Nov. 25, 1952 J. C. CANTLEY 2,618,931

PRESSURE APPLYING MECHANISM

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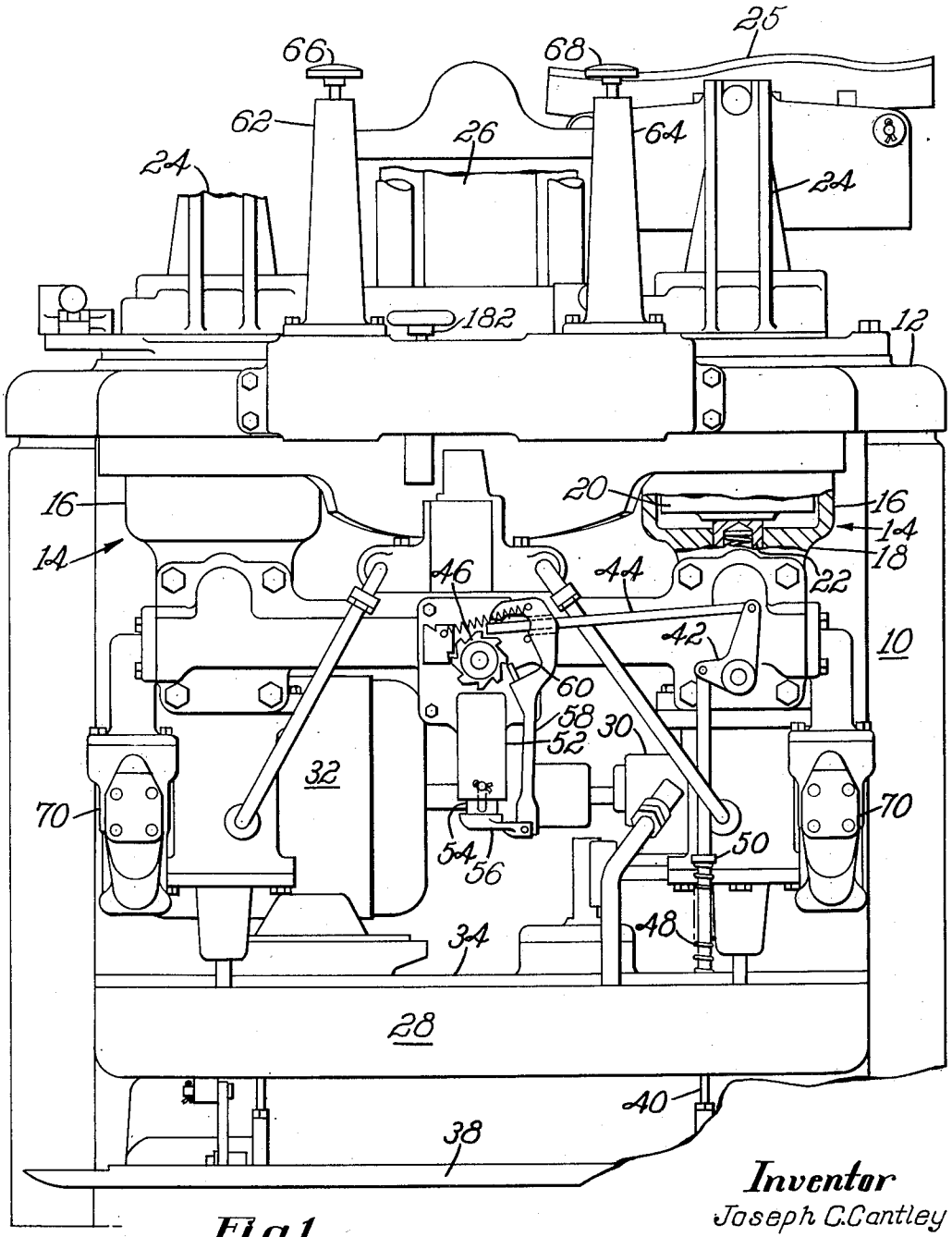


Fig.1.

