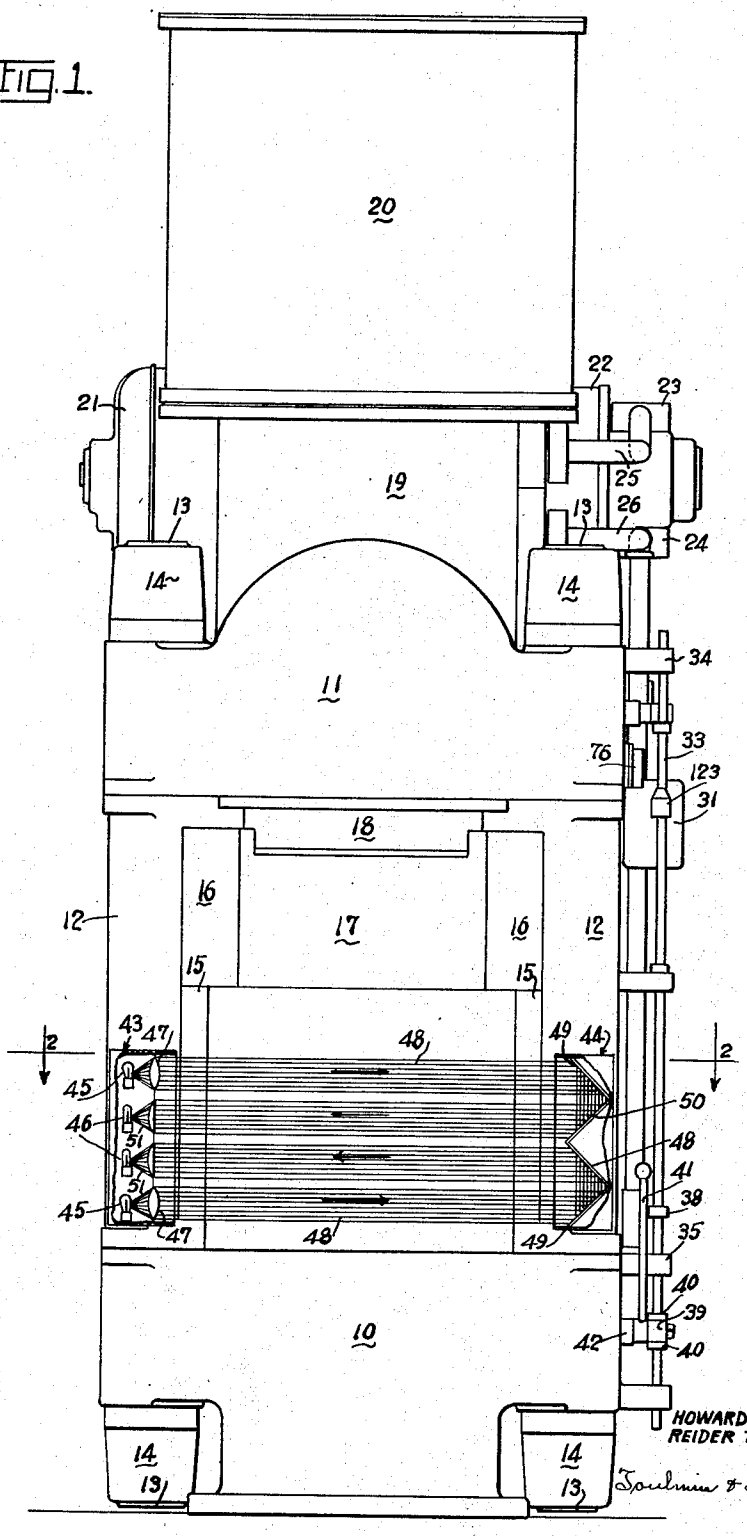
May 13, 1941. H. F. MacMILLIN ET AL 2,241,556

PHOTOELECTRICALLY CONTROLLED PRESS

Filed June 20, 1938 3 Sheets-Sheet 1

Fig. 1.



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Filed June 20, 1938 3 Sheets-Sheet 2

Fig. 2.

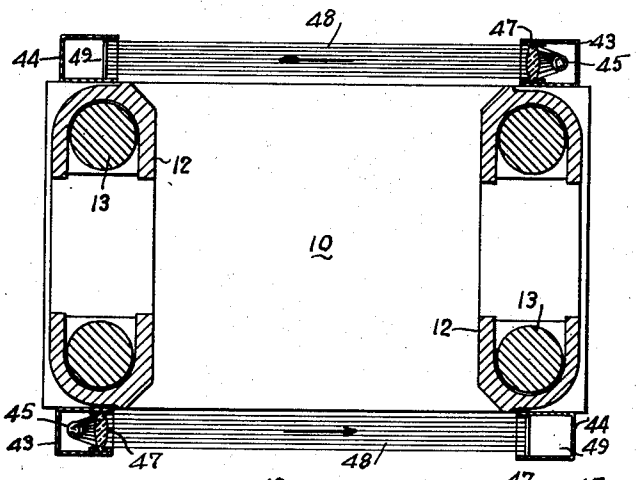


Fig. 3.

