

July 18, 1939.

P. C. POCOCK ET AL

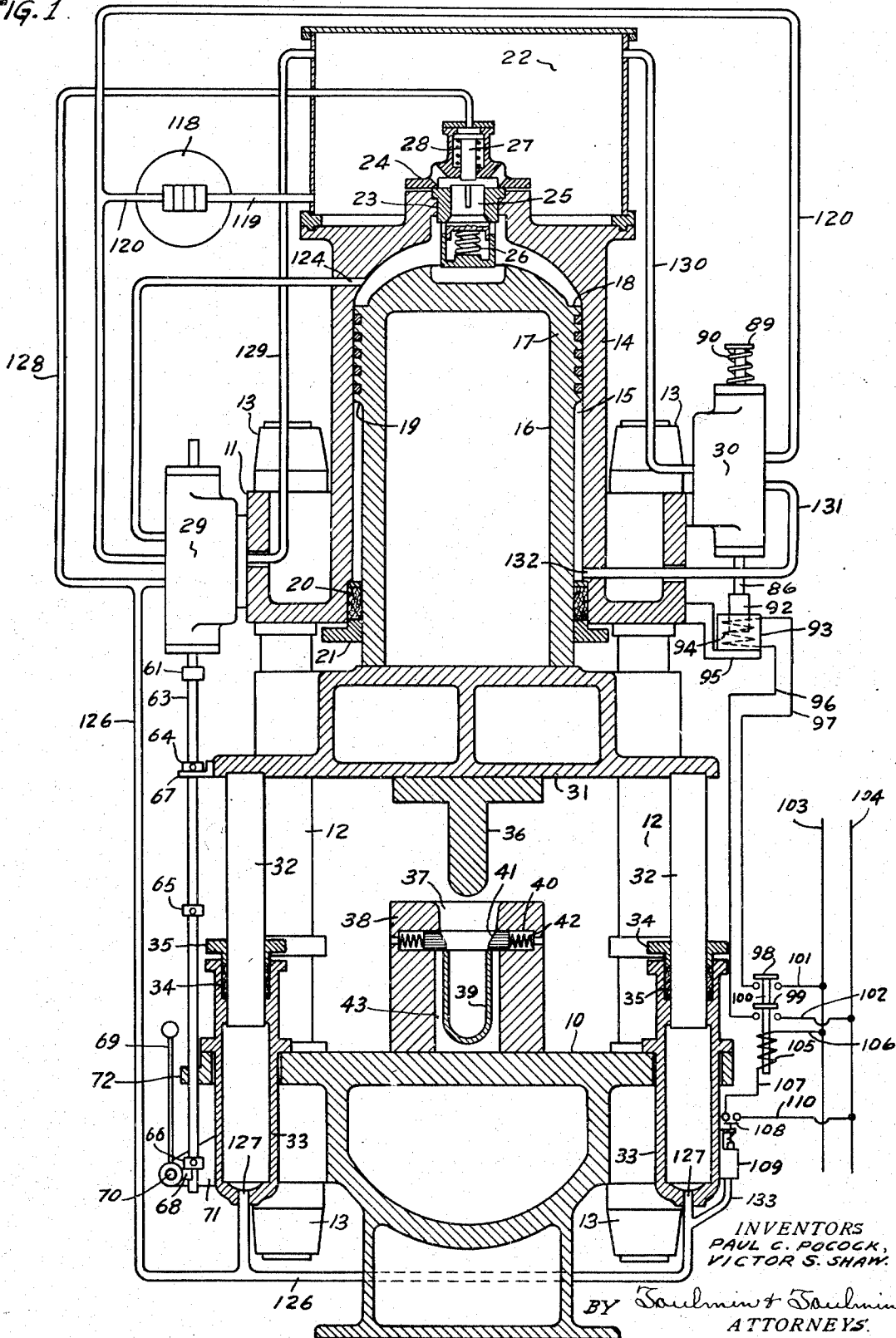
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HYDRAULIC PRESS WITH VARIABLE RETRACTION FOR PLATENS

Filed Dec. 8, 1937

3 Sheets-Sheet 1

FIG. 1.