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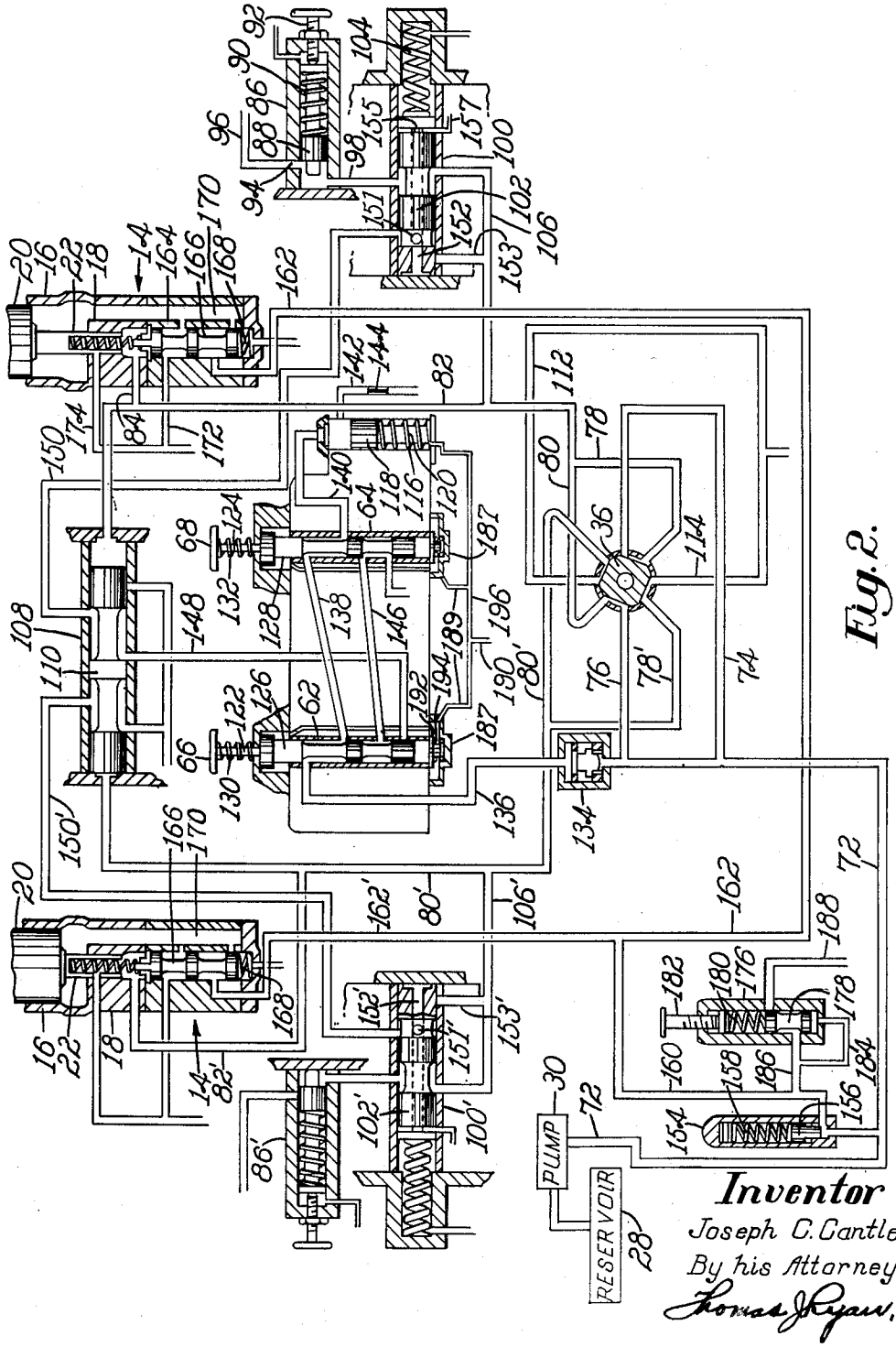


Fig. 2.

