May 9, 1944. V. W. PETERSON ET AL 2,348,439

PRESS AND THE LIKE

Original Filed Oct. 22, 1937 3 Sheets-Sheet 1

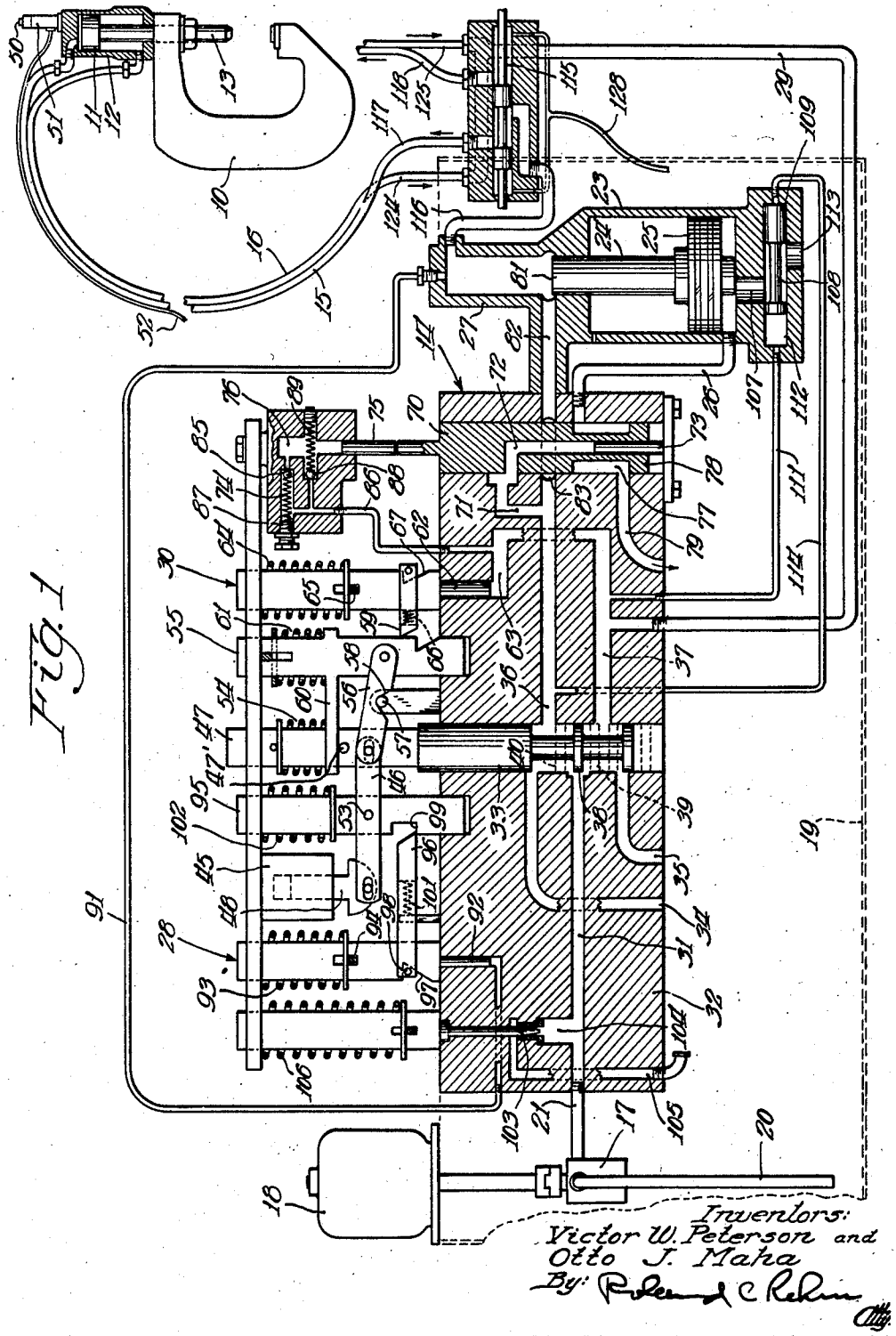