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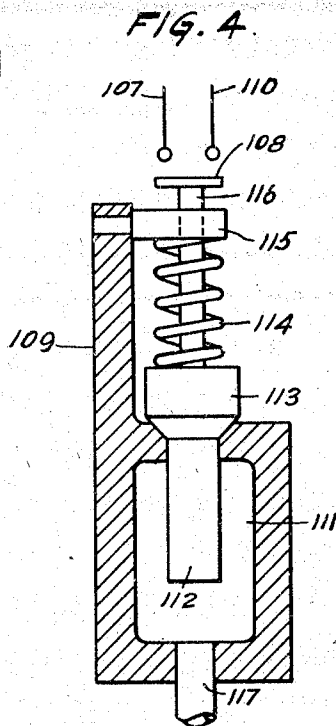
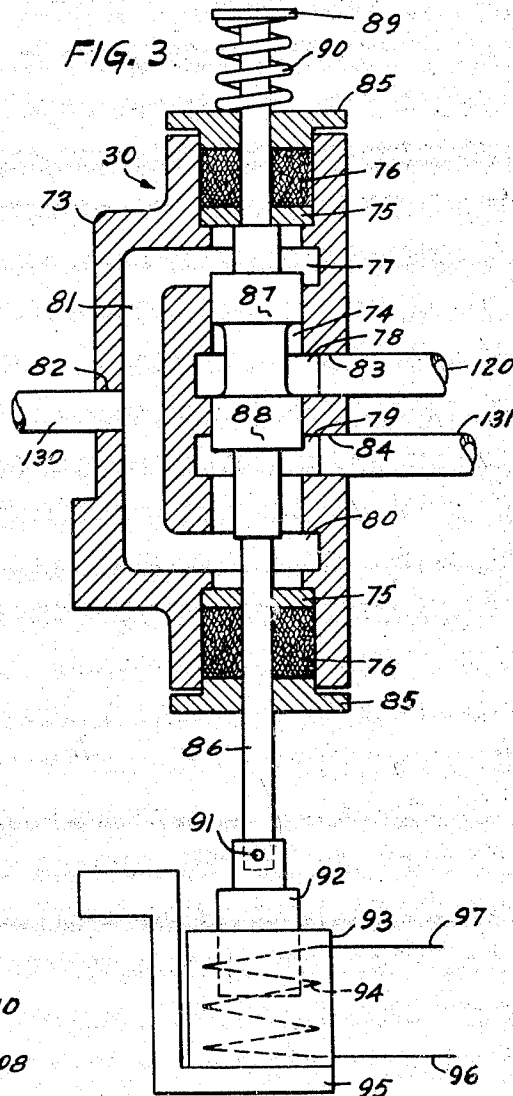
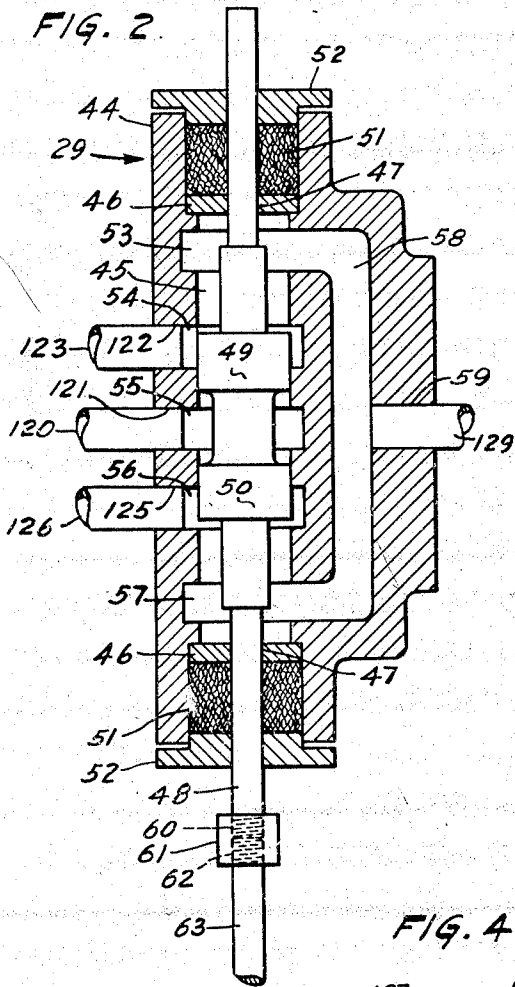
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3 Sheets-Sheet 3

FIG. 5.

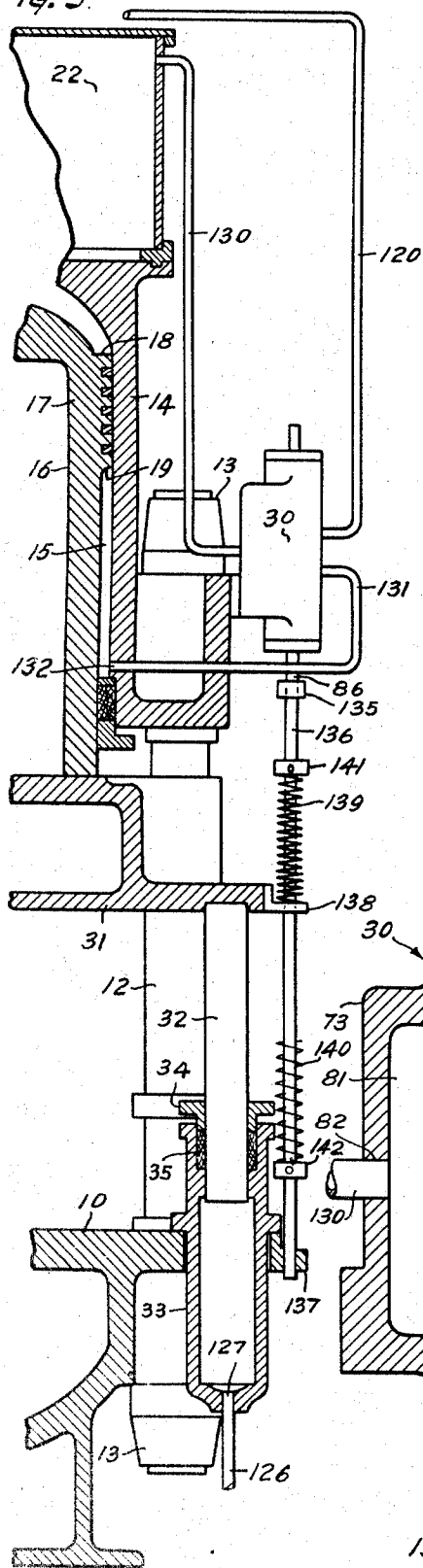


FIG. 7.

