Nov. 28, 1933. E. BROCKEL 1,937,007

HYDRAULIC PRESS CONTROL MECHANISM

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Fig. 1.

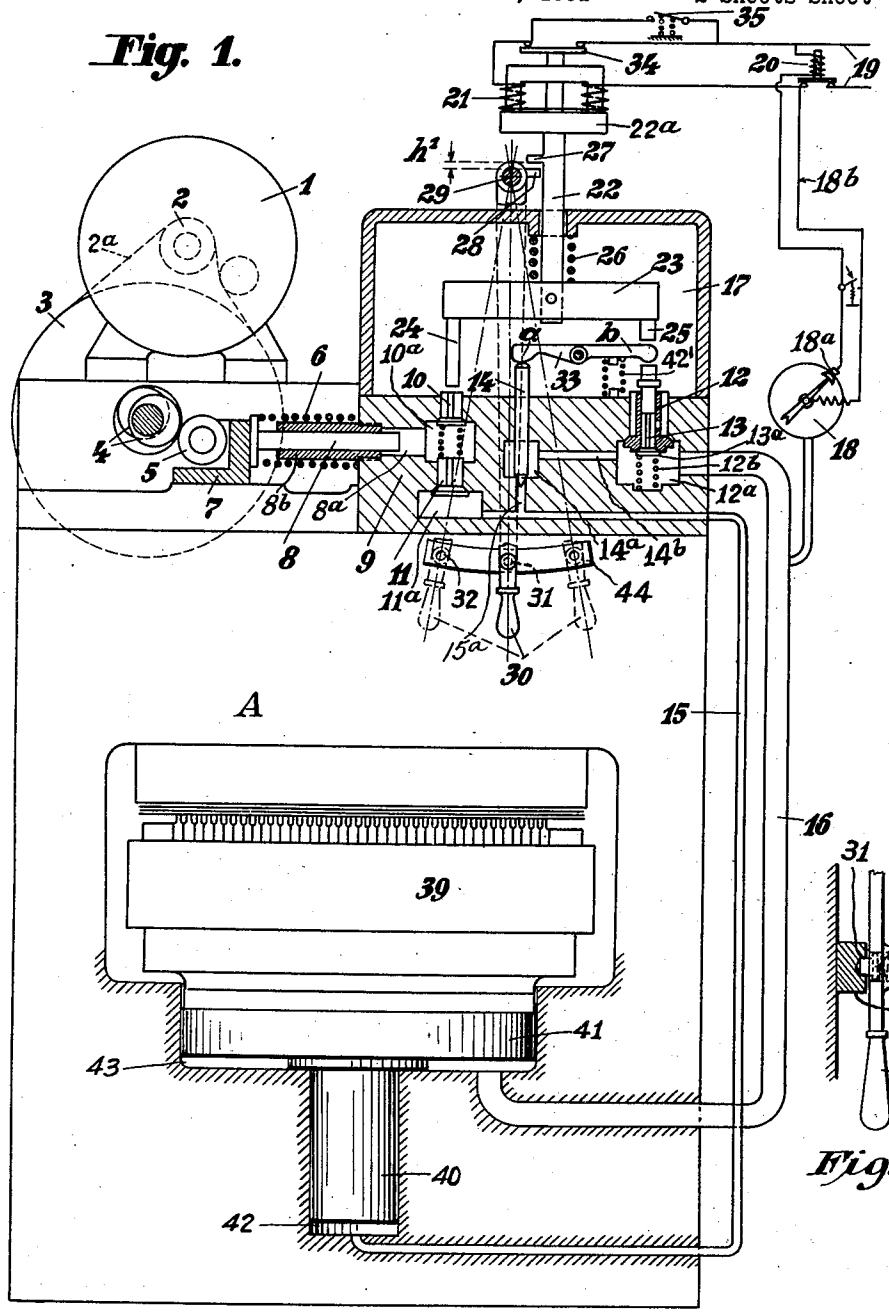


Fig. 3.

