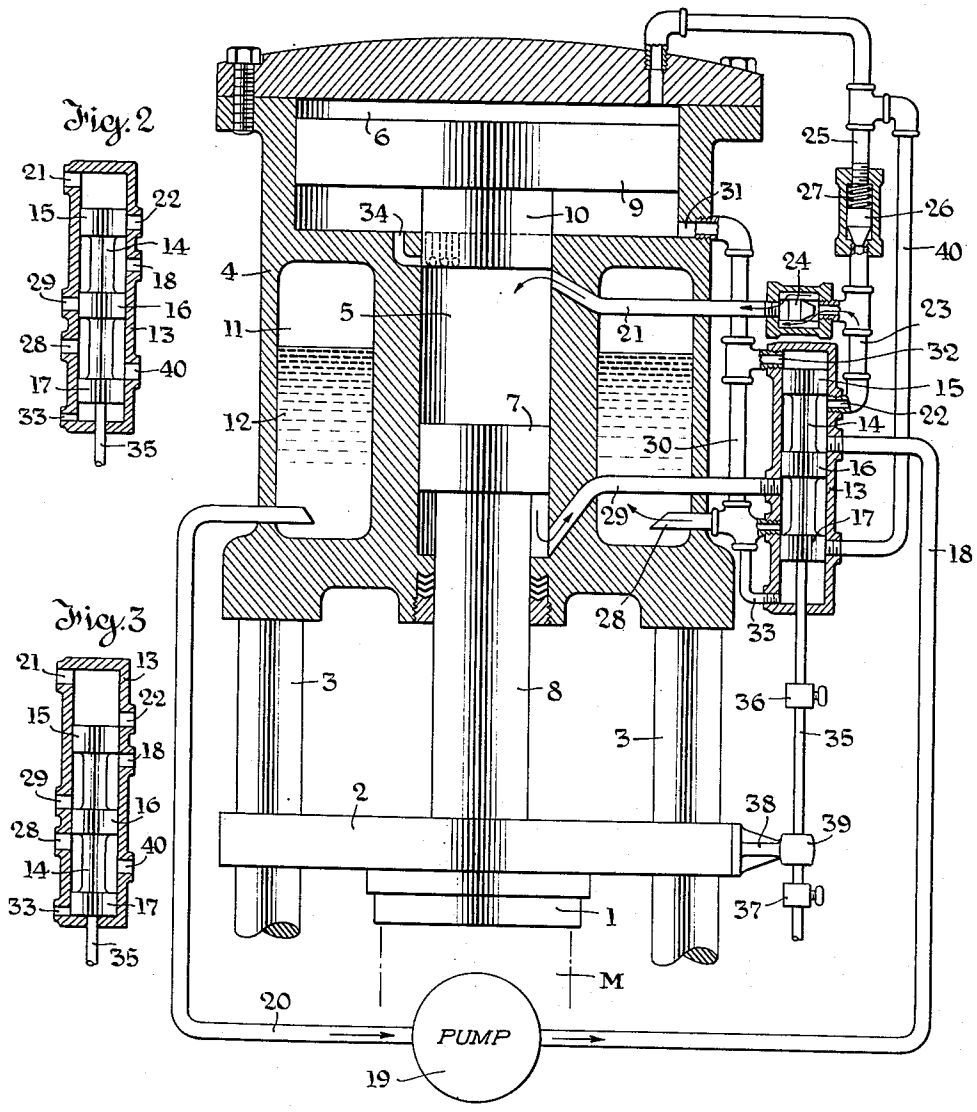


Fig. 2

Fig. 3

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HYDRAULIC PRESS

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3 Claims. (Cl. 60—54.5)

The invention relates to new and useful improvements in an hydraulic press and more particularly to a press wherein the ram is moved quickly into contact with the work by a relatively small fluid operated piston and wherein the ram is moved for operation upon the work by a relatively large piston.

An object of the invention is to provide an hydraulic press of above type which is so constructed that the large and small pistons which impart movement to the ram are disconnected and independently operated.

A further object of the invention is to provide a press of the above type wherein the large working piston operates through a fluid connection upon the smaller piston for moving the ram into engagement with the work.

In the drawing which shows by way of illustration one embodiment of the invention:

Figure 1 is a sectional view through the upper portion of a press containing the improvements.

Figure 2 is a view through the fluid control valve for the press with the valve positioned for stopping the movements of the pistons.

Figure 3 is a view similar to Figure 2 but showing the valve shifted to a position for causing the pistons to be retracted and the ram lifted from the work.