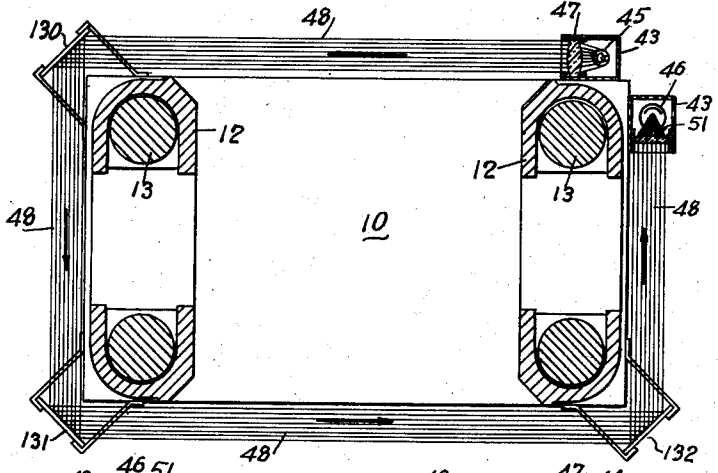
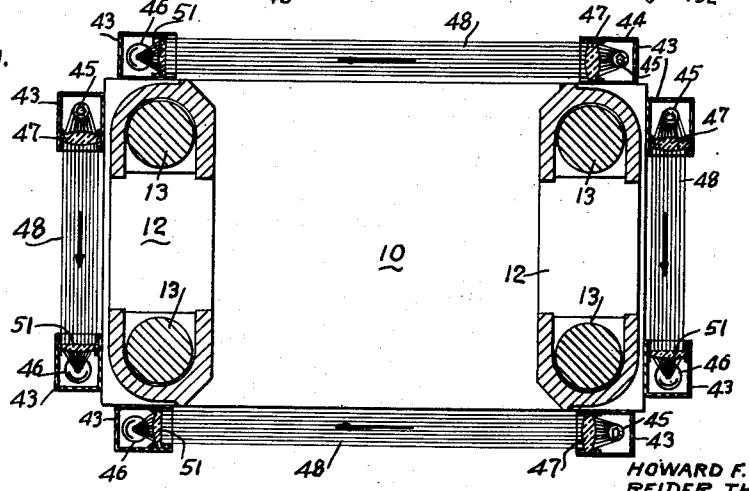


Fig. 4.



