Dec. 30, 1947. T. L. MAY 2,433,672

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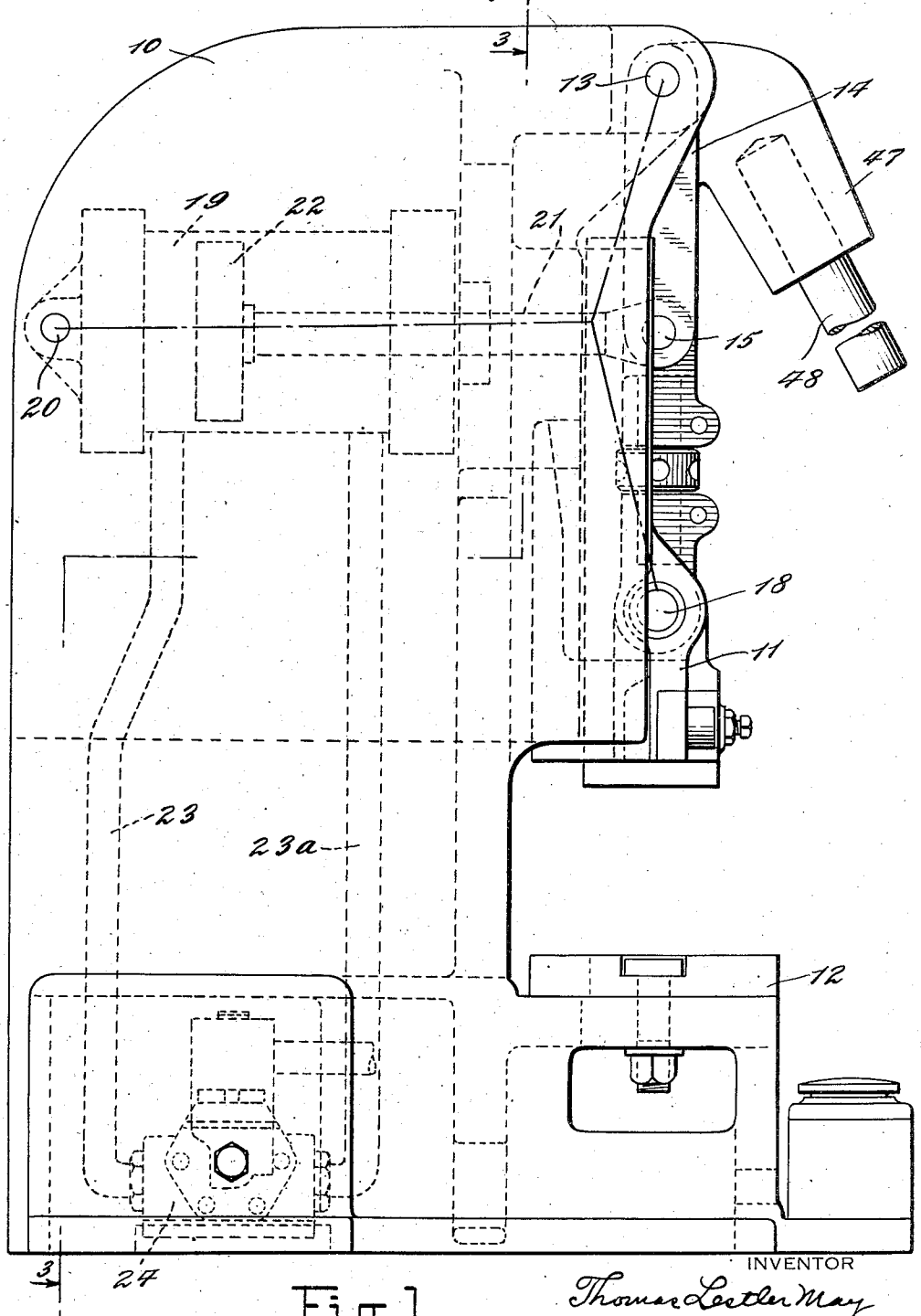

Fig. 1.

