June 6, 1939. K. C. MONROE 2,161,375

CONTROL MECHANISM FOR HYDRAULIC PRESSES

Filed May 17, 1937 2 Sheets-Sheet 1

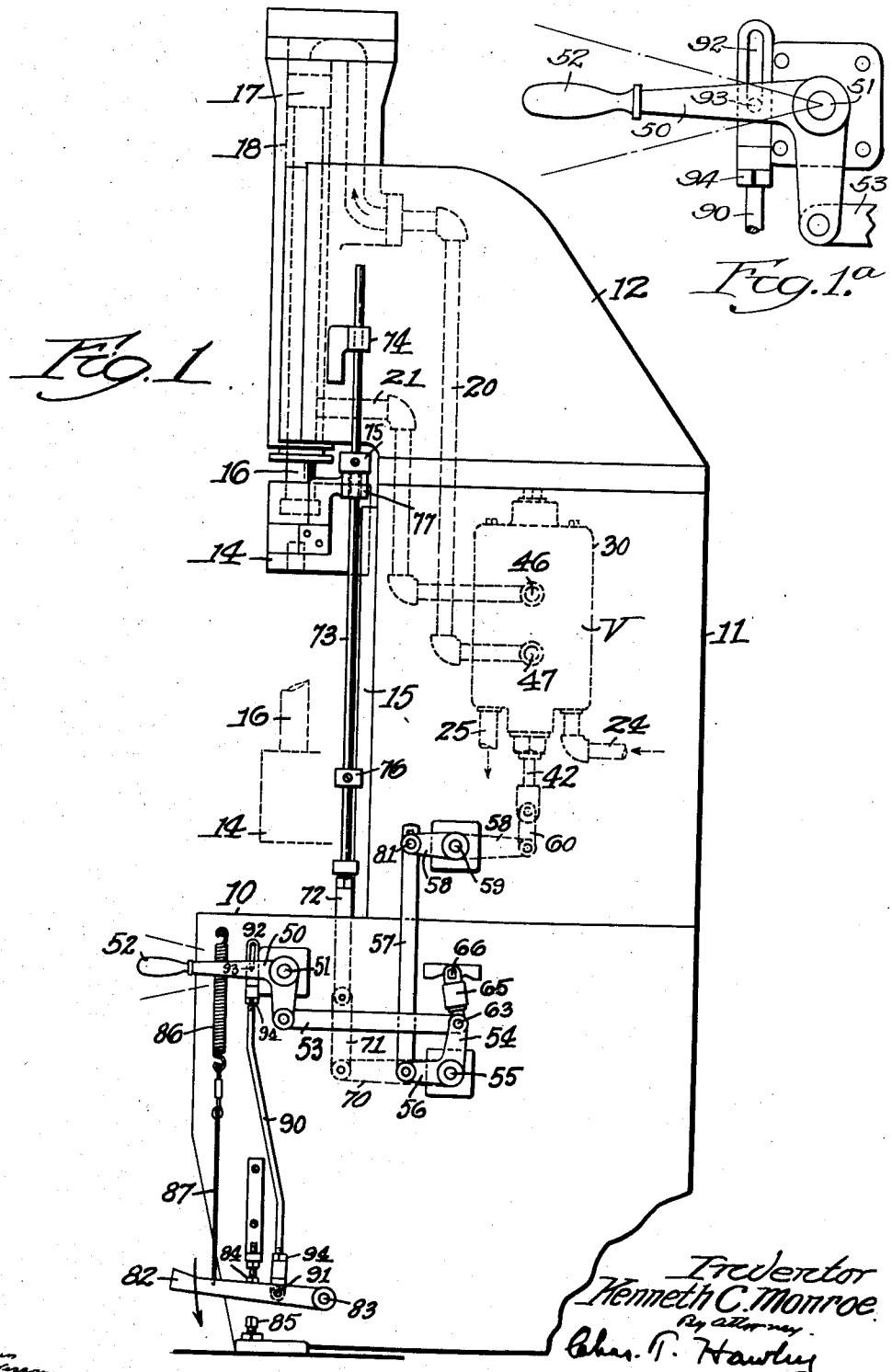


Fig. 1

Fig. 1a

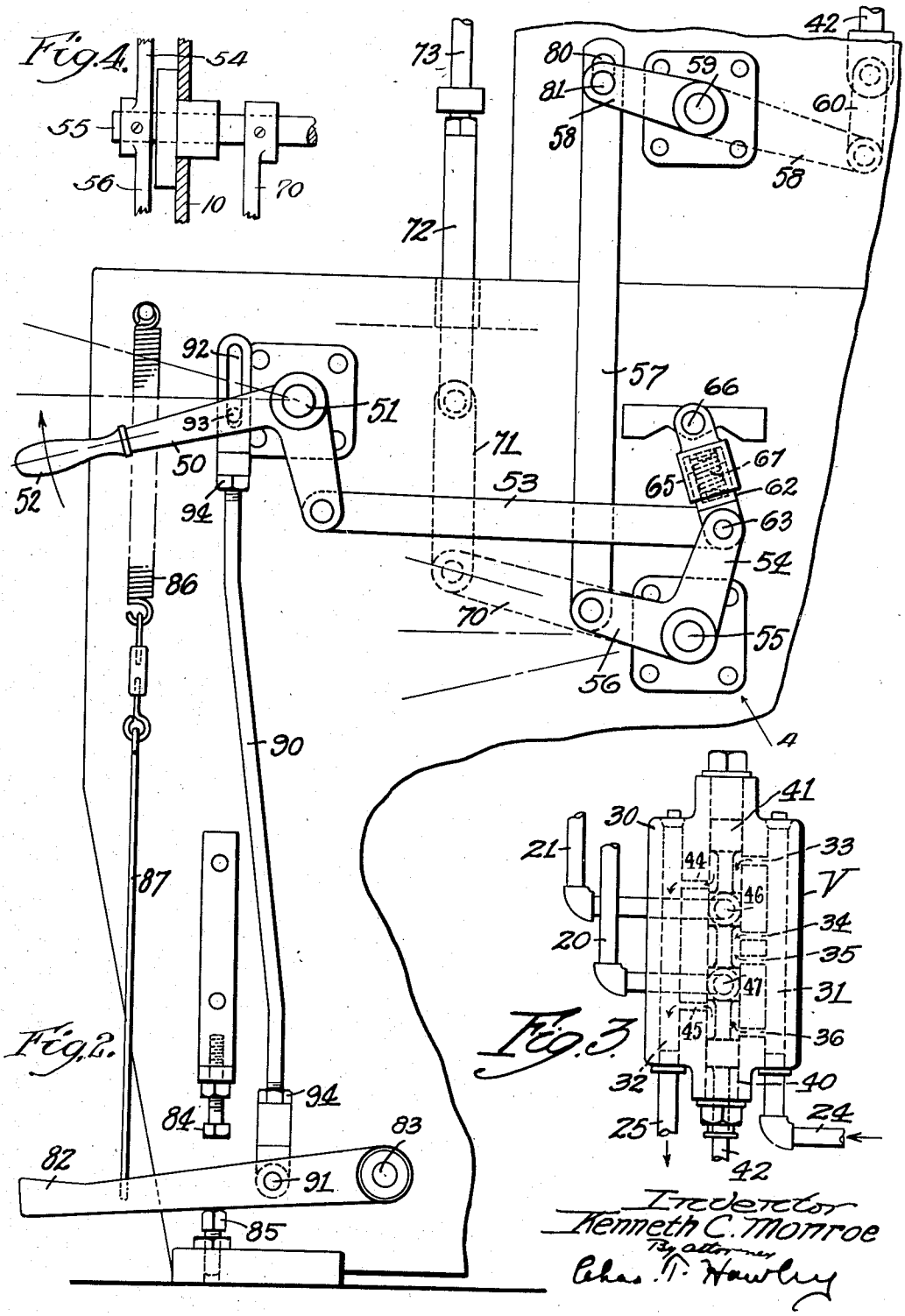
Witness
C. F. Mason.

Inventor
Kenneth C. Monroe
By attorney
Chas. T. Hawley

June 6, 1939. K. C. MONROE 2,161,375

CONTROL MECHANISM FOR HYDRAULIC PRESSES

Filed May 17, 1937 2 Sheets-Sheet 2



Patented June 6, 1939 2,161,375

UNITED STATES PATENT OFFICE

2,161,375

CONTROL MECHANISM FOR HYDRAULIC PRESSES

Kenneth C. Monroe, Hudson, Mass., assignor to The Lapointe Machine Tool Company, Hudson, Mass., a corporation of Maine

Application May 17, 1937, Serial No. 142,952

7 Claims. (Cl. 121—38)

This invention relates to mechanism for controlling a hydraulic press. In the use of such presses on certain operations, it is desired that the machine be foot-controlled, that the machine continue to operate as long as the foot pedal is depressed, and that the machine always come to rest in raised or inoperative position after the pedal is released.

