Aug. 30, 1932. D. B. REESE 1,874,804

AUTOMATIC STOP MECHANISM

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Fig. 1.

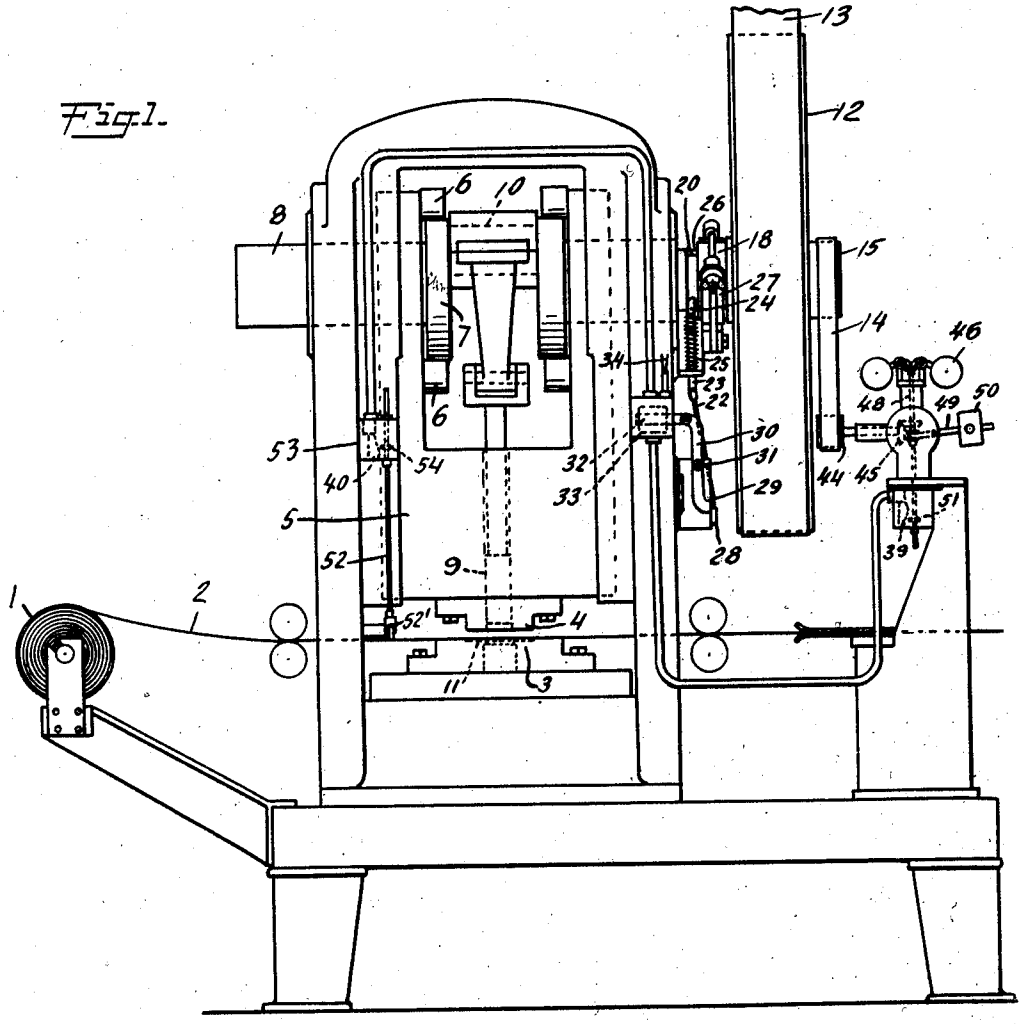


Fig. 2.

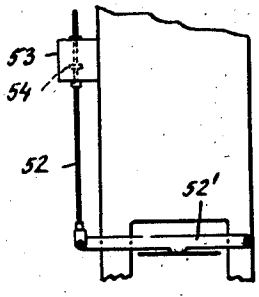


Fig. 3.

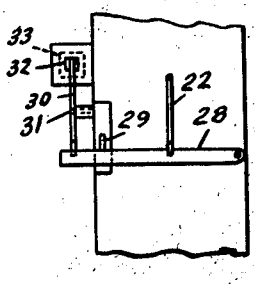
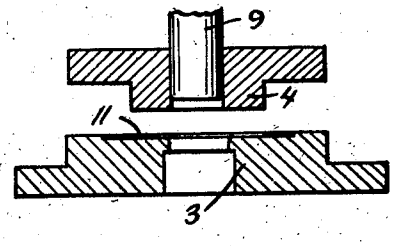


Fig. 4.



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Fig. 5.