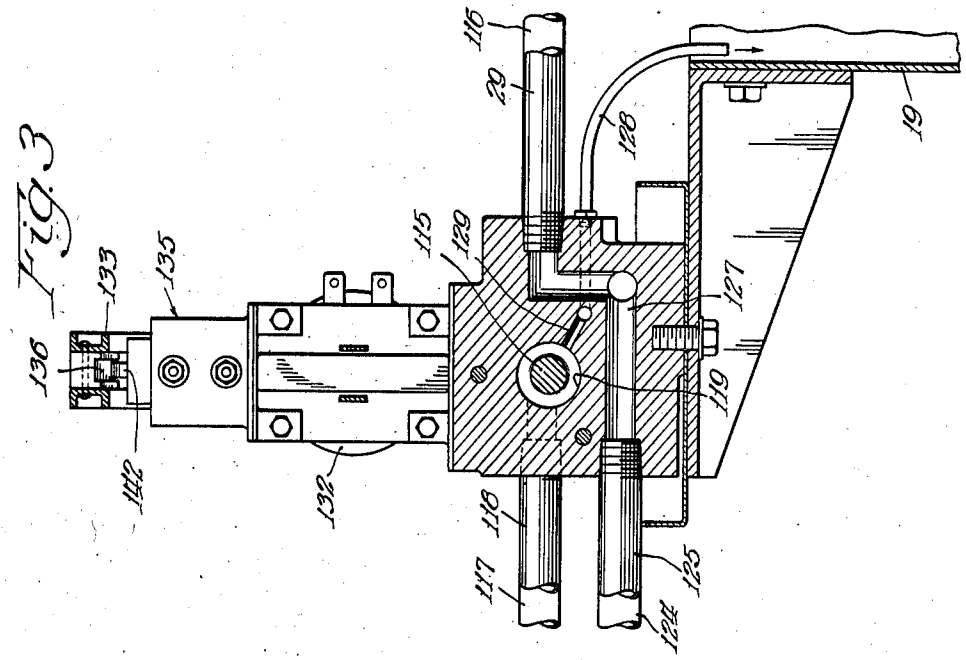
Fig. 1

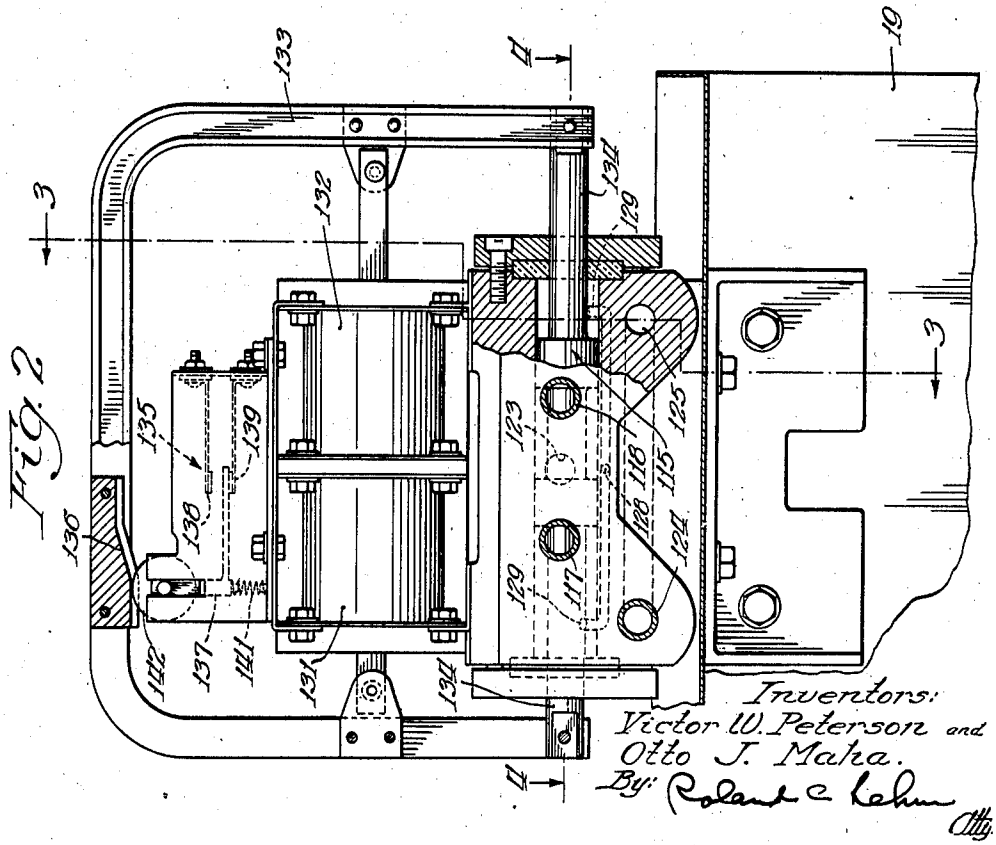
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PRESS AND THE LIKE

