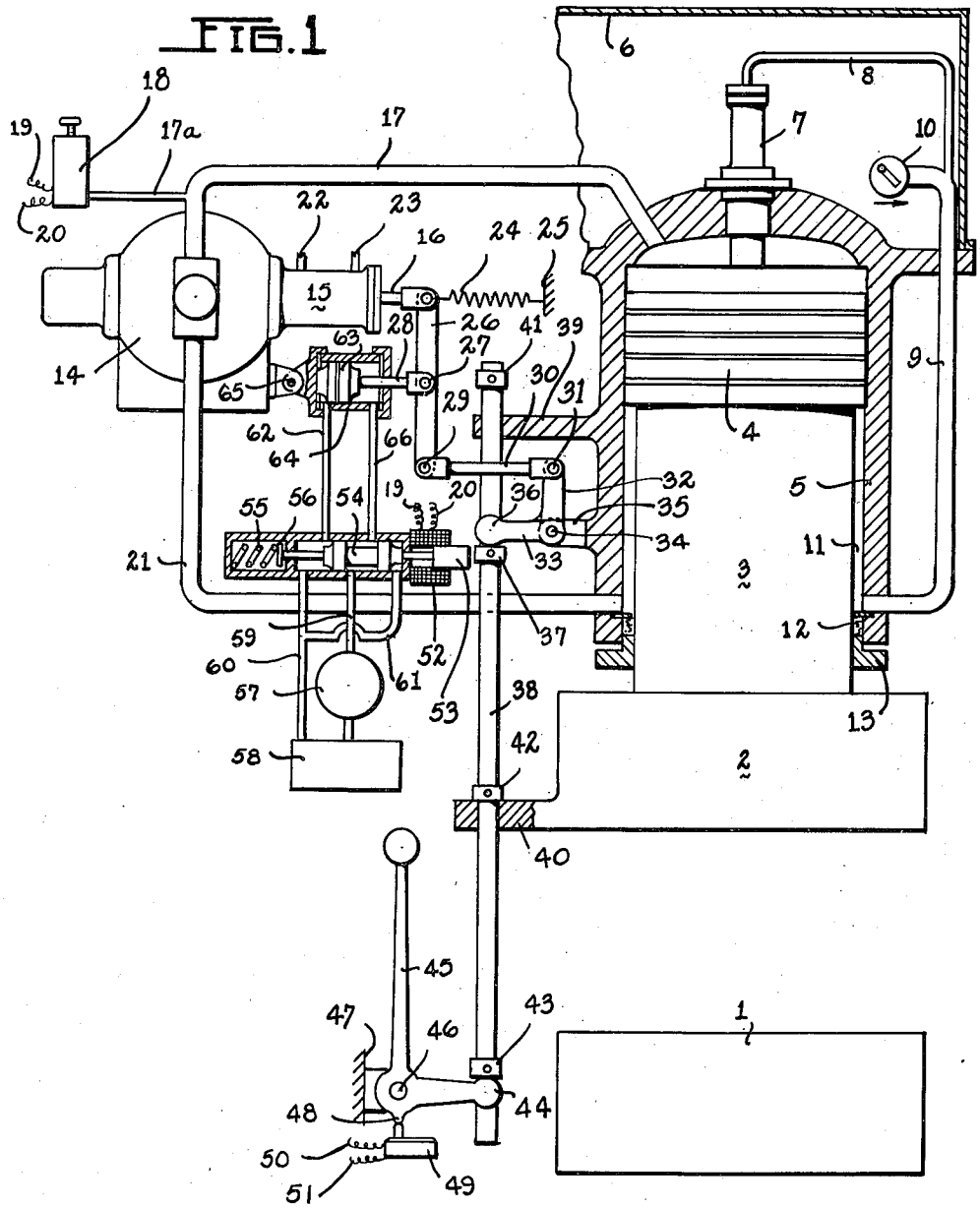
April 5, 1949. H. F. MacMILLIN ET AL 2,466,604

