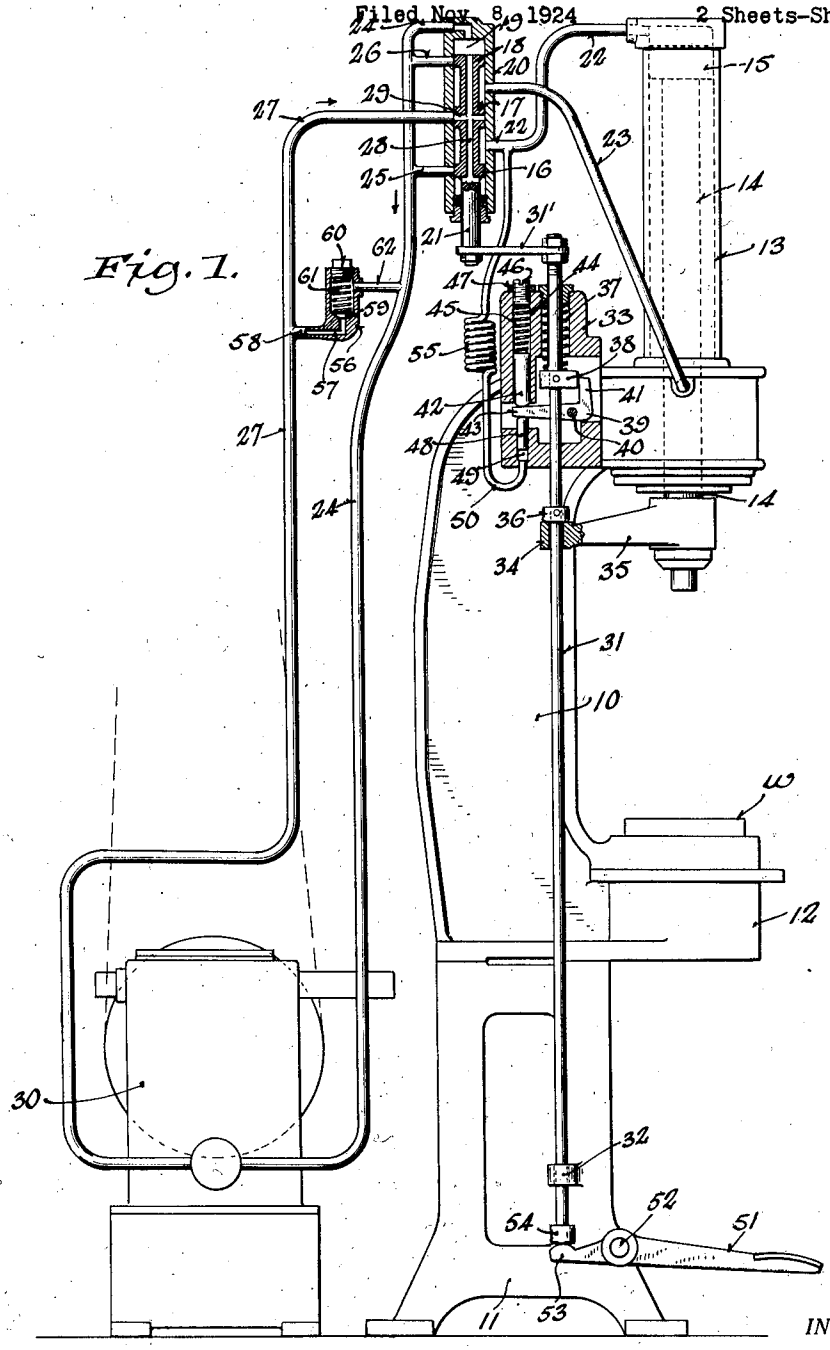
Nov. 20, 1928. 1,692,771

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HYDRAULIC PRESS

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Fig. 1.