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PRESS AND THE LIKE

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Fig. 5

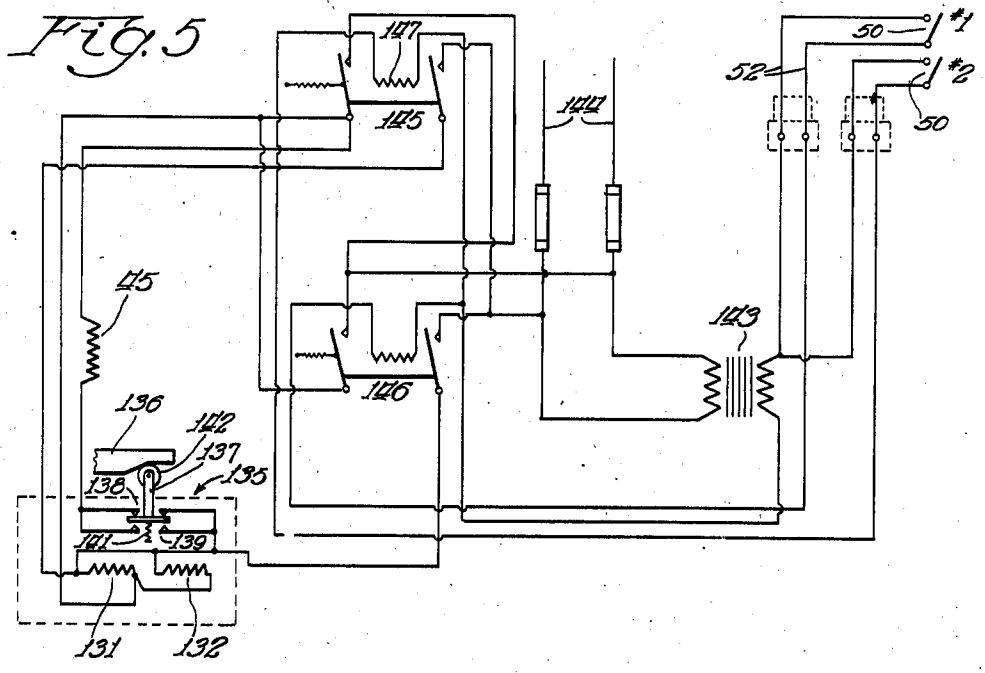
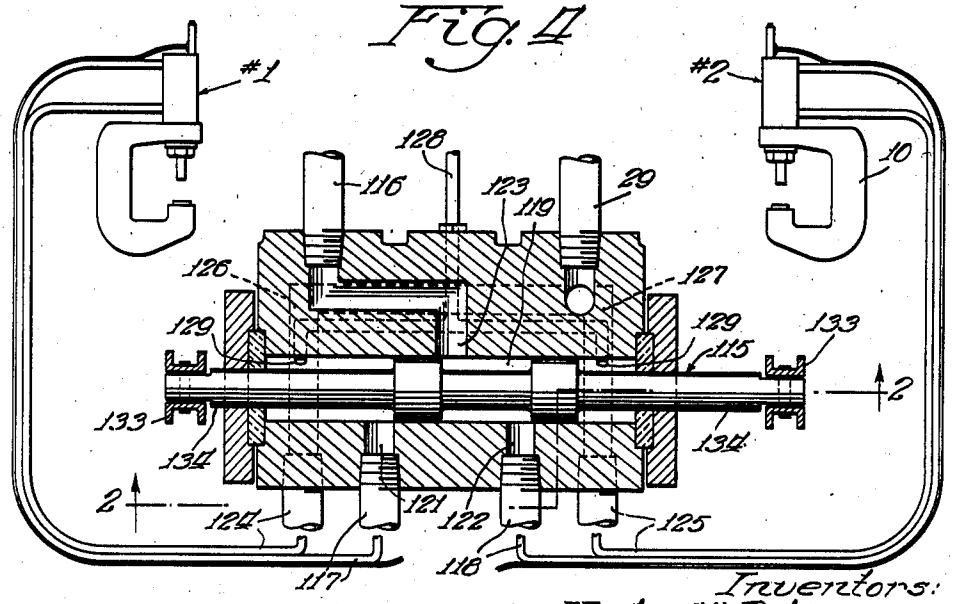