PRESS REVERSING LINKAGE SYSTEM

Filed Nov. 6, 1944 2 Sheets-Sheet 1

FIG. 1



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FIG. 2

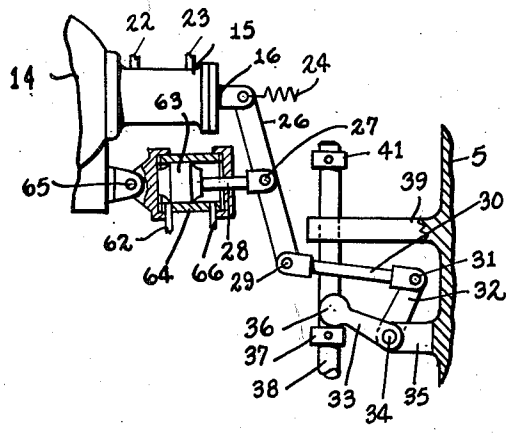


FIG. 3

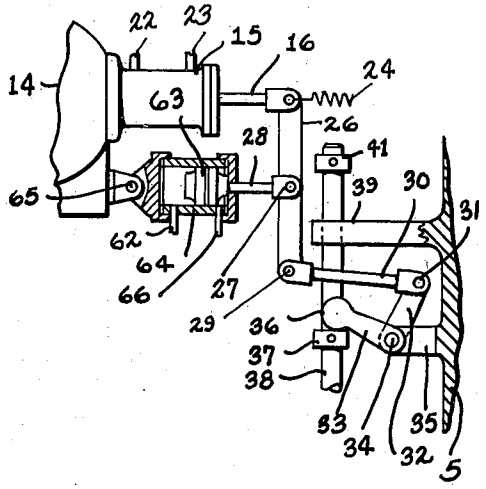


FIG. 4

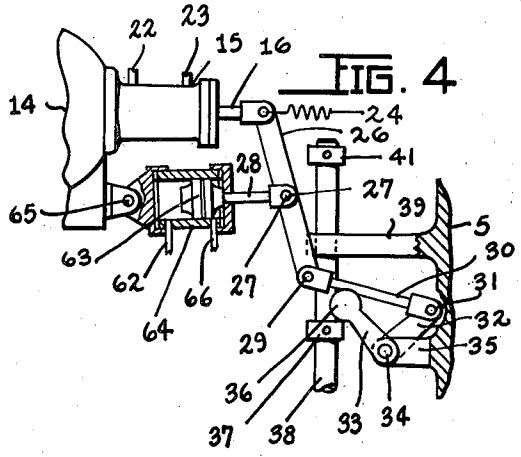


FIG. 5

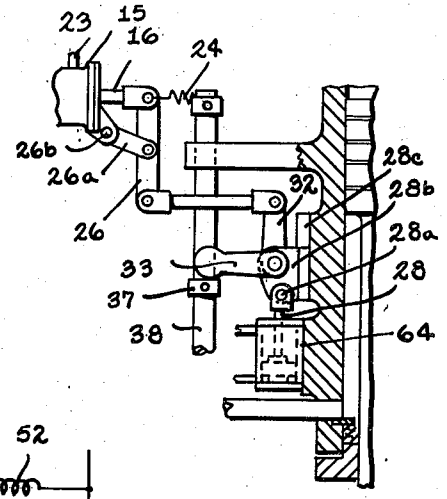
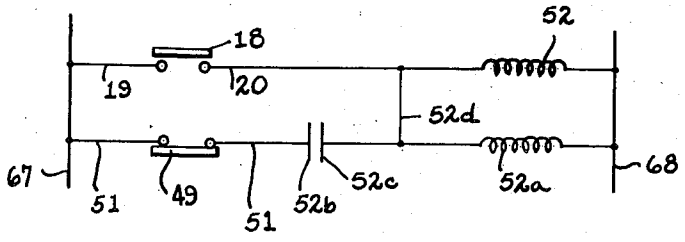


FIG. 6



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PRESS REVERSING LINKAGE SYSTEM

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4 Claims. (Cl. 103—38)

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Our invention relates to hydraulic presses and controls therefor and particularly hydraulic presses utilized for the forging of metals.

It is the object of our invention to provide a system, without control of the operator, of automatically withdrawing the pressing platen from the hot work piece to prevent the latter from being cooled by the conduction of heat through the platen.

It is an object of our invention to provide means of accomplishing the foregoing object such that the withdrawal of the platen does not depend upon the judgment of the operator.

It is a further object of our invention to provide a hydraulically actuated fulcrum for an actuating linkage which reverses a pump connected in a closed circuit with a press platen.

It is an object to provide a supplementary hydraulic circuit for supplying fluid power to a hydraulically actuated movable fulcrum in order to bring about reversal of the platen upon the accomplishment of a predetermined pressure in the main hydraulic system.