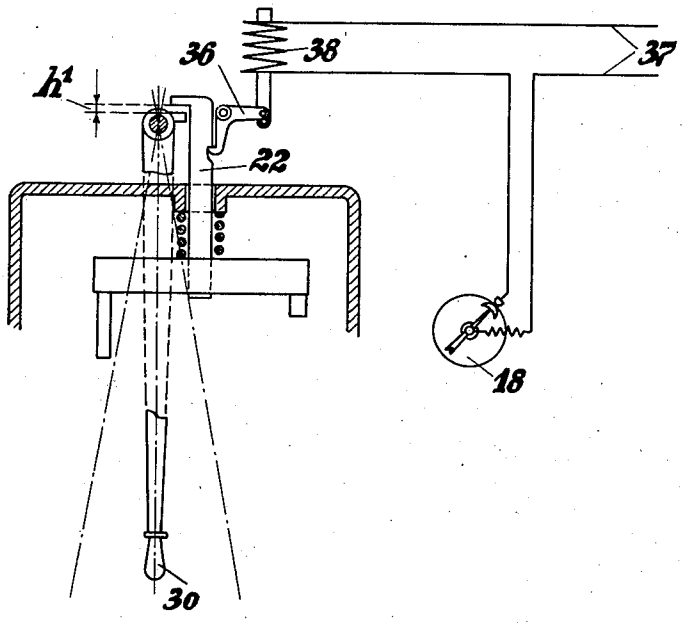
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Fig. 2.



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HYDRAULIC PRESS CONTROL MECHANISM

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7 Claims. (Cl. 138—17)

This invention relates to control means for hydraulic presses such, for example, as matrice molding presses, and has generally in view to provide improved means for controlling the pressure pumps and thereby the applied pressure of such presses.

In a known device for controlling hydraulic presses, a switch gear is provided by means of which the suction valves of the press pump are released when the pump is started and are prevented from closing when the pumping action is stopped. The switch gear is operated by a crank which rotates in harmony with the pump shaft and the gear is inclusive of a pawl which must be released to stop the pumping action, but which is releasable only when the crank is in a single definite position of rotation, electro-magnetic control means for the gear being provided so that upon energization of said means the pawl is released when the crank reaches its said predetermined position of rotation.

One material disadvantage of a device as briefly set forth above is that the pumping action of the pump is not always stopped immediately upon energization of the electro-magnetic control means, inasmuch as the pump may continue to operate for a shorter or longer period of time, sometimes completing even as much as substantially a complete revolution, after actuation of the electro-magnetic control means and prior to release of the pawl. Thus, even though the electro-magnetic control means is energized either manually or by means of a manometer at the time the desired pressure is attained, an excess pressure may be produced inasmuch as only a partial revolution of a pump having a plurality of cylinders and pistons may produce considerable excess pressure.

Another material disadvantage of a device as described is that the sequence of operations of its parts, that is, starting the pump, stopping the pumping action, and lowering the press table cannot be varied. Consequently, in case the amount of the pressure applied to the press is perceived to be too low for example, it is necessary to lower the table before the device can be adjusted to obtain a higher applied pressure.

Accordingly, one of the special objects of the present invention is to provide a control means for hydraulic presses which means is effective immediately upon initiation of operation thereof to stop the pumping action of the pump, whereby excess pressures may be avoided.

Another special object of the invention is to provide a control means embodying a construction whereby the applied pressure may be varied at any time during operation of the press, thus to avoid the inconvenience and loss of time incident to lowering the press table in order to change the applied pressure as is necessary in the case of the known type of control means heretofore mentioned.

With the foregoing and various other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the drawings, wherein like characters of reference denote corresponding parts in the different views:

Figure 1 is a schematic side elevation, partly in section, showing a hydraulic press provided with control means in accordance with one practical embodiment of the invention.

Figure 2 is a fragmentary view similar to Figure 1 illustrating an alternative embodiment of the invention; and

Figure 3 is a detail sectional view showing the holding means for the actuating lever of the control means.

Referring to the drawings in detail, A designates generally a hydraulic press inclusive of a table 39 having relatively small and large pistons 40, 41, respectively, operating in cylinders 42, 43, respectively, the smaller cylinder being provided to receive liquid under pressure for the purpose of quickly elevating the table to an operative position, and both cylinders, but primarily the larger cylinder, being provided to receive liquid under pressure for the purpose of completing a molding operation or the like after the table has been elevated to an operative position by liquid under pressure admitted to the smaller cylinder.

