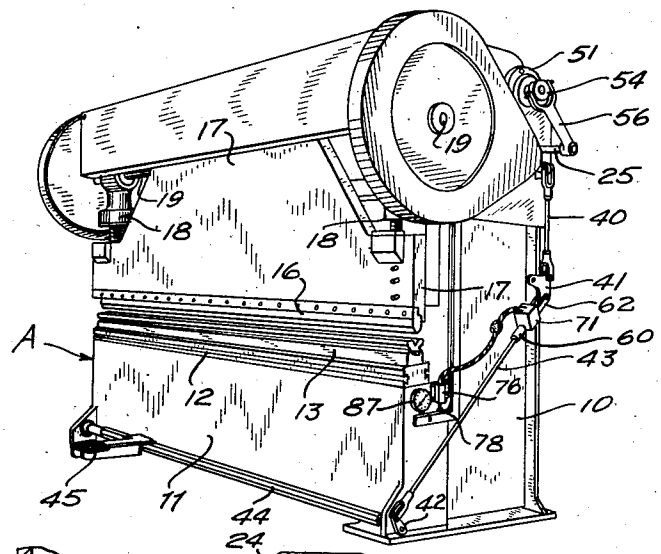
Nov. 7, 1944. C. J. BATH 2,362,343

CONTROL MECHANISM FOR PRESS BRAKES OR SIMILAR MACHINES

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Fig. 1.



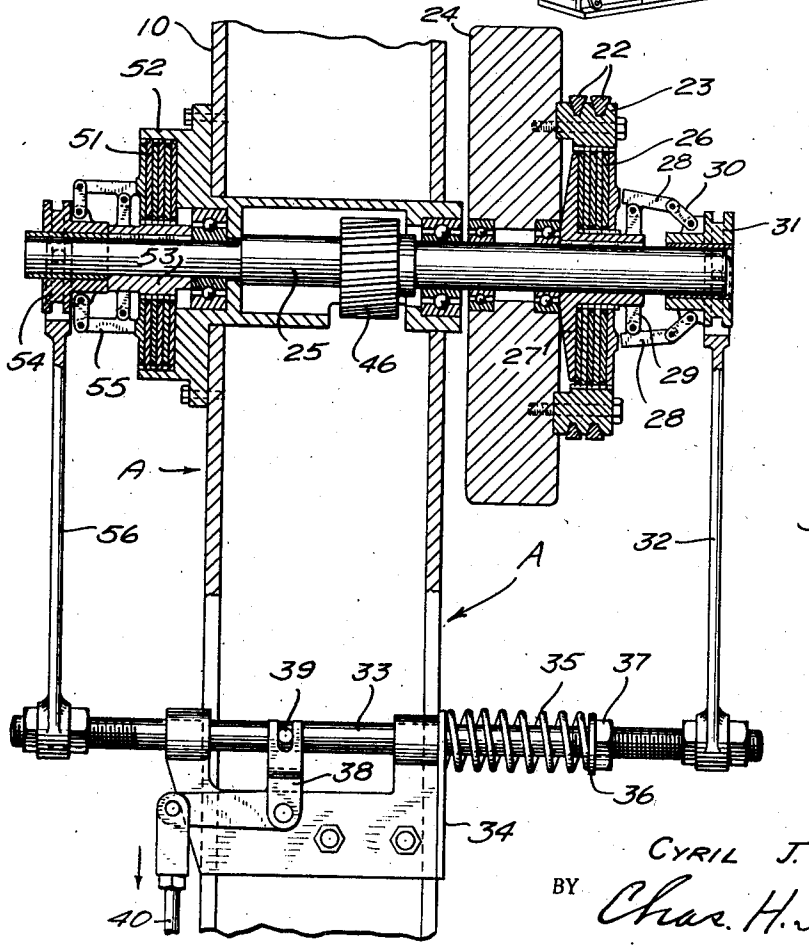


Fig. 3.