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UNITED STATES PATENT OFFICE

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PRESSURE APPLYING MECHANISM

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Application August 2, 1950, Serial No. 177,311

10 Claims. (Cl. 60—52)

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This invention relates to pressure applying mechanisms, and is illustrated herein as embodied in a fluid pressure operated machine for applying pressure to shoe bottoms, as illustrated and described in United States Letters Patent No. 2,459,845, granted January 25, 1949, to T. H. Seely et al., but it will be understood that the invention is not thus limited in its application.

It is an object of the invention to provide an improved machine of the type referred to above having provisions for safeguarding the operator against injury.

The Seely et al. machine includes a rotary distributor valve which is turned 45° upon each depression of a treadle to cause simultaneous admission of pressure fluid to one station of the machine and exhaust of the fluid from the other station. Admission of pressure fluid to one station of the machine causes a sole supporting pad to be raised thus moving a shoe on the pad into engagement with heel and toe abutments and then to exert pressure through the pad on the shoe bottom. Pressure fluid is first admitted into a cylinder housing a small piston causing rapid upward movement of the pad box and after the shoes moves into engagement with the abutments the pressure fluid operates a large piston to obtain the final high pressure. The operator places the shoe on the pad and then steps on the treadle and there is always a danger that unless his hands are removed from over the shoe and last before stepping on the treadle they may be caught between the last and one of the abutments causing severe injury to the hands. To eliminate this hazard, and in accordance with a feature of the invention, a pair of manual controls is provided which requires the use of both hands of the operator before pressure sufficient to injure the operator is applied to the work. These manual controls are employed in conjunction with the treadle, provision being made in accordance with a further feature of the invention for moving the pad box upwardly under sufficient pressure to bring the shoe into engagement with the abutments, the pressure not being substantially greater than that required to lift the pad box and the work thereon so that should the operator have his hand on the top of the last no injury will occur. It is desirable that initial upward movement of the pad box be under the control of the treadle so that the operator may hold the shoe in place if he so desires until it is clamped against the heel and toe abutments. After this initial clamping pressure has been applied which, as stated above is insufficient to cause injury to

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the operator, the application of additional pressure requires that both manual controls be operated simultaneously which necessitates the use of both hands of the operator. With this arrangement both hands of the operator are available to hold or move the work at all times until it is clamped by the heel and toe abutments after which there is no necessity for the operator to handle the work further, but both hands must be removed from the danger zone and engaged with the manual controls before any substantial pressure may be applied by the machine to the work.

Provision is made in accordance with a still further feature of the invention to insure that both manual controls must be operated during each cycle of operation of the machine, that is, they must each be depressed and then released and the machine cannot be operated if either one or both of the controls are tied in the pressure-applying positions.

The above and other features of the invention, including various details of construction and novel combinations of parts will now be described by reference to the drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a front elevation, partly in section, of a portion of one form of machine in which the invention is embodied; and

Fig. 2 is a schematic view of the fluid pressure system of the machine.

The invention is illustrated as embodied in a machine having a base in the form of a housing 10 carried by and depending from the top wall 12 of which is a pair of fluid pressure motors 14, one at each side of the machine and located within the housing 10. Each of the motors comprises a large cylinder 16 and a small cylinder 18 in which are vertically movable large and small pistons 20 and 22 connected for conjoint movement. Each of the large pistons projects upwardly through the top of the housing and carries a yoke 24 in which is carried a work supporting member 25 which may be in the form of a pad box for supporting a sole and lasted shoe. Also, as shown in the Seely et al. patent the machine is provided with a pair of holddown members against which the lasted shoe is forced by the upward movement of the pad box to exert pressure on the bottom of the shoe, these holddown members being carried by an upwardly extending supporting post 26.

