

July 29, 1941.

L. R. WILLIAMSON

2,250,882

PRESS

Filed April 20, 1933

2 Sheets-Sheet 1

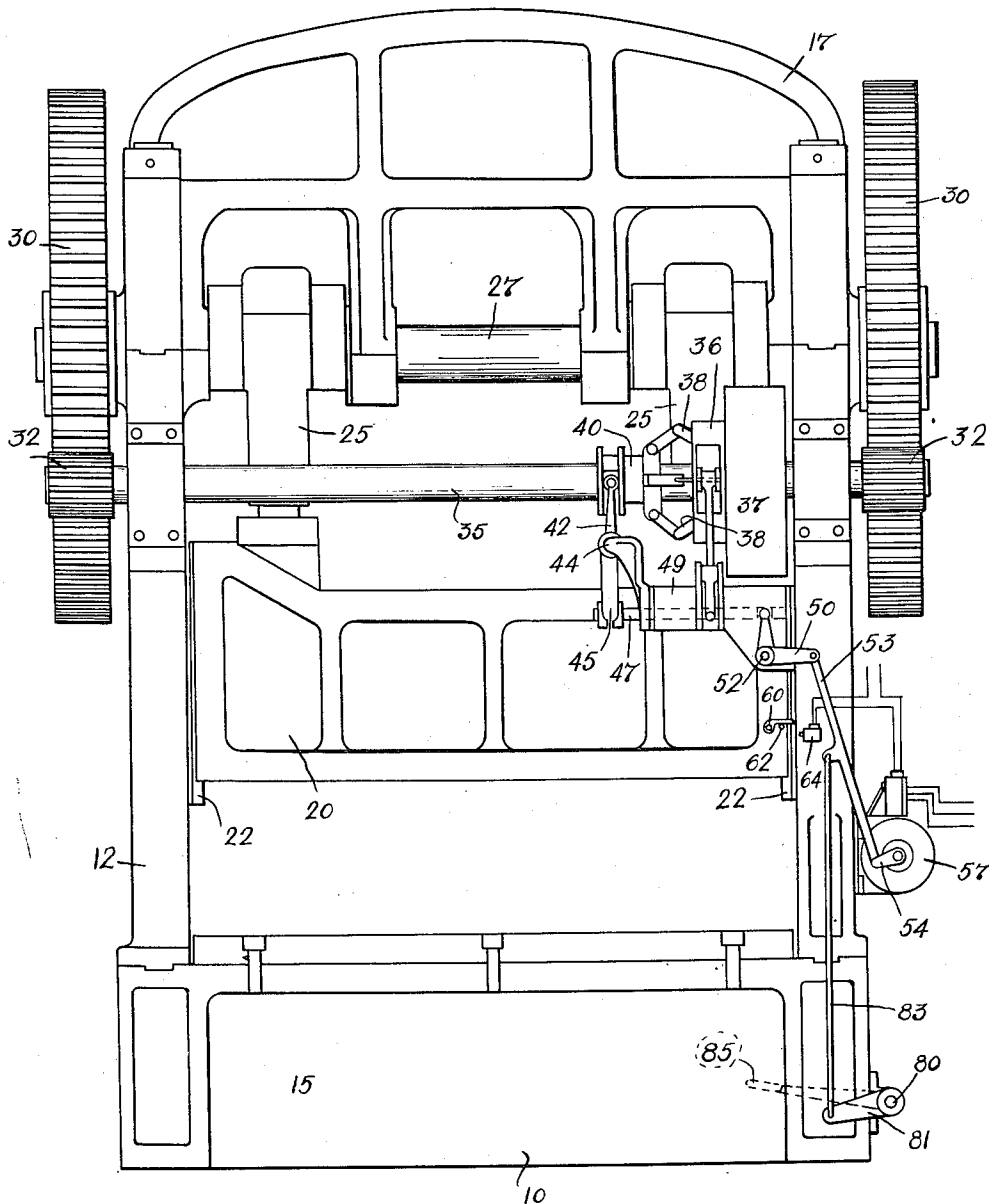


Fig. 1

INVENTOR.
Larkin R. Williamson
BY
Ray, Oberlin & Ray
ATTORNEYS.