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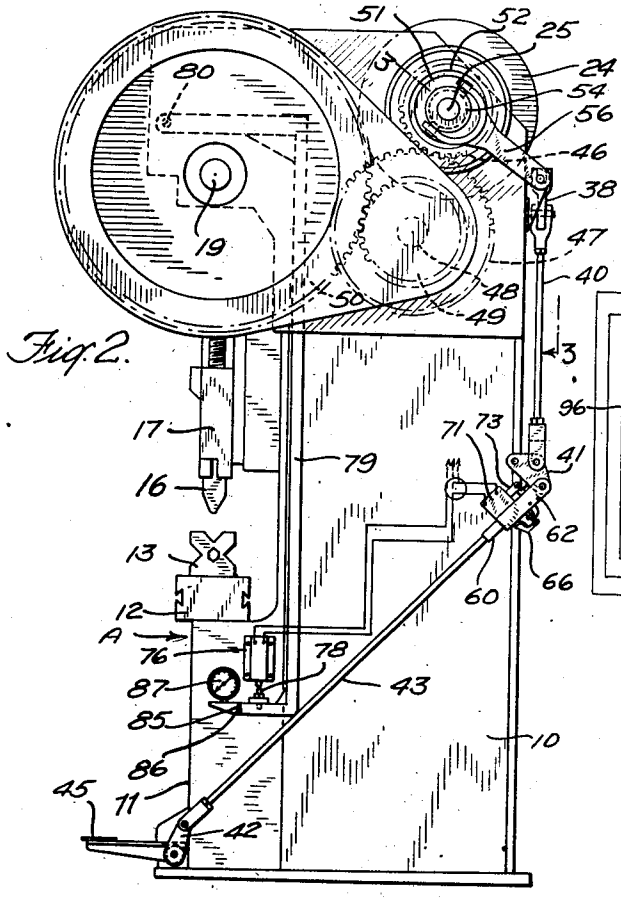


Fig. 2.

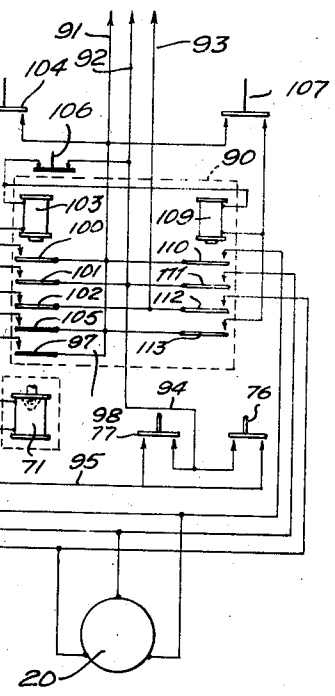


Fig. 5.

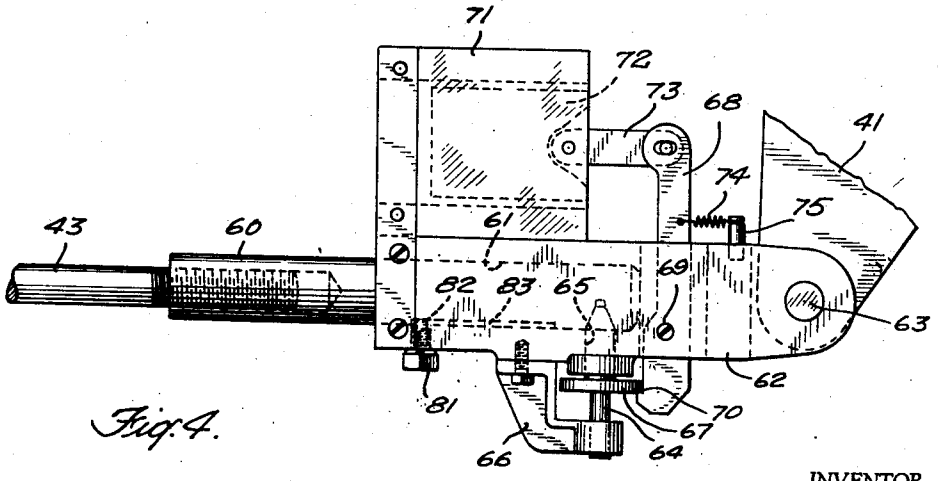


Fig. 4.

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UNITED STATES PATENT OFFICE

2,362,343

CONTROL MECHANISM FOR PRESS BRAKES OR SIMILAR MACHINES

Cyril J. Bath, Hudson, Ohio

Application February 6, 1942, Serial No. 429,785

9 Claims. (Cl. 192—150)

This invention relates generally to control mechanisms for press brakes or similar machines having a die carrying slide or ram which is reciprocated towards and away from a stationary die support or bed.