Mounted on or adjacent to the press A is a combined pump and valve casing or body 9 at the top of which is a vessel or container 17 for liquid. Provided in the casing or body 9 near opposite sides thereof are two valve chambers 10*a* and 12*a* which are connected with the vessel 17 by passageways controlled by check valves 10 and 12, respectively, which valves open in the direction of the valve chambers. Also provided in the casing or body 9 below the valve chamber 10*a* is a valve chamber 11*a* which is connected with the valve chamber 10*a* by a passageway controlled by a check valve 11 which opens in the

direction of the valve chamber 11*a*. A fourth valve chamber 14*a* is provided in the casing or body 9 between the valve chambers 10*a*, 12*a* and is connected with the chamber 12*a* by a duct 14*b* and with the chamber 11*a* by a duct 15*a* which duct opens through one side of the casing or body 9 and is connected by a pipe 15 with the bottom of the smaller press cylinder 42. An upwardly opening valve 14 controls flow of liquid from the duct 15*a* into the chamber 14*a* and from said chamber through the duct 14*b* to the chamber 12*a*, and, as shown, said valve 14 projects upwardly above the casing or body 9 into the vessel 17.

The valve 12 which is relatively large, has a passageway formed therethrough which is controlled by a smaller valve 13*a* the stem 13 of which extends upwardly through the valve 12 into the vessel 17, said valve 13*a* opening in the same direction as valve 12 and being maintained normally closed against the valve 12 and the latter valve being maintained normally closed against its seat by a spring 12*b*. At 16 is designated a pipe which connects the valve chamber 12*a* with the bottom of the larger press cylinder 43.

Formed in the casing or body 9 and in communication at its inner end with the valve chamber 10*a* is a chamber 8*a* which accommodates the inner end portion of a pump plunger or piston 8, which plunger or piston is slidably guided in a sleeve 8*b* rigidly secured to the casing or body 9 and is urged constantly outwardly by a spring 6. At the outer end of the plunger or piston 8 is a crosshead 7 and carried by this crosshead is a roller 5 which cooperates with a cam 4 on a shaft 4*a* which is suitably driven as, for example, by means of an electric motor 1 having a pulley 2 connected by a belt 2*a* with a pulley 3 on said shaft 4*a*. Thus, when the motor 1 is in operation the pump plunger or piston 8 is reciprocated by reason of being forced inwardly by the cam 4 and outwardly by the spring 6, which obviously results in liquid being taken from the vessel 17 through the passageway controlled by the valve 10 and forced under pressure through the passageway controlled by the valve 11 into the valve chamber 11*a*.

Bridging the upper ends of the valves 14 and 13*a* is a lever 33 which is pivoted intermediate its ends *a* and *b* as shown, while cooperating with said lever is a spring 42 which tends constantly to rock the lever in a direction to cause the end *a* thereof to exert a downward force on the valve 14 and to maintain said valve normally closed. In the normal position of said lever, that is, when the end *a* thereof is engaged with the valve 14 and said valve is closed, the other end *b* of the lever is suitably spaced above the upper end of the stem 13 of the valve 13*a* so that the valve 14 may be opened without opening the valve 13*a*.

Slidable through an opening in the top of the vessel 17 is a rod 22 which carries, above the vessel, an armature 22*a* and, within the vessel, a cross bar 23 having a pair of depending pins 24 and 25 which respectively overlie the valve 10 and the end *b* of the lever 33. The armature 22*a* cooperates with an electro-magnet 21, and when said magnet is energized the rod 22 and the cross bar 23 are held in an elevated position with the bottoms of the pins 24 and 25 suitably spaced above the valve 10 and the end *b* of the lever 33, respectively, whereby the valves 10, 12 and 13*a* are permitted to close. At 26 is designated a spring which tends constantly to force the rod 22 downwardly and which becomes effective to force said rod downwardly when the electro-magnet 21 is deenergized.

Pivoted as at 29 adjacent to the rod 22 is a lever 30 which has a normal position as illustrated in full lines in Figure 1 and which is manually swingable between the dotted line positions shown in said figure, said lever operating over a segment 44 having recesses 31 and 32 to receive a spring pressed pin 43' carried by the lever whereby the latter may be retained in any one of its different operative positions.

On the lever 30 is a lug 28 which extends towards the rod 22 and which underlies a lug 27 projecting laterally from said rod, the arrangement of said lugs being such that when the rod 22 is held in its elevated position by the magnet 21 and the lever 30 is in its normal vertical or intermediate position as shown by full lines in Figure 1 the lugs are spaced apart an amount *h'* such that, upon deenergization of the magnet, the rod 22 is halted in its downward movement by the lug 28 only after the pin 24 has engaged the valve 10 and prevents the same from closing, but before the pin 25 is moved so far downwardly as to prevent closing of the valves 12, 13*a*.