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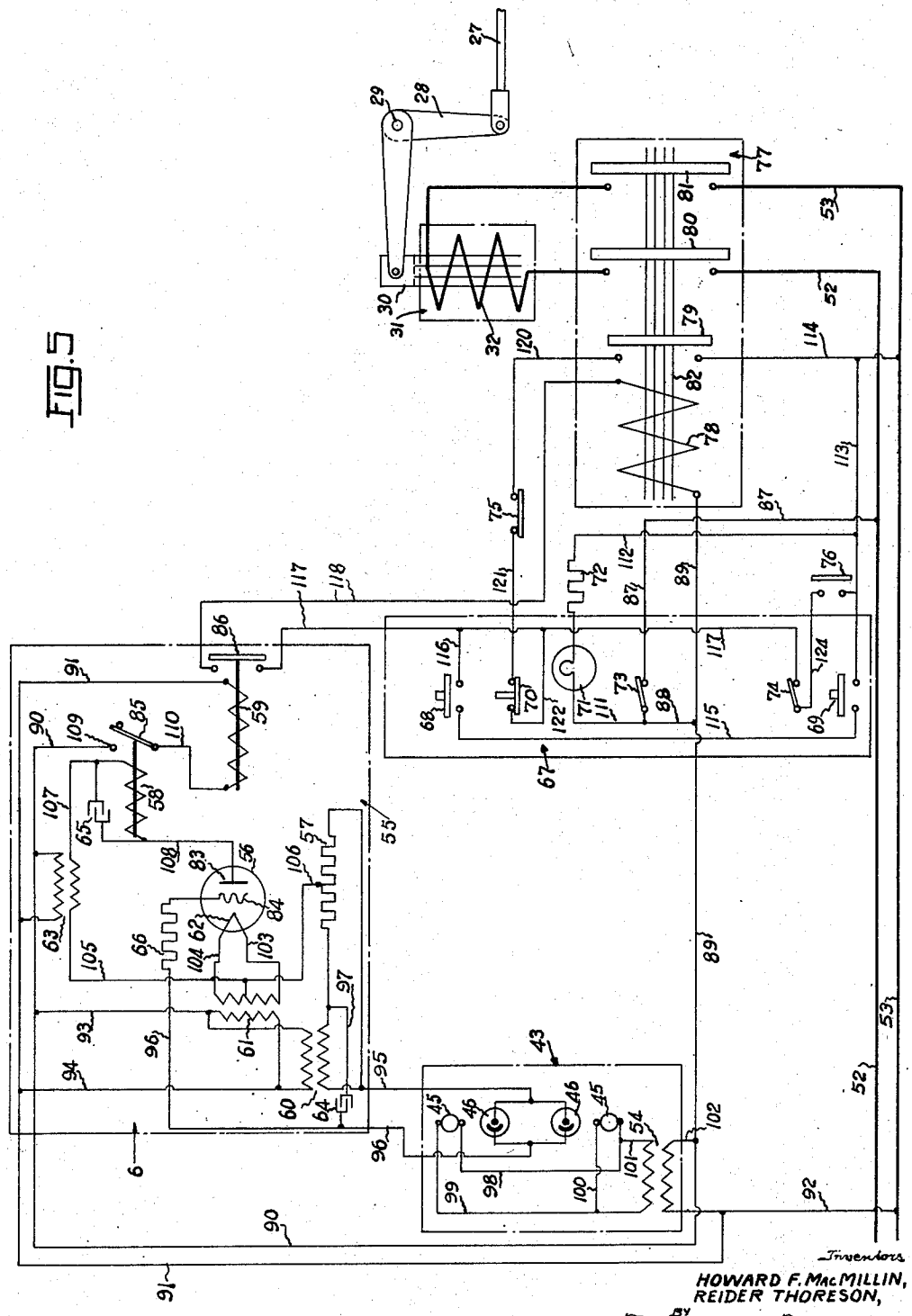
Filed June 20, 1938 3 Sheets-Sheet 3

FIG. 5



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Patented May 13, 1941 2,241,556

UNITED STATES PATENT OFFICE

2,241,556

PHOTOELECTRICALLY CONTROLLED PRESS

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Application June 20, 1938, Serial No. 214,852

5 Claims. (Cl. 192—130)

This invention relates to press control systems, and in particular, to electrical systems for controlling presses.

One object of this invention is to provide a photoelectric circuit for controlling the plunger movements of a hydraulic press in such a manner that the press plunger remains inoperative if the light beam for actuating the photoelectric circuit becomes broken.

Another object is to provide a photoelectric press control system, wherein the press control circuit is arranged selectively for full automatic or semi-automatic operation, but under the control of a photoelectric circuit having a light beam extending across a portion of the press in position for interruption by the hands or body of the operator, so that the light beam must be uninterrupted if the circuit is to be energized.

Another object is to provide a press control system arranged for full automatic or semi-automatic control of the press, this system including a photoelectric circuit having a light beam which when uninterrupted actuates a relay to complete the energization of the press control circuit but which, when interrupted, as by the hands or body of the operator, deenergizes the relay and accordingly deenergizes the press control circuit, thereby making it temporarily impossible to operate the press and endanger the operator.

In the drawings:

Figure 1 is a diagrammatic front elevation of a press partly broken away, and showing the installation of the photoelectric system in a typical press installation.

Figure 2 is a horizontal section through the press shown in Figure 1, taken along the line 2—2 therein.

Figure 3 is a horizontal section similar to Figure 2, but showing a modification.

Figure 4 is a horizontal section similar to Figures 2 and 3, but showing a further modification.

Figure 5 is a wiring diagram of the photoelectrically controlled press circuit of this invention.

General arrangement

In general, the photoelectrically controlled press circuit of this invention consists of an electrical circuit having electrical means for operating the control rod for controlling the distribution of pressure fluid to the press. This electrical operating means is energized by a circuit in such a manner as to provide for semi-automatic or full automatic operation of the press. Semi-automatic operation occurs when the ram executes a pressing stroke, halts, returns to its retracted position and again halts until the circuit is again energized by the operator. Full automatic operation occurs when the press ram immediately reverses upon returning to its retracted position and executes another pressing stroke, without the intervention of the operator, thereby repeating an indefinite number of pressing and retraction strokes until halted by the operator. Arranged to be intercepted by the arms or body of the operator is a light beam for operating a photoelectric circuit disposed in such a manner that the light beam will be broken or interrupted when the operator is loading or unloading the press. The photoelectric circuit is so arranged that a relay controlling the energization of the press control circuit is energized and closed as long as the light beam remains unbroken, but is deenergized and opened when the light beam is broken, as by the hands or body of the operator.