Fig. 4



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2,348,439

PRESS AND THE LIKE

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Original application October 22, 1937, Serial No. 170,407, now Patent No. 2,308,712, dated January 19, 1943. Divided and this application January 26, 1942, Serial No. 428,252

4 Claims. (Cl. 60—97)

This invention relates to riveting and other presses, among other objects aims to provide improved control means for multiple press units.

The invention may be readily understood by one illustrative apparatus embodying the invention and shown in the accompanying drawings.

In said drawings:

Fig. 1 is a view in the form of a diagrammatic section illustrating the apparatus;

Fig. 2 is an elevation, partly in section, of a shuttle valve and its operating mechanism;

Fig. 3 is a transverse section taken on the plane 3—3 of Fig. 2;

Fig. 4 is a plan section taken on the plane 4—4 of Fig. 2; and

Fig. 5 is a diagram illustrating certain electrical control circuits.

This application is a division of our co-pending application Serial No. 170,407, since issued as Patent No. 2,308,712, wherein an improved unit for supplying power to a press is disclosed and claimed. The present application relates to the control of multiple press units. Where a plurality of press units are operated successively, that is, not simultaneously, from a single power unit, it is important that operation of idle press units be prevented without, however, interfering with or delaying the operation of a given press unit when its use is needed. This prevents injury of workmen and waste of power.

One form of power unit, that disclosed in the aforesaid co-pending application, is diagrammatically illustrated in Fig. 1 and will first be briefly described. An earlier form of said power unit is disclosed in our Patent No. 2,241,645. For a more complete description of the structure and operation of said unit reference is made to said patent and said co-pending application.

The power unit is here shown operating a riveting press 10, but it will be understood that the press unit may be a punch or other instrumentality connected either by flexible or rigid lines with the power unit. The illustrative riveting press comprises an operating piston 11, cylinder 12, and a riveting tool or plunger 13. The riveter is connected to the power unit 14 through flexible lines 15 and 16, the former transmitting fluid for the advance or power stroke and the latter for the return stroke.

To secure rapid advance of the tool or plunger into operative engagement with the work, fluid is supplied to the head end of the cylinder in large volumes at relatively low pressures up to approximately one thousand (1000) pounds per square inch. These are sufficient to close the tool quickly on the work. Thereafter intensified pressures up to about five thousand (5000) pounds per square inch are applied to complete the operation.

The primary fluid pressure is supplied in this instance by rotary vane pump 17 driven by an electric motor 18. The pump inlet is immersed in a reservoir of oil in the case 19 of the apparatus, the oil entering the pump through inlet pipe 20 and being discharged therefrom through pipe 21. Except for periods when the pressure is actually in operation, fluid delivered by the pump is short circuited or returned to the reservoir at practically zero pressure, the motor operating at practically no load.

For the final or high pressure operation, the fluid pressure delivered to the work cylinder is intensified by an intensifier 23 represented by small and large pistons 24 and 25, the pump supplying pressure through pipe 26 to the face of the large piston 24 which has four to five times the area of the small piston. The volume of the high pressure intensifier cylinder 27 is made sufficient not only to complete the work stroke of the press, but to compensate for the stretching or expansion of the apparatus and hose lines under the very high pressure which is developed.

The return stroke of the work piston is controlled by pressure-responsive device 28 (Fig. 1) which operates to direct the pump pressure through pipe 29 and return line 16 to the opposite or return face of the work piston and to open the head end of the cylinder 12 and the intensifier to discharge. The return stroke is under control of a pressure-responsive device 30 which operates when a predetermined pump pressure is reached to effect neutralization of the system by connecting both the pump and the return line 29 with discharge, thereby dropping the pump pressure to substantially zero and relieving the load on the motor.

