Dec. 27, 1938. I. HARTER 2,142,052

PRESS

Filed Nov. 22, 1934 4 Sheets-Sheet 1

Fig. 1

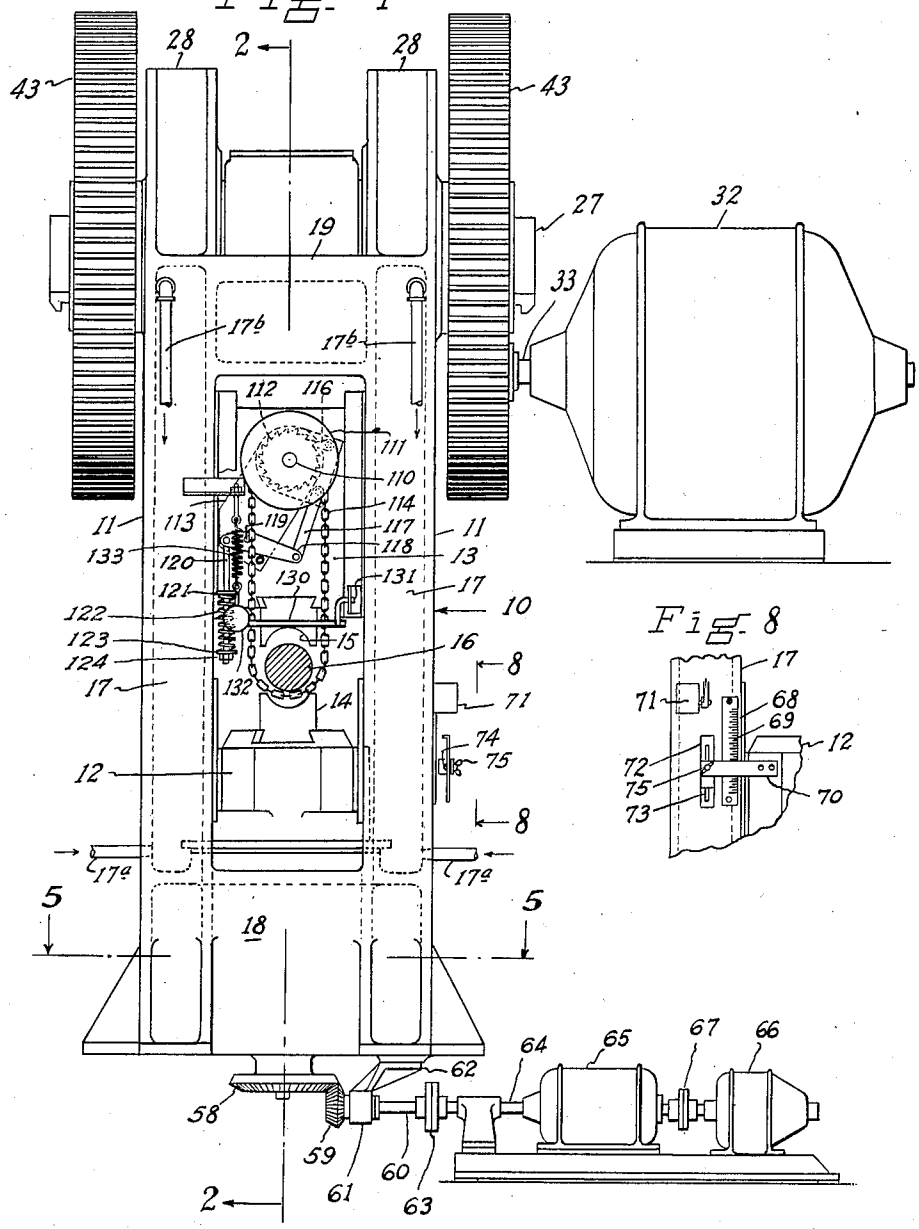


Fig. 8

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