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2 Sheets-Sheet 2

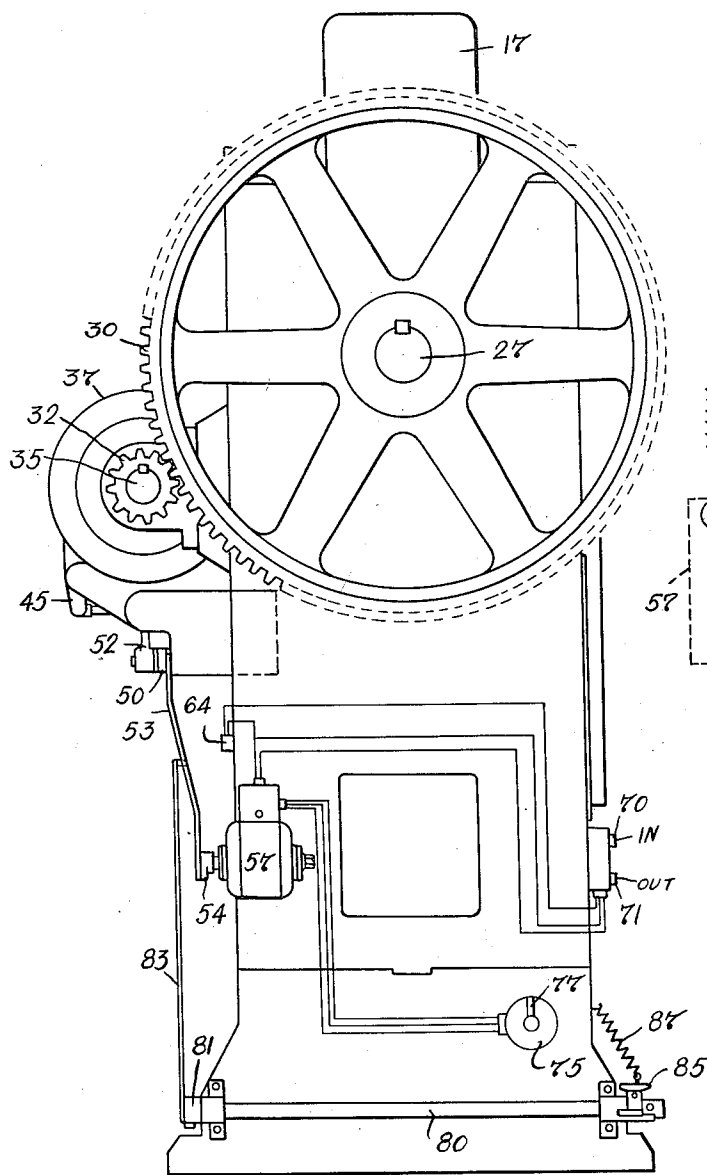


Fig. 2

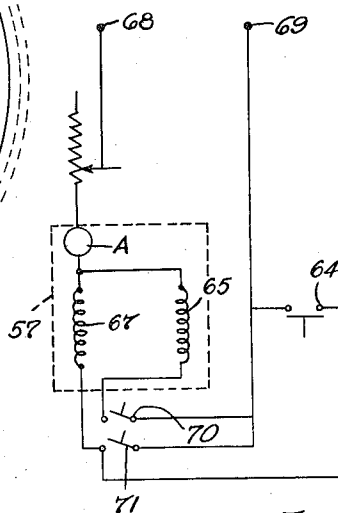


Fig. 3

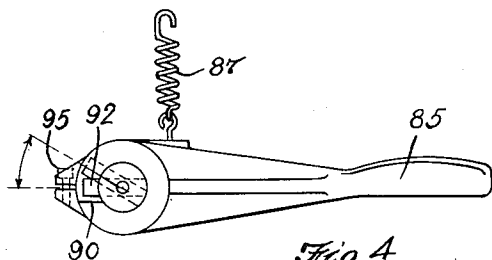


Fig. 4

BY

INVENTOR.
Larkin R. Williamson
Ray, Oberlin & Gray
ATTORNEYS,

UNITED STATES PATENT OFFICE

2,250,882

PRESS

Larkin R. Williamson, Cincinnati, Ohio, assignor
to E. W. Bliss Company, Brooklyn, N. Y., a corporation of Delaware