Supported in the lower part of the housing 10 is a reservoir 28 for oil or other suitable pressure fluid by which the machine is operated. Oil is

drawn from the reservoir by a pump 30 driven by a motor 32 mounted on a cover plate 34 secured to the top of the reservoir. A rotary valve 36 (Fig. 2) directs pressure fluid to one or the other of the fluid pressure motors 14 depending upon its position and it is rotated 45° upon each depression of a treadle 38 to admit pressure fluid into one of the fluid pressure motors and to exhaust it from the other. The treadle 38 is connected by a link 40 to one arm of a bell crank lever 42, the other arm of which has pivoted to it a rod 44 which cooperates with a ratchet 46 connected to the valve 36 so that upon each depression of the treadle 38, the valve 36 turns 45° in a counterclockwise direction. A spring 48 acting between the top of the reservoir and a collar 50 secured to the link 40 normally maintains the treadle in its upper position as illustrated. Provision is also made for moving the valve 36 into an intermediate position so that pressure fluid exhausts from both of the fluid pressure motors in the event that the pump 30 is shut down and for preventing actuation of the valve by the treadle 38 until the pump is again started. This consists of a cylinder 52 connected to the high pressure side of the pump and containing a piston 54 normally urged upwardly but held in the down position when the pump is operating. Pivoted to a bracket 56 at the lower end of the piston 54 is an upwardly extending member 58 carrying a pawl 60 which when the pump is shut down and the piston 54 is moved upwardly, turns the ratchet 46 22½° to exhaust both of the fluid pressure motors. At this time the rod 44 which passes through a slot in the upper end of the member 58 is lifted out of operative relation to the ratchet 46 so that the valve cannot be operated upon depression of the treadle until the pump is again started and the member 58 moved downwardly. These features thus far referred to are described in greater detail in the Seely et al. patent.

Carried by the top 12 of the housing 10 is a pair of valve housings 62, 64 containing valves to be described to which are connected buttons 66, 68 by which the operator can depress the valves. In the normal operation of the machine the operator depresses the treadle 38 rotating the distributor valve 36 to connect one of the cylinders 18 to the outlet of the pump and to exhaust the pressure fluid from the other motor 14, as will be more fully explained, whereupon one of the work supports moves upwardly. The pressure of the operating fluid by which the support is moved upwardly is limited by a relief valve contained in a manifold 70, the valve being adjusted to limit the pressure of the fluid to that which is required to raise the work support with the work thereon. Thus if the operator should inadvertently leave his hand between the work and the hold down members insufficient pressure will be applied to cause him any injury. In order to apply operating pressure to the work it is necessary that the operator depress both buttons 66, 68, the valves 62, 64 being connected in series, whereupon the full operating pressure will be applied to the work as will be described.

The fluid pressure system will now be described by reference to Fig. 2. Those portions of the fluid pressure system except for the motors 14 which are duplicated in the two stations of the machine are identified by similar reference characters but those on the left are provided with a prime. It will be assumed that the valve 36 has been moved by the treadle into the position shown in Fig. 2. This movement of the valve permits flow of fluid from the pump 30 through pipes 72, 74, 76, the chamber of valve 36, pipes 78, 80, 82 and through a port 84 of the cylinder 18 to act upon the small piston 22 and force the work support upwardly. The pressure applied to the small piston 22 is limited at this time by a relief valve 86 to that which is sufficient to move the support and the work upwardly. This valve includes a valve member 88 which is urged toward the left by a light spring 90 the action of which may be regulated by an adjusting screw 92. When the pressure of the fluid in the left end of the valve 86 attains a predetermined value, the valve member 88 moves to the right against the spring 90 permitting exhaust of fluid through a port 94 and a pipe 96 which conducts the fluid back to the reservoir 28. The valve 86 has an inlet port connected by a pipe 98 to a pressure control valve 100 having a valve member 102 urged by a spring 104 to the left into the position shown in Fig. 2. The pipe 82 is connected by a pipe 106 to the valve 100 and with the valve member 102 in the position shown fluid passes around a reduced portion of the valve member to pipe 98 and thence into the relief valve. Accordingly with the valve member 102 in the position shown the pressure of the fluid in the cylinder 18 is limited by the relief valve 86 so that the pressure available to move the shoe support upwardly is insufficient to cause injury to the operator.