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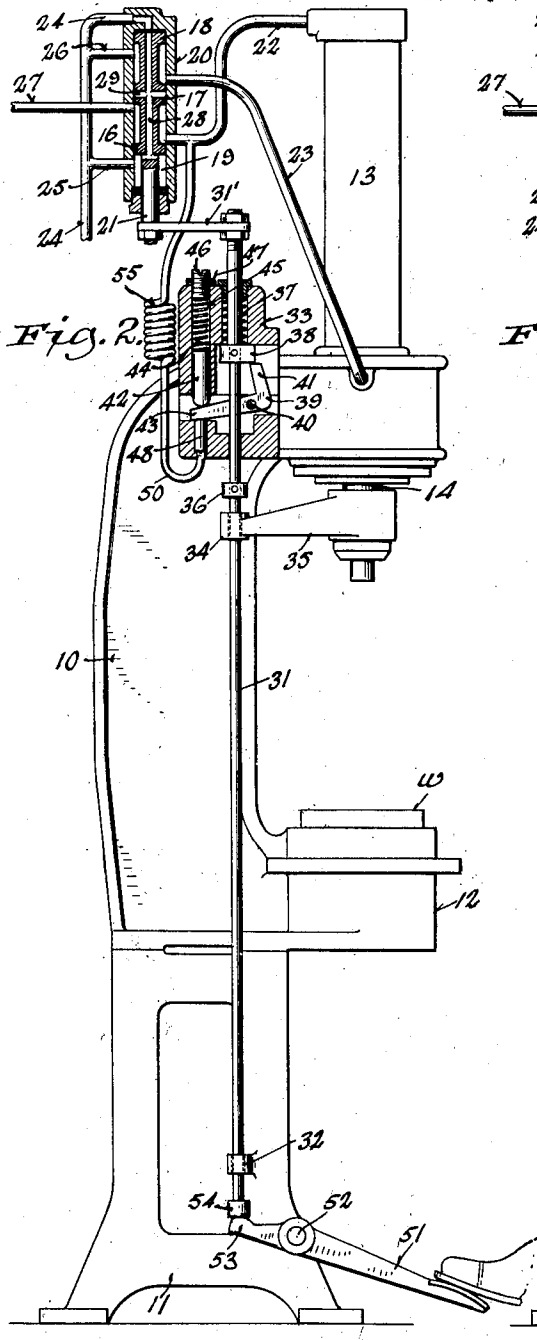


Fig. 2.

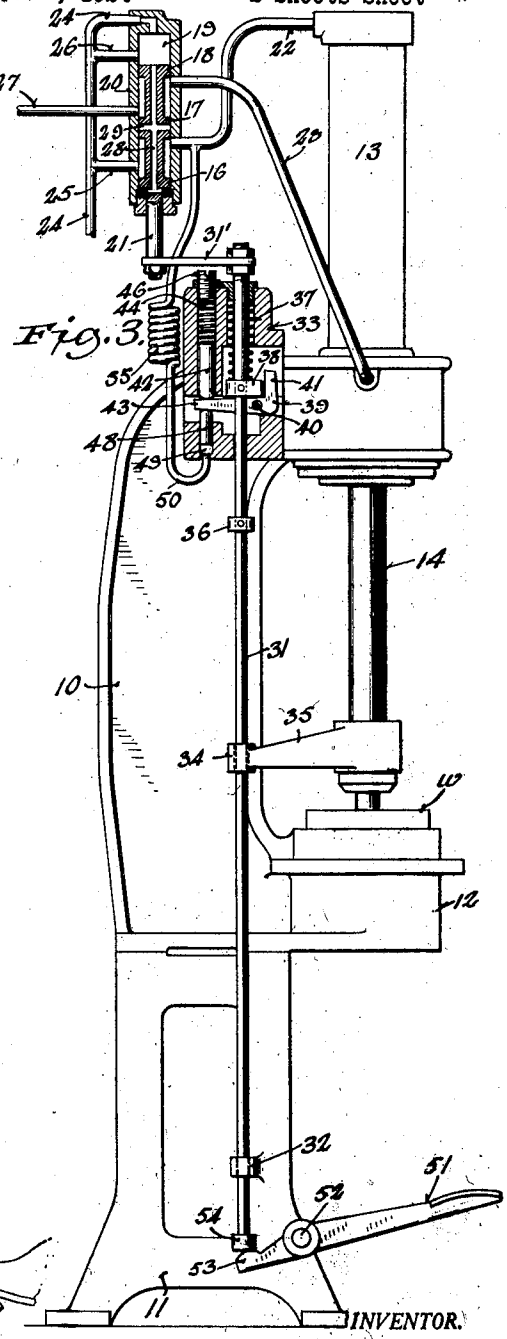


Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## HYDRAULIC PRESS.