The hydraulic press embodying the invention is in many respects of the usual construction and only the portions of the press containing the novel features have been illustrated. The ram 1 for contacting with the material is carried by a cross head 2 mounted for reciprocation on columns 3. Mounted at the upper end of the columns 3 is a housing 4 having a working chamber 5 and working chamber 6 respectively constituing a relatively small lower cylinder and a relatively large upper cylinder. The two chambers are connected together. The chamber 5 is cylindrical and is of much smaller diameter than chamber 6, which likewise is cylindrical. Mounted for reciprocation in the chamber 5 is a piston 7 connected to the upper end of a piston rod 8 which in turn is connected to the cross head for moving the ram. Mounted for reciprocation in the chamber 6 is a piston 9 which conforms in diameter to the chamber 6. This piston 9 carries an auxiliary piston or stem 10 which fits within the chamber 5. These pistons are the usual construction and have only been illustrated diagrammatically.

The cylinder is provided with a chamber 11 which surrounds the chamber 5 and serves as a sump or storage reservoir for the operating fluid which is indicated at 12.

The valve mechanism for controlling the supply of fluid to and from the chambers 5 and 6 includes a valve casing 13 having a cylindrical bore in which is located a valve 14 having three heads 15, 16, and 17. The valve is cut away between these heads so as to provide passage for the fluid. These heads contact the inner wall of the valve casing.

The valve casing has a port in the side wall thereof to which a pipe 18 is connected. This pipe 18 is connected to the fluid pump 19 at the pressure side thereof. A pipe 20 connects the pump with the sump or reservoir 11 so the fluid is drawn through the pipe 20 and delivered under pressure by the pump 19 to the valve casing.

A pipe 21 leads through the cylinder wall to the chamber 5 and serves as a means for supplying operating fluid to the chamber 5 above the piston 7. The valve casing has a port 22 which is controlled by the valve head 15. This port is connected to a pipe 23 and the pipe 23 is connected to the pipe 21 through a check valve 24 which permits fluid to pass into the chamber 5 but prevents fluid from the chamber 5 passing from the pipe 21 into the pipe 23. At certain times in the cycle or operation of the press the pipe 23 is also connected to a pipe 25 which leads through the cylinder head to the chamber 6 above the piston 9 therein. Between the pipe 25 and pipe 23 is a check valve 26 which permits fluid to pass into the pipe 25 and thence into the chamber 6 but which prevents fluid from passing from the chamber 6 through the pipe 25 to the pipe 23. There is a spring 27 which normally holds this valve 26 closed until the pressure on the line develops to a degree that will open the valve.

The pipe 28 leads from the sump or reservoir 11 to the valve casing and is connected thereto between the valve heads 16 and 17 at all times. A pipe 29 is connected to the chamber 5 below the piston 7 and to the valve casing so that said pipe is controlled by the valve head 16. This pipe 29 serves the double purpose of exhausting the fluid from beneath the piston 7 during the movement of the ram up to the work and during the working stroke of the ram. It also serves the function of raising the piston and moving the ram away from the work.

Connected to the pipe 28 is pipe 30. This pipe 30 is connected at 31 to the chamber 6 below the piston 9. It is also connected at 32 to the upper end of the valve housing. This pipe serves to

exhaust fluid from beneath the piston 9 in the chamber 6. It also serves to prevent fluid from being trapped in the valve casing at the upper end of the valve 3. There is a pipe 33 connected with pipe 28 at the lower end of the valve casing to prevent fluid from being trapped therein.

The portion of the cylinder having the chamber 5 is provided with a series of ports 34. These ports are covered during the working stroke of the piston 9 by the auxiliary piston 10. When the piston 9 moves to the upper end of its stroke, the ports are uncovered so that there is a fluid connection between the chamber 5 above the piston 7 and the chamber 6 beneath the piston 9.

Attached to the valve is a valve operating rod 35 which is provided with adjustable collars 36 and 37. Attached to the cross head 2 is an arm 38 carrying a sleeve 39 which slides freely on the rod 35 until said sleeve contacts with the collar 37 or the collar 36 and then it will move the rod and thus the valve is moved to different set positions.

As shown in Figure 1, the ram has been moved downward into contact with the material as indicated by the broken line in the drawing. The valve is so positioned that fluid from the pump line 18 passes from the valve casing into the pipe 23 through the check valve 24 and the pipe 21 to the chamber 5 above the piston 7. The piston being small, it has been moved rapidly from its extreme upper position so as to bring the ram into contact with the work. When the ram is restrained in its downward movements by the work, pressure on the fluid will open the valve 26 and furnish fluid to the chamber 6 above the piston 9. The fluid in the chamber 5 above the piston 7 is restrained from discharge through the pipe 21 by the closing of the check valve 24 and thus it is that the auxiliary piston engaging the column of fluid between the same and the piston 7 will move the ram downward for operation upon the work. This is accomplished by the fluid pressure on the piston of larger diameter. When the sleeve 39 by this downward working stroke of the ram contacts with the collar 37, the valve will be shifted to the position shown in Figure 2. This positions the valve head 15 so that the port 22 leading to the pipe 23 is closed. This cuts off the supply of fluid pressure both to the chamber 5 and also the chamber 6 above the pistons therein and stops further movement of the ram.