In machines of this character a blank is shaped between two cooperating dies, one of which is secured to the stationary die support or bed and the other of which is carried by the reciprocating slide or ram. When a blank is being shaped between the dies, as the movable die approaches the stationary die, the frame of the machine is stretched. The amount the frame is stretched is dependent upon the nature of the work being done, the setting of the dies, and the thickness of the blank. If the frame is stretched beyond a certain point it will be injured or broken. As most machines of this character are capable of exerting a force sufficient to injure or break the frame or other parts of the machine, extreme care must be taken in selecting the work for the machine and in setting and adjusting the dies, so the machine will not be overloaded. It has been found by experience that even though great care is exercised in operating machines of this character they are frequently injured or broken. This is caused by various different conditions of operation. The dies may get out of adjustment or a thicker blank than that for which the dies are set may be encountered or something may accidentally, and unknown to the operator, get between the dies. Machines have been broken when a new set of dies are being installed and adjusted.

In order to eliminate any possibility of injuring the machine due to overload I have incorporated into my control mechanism a safety device for automatically stopping the operation of the machine when a certain predetermined load is reached. This safety device utilizes the inherent stretching of the frame and operates to throw out the clutch and disconnect the drive from the slide or ram, when the frame has been stretched a predetermined amount. This safety device functions only when the motor is running in one direction, as I have also provided means for rendering it ineffective to disengage the clutch when the motor is running in the reverse direction. This makes it possible to reverse the motor and back the ram away from the work after the machine has been stopped due to an overload.

The construction of my control mechanism is such that it can be easily and cheaply manufactured and yet is very efficient and reliable in operation and can be readily applied to machines now in use without requiring extensive changes thereto.

In the following specification and the drawings forming a part thereof I have illustrated and described one embodiment of my invention as applied to a press brake of well known standard construction.

In the drawings:

Fig. 1 is a perspective view of a press brake having my invention applied thereto;

Fig. 2 is an end elevation, on a somewhat larger scale, of the right-hand end of the press brake shown in Fig. 1;

Fig. 3 is a section through the flywheel, clutch and brake, taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged detail side elevation of that part of my control mechanism which disconnects the foot treadle from the rest of the clutch operating mechanism when the press brake has been subjected to an overload; and

Fig. 5 is a wiring diagram showing the various electrical circuits forming a part of my control mechanism.

Referring to the drawings by reference characters, A indicates generally a standard press brake having a frame made up of steel plate suitably welded together. The frame consists of a pair of spaced uprights 10, the lower ends of which are connected together by a front plate 11, which has a die support 12 welded or otherwise suitably secured to the upper edge thereof. The upper surface of the die plate 12 forms the supporting surface or abutment for the lower stationary die or punch 13, as the case may be. The upper movable die or punch 16 is connected to the lower end of a slide or ram 17 slidably supported above the die plate 12 and adapted to be reciprocated toward and from the same by a suitable crank mechanism. The mechanism shown for reciprocating the ram 17 comprises adjustable pitmans 18 connected to the ram 17 and to suitable cranks on crank-shafts 19 rotatably supported in the frame A. The crank-shafts 19 are adapted to be rotated or driven by a three-phase alternating current electric motor 20 of conventional construction housed within the frame A and operatively connected by a flexible drive connection 22 to a pulley 23 bolted to a flywheel 24 rotatably supported on a short shaft 25, which shaft is in turn rotatably supported in the frame A, see Fig. 3. The pulley 23 and, in turn, the flywheel 24 and the drive wheel are adapted to be operatively connected to and disconnected from the shaft 25 by the friction disk

clutch 26, alternate disks of which are keyed to the inside of the pulley 23 and to a member 27 keyed to the shaft 25.