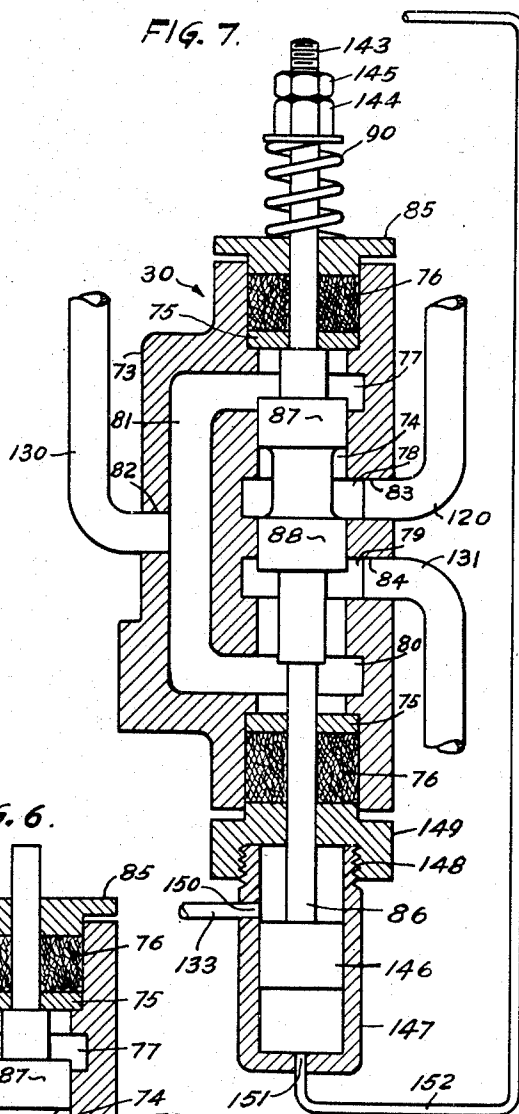
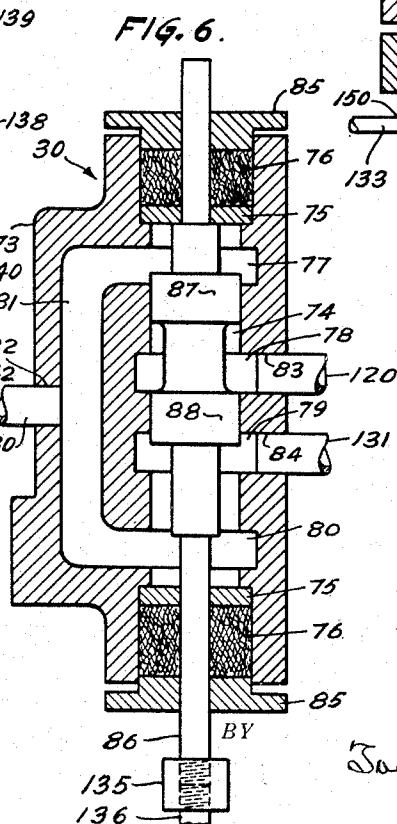


FIG. 6.



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HYDRAULIC PRESS WITH VARIABLE RETRACTION FOR PLATENS

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Application December 8, 1937, Serial No. 178,772

10 Claims. (Cl. 60—97)

This invention relates to press circuits, and in particular, to a press circuit providing variable forces for retracting the platen.

One object of this invention is to provide a hydraulic press circuit with means for applying different forces for retracting the press platen.

Another object is to provide a hydraulic press with a plurality of means for retracting the platen, and for selectively applying a greater force in one part of the retraction operation than in another part.

Another object is to provide a hydraulic press with means for automatically applying a relatively large retracting force to the platen at the start of the retraction operation, and subsequently to apply a smaller retraction force.

Another object is to provide a hydraulic press having a plurality of retraction plunger areas for providing different amounts of retraction force at different portions of the retraction part of the operating cycle.

Another object is to provide a hydraulic press with a retraction plunger and an auxiliary retraction plunger, together with means for bringing the auxiliary retraction plunger into and out of operation, for applying a larger amount of retraction pressure in a predetermined portion of the retraction stroke.

Another object is to provide a hydraulic press with means responsive to the attainment of a predetermined pressure upon the retraction stroke to apply an additional retraction force to the press platen.

Another object is to provide a hydraulic press with a double-acting main plunger having a retraction area and a retraction plunger having an additional retraction area, together with means responsive to the attainment of a predetermined pressure upon the retraction stroke for applying both of said retraction areas to the work of retracting the press platen.

Another object is to provide a method of pressing workpieces, including temporarily applying an additional force to separate the pressing members at the completion of the working stroke.

In the drawings:

Figure 1 is a central vertical section through one embodiment of a hydraulic press according to the present invention.

Figure 2 is an enlarged central vertical section through the four-way operating valve shown in Figure 1.

Figure 3 is an enlarged central vertical section through the three-way auxiliary retraction valve shown in Figure 1.

Figure 4 is an enlarged central vertical section through the pressure-responsive switch shown in Figure 1.

Figure 5 is a modification similar to the right-hand portion of Figure 1, but showing mechanical means for shifting the retraction valve.

Figure 6 is an enlarged vertical section through the retraction valve shown in Figure 5.

Figure 7 is an enlarged vertical section through a modified retraction valve for use in the circuit of Figure 1, wherein the retraction valve is shifted by hydraulic means.

