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FLUID PRESSURE CONTROL SYSTEM

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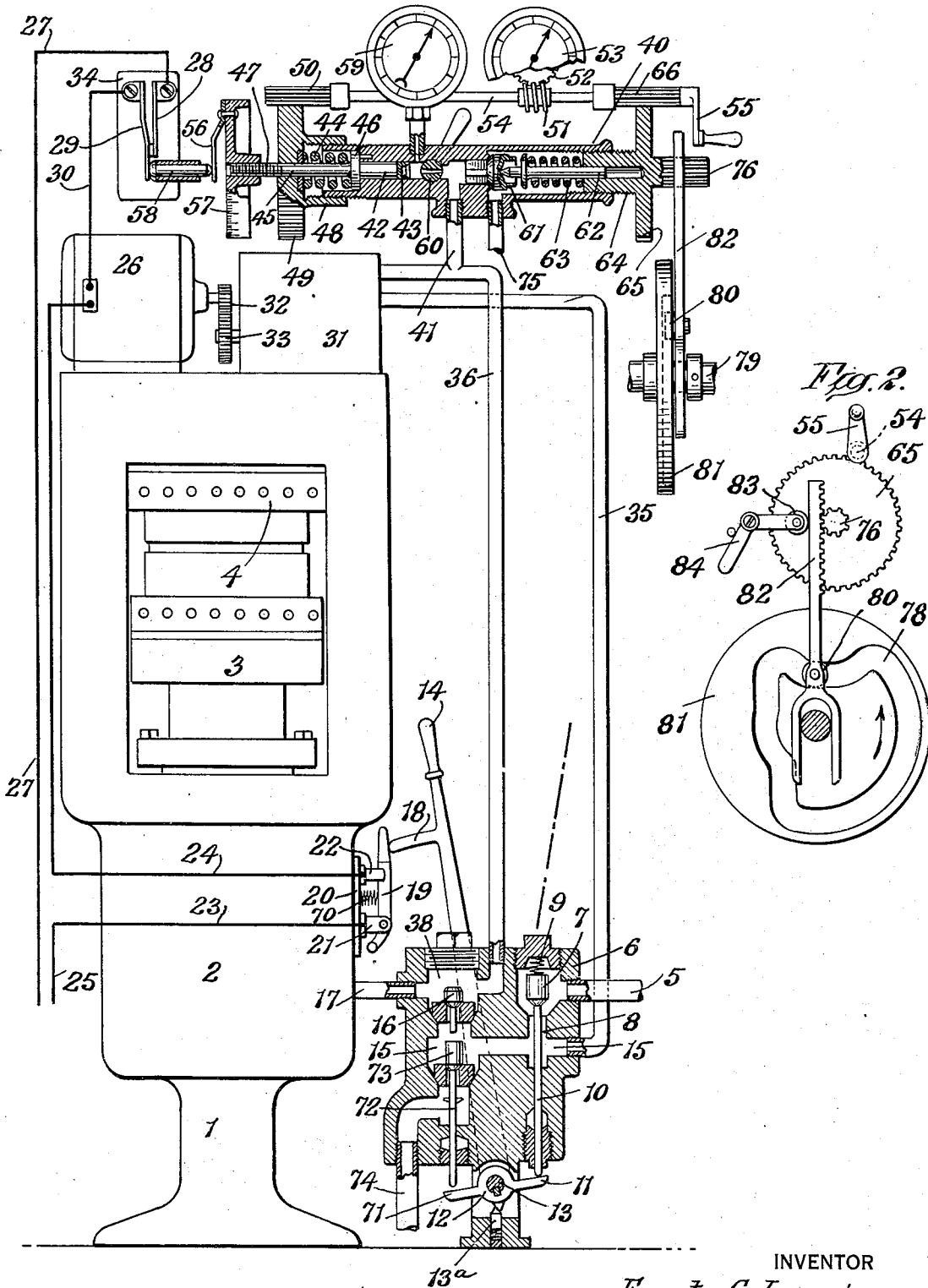


Fig. 1.

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FLUID PRESSURE CONTROL SYSTEM

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8 Claims. (Cl. 103—25)

This invention relates to means for controlling the application of fluid pressure and particularly in conjunction with hydraulically operated mechanisms, such as hydraulic rams used for polishing or molding and the like.

