Dec. 20, 1949 D. CROSS 2,491,551

HYDRAULIC PRESS

Filed Feb. 10, 1945

Fig. 1.

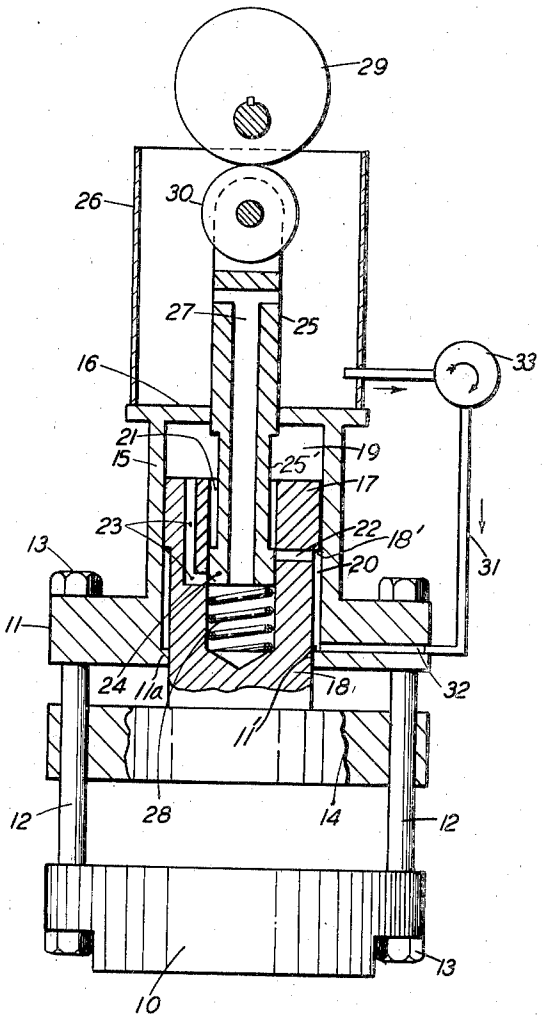


Fig. 2.

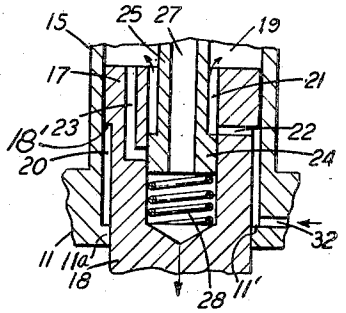
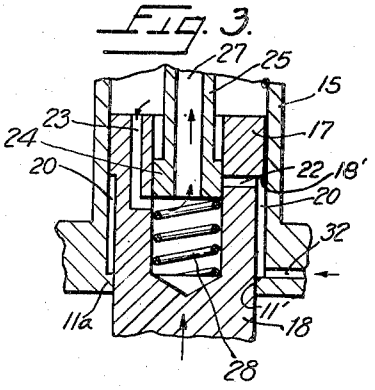


Fig. 3.



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Patented Dec. 20, 1949

2,491,551

UNITED STATES PATENT OFFICE

2,491,551

HYDRAULIC PRESS

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Application February 10, 1945, Serial No. 577,254

4 Claims. (Cl. 121—41)

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This invention relates to a hydraulic press.

The principal object of the invention is the provision of improvements in a press of the indicated character, whereby a more accurate control of the fluid is attained, to the end, that a more accurate control of the speed and travel of the ram or platen is achieved.

Other objects and advantages of the invention are that it enables a simplified construction of a press of the character mentioned. The press will be inexpensive to build and maintain. External piping will be reduced to a minimum.

With the foregoing, other objects and advantages will appear when the following specification is read in connection with the accompanying drawing, in which,

Figure 1 is a central vertical sectional view of a hydraulic press embodying the features of the invention, the platen being shown in its up position, and the control valve being closed.

Figure 2 is a fragmentary vertical sectional view showing the parts of the valve disposed to allow flow of the fluid to cause the downward stroke of the platen.

Figure 3 is a view similar to Figure 2, but showing the parts of the valve disposed to allow flow of the fluid to cause the upward stroke of the platen.