Referring to the drawings in detail, Figure 1 shows diagrammatically a press equipped with the photoelectric control system of the invention. This press consists of a bed 10 and head 11, interconnected by side members 12 and held together by strain rods 13 with nuts 14 threaded upon their opposite ends. The press side members 12 contain guideways 15, which are engaged by the guide plates 16 secured to the press platen 17 for guiding the latter in its reciprocation. The platen 17 is secured to the main plunger 18, which reciprocates in the main cylinder 19 mounted in the press head 11. Above the main cylinder 19 is mounted the surge tank 20 for containing the operating fluid, such as oil.

Also mounted upon the press head 11 is an electric motor 21, arranged to drive a pump 22, preferably of the reversible variable delivery type. The pump 22 is provided with junctions 23 and 24 for the connection of pipes 25 and 26 for delivering pressure fluid from the pump 22 to the remainder of the hydraulic circuit. The details of the hydraulic circuit and pump control circuit in themselves form no part of the present invention and may be of any suitable type. A typical pump control circuit is disclosed and claimed in the Ernst Patent No. 2,038,272 of April 21, 1936. The reversible variable delivery pump 22 is preferably of the radial piston type having a servomotor for shifting the flow-control member or shift ring thereof under the direction of a servomotor control valve operated by a valve rod, as set forth in the above-mentioned patent.

The servomotor valve rod of the pump 22 is connected, through suitable linkage (not shown),

to a final link 27 (Figure 5) attached to one arm of a bellcrank 28 pivoted upon the shaft 29. The other arm of this bellcrank 28 is connected to the armature 30 of a solenoid 31, having a winding 32. The servomotor control of the pump is so arranged that when the solenoid 31 is energized, pressure fluid is supplied by the pump 22 to the main cylinder to cause the main plunger 18 and platen 17 to move downwardly. When the solenoid 31 is deenergized, however, the pressure fluid from the pump 22 is redirected to cause the main plunger 18 and platen 17 to move upwardly. The servomotor valve rod of the pump 22 is also mechanically connected to the control rod 33 of the press in such a manner as to be actuated manually. For this purpose the control rod 33 is mounted in brackets 34 and 35, attached respectively to the head 11 and bed 10 of the press. The platen 17 is also provided with an arm 36, which serves to actuate the control rod 33 to shift the pump servomotor valve when the platen arm 36 reaches either of the collars 37 or 38 upon the control rod 33. The control rod 33 may also be moved manually by means of the yoke bellcrank lever 39 engaging the control rod 33 between the spaced collars 40, and having a hand lever 41 for actuating this mechanism. The bellcrank lever 39 is mounted upon a jack shaft 42, supported upon the bed 10 of the press.

Mounted upon one side of the press is a light source and photocell unit 43, cooperating with a mirror unit 44 upon the opposite side of the press. The unit 43 contains a pair of electric light bulbs 45 and a pair of photoelectric cells 46 connected electrically, as shown in Figure 5, in a manner subsequently to be described. The light coming from the light bulbs 45 is rendered parallel by the lenses 47, and passes in beams 48 of parallel rays to the mirrors 49 and 50, where it is reflected and returned to lenses 51 focused upon the light sensitive elements in the photoelectric cells 46. Thus, if any object intercepts any of the light beams 48, the light reaching the photocells 46 is cut off and the control circuit is actuated in a manner to prevent the occurrence of the forward stroke of the main plunger 18 and platen 17, as described below.

Electrical system

Referring to Figure 5, the electrical system for controlling the press is energized by a pair of power lines 52 and 53. The electrical system consists of a number of different units, each containing a number of electrical elements. The arrangement of the photocell and light source unit 43 has already been described. This unit, however, also contains a transformer 54 for energizing the light sources 45. Each of the photoelectric cells 46 consists of two elements, namely, an anode and a cathode in a bulb containing a small amount of argon gas. The cathode is coated with a caesium compound, which has the property of emitting electrons when light strikes it. The circuit is arranged in such a manner that a voltage is impressed thereon between the anode and the cathode, and the electron flow takes place from the cathode to the anode, and in this manner carries an electric current. The value of this current is determined by the amount of light falling upon the cathode.