Application filed November 8, 1924 Serial No. 748,634.

This invention relates to hydraulic presses and the like, and particularly to control mechanism therefor.

In some commercial operations it is highly desirable that the machine employed be capable of exerting a certain predetermined pressure upon the work and then to automatically withdraw therefrom, so as to permit the replacement of work in the machine. Such is the case, for instance, in assembling operations wherein the predetermined pressure is required to effect proper assembly of the parts operated upon.

One object of the present invention is the provision of a hydraulic press of control mechanism by which the above operation may be obtained.

Other objects and advantages will appear from the following description of an illustrative embodiment of this invention.

In the accompanying drawings:

Figure 1 is a view in elevation, partly in section, of a hydraulic press constructed in accordance with the present invention.

Figures 2 and 3 are similar views illustrating the relative positions of the parts in different operating stages.

The press selected for illustration comprises the conventional C-frame 10, supported upon a base 11, and provided with the usual stationary bed 12 for receiving the work *w*. A power cylinder 13 is fixed in the upper portion of the C-frame in vertical position above the bed 12. The plunger 14 of the press is actuated by a piston 15 reciprocable in the cylinder 13.

In this instance, a four-way valve of appropriate form controls the delivery of fluid to and from the opposite ends of the cylinder 13. The valve shown comprises a piston having three heads 16, 17 and 18, integrally connected and reciprocable as a unit in a cylinder bore 19 of the valve casing 20. The piston valve is controlled by a stem 21 connected thereto and projecting through one end of the casing. A pipe 22 connected with the upper end of cylinder 13 communicates at all times with that portion of the valve casing between the heads 16 and 17 of the valve, and a pipe 23 connected with the lower end of the cylinder 13 communicates at all times with that portion of the valve casing between the heads 17 and 18 of the valve. A fluid discharge pipe 24 communicates at all times with the upper end of the valve casing and is provided with branch pipes 25 and 26 opening into the side of the valve casing and controlled by the heads 16 and 18 of the valve. A fluid supply pipe 27 enters the side of the valve casing at such point as to be controlled by the intermediate head 17 of the valve. A longitudinal duct 28 in the valve maintains communication between the end portions of the valve casing and is intersected by a transverse duct 29 in the head 17 of the valve.

The arrangement is such that when the valve is in the intermediate position shown in Figure 1 fluid delivered through the pipe 27 enters the duct 29 and passes through the duct 28 into the upper end of the valve casing and is discharged through the pipe 24 without entering either of the pipes 22 or 23. This is the position of the valve when the press is at rest. By shifting the valve upwardly into the position shown in Figure 2 the supply pipe 27 is uncovered by the head 17 and communication is established between this pipe and pipe 22 leading to the upper end of the cylinder 13. In the upper position of the valve branch pipe 26 is likewise uncovered by the head 18 and placed in communication with the pipe 23 leading to the lower end of the cylinder. Fluid is thus admitted to the upper end of the cylinder through pipes 27 and 22 and discharged through pipes 23, 26 and 24 to effect a downward travel of the piston and press plunger. By shifting the valve downwardly into the position shown in Figure 3, communication is established between pipe 27 and pipe 23 through the valve casing above the head 17, and communication is established between branch pipe 25 and pipe 22. Fluid is then delivered to the lower end of cylinder 13 through pipes 27 and 23 and discharged from the upper end through pipes 22, 25 and 24 to effect an upward travel of the piston and plunger.

In this instance, pipes 24 and 27 are connected to the intake and discharge sides, respectively, of a pump 30. The pump may be of any appropriate type, that shown being a variable displacement, smooth delivery pump, such as is fully described in my copending application, Serial No. 701,356, filed March 24, 1924.