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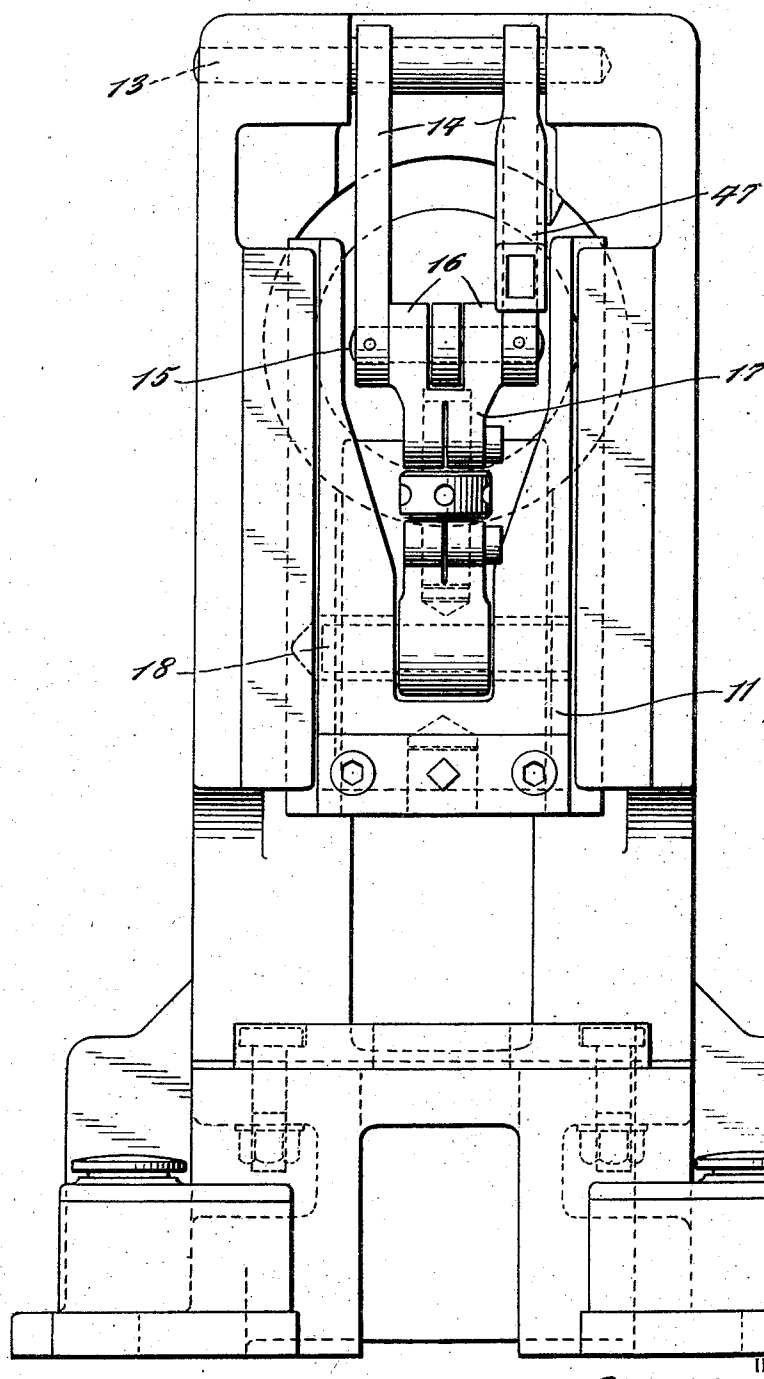

Fig. 2.