The circuit is also provided with a photoelectric relay unit, generally designated 55. This unit includes a so-called pliotron tube 56, an adjusting potentiometer 57, a sensitive relay 58 under the control of the pliotron tube 56, a heavy-duty relay 59 under the control of the sensitive relay 58, a photocell transformer 60 for applying the voltage between the anode and cathode of the photocells 46, a transformer 61 for supplying current to energize the filament 62 of the pliotron tube 56, and a transformer 63 for supplying current to the photoelectric relay unit 55. Condensers 64 and 65 and a high impedance 66 are also included in the photoelectric relay unit 55.

The electrical control system is provided with a push-button switch unit 67 containing a pair of forward push-button switches 68 and 69, a reverse push-button switch 70, a signal light 71 and a resistor 72. Also provided is a hand automatic switch 73, which when opened, enables the circuit to be operated only by hand, and when closed permits the full automatic or semi-automatic energization of the circuit. The photoelectric system is energized whenever the automatic selector switch 73 is closed in the manner shown in Figure 5. The selection of the type of automatic control is determined by the automatic selector switch 74, which when open, permits only semi-automatic operation of the circuit, but which when closed, permits full operation with an indefinitely repeated number of pressing and retraction strokes of the press.

Elsewhere on the press is mounted a normally closed forward limit switch 75 for limiting the forward stroke of the press. This forward limit switch 75 may be either pressure-responsive or position-responsive. If pressure-responsive the switch 75 is opened when the pressure within the press circuit reaches a predetermined amount. If, however, the switch 75 is position-responsive, it is opened by the platen or mechanism connected thereto when the platen reaches a predetermined position on its forward stroke. The switch 75, for example, may be operated by the control rod 33 (Figure 1) when the platen arm 36 reaches the collar 38. Whatever the manner of actuating the forward limit switch 75, however, its actuation causes the reversal of the press operating circuit to reverse the travel of the main plunger 18 and platen 17. Also mounted elsewhere in the press is the normally open retraction limit switch 76. This switch is arranged to be closed when the press platen 17 reaches its upper or retracted position, such as when the platen arm 36 (Figure 1) engages the collar 37 upon the control rod 33.

Arranged to be controlled by the current from these various elements is a contactor switch unit 77 (Figure 5) having an operating coil 78 and normally open switch bars 79, 80 and 81 mounted upon the armature rod 82. The switch bars 80 and 81 serve directly to energize the solenoid winding 32 when the contactor operating coil 78 is energized, whereas the switch bar 79 serves to maintain a holding circuit for the energization of the operating coil 78. The press control system is so arranged that when the solenoid winding 32 is energized the platen 17 and main plunger 18 will move downwardly upon a pressing stroke, whereas when the solenoid winding 32 is deenergized they will move upwardly upon a retraction stroke.

The pliotron tube 56 contains the filament 62, previously described, and also an anode 83 and a grid 84. When the pliotron tube 56 is energized from the transformer 61 a stream of electrons flows from the cathode or filament 62 to the anode 83. The grid 84, however, regulates the flow of electrons, depending upon the amount of positive charge on the grid 84. By passing

the photocell current through the high impedance 66 and applying the resulting voltage to the pliotron grid 84, the pliotron current is placed under the control of the current from the photocells 46 and hence is controlled by the amount of light falling upon the cathodes of the photocells 46. This pliotron current flowing from the anode 83 is of sufficient strength to actuate the sensitive relay 58, closing the switch bar 85 thereof, and consequently energizing the relay 59 to close its switch bar 86. By adjusting the potentiometer 57 the current can be controlled in such a manner that the sensitive relay 58 is energized sufficiently to close its switch bar 85 when precisely the desired amount of light strikes either of the photocells 46 from the light sources 45.

Operation

Assuming that the operator has closed the motor switch to start the motor 21 and pump 22 in operation, the selection of the type of operation must next be made. If it is desired to operate the system manually, the hand automatic switch 73 is kept open and the press can then only be operated by manually moving the control rod 33, as by the hand lever 41. If it is desired to operate the press automatically, however, the hand automatic switch 64 is closed. When this switch is closed the press will operate in either a semi-automatic or automatic cycle, depending upon the setting of the automatic selector switch 74. If the switch 74 is kept open, semi-automatic operation occurs so that the operator must start each new pressing cycle of the press by closing the forward switches 68 and 69. If the switch 74 is closed, however, full automatic operation occurs so that once the operator has closed the forward switches 68 and 69, the press plunger 18 and platen 17 continue to execute an indefinite number of pressing and retraction strokes as long as the circuit is energized, unless it is temporarily deenergized by opening the reverse switch 70 or by interrupting the light beam 48 to deenergize the heavy-duty relay 59.