The disks of the clutch 26 are adapted to be clamped together by bell-crank levers 28 pivotally connected to bosses 29 formed integral with the member 27. One end of each of the levers 28 is adapted to engage the outer disk of the clutch 26, as viewed in Fig. 3, while the opposite ends thereof are connected by links 30 to a member 31 slidably supported on the shaft 25 and adapted to be moved therealong by a forked member 32 adjustably fixed to one end of a rod 33 slidably but non-rotatably carried by a bracket 34 bolted to the frame A. The rod 33 is continuously urged towards the right as viewed in Fig. 3 by a compression spring 35 interposed between the right-hand side of the bracket 34 and a washer 36 held in position on the rod 33 by a nut 37 which also provides means for adjusting the tension of the spring 35. The rod 33 is adapted to be moved towards the left, as viewed in Fig. 3 against the action of the spring 35 to engage the clutch 26 by a bell-crank lever 38 pivotally connected to the bracket 34. One arm of the lever is forked and engages a pin 39 fixed in the rod 33. The other arm of the bell-crank lever 38 is operatively connected by an adjustable link 40 to a lever 41 pivoted on the frame A. The lever 41 is in turn connected to a lever 42 by a link 43. The lever 42 is fixed to one end of a shaft 44 rotatably supported in the frame A and extending across the front of the machine. The shaft 44 is hexagonal or irregular in shape and carries a treadle 45 which is slidable thereon. This construction allows the treadle 45 to be located at the most convenient place, depending upon the particular work being performed by the machine at any given time. If desired, provision can be made for disengaging the clutch 26 upon each rotation of the crank-shafts 19.

The shaft 25 is operatively connected to the crank shafts 19 by a pinion 46 keyed to the shaft 25 and continuously in mesh with a gear 47 keyed to a shaft 48 extending the length of the machine. The shaft 48 is in turn connected to the crank-shafts 19 by pinions 49 fixed to the shaft 48 and gears 50 fixed to the crank-shafts 19. When the treadle 45 is depressed by the operator, the rod 33 is shifted to the left as viewed in Fig. 3 and the clutch 26 engaged. The ram 17 is thereupon reciprocated. When the treadle 45 is released, the rod 33 moves toward the right as viewed in Fig. 3 under the action of the spring 35, disengaging the clutch 26. Simultaneously with the disengagement of the clutch 26, a friction disk brake 51 applied to the shaft 25 is engaged so as to rapidly bring the ram 17 to a stop. This brake is somewhat similar in construction to the clutch 26 and consists of a plurality of disks, alternate ones of which are keyed to a member 52 bolted to the frame A and to a member 53 keyed to the shaft 25. The disks are clamped and released by a slidable member 54 and toggle mechanism 55 similar to that employed to actuate the clutch 26. The member 54 is operatively connected to the left-hand end of the rod 33 by a forked member 56, similar to the member 32, and adjustably connected to the rod 33.

From the foregoing it will be apparent that the clutch 26 will be held engaged against the action of the spring 35 and the ram 17 reciprocated as long as the treadle 45 is depressed by the operator; and that the clutch 26 will be disengaged and the brake 51 applied by the spring 35 when the operator releases the treadle 45, which will stop the movement of the ram.

In order to prevent injury to the press due to an overload I provide a safety device for automatically disconnecting the treadle 45 from the rod 33 when a predetermined force is exerted by the ram. As previously stated this safety device utilizes the stretching of the frame which is inherent in all machines of this type.

As shown in Fig. 4 the upper end of the link 43 includes a cylindrical member 60 slidably supported in a bore 61 in a member 62 which in turn is pivotally connected to the lever 41 by a pin 63. The members 60 and 62 are normally held in fixed relationship with respect to each other by a transversely extending pin or rod 64 which has one end slidably supported in a transverse bore 65 in the member 62 which opens into the bore 61. The other end of the rod 64 is slidably supported in a bore formed in a bracket 66 which is bolted to the member 60. The inner end of the rod or pin 64 is cone or wedge-shaped and normally engages in a cone or wedge-shaped notch in the member 60. The pin or rod 64 has an enlarged disc 67 formed integral therewith about midway between its ends through the medium of which the cone or wedge-shaped end of the rod is held in the notch in the member 60 by a lever 68 pivotally connected to the member 62 by a screw 69. The lower end of the lever 68 as viewed in Fig. 3 is provided with a latch 70 that normally engages behind the enlarged disc 67 of the pin or rod 64 and maintains the same in its normal position. The lever 68 is adapted to be rotated in a counterclockwise direction about its pivot 69, to release the pin or rod member 64, by a solenoid 71, the armature 72 of which is operatively connected to the upper end of the lever 68 by a link 73. A small spring 74 is connected to the lever 68 and a pin 75 fixed to the member 62 continuously urges the lever 68 in a direction to engage the latch 70 behind the enlarged disc 67 on the pin or rod 64.