This method of operation has been heretofore common in mechanically operated presses, and it is the general object of my invention to provide improved control mechanism through which these desired results may be effectively and conveniently attained in a hydraulic machine.

A further object of my invention is to provide a control mechanism for a hydraulic press which normally holds the actuating mechanism of the press inoperative but which releases said mechanism for continuous automatic operation when a foot pedal is depressed by the operator.

My invention further release to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a side elevation of a hydraulic press having my improved control mechanism applied thereto;

Fig. 1a is an enlarged side view of certain parts shown in Fig. 1.

Fig. 2 is an enlarged side elevation of the control mechanism;

Fig. 3 is an enlarged side elevation of the main valve of the hydraulic press, and

Fig. 4 is an enlarged detail view looking in the direction of the arrow 4 in Fig. 2.

Referring to Fig. 1, I have shown a hydraulic press comprising a base or platen 10, an upright support 11 and a top frame member 12. A tool holder 14 is mounted to slide in vertical guideways 15 in the front face of the support 11 and is connected by a piston rod 16 to a piston 17 slidable in a main cylinder 18 mounted at the front of the top frame member 12.

The upper and lower ends of the cylinder 18 are connected through pipes 20 and 21 to a main valve V provided with a supply pipe 24 and an exhaust pipe or connection 25. Oil under pressure is furnished to the supply pipe 24 from a pump or other suitable source of supply.

The main valve preferably comprises a casing 30 (Fig. 3) having a longitudinal intake passage 31 connected to the supply pipe 24 and a longitudinal exhaust passage 32 connected to the exhaust pipe 25. Ports 33, 34, 35 and 36 connect the intake passage 31 with the valve cylinder 40 in which a piston valve 41 is slidable. The valve 41 comprises a plurality of short piston elements spaced apart and mounted on a piston rod 42.

The exhaust passage 32 is connected by ports 44 and 45 to the valve cylinder 40. The pipes 20 and 21 are connected to ports 46 and 47 in the casing 30.

When the valve 41 is in the normal or inoperative position shown in Fig. 3, the ports 46 and 47 are closed, the intake passage 31 is connected to the cylinder 40 through the intake ports 33 and 36, and the cylinder 40 is connected through the exhaust ports 44 and 45 to the exhaust passage 32, so that the output of the pump circulates freely and is immediately returned through the exhaust pipe 25 to the pump or storage tank.

With the parts in the position described and with the ports 46 and 47 closed, no oil can enter or leave the cylinder 18 and the piston and tool holder are locked in raised position.

If the valve rod 42 and the piston valve 41 are moved downward, the exhaust port 45 will be closed, also the intake ports 33 and 34, and the intake port 35 will be connected through the port 47 and pipe 20 to the upper end of the main cylinder 18. At the same time the pipe 21 will be connected through the port 46 and exhaust port 44 to the exhaust passage 32. A working or down stroke of the press will then take place.

If the valve 41 is raised above the position shown in Fig. 3, the intake ports 35 and 36 and the exhaust port 44 will be closed, the intake passage 31 will be connected through the ports 34 and 46 and the pipe 21 to the lower end of the cylinder 18, and the upper end of the cylinder will be connected through the pipe 20, port 47 and exhaust port 45 to the exhaust passage 32, thus effecting an upward or return movement of the piston 17 and the tool holder 14 associated therewith.

The parts thus far described are of a more or less usual construction and are shown and described for purposes of illustration.

I will now describe my improved mechanism for controlling the operation of the hydraulic machine previously described. For this purpose I provide a bell crank 50 pivoted at 51 and having a handle extension 52. The depending arm of the bell crank 50 is connected by a link 53 to a bell crank 54 mounted on a short shaft 55. The second arm 56 of the bell crank 54 is connected by a link 57 to a lever 58, pivoted at 59 and con-

nected by a link 60 to the lower end of the valve rod 42.

