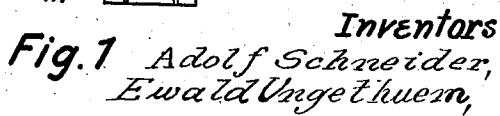


A. SCHNEIDER ET AL

TOGGLE LEVER PRESS

Filed April 5, 1938

5 Sheets-Sheet 1



By John B. Brady
Attorney

2,387,041

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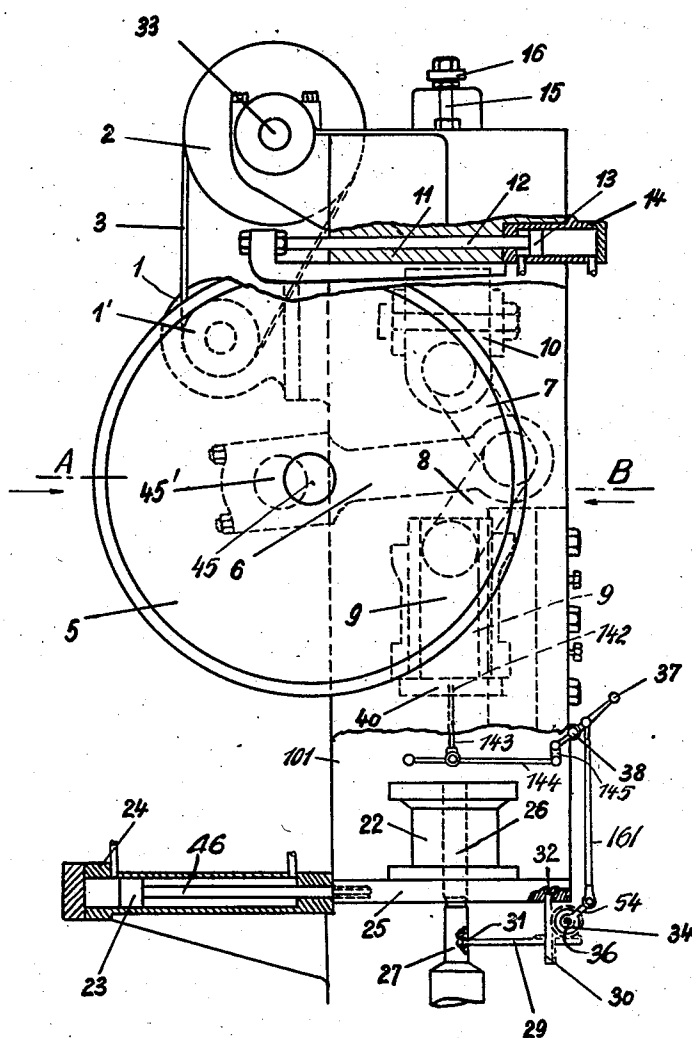


Fig. 2

Inventors
Adolf Schneider,
Ewald Ungethuern,

by John B. Brady
Attorney

Oct. 16, 1945.