Energization of the solenoid 71 is controlled by micro switches 76 and 77 operatively connected in a parallel circuit with each other and in a series circuit with the solenoid 71. The micro switches 76 and 77 are normally open switches and are located at opposite ends of the machine. Both switches are alike and are operated in the same manner so only the one visible in the drawings will be described in detail. The contacts of the micro switch 76 located on the right-hand end of the machine are normally open but are adapted to be closed by an adjustable abutment 78 fixed to the lower end of a U-shaped member 79 the upper end of which is connected to a pin 80 fixed to the frame A above the crank shafts 19. The U-shaped member 79 spans the throat of the end members or side frames of the press brake in such a manner that when the press is subjected to overload and the side frames or end plates 10 are stretched, the abutment member 78 is raised with the result that when the overload reaches a predetermined amount the contacts of the micro switch 76 are closed, the solenoid 71 energized, and the latch 68 moved away from the enlarged disc 67 of the pin or rod member 64, with the result that the pin or rod 64 is free to move and release the member 60, or in other words, disconnect the members 60 and 62. A bolt 81 provided with a cylindrical inner end 82 which engages within a slot 83 in the member 60 allows the parts 60 and 62 to move apart a suf-

ficient distance to release the clutch 26 while maintaining the same in assembled relationship.

The lower end of the U-shaped member 79 is held in position by a pin 85, carried by the end plate 10, which projects through an elongated aperture 86 in the member 79. This construction holds the member 79 in position without interfering with its operation. If desired, a micrometer dial gauge 87 graduated either in thousandths of an inch or in tons stress applied by the ram may be fixed to the end plate 10 in such a manner that its operating plunger engages either the upper surface of the lower end of the member 79 or an adjustable abutment member connected thereto. A device of this character calibrated in tons stress applied by the ram is very helpful in adjusting the overload at which the micrometer switch or switches are actuated to release the driving clutch 26. The micro switch 77 is located at the opposite end of the press and is operated in a similar manner. The construction is such that the clutch 26 will be disconnected in the event either of the end members or frames of the machine is subjected to strain beyond a predetermined safe amount.

Power for operating the solenoid 71 is obtained from the motor control panel 90 in such a manner that the solenoid 71 will be energized upon closing of either of the micro switches 76 and 77 only in the event that the drive motor 20 is connected to the power lines 91, 92 and 93 in a manner to rotate in the forward direction. This allows the motor to be reversed and the ram backed off the work in the event that the machine is stopped due to overload, without the use of supplemental means for rendering the safety feature inoperative.

Reference to the wiring diagram, Fig. 5, will show that the electric circuit for the solenoid 71 is from the power line 92 through the line 94, normally open contacts of one or the other or both of the micro switches 76 and 77, line 95, solenoid 71, line 96, contact bar 97 of motor control panel 90 and wire 98 to line 91. The contact bar 97 is operated simultaneously with the contact bars 100, 101 and 102 which connect the drive motor with the power lines in such a manner that the motor rotates in a forward direction upon energization of the operating solenoid 103, which solenoid is adapted to be energized by a normally open push button switch 104 located at some convenient point on the machine. When the solenoid 103 is energized, a holding circuit is established by the closing of contact bar 105 which maintains the solenoid energized after the push button switch 104 is released. A normally closed stop push button switch 106 provides means for stopping the motor 20 at any time.

The drive motor can be rotated in the opposite direction by closing a normally open reverse push button switch 107 which when closed energizes a solenoid 109 which in turn actuates the contact bars 110, 111, 112 and 113, the first three of which connect the motor 20 to the power lines in such a manner that it rotates in the reverse direction while the latter establishes a holding circuit for maintaining the solenoid 109 energized after the push button switch 107 is released. It will be observed that when the motor is operated in the reverse direction the circuit to the solenoid 71 is opened at the contact bar 97 irrespective of whether the contacts of the micro switches 76 and 77 are opened or closed.

From the foregoing description of the preferred embodiment of the invention, it will be apparent that the objects heretofore enumerated and others have been accomplished and that there has been provided a novel and improved control mechanism for crank-operated machines such as press brakes and the like, which is inexpensive in construction, reliable in operation and which can be readily applied to existing commercial machines without requiring any extensive changes therein, and that there has also been provided a novel and improved means which will prevent injury to the machine due to overload while permitting the punch or die to be readily backed off the work by the motor in the event the press brake or machine is stopped because of overload.