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3 Claims. (Cl. 192—84)

This invention relates to press mechanism and is more particularly directed to novel mechanism in connection with metal working presses for actuating and controlling the reciprocating die slide.

Metal working machines, including a pair of dies, one of which is carried by a reciprocating slide or head are subject to certain operating difficulties necessitating the provision of means for positive control. For instance, modern presses operate at a comparatively high speed and each operating cycle includes starting and stopping movement of the slide which should be accomplished as smoothly as possible.

Presses, of types heretofore built, have frequently been subject to violent shock at the instant of starting due to the conflicting inertia effects of the stationary slide and the rotating flywheel. This shock was correspondingly increased as production requirements necessitated the speeding up of presses.

The operation of inching the slide during adjustment of the dies must be closely controlled. Since this operation is frequently performed at a time when the dies are out of alignment it is very desirable that as little driving force as possible be applied to the slide to prevent transmissal of a destructive load thereto.

It has been the object of my invention to devise a press which incorporates fine control of the press mechanism and materially reduces the shock of starting when the press is operated at present day speeds. Another object of the invention has been to accurately control the application of power to the press to engage the clutch parts during an interval which allows some time for acceleration of the slide parts before the clutch is fully engaged. Still another object has been to control the amplitude of the driving force during inching to prevent die breakage. An additional object has been to provide mechanism to automatically stop the die slide at the termination of each stroke.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical means in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a side elevation of my improved press;

Fig. 2 is an end elevation thereof;

Fig. 3 is a schematic wiring diagram showing the electrical connections for the controls; and

Fig. 4 is a detail of the manual safety throw-out lever.

In general, my improved press includes, among other features, a reciprocable die slide, power to drive the slide, clutch mechanism between the slide and power source and an electric motor to actuate the clutch.

This combination includes a motor which has novel characteristics rendering it very valuable in conjunction with the other elements of the press. I call this a torque motor because of its peculiar operating characteristics. When connected to a press it will commence rotation and continue until it assumes the load the press subjects it to at which time the motor will stall. The motor will remain stalled under the load; its electrical characteristics being such that the load is maintained and applied as long as the motor is connected to the power source. The time period for which the load may be sustained is governed by the resistance of the motor to the heating effect due to the stalling overload. This period is greatly in excess of the duration of the press operating cycle however.

The motor is connected to the press clutch and engages and disengages the same. Rotation in one direction engages the clutch and reversal releases the clutch to stop the press. The motor is controlled through a circuit which permits the operator to start and stop it instantly.

This feature of instantaneous starting and stopping is relied on to vary the drive force applied to the slide. The motor actuates linkage and this in turn acts to control the clutch which is of the ordinary disc type engaged by axial movement of the pressure plate. The amount of slippage between the clutch plates is governed by the force applied to the pressure plate by the torque motor. Thus for inching, the motor engages the clutch plates only enough to drive the slide until resistance is encountered, at which time the plates slip and the press drive becomes ineffective and the slide stalls.

The same elastic engagement of the clutch by the motor which avoids damage during inching also permits absorption of the shock of engagement due to the static and kinetic inertia effects of the slide and flywheel respectively.

The degree of precision by which the motor and hence the clutch can be controlled permits accurate and close control of the slide especially

desirable during the aforesaid inching. In a press such as I have invented the slide may be moved exactly to a desired point and stopped and held there, thus facilitating adjustment of the dies and the like.