Fig. 3

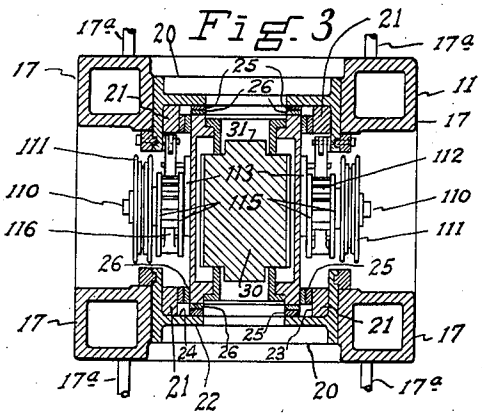


Fig. 4

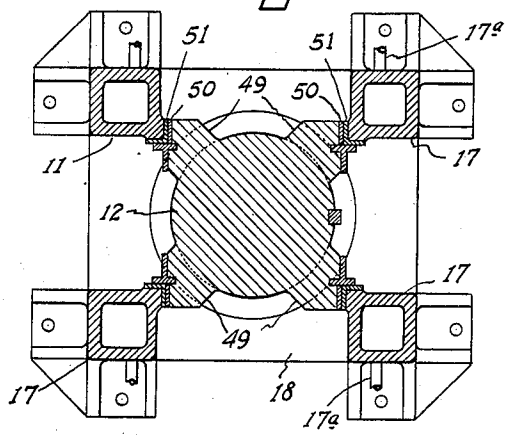
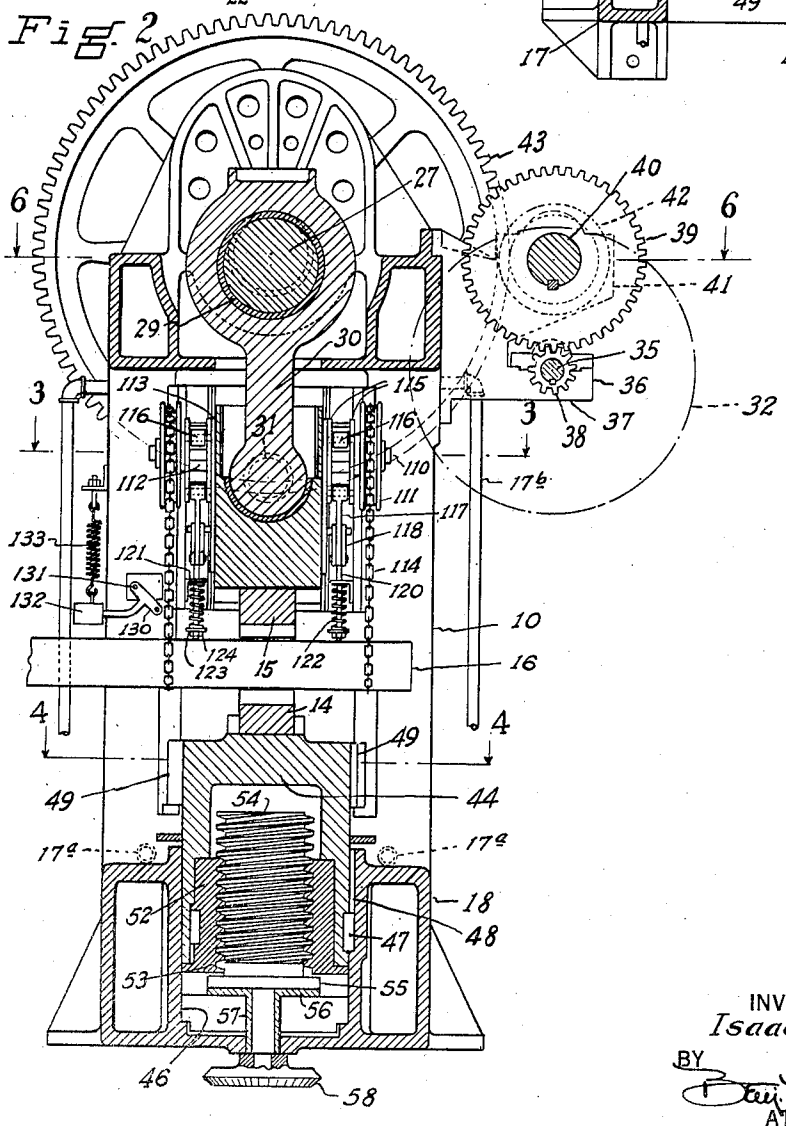