It will be understood that although I have illustrated and described my invention in connection with a press brake, it can also be applied to various other types of machines of this general character; and that various modifications can be made in the construction of my control mechanism as illustrated and described herein without departing from the scope of the invention as pointed out in the following claims.

Having thus described my invention, what I claim is:

1. A control mechanism for a press brake having a frame and a ram which is driven through a clutch, said control mechanism comprising manually operable means for holding said clutch in driving engagement, and means associated with said frame and said first mentioned means and operable to render said first mentioned means ineffective to hold said clutch in driving engagement when the frame has been stretched beyond a predetermined point.

2. A control mechanism for a press brake having a frame and a ram which is driven by a reversible motor through a clutch, said control mechanism comprising manually operable means for holding said clutch in driving engagement, means associated with said manually operable means and said frame and operable to render said manually operable means ineffective to hold said clutch in driving engagement after said frame has been stretched beyond a predetermined point with the motor running in one direction, and means operable to render said second mentioned means inoperative when the motor is rendered effective to run in the reverse direction.

3. A control mechanism for a press brake having a frame and a ram which is driven by a reversible motor through a clutch, said control mechanism comprising manually operated means for holding said clutch in driving engagement, means associated with said frame and said manually operable means and operable by the stretching of the frame beyond a predetermined point when the motor is running in one direction to disengage said manually operable means from said clutch, and means operable to render said last mentioned means inoperative when the motor is rendered effective to run in the reverse direction.

4. A control mechanism for a press brake having a frame and a ram which is driven by a reversible motor through a clutch, said control mechanism comprising manually operated means for holding said clutch in driving engagement, electrically operated means for disengaging said manually operated means from said clutch, means operated by the stretching of the frame beyond a predetermined point when the motor is running in one direction for rendering said electrically operated means operative to disengage said

manually operated means from said clutch, and means for rendering said last mentioned means ineffective when the motor is rendered effective to run in the reverse direction.

5. A control mechanism for a press brake having a frame and a ram which is driven by a reversible motor through a clutch, said control mechanism comprising manually operated means including two disengageable members for holding said clutch in driving engagement, a latch for locking said disengageable members together, electric means associated with said frame and said latch and operable by the stretching of the frame beyond a predetermined point to release said latch and disengage said disengageable members.

6. A control mechanism for a press brake having a ram which is driven through a clutch, said control mechanism comprising a spring for disengaging the clutch, mechanism for engaging the clutch against the action of the spring, said mechanism including an expansible link consisting of two telescoping members, interengaging means between said telescoping members for locking them together so that they will move in unison, and means operable to disengage said telescoping members so that they may move indepently of each other when the press brake exerts a pressure beyond a predetermined amount.

7. A control mechanism for a press brake having a frame and a ram which is driven through a clutch, said control mechanism comprising means for holding said clutch in engaged position, said means including two telescoping members, a latch carried by one of said members for locking said telescoping members together so that they will move in unison, means for disengaging said latch to render said mechanism inoperative to hold said clutch engaged when the press brake has been loaded beyond a predetermined amount, said last mentioned means comprising a solenoid carried by one of said telecoping members and operatively connected to said latch, a switch operable when closed to energize said solenoid, and means secured to said frame and operable to close said switch when the frame has stretched beyond a predetermined amount.

8. A control mechanism for a press brake having a frame and a ram which is driven by a reversible motor through a clutch, said control mechanism comprising means for holding said clutch in driving engagement, electrically operated means for rendering said clutch holding means ineffective to hold said clutch in driving engagement, means operated by the stretching of the frame beyond a predetermined point when the motor is running in one direction for rendering said electrically operated means operative to render said clutch holding means ineffective to hold said clutch in driving engagement, and means for rendering said last mentioned means ineffective when the motor is rendered effective to run in the reverse direction.

9. A control mechanism for a press brake having a frame and a ram which is driven through a clutch, said control mechanism comprising means for holding said clutch in engaged position, said means including two telescoping members, a latch carried by one of the said members for locking said telescoping members together so that they will move in unison, means for disengaging said latch to render said mechanism inoperative to hold said clutch in engaged position, said last mentioned means comprising a solenoid carried by one of said telescoping members and operatively connected to said latch, and automatic means for energizing said solenoid when the press brake has been loaded beyond a predetermined amount.

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