The pipe 82 also has a connection to one end of the housing of a selector value 108 in which is mounted a valve member 110 which assumes the position shown in Fig. 2 with the valve 36 in the position illustrated. If now the valve 36 is moved through an angle of 45° by the operator depressing the treadle, the fluid flows through pipes 78', 80' into the left end of the valve 108 to shift the valve member into its other position. It will be understood that fluid is permitted to exhaust from one end of the valve 108, when its opposite end is connected to a source of pressure, through pipes 112, 114 which conduct the pressure fluid back to the reservoir. The purpose of the selector valve is to control the flow of fluid either to the valve 100 or valve 100', depending upon which station of the machine is being operated, as will be described to operate the valve 100 or 100' and render the relief valve 86 or 86' ineffective.

For moving the pressure control valve 100 or the other pressure control valve 100', a pressure fluid accumulator 116 is provided. This accumulator includes a cylinder having a piston 118 urged upwardly by a spring 120. The upper end of the cylinder is maintained filled with pressure fluid as long as the buttons 66, 68 of the control valves 62, 64 are in the positions illustrated. These buttons are connected by stems 122, 124 to valve members 126, 128 which are normally maintained in their upper positions by springs 130, 132. With the valves in these positions the pipe 72 connected to the high pressure side of the pump 30 is connected through a check valve 134 and a pipe 136 to the upper portion of the chamber of valve 62, which is in turn connected by a pipe 138 to the upper portion of the chamber of valve 64. A pipe 140 provides communication between the upper end of the chamber of valve 64 and the accumulator 116 so that as long as the valve members 126, 128 remain in their uppermost positions the upper portion of the accumulator will be maintained filled with pressure fluid. In order to insure that no air is trapped within

the upper end of the accumulator a pipe 142 having a restriction 144 therein provides communication between the accumulator and the fluid reservoir so that pressure fluid flows continually through the accumulator and any air which might be trapped therein will pass through the pipe 142 back to the fluid reservoir. The flow through the pipe 142 is retarded by the restriction 144 so that when it is desired to utilize the pressure fluid in the accumulator to operate one of the pressure control valves 100, 100' there will be no substantial loss of pressure fluid through the pipe 142.

If the valve members 126, 128 are now simultaneously depressed against the actions of the springs 130, 132 the supply pipe 72 will be cut off from the accumulator and the pressure fluid in the accumulator will be forced by the piston 118 through the pipe 140, the valve 64 and pipe 146, the valve member 62 and a pipe 148 into the selector valve 103. With the selector valve member 110 in the position shown the pressure fluid will then pass through a pipe 150 into the left end of the chamber of valve 100 by way of a port 151 and passage 152 in the valve member 102, thus acting on the valve member to move it to the right against the action of the spring 104. As soon as the valve member 102 has moved a short distance pressure fluid flows from the pipe 106 through a pipe 153 into the extreme left end of the valve 100 so that pressure from the pump is available to complete the movement of the valve 100 and hold it in its right-hand position as long as the right-hand station of the machine is under pressure. To prevent premature operation of valve member 102 which might occur if pressure fluid from pipe 106 leaked into the left end of the cylinder 100, the bore 152 communicates by way of a port 155 with a pipe 157 which conducts the fluid back to the reservoir with the valve member 102 in the position illustrated. It will be understood that only sufficient pressure fluid is stored in the accumulator to initiate action of the valve member 102 but that the pressure from the pump holds the valve member in its right-hand position once it has been so moved. In order to store fluid in the accumulator for similar operation of the valve 100' after the machine has been treadled and valve 36 moved 45°, both valves 126 and 128 must be released to connect the upper end of the accumulator with the high pressure side of the pump. Thus if either one or both of the valves 126, 128 should be held down the left-hand side of the machine cannot be operated under any greater pressure than that permitted by the relief valve 86'. Once, however, that the pressure control valve 100' has been moved against the action of its spring, communication between the high pressure side of the pump and the relief valve 86 is interrupted and additional pressure is available to operate on the work piece as described in connection with valve 100.