Referring to Figure 1, it will be seen the hydraulic press includes a bed 10 on which the work to be pressed or operated upon may rest. A head 11 is arranged above the bed 10 in spaced relation thereto, the head 11 being supported in said relation by a plurality of vertical shouldered rods 12 and nuts 13. A platen or ram 14 is mounted for up and down or reciprocable movement on the rods 12 which serve as guides for this purpose. The platen 14 is arranged between the bed 10 and the head 11 so as to move up and down with respect to the upper flat surface of the bed. While I have shown and described the press as being vertically disposed the same may be arranged horizontally if desired without departing from the spirit of my invention.

A hydraulic system, according to the present invention, is provided to operate the platen 14. This system is one which controls the flow of fluid in such manner that the speed and travel of the platen may be more accurately controlled than heretofore in machines of the stated character. The hydraulic system includes an upright cylinder 15 on the head 11 integral therewith. The cylinder 15 is closed at its top end by a wall or head 16 and is open at the opposite or lower end through the head 11. A piston or plunger 17 is slidable in the cylinder, and said piston is connected with the platen 14 below the head 11 at its lower end, to cause the platen to move in unison with the piston. The inside cylindrical surface of the cylinder 15 extends through the head 11. The lower part of the piston 17 projects downwardly through the head 11 which provides the lower end wall or head of the cylinder.

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The plunger 17 is of suitable size to provide a main fluid chamber 19 at the top of the piston and a fluid chamber 20 at the bottom of the cylinder. To this end the plunger 17 is made thick enough to fill the cylinder 15 at its upper end; and between this end and the platen 14 is a reduced section or neck 18. At the inner end of the neck is an annular shoulder 18'. The opening through the head 11 has a rim 11a projecting inward against the section 18 and presenting a shoulder 11'. The chamber 20 thus surrounds the piston 17 and is between the shoulders 18' and 11'. The capacity of the chamber 19 is larger than the chamber 20.

The piston 17 has a central bore 21 therein. A horizontal passage or duct 22 in the piston establishes communication between the chamber 20 and the bore 21. An L-shaped passage 23 in the piston establishes communication between the chamber 19 and the lower portion of the bore 21. The duct or passage 22 opens into the bore 21 at a point above where the passage 23 opens into the bore 21.

A slidable valve member 24 operates within the bore 21. The valve member has a stem 25, reduced in diameter for a portion of its length, as at 25'; to leave a space around the bore above the valve member serving as an annular passage communicating with the chamber 19, and capable of communicating with the chamber 20 through the passage or duct 22, by reason of the downward movement of the valve member 24. The stem 25 extends upwardly through the wall 16 into a fluid or liquid supply tank or reservoir 26 on the cylinder 15. Extending through the valve member 24 and its stem 25 is a duct or passage 27 which opens outwardly at opposite sides of the stem near its upper end. The passage 27 communicates with the bore 21. The valve member 24 is acted on by a helical spring 28 arranged at the bottom of the bore 21 to cause the upward return movement of the valve member in conjunction with suitable motion transmission means, which in the present instance includes a cam 29 which acts on a roller 30 on the upper end of the stem 25. The cam 29 and spring 28 cause the valve member 24 to reciprocate, and with the piston 17 said valve member constitutes valve means to control the flow of the fluid in a manner to be explained.

The hydraulic system also includes a conduit in the form of a pipe 31 connecting the interior of the tank 26 near the bottom with a duct or passage 32 in the head 11. The passage 32 leads to the chamber 20 at the bottom thereof. A pump 33 is connected in the pipe 31 to draw fluid from the tank 26 and deliver it to the chamber 20 under pressure of the degree required.

In Figure 1 the parts are in a neutral relationship. The cam 29 has stopped rotating at top dead center. The spring 28 exerts upward pressure on the valve member 24 and in coaction with the cam holds the valve member in a neutral position in which it blocks both passages 22 and 23. Then the platen 14 is in its up or retracted position, as shown.