Referring now to the drawings, the main frame of the press is designated at 10, which in the present instance is an upright frame having vertical side members 12 resting on a base 15 and supporting a crown 17. A head or ram 20 is slidably supported for reciprocation in guide rails 22 on the side frame members 12. The ram is reciprocated by a pair of cranks 25 secured to a crankshaft. A bull gear 30 is carried at each end of the crankshaft and meshes with a pinion 32 secured to a supplemental shaft 35.

Rotative power is supplied to the supplemental shaft 35 from a suitable motor (not shown) carried by the crown and connected thereto through belting passing over the pulley 37. The pulley wheel normally acts as a flywheel and is continuously driven by the motor. When the press is to be operated the rotating flywheel is connected through a clutch to the shaft 35, which then rotates to drive the press.

A series of toggle arms 38 are employed to actuate the clutch, indicated at 36, which is preferably of the friction type and which is engaged and disengaged by straightening or flexing the toggles. For actuating the toggles they are connected at one end to a collar 40 which is slidable on the shaft 35. An annular yoke-receiving recess is formed in the collar and accommodates the forked member 42, which in turn is pivotally carried by the frame at 44 adjacent the yoke mid-region. The depending end of the yoke is pivotally connected at 45 to a shift bar 47 slidably journaled in the frame extension 49 to reciprocate crosswise of the press.

The bar 47 is shiftably engaged by one arm of a bell crank 50 pivoted to the main frame at 52. The other arm of the crank is connected to a rigid link 53, the lower end of which in turn is pivotally secured to an arm 54 rotatably driven by the shaft of the electric motor.

This motor, designated at 57, is the above described torque motor and as such may be driven to pick up full load and then cease rotation and maintain the load without slipping back. It is also of the reversible over-load type and is so wound and insulated as to be capable of being maintained under the influence of the electric current while stalled for a period sufficient to operate the press through a cycle. After the press has completed the cycle, the load is removed from the motor and the press stopped.

The press is stopped by the finger mechanism shown in Fig. 1 mounted on the side of the head and cooperating with a switch carried by the frame. This mechanism comprises a pivot finger 60 carried by the head 20 and normally resting on a pin 62 and is thus prevented from rocking downwardly beyond the pin. A switch 64 connected in the motor operating circuit is mounted on the frame in position to be engaged by the said arm. As the head descends, the arm 60, coming in contact with the switch 64 and since the former is free to pivot, it merely raises and passes by the switch without actuating the same. On the up-stroke, however, the arm 60 is prevented by the pin 62 from downward movement when it contacts with the switch 64. Thus the arm throws the switch only in passing upwardly and stops the press by reversing the motor 57,

which, upon reversing, disengages the clutch as hereinafter more fully appears.

The wiring diagram to control the aforesaid operation of the motor 57 is indicated in Fig. 3. As seen in this figure there is provided an armature A, a forward driving motor winding 65 and a reverse motor winding 67. These windings are alternately connected across the line 68—69 by a pair of manually operated switches 70 and 71, also shown in Fig. 2. The wiring diagram also includes the switch 64, actuated by upward movement of the press head and the closing of which short circuits current from 69 to 68 through the motor reverse winding 67.

The press is operated as follows, reference being had to the wiring diagram just described. The switch 70 is thrown in and connects lines 69 and 68 through the forward winding of the motor. This causes the motor to rotate in a clockwise direction, as shown in Fig. 1, and through link 53 shifts the bell crank 50 and thence the bar 47. This motion rocks the yoke 42 about its pivot 44 to move the collar 40 to the right and act through the toggles 38 to engage the clutch and drive the press. The head 20 then is moved downwardly along the guide rails 22 to the end of its stroke without actuating the switch 64 and then is retracted upwardly by the crank 27. On the upward stroke the arm 60 throws the switch 64 into the circuit and stops the press.