Connected with the pipe 16 is a manometer 18 inclusive of a suitable switch 18*a* which becomes effective to close a relay circuit 18*b* when a certain predetermined pressure has been built up in the pipe 16 and below the press piston 41. The circuit 19 of the electro-magnet 21 is under the control of a switch 20 in the relay circuit 18*b*, the switch 20 being normally closed to maintain the circuit 19 normally closed and being opened to open the circuit 19 when the relay circuit is closed. The circuit 19 also is under the control of a switch element 34 carried by the rod 22, said switch element 34 closing the circuit when the rod is in its elevated position and opening the circuit when the rod descends. At 35 is designated a switch by means of which the contacts in the circuit 19 with which the switch element 34 cooperates may be bridged when the rod 22 is lowered and the switch element 34 is spaced from said contacts.

Assuming the press table to be in a lowered position, the circuit 19 of the electro-magnet 21 to be closed with said magnet holding the rod 22 in its elevated position and the lever 30 to be in its normal intermediate position, the operation of the mechanism is as follows: Operation of the pump causes liquid to be taken from the vessel 17 and forced through the pipe 15 beneath the smaller press piston 40, thereby to quickly elevate the press table to any operative position. During upward movement of the press table liquid is sucked through the valve 12 into the pipe 16 so that said pipe and the larger press cylinder 43 are maintained flooded with liquid. The spring 42' is sufficiently strong to hold the valve 14 closed against the opening pressure exerted thereagainst by the pumped liquid during elevation of the table 39 inasmuch as only a relatively low pressure is required to lift the table, so that during lifting of the table liquid does not flow from the duct 15*a* into the valve chamber 14*a*. However, when the table 39 reaches an elevated position in which its further upward movement is resisted as the actual molding or pressing operation begins, the pressure of the liquid in the duct 15*a* obviously is increased, with the result that the spring 42' is overcome by the pressure of the liquid against the valve 14 and said valve is opened, admitting the pumped liquid through the duct 14*b* into the valve chamber 12*a*, the pipe

16 and the press cylinder 43 below the larger piston 41. When the valve 14 is opened the end *b* of the lever 33 is swung downwardly against the stem of the valve 13*a*, but said valve is not opened due to the relative lengths of the lever arms *a* and *b* being such that a relatively weak spring 12*b* is effective to hold the valves 12, 13*a* closed against a relatively high pressure exerted upon the valve 14. At the same time the pressure exerted by the lever on the valve 13*a* is such that only a relatively slight additional pressure is necessary to open said valve. The pumping continues until the desired predetermined pressure has been built up below the table 39, but immediately the predetermined pressure has been attained the manometer 18 by means of its switch 18*a* closes the relay circuit 18*b* with the result of opening the switch 20 of the circuit 19 and causing deenergization of the electro-magnet 21. Immediately upon deenergization of the electro-magnet 21 the armature 22*a* is released and the rod 22 is forced downwardly by the spring 26 until the lug 27 engages the lug 28. Thereby the pin 24 is caused to engage the valve 10 and to prevent said valve from closing, thus immediately stopping the pumping action of the pump, although the pump may continue to operate idly. There is no escape for the liquid under pressure acting against the press table 39 and therefore the table may be maintained under pressure as long as may be desired. On the other hand, to release the pressure and to permit the press table to move downwardly all that is required is to manually move the lever 30 to the left hand dotted line position shown in Figure 1. When this is done the lug 28 is moved downwardly and the rod 22 is permitted to move further downwardly under the influence of the spring 26, whereupon the pin 25 engages the end *b* of the lever 33 and forces the same downwardly with the result of opening the valve 13*a*. This permits escape of the liquid under pressure from the pipes 15 and 16 back into the vessel 17 whereupon the table 39 gravitates to its normal power position. In this connection, due to the pressure exerted by the lever 33 on the valve 13*a*, only a relatively weak spring 26 is required to move the rod 22 downwardly to effect opening of the valve 13*a*. Consequently, the lever 30 is easily swingable to the right from its left hand position illustrated in Figure 1 to restore the mechanism to an operative status following release of the pressure beneath the pistons 40, 41.