When the hand automatic switch 73 is closed, the photoelectric cell unit 43 and photoelectric relay unit 55 are energized by current flowing from the power line 53, through the line 87, the hand automatic switch 73, the lines 88, 89 and 90, the primary winding of the transformer 63 and the lines 91 and 92 leading to the power line 53. The same energization of the line 90 also energizes the primary windings of the transformers 60 and 61 by way of the lines 93 and 94, arranged to bridge the lines 90 and 91. The transformer 60, when energized, produces a voltage between the anode and cathode of the photocells 46, through the lines 95, 96 and 97 and the condenser 64. The light sources 45 are energized, through the lines 98, 99, 100 and 101, by the energization of the transformer 54, the primary of which is energized through the lines 92 and 102 bridging the power line 83 and the line 89, the energization of which has been previously described.

The energization of the primary winding of the pliotron transformer 61 supplies current through the lines 103 and 104 to energize the filament or cathode 62 of the pliotron tube 56. The midpoint of the secondary winding of the pliotron transformer 61 is connected to the line 105 leading from the secondary winding of the transformer 63 to the movable contact or slider 106 of the potentiometer 57. The opposite end of the secondary winding of the transformer 63 is connected by the line 107 to the sensitive relay 58, the opposite side of which is connected by the line 108 to the anode 83 of the pliotron tube 56. The line 90 terminates at the contact 109 opposite the relay switch bar 85, from which the line 110 runs to the heavy-duty relay 59, the opposite side of which is connected to the line 91. With the hand automatic switch 73 and automatic selector switch 74 closed, the entire photoelectric circuit is thus energized and the signal light 71 is illuminated through the resistor 72 and the lines 111 and 112 leading respectively to the lines 89 and 113, the latter leading to the line 114 which is connected to the power line 53.

To start the press in full automatic operation so that it will execute an indefinitely repeated number of pressing and retraction strokes, the operator now depresses both of the forward switches 68 and 69. By supplying two switches the operator is obliged to use both hands in starting the press, hence, cannot get his hands in the path of the platen, with possible danger of injury. When the push-button forward switches 68 and 69 are closed, the operating coil 78 of the contactor switch 77 is energized. This takes place by current passing from the power line 53, through the lines 114 and 113, the now closed forward push-button switch 69, the line 115, the now closed forward push-button switch 68, the lines 116 and 117, the heavy-duty relay switch bar 86, which is now closed upon its contacts by the energization of the photocell circuit, the line 118 leading to the operating coil 78, the lines 89 and 88, the hand automatic switch 73 and the line 87 leading to the power line 52. The energization of the operating coil 78 closes the contact switch bars 80 and 81 upon their contacts, energizing the winding 32 of the solenoid 31.

The same operation closes the switch bar 79 upon its contacts, and thereby energizes a holding circuit for the operating coil 78 when the forward push-button switches 68 and 69 are released by the operator. This holding circuit runs from the power line 53, through the line 114, the now closed contactor switch bar 79, the line 120, the forward limit switch 75, the line 121, the normally closed reverse switch 70, the line 122, the line 117, the now closed switch bar 86 of the heavy-duty relay 59, the line 118, the contactor switch operating coil 78, the line 89, the hand automatic switch 73 and the line 87 leading to the power line 52.

Thus, the solenoid 31 remains energized when the forward push-button switches 68 and 69 are released, thereby drawing down the solenoid armature 30 and shifting the bellcrank 28 and the rod 27 to set the servomotor control valve of the pump 22 in a position to cause the pump 22 to deliver pressure fluid to the main cylinder 19 to force the main plunger 18 and platen 17 downwardly upon a forward or pressing stroke. Assuming that nothing is interposed in the light beams 48 to break the path thereof, the heavy-duty relay 59 remains closed with its normally open switch bar 86 engaging its contacts, and the press platen 17 moves downwardly upon a pressing stroke until the forward limit switch 75 is opened. If 75 is a pressure-responsive switch it will be actuated in response to the building up of a predetermined pressure against the platen 17, whereas if it is a position-responsive switch it will be actuated when the platen 17 reaches a

predetermined position, as heretofore described. In either case, the opening of the forward limit switch 75 breaks the holding circuit for the operating coil 78 of the contactor switch 77, deenergizing it and consequently opening its switch bars 79, 80 and 81 and deenergizing the solenoid winding 32.

When this occurs the pump servomotor control valve of the pump 22 is shifted, as by a spring, so as to reverse the delivery of fluid from the pump 22 and to cause the platen 17 and main plunger 18 to execute a retraction stroke. The platen 17 moves upwardly until its arm 36 engages the collar 37, raising the control rod 33 and shifting the pump control into a neutral delivery position so that the delivery of pressure fluid is terminated, either to or from the main cylinder 19. In this position, therefore, the main plunger 18 and platen 17 would come to a halt if the automatic selector switch 79 were open, hence, a semi-automatic pressing cycle will have been accomplished. To start the platen 17 on another forward stroke with the automatic selector switch 74 open, it is necessary for the operator to again depress the forward push-button switches 68 and 69.