A plunger 62 (Fig. 2) is mounted on the pivot stud 63 which connects the associated ends of the link 53 and bell crank 54. The plunger 62 is slidable in an open-end cylinder 65, pivoted at 66 and housing a compression spring 67. The parts just described collectively form a spring actuated toggle.

An arm 70 is secured on the shaft 55 which supports the bell crank 54, and this arm 70 is connected by a link 71 to an end member 72 which is secured to the lower end of a reverse rod 73.

The reverse rod 73 is slidable in a bearing 74 (Fig. 1) fixed to the frame member 12, and is provided with upper and lower stop collars 75 and 76. The rod 73 passes freely through an opening in a bracket 77 mounted on the tool holder 14 and is vertically moved therewith.

As the tool holder 14 moves up and down, the bracket 77 alternately engages the collars 75 and 76 and causes corresponding movements of the main valve, as will be hereinafter described.

The link 57 (Fig. 2) is connected to the lever 58 by means of a slot 80 and stud 81. This is to provide lost motion and effect a lag in the movement of the main valve, for a desired purpose.

A foot pedal 82 is pivoted at 83 and is mounted to swing between an upper stop 84 and a lower stop 85, both of which may be vertically adjusted. The pedal 82 is normally held in the raised position shown in Fig. 1 by a heavy spring 86, connected to the pedal through a rod 87.

A link 90 is pivoted at 91 to the pedal 82 and is provided at its upper end with an elongated slot 92 which receives a stud 93 on the bell crank 50. The end portions of the link 90 are threaded for longitudinal adjustment, and lock nuts 94 are provided to maintain the adjustment.

Having described the details of construction of my improved control mechanism, I will now described its operation.

The parts are shown in Fig. 1 in normal position, with the press inoperative and with the output of the pump by-passed to the exhaust. It will be noted that the pin 93 on the bell crank 50 is seated in the lower end of the slot 92, so that the heavy spring 86 resists further movement of the bell crank 50. It will also be noted that the pivot 63 which connects the link 53 with the bell crank 54 is slightly beyond or to the right of the center line which connects the pivots 55 and 66. Furthermore, the lost motion has been taken up at the upper end of the link 57, so that the stud 81 is at the lower end of the slot 80.

The pedal 82 and heavy spring 86 thus act definitely to hold the parts in neutral position and to prevent further movement of the valve V and operation of the press.

When the pedal 82 is depressed, the slot 92 in the link 90 is moved downward, so that the stud 93 thereafter swings free in the slot 92. This releases the bell crank 50.

As soon as the bell crank 50 is released, the toggle spring 67 (Fig. 2) in the casing 65 acts against the plunger 62 and swings the pivot 63 of the toggle to the right, thus swinging the bell crank 54 to the position shown in Fig. 2. This effects movement of the piston rod 42 and associated piston elements downward in the main valve V, and sets the valve for a downward or working stroke as previously described.

As the stroke nears completion, the bracket 77 on the tool holder 14 engages the collar 76 and acts through the arm 70 to swing the bell crank 54 in an anti-clockwise direction to a point beyond dead center, whereupon the toggle spring 67 completes the movement to the left and thus accomplishes reverse movement of the piston rod 42 and piston elements in the main valve V.

The slot 80 in the link 57 provides sufficient lag in the movement of the main valve so that the spring toggle members pass the dead center before the main valve is moved sufficiently to entirely cut off the oil feed to the main cylinder. This provision of lost motion and accompanying lag thus enables the machine to operate continuously so long as the foot pedal remains depressed.

Whenever the foot pedal is released, however, the link 90 will move upward, engaging the pin 93 and preventing movement of the bell crank 50 to the position shown in Fig. 2, as the toggle spring 67 is not strong enough to overcome the heavy spring 86.

The slotted link 92, however, permits free upward movement of the bell crank 50, so that the machine will not stop at the end of a down stroke but only as the next ensuing up stroke is completed. Consequently the machine always stops with the tool holder 14 in raised position, but will operate continuously as long as the foot pedal is held depressed.

It will be understood that manual pressure may be applied to the handle 52 to overcome the spring 86 and thus effect independent control of the main valve in any manner desired.