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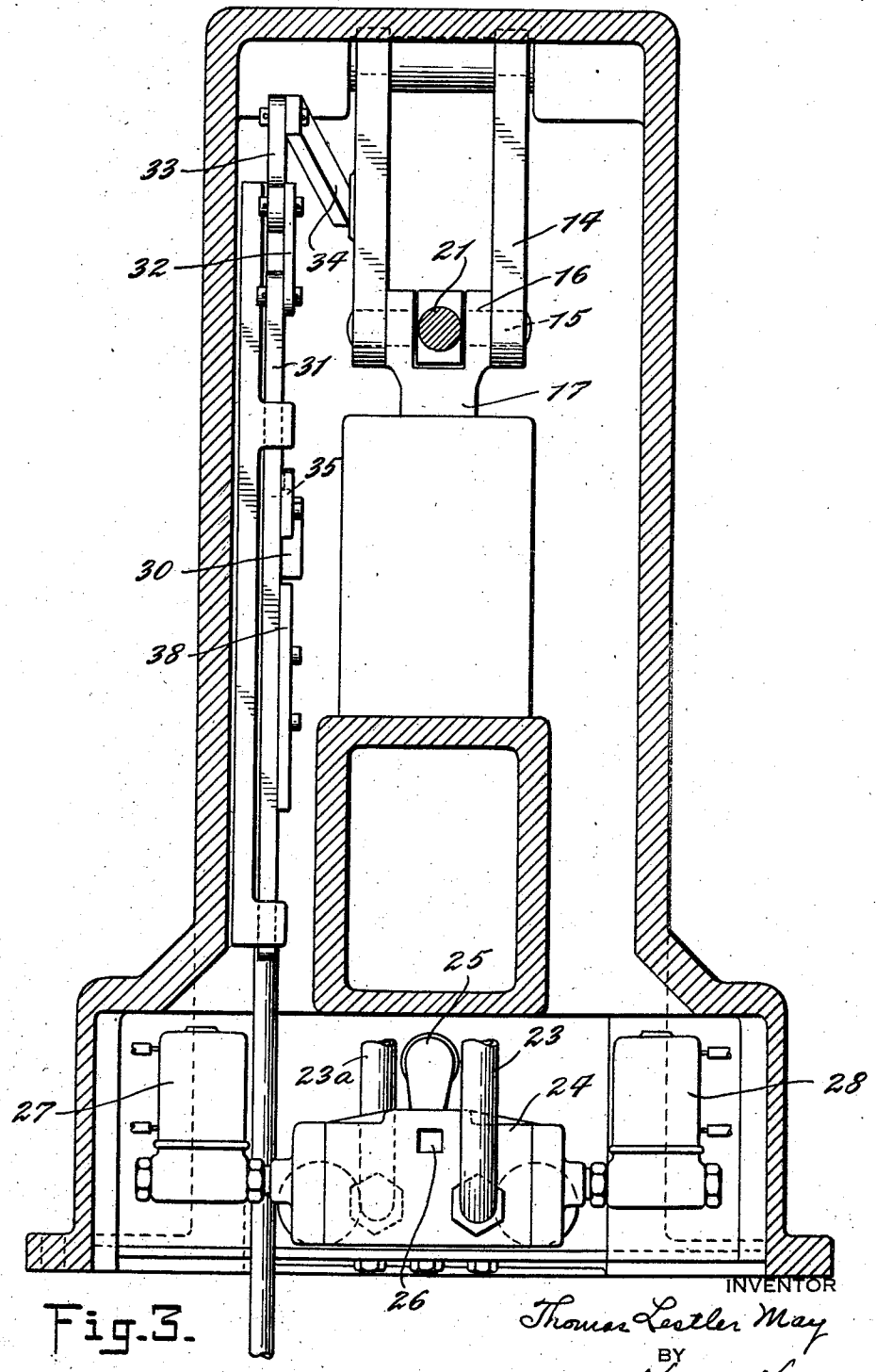

Fig. 3.