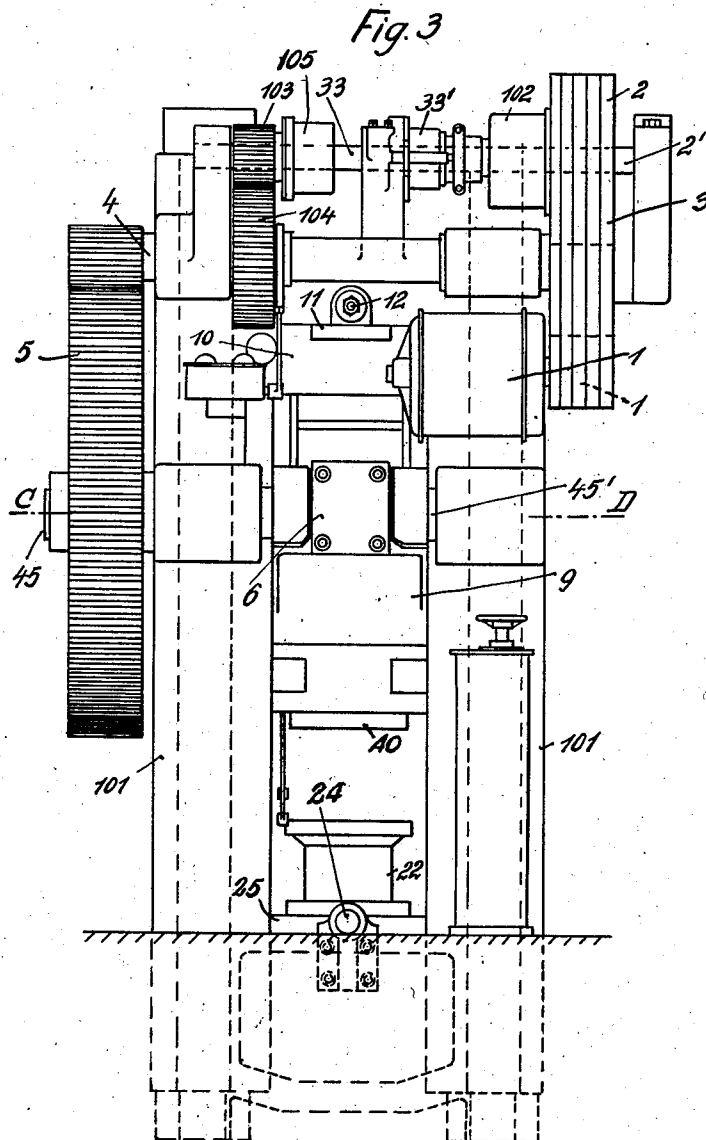
A. SCHNEIDER ET AL

2,387,041

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5 Sheets-Sheet 3



Inventors
Adolf Schneider,
Ewald Ungethuern,
by John C. Brady
Attorney

Oct. 16, 1945.

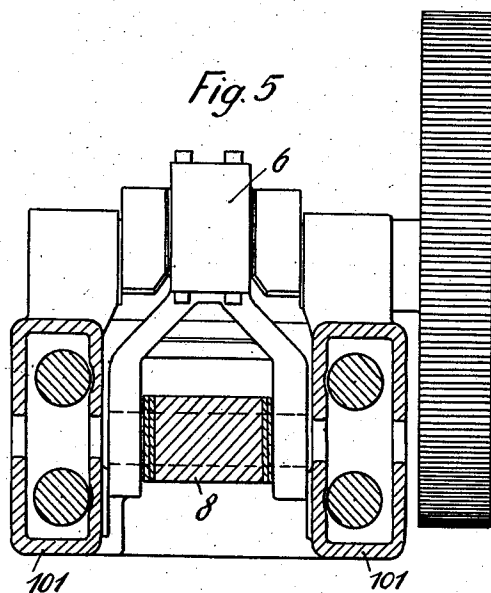
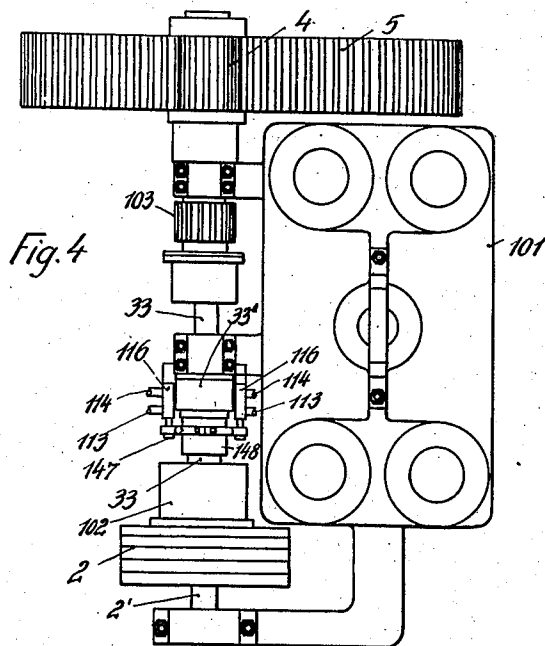
A. SCHNEIDER ET AL

2,387,041

TOGGLE LEVER PRESS.