General arrangement

In general, the hydraulic press circuit of this invention consists of a hydraulic press having a main plunger for moving the platen upon a working stroke, and a plurality of retraction plunger areas for retracting the plunger, certain of said areas being inserted in the circuit during a predetermined portion of the retraction stroke in order to apply a greater retraction force during one portion of the retraction stroke than during another portion. Means, such as a pressure-responsive switch, and an electrically operated valve are provided for distributing pressure fluid to the additional retraction plunger area in response to the attainment of a predetermined pressure upon the retraction stroke.

In performing certain kinds of pressing operations with hydraulic presses, a considerably larger force is needed in the initial part of the retraction stroke than is subsequently needed for the remainder of the retraction stroke. This problem is present in hydraulic metal-working presses having dies for forming or drawing metal parts. At the end of the working stroke of such a press the two dies are so firmly engaged with the work-piece that a considerably greater force is necessary for separating the dies than for subsequently retracting the platen and main plunger against the forces of friction and gravity.

Hitherto, when sufficient retraction plunger area has been provided to insure sufficient force for separating the dies under such conditions, this area has been unnecessarily large for use throughout the remainder of the retraction stroke. As a consequence, there has been a serious loss of speed in the retraction stroke resulting from the large size of the retraction area and the large volume of pressure fluid required to serve this large retraction area. Alternatively, it has been necessary to provide an additionally high capacity pressure system, such as an additional hydraulic pump and motor for sup-

plying the additional force needed for separating the dies at the start of the retraction stroke, but unnecessary during the subsequent portion of the retraction. Accordingly, with the previous arrangements of separating the dies by using a constant ram area on the retraction stroke, much power has been wasted, and unnecessarily large and extensive equipment has been required to supply the pressure fluid necessary to apply the requisite retraction force for separating the dies and for maintaining the desired speed of retraction.

By the provision of an auxiliary retraction plunger area, according to the present invention, and by making it possible to insert and withdraw this auxiliary retraction plunger area from the stroke, it is possible to utilize the additional area only for separating the dies. Once the dies have been separated, however the additional area is withdrawn from the circuit and the platen is subsequently retracted at a higher speed without requiring additional pumping equipment of high capacity. According to the present invention, therefore, the desired speeds of operation are maintained with smaller capacity pumping equipment than has hitherto been necessary, because the maximum retraction power is applied only during the short portion of the retraction stroke during which it is required. According to the present invention, furthermore, two separate and distinct retraction plunger areas are provided for retracting the main plunger and platen, valves being provided for selectively admitting pressure to one or both of these retraction plunger areas, as required by the forces demanded at different portions of the retraction stroke.

Press construction

Referring to the drawings in detail, Figure 1 shows a preferred embodiment of the press circuit of this invention. In this embodiment the press is provided with a bed 10 and head 11, forming bottom and top press members, and interconnected by strain rods 12 having nuts 13 threaded upon the upper and lower ends, respectively. The press head contains a main cylinder 14 having a main cylinder bore 15, within which a main plunger 16 is reciprocable. The latter is provided with a piston head 17 having a forward or working area 18 and a retraction or return area 19. A packing 20, urged into contact with the plunger 16 by the gland 21, prevents leakage around the main plunger 16 at the entrance to the main cylinder bore 15.

Mounted upon the main cylinder 14 is a surge tank 22 for supplying the working fluid to the circuit. The main cylinder 14 is also provided with an aperture 23, within which is inserted a surge valve 24 having a surge valve member 25 urged upwardly by a coil spring 26 in the direction of closing the passageway through the valve. The surge valve 24 also contains a plunger 27, urged upwardly by the coil spring 28 and downwardly by pressure fluid supplied thereto in order to forcibly maintain the surge valve member 25 in an open position, directly upon the return or retraction stroke of the press, and responsive to the supplying of pressure fluid to the retraction cylinders. This surge valve 24 in itself forms no part of the present invention, and is disclosed in the Ernst Patent No. 1,892,568 of December 27, 1932.

Likewise mounted upon the press head 11 is a four-way operating valve, generally designated 29, and a three-way retraction control valve, gen-

erally designated 30. Both of these valves are described subsequently in detail. Secured to the main plunger 16 is a platen 31, suitably guided for reciprocation. Connected to the platen 31 are retraction or push-back plungers 32, reciprocating in retraction or push-back cylinders 33 mounted upon the press bed 10. The retraction cylinders 33 are also provided with packings 34 and glands 35 for the prevention of leakage.

Die construction

The press construction of this invention is adapted to handle any kind of pressing operation, equipment suitable for metal drawing being shown purely for purposes of illustration and not by way of limitation. To this end the platen 31 is provided with a punch 36 cooperating with the bore 37 of a die 38 mounted upon the press bed 10. In Figure 1 the press is shown as having performed a pressing operation upon a workpiece 39, represented as a deep cylindrical shell of metal closed at one end. The operation which the press is shown to have performed upon this workpiece has consisted in smoothing the outer surface of the workpiece 39 by pushing it through the bore 37 by means of the punch 36. The die 38 is provided with transverse sockets 40 containing pawls 41 urged by springs 42 inwardly to positions engaging the top of the workpiece after the pressing operation has been concluded. These pawls engage the workpiece 39 and prevent it from following the punch 36 when the platen 31 and punch 36 are withdrawn from the die 38 on the retraction stroke. The die 38 is provided with a cavity 43 for receiving the workpiece after the pressing operation has been performed.