One of the objects of the invention is to provide a simple and effective means by which the ordinary water supply may be employed as the fluid, and means by which the pressure of the water may be increased to a desired extent to insure positive and satisfactory operation of the ram or press, and means by which the fluid may be maintained at such predetermined pressure.

Another object of the invention is to provide, in a system of this character, a novel form of pressure-controlled switch mechanism by means of which the operation of a pump or other fluid-pressure increasing means may be controlled.

Another object of the invention is to provide, in combination with a pressure-controlled switch of the character mentioned, suitable adjusting means enabling positive control of the pressure desired, to be secured, such means also including a safety pressure control.

These and other objects are attained by the structure hereinafter described and more particularly pointed out in the claims appended hereto.

In the accompanying drawing, wherein an illustrative embodiment of the invention is disclosed, Fig. 1 is an elevation of the improved mechanism, with some of the parts in section and also out of proportion as to size, in order to more clearly illustrate the improved construction; and Fig. 2 is a view of the mechanism for automatically increasing and decreasing the fluid pressure at predetermined times.

At 1 is shown the base of a hydraulic press of more or less conventional construction and of a type usually employed for molding or polishing purposes, the same supporting the cylinder or chamber in which the fluid under pressure is forced to thereby raise the ram 3 and bring it into contact with the material to be pressed and force it against the upper platen 4. The elements thus far described are part of the usual press and possess no novelty as far as the present invention is concerned. In the present apparatus, it is desirable, although not necessary to do so, to employ as the fluid for elevating the ram 3, the water obtainable from the conventional water supply system or city water mains under the usual pressure of from fifty (50) to ninety (90) pounds per square inch. By the employment of the mechanism hereafter described, the water so

obtained will have its pressure raised to a predetermined extent and such pressure will be maintained for any desired period of time. It will, of course, be understood that oil or other fluid under low pressure may be used instead of the conventional water supply, and when I herein refer to water as the fluid used, I mean to include any other fluid suitable for the purpose.

A pipe 5 is shown leading from a low pressure source or city water supply, said pipe being connected into a valve chamber or housing 6 provided with passage 8 normally closed when the mechanism is in an inoperative condition, by valve 7 under pressure of the spring 9. During the operation of the mechanism, the valve 7 is maintained in an open or raised position, as shown in the drawing, by means of the lifter rod 10 which is elevated by means of the finger 11 formed on a rocker 12, said rocker being secured on a shaft 13 on which is also secured a hand lever 14. In the drawing, the hand lever is shown in its "on" position, in which position it is maintained by the spring-pressed detent 13a, and at which time the lifter rod is in raised position and is holding the valve 7 open so that the water entering through pipe 5 flows through passage 8 into the connected passage 15 and raises the gravity valve 16 from its seat to allow the water to flow through chamber 38 and enter the pipe 17 to reach the interior of the press chamber 2. As the water, under normal city water pressure, enters the chamber 2 it raises ram 3 as far as it will go.

Provided on the hand lever 14 is a projection 18 which, when the lever is moved to "on" position, as shown in the drawing, comes into contact with the operating lever 19 of an electric switch 20, causing said lever 19 to be forced over against the pressure of spring 70 to bridge the contacts 21 and 22 of the switch 20 and establish continuity between the sections 23 and 24 of wire 25, said wire 25 constituting one side of a power line extending from a source of electric current. Contact 22 of the switch connects to wire 24 which extends to an electric motor 26, mounted on the top of the press or at any other convenient location. The other side of the power line, indicated by wire 27, extends to a contact member 28 of switch 34, said contact member being normally in contact with spring contact finger 29, connected by wire 30 to motor 26. Motor 26 drives a hydraulic pump 31 which may be of known construction, by means of the gears 32 and 33 so that as long as both switches 20 and 34 are

closed, the circuit to the motor 26 will be closed and the motor will remain in operation to drive the hydraulic pump 31 and raise the pressure of the water in the system.

The inlet to the pump consists of the pipe 35 connected at one end into the passage 15 and at its other end to the pump so that the water will be drawn through pipe 35 by the pump and forced out of the pump through pipe 36 which has its lower end connected to the valve housing 6 and directed into the chamber 38 communicating with pipe 17.