Fig. 2



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Fig. 5

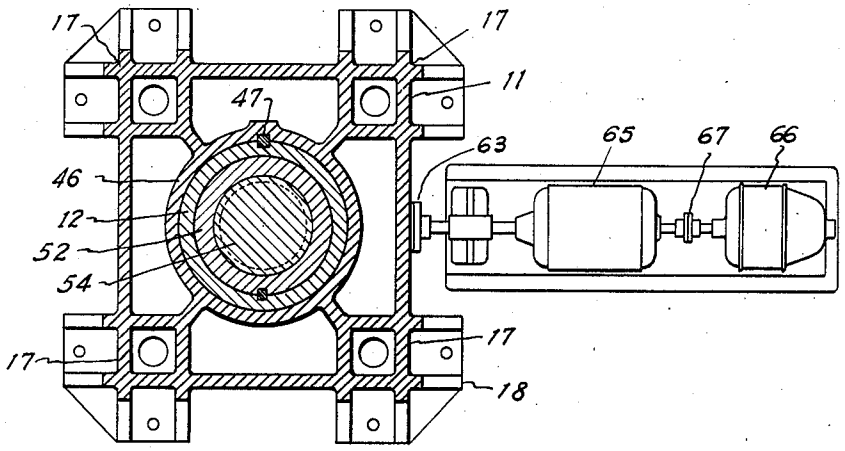
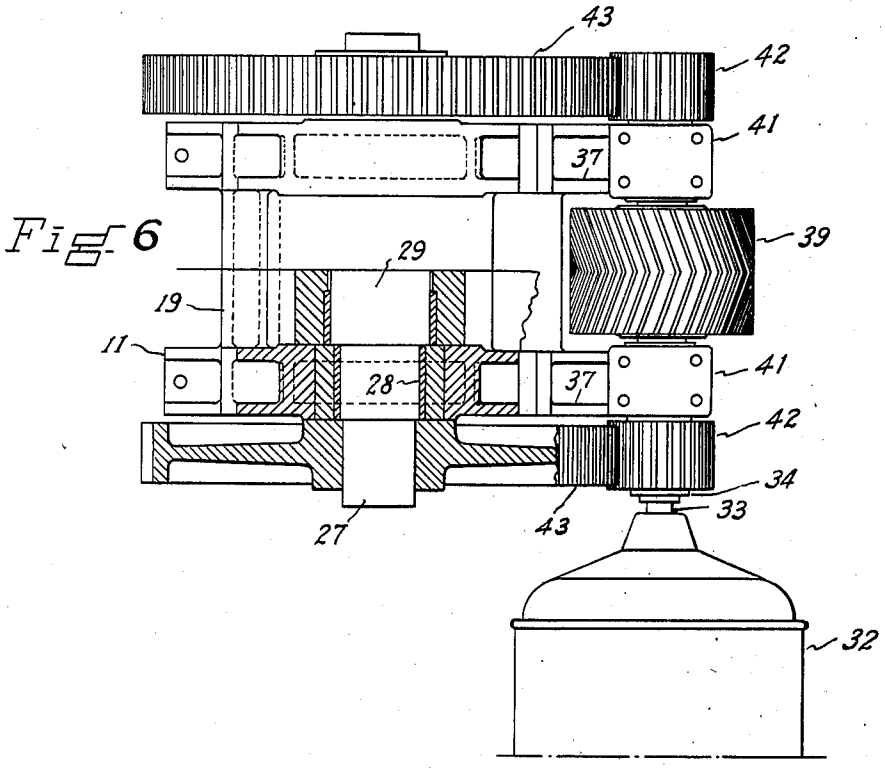


Fig. 6



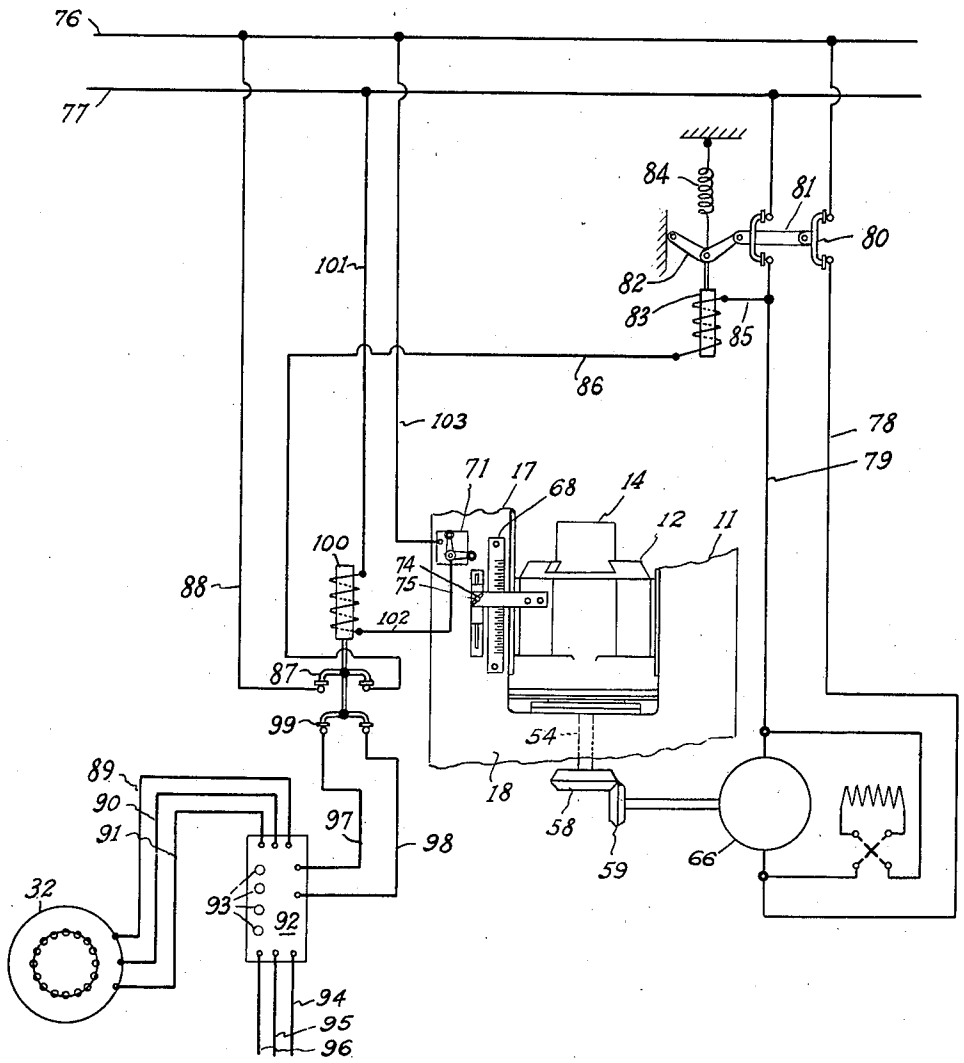
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Fig. 7