Valve arrangement

The four-way operating valve 29 and three-way retraction control valve 30 are of the piston type, having heads arranged upon valve rods for controlling the distribution of the fluid passing therethrough. The four-way operating valve 29 (Figure 2) consists of a casing 44 having a bore 45 and end plugs 46 with apertures 47 for the reciprocation of a valve rod 48 with spaced piston heads 49 and 50 thereon. Packings 51 and glands 52 prevent leakage around the valve rod 48. The casing 44 is provided with five annular enlargements 53, 54, 55, 56 and 57. The end enlargements 53 and 57 are interconnected by the passageway 58, terminating in the exhaust port 59. The lower end of the valve rod 48 is threaded, as at 60, for the connection of a threaded collar 61, into which is inserted the upper threaded end 62 of the control rod 63. The latter is provided with adjustable collars 64, 65 and 66, adjustably secured thereto. The upper and intermediate collars 64 and 65 are arranged to be engaged by the platen arm 67, secured to the platen 31. The lower collar 66, however, is engaged by the arm 68 of a bellcrank hand lever 69 pivoted, as at 70, to the bracket 71 upon the press bed 10. The control rod 63 is guided in its reciprocation by the bored bracket 72 extending transversely from the bed 10.

The three-way retraction control valve 30 (Figure 3) is of similar construction to the four-way operating valve 29 and is similarly provided with a casing 73, with a bore 74 closed by end plugs 75 with packings 76, and having four annular enlargements 77 to 80, inclusive. The end enlargements 77 and 80 are interconnected by the passageway 81, terminating in the exhaust port 82, whereas the central enlargements 78 and 79 75

terminate in the ports 83 and 84. Glands 85 similarly prevent leakage around the valve rod 86, which passes therethrough. The valve rod 86 is provided with spaced heads 87 and 88 for controlling the distribution of the fluid to the various ports of the retraction control valve 30 according to the position of the valve rod 86.

On the upper end of the valve rod 86 is a flange 89 serving as an abutment for one end of the coil spring 90, the opposite end of which engages one of the glands 85 and serves to urge the valve rod 86 upwardly. Connected to the lower end of the valve rod 86, as at 91, is the armature plunger 92 of a solenoid 93, having a winding 94 which when energized serves to pull the armature 92 and valve rod 86 downwardly against the urge of the coil spring 90. The solenoid 93 is mounted upon a bracket 95, secured to the press head 11.

The winding 94 of the solenoid 93 is energized by the lines 96 and 97 leading to the contacts of the switch bars 98 and 99 of the contactor switch 100. The opposite contacts thereof are connected by the lines 101 and 102 to the power lines 103 and 104, respectively. The contactor switch 100 is provided with an operating coil 105 connected by the line 106 to the power line 103, and likewise connected by the line 107 to the contacts of the switch bar 108 of the pressure-responsive switch 109. From the opposite contact thereof the line 110 leads to the power line 104. The pressure-responsive switch 109 (Figure 4) is mounted upon the press bed 10, and is provided with a cylinder bore 111, reciprocally receiving a plunger 112, the upper end of which is enlarged at 113 to engage one end of a coil spring 114, the opposite end of which engages a bracket 115. The coil spring 114 urges the switch plunger 112 and the switch rod 116 attached thereto in a downward direction, tending to separate the switch bar 108 from its contacts. The pressure-responsive switch 109 is therefore a normally open switch, and closes only when the pressure within the cylinder bore 111 rises to a point sufficient to overcome the thrust of the coil spring 114. A port 117 serves for the admission of pressure fluid to the cylinder 111.

Hydraulic circuit

The hydraulic circuit interconnecting the hydraulic elements previously described is shown in Figure 1. Pressure fluid is provided by a hydraulic pump 118 of any suitable type. The pump 118 receives fluid from the surge tank 22 over the suction line 119, and discharges pressure fluid through the pressure line 120 leading to the central port 121 of the operating valve 29. The pressure line 120 also leads to the upper port 83 of the retraction control valve 30. From the upper port 122 of the operating valve 29, line 123 leads to the port 124 in the head of the main cylinder 14. From the lower port 125 of the operating valve 29, the line 126 leads to the ports 127 in the retraction cylinders 33. A branch 128 leads to the top of the surge valve 24 for actuating the valve opening plunger 27 upon retraction stroke of the press. From the remaining or exhaust port 59 of the operating valve 29, the exhaust line 129 runs back to the surge tank 22. In the position shown in Figure 2 the operating control valve has been lifted into its neutral position by the platen arm 67, so that fluid from the pressure line 120 is entrapped between the valve heads 49 and 50.

The exhaust port 82 of the retraction control valve 30 is connected by the exhaust line 130

to the surge tank 22. The remaining port 84 thereof is connected by the line 131 to the lower port 132 in the main cylinder 14 on the opposite side of the piston head 17 from the head port 124. The spring 90 normally urges the valve heads 87 and 88 of the retraction control valve 30 into the position shown in Figure 3, wherein the pressure fluid from the line 120 normally is entrapped between the heads 87 and 88. When the solenoid 93 is energized, however, and the valve rod 86 is drawn downwardly, the heads 87 and 88 move into positions connecting the pressure line 120 and pressure port 83 with the port 84 and line 131 leading to the auxiliary retraction area 19 of the main piston head 17.