The pump is connected through pipe 21 and passage 31 in valve block 32 with a main or primary valve 33 which controls the forward and return stroke of the piston and terminates movement of the piston at any point in the cycle. In this instance, the valve comprises a double spool or piston valve controlling passages 34 and 35 leading to exhaust, a passage 36 leading to the power side of the work cylinder, and the passage 37 leading to the return side of the work piston. Valve 33 is illustrated in full lines in its neutral or short circuited position, in dotted lines 39 in its lower position wherein the pump is connected with the passage 36, and in dotted lines 40

in its upper position wherein the pump is connected to the reverse passage 37, the passage 36 being connected to discharge through passage 34.

If it be desired for any reason, the forward stroke of the work piston may be arrested and reversed at any time. This operation is effected by relatively shifting the fulcrum points of the floating lever 46 which connects the primary valve stem 47 with the solenoid armature 48. The solenoid is energized by a control switch such as a push button 50 at the end of the operating handle 51 on the riveter. The lines 52 lead from the push button to a relay for controlling the solenoid 45. When armature 48 is actuated, lever 46 operates through its fulcrum 53 to depress the primary valve to position 39. To effect movement of the valve to reverse position (i. e., position 40) the returning spring 54 is automatically pre-compressed to a degree greater than that for holding it in the neutral position illustrated in full lines in Fig. 1 by means in the form of a cocking pin 55. The latter is elevated by secondary lever 56 connected with both valve stem 47 and the cocking pin and fulcrumed at an intermediate point 57. The lever is notched at 58 to provide a seat for the fulcrum so that the lever may be elevated clear of the fulcrum upon the upward movement of the primary valve to reverse position. The cocking pin is held in its cocked or its spring-compressing postion by a latch 59 controlled by the pressure-responsive device 30 which is actuated upon a predetermined back pressure to permit the latch and withdraw the cocking pin to return to its unlatched position (that in Fig. 1) to restore the pin 55 to the normal condition necessary for a return of the primary valve to neutral position at the end of the cycle of operations. Cocking pin 55 carries an arm 60 upon which the end of the spring 54 seats and by which the spring is additionally pre-compressed upon elevation of the cocking pin. The latter is returned to its uncocked position by spring 61.

The pressure-responsive device 30 comprises a plunger 62, connected through passage 63 with the return pressure line 37, which is held down by a pre-loaded spring 64 until a predetermined back pressure has been reached. The loading of spring 64 may be adjusted by key 65 or in any other appropriate manner. Latch 59 is pressed toward the cocking pin by spring 66 and is withdrawn therefrom upon actuation of pressure-responsive device 30 by the cam surface 67 which engages the opposite end of latch 59.

If solenoid 45 be deenergized at any point in the forward stroke of the work piston, spring 54 (having been additionally loaded by the cocking pin) will elevate the primary valve to its return position 40 (lifting lever 56 clear of its fulcrum 57). Such return position is maintained until either the solenoid be reenergized or until the cocking pin be released.

Control of the operation of the intensifier is effected by pressure-responsive valve 70 which connects pump pressure with the intensifier passage 26 and which is exposed to pump pressure from passage 71, whose orifice registers with a small bore 72 inside the valve. The lower portion of the bore is closed by pin 73. The intensifier valve is controlled by a pre-loaded spring 74 to which pressure is communicated by an intervening plunger 75 which acts on the fluid confined in valve chamber 76. Raising of valve 70 at a predetermined pressure connects passages 36 and 26 by means of passage 77 around the valve. At the same time the lower end 78 of the valve cuts off discharge passage 79. As the intensifier operates the end 81 of the plunger 24 cuts off passage 82 connected with the passage 36 by the annular passage 83 around the intensifier valve. To prevent chattering of the intensifier valve, the fluid displaced from chamber 76 passes through valve 85 (controlled by preloaded spring 74) through pipe 86 to discharge. The intensifier valve, therefore, cannot be returned to initial position upon the drop in pump pressure which ensues upon initial operation of the intensifier. The loading on spring 74 is adjusted by screw plug 87.