When the pressure beneath the pistons 40, 41 has been released the manometer 18 operates to again open the relay circuit 18*b* thereby to close the circuit 19 of the electro-magnet 21 at the switch 20. Consequently, all that is required to restore the mechanism to an operative status is to swing the lever 30 to the right hand dotted line position shown in Figure 1. When this is done the lug 28 operates under the lug 27 to lift the rod 22 until the switch element 34 completes closing of the circuit 19 and the armature 22*a* is engaged and held by the magnet 21, whereupon the lever is returned to its normal intermediate full line position. The valve 10 then is permitted to close and the spring 42 operates to close the valve 14 whereupon the operation described may be repeated. Obviously, instead of manually lifting the rod 22 by means of the lever 30 the magnet 21 may be employed to accomplish the same purpose simply by closing the normally open switch 35.

Referring now to Figure 2 of the drawings, it will be observed that the rod 22 is held in an elevated position by means of an intermediately pivoted lever 36 one arm of which is engaged in a notch of the rod and the other arm of which is connected with the core of a solenoid winding 38 in a circuit 37 corresponding to the circuit 19 shown in Figure 1 of the drawings. The circuit 37 is normally open but includes a manometer controlled switch so that it is closed when a predetermined pressure is attained. When the winding 38 is deenergized the lever 36 is in a position holding the rod 22 against downward movement, but when the circuit 37 is closed and the winding 38 is energized the solenoid core operates to swing the lever 36 to release the rod 22. In other respects the mechanism is or may be the same as illustrated in Figure 1 and has or may have the same mode of operation as the mechanism illustrated in Figure 1.

I claim:

1. In combination, a hydraulic press inclusive of a member to be actuated by liquid under pressure, a vessel to contain liquid for actuating said member, a pump for taking liquid from said vessel and delivering it under pressure to actuate said member, a valve controlling the pumping action of said pump, a second valve controlling release of the liquid after its pressure has been raised by said pump, a normally restrained member operable when released to hold said first mentioned valve in a position to stop the pumping action of the pump, means to release said member when the pump has developed a desired pressure of the liquid, said normally restrained member being effective to open the pressure relief valve by continued movement after it has cooperated with the pump valve to stop the pumping action of the pump, and means to stop said normally restrained member following release thereof after the same has stopped the pumping action of the pump and prior to opening of the relief valve, said stop means being manually movable to a position to permit continued movement of the normally restrained member to open the relief valve.

2. The combination as set forth in claim 1 in which the stop means also is manually movable to another position to return the normally restrained member to its original position.

3. The combination as set forth in claim 1 in which the normally restrained member is held normally restrained by electro-magnetic means.

4. The combination as set forth in claim 1 in which the normally restrained member is held normally restrained by electro magnetic means and in which a manometer controlled switch controls said electro-magnetic means.

5. The combination as set forth in claim 1 including means whereby the pressure of the pumped liquid is utilized to permit opening of the relief valve against the pressure of the pumped liquid by a pressure considerably less than that of the pumped liquid.

6. In combination, a hydraulic press inclusive of a member to be actuated by liquid under pressure, a vessel to contain liquid for actuating said member, a pump for taking liquid from said vessel and delivering it under pressure to actuate said member, a valve controlling the pumping action of said pump, a second valve controlling release of the liquid after its pressure has been raised by said pump, a normally restrained member operable when released to hold said first mentioned valve in a position to stop the pumping action of the pump, means to release said

member when the pump has developed a desired pressure of the liquid, said normally restrained member being effective to open the pressure relief valve by continued movement after it has cooperated with the pump valve to stop the pumping action of the pump, a stop on said normally restrained member, a pivoted lever having a normal intermediate position and having a stop engageable by the first mentioned stop when the normally restrained member is released and when the lever is in its normal position to limit movement of the released normally restrained member after the same has stopped the pumping action of the pump and prior to opening of the relief valve, said lever being manually swingable from its normal intermediate position to a position to permit sufficient continued movement of the normally restrained member to open the relief valve and being also swingable to another position to return the normally restrained member to its normal position.

7. The combination as set forth in claim 6 including an intermediately pivoted lever having one arm thereof interposed between the relief valve and the normally restrained member and its other arm cooperating with a valve which is opened by the pressure of the pumped liquid whereby the normally restrained member is required to exert only a relatively minor force on the relief valve to open the same against the pressure of the pumped liquid.

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