Operation

In the operation of the press circuit of the present invention the auxiliary retraction area is ordinarily out of the operating circuit, and is brought into the circuit by the retraction control valve 30 only when its additional force is necessary. Let it first be assumed that the various elements of the press circuit are in the positions shown in Figures 1, 2 and 3. The operator removes the workpiece 39, which has been finished in the previous operation of the press, and places a new workpiece upon the punch 36, above the aperture 37 in the die 38. The operator now shifts the hand lever 69 to the left, causing the arm 68 to lift the collar 66 and control rod 63, thereby moving the valve rod 48 and valve heads 49 and 50 of the operating valve 29 upwardly, and connecting the pressure line 120 with the line 123.

Assuming that the pump 118 has been started, pressure fluid now flows therefrom along the line 120, through the operating valve 29, and along the line 123, through the head port 124, into the main cylinder bore 15 above the piston head 17. At the same time the line 126 is connected through the operating valve 29 to the exhaust line 129, thereby permitting fluid to flow from the retraction cylinders 33, back to the surge tank 22 by way of the line 126, the operating valve 29 and the line 129. This permits the main plunger 16 and platen 31 to descend by gravity. The suction thereby created above the main plunger head 17 causes the surge valve member 25 to push against the thrust of the coil spring 26, thereby permitting fluid to pass indirectly through the surge valve 24, into the space above the main plunger head 17. This permits the main cylinder to fill rapidly with fluid, without depending upon the fluid supplied thereto by the pump 118.

When the punch 36 encounters the workpiece 39 and resistance is built up, the main plunger 16 and platen 31 cease to move by gravity. Pressure is then built up in the head of the main cylinder 14 above the piston head 17, this pressure automatically closing the surge valve member 25, assisted by the coil spring 26. The pump 118 thereafter continues to supply pressure fluid to continue the pressing operations upon the workpiece 39 until these operations have been completed. Just before the completion of the pressing operation and when the platen has neared the lower limit of its working stroke, the platen arm 67 engages the collar 65 upon the control rod 63, moving the latter downwardly and shifting the valve rod 48 of the operating valve 29 into a position wherein the pressure line 120 is connected to the retraction line 126 leading to the retraction cylinders 33. At the same time the line 123 is connected with the exhaust line 129 and pres-

sure through the branch line 128, from the line 126, enters the surge valve 24 and urges the plunger 27 thereof downwardly, forcibly opening the surge valve member 25. The pressure fluid

5 entering the retraction cylinders 33 engages the retraction plungers 32 and urges the platen 31 upwardly upon its retraction stroke.

If the force required to separate the punch 36 from engagement with the workpiece 39 and 10 die 38 does not exceed the normal operating pressure within the retraction cylinders 33, the platen 31 rises and proceeds upon its retraction stroke until the platen arm 67 engages the collar 64 and raises the control rod 63. This shifts the valve 15 rod 48 and heads 49 and 50 of the operating valve 29 into the neutral position thereof, thereby entrapping the pressure fluid from the line 120 within the operating valve 29, and holding the platen 31 in its retracted position.

20 Meanwhile the space beneath the piston head 17 of the main plunger 16 has been in communication with the surge tank 22 by way of the line 131, which is normally connected to the exhaust line 130 of the retraction control valve 30, as 25 shown in Figure 3. Accordingly as the main plunger 16 moves downwardly upon its working stroke, the fluid beneath the main piston head 17 passes directly along the line 131, through the detraction control valve 30 and the line 130, into 30 the surge tank 22. On the normal return or retraction stroke, as described above, the fluid passes from the surge tank 22, along the line 130, through the retraction control valve 30 and line 131, into the space beneath the main piston 35 head 17, filling this space with the proper amount of fluid. Accordingly, under normal operating conditions, the auxiliary retraction area 19 on the under side of the main piston head 17 has no effect upon the speed or force of the main plunger 40 16, and absorbs none of the pressure fluid delivered by the pump 118.

If, however, the punch 36 engages the workpiece 39 at the end of the working stroke with such friction that an abnormally large force is 45 required to separate them, pressure builds up within the retraction cylinders 33 and is transmitted along the line 133 leading to the cylinder 111 of the pressure-responsive switch 109. At a predetermined pressure sufficient to overcome 50 the thrust of the coil spring 114 the plunger 112 rises and causes the switch bar 108 to engage its contacts, closing the circuit between the lines 110 and 107, thereby energizing the operating coil 105 of the contactor switch 100. The 55 switch bars 98 and 99 thereof then close upon their contacts, closing the circuit between the lines 101 and 97, and also between the lines 102 and 96, respectively. This energizes the winding 94 of the solenoid 93, causing the armature 92 thereof and valve rod 86 of the retraction control valve 30 to be drawn downwardly, overcoming the thrust of the coil spring 90.

When this occurs the valve heads 87 and 88 are shifted so that the pressure line 120 now communicates with the line 131 leading to the lower 65 part of the main cylinder bore 15. Accordingly, pressure fluid now passes from the pump 118, along the line 120, through the retraction control valve 30 and along the line 131, through the 70 port 132, into the space beneath the auxiliary retraction area 19 of the main piston head 17. At the same time the lower valve head 88 closes the connection between the line 131 and the exhaust line 130 leading to the surge tank 22. The 75 pressure fluid passing into the lower part of the

main cylinder bore 15 engages the auxiliary retraction area 19 of the main plunger 16, and adds this area to the area of the retraction plungers 32, thereby increasing the force available 5 for lifting the platen 31 and separating the punch 36 from the workpiece 39 and die 38.