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Inventors
Adolf Schneider,
Ewald Ungethuem,
By John B. Gredy
Attorney

Oct. 16, 1945.

A. SCHNEIDER ET AL

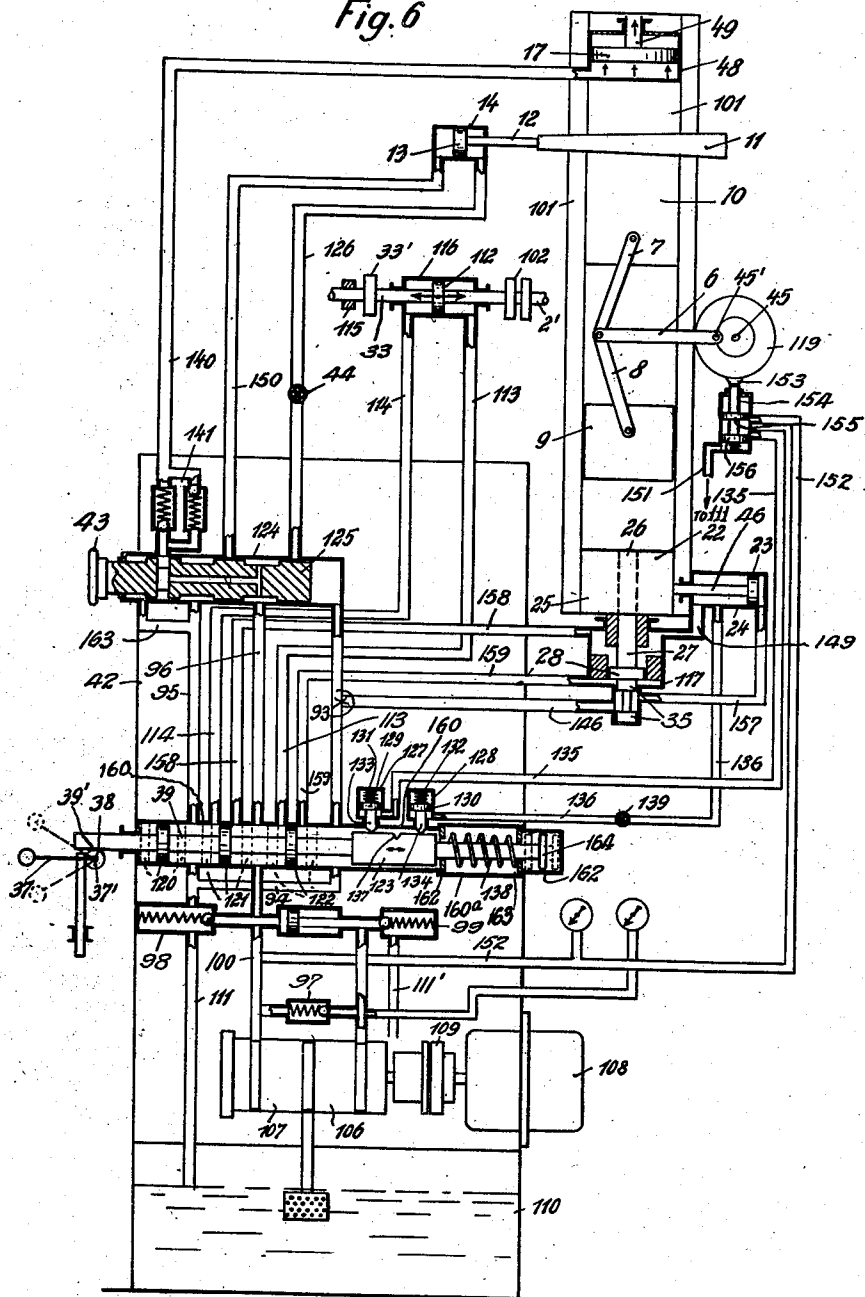
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Fig. 6



Inventors
Adolf Schneider,
Ewald Ungethuem,
by John C. Crady
Attorney

UNITED STATES PATENT OFFICE

2,387,041

TOGGLE LEVER PRESS

Adolf Schneider and Ewald Ungethuem, Karlsruhe, Baden, Germany; vested in the Alien Property Custodian

Application April 5, 1938, Serial No. 200,282
In Germany April 10, 1937

4 Claims. (Cl. 100—70)

This invention relates to a toggle lever press. It is an object of the invention to increase the speed and output of toggle lever presses, to simplify the construction and to reduce the manufacturing cost of such presses.