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UNITED STATES PATENT OFFICE

2,142,052

PRESS

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Application November 22, 1934, Serial No. 754,255

11 Claims. (Cl. 78—98)

This invention relates to apparatus for working metal and more particularly to a forge press.

An object of this invention is to provide a press of improved construction wherein the amount of forging done on the material at any one stroke is under the direct control of the operator, and wherein there is a uniformity of finished product, both as to the amount of forging done on the material and as to the final finish allowance of material on the forging itself, thereby causing a saving in the finishing costs.

A further object is to provide an improved press wherein the handling of the material by the operator during the operation of the press is facilitated.

A further object is to prevent damage to the press in case the operator becomes careless and allows the working clearance between the dies to go below a predetermined minimum.

The above and other objects are effected by my invention, as will be apparent from the following description and claims when taken in connection with the accompanying drawings, in which:

Fig. 1 is a front elevational view illustrating one preferred embodiment of my improved press;

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a horizontal sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a partial plan, partial-sectional view of my improved press, the portion shown in section being taken on the line 6—6 of Fig. 2;

Fig. 7 is an electrical diagram illustrating the operation of the press and an automatic means for stopping the press in case the working clearance goes below a predetermined minimum; and

Fig. 8 is a fragmentary side elevation of Fig. 1, looking in the direction indicated by the arrows 8—8 of Fig. 1.

Referring to the drawings in detail, it will be observed that I have shown my invention as embodied in a press 10 for forging metallic members of varying sizes and shapes. The press comprises a frame 11, an anvil block 12 mounted in the lower portion of the frame, and a vertically movable cross-head or ram 13 mounted in the upper portion of the frame. Dies 14 and 15 are fixed respectively to the anvil block 12 and ram 13. The operation of the press provides for working engagement of the dies 14 and 15 with a member 16 to be worked on, in a manner well known in the art.

The press frame 11 comprises four substantially vertical columns 17 joined together at their bottom to form a base member 18 and joined together at their upper ends to form a cap or head member 19. In so far as certain of the broader aspects of my invention are concerned the frame may be constructed in any suitable manner; however, in the embodiment shown on the drawings I have chosen to illustrate the frame as consisting of a single steel casting. Such a construction is extremely sturdy and possesses distinctive advantages over the conventional sectional type of construction wherein tension bolts are provided which become loose in operation and have to be tightened from time to time.

In order to provide for uniform operation of the press the columns are water cooled to prevent expansion and contraction incident to changes in temperature thereof. I have indicated at 17*a* inlet pipes for the cooling water which flows upwardly through the hollow interior of columns 17 and through outlet pipes 17*b* in the upper ends thereof.

The columns 17 are arranged to provide guideways for the ram or cross-head 13 (see Fig. 3). To this end, frame members 20 are disposed between pairs of columns 17 at opposite sides of the vertical center line of the frame and are fixed to the columns. Vertically disposed blocks 21 are fixed to the frame members 20 and the outer surfaces thereof in conjunction with adjacent flange portions 22 of the frame members 20 provide surfaces 23 and 24 disposed at right angles to one another and to which are respectively secured vertical guide plates 25 which are slidably engaged by corresponding guide plates 26 fixed to the ram. Either the guide plates 25 or 26 may be easily replaced in case of wear.