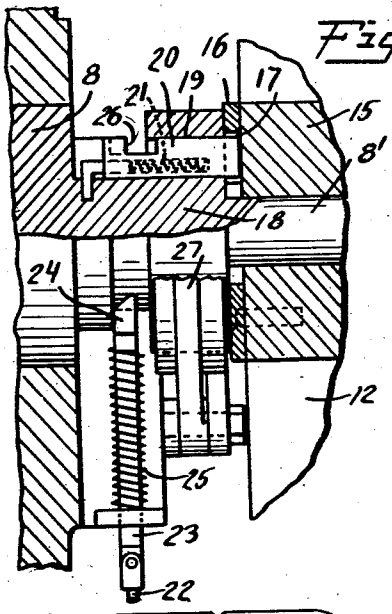


Fig. 6.

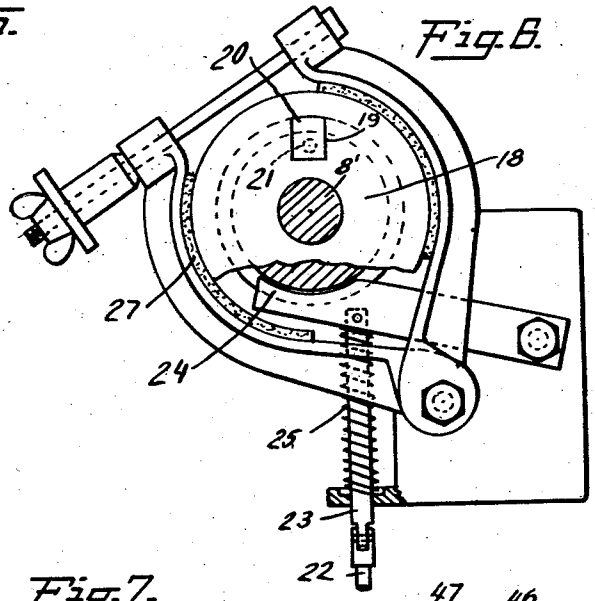


Fig. 7.

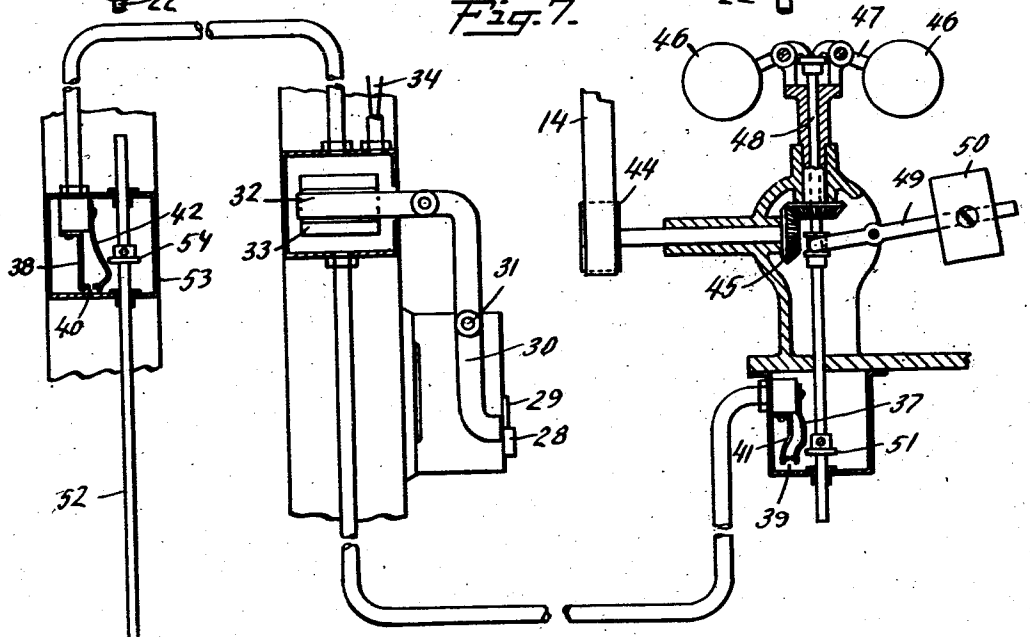
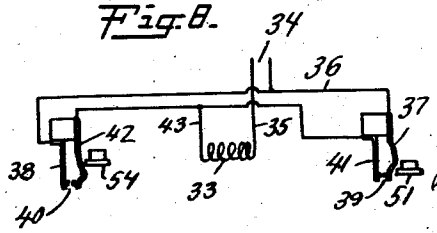


Fig. 8.



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UNITED STATES PATENT OFFICE

DAVID B. REESE, OF MADISON, WISCONSIN, ASSIGNOR TO BURGESS BATTERY COMPANY, OF MADISON, WISCONSIN, A CORPORATION OF WISCONSIN

AUTOMATIC STOP MECHANISM

Application filed October 16, 1929. Serial No. 400,057.