Another object of the invention is to facilitate the operation of toggle lever presses.

Another object of the invention is to facilitate the ejecting operation.

Still another object is to provide a simple means for adjusting the end positions of the ram.

With these and further objects in view, we provide means for effecting the control of the press by hydraulic pressure. More particularly, we control the end positions of the ram, the press table, the ejector and the main shaft by hydraulic pressure.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings showing by way of example and diagrammatically an embodiment of our toggle lever press.

Fig. 1 is an elevation, partly in section, viewed in the direction of arrow A in Fig. 2 of a toggle lever press having the invention applied thereto.

Fig. 2 is a side elevation, partly in section, of the press shown in Fig. 1.

Fig. 3 is an elevation of the same press viewed in the direction of the arrow B in Fig. 2.

Fig. 4 is a plan view of the press.

Fig. 5 is a section on line C—D in Fig. 3.

Fig. 6 is a schematic diagram of the control system.

Referring now to the drawings in greater detail, and first to Figs. 1 to 5, the press comprises a main frame 101 in which the press table 22 is mounted for lateral sliding motion under action of a hydraulic system 23, 24, 46, as will be hereinafter described. A ram 9 is mounted to slide vertically in suitable guides of the main frame, under action of a toggle lever system 6, 7, 8, 10, in the manner known per se.

The drive of the press will now be described. A pulley 2 fast on a shaft 2' is driven from a motor 1 with pulley 1', by a number of cone belts 3, and in turn drives, through coupling 102, main shaft 33, a slipping clutch 105 and gear wheels 103, and 104, and shaft 4 and a gear wheel 5 on shaft 45. Mounted on a crank 45' of shaft 45 is a connecting rod 6 acting upon a toggle lever system comprising thrust rods 7 and 8, a stationary support or abutment 10 and a ram 9 upon which the pressure of said system is exerted. The support 10 bears against an adjustable wedge member 11 which in turn bears against the transverse or bridge portion of the main frame 101.

The wedge member 11 is mounted to be movable in a horizontal direction by a thrust rod 12 forming part of a piston 13 movable in a cylinder

14 by hydraulic pressure which is fed and controlled in the manner which will be hereinafter described, so as to control the vertical position of the support 10 which bears against the lower inclined face of said wedge member 11.

The toggle joint support 10 is connected, through two tension rods 15, with a cross bar 16 which can be acted upon by hydraulic pressure in the cylinder 48, through a piston 17 and piston rod 49, thus urging the toggle joint support 10 against the wedge face 11 and locking the wedge member in its adjusted position. The actual position of the adjustable wedge member 11 is shown by an indicator 18 consisting of an index 50 movable on a scale 51 and rotated, through a bevel gear 52 fast on the pointer shaft and a bevel gear 53 fast on the left hand end of shaft 19, from a rack 21 fast on the adjustable wedge member 11 and engaging a toothed wheel 20 fast on the opposite end of shaft 19. In this manner, the lower and upper end positions of the ram 9 are controlled, locked and indicated.

The press table 22 can be horizontally moved by means of a hydraulic piston 23 movable in a cylinder 24 and secured to a thrust rod 46 connected with the plate 25. An ejector rod consisting of an upper part 26 and a lower part 27 extends through the plate 25 and the table 22. Connected to said lower portion 27 is a piston 28 movable in a hydraulic cylinder 117 under control of the pressure of a liquid admitted to either side of the cylinder 117 by ducts and control valves, which will be hereinafter described. In order to ensure that the ejecting operation can take place only when the ejector member 26 is positioned accurately vertically above the member 27, partly toothed rods 29, 30 moved by a toothed wheel 34 on shaft 36, are provided to engage recesses 31 and 32 of the member 27 and the plate 25 respectively when said parts are in the correct positions. The shaft 36 is rotated by depression of the lever 37, pivoted at 38, through a rod 161 and a lever 54. The lever 37 is connected by shaft 38 with a valve controlling rod 39 controlling the press liquid for a hydraulic system 112, 116 (Fig. 6) by which the coupling 102 is operated as will be hereinafter described.