In the present description of the operation, however, it has been assumed that the operator has closed the automatic selector switch 74 in order to bring about full automatic operation so as to cause the press platen 17 to execute an indefinite number of pressing and retraction strokes. As the platen arm 36 moves upwardly to engage the collar 37 and lift the control rod 33, the upward motion of the latter lifts the cam collar 123 and closes the normally open retraction limit switch 76 (Figures 1 and 5) before the control rod 33 has risen a sufficient distance to place the pump control in a neutral or no delivery position. The closing of the retraction limit switch 76 completes an energization circuit, which bridges around the now open forward push-button switches 69 and 68. This bridging circuit runs from the line 113 (which is already connected through the line 114 to the power line 53), through the now closed switch bar of the retraction limit switch 76, the line 124, the now closed automatic selector switch 74, the line 117, the now closed switch bar 86 of the heavy-duty relay 59, the line 118, the contactor switch operating coil 78, the lines 89 and 88, the hand automatic switch 73 and the line 87 leading to the power line 52.

The energization of the contactor switch operating coil 78 again closes its switch bars 79, 80 and 81, energizes the holding circuit through the switch bar 79 and also energizes the solenoid coil 32 through the switch bars 80 and 81. The energization of the solenoid 31 again draws downwardly its armature 30 and again shifts the control of the pump 22 to its forward delivery position. The plunger 18 and platen 17, therefore, start downwardly upon another pressing stroke, after halting only momentarily at the top of the retraction stroke. Another pressing stroke will therefore be executed in the foregoing manner, and retraction will occur when the forward limit switch 75 is opened, either by pressure or by the platen reaching a predetermined position, as heretofore described, and the press platen 17 will execute an indefinite number of uninterrupted pressing and retraction strokes.

If, however, the operator has not completed his unloading or loading of the press, or for any reason is not clear of the press at the time the platen 17 starts downwardly upon another pressing stroke, his hands or body or the article being worked upon will obstruct the light beam 48. When the light beam 48 is thus interrupted the light no longer falls in sufficient quantity upon the photocells 46, and hence, an insufficient amount of current reaches the pliotron grid 84 through the line 96 and resistor 66 sufficient to supply enough current from the pliotron anode 83, through the line 108, to keep the sensitive relay 58 energized. As a consequence, the sensitive relay switch bar 85 flies open, thereby deenergizing the operating coil of the heavy-duty relay 59, the switch bar 86 of which also flies open. When this occurs the circuit between the lines 117 and 118 is broken, thereby deenergizing the contactor switch operating coil 78, consequently deenergizing the solenoid 32 and placing the pump control in a reverse delivery position to bring about a retraction stroke of the platen 17 and plunger 18, in the manner previously described. Thus, the operator will be protected, and the main platen 17 will be prevented from moving downwardly until the operator removes his hands or finishes his unloading or loading operation.

Moreover, reversal of the pump control to bring about a retraction stroke of the platen will also automatically take place in the same manner if the operator interposes his hands or any opaque object in the path of the light beam after the platen has already commenced its downward or forward stroke.

When this has been finished and as soon as the light beam 48 is no longer obstructed, the current in sufficient quantities again flows along the line 96 to the pliotron grid 84, causing sufficient current to flow along the line 108 from the anode 83 to reenergize the sensitive relay 58 and close its switch bar 85. This again energizes the heavy-duty relay 59 and closes its switch bar 86, thereby again closing the previously broken circuit between the lines 117 and 118, and permitting the operating coil 78 of the contactor switch 77 to be reenergized. Thus, the solenoid winding 32 will be reenergized and the pump control placed in a forward delivery position to cause the press platen 17 to move downwardly upon a forward stroke as soon as the interruption of the light beam 48 is terminated and the light beam again strikes the photoelectric cells 46. In this manner the operator is completely protected against injury if he is delayed in removing his hands from the press before the platen starts downwardly. This photoelectric press control system, therefore, removes a serious hazard which has previously endangered the operator in the operation of a press under a full automatic system of operation.

Modified arrangements

The modified arrangement shown in Figure 3 employs mirrors 130, 131 and 132, placed at three corners of the press so that the light beam 48 will pass completely around the four sides of the press from the light source 45 to the photocell 46. The arrangement shown in Figure 3, therefore, protects not only the front and back of the press, as in the principal form shown in Figures 1 and 2, but also protects the operator against injury in case he inserts his hands through the sides of the press, between the side members 12. Any interruption of the light beam 48, whether at the front or back of the press or at the sides, immediately causes the opening of the heavy-duty

relay 59 and the consequent deenergization of the contactor operating coil 78 with the subsequent reversal and retraction of the main plunger 18, in the manner previously described.