The press 10 is provided with a drive shaft 27 rotatably mounted in spaced bearings 28 carried by the frame. The shaft 27 is shown as being a one piece forging with an eccentric portion 29 at its center, on which is journaled the upper end of a connecting rod 30, the lower end of the connecting rod being pivotally connected to the ram 13 as indicated at 31.

The drive shaft 27 is suitably operated through reduction gearing from an electric motor 32 of the variable speed type. The motor is indicated in Fig. 7 as being of the three phase squirrel cage induction type. The motor shaft 33 is connected through a coupling 34 to a shaft 35 journaled in spaced bearings 36 carried by brackets 37 fixed

to the frame 11. A pinion 38 is fixed to the shaft 35 and meshes with a gear 39 fixed to a pinion shaft 40, the latter being journaled in bearings 41 also carried by the brackets 37. Pinions 42 are fixed to the outer ends of the shaft 40 and mesh respectively with gears 43 fixed to the outer ends of the drive shaft 27.

One of the principal features of the present invention is that of providing for varying the working clearance between the dies 14 and 15 by moving the lower anvil block 12 toward and away from the ram 13, as desired. The purpose of this is to accommodate for different sizes of work, to control at all times the amount of forging done for each stroke of the ram, and to provide for predetermined uniform sizes in the finished product with a minimum of excess metal so as to minimize finishing costs.

The anvil block 12 is shown as being in the form of a hollow cylinder with a closed upper end 44 for holding the die 14. The lower end of the anvil block slidably fits within a cylindrical portion 46 of the base member 18. A key 47 fixed to the anvil block and slidably fitting within a vertical groove 48, in the base member permits vertical movement of the anvil block, but prevents movement of the anvil block about its vertical axis so as to maintain the desired matching relation of the dies 14 and 15.

As a further means of guiding the anvil block to permit vertical movement thereof, the upper end of the anvil block is provided with wing portions 49, four in number, which are respectively arranged adjacent the four hollow columns 17 of the frame (see Fig. 4). The wing portions 49 are provided with guide surfaces 50 which engage respectively corresponding surfaces 51 provided at the inside corner of each of the columns 17.

A sleeve-like nut member 52 is fixed within the hollow interior of the anvil block and is provided with internal screw threads 53 which receive an exteriorly threaded operating and supporting member 54, the latter being provided with a flange 55 which rests upon a flange 56 formed on the upper end of a bushing member 57 which extends through and is fixed to the base member 18 of the press frame. The lower end of the member 54 is of reduced cylindrical form and is journaled in the bushing member 57. A bevel gear 58 is keyed to the extreme lower end of the member 54 and meshes with a bevel pinion 59 keyed to one end of a shaft 60 (see Fig. 1). The shaft 60 is suitably journaled within a bearing 61 carried by a bracket 62 fixed to the base member 18 of the frame. The end of the shaft 60 opposite the bevel pinion is connected by a coupling 63 with a shaft 64 of a speed reducing unit 65. An electric motor 66 is operatively connected by a coupling 67 with the speed reducing unit 65. The motor 66 is preferably of the reversible type and is indicated in Fig. 7 of the drawings as being a shunt wound reversing motor. It will thus be seen that the motor 66 acting through the reduction unit 64, bevel pinion 59, bevel gear 58, and screw threaded member 54, serves to raise or lower the anvil block 12 to any desired position.

In operation, the cross-head or ram 13 is constantly moved up and down, the amount of movement being fixed by the design of the eccentric portion 29. The amount of forging done on the member 16 for any one stroke is determined by the position of the anvil block 12. In the drawings, the anvil block is shown as being in its lowermost position and with the ram being reciprocated no working engagement of the dies with the member can be had. After the member 16 is inserted between the dies as shown, the main motor 32 is started, and the anvil block motor 66 operated to elevate the anvil block to a position determined by the amount of forging desired to be done on the member 16 for one stroke. The member 16 is then passed through the press, the ram effecting working engagement of the dies with the member 16. Should more forging on the member 16 be required, the anvil block is elevated still further and the forging process repeated. Usually, the act of raising and lowering the anvil block is effected without stopping the ram, the operator governing his movements by the continuous movement of the ram, such procedure being conducive to large production.