Connected to the pipe 72 is a pressure regulating valve 154 having a valve element 156 urged downwardly by a spring 158 to control the maximum amount of pressure in the pipe 72. This valve is preferably set to open only after the pressure reaches a relatively high value such as 180 to 190 pounds per square inch which will be the pressure acting upon the small piston 22 after the two hand control valves have been operated. The outlet of the pressure regulating valve 154 is connected by pipes 160, 162 to the chamber of a valve 164 in the lower end of the cylinder 18. This valve includes a valve member 166 urged upwardly by a spring 168 into the position shown in Fig. 2 in which communication between the pipe 162 and a passageway 170 leading into the large cylinder 16 is cut off. However, when the pressure below the piston 22 reaches a predetermined value the valve member 166 will be forced downwardly by the pressure acting thereon permitting pressure fluid to flow into the passageway 170 and into the large cylinder 16 to act upon the large piston 20 applying the final pressure to the work. During initial upward movement of the pistons pressure fluid is drawn into the large cylinder 16 by way of passageway 170 and pipe 172 which is connected to the fluid reservoir. A pipe 174 provides communication between the reservoir and the upper end of the cylinder 18 so that in the event the machine is operated with no work on the work support the piston 22 will uncover a port communicating with the pipe 174 before the pistons have been forced upwardly too far permitting the pressure fluid to flow back by way of pipe 174 to the reservoir.

The pressure of the fluid applied to the large piston 20 is regulated by a valve 176 having a valve member 178 urged downwardly by a spring 180 the force of which is controlled by an adjusting screw 182. A pipe 184 provides communication between the pipe 160 and the bottom of the valve 176 so that when the pressure in the pipe 160 attains a predetermined value the valve member 178 is forced upwardly permitting fluid to pass through pipes 186, 188 back to the fluid reservoir. The valve 176 is preferably set at any desired pressure between limits of say 25 and 200 pounds per square inch, it being understood that the pressure per square inch against the piston 20 may be substantially less than that which is available for forcing the piston 22 upwardly.

It is essential that the valve members 126, 128 be held down for a long enough time to permit the fluid in the accumulator to act upon the pressure control valve 100 or 100'. Provision is therefore made for preventing return movement of these valve members too rapidly in the event that the operator should only momentarily keep his hands on the buttons 66, 68. Below each of the valves 62, 64 is a chamber 187 connected by pipes 189, 190 to the fluid reservoir. Communication between the chambers 186 and the valve chambers 62, 64 is controlled by a valve member 192 normally urged upwardly by a spring 194, the valve member being provided with a small central orifice through which fluid can pass at all times. Upon downward movement of the valve members 126, 128, the valve members 192 are forced downwardly against the action of the springs 194 and immediately return into their closed positions when the movement of the valve members 126, 128 stops. Fluid now can flow into the lower ends of the valve chambers 62, 64 only through the restricted orifices in the valve members 192 so that a dashpot effect results and the valve members can return only slowly to their upper positions. The lower portion of the accumulator 116 is connected by pipes 196, 190 to the fluid reservoir so that the lower end of the accumulator is always maintained full of motive fluid.

In describing the operation of the machine it will be assumed that the station at the right side of the machine has been under pressure, that a work piece has been placed in the station at the left side of the machine to be operated upon and that treadle 38 is depressed to turn the valve

36, 45° from the position shown in Fig. 2. Pipe 82 which communicates with the cylinder 18 at the right side of the machine is now placed in communication with the reservoir through pipes 80, 78, 112 and 114 whereupon the pressure in the cylinder drops and the valve member 166 moves into the position illustrated. Fluid in the large cylinder 16 now passes through pipes 172, 174 to the reservoir whereupon pistons 20, 22 descend by gravity lowering the work support and permitting removal of the work piece thereon.