As above pointed out, the present invention provides for an automatic control by which the press plunger may be caused to advance and apply a predetermined pressure upon the work and then to automatically

withdraw from the work. Although various forms of mechanism for this purpose may be devised, that which will now be described is quite satisfactory. The mechanism shown includes a rod 31 mounted for longitudinal reciprocation in an appropriate bearing bracket 32, carried by the base 11 of the press, and extending upwardly through a block 33 secured to the head of the press. The upper end of this rod is rigidly connected through an arm 31' with the stem 21 of the valve so as to move in unison therewith. Rod 31 extends loosely through the end 34 of a rigid arm 35, fixed to and carried by the press plunger. A collar, adjustably fixed to the rod 31, is arranged to be engaged and lifted by the end 34 of the arm when the plunger approaches the upper limit of its stroke. A coiled compression spring 37, confined within the block 33, surrounds the rod 31, and bears at all times upon a lug 38, fixed to the rod, so as to yieldably press the rod downwardly. A latch 39 is mounted upon a horizontal pivot pin 40 within the block 33 beneath the lug 38. This latch is provided with an upright nose portion 41 adapted to engage beneath and releasably retain the lug 38 in its upper extreme position when the rod 31 has been elevated. A spring pressed plunger 42 within the block 33 bears at all times upon the horizontal tail portion 43 of the latch and tends to rock the latch into lug engaging position. The plunger 42 is pressed by a spring 44, housed within a bore 45 in the block 33 and confined between the plunger and a plug 46 screwed into the upper open end of the bore. The tension of the spring may be varied to best suit the conditions at hand by turning the plug 46. The plug may be fixed in any position of adjustment by a lock nut 47 or the like. A fluid actuated plunger 48, mounted in a bore 49 in the block 33, is arranged to bear upwardly upon the tail portion 43 of the latch. The bore 49 communicates with pipe 22 through a pipe 50.

Any appropriate means, such as a foot lever 51, is provided by which the operator may shift the rod 31. In this instance, the lever 51 is mounted intermediate its ends upon a fixed pivot 52 with its inner end 53 bearing upwardly against the lower end 54 of the rod.

Figure 1 illustrates the position of the several parts when the press is at rest. It will be noted from an inspection of this figure that the press plunger 14 is in its uppermost position, and that the rod 31 is supported in an intermediate position by engagement of the arm 35 beneath the collar 36. The control valve is also in intermediate position, because of its rigid connection 31' with the rod, and fluid delivered by the pump through pipe 27, passes through the valve and back through pipe 24 to the pump without entering pipes 22 or 23 as above explained.

To begin an operating cycle the operator depresses the outer end 55 of the foot lever 51, thereby forcing the rod 31 upwardly against the pressure of spring 37 until the lug 38 thereon has cleared the upright nose portion 41 of the latch 39. When this occurs the latch is rocked by the spring pressed plunger 42 into engaging position beneath the lug 38, as indicated in Figure 2. This upward movement of the rod 31 shifts the control valve into the position shown in this figure, thereby opening comunication between pipes 27 and 22, and between pipes 23 and 24, and causing the piston and plunger to begin a downward or working stroke, as above explained. The plunger 14 continues downwardly until forced against the work. When this occurs the pressure established between the plunger and work is immediately transmitted through the piston 15 to the fluid in the upper end of the cylinder and thence through pipes 22 and 50 to the bore 49. The instant that the pressure in the bore 49 becomes great enough to cause the plunger 48 to rock the latch 39, against the pressure of spring 44, the nose portion 41 is withdrawn from beneath the lug 38, and the rod 31 shifts downwardly, under the influence of spring 37, into the position shown in Figure 3. This action of the rod, of course, shifts the control valve into the position shown in this figure and communication is established between pipes 27 and 23, and between pipes 24 and 22, thereby causing the press plunger to begin its upward or return stroke, as above explained.

The plunger 14 continues its upward or return stroke until the end 34 of the arm 35 has engaged beneath the collar 36 and lifted the rod 31, and consequently the valve, into the intermediate position shown in Figure 1. When this has occurred pipes 22 and 23 are again disconnected from pipes 24 and 27 and the press comes to rest.

Since the fluid pressure necessary to rock the latch 39 into releasing position is dependent upon the pressure exerted by the spring 44, and since this fluid pressure is proportional to the pressure between the plunger and the work, it will be noted that the pressure exerted by the press upon the work may be varied and controlled by adjusting the spring 44.