In order to guide the operator during his work and to assure a minimum of excess metal on the finished forging, I provide a gauge 68 comprising a scale 69 fixed to the press frame and an indicator 70 carried by the anvil block 12.

In order to prevent damage to the press in case the operator becomes careless and allows the anvil block to move up to a point where the die 14 will be engaged by the die 15 of the ram on the down stroke of the latter, I provide an automatic limit switch 71 which is adapted to be engaged by a vertically adjustable member 72 carried by the outer end of the indicator 70 when the anvil block is raised beyond a predetermined point (see Figs. 1, 7 and 8). The member 72 serves to operate the switch 71 to stop the anvil block motor 66 and main motor 32.

The vertical adjustment of the member 72 is provided by a vertical slot 73 in the member 72 which receives a bolt 74, the latter also extending through the outer end of the indicator 70. A wing nut 75 serves to tighten the bolt 74 and hold the member 72 in its adjusted position. If desired, the member 72 may be so positoned as to operate the limit switch 71 in case the working clearance between the dies goes below a predetermined minimum. In such a case, the limit switch would serve as a means for assuring a predetermined final dimension for the member 16 being forged should the operator become careless.

In Fig. 7, I have indicated diagrammatically the manner in which the press is automatically stopped in case the anvil block is elevated beyond a predetermined point. The lead wires 76 and 77 indicate a source of electric current, preferably direct current, at a suitable voltage. The anvil block motor 66 which is shown to be of the reversing shunt wound type is supplied with current by lead wires 78 and 79 connected respectively to the wires 76 and 77. A low-voltage circuit breaker 80 is disposed in the circuit supplying current to the motor 66 and comprises a switch 81 operated by a toggle arrangement 82, the toggles being urged toward closed-switch position by a solenoid 83 and towards open-switch position by a spring 84. The solenoid 83 is connected by a lead 85 with the lead wire 79 and by a lead 86 with one side of a switch 87, the other side of the switch being connected by a lead 88 with the other side of the supply circuit, i. e., the lead wire 76.

The main motor 32 is shown as being of the variable speed three phase squirrel cage induction type and is supplied with AC current at a suitable voltage by leads 89, 90, 91 connected to a push button station 92 having buttons 93 for effecting operation of the motor at the different speeds and for stopping the motor. The AC

current supply is indicated by the leads 94, 95 and 96. Leads 97 and 98 are a part of a circuit; which circuit is operatively connected to the stop-button on the push button station 92 and when this operating circuit is opened the main motor is stopped. A switch 99 is provided in the latter circuit for controlling the same.

The switches 87 and 99 are connected together and to a solenoid 100 for operation thereby in unison, the solenoid 100 being connected to one side of the DC current supply by lead wire 101, and to the other side of the DC current supply through the limit switch 71 by leads 102 and 103.

When the anvil block is elevated beyond a predetermined position the limit switch 71 is closed by the adjustable member 72 on the indicator 70, thus establishing a circuit through the leads, 103 and 102 through the solenoid 100, and lead 101. The solenoid 100 when energized acts to open switches 87 and 99. Opening of the switch 87 opens the circuit formed by the leads 88, 86, solenoid 83 and lead 85, thereby de-energizing the solenoid 83 and permitting the spring 84 to act through the toggle 82 to open the switch 81 and stop the motor 66. Opening the switch 99 opens the circuit including the leads 97 and 98 which circuit is connected to the stop button on the push button station 92 and thereby stops the motor 32.

It is to be noted at this point that my invention, in certain of its broader aspects, is not to be considered as being limited to the specific means shown for elevating and lowering the lower anvil block and to the means shown for preventing damage to the press in case the anvil block is elevated beyond a predetermined point, because other means falling within the intended scope of this invention may be used for performing these functions; for example, the anvil block may be raised and lowered hydraulically instead of mechanically and a pressure relief valve may be connected to the operating cylinder for relieving the hydraulic pressure in case the anvil block is elevated to a point where the ram contacts with the anvil on its down stroke.

In accordance with the present invention, I also provide an improved means for automatically rotating the member 16, to be forged, between strokes of the ram 13. From an examination of Figs. 1, 2 and 3, it will be observed that at each side of the ram and extending parallel to the axis of the member there is provided a stub shaft 110 carrying a sheave 111, and a ratchet wheel 112. Each shaft 110 is carried by a plate 113 fixed to the ram 13. An endless chain 114 encircles each of the sheaves and the member 16 to be forged. Mounted on each shaft 110 and at opposite sides of each ratchet wheel 112 are cheek plates 115 which carry a pawl 116 pivoted thereto and engaging the ratchet wheel. Each pair of cheek plates 115 is loosely mounted on its respective shaft 110 and is connected by a link 117 with the one end of a lever 118, the latter being pivotally mounted intermediate its ends on a pin 119 carried by the plate 113. The other end of the lever 118 is pivotally connected to the upper end of a rod 120, the latter passing freely through an opening in a bracket 121 rigid with a frame column 17 and connected to such bracket by a compression spring 122, one end of the latter bearing against the bracket 121 and the other end bearing against a washer 123 held on the lower end of the rod 120 by an adjustable nut 124.