When the cam 29 is put into operation while the parts are in the relationship shown in Figure 1, the valve member 24, which is at the top of its stroke, will be moved downwardly by the cam 29 acting on the roller 30. This will compress the spring 28. Passage 22 will be opened and thereby connects the main chamber 19 with the chamber 20. Passage 23 will remain closed. The main area of the chamber 19 being much larger than the area of the chamber 20, the piston 17 is caused to move downwardly under pressure of the fluid in response to the operation of the pump 33. The fluid is drawn from the tank 26 by the pump which delivers it to the top of the piston 17 through the pipe 31 at the outlet side of the pump, passage 32, chamber 20, passage 22, bore 21 to the chamber 19, as shown in Figure 2. The piston 17 closely follows the valve member 24 until the latter has been moved to the limit of its downward stroke wherein the valve member blocks the passage 22, and so shuts off the flow of fluid from the chamber 20, as shown in Figure 3. The piston 17 being forced downwardly moves the platen 14 likewise to carry out a pressure operation on work placed on the bed 10.

As the cam 29 rotates past bottom dead center, the spring 28 which is compressed moves the valve member 24 upwardly with the roller 30 in contact with the cam. In the upward movement of the valve member the passage 23 will be opened thereby connecting the chamber 19 with the bore 21, passage 27 and the tank 26. This causes the piston 17 and the platen 14 to move upwardly to the limit of their upward stroke, because there is some pressure in the chamber 20 and none in the chamber 19.

The cam 29 stopped at top dead center, stops the valve member 24 in an up position. The piston 17 continues to move upwardly until the pasage 23 is blocked by the valve member, thereby trapping fluid in the main chamber 19. Pressure builds up in the chamber 19, until the forces due to pressure in chamber 19 and the stress in the spring 28 are equal, and as a result, the piston 17 stops in the up retracted position, as shown in Figure 1. The piston 17 always moves to match the speed and position of the valve member 24, and its movement can be accurately controlled by any desired motion determined by the pattern of the cam 29.

The spring 28 also serves to hold the valve member 24 in reverse or up position, so that when the motor and pump are started, the press will rise to its up position. When the ram 17 reaches its uppermost or neutral position as shown in Figure 1, the pump 33 is bipassed or unloaded by any well known means, such as a valve, or by using a radial piston pump moved to neutral position to maintain the pressure in the chamber 20 at all times to replace slippage. This is common practice in this art.

From the foregoing it will be understood that the invention herein described embodies a mechanically and hydraulically operated valve means for controlling the flow of fluid in such manner that a ram or platen may be operated accurately with effectual speed and desired travel.

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

1. A hydraulic press comprising a cylinder having one end closed and the other open, a plunger in the cylinder projecting through the open end thereof, a platen secured to the projecting end of the plunger, the cylinder and plunger being shaped to provide a chamber between the plunger and the inside surface of said cylinder, said chamber terminating adjacent the open end of the latter, said press having a duct communicating with said chamber and connected to a supply of motive fluid, the plunger also having a bore extending into it from the inner end, a valve in said bore, a stem for the valve projecting through the closed end of the cylinder, said stem being of less diameter than the bore to define an annular passage around the stem in said bore adjacent the inner end of the plunger, said stem also having a passage through the same and the valve to connect the inner end of the bore to the exterior of the cylinder, means in the bore to resist the movement of the valve inward thereof, the plunger also having a duct connecting the bore between its ends to said chamber, and another duct opening through the inner end of the plunger and connected to said bore between the inner end thereof and the first-named duct, and means for actuating said valve to move inward in said bore to put the annular passage in the bore around the stem into communication with said chamber, the motive fluid then being permitted to enter the cylinder and force the plunger out till the second duct establishes communication between the bore and the interior of the cylinder to permit the fluid in the cylinder to exhaust through the passage in said stem to the exterior of the cylinder.

2. The hydraulic press according to claim 1, which also has a reservoir for the motive fluid connected to the closed end of the cylinder.

3. The hydraulic press according to claim 1, in which the chamber between the plunger and the interior surface of the cylinder is formed by a section of the plunger of less thickness than the inner end thereof, said end presenting a shoulder which forms one end of said chamber, and the opposite end of the cylinder having an inward extending rim also presenting a shoulder around the reduced section of the plunger and forming the opposite end of said chamber.

4. The hydraulic press according to claim 1, which also has a reservoir for the motive fluid connected to the closed end of the cylinder and surrounding the outer portion of the valve stem, and in which said chamber is formed by a section of the plunger of less thickness than the inner end thereof, the plunger having a peripheral shoulder adjacent said end forming one end of the chamber, and the cylinder having an inward projecting rim presenting another shoulder and forming the other end of said chamber.

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