This invention relates to control devices for power operated automatic machinery, more particularly to that type of machinery to which power is transmitted from a prime mover or other source by means of a clutch. It is also applicable, however, to machines to which power is supplied by direct drive from a prime mover. In the operation of such machinery, circumstances occasionally arise where continued operation will result in damage or excessive wear to the machine, or, at least, a waste of power. It is desirable at such times that the machine be stopped as quickly as possible and my invention provides means for automatically stopping a power operated machine upon the occurrence of such predetermined conditions. The invention is illustrated in connection with an ordinary power driven press for stamping and shaping articles out of sheet metal but it is not limited to that class of machinery but may be used upon any mechanism where similar problems occur.

In the ordinary operation of a power press, it occasionally occurs, as will be explained hereinafter, that punched stock accumulates in the dies. The continued operation of the punch under such circumstances results in excessive wear upon the cutting surfaces and considerable damage may be done to the dies. If the press is driven from a line shaft by a powerful prime mover, failure of the press may occur. If it is individually driven by a motor, the latter may become stalled and burn out.

Upon exhaustion of the unpunched stock which is being fed to the press, further operation causes a useless consumption of power and results in unnecessary wear upon the cutting edges of the dies.

It is the general object of this invention to provide, in a power operated machine, means for automatically stopping the machine upon the occurrence of conditions such that further operation will result in damage or useless wear to the machine or if, for any other reason, continued operation is not desired.

More specifically, it is the object of this invention to provide an automatic stop mechanism for a power press which will operate upon accumulation of punched stock in the dies and upon exhaustion of the unpunched stock being fed to it.

Very briefly, the general principle upon which my invention operates is as follows. Accumulation of stock between the dies causes speed decrease of the press. A device is provided which is responsive to such speed decrease, and further mechanism is provided which operates to disengage the clutch between the press and its source of power selectively upon operation of the speed responsive device or upon exhaustion of unpunched stock.

The clutch disengaging mechanism comprises an electro-magnetically operated solenoid with its armature arranged to cause actuation of the clutch disengaging lever upon energization of the solenoid. The solenoid is connected in series with a source of electrical energy but between the two there are two normally open, parallel connected switches. Closure of either switch closes the circuit between the energy source and the solenoid. One switch is adapted to be closed upon operation of the speed responsive device and the other upon exhaustion of unpunched stock.

Due to the familiarity of those engaged in engineering and mechanical arts with the ordinary power press, only so much reference thereto as is necessary for a clear understanding of my invention, will be made in the following description and drawings wherein,

Fig. 1 is a general view of an ordinary double action cam press, equipped with the automatic stop mechanism which is the subject of my invention,

Fig. 2 is a detail view of a portion of the circuit controlling means actuated by the exhaustion of stock.

Fig. 3 is a similar view of the solenoid armature and clutch lever.

Fig. 4 is a detail view of the punch and die mechanism.

Fig. 5 is a front view of the power press clutch mechanism, parts being shown in section,

Fig. 6 is a side view of the clutch mechanism shown in Fig. 5.

Fig. 7 is a detailed diagrammatic view of my invention, and

Fig. 8 is a diagrammatic view of the solenoid energizing circuit.

Like numbers designate like parts in the several drawings.

Referring to Fig. 1, the unpunched sheet metal is supplied in rolls 1 which are supported upon a suitable supporting device from which the strip 2 is unrolled and fed automatically to the die 3. The strip 2 remains stationary during the stamping operation and advances the required distance between such operations. The strip feeding means may be of any conventional type and is, therefore, not disclosed. The stationary die 3 cooperates with reciprocating blanking punch 4 which stamps out a blank from strip 2. Blanking punch 4 is supported in slide 5, to which vertical reciprocal motion is transmitted by means of rollers 6, which in turn, are actuated by cams 7. Cams 7 are rigidly mounted upon crank shaft 8. Slide 5 and blanking punch 4 have central vertical openings within which drawing punch 9 (see Fig. 4) reciprocates vertically and independently of slide 5 and punch 4, motion being transmitted to drawing punch 9 by means of crank 10 which is also driven by crank shaft 8.

The blanking punch 4 moves slightly in advance of the drawing punch 9 in the conventional manner. Blanking punch 4 shears a blank from strip 2 and then stops its downward movement at such a point that it holds the blank upon shoulder 11 of die 3. Drawing punch 9 descends and draws the blank between itself and the constricted portion of die 3, this space being equal to the thickness of the sheet metal. The blank assumes a shallow cup shape. Suitable mechanism, not shown, is provided for stripping the shaped blank from drawing punch 9 during its upward movement.

It occasionally happens that drawing punch 9 shears through the blank, leaving a collar or annular ring of metal upon shoulder 11, part of which may extend downward into the constricted portion of die 3. Upon its next downward movement, blanking punch 4 encounters two thicknesses of metal upon shoulder 11 with the result that blanking punch 4 can reach the end of its stroke only by crushing the double thickness of metal into a single thickness. Drawing punch 9, likewise, finds a double thickness of metal between it and the walls of