Referring now to Fig. 6, there is shown a diagram of the hydraulic control system. Two gear pumps 106 and 107, connected through valve 97 and driven by an electromotor 108, through a coupling 109, supply oil or water under pressure from a storage tank 110 through pipe 100 into the pipe system comprising the control valves, cylinders and pistons, while the excessive quantities of oil are fed back into the storage tank 110, through relief valves 98 and 99 and pipes 111 and 111'. The elements of the hydraulic pipe system are known per se and need not be described in detail here. Therefore, it will be suffi-

cient to refer to the typical parts of the machine illustrated in the diagram and forming part of the invention.

The main shaft 33 is mounted to be axially movable by means of a piston 112 arranged in a cylinder 116 and controlled by hydraulic pressure through pipes 113 and 114. Thus, when the pressure in pipe 114 exceeds the pressure in pipe 113, the piston 112 and shaft 33 will be moved in right hand direction and shaft 33 will be coupled with the driving shaft 2', by engagement of the coupling 102 so that the toggle lever system is operated. Again, when the pressure in pipe 113 exceeds the pressure in pipe 114, the piston 112 and shaft 33 will be moved in a left hand direction, releasing the coupling 102, and the flange or collar 33' on shaft 33 will engage the stationary brake disc 115, so that the press comes to a standstill. It will be understood that it is not necessary for the main shaft 33 to pass through the cylinder 116, but in practice the mechanical connection between piston 112 and shaft 33 or coupling 102 and brake 115 respectively will be established in the manner shown in Fig. 4, by means of a twin arrangement of cylinders 116 operating on shaft 33 by a cross bar 147 engaging a suitable annular groove in the shaft 33 or in a flange 148 on said shaft respectively.

The operations of the press are controlled entirely by hydraulic pressure by movement of lever 37 which actuates rod 39 through a rack and pinion connection at 39'. The rod 39 extends through a valve casing 160 and carries control pistons 120, 121 and 122 and member 123, which are shown in full line in middle positions as maintained by a spring 138. The spring 138 is operative to restore the rod and the associated control pistons to the full line position shown from either of the dotted line positions shown, which are the positions occupied by the control pistons when the lever 37 is moved to upper and lower operating positions. Spring pressed latching members 133 and 134 are disposed for engagement with the notch 137 in member 123 in the respective actuated positions of the member 123 and rod 39; the latching members are adapted to be released by hydraulic pressure on pistons 129 and 130, as will be further described, for allowing spring 138 to restore the rod 39 to middle position.

Piston 120 is essentially a sealing member. Piston 121 alternately opens pipe 114 to pressure from pipe 100, when lever 37 is depressed, and pipe 158 to discharge pipe 111, when lever 37 is raised. Piston 122 alternately opens pipe 159 to pressure from pipe 100, when lever 37 is raised, and pipe 113 to discharge pipe 111 through connecting pipe 94, when lever 37 is depressed. It will be noted that pressure supply is continuous from pipe 100 to pipe 96 leading to valve 125, and that discharge pipes 95 and 111, and 93 and 94, are similarly continuously open through valve casing 160.