Referring to the drawings:

Figure 1 is a diagrammatic view, partially in section, showing the association of the platen, pressing cylinder, main hydraulic circuit and supplementary hydraulic circuit for the actuation of the floating fulcrum;

Figure 2 is a detailed view showing the fulcrum control and pump control mechanism in a forward position;

Figure 3 is a similar view showing the pump moved to a reverse position due to the action of the floating fulcrum;

Figure 4 is a view showing the parts in a neutral position with the floating fulcrum in its Figure 3 position;

Figure 5 is a modification showing the location of the actuating piston and cylinder upon the cylinder housing and connected to a slide which supports the bell crank linkage connected to the pump reversal mechanism;

Figure 6 is a diagrammatic view of the electrical circuit involved in this invention.

Referring to the drawings in detail 1 is a press bed upon which is mounted a work piece to be forged. The work piece is engaged by the platen 2 which is mounted upon one end of the piston rod 3, the upper end of which, in a piston 4, engages the interior walls of the main cylinder 5 within which it reciprocates. Mounted upon the head of the cylinder 5 is a surge tank 6. Within the tank and also mounted upon the head of the cylinder 5 is the surge valve 7 connected by a pipe

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8 to the pipe 9 which contains a check valve 10. The lower end of the pipe 9 communicates with the space 11 between the inner wall of the cylinder 5 and the outer wall of the piston rod 3. The lower end of this cylinder 5 is sealed by the packing 12 and gland 13.

Closed circuit system for main actuation

The pump 14, a reversible pump, is provided with a servomotor control 15 that serves through the piston rod 16 to reverse the pump so that the flow to the opposite ends of the cylinder 5 will be reversed in order to reciprocate the platen 2. The pipe 17 is connected to one side of the pump and to the side of the cylinder 5. In this pipe 17 is a branch pipe 17*a* containing an adjustable pressure switch 18 which is adapted to be closed upon the accomplishment of a predetermined pressure in the line 17. The wires 19 and 20 represent the opposite sides of the electrical circuit which may be thus opened and closed according to the pressure conditions in the closed circuit from the main pump 14.

The other side is connected by the line 21 to the lower end of the cylinder 5 below the piston 4. It will, therefore, be apparent that the direction of fluid as supplied by the pump 14 will determine the reciprocation and direction of movement of the platen 2. The servomotor 15 is supplied with pressure fluid through the pipes 22 and 23 in the usual manner. The shifting piston rod 16 is yieldingly operated by a spring 24 which pulls it towards the right hand. This spring is attached to an abutment 25 on the press.

Linkage control

The normal linkage control for operating the press consists of a lever 26 pivoted at 27 upon the rod 28 and connected at its other end at 29 to a pitman 30 which in turn is pivoted at 31 to one arm 32 of a bell crank, the other arm of which is 33. This bell crank is pivoted at 34 upon a bracket 35 formed on the press cylinder 5. The free end of the bell crank arm 33 as at 36 is adapted to engage a collar 37 that is mounted upon a shift rod 38 the upper end of which is guided in the bracket 39 on the cylinder 5 and the lower end of which passes through an ear 40 on the platen 2. The upper end of the shift rod 38 is provided with a restraining collar 41. The median portion of the shift rod 38 is provided with a shift collar 42. This collar 42 engages the bracket 40 on the platen 2 so that as the platen rises it will lift the rod 38. This results in the collar 37 engaging the bell crank arm 33 on its head

36 moving it upwardly. This in turn moves the bell crank arm 32 to the right hand which pulls with it the pitman link 30 to the right hand and moves the lower end of the lever 26 to the right hand and pushes the upper end to the left.

The lower end of the shift rod 38 is provided with a collar 43 which engages with the bell crank arm 44 on the lever 45 which constitutes the other arm of the bell crank which is pivoted at 46 on the arm 47. This bell crank system is provided with a cam nose 48 for engaging with a switch member 49 for opening and closing a switch to which are connected the wires 50 and 51.

Actuating system for the movable fulcrum

When the pressure in the lines 17 and 17*a* accumulates to a point where the switch 18 closes, it energizes a solenoid 52 which is connected by the wires 19 and 20 to the switch 18. This causes the core 53 of the solenoid to move to the left hand to shift the valve member 54 against the spring 55 in the cylinder 56. Pressure is supplied to that cylinder by the auxiliary pump 57 from the sump tank 58 through the pipe 59 to the cylinder. The pipes 60 and 61 are adapted to drain back the fluid from the cylinder 56 to the sump tank 58. When this shift takes place the pressure is applied through the pipe 62 to the left hand of the piston 63 which is connected to the piston rod 28. This piston operates within the cylinder 64 mounted at 65 on the main pump. The right hand movement of the piston 63 moves the floating fulcrum 27 to the right hand (see Figures 3 and 4). Upon the deenergization of the solenoid 52 the spring 55 shifts the valve 54 to the right hand as shown in Figure 1 and the pressure through the pipe 66 will shift the piston 63 back to the position shown in Figure 1.