In some instances, it is desirable to effect a slight delay in the return stroke of the plunger or to control the degree of pressure applied to the work with greater accuracy than is possible with the mechanism thus far described. In such instances provision is made for restricting the flow of fluid through the pipe 50. This is ordinarily accomplished by connecting a coil of small diameter tubing 55 in series with this pipe. This will result in a delayed action of the plunger 48 and a consequent delay in the tripping of the latch 39. By the application of a relief valve to

the fluid supply pipe 27, all danger of excessive pressures, due to this delayed action, is avoided, and by adjusting such valve the pressure to be established between the plunger and work can be very accurately determined. A standard form of relief valve for this purpose is shown in section in Figure 1. It comprises a casing 56 having a passage 57 communicating through pipe 58 with the fluid supply pipe 27. A spring loaded valve 59 controls the flow of fluid through passage 57, and a screw plug 60 is employed for determining the pressure in the spring 61. The casing 56 is preferably connected to the pipe 24 through a pipe 62, so that fluid escaping past the valve 59 may be returned to the pump. By adjusting the plug 60, the maximum pressure in the circuit and consequently the pressure applied by the press plunger to the work may be determined with extreme accuracy.

Various changes may be made in the embodiment of the invention hereinabove specifically described, without departing from or sacrificing any of the advantages of the invention as defined in the appended claims.

I claim:

1. In a hydraulic press the combination of a plunger, fluid actuated means for reciprocating said plunger toward and from the work, means for controlling the direction of movement of said plunger, latch mechanism for releasably retaining said control means in one position to effect movement of said plunger toward the work, and means responsive to the pressure exerted by said plunger upon the work for releasing said latch mechanism to effect movement of said plunger away from the work.

2. In a hydraulic press the combination of a plunger, fluid actuated means for reciprocating said plunger toward and from the work, means for controlling the movement of said plunger, means under the control of the operator for shifting said control means into one position to effect movement of said plunger in one direction, latch mechanism for releasably retaining said control means in said position, and means responsive to the pressure exerted by said plunger upon the work for releasing said latch mechanism to effect movement of said plunger from the work.

3. In a hydraulic press the combination of a plunger, fluid actuated means for driving said plunger, valve mechanism for controlling the direction of movement of said plunger, means under the control of the operator for shifting said valve mechanism to effect movement of said plunger toward the work, latch mechanism for releasably retaining said mechanism in one position, and means responsive to the pressure exerted by said plunger upon the work for releasing said latch mechanism to effect movement of said plunger from the work.

4. In a hydraulic press the combination of a plunger, fluid actuated means for driving said plunger, means responsive to an increase in pressure in said fluid actuated means for reversing the movement of said plunger, and means including a restricted fluid passage for delaying the action of said reversing means.

5. In a hydraulic press the combination of a plunger, fluid actuated means for driving said plunger, valve mechanism for controlling the action of said means, means responsive to an increase in pressure in said fluid actuated means for shifting said valve mechanism to reverse the movement of said plunger, and means including a restricted fluid passage for delaying the action of said last named means.

6. In a hydraulic press the combination of a plunger, fluid actuated means for driving said plunger, means responsive to an increase in pressure in said fluid actuated means for reversing the movement of said plunger, means for delaying the action of said reversing means, and means for preventing an excessive pressure in said fluid actuated means.

7. The combination of a driven member, hydraulic means for driving said member, control means therefor, latch mechanism for releasably retaining said control means in one position, and means responsive to a predetermined change in hydraulic pressure in said hydraulic means for releasing said latch mechanism.

8. The combination of a reciprocable member, hydraulic means for driving said member, reversing mechanism therefor, latch mechanism for releasably retaining said mechanism in one position, and means responsive to an increase in hydraulic pressure in said hydraulic means for releasing said latch mechanism.

9. The combination of a hydraulically actuated member, a pump for supplying a driving liquid thereto, a reversing valve, latch mechanism for releasably retaining said valve in one position, and means responsive to an increase in pressure in said driving liquid for releasing said mechanism.

10. The combination of a driven member, hydraulic means for driving said member, a reversing valve, means under the control of the operator for operating said valve to effect movement of said member in one direction, latch mechanism for releasably retaining said valve in one position, pressure responsive means for operating said latch mechanism to thereby effect operation of said valve to reverse the movement of said member, and means movable with said member and operable to shift said valve into neutral position to thereby bring said member to rest.

In witness whereof, I hereunto subscribe my name this 25th day of October, 1924.

WALTER FERRIS.