The return cycle commences when the intensifier pressure communicated through line 91 to plunger 92 is great enough to compress spring 93 and withdraw latch 96 to release fulcrum pin 95 and to permit shifting of the primary valve to reverse position. In the latter position pump pressure is delivered through lines 63 and 86 past check valve 88 to return the intensifier valve to initial position. Latch 96 is pressed toward the fulcrum pin by spring 101 and when it engages the shoulder 99 serves to hold the fulcrum pin in lowered position.

Resistance to further movement of the work piston at the end of the return stroke causes a rise in pump pressure to a predetermined level sufficient to raise plunger 62 and release the cocking pin 55, thereby allowing the primary valve to return to neutral position. On release of the push button by the operator, solenoid 45 is de-energized thereby allowing the fulcrum pin to return to its lower position where it is held by latch 96, plunger 92 having in the meanwhile been lowered by the fall of the pressure in the intensifier cylinder. A new cycle may be started at any point in the return stroke of the work piston simply by pressing the push button 50.

A safety valve 103 protects the pump against excessive pump pressure by opening the line to discharge through passages 104 and 105 if the pump pressure rises to a value sufficiently to compress the pre-loaded spring 106. To prevent development of excessive back pressure and excessive oil velocity, the intensifier cylinder 23 is provided with a substantially large port 107 controlled by a dump valve 108 in the form of a spool valve 109, to allow direct discharge of the substantial volume of oil in cylinder 23 without the necessity for returning through line 26 whence it came. The dump valve is opened by the development of pressure in return line 37 to which the valve cylinder 112 is connected by line 111. Oiil passes easily and at relatively low velocities through port 107, valve 108 and discharge opening 113. The dump valve is returned to closed position as soon as pressure for the forward stroke of the work piston develops in line 36 with which the valve cylinder is connected through line 114.

More than one press unit may be operated from a single power unit provided the press units operate either simultaneously or successively. For example, a single operator may require two or more riveting yokes, one yoke being specially designed to reach rivets which cannot be set by a standard yoke. Since only one riveter is operated at a time, a single power unit may be employed in conjunction with a control device which connects the power unit with the riveter about to be used and prevents the accidental or deliberate operation of any other riveter con-

nected to the same unit, while the first-named riveter is thus connected. The apparatus is here shown provided with such a controlling device which may advantageously be in the form of a shuttle valve 115 (see Figs. 1 to 4) which operates to connect the pressure fluid delivered from the unit through the pipe 116 with the unit in use.

As shown in Fig. 4, the high pressure lines 117 and 118 from the respective work cylinders communicate with the shuttle valve cylinder 119 through ports 121 and 122. The shuttle valve is in the present instance in the form of a balanced spool valve which is adapted to connect the pressure fluid delivered through port 123 with either port 121 or 122 depending upon the position of the shuttle valve. The return lines 124 and 125 from the respective work cylinders are connected through passages 126 and 127 in the shuttle valve block with the return line 29. Inasmuch as the high pressure line is under selective control, it is unnecessary to control the return lines. They may be in communication at all times with return line 29. When pressure develops in the latter line, it simply is applied as static pressure to any inactive work cylinder. A drain pipe 128 is connected with ports 129 in the shuttle valve cylinder at points beyond the shuttle valve to drain away any fluid which may leak past the ends of the shuttle valve and return the same to reservoir 19.

The shuttle valve is in this instance operated by solenoids 131 and 132 connected, as presently explained, in circuits controlled by the control switches on the respective press units. The solenoid armatures or cores operate the shuttle valve yokes 133 connected with the projecting shuttle valve rods 134. Energization of one solenoid shifts the valve to one position where it remains until the first solenoid is deenergized and the other is energized to reverse the position of the valve. Mere energization of the other solenoid is not sufficient to effect shifting since its initial power, because of the greater magnetic air gap, is not great enough to overcome that of the first solenoid which, in its closed position wherein the magnetic air gap is relatively small, develops substantially more power than the other develops in its open position. In the present arrangement the energization of the main solenoid 45 is made impossible until the shuttle valve has been shifted to one operative position. A circuit through the main solenoid 45 cannot be closed while the shuttle valve is in intermediate position. For this purpose the control mechanism is provided with a switch 135 advantageously in the form of a double pole switch of conventional design which in both its upper and lower positions closes a circuit through the main solenoid 45. The aforesaid switch is here shown operated by a cam 136 carried by yoke 133 (see Fig. 2) which in one position depresses the switch plunger 137 to close one pair of contacts 139 and in the extreme position allows the aforesaid plunger to rise to connect the other pair of contacts 138. The switch spring 141 is arranged to press the plunger 137 upwardly when cam 136 clears the plunger roller 142.