The modification shown in Figure 4 is similar in principle to that shown in Figure 3 in that it protects all four sides of the press by photoelectric light beams instead of merely the front and back of the press. The arrangement shown in Figure 4 differs from that shown in Figure 3 in that no mirrors are employed, but in their stead four complete sets of photocell units, comprising the light source 45 and photocell 46, are used, each photocell unit protecting a single side of the press. The operation, however, and the result are similar to those obtained in Figure 3, but a more positive operation is insured because the intensity of the light beam will not be retarded by the deterioration or dust coating of the mirrors 130.

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 a press control system for a hydraulic press, a reciprocable platen, a hydraulic motor for moving said platen in the forward and reverse directions, a reversible variable delivery pump having a pump flow-controller therein, an electrical control circuit for controlling the actuation of said platen-moving means and including electromagnetic means connected to said flow-controller for automatically shifting said flow-controller to control the motion of said hydraulic motor and platen in response to the attainment of predetermined conditions during the power driven working and power driven return strokes of said platen for effecting completely automatic operation of said platen, a photoelectric circuit having its light beam extending across an access opening to said platen, and means responsive to the interception of said light beam for altering the electrical condition of said electrical control circuit instantaneously to reverse the power driven motion of said hydraulic motor upon the occurrence of said interception during forward motion of the platen.

2. In a press control system for a hydraulic press, a reciprocable platen, a hydraulic motor for moving said platen in the forward and reverse directions, a reversible variable delivery pump having a pump flow-controller therein, an electrical control circuit for controlling the actuation of said platen-moving means and including electromagnetic means connected to said flow-controller for automatically shifting said flow-controller to control the motion of said hydraulic motor and platen in response to the attainment of a predetermined condition during the power driven working and power driven return strokes of said platen for effecting completely automatic operation of said platen, a photoelectric circuit having its light beam extending across an access opening to said platen, and relay means having a circuit interrupter disposed in said electrical circuit, said relay means being responsive to the interception of said light beam for shifting said circuit interrupter to alter the electrical condition of said electrical control circuit instantaneously to reverse the power driven motion of said hydraulic motor upon the occurrence of said interception during forward motion of the platen.

3. In a press control system for a hydraulic press, a reciprocable platen, a hydraulic motor for moving said platen in the forward and reverse directions, a reversible variable delivery pump having a pump flow-controller therein, an electrical control circuit for controlling the actuation of said platen-moving means and including electromagnetic means connected to said flow-controller for automatically shifting said flow-controller to control the motion of said hydraulic motor and platen in response to the attainment of a predetermined condition during the power driven working and power driven return strokes of said platen for effecting completely automatic operation of said platen, a photoelectric circuit having its light beam extending across an access opening to said platen, and relay means having a circuit interrupter disposed in said electrical circuit, said relay means being responsive to the interception of said light beam to release said circuit interrupter and open said electrical control circuit instantaneously to reverse the power driven motion of said hydraulic motor upon the occurrence of said interception during forward motion of the platen.

4. In a press control system for a hydraulic press, a reciprocable ram, a hydraulic motor connected thereto, a reversible variable delivery pump having a flow-controller therein for reversing the delivery of pressure fluid from said pump to said hydraulic motor to operate said ram upon the power driven working and power driven return strokes, electrically-actuated means for shifting said flow-controller, an electrical circuit for controlling the energization of said electrically-actuated shifting means, a photoelectric circuit having its light beam extending across an access opening to said ram, and means responsive to the interception of said light beam for altering the electrical condition of said electrical circuit to alter the energization of said electrically-actuated shifting means and instantaneously reverse the power driven motion of said hydraulic motor upon the occurrence of said interception during forward motion of the platen.

5. In a press control system for a hydraulic press, a reciprocable ram, a hydraulic motor connected thereto, a reversible variable delivery pump having a flow-controller therein for reversing the delivery of pressure fluid from said pump to said hydraulic motor to operate said ram upon the power driven working and power driven return strokes, electrically-actuated means for shifting said flow-controller, an electrical circuit for controlling the energization of said electrically-actuated shifting means, a photoelectric circuit having its light beam extending across an access opening to said ram, and an electrical relay means having a circuit interrupter disposed in said electrical circuit, said relay means being responsive to the interception of said light beam for altering the electrical condition of said electrical circuit to alter the energization of said electrically-actuated shifting means, and instantaneously reverse the power driven motion of said hydraulic motor upon the occurrence of said interception during forward motion of the platen.

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