The operation of the above described apparatus is as follows:—

When the crosshead or ram 13 is moved upward a given distance the chains 114 lift the member 16 to be forged clear of the die 14. One end of each lever 118 is held down by the rod 120, which is connected through its respective spring 122 and bracket 121 to a frame column 17. Further upward movement of the ram carries with it each pivot pin 119 which causes its respective lever 118 to move about the pivotal connection with the upper end of the rod 120 and move through the link 117 the cheek plates 115 about the shaft 110, thereby moving its respective pawl 116, which engages and imparts rotary movement to its ratchet wheel 112 and sheave 111. Rotation of the sheaves 111 will result in the movement of the chains 114, and rotation of the member 16, an amount determined by the amount of rotation imparted by the pawls. The amount of rotation is determined by the adjustment of the nut 124 on the rod 120. When the ram moves downward, the pawls 116, cheek plates 115, links 117 and levers 118 remain in their relative positions until the compression of the spring 122 has been released sufficiently for the combined weight of the unbalanced portions of the cheek plates, the weight of the pawls, the links, and long arms of the levers, to cause each pawl to ride downward over the teeth of its respective ratchet wheel and assume a new and lower position so that it may be able to impart additional rotary motion to its ratchet wheel upon the next upward movement of the ram 13. Thus, upon every upward movement of the ram, the member 16 is rotated a certain amount to present new surfaces thereof to be worked on.

I also provide for advancing the member 16 being forged through the press. A member 130 extends across and engages one of the chains 114. The member 130 is pivoted at its opposite ends by trunnions 131 carried by columns 17 of the press frame and is held in engagement with the chain 114 by a weight 132, the latter being counterbalanced a predetermined amount by a spring 133 fastened to a column 17. When the member 16 to be forged rests on the bottom die 14 and the chain 114 is slack, the member 130 due to the weight 132 moves the chain along the member 16 toward the right as viewed in Fig. 2, and when the chains 114 are tightened again due to the upward movement of the ram, the member 16 will swing clear of the die 14 and to the left, due to the change in position of the left-hand chain with respect to the member 16. When the member 16 again contacts with the die 14 and the chains are slack, the right-hand chain or the chain not being engaged by the member 130 will again assume a vertical position. Thus, the member 16 will be automatically moved lengthwise as well as rotated during the operation of the press.

While I have shown my invention in only one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as specifically set forth in the appended claims.

I claim:—

1. In a press, the combination of an anvil block; a die secured to the block; a reciprocable ram; a die secured to the ram; means for mov-

ing the ram through a set stroke toward and away from the anvil block to effect intermittent engagement of the dies with a member to be worked on; and means operated by the relative movement of the ram and anvil block away from one another for lifting and turning said member and thereby presenting new surfaces to be worked on.

2. In a press, the combination of an anvil block; a die secured to the upper side of the block; a ram disposed above the anvil block; a die secured to the under side of the ram; means for moving the ram toward and away from the anvil block to effect intermittent working engagement of the dies with a member to be worked on; a rotatable sheave carried by the ram; an endless flexible member encircling the member to be worked on and the sheave and being supported by the latter; the flexible member being of such a length that as the ram is moved away from the anvil block the member to be worked on is lifted by the flexible member and out of contact with the die on the anvil block; and means operated by the movement of the ram away from the anvil block for rotating the sheave and thereby turning the member to be worked on and presenting new surfaces for engagement by the dies.

3. In a press, the combination of cooperating dies and holders for the dies relatively movable towards and away from one another to effect intermittent working engagement of the dies with a member to be worked on; and means providing for lifting, turning and feeding said member between working engagements therewith so as to present new surfaces to be worked on.

4. In a press, the combination of cooperating dies and holders for the dies relatively movable towards and away from one another to effect intermittent working engagement of the dies with a member to be worked on; means for lifting and turning said member as the dies move away from one another to present new surfaces to be worked on; and means cooperating with the first named means for also feeding said member.