Fig. 5 illustrates one appropriate circuit arrangement. Preferably a transformer 143 is employed to step down the voltage of supply lines 144 to impose only a relatively low voltage on the lines leading to the push button switches 50 on the respective press units (in this instance designated #1 and #2), and double pole relay switches 145 and 146 controlled by the low voltage circuits are employed to deliver normal line voltage to the operating solenoids. Thus when the circuit is closed in #2 press unit, the relay coil 147 controlling relay contactor 145 is energized, thereby closing the circuit through shuttle valve solenoid 131 shifting the solenoid to the position illustrated in Fig. 2 and closing the circuit through the power operating solenoid 45. It will be noted that the operating solenoid 45 is in circuit both with the switch 135 and with the respective relays 145 and 146 and requires the closing of switch 135 and one of the relays in order to establish a circuit which would energize the operating solenoid 45. Thus if the push button circuit be opened at any time during the cycle of operation, its relay switch 145 would open, thereby de-energizing solenoid 45 and making possible the same control of the press piston as above described in connection with the operation of a single press unit.

Upon de-energization of one shuttle valve solenoid, the other may be energized to shift the valve to connect its press with the power unit. Accidental operation of any idle press is impossible.

More than two press units may be operated by a single power unit by duplicating the shuttle valve and its controlling apparatus, that is, by connecting other shuttle valves with the high pressure outlets 117 and 118 leading from the preceding shuttle valve and connecting a pair of press units to each of the former shuttle valves.

Obviously the invention is not limited to the details of the illustrative construction since these may be variously modified. Moreover it is not indispensable that all features be used conjointly since various features may be used to advantage in different combinations and sub-combinations.

Having described our invention, we claim:

1. In apparatus of the character described, the combination of a plurality of fluid operated presses adapted to be selectively separately operated, a single power unit for supplying fluid pressure to each of said presses, fluid lines leading from said power unit to each of said presses, control mechanism for selectively connecting said power unit with a single selected press and for disconnecting said power unit from all other presses, a plurality of control devices one associated with each of said presses for actuating the control mechanism to connect the power unit with the press whose control device is operated and to disconnect said power unit from all other presses as aforesaid.

2. In apparatus of the character described, the combination of a plurality of fluid operated presses adapted to be selectively separately operated, a single power unit for supplying fluid pressure to each of said presses, fluid lines leading from said power unit to each of said presses, control mechanism for selectively connecting said power unit with a single selected press and for disconnecting said power unit from all other presses, a plurality of control devices one associated with each of said presses for actuating the control mechanism to connect the power unit with the press whose control device is operated and to disconnect said power unit from all other presses as aforesaid, said control mechanism having means for rendering the control devices on said other presses ineffective during the work stroke of the selected press.

3. In apparatus of the character described, the combination of a plurality of fluid operated presses adapted to be selectively separately operated, a single power unit for supplying fluid pressure to each of said presses, and including a pump and main valve normally in neutral position to permit said pump to idle, fluid lines leading from said power unit to each of said presses, selector means for connecting said power unit with one of said presses and for simultaneously disconnecting it from all other presses, a plurality of control devices one associated with each of said presses for actuating said main valve and said selector means to direct pressure fluid to the press whose control device was actuated and to cut off supply from all other presses, and means associated with said control devices for rendering the control devices on all said other presses ineffective during the work stroke of the selected press.

4. In apparatus of the character described the combination of a plurality of fluid operated presses adapted to be selectively operated and including a pump and main valve normally in neutrol position to permit said pump to idle, forward and return lines leading from said power unit to each of said presses, selector means for connecting said power unit with the forward line of the selected press and for disconnecting the forward lines of all other presses, the return lines of all other said presses being connected at all times with said power unit, a plurality of control devices one associated with each of said presses for actuating said main valve and said selector means to direct pressure fluid to the press whose control device was actuated and to cut off supply from all other presses, and means associated with said control devices for rendering the control devices on all said other presses ineffective during the work stroke of the selected press.

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