As soon as the punch 36 has been loosened from its engagement with the workpiece 39, the force required to retract the punch 36 and platen 31 greatly diminishes and accordingly the 10 pressure in the retraction cylinders 33 drops. This pressure drop is transmitted along the line 133 to the cylinder 111 of the pressure-responsive switch 109, permitting the plunger 112 thereof to move downwardly under the urge of the coil 15 spring 114, separating the switch bar 108 from its contacts and opening the circuit between the lines 107 and 110. This deenergizes the operating coil 105 of the contactor switch 100, opens the circuit between its switch bars 98 and 99 20 and their contacts, and deenergizes the lines 96 and 97. The consequent deenergization of the solenoid 93 permits the coil spring 90 to move the valve rod 86 of the retraction control valve 30 upwardly to its original position, cutting off 25 the further flow of pressure fluid from the line 120 to the space beneath the auxiliary retraction area 19 of the main plunger 16, and opening the latter to a supply of pressure fluid, reaching it by way of the exhaust line 130, the retraction 30 control valve 30 and the line 131.

With the auxiliary retraction area 19 thus removed from the circuit, the temporary slowing down of the platen 31, due to its presence, is 35 ended and the platen 31 continues to move swiftly upward, under the influence of the retraction plungers 31 alone. When the platen arm 67 engages the collar 64 and shifts the operating valve rod 48 to its neutral position, the pressure fluid from the line 120 is again entrapped between the valve heads 49 and 50, and the main plunger 16 is held in a stationary position until the control rod 63 is moved upwardly to start another working cycle.

In the circuit shown in Figure 1 the manually 45 operated lever 69 is shown for simplifying the disclosure. It will be understood, however, that the four-way operating valve 29 may be shifted by other means, such as by any suitable electric or hydraulic arrangement. Similarly, the retraction 50 control valve 30 may be shifted by means of manual or hydraulic means in order to insert and remove the auxiliary retraction plunger area from the circuit. It will also be understood that these valves may be shifted mechanically in response to movement of any suitable portion of the press. In place of the spring 90, other suitable means, such as a pressure cylinder, may be used for returning the valve rod 86 of the retraction control valve 30 to its upper position. 60

The modification shown in Figure 5 provides mechanical means for shifting the retraction control valve 30. The valve 30 is generally similar to the valve 30 in Figure 1, except that the spring 90 and the flange 89 are omitted. The 65 valve rod 86, however, is connected to a control rod 136 by means of the connection 135, and is guided at its lower end by a lug 137 upon the bed 10 of the press.

Extending laterally from the platen 31 is a 70 platen arm 138, arranged to engage coil springs 139 and 140, mounted respectively above and below the platen arm 138 and positioned by means of adjustable collars 141 and 142, respectively. The upper spring 139 is provided to per- 75

mit the platen 31 to continue to move upwardly after it has shifted the valve 30 to its uppermost position without causing damage to the control rod 136 or the parts actuated thereby. This provision is made because the stroke of the platen 31 is greater than the stroke of the valve 30. The lower spring 140 serves to move the control rod 136 and valve rod 86 downwardly when the spring 140 is engaged by the platen arm 138 on the downward stroke of the platen.

In adjusting the press for operation, the collar 142 is moved along the control rod 136 into such a position that the spring 140 will be engaged by the platen arm 138 to shift the control rod 136 downwardly when the platen 31 nears the lower limit of its stroke. In this manner the auxiliary return area 19 is caused to be opened to the entrance of pressure fluid by way of the valve 30 as soon as the return stroke of the platen 31 is started by admitting pressure fluid to the lines 126 and 128, in response to the operation of the four-way operating valve 29. The upper collar 141 is adjusted during the setting-up operations of the press to such a position along the control rod 136 that the latter will be moved upwardly when the platen 31 has returned a sufficient distance on its return stroke to free the workpiece from the punch. At that point the platen arm 138 engages the coil spring 139, and the latter moves the collar 141 and control rod 136 upwardly, together with the valve rod 86, shifting the valve 30 and shutting off the auxiliary retraction area 19 from pressure fluid. In this manner the auxiliary retraction area 19 is removed from service at a predetermined point on the return stroke of the platen 31.

In the modification shown in Figure 7, the valve 30 as a whole is similar to that of Figure 1 and has a similar coil spring 90. The upper end of the valve rod 86, however, is threaded, as at 143, and provided with a nut 144 and locknut 145, whereby the force of the spring 90 may be adjusted. On the lower end of the valve rod 86 is a piston head 146, mounted for reciprocation in a cylinder 147, threaded as at 148 into a threaded flange 149 serving to close the lower end of the valve casing 73. The upper end of the cylinder 147 communicates, through a port 150, with a conduit 133, whereas the lower end of the cylinder is provided with a port 151, communicating with a conduit 152, which has a drain line leading back to the surge tank 22 for draining away fluid which escapes past the piston 146. The conduit 133 is connected to the return pressure fluid line 126 and is the same conduit as the conduit 133 employed for actuating the pressure switch 109 in Figure 1.