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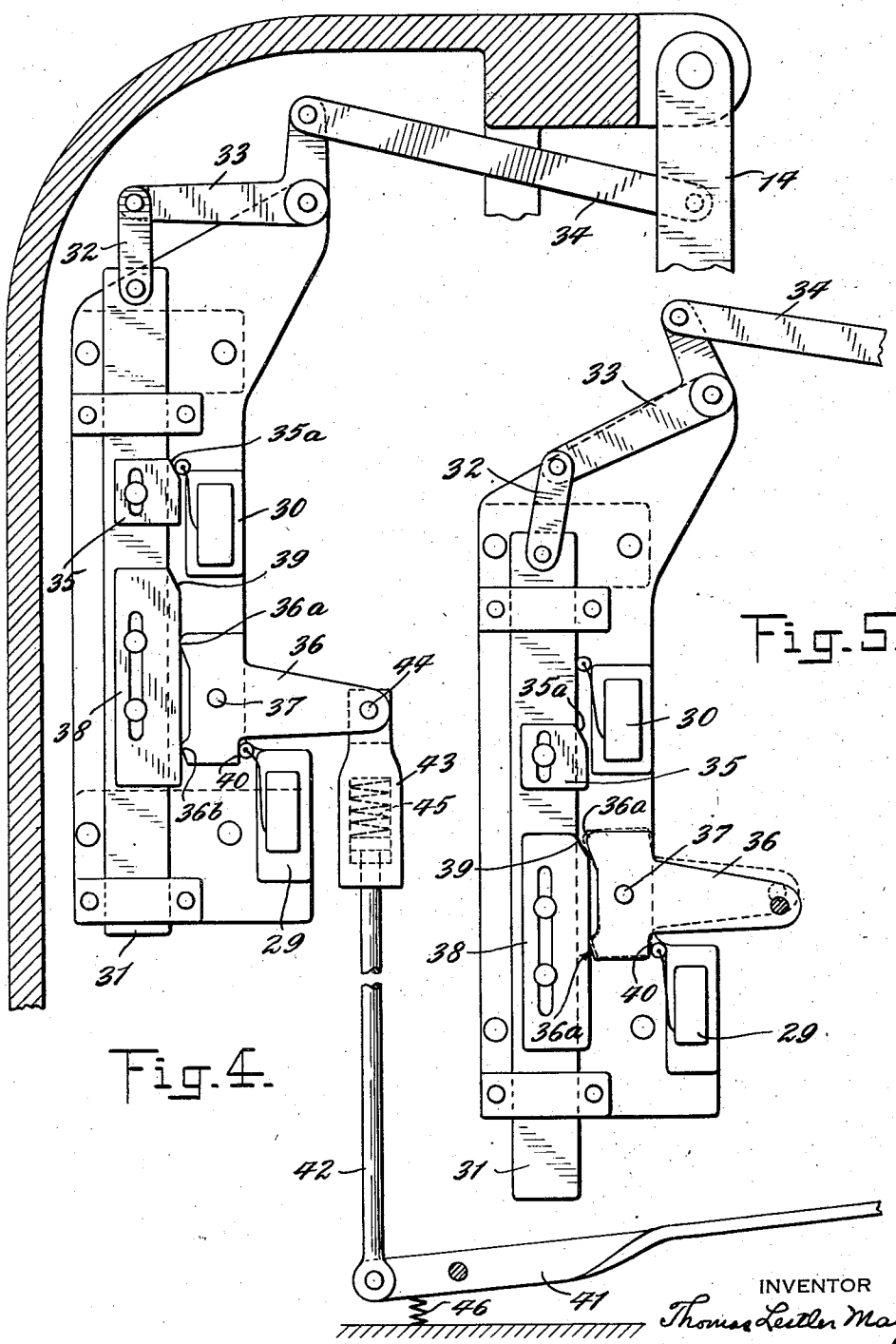

Fig. 4.

Fig. 5.