From the foregoing, it will be obvious that when switches 20 and 34 are closed, and lever 14 is in its "on" position, water will be delivered into chamber 2 and will raise the press ram as far as it will go. Motor 26 being in operation, will drive the pump 31 which will proceed to build up the pressure of the water until a predetermined pressure is reached, the means for controlling the pressure being presently described.

At 40 is shown a housing containing the pressure-control means. Pipe 36 is provided with a branch 41 leading into the interior of the housing so that the water under pressure may be forced into the housing and into contact with a piston 42, said piston being provided with a packing 43 at one of its ends. The piston is movable toward the left under pressure of the water when the water pressure reaches a predetermined point, and against the compression of coil spring 44 which surrounds the stem portion 45 of the piston. One end of the spring bears against the disk 46 on the piston and has its other end bearing against wear plate on the inside of an adjustable cap member 48 threaded on one end of the housing 40. The cap member 48 is internally threaded for adjustable reception on complementary threads provided on the outside of the housing 40 so that by rotative movement of the cap member 48, the compression of the spring 44 may be adjusted. Cap member 48 is provided with a gear portion 49 in mesh with a gear 50 located at the end of a manually rotatable shaft 54 carrying a worm 51 meshing with a gear 52 secured on the pointer shaft of a setting indicator 53. Shaft 54 is provided with a crank 55 by which it may be manually rotated, and when so rotated, the indicator 53 will show the pressure at which a finger 56 carried by a drum 57 adjustably mounted on the exposed threaded end 47 of stem 45 of piston 42 will force a plunger 58 to the left for a sufficient extent to cause it to move contact finger 29 away from contact member 28 and thus open circuit to the motor 26.

When the water under pressure forced into the housing 40 by the action of the pump reaches a predetermined pressure, according to the adjusted compression of the spring 44 and the adjustment of drum 57 on the threaded end 47 of the stem 45, the finger 56, operative against plunger 58, will open switch 34 and break circuit to the motor 26, causing the motor to cease operation of the pump 31 and discontinue the building up of greater fluid pressure. The pressure then reached will be maintained as long as the joints are tight and nothing occurs to change it. Should the pressure be lowered for any reason, spring 44 will force the piston 42 to the right, allowing contacts 28 and 29 to close and the motor will resume operation and will bring the fluid pressure up to the required level, at which time the motor will again be shut off, as previously explained.

In order to permit the water pressure to be transmitted to the piston 42 and to the pressure gauge connected into the housing 40 without violent surging and shocks, a throttling cock 60 is provided, the same being located in the housing between the inlet pipe 41 and the piston 42. This throttling cock has a small aperture passing through it, and may also be used when desired, as a valve by means of which the control device may be shut off at any time.

At the right end of the housing 40 is provided a safety valve 61 normally held in closed position by means of the stem 62 forced against the valve by means of the coil spring 63. The spring bears against a threaded plug member 64 adjustable into the internally threaded end of the housing 40 to thereby regulate the compression of the spring 63 and control the point at which the safety valve 61 will be opened by excess water pressure. The plug 64 is provided with a toothed portion or gear 65 in mesh with a gear 66 on the shaft 54 so that rotation of said shaft will adjust the compression of the spring 62 for the required extent. The threads on cap member 48 and on plug 64 are opposite. That is to say, one is a right hand thread and the other a left hand thread so that as shaft 54 is rotated the cap and plug will either move toward one another or away from one another so that they simultaneously increase or decrease the compression of the springs 44 and 63.

From the above description, the operation of the improved control mechanism will be readily understood.

To start the mechanism in operation, handle 14 is swung to the left, or to the position shown in the drawing. This causes switch 20 to be closed, and since switch 34 is in closed position at this time, the motor 26 starts operation and pump 31 is driven thereby. Valve 7 being opened, water flows into chamber 2 and is also fed to the hydraulic pump 31 and the ram 3 of the press is elevated by the low or normal water pressure, as far as it will go. Next check valve 16 will close by gravity and the pump will continue to build up the pressure of the water until the selected point indicated by the setting gauge 53 is reached. The pressure at this time, being sufficient to overcome compression of the spring 44, will shift the piston 42 to the left sufficiently to cause finger 56 to force plunger 58 over and cause it to open circuit between contact members 28 and 29 and thereby stop the motor.