At the same time pressure fluid passes through pipes 72, 74, 76, 78', 80' and 82' into the small cylinder 18 at the left side of the machine, whereupon the fluid acts upon the small piston 22 to raise it and the large piston 20 until the work is clamped between its support and the holddown members, the pressure being limited by the relief valve 86' so that no injury will occur to the operator if his hand should be caught between the work and the holddown members. If the work is not properly positioned on the work support it can be moved by the operator because it is clamped under very light pressure.

Pressure fluid also passes from the pipe 80' into the left end of the selector valve 100 to move the valve member to the right, the fluid in the right end of this valve exhausting through the valve 36 to the reservoir. If now the buttons 66, 68 are depressed by the operator the pressure fluid in the accumulator 116 is forced by upward movement of piston 118 under the action of spring 120 through pipes 140, 146, 148, 150' into the right end of the pressure control valve 100' by way of port 151' and bore 152'. The valve member 102' is now moved to the left and after it has moved a slight distance the right end of the housing of the valve is placed in communication by way of pipe 153' with pipe 106' through which pressure fluid is forced by the pump thus to maintain the valve element 102' in its left-hand position cutting off flow to the low pressure relief valve 86'. The pressure within the small cylinder 18 at the left side of the machine now increases to a value dependent upon the setting of the valve 154 and after this pressure rises to a predetermined value the valve member 166 is moved downwardly against the action of the spring 168 whereupon pressure fluid flows from the pipe 162' into the passageway 170 leading to the large cylinder 16 and heavy pressure, limited by the setting of the relief valve 176, is applied to the work.

The pressure remains on the work in the left side of the machine until the distributor valve 36 is again turned through an angle of 45° and in order for the right-hand side of the machine to be operated under high pressure the buttons 66, 68 must be released permitting the valve members 126, 128 to assume the positions illustrated and permitting pressure fluid to pass into the upper end of the accumulator 116. Thus if the operator attempts to render the machine unsafe by tying down either or both of the buttons 68 he will be unable to operate the machine.

From the above it will be seen that by stepping on the treadle the work piece may be clamped under very light pressure during which time the operator may hold the work and move it if necessary so that it will be properly positioned on the work support but he must remove his hands from the work and operate the two buttons 66, 68 in order to apply heavy pressure to the work. Thus his hands are available to insure that the work is properly positioned for the pressure applying operation but this operation cannot be initiated until his hands are removed from the danger zone.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, a pump, a supply pipe for delivering pressure fluid from said pump to said fluid pressure operated means, operator controlled means for connecting said pump to said supply pipe, a relief valve connected to said supply pipe to limit the pressure of the fluid therein to a low predetermined value, and means for interrupting the flow of pressure fluid from said supply pipe through said relief valve, said last named means comprising a pair of serially connected manually operated valves.

2. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, operator controlled means for directing fluid to said fluid pressure operated means to move said member into pressure applying position, a relief valve operative to limit the pressure of the fluid to a low predetermined value, a fluid pressure operated valve controlling flow of fluid from said fluid pressure operated means to said relief valve, means urging said flow control valve into open position, and means connecting an end of said flow control valve to a source of fluid pressure to move said valve to closed position, said last named means including a pair of manual controls simultaneous operation of which is required to connect said flow control valve to the source of fluid pressure.

3. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, means for directing pressure fluid to said fluid pressure operated means, a low pressure relief valve connected to said fluid pressure operated means, a member operative in response to the application of fluid pressure thereto for rendering said low pressure relief valve ineffective, and a pair of serially connected manually operated valve members for controlling the application of fluid pressure to said member.

4. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, a low pressure relief valve for limiting the pressure of the fluid applied to said fluid pressure operated means, a second fluid pressure operated member for rendering said relief valve ineffective, means for directing pressure fluid to said second fluid pressure operated member for moving said member into operative position, and a pair of spaced serially connected manually operated valves in control of said last named means.

5. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, a low pressure relief valve for limiting the pressure of the fluid applied to said fluid pressure operated means, a second fluid pressure operated member movable into operative position in which it renders said relief valve ineffective, a fluid pressure accumulator, a pair of spaced manually operated valves, means

operative with said valves in first predetermined positions for directing pressure fluid to said accumulator, and means operative with said valves in second predetermined positions for directing the pressure fluid in the accumulator to said second fluid pressure operated member to move the member into operative position whereby the pressure applied to the work piece exceeds the pressure at which said relief valve is set.

6. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, fluid pressure operated means for thus moving said member, a low pressure relief valve for limiting the pressure of the fluid applied to said fluid pressure operated means, a second fluid pressure operated member movable into operative position in which it renders said relief valve ineffective, a fluid pressure accumulator, a pair of spaced manually operated valves, means operative with said valves in first predetermined positions for directing pressure fluid to said accumulator, means operative with said valves in second predetermined positions for directing the pressure fluid in the accumulator to said second fluid pressure operated member to move the member into operative position whereby the pressure applied to the work piece exceeds the pressure at which said relief valve is set, and other means for directing the pressure fluid to said second fluid pressure operated member following return movement of said valves to the first predetermined positions.

7. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, a small piston for moving said member rapidly into pressure applying position, a large piston for exerting heavy pressure on said member, a small cylinder and a large cylinder housing said small and large pistons respectively, means for supplying pressure fluid to said cylinders including a pump, a low pressure relief valve for limiting the pressure of the fluid in the small cylinder to a low value, a main control valve for directing pressure fluid to said small cylinder, a pair of spaced manual control members, means operative in response to simultaneous actuation of said control members for rendering said low pressure relief valve ineffective, and means operative in response to an increase in the pressure of the fluid in the small cylinder for directing pressure fluid to said large cylinder.

8. Pressure applying mechanism comprising a member movable to apply pressure to a work piece, a small piston for moving said member rapidly into pressure applying position, a large piston for exerting heavy pressure on said member, a small cylinder and a large cylinder housing said small and large pistons respectively, means for supplying pressure fluid to said cylinders including a pump, a low pressure relief valve for limiting the pressure of the fluid in the small cylinder to a low value, a main control valve for directing pressure fluid to said small cylinder, a fluid pressure operated member movable, in response to the application of pressure fluid thereto, into a position in which the flow of pressure fluid to the low pressure relief valve is interrupted, a pair of spaced manually operated serially connected valves, means operative in response to simultaneous actuation of said valves for directing pressure fluid to said fluid pressure operated member, and means operative in response to an increase in the pressure of the fluid in the small cylinder for directing pressure fluid to said large cylinder.

9. Pressure applying mechanism comprising a pair of pressing stations each of which comprises a member movable to apply pressure to a work piece, a piston connected to said member, and a cylinder housing said piston, a pump, a valve movable into different positions for directing pressure fluid into one or the other of said cylinders, a treadle for operating said valve, a low pressure relief valve connected to each cylinder for limiting the pressure of the fluid therein to a low predetermined value, a fluid pressure operated member associated with each relief valve and operative in response to the application of pressure fluid thereto for rendering the associated relief valve ineffective, a pair of spaced manually operative members, and means operative in response to simultaneous operation of said members for directing the pressure fluid to the fluid pressure operated member of the station which is being operated.

10. Pressure applying mechanism comprising a pair of pressing stations each of which comprises a member movable to apply pressure to a work piece, a piston connected to said member, and a cylinder housing said piston, a pump, a valve movable into different positions for directing pressure fluid into one or the other of said cylinders, a treadle for operating said valve, a low pressure relief valve connected to each cylinder for limiting the pressure of the fluid therein to a low predetermined value, a fluid pressure operated member associated with each relief valve and operative in response to the application of pressure fluid thereto for rendering the associated relief valve ineffective, a pressure fluid accumulator, a pair of spaced serially connected manually operated valves, means operative with said valves in predetermined positions for directing pressure fluid to said accumulator, means operative with said valves in other predetermined positions for exhausting the fluid from said accumulator, a selector valve for directing the fluid from said accumulator to one or the other of said fluid pressure operated members, and means for automatically positioning said selector valve in accordance with the station being operated.

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