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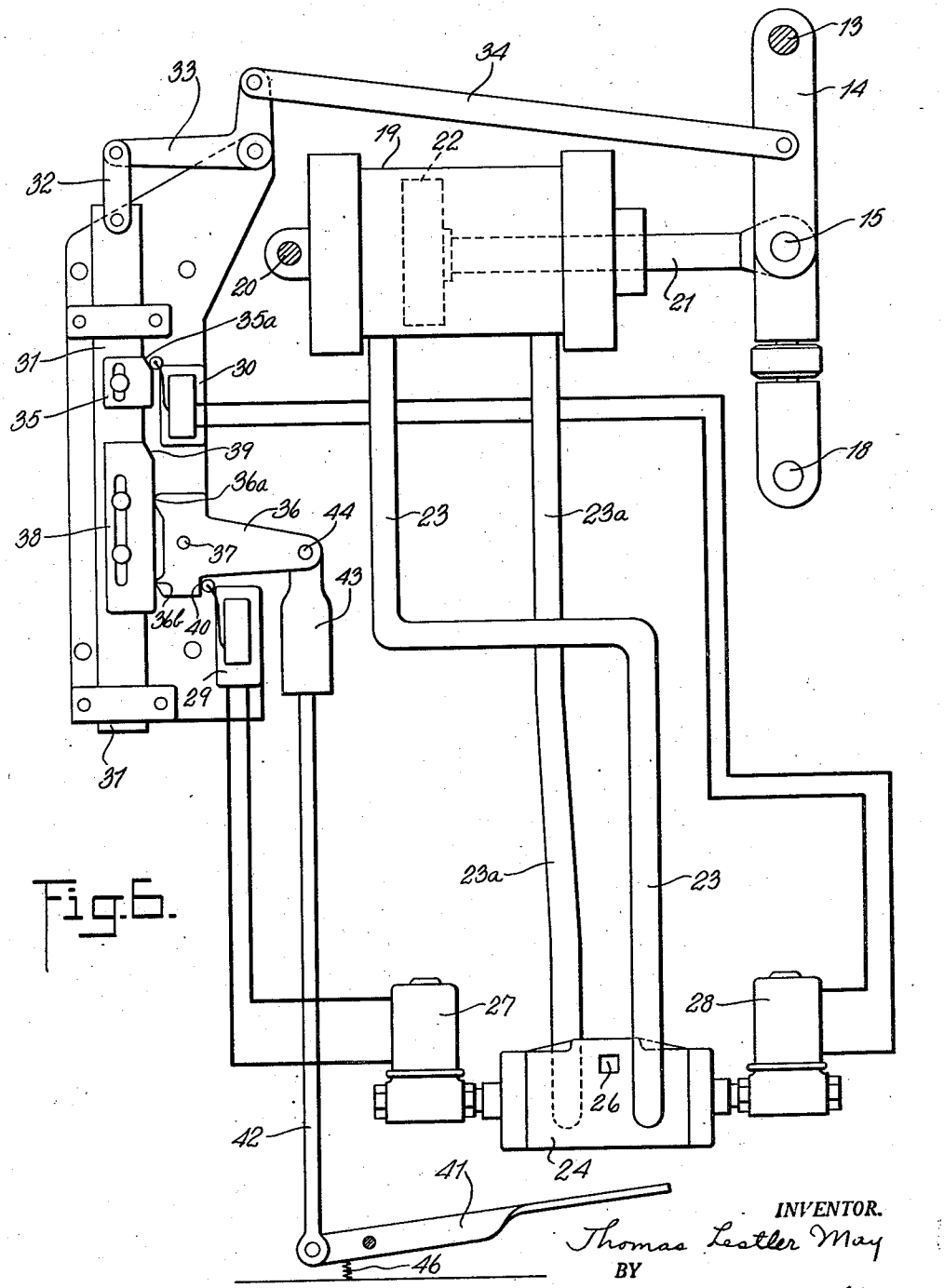

Fig. 6.