Turning to Figure 6, 67 and 68 indicate the main power lines. Across these lines are connected the following: the lines 19 and 20 including the switch 18 and the solenoid 52. There is also connected across these wires 67—68 the wires 50—51 which contain the switch 49, the holding relay 52*a* and the holding contacts 52*b* and 52*c*, one end of the relay 52*a* and the solenoid 52 being interconnected at 52*d*.

Referring to the modification in Figure 5 the cylinder 64 is mounted in a vertical position on the side wall of the cylinder 5. Its piston rod 28 is connected at 28*a* to a slide block 28*b* that operates on a slide 28*c* on the side walls of the cylinder 5. By thus providing a floating fulcrum for the bell crank 32—33 the same result is secured as providing a floating fulcrum for the lever 26. In this modification the lever 26 is provided with a fixed fulcrum through the link 26*a* which is mounted at 26*b* upon the end of the servomotor cylinder 15.

Method of operation

The operator starts the press platen 2 downwardly by pulling the lever 45 to the left hand as it is viewed in Figure 1. In doing so the switch 49 is permitted to close. He has also shifted the shift rod 38 upwardly so as to bring the parts in substantially the position shown in Figure 2. The press then continues downwardly so long as the lever 45 remains shifted until the pressure accumulates in the tonnage control switch 18 sufficiently to energize the solenoid 52 through closing the circuit and thereafter the valve 54 is shifted to the left hand and the piston 63 moves to the right as in Figure 3. Spring 24 of the pump causes the piston rod 16 to move to the right hand along with the movement of the piston rod 28 with the piston 63 to the right hand, all as shown in Figure 3. This brings about a reversal of direction of the platen which then moves upwardly. As the result of its upward movement the shift rod 38 through its collar 37 engages the arm 33 of the bell crank pivoted at 34 moving it upwardly still further as shown in Figure 4, thereby bringing the press to neutral position because, by such action, the piston rod 16 has been moved to the left hand against the servomotor spring in the main pump 14. The press is now at rest. It is necessary for the operator to move the lever 45 to its vertical position in order to open the switch 49 and deenergize the electrical system thereby permitting the piston 63 to move back to its original position at the extreme left hand. The system is now in position for another stroke.

It will be apparent that this invention is not limited in use to a closed circuit but may be employed in an open circuit as well by fitting the controls to a valve means operable to control the flow of fluid to both sides of a ram.

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

Having thus fully described our invention what we claim as new and desire to secure by Letters Patent is:

1. In combination in a pump control, a cylinder, piston and piston rod, reversing linkage pivotally fulcrumed upon the end of said piston rod for varying the delivery of said pump, a reversing valve, a pump and sump connected thereto, said valve being connected to opposite ends of said cylinder, a solenoid operably connected to said reversing valve and hydraulic means for controlling the opening and closing of the electrical circuit to energize said solenoid whereby when it is energized or deenergized said pivotal support of the linkage will be shifted and the delivery of said pump varied independently of the position of the rest of said linkage.

2. In combination in a pump control, a cylinder, piston and piston rod, reversing linkage pivotally fulcrumed upon the end of said piston rod for varying the delivery of said pump, a reversing valve, a pump and sump connected thereto, said valve being connected to opposite ends of said cylinder, a solenoid operably connected to said reversing valve, hydraulic means for controlling the opening and closing of the electrical circuit to energize said solenoid whereby when it is energized or deenergized said pivotal support of the linkage will be shifted to vary the delivery of said pump, and mechanically operated hand means adapted to mechanically shift said linkage to vary the delivery of said pump and deenergize said electrical circuit.

3. In combination, a reversible pump, a servomotor movable into a first position to place said pump on forward stroke or into a second position to place said pump on reverse stroke or into a third position to place said pump in neutral, manual means movable into three positions for positioning said servomotor in its respective three positions, fluid operable means for positioning said servomotor in its second position entirely independently of the position of said manual means, and means responsive to the positioning of said manual means in its third position for making said fluid operable means ineffective.

4. In combination, a reversible pump, a servomotor connected with said pump for reversing its delivery, manual means for actuating said servomotor and including a lever movable in both directions from a neutral position, electrically operated means responsive to a predetermined pressure developed by said pump for actuating said servomotor independently of the position of said manual means, and means operated by said lever when the same is in or passes through said neutral position for making said electrical means ineffective.

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