5. In a press, the combination of an anvil block; a die secured to the upper side of the block; a ram disposed above the anvil block; a die secured to the under side of the ram; means for moving the ram towards and away from the anvil block to effect intermittent working engagement of the dies with a member to be worked on; a rotatable sheave carried by the ram; an endless flexible member encircling the member to be worked on and the sheave and being supported by the latter; the flexible member being of such a length that as the ram is moved away from the block the member to be worked on is lifted by the flexible member and out of contact with the die on the anvil block; means operated by the movement of the ram away from the anvil block for rotating the sheave and thereby turning the member to be worked on and presenting new surfaces for working engagement by the dies; and means engaging said flexible member for moving the latter along the member to be worked on during working engagement so that when the member to be worked on is next lifted by the flexible member the member to be worked on will be moved laterally as well as being turned.

6. In apparatus of the character described, the combination of a frame having vertically arranged column members, an eccentric drive shaft mounted in the upper part of said frame, a reciprocable ram, a connecting rod connecting said drive shaft and ram, a hollow cylindrical anvil block mounted in the lower part of said frame, wing extensions on said anvil block having a guide engagement with said column members permitting vertical and preventing rotary movement of said anvil block relative to said frame, a screw member fitting within said anvil block for moving said anvil block towards and away from said ram, said screw member being supported in the base of said frame and arranged to transmit stresses on said anvil block to said frame, power cut-off means mounted on said frame and controlling the operation of said ram and anvil block, and means mounted on said anvil block for actuating said power cut-off means when said anvil block reaches a predetermined elevation.

7. In apparatus of the character described, the combination of a vertical frame having hollow corner column members, an eccentric drive shaft horizontally arranged in the upper part of said frame, a reciprocable ram, a connecting rod connecting said drive shaft and ram, a hollow cylindrical anvil block mounted in the lower part of said frame, wing extensions on said anvil block having a guide engagement with corresponding column members permitting vertical and preventing rotary movement of said anvil block relative to said frame, a nut fitting within said anvil block, a screw member engaging said nut for moving said anvil block towards and away from said ram, said screw member being supported in the base of said frame and arranged to transmit stresses on said anvil block to said frame, means for circulating a cooling fluid through said column members, and an electric motor drive for said screw member.

8. In apparatus of the character described, the combination of a frame having vertically arranged hollow column members, an eccentric drive shaft mounted in the upper part of said frame, a reciprocable ram, a connecting rod connecting said drive shaft and ram, a hollow cylindrical anvil block mounted in the lower part of said frame, wing extensions on said anvil block having a guide engagement with said column members permitting vertical and preventing rotary movement of said anvil block relative to said frame, a screw member fitting within said anvil block for moving said anvil block towards and away from said ram, said screw member being supported in the base of said frame and arranged to transmit stresses on said anvil block to said frame, means for circulating a cooling fluid through said column members, power cut-off means mounted on said frame and controlling the operation of said ram and anvil block, and means mounted on said anvil block for actuating said power cut-off means when said anvil block reaches a predetermined elevation.

9. In a power press, a frame, a hollow cylindrical anvil block vertically movable in the lower part of said frame, a reciprocable ram vertically movable in the upper part of said frame, means for moving said ram through a set stroke toward and away from said anvil block to effect intermittent working engagement with a member being worked on, and means for vertically moving said anvil block comprising an internally threaded sleeve member fixed within said anvil block, an externally threaded elevating screw arranged coaxially within said anvil block and in threaded engagement with said sleeve member, means for transmitting the working stresses on said anvil block and screw to said frame, a reversible elec-

tric motor, and drive mechanism operatively connecting said motor and screw.

10. In a power press, a frame, an anvil block vertically movable in the lower part of said frame, a reciprocable ram vertically movable in the upper part of said frame, means for moving said ram through a set stroke toward and away from said anvil block to effect intermittent working engagement with a member being worked on, and means for vertically moving said anvil block comprising an externally threaded elevating screw engaging said anvil block, an electric motor, drive mechanism operatively connecting said motor and screw, a limit switch adapted to stop said motor, and means on said anvil block for actuating said limit switch when said anvil block is elevated to a predetermined point.

11. In a power press, a frame, an anvil block vertically movable in the lower part of said frame, a reciprocable ram vertically movable in the upper part of said frame, an electric motor for moving said ram through a set stroke toward and away from said anvil block to effect intermittent working engagement with a member being worked on, and means for vertically moving said anvil block comprising an externally threaded elevating screw engaging said anvil block, a second electric motor, drive mechanism operatively connecting said last mentioned motor and screw, a limit switch adapted to simultaneously stop said motors, and means on said anvil block for actuating said limit switch when said anvil block is elevated to a predetermined point.

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