The adjustment of the press stroke by wedge 11 is controlled by valve 125 by movement of handle 43. The valve includes a valve casing 124 within which the valve member 125 is slidable by handle 43. In the middle position shown, pressure is admitted from pipe 96 through passages in the valve member and pipe 140 to cylinder 48 where piston 17 is raised and the support 10 is likewise raised, through rods 15, to position against wedge 11. When handle 43 is drawn out, pressure is cut off from pipe 140 and

supplied to pipe 150 while pipe 126 is opened to discharge pipe 93 and pipe 140 to discharge pipe 95, whereupon piston 17 and support 10 are dropped, freeing wedge 11, and piston 13 is moved to the right to shift the wedge 11 in that direction, Fig. 6. In reverse manner, when handle 43 is moved inward beyond middle position, pipe 140 is again cut off from pressure and opened to discharge by-pass pipe 163, while pipe 150 is opened to discharge pipe 95 and pressure is supplied to pipe 126 whereby piston 13 is forced to the left and shifts wedge 11 accordingly. Throttle valve 44 in pipe 126 regulates the rate of movement of wedge 11 in either direction. Tension valve 141 is inserted in pipe 140 to maintain the fluid therein at proper pressure depending upon the pressure conditions imposed.

With the support 10 in adjusted position, the press is ready for operation under control of lever 37. Lever 37 is raised to eject the work pressed and to run out the table 25 for removal of the work and placement of another piece, whereupon the lever is depressed to effect one pressing operation—which may be repeated if subsequent pressing operations with the same or a different tool is desired—after which movement again upward of lever 37 will present the pressed work for removal. The press table is automatically returned to position and the operation of the press is automatically limited to one stamping operation as will be explained while safety is assured by the several rod and recess provisions—as described in reference to rods 31 and 32, and as will be described in reference to rod 143 and recess 142.

When lever 37 is raised, fluid pressure is transmitted from pipe 109 through pipe 113 to maintain the coupling 102 disengaged, and through pipe 159 to the cylinder 117 below piston 28 to raise the ejector rod 27 and the coating member 26 in the shiftable press table. As the piston 28 nears the limit of its stroke, valve portions 35 operate to admit fluid pressure to pipe 157, from pipe 159, and thence behind piston 23 in cylinder 24 which operates to run out the table 22 and plate 25, the upper portion 26 of the ejector being carried out of alignment with rod 27.

When lever 37 was raised, member 123 carried by the rod 39, was displaced so that latch member 134 engaged the recess 137 to hold lever 37 in raised position. As the piston 23 travels in cylinder 24, it eventually uncovers pipe 136 by which pressure is conducted to cylinder 128 beneath piston 130, which operates to raise latch member 134 and release rod 39. A throttle valve 139 in pipe 136 delays the operation of piston 130 a time sufficient for removal of the work and placement of another piece. Rod 39 then moves to middle position under the action of spring 138, whereupon pressure is transmitted through pipe 158 to cylinder 117 above piston 28 and at the same time to cylinder 24 to return pistons 28 and 23 respectively to their former positions. Table 22 and plate 25 follow piston 23 and when the ejector portion 26 is again aligned with portion 27 it drops into abutment with member 27. Pipe 148, uncovered by lower valve portion 35, communicates with discharge pipe 93 and releases the pressure from cylinder 24 while pipe 159, opened to discharge when rod 39 was returned to middle position, releases the pressure below piston 28.

When lever 37 is depressed, as is in order when the foregoing operations have been completed,

fluid pressure is transmitted from pipe 100 through pipe 158 to maintain the ejector rod depressed and the plate 25 in position, and through pipe 114 to move shaft 33 to engage the coupling 102 and drive the toggle mechanism of the press. At the time lever 37 is depressed, member 123 carried by rod 39 is displaced so that latch member 133 engages the recess 137 to hold rod 39 to the left.

The shaft 45 driving the toggle mechanism makes one complete revolution, effecting one pressing operation, whereupon lobe 153 on cam 119 depresses valve rod 154. Fluid pressure from pipe 100, transmitted through pipe 152 and acting on valve piston 155 in cooperation with spring 156, is then transmitted through pipe 135 to cylinder 127 below piston 129 which operates to raise latch member 133 and allow rod 39 to return to middle position under the action of spring 138. While shaft 45 is turning, pipe 135 is connected to discharge through pipe 151 which connects with pipe 111.

If several tools are employed, these are selected in turn and lever 37 depressed for effecting the operation of each with respect to the work piece, after which lever 37 is raised, the work ejected, and replaced when the table and plate are run out, as described. Where it is intended to use several tools, for example one punch each for the first, second and finishing operations, the three different punches may be mounted on the tool carriage 40, Figs. 1-3, which can be moved manually for bringing the punches successively into their operating positions.