If for any reason the pressure of the fluid should be increased to any great extent, the excess pressure will be relieved by opening of the safety valve 61, the water then flowing out of the outlet pipe 75. On the other hand, should the pressure decrease due to shrinkage, leakage, or other cause, spring 44 will move piston 42 to the right permitting contacts 28 and 29 to close circuit to the motor which will set the pump in operation to again build up the pressure to the desired point.

To remove the pressure and open the press, the handle 14 is swung to the right, or to the position indicated by the dotted line. This permits switch control lever 19 to be opened under pressure of the spring 70 which breaks circuit to the motor. Finger 71 on the rocker 12 is raised and this lifts the stem 72 of a valve 73 and holds the valve open. When valve 73 is raised, it lifts valve 16 and holds it open. The

water will then flow past both valves 16 and 73 and out of the pipe 74.

While I have herein described the pump 31 as being electrically operated, and the control of operation of the motor 26 by switch 34, there are occasions when a steam driven pump will be employed. In such case, the control of operation of the pump 31 will be had by opening of a valve rather than a switch. It will therefore be obvious that a valve may be substituted in place of switch 34 when steam is used as the means of pump operation. Therefore, in herein referring to the opening of switch 34, I wish to be understood as meaning, as an alternative, the opening of a valve in cases where steam constitutes the pump-operating medium.

I have also herein described the adjustment of the springs 44 and 63 by manual rotation of the shaft 54. In Fig. 2 is disclosed a means for automatically changing the compression of said springs to thereby permit an increase or cause a decrease in the fluid pressure. Therein is shown a shaft 79, driven by a suitable electric motor or other source of power not shown, and on which is secured a cam 81 provided with a cam groove 78 in which a roller 80 on the end of a rack 82 is located. The rack 82 is in mesh with a pinion 76 formed on and projecting from gear 65. In certain cases, wherein it is desirable to change at predetermined times, the pressure applied by the press, the automatic means just described will operate to do so. According to the shape of the cam groove, the rack 82 will be raised or lowered thus rotating in the proper direction and through pinion 76 and gear 65, the adjusting shaft 54, which will either increase or decrease the compression of the springs 63 and 44. The rack 82 may be held in mesh with pinion 76 by means of a roller 83 on a lever 84. By movement of the lever the roller 83 may be swung away from the rack, permitting the rack to swing out of mesh with pinion 76 thereby freeing the automatic mechanism from operative engagement with the spring adjusting means, and permitting said means to be manually operated by rotative movement of the handle 55.

While I have shown several embodiments of the invention, it is obvious that the same is not to be restricted thereto but is broad enough to cover all structures coming within the scope of the annexed claims.

What I claim is:

1. In a device of the character described, means for increasing the pressure of fluid in a hydraulically operated apparatus, a motor for operating said pressure-increasing means, an electric circuit connecting said motor with a source of current, a switch for controlling the electric circuit, said switch being normally closed, said switch including a housing, a piston mounted for movement in one direction in said housing under the pressure of fluid entering said housing from the pressure-increasing means, a spring in said housing for opposing movement of the piston under fluid pressure, the piston having a projecting portion extending out of the casing, said projecting portion carrying an adjustable switch-opening element which opens the switch when the piston is moved under predetermined fluid pressure, a safety valve in said housing, spring means for normally holding said safety valve closed, and a single means for adjusting both the compression of the safety valve spring and that of the spring for opposing piston movement.

2. In a device of the character described, means for increasing the pressure of fluid in a hydraulically operated apparatus, said means being electrically operated, an electric circuit for controlling the operation of said means, a switch in said circuit, a housing into which the fluid under pressure enters, a piston in said housing against which the fluid under pressure is operative, a spring for opposing movement of the piston by the fluid under pressure, the housing having a fluid outlet, a safety valve interposed between the fluid inlet and the fluid outlet, a spring for normally holding the safety valve in closed position, a switch-operating member carried by the piston and disposed externally of the housing, said switch-operating member opening the switch when the pressure of fluid against the piston reaches a predetermined amount and the piston is moved thereby against the compression of its spring, and means for simultaneously increasing or decreasing the compression of the springs for the piston and the safety valve.