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UNITED STATES PATENT OFFICE

2,433,672

PRESS

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Application July 1, 1944, Serial No. 543,145

13 Claims. (Cl. 100—70)

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This invention relates to presses.

An object of this invention is a press having fluid pressure-operated means for effecting relative movement of a pair of dies.

In a press embodying the invention, a toggle joint has one end pivotally supported and the other end connected to a head guided for rectilinear movement. A double-acting fluid-pressure motor is connected to the knee of the toggle joint and means, including a four-way valve, are provided for flowing actuating fluid to and from said motor. The valve is controlled by a pair of solenoids and switches are provided for effecting energization of said solenoid in accordance with the position of the press head. Control means also are provided for starting and stopping the press.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a side elevation of a press embodying the invention;

Fig. 2 is a front elevation;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a side elevation of the control mechanism in one position,

Fig. 5 is a fragmentary view similar to Fig. 4 in a different position of the control mechanism, and Fig. 6 illustrates the invention schematically.

The press embodies a hollow frame 10 in which a head 11 is mounted on suitable guides for vertical reciprocation toward and away from a bed 12. A shaft 13 is mounted in the upper end of the frame and rotatably supports a sleeve to which are rigidly attached two arms 14. A pin 15 extends through apertures in the free ends of the arms and also passes through apertures in ears 16 formed at one end of an adjustable length bar 17, the remaining end of which has an aperture through which extends another pin 18, this latter being journalled to the head 11.

A fluid-pressure cylinder 19 is pivotally supported at one end by a pin 20 and at its other end has an opening through which extends a connecting rod 21. At the inner end of the connecting rod 21 is provided a piston 22 within the cylinder 19. The remaining end of the rod 21 has an aperture through which passes the pin 15. The arms 14 and the bar 17 constitute a toggle joint by means of which the head 11 may be caused to reciprocate vertically and power for effecting operation of the toggle joint is obtained from the double-acting fluid-pressure motor consisting of cylinder 19, connecting rod 21 and piston 22.

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Operating fluid is supplied to opposite ends of the cylinder 19 through pipes 23 and 23a which are connected to delivery ports of a four-way valve 24 having an inlet connection 25 from a pump (not shown) and a discharge aperture 26 communicating with a tank (not shown). Solenoids 27 and 28 are provided for actuating the valve 24. The valve 24 is of standard construction and is so arranged that upon energization of the solenoid 27 the valve is actuated to cause fluid to flow from the inlet 25 through the pipe 23 to the left end of the cylinder and fluid is caused to flow from the right end of the cylinder 19 through the pipe 23a and discharge aperture 26, thus causing movement to the right of the piston 22. The valve remains in this position upon de-energization of the solenoid 27 until energization of the solenoid 28 which causes actuation of the valve 24 to reverse the connections to cause movement of the piston 22 to the left. Movement of the piston 22 to the right expands the toggle to cause downward movement of the head 11 while movement to the left of piston 22 retracts the toggle to cause upward movement of the slide 11.

Energization of the solenoids 27 and 28 is controlled by two normally-open limit switches 29 and 30. Closing of the switch 29 causes energization of the solenoid 27 while closing of the switch 30 causes energization of the solenoid 28. A slide 31 is supported by the frame 10 for vertical reciprocation and is connected at its top end through a link 32, bell crank lever 33 and link 34 to an arm 14. The arrangement of these connections is such that downward movement of the head 11 is accompanied by upward movement of the slide 31 and vice versa.

The slide 31 carries a cam member 35 having an oblique surface 35a which engages the limit switch 30 on the upward movement of the slide to close said switch at the upper limit of the slide movement. A lever 36 is pivotally supported from the frame 10 by a pin 37. The slide carries a cam 38 for cooperation with the lever 36. The upper right-hand corner of the cam 38 is oblique as at 39 and the left-hand face of the lever 36 is provided with two spaced projections 36a and 36b. The arrangement is such that when the slide 31 is in its lowermost position the lever 36 may be oscillated slightly but after the slide 31 has moved upwardly a predetermined extent, the cam 38 is operative to hold the lever 36 immovable by reason of the engagement of the projections 36a and 36b therewith. The lever 36 is provided with a

shoulder 40 engageable with the limit switch 29 and the arrangement of the shoulder 40 is such that when the slide 31 has been lifted to render the lever 36 immovable, the limit switch 29 is in open condition and can be closed only by counterclockwise rotation of the lever 36 with the slide 31 in its lowermost position.