While my improvements are of general application to hydraulic presses and to machines for performing similar operations, they are of particular utility when embodied in machines used for tube drawing operations. In such machines, extended tool travel is required, as the tubes may be long and the tool must be withdrawn a substantial distance beyond working position in order that a tube may be replaced. Uniform speed is also much to be desired. These conditions are fully met in the construction herein disclosed.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. In a hydraulic press, in combination, hydraulic actuating mechanism, a reversing valve therefor, automatic means to move said valve alternately in opposite directions to spaced operative positions, and manually controlled means normally overpowering said automatic means and preventing automatic movement of said valve substantially beyond neutral mid-position in one direction only but leaving said automatic means free to move said valve in the opposite direction.

2. In a hydraulic press, in combination, hydraulic actuating mechanism, a reversing valve therefor, an actuating device for said valve, mechanical means to give said actuating device the first part of its reversing movement, a spring to complete said movement, and manually controlled means normally effective to prevent completion of said partial reversing movement of said actuating device by said spring beyond neutral mid position in one direction only but leaving said actuating device freely movable by said spring in the opposite direction to fully reverse said valve.

3. In a hydraulic machine having a tool holder, a hydraulic cylinder and piston connected to move said tool holder toward and from the work and a shiftable valve effective to direct a flow of oil under pressure alternately to opposite ends of said cylinder, that improvement in control

mechanism for said machine which comprises a spring-actuated element connected to move said shiftable valve, automatic means to move said spring-actuated element beyond neutral mid-position alternately in opposite directions, and manually controlled means to limit movement of said spring-actuated element in one direction substantially to neutral mid-position but leaving said valve freely movable by said spring-actuated element in the opposite direction.

4. In a hydraulic machine having a tool holder, a hydraulic cylinder and piston connected to move said tool holder toward and from the work, a shiftable valve effective to direct a flow of oil under pressure alternately to opposite ends of said cylinder, that improvement in control mechanism for said machine which comprises a spring-actuated element connected to move said shiftable valve, automatic means to move said spring-actuated element beyond neutral mid-position alternately in opposite directions, and manually controlled means to prevent said spring-actuated element passing substantially beyond neutral mid-position in one direction only but leaving said valve freely movable by said spring-actuated element in the opposite direction.

5. In a hydraulic machine having a tool holder, a hydraulic cylinder and piston connected to move said tool holder toward and from the work and a shiftable valve effective to direct a flow of oil under pressure alternately to opposite ends of said cylinder, that improvement in control mechanism for said machine which comprises a spring-actuated toggle element connected to move said shiftable valve, automatic means to move said spring-actuated element beyond dead center alternately in opposite directions, manual means to move said spring-actuated toggle element in either direction, and manually releasable means normally effective to prevent movement of said manual means and toggle element in one direction substantially beyond neutral mid-position but leaving said valve freely movable by said toggle element in the opposite direction.

6. In a hydraulic machine having a tool holder, a hydraulic cylinder and piston connected to move said tool holder toward and from the work and a shiftable double acting valve effective to direct a flow of oil under pressure alternately to opposite ends of said cylinder, that improvement in control mechanism for said machine which comprises a spring-actuated element connected to move said shiftable valve, said valve being in neutral mid-position when said spring-actuated element is in mid-position, automatic means effective to move said spring-actuated element beyond neutral position alternately in opposite directions, means normally effective to prevent completion of the movement of said spring-actuated element by said automatic means substantially beyond neutral mid-position in a direction to cause said valve to effect an advance movement of the tool holder toward the work, and manual means to release said preventing means.

7. In a hydraulic machine having a tool holder, a hydraulic cylinder and piston connected to move said tool holder toward and from the work and a shiftable double acting valve effective to direct a flow of oil under pressure alternately to opposite ends of said cylinder, that improvement in control mechanism for said machine which comprises a spring-actuated toggle element connected to move said shiftable valve, said valve being in neutral mid-position when said spring-actuated element is in mid-position, automatic means effective to move said spring-actuated toggle element beyond dead center alternately in opposite directions, a pedal associated with said spring-actuated element, and a spring to raise said pedal to normal position, thereby preventing completion of the shifting movement of said spring-actuated toggle element by said automatic means substantially beyond neutral mid-position in a direction to cause said valve to effect an advance movement of the tool holder toward the work, and said pedal releasing said spring-actuated element for immediate movement by said automatic means when said pedal is depressed.

KENNETH C. MONROE.