3. In a device of the character described, means for increasing the pressure of a fluid in a hydraulically operated apparatus, said means being controlled by an electric circuit, a switch in said circuit, a housing threaded at its opposite ends, a piston movable in said housing by the pressure of fluid entering the housing and imposed upon the piston, a spring for opposing movement of the piston under pressure of the fluid, a cap adjustable on one of the threaded ends of the housing for adjusting the compression of said spring, a portion of the piston extending through said cap and projecting beyond the same, said projecting portion of the piston carrying an adjustable switch operating element, a safety valve in the housing for relieving the pressure of fluid therein should the pressure exceed a predetermined amount, a spring for normally holding said safety valve in closed position, and a closure member adjustable on the second threaded end of the housing for adjusting the compression of the safety valve spring.

4. In a device of the character described, means for increasing the pressure of a fluid in a hydraulically operated apparatus, said means being controlled by an electric circuit, a switch in said circuit, a housing threaded at its opposite ends, a piston movable in said housing by the pressure of fluid entering the housing and imposed upon the piston, a spring for opposing movement of the piston under pressure of the fluid, a cap adjustable on one of the threaded ends of the housing for adjusting the compression of the spring, a portion of the piston extending through said cap and projecting beyond the same, said projecting portion of the piston carrying an adjustable switch operating element, a safety valve in the housing for relieving the pressure of fluid therein should the pressure exceed a predetermined amount, a spring for normally holding said safety valve in closed position, a closure member adjustable on the second threaded end of the housing for adjusting the safety valve spring, and means for simultaneously shifting the cap and closure member on the opposite ends of the housing in opposite directions to thereby either simultaneously increase or decrease the compression of the piston spring and safety valve spring.

5. In a device of the character described, means for increasing the pressure of fluid in a hydraulically operated apparatus, said means being controlled by an electric circuit, a switch in said circuit, a housing having at its opposite ends ele-

ments adjustable by means of screw threads for respectively adjusting the pressure imposed by a spring against a hydraulic piston and at the other end the pressure imposed by a spring against a safety valve, means for conveying hydraulic fluid into the housing between the safety valve and hydraulic piston so that by adjustment of the two screw threaded elements, the resistant pressure against the piston as well as against the safety valve may be relatively adjusted to conform with the pressure required at any time during the operation and the safety valve may be set accurately to prevent the pressure exceeding maximum required.

6. In a hydraulically operated mechanism, electrically operated means for increasing the pressure of the operating fluid, a switch for controlling the operation of said means, said switch being normally closed, switch-operating means for opening said switch when the pressure of the fluid reaches a predetermined amount, said switch-operating means being actuated into switch-opening position by fluid pressure, means for resisting switch-opening movement of the switch-operating means, a safety valve for preventing the imposition of excess fluid pressure on the switch-operating means, means for applying pressure on said safety valve to prevent opening of the same by fluid pressure below a predetermined amount, and adjusting means for simultaneously increasing or decreasing the pressure of the resisting means for the switch-operating means and the pressure of the pressure-applying means for the safety valve.

7. In a device of the character described, means for increasing the pressure of fluid in a

hydraulically operated apparatus, a source of power for operating said pressure-increasing means, control means for controlling the power flow from the source of power to the pressure-increasing means, said control means including an actuating means operative to interrupt the power flow from the source to the pressure-increasing means when the fluid pressure reaches a predetermined amount, and an automatically operated control device for causing the actuating means to become operative to interrupt the power flow at selected predetermined times, said means being also operative to selectively determine the times at which said actuating means will become operative.

8. In a device of the character described, a housing into which fluid under pressure enters, means for increasing the pressure of the fluid, a source of power for operating the pressure-increasing means, a controlling device by which the power to the pressure-increasing means is cut off, said controlling device including a movable element located in the housing and movable relative thereto by fluid pressure entering the housing for operating the controlling device, adjustable means for opposing movement of said movable element under fluid pressure, a valve in the housing opened by fluid pressure in excess of a predetermined amount, adjustable means for normally holding the valve closed, and mechanism for automatically adjusting at predetermined selected times, the means for opposing movement of the movable element and for adjusting the means for holding the valve closed.

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