The lever 36 is operated by a treadle 41 equipped with a link 42 extending into a hollow member 43 pivotally attached to the lever 36 by a pin 44. A spring 45 is interposed between the upper end of the link 42 and the member 43. Clockwise movement of the treadle 41 tends to compress the spring 45 to tend to cause counterclockwise rotation of the lever 36. A spring 46 biases the treadle 42 counterclockwise.

Assume that the press is at rest in which condition the head 11 is in its uppermost position with the slide 31 in its lowermost position and the piston 22 is at the left end of the cylinder 19. The treadle 41 is in its unactuated position and the lever 36 likewise is in its unactuated position as shown in full lines in Fig. 5 with clearance between the surface 39 of the cam 38 and the projection 36*a* of the lever 36. Both switches 29 and 30 are open and both solenoids 27 and 28 are de-energized, and the position of the valve 24 is such that the inlet 25 is in communication with the pipe 23. Clockwise rotation of the treadle 41 tends to compress the spring 45 thereby causing counterclockwise rotation of the lever 36 from its full line position to its dotted line position in which the projection 36*a* engages the surface 39. Such rotation of the lever 36 closes the limit switch 29 thereby energizing the solenoid 27 with concomitant setting of the valve 24 to cause fluid flow through the pipe 23 into the cylinder 19 to force the piston 22 to the right to expand the toggle joint and force the head 11 downwardly. Such movement of the head 11 is accompanied by upward movement of the slide 31 which causes clockwise rotation of the lever 36 to its original position (Fig. 4) to permit the limit switch 29 to open the energizing circuit of the solenoid 27 with concomitant return of the treadle 41 to its original position unless it has been held in its actuated position in which event the spring 45 yields to permit c ockwise rotation of the lever 36. Further upward movement of the slide 31 brings the cam 35 into position to close the limit switch 30 at the end of the down stroke of the head 11 whereupon the solenoid 28 is energized to set the valve 24 in condition to cause fluid to flow through the pipe 23*a* into the cylinder 19 to cause leftward movement of the piston 22 and contraction of the toggle joint with corresponding lifting of the head 11. If the treadle 41 has been released and restored to its original position by the spring 46, the press will come to rest after the piston 22 has reached the limit of its leftward movement as the switch 29 will remain open. Assuming, however, that the tread e 41 has been held in actuated position, the spring 45 will be under compression by reason of the clockwise movement of the lever 36 and upon sufficient downward movement of the slide 31 will expand to cause counterclockwise movement of the lever 36 to again close the switch 29 and limit the cycle.

A socket member 47 is rigidly attached to one arm 14 and is adapted to receive the end of a rod 48. The rod 48 is used by the mechanic to effect manual operation of the toggle joint in connection with preparing the press for operation so as to make certain that the upper and lower dies are in proper relation to each other at the downward limit of the head movement. By use of the rod 48, the toggle joint may be manually operated in the same manner that it is operated by the hydraulic motor. It is to be understood that the limit switch circuits are both de-energized before manual operation of the press is attempted.

The cams 35 and 38 are adjustably supported by the slide 31. By proper adjustment of these cams, the stroke of the press head may be varied as desired. Also, by changing the size of the pipes 23 and 23*a*, the speed of operation of the fluid-pressure motor may be regulated as desired.