In the operation of the modification shown in Figure 7 the four-way operating valve 29 is shifted so as to admit pressure fluid into the lines 126 and 128 for retracting the platen 31 by means of pressure fluid admitted to the retraction cylinders 33. The resistance to the withdrawal of the punch occasioned by the friction between the punch and the workpiece causes pressure to be built up within the retraction cylinders 33, and this pressure is transmitted along the conduit 133 into the chamber above the piston head 146 in the cylinder 147 (Figure 7). When this pressure becomes sufficiently great to overcome the thrust of the coil spring 90, it shifts the piston head 146 and valve rod 86 downwardly, shifting the valve heads 87 and 88 for admitting pressure fluid from the line 120 and the line 131, leading through the port 132 to the auxiliary retraction area 19

of the main plunger 16. As soon as the punch is freed from engagement with the workpiece by the force of the auxiliary retraction area 19 added to the effect of the retraction plungers 32, the pressure within the retraction line 126 drops. The consequent drop in the line 133 permits the spring 90 to shift the valve heads 87 and 88 upwardly, thereby cutting off the auxiliary retraction area 19 from the supply of pressure fluid in the conduit 120. The press platen 31 thenceforth continues its retraction stroke under the influence of the retraction plungers 32 alone.

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

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

1. In a hydraulic press circuit, a platen, a main plunger connected thereto, main retraction means for retracting said main plunger, and auxiliary retraction means selectively insertible in said circuit during a minor part of the retraction stroke of said main retraction means for temporarily amplifying the force of said main retraction means.

2. In a hydraulic press circuit, a platen, a main plunger connected thereto, main retraction means for retracting said main plunger, auxiliary retraction means selectively insertible in said circuit during a minor part of the retraction stroke of said main retraction means for temporarily amplifying the force of said main retraction means, and means responsive to the attainment of a predetermined pressure in said main retraction means for rendering said auxiliary retraction means operative.

3. In a hydraulic press circuit, a platen, a main plunger connected thereto, a main retraction plunger connected thereto, an auxiliary retraction plunger area, and a valve for selectively admitting pressure fluid to said auxiliary retraction plunger area during a minor part of the retraction stroke of said main retraction plunger for temporarily amplifying the force of said main retraction plunger.

4. In a hydraulic press circuit, a platen, a main plunger connected thereto, a main retraction plunger connected thereto, an auxiliary retraction plunger area, a valve for selectively admitting pressure fluid to said auxiliary retraction plunger area during a minor part of the retraction stroke of said main retraction plunger for temporarily amplifying the force of said main retraction plunger, and means responsive to the attainment of a predetermined pressure in said main retraction plunger for shifting said valve to admit pressure fluid to said auxiliary retraction plunger area.

5. In a hydraulic press circuit, a platen, a main plunger connected thereto, a main retraction plunger connected thereto, an auxiliary retraction plunger area on said main plunger, means for selectively inserting and withdrawing said auxiliary retraction plunger area from said circuit during a minor part of the retraction stroke of said main retraction plunger for temporarily amplifying the force of said main retraction plunger, and means responsive to the attainment of a predetermined pressure in said main retraction plunger for shifting said valve to admit pressure fluid to said auxiliary retraction plunger area.

6. In a hydraulic press circuit, a platen, a main

plunger connected thereto, a main retraction plunger connected thereto, an auxiliary retraction plunger area, a valve for selectively admitting pressure fluid to said auxiliary retraction plunger area during a minor part of the retraction stroke of said main retraction plunger for temporarily amplifying the force of said main retraction plunger, electrical means for shifting said valve, and means responsive to the attainment of a predetermined pressure in said retraction plunger area for energizing said electrical means to shift said valve to admit pressure fluid to said auxiliary retraction plunger area.

7. In a hydraulic press circuit, a platen, a main plunger connected thereto, a main retraction plunger connected thereto, an auxiliary retraction plunger area, a valve for selectively admitting pressure fluid to said auxiliary retraction plunger area during a minor part of the retraction stroke of said main retraction plunger for temporarily amplifying the force of said main retraction plunger, a tank for supplying fluid to said circuit, said valve being normally positioned for maintaining communication between said auxiliary retraction plunger area and said tank, and means responsive to the attainment of a predetermined pressure in said retraction plunger for shifting said valve to admit pressure fluid to said auxiliary retraction plunger area and cut off communication thereto from said tank.

8. In a hydraulic press circuit, a platen, a main plunger connected thereto, main retraction means for retracting said main plunger, auxiliary retraction means selectively insertable in said circuit

during a minor part of the retraction stroke of said main retraction means for temporarily amplifying the force of said main retraction means, and means responsive to a predetermined motion of said platen for withdrawing said auxiliary retraction means from the circuit.

9. In a hydraulic press circuit, a platen, a main plunger connected thereto, main retraction means for retracting said main plunger, auxiliary retraction means selectively insertable in said circuit during a minor part of the retraction stroke of said main retraction means for temporarily amplifying the force of said main retraction means, and hydraulically-actuated means responsive to the attainment of a predetermined pressure in said main retraction means for rendering operative said auxiliary retraction means.

10. In a hydraulic press circuit, a platen, a main plunger connected thereto, main retraction means for retracting said main plunger, auxiliary retraction means selectively insertable in said circuit during a minor part of the retraction stroke of said main retraction means for temporarily amplifying the force of said main retraction means, and hydraulically-actuated means responsive to the attainment of a predetermined pressure in said main retraction means for rendering operative said auxiliary retraction means and responsive to a pressure drop below said predetermined pressure for rendering inoperative said auxiliary retraction means.

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