The press serves in particular for the forging of cartridge bottoms, or for the manufacture of forks, knives, and spoons, or generally, whenever three tools operate in sequence, the first tool roughing, the second finishing and the third sizing the work. The pressure under which the work is pressed, is high and the stroke of the ram is comparatively short. Instead of three tools, two tools, or one tool might be used. After the third or finishing tool has performed its operation, the handle or control lever 37 is raised, oil under pressure enters the pipe 159 and the operation already described is repeated.

The spring 138 operates between stops 162, 163, which are disposed in an enlarged portion 160a of the casing 160 and abut against opposite shoulder portions of smaller diameter. When rod 39 is moved to the right, member 123 engages stop 162 which moves to the right and compresses spring 138 against the stop 163, until latch 134 engages the notch 137. When rod 39 is moved to the left, a head member 164, on rod 39 engages stop 163 which moves to the left and compresses spring 138 against the stop 162 until latch 133 engages notch 137. With rod 39 in either right or left operated position, therefore, spring 138 is compressed to restore the rod to middle position when the holding latch is raised. In order to ensure that the tool carriage is in the correct position when the press is operated, a recess 142 is provided in the carriage 40 and a lock member 143 is provided to engage said recess when the carriage is in its working position, thereby releasing the control members 37, 38 for the drive of the machine, through rods 144, 145.

The machine cannot be started when the tool slide or carriage 40 is not in the proper position, that is, the rest rod 143 does not engage in the opening 142. If it does so engage, the handle 37 can be thrown over since it is connected to the rest rod 143 through links 144 and 145.

While we have herein shown and described certain preferred embodiments of our invention, we wish it to be understood that we do not confine ourselves to all the precise details herein set forth by way of illustration, as modification and variation may be made without departing from the spirit of the invention or exceeding the scope of the appended claims.

We claim:

1. In a toggle lever press, a ram, a motor for driving said ram, clutch means for coupling said motor to said ram; a hydraulic operating system comprising a source of hydraulic pressure, means for utilizing said pressure to operate said clutch means, a control valve selectively operative to apply pressure to the last said means for mechanically driving said ram, said control valve having retaining means effective in the operated position of said valve, automatic releasing means connected with said ram and with said retaining means and operative to release said retaining means when said ram has completed one cycle of operation in said press, whereby pressure is removed from said clutch means, a table for said press having work ejecting means; and actuating means for said control valve having safety means operatively related to said work ejecting means and effective to prevent operation of said control valve when said work ejecting means is in operation.

2. In a toggle lever press, a table and work ejecting means vertically operable through said table; a hydraulic operating system comprising a source of hydraulic pressure, means for utilizing said pressure to operate said work ejecting means with respect to said table, a control valve selectively operative to apply pressure to said means, said control valve having retaining means effective in the operated position of said valve, and automatic releasing means controlled by said work ejecting means and effective with respect to said retaining means to release said valve.

3. A toggle lever press as set forth in claim 2 wherein the table is movable and provided with means for utilizing hydraulic pressure to shift the table, and in which said work ejecting means is divided into an upper portion movable with said table and a lower actuated portion; and including valve means associated with said lower portion and with said means for utilizing hydraulic pressure to operate said work ejecting means, for applying pressure to the means for utilizing pressure to shift said table, when said work ejecting means has been operated; said automatic releasing means being also controlled by the table and operative to release said control valve when the table has substantially completed a predetermined movement, whereby both said pressure utilizing means are restored to inactive condition.

4. A toggle lever press according to claim 2 and further comprising means for shifting said table and ejecting means relative to said pressure utilizing means, a feeler for locking said utilizing means against operation, a second feeler for locking said table against horizontal shifting when said utilizing means is in engageable relationship to said ejecting means, and means jointly controlled by said feelers when in said locked positions for permitting the operation of said valve.

ADOLF SCHNEIDER,
EWALD UNGETHUEM,