When the switch 64 is closed, the current is shorted from the terminal 69 to the terminal 68 through the reverse winding 67, (Fig. 3). As a consequence the motor 57 rotates in a counterclockwise direction to act through the aforementioned linkage and disengage the clutch and break the drive between the shaft 35 and the pulley wheel 37.

The switch 71 is provided (Figs. 2 and 3) as an auxiliary stopping means if the operator cares to stall the machine before the automatic throw-out switch has acted. In this instance the current is again shorted from the terminal 69 to 68 through the reverse winding and the clutch thrown out to stop the press. Each of the switches 64, 70, and 71 is of the type, which, when actuated, alternately makes and breaks a circuit and the switch controlling element or push button returns to its original position after each actuation.

In "inching" the head during the adjustment it is desirable to limit the clutch engaging force of the torque motor and thus decrease the resistance necessary to slip the clutch. To accomplish this a rheostat 75 is provided, which is adjustable by rotation of the arm 77 to vary the motor input, and hence the torque developed. Thus, if the torque developed is low and during "inching" the two die faces improperly register the clutch will slip independently of further movement of the torque motor due to the low force applied by collar 40.

It is desirable to provide a mechanical safety stop which may be operated independently of the electrical circuits to stop the press if the current supply to the torque motor fails. To this end, a rock shaft 81 is carried on the lower portion of the base and at one end is connected through a rock arm and a link 83 to the link 52 actuating the clutch. To the other end of the shaft is secured a foot pedal mechanism which is conveniently positioned adjacent the operating die opening of the press and the electric switches.

This mechanism is best shown in Fig. 4 and comprises a foot pedal 85 idly carried on the shaft

80 and normally retained in an upward position by the spring 87 connected to the base. The foot pedal includes a shoulder 90 formed thereon and adapted to register with a pin 92 fixedly carried by the rock shaft 80. As shown in solid lines in Fig. 4, when the press is operating the link 83 moves the shaft and pin 92 to the position there shown. At this time, if the foot pedal 85 is stepped on the shoulder 90 forces the pin 92 in a clockwise direction and shifts the link 83 to stop the press. The foot pedal 85 is aligned on the rock shaft 80 by the bolt and shoulder construction indicated at 95.

From the foregoing description it will be seen that I have provided a new and improved press adapted to be readily controlled and which includes novel safety features as well as extreme simplicity of operation. The press further may be electrically controlled and is positive in action. It may be so adjusted that a predetermined load between the bed and the head will stall the press without harm to the parts. Furthermore, the press automatically stops itself at the end of each cycle.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a metal working press of the type comprising a reciprocable die head, a shaft, means connecting the shaft to the die head to reciprocate the same, power means and a clutch between the power means and said shaft; means for controlling the clutch comprising a reversible motor operative to assume and stall under a load, clutch

actuating connections between said motor and clutch, a source of power for actuating said connections to engage the clutch by rotation of said motor, and means responsive to reciprocation of said die head for reversing said motor for actuating said connections to disengage the clutch.

2. In a metal working press of the type comprising a reciprocable die head, a shaft, means connecting the shaft to the die head to reciprocate the same, power means and a clutch between the power means and said shaft; means for controlling the clutch comprising a reversible torque motor operative to assume and stall under a load and maintain said load while stalled, clutch actuating connections between said motor and clutch, a source of power for actuating said connections to engage the clutch by rotation of said torque motor, and means operable in response to the upward movement of said head for reversing said torque motor for actuating said connections to disengage the clutch once during each operating cycle of said head.

3. In a metal working press of the type comprising a reciprocable die head, a shaft, means connecting the shaft to the die head to reciprocate the same, power means and a clutch between the power means and said shaft; means for controlling said clutch comprising a reversible torque motor operative to assume and stall under a load and maintain said load while stalled, clutch actuating linkage between said motor and clutch, a source of power for actuating said torque motor to actuate said linkage and engage the clutch, a switch connecting said power source with said motor, and means operative after each cycle of movement of said head to actuate said switch and reverse said motor to disengage said clutch.

LARKIN R. WILLIAMSON.