Any suitable operating fluid may be used to effect reciprocation of the piston 22 in the cylinder 19. It is contemplated that the operating fluid may be a suitable liquid such as oil or water or may be a suitable gas or vapor such as air or steam. In any event, flow of the operating fluid to the cylinder 19 is controlled in the manner above described.

It is of course understood that various modifications may be made in the apparatus above described without in any way departing from the spirit of the invention as defined in the appended claims.

I claim:

1. In a press, a head guided for recti linear movement, a toggle joint having one end supported for oscillation about a fixed pivot and the other end pivotally connected to said head, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, switches for controlling energization of said solenoids, and means including members on said slide for effecting actuation of said switches.

2. In a press, a toggle joint having one end pivotally supported and the other end guided for rectilinear movement, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, a normally open switch for controlling energization of each solenoid, a first cam member on said slide effective to close one switch at one end of said s ide stroke, a pivoted lever movable between two positions, a second cam member on said slide effective to hold said lever immovable in one position except with the slide at the remaining end of its stroke, said lever being effective to close the other switch upon movement of said lever into its second position, and means for actuating said lever.

3. A press according to claim 2 characterized by said lever-actuating means including a resilient member.

4. In a press, a toggle joint having one end pivotally supported and the other end guided for rectilinear movement, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, a normally open switch for controlling energization of each solenoid, a first cam member on said slide effective to close one switch at one end of said slide stroke, a pivoted lever mov-

able between two positions and having two projections extending toward said second cam member for engagement therewith except with the slide at the remaining end of its stroke to hold said lever immovable, said lever being effective to close the other switch upon movement thereof into its second position, and means for actuating said lever.

5. A press according to claim 4 characterized by said lever-actuating means including a resilient member.

6. In a press, a toggle joint having one end pivotally supported and the other end guided for rectilinear movement, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, a switch for controlling operation of each solenoid, means including a first cam member on said slide for actuating one switch to close it at the end of the slide stroke but otherwise to keep it open, a pivoted lever movable between two positions, means including a second cam member on said slide effective to hold said lever immovable in one position except with the slide at the remaining end of its stroke, means including said lever to actuate the other switch to close it upon movement of said lever into its second position but otherwise to keep it open, and means for actuating said lever.

7. A press according to claim 6 characterized by said lever-actuating means including a resilient member.

8. In a press, a head guided for rectilinear movement, a toggle joint having one end supported for oscillation about a fixed pivot and the other end pivotally connected to said head, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, switches for controlling energization of said solenoids, and means including said slide for effecting actuation of said switches.

9. In a press, a toggle joint having one end pivotally supported and the other end guided for rectilinear movement, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, switches for controlling energization of said solenoids, automatic means including said slide for actuating one of said switches, and operator-controlled means for actuating the remaining switch.

10. In a press, a toggle joint having one end pivotally supported and the other end guided for rectilinear movement, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a valve for controlling fluid flow to and from said motor, a pair of solenoids for actuating said valve, switches for controlling energization of said solenoids, automatic means including said slide for actuating one of said switches, operator-controlled means for closing said other switch, and means including said slide for opening said last-named switch.

11. A press according to claim 10 characterized by said operator-controlled means including a resilient member.

12. In a press, a head guided for rectilinear movement, a toggle joint having one end supported for oscillation about a fixed pivot and the other end pivotally connected to said head, a double-acting fluid-pressure motor connected to the knee of the toggle joint, a valve for controlling fluid flow to and from said motor, a slide operated by said toggle joint, and means including said slide for effecting actuation of said valve.

13. In a press, a head guided for rectilinear movement, a toggle joint having one end oscillatable about a fixed pivot and the other end pivotally connected to said head, a double-acting fluid pressure motor connected to the knee of the toggle joint, a valve for controlling fluid flow to and from said motor, a slide, means for effecting reciprocation of said slide upon actuation of said toggle joint, a pair of solenoids for actuating said valve, switches for controlling energization of said solenoids, means including said slide for effecting actuation of said valve and additional operator-controlled means for effecting actuation of said valve.

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