When it is desired to move the ram to the raised position, the valve rod is shifted so as to position the valve as shown in Figure 3. Fluid under pressure from the pipe 18 is now delivered to the pipe 29 and from the pipe 29 to the chamber 5 below the piston 7. There is a pipe 40 which is connected to the pipe 25 and when the valve moves to the position shown in Figure 3, this pipe 40 connects through the valve casing with the pipe 28 leading to the sump. This permits the fluid at the upper end of the piston 9 to return to the sump as the piston is raised by the upward movement of the piston 7. The check valve 24 will close so as to prevent the fluid from passing out through the pipe 21 and the fluid trapped by the auxiliary piston 10 and the piston 7 serves to lift the piston 9 in the manner stated. When, however, the piston 9 reaches the upper end of its stroke, the ports 34 will be uncovered and permit fluid to flow from the chamber 5 into the chamber 6 beneath piston 9 and through the pipe 30 to the sump. This will leave the chamber between the pistons 10 and 7 filled with fluid but it permits the piston 7 to move upward a greater distance for lifting the ram from the work. In other words, while the piston 7 through the fluid moves the piston 9 upward, the piston 7 can continue the upward movement after the piston 9 has reached the limit of its upward movement.

While the small piston operates to move the ram quickly into engagement with the work and the piston 9 operates through the piston 7 for the working stroke of the ram on the material, the two pistons move independently and the connection between the two is the fluid connection trap in the chamber 5 between the piston 7 and the auxiliary piston 10.

It is obvious that many changes may be made in the details of construction without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. An hydraulic press comprising a unitary housing including an upper relatively large cylinder and a lower relatively small cylinder, a reservoir surrounding the small cylinder and having a supply of liquid therein, a ram adapted to be actuated by liquid under pressure, a piston in said upper cylinder having a stem extending into and slidably fitting said lower cylinder, a piston connected to said ram and disposed in said lower cylinder and constantly spaced from said stem by a liquid column, and longitudinally shiftable control valve means for controlling actuation of the ram and operable to first direct liquid under pressure only to said lower cylinder between said stem and the lower piston for effecting rapid movement of the ram toward the work and then automatically operable upon building up of a predetermined pressure to direct liquid under pressure to said upper cylinder for forcing the piston therein downwardly thereby to transmit increased operating force to the ram through the liquid column between said stem and lower piston, means movable with the ram to automatically actuate the valve means to terminate movement of the ram in each direction of travel, said valve being shiftable manually to initiate movement of the ram in each direction, said control valve means having provision for directing pressure liquid from said reservoir to the small cylinder beneath the piston therein when the ram is being lifted and for trapping a liquid column beneath said small piston to retain the ram in the raised position following a press operation.

2. An hydraulic press comprising a unitary housing including an upper relatively large cylinder and a lower relatively small cylinder, a reservoir surrounding the small cylinder and having a supply of liquid therein, a ram adapted to be actuated by liquid under pressure, a piston in said upper cylinder having a stem extending into and slidably fitting said lower cylinder, a piston connected to said ram and disposed in said lower cylinder and constantly spaced from said stem by a liquid column, and longitudinally shiftable control valve means for controlling actuation of the ram and operable to first direct liquid under pressure only to said lower cylinder between said stem and the lower piston for effecting rapid movement of the ram toward the work and then automatically operable upon building up of a predetermined pressure to direct liquid under pressure to said upper cylinder for forcing the piston therein downwardly whereby to transmit increased operating force to the ram through the liquid column between said stem and lower piston, means movable with the ram to automatically actuate the valve means to terminate movement of the

ram in each direction of travel, said valve being shiftable manually to initiate movement of the ram in each direction, said control valve means including devices for releasing pressure liquid from above the large piston and directing it into said reservoir.

3. An hydraulic press comprising a unitary housing including an upper relatively large cylinder and a lower relatively small cylinder, a reservoir surrounding the small cylinder and having a supply of liquid therein, a ram adapted to be actuated by liquid under pressure, a piston in said upper cylinder having a stem extending into and slidably fitting said lower cylinder, a piston connected to said ram and disposed in said lower cylinder and constantly spaced from said stem by a liquid column, and longitudinally shiftable control valve means for controlling actuation of the ram and operable to first direct liquid under pressure only to said lower cylinder between said stem and the lower piston for effecting rapid movement of the ram toward the work and then automatically operable upon building up of a predetermined pressure to direct liquid under pressure to said upper cylinder for forcing the piston therein downwardly whereby to transmit increased operating force to the ram through the liquid column between said stem and lower piston, means movable with the ram to automatically actuate the valve means to terminate movement of the ram in each direction of travel, said valve being shiftable manually to initiate movement of the ram in each direction, said control valve means including devices for releasing pressure liquid from above the large piston and directing it into said reservoir, and means providing constant free communication between the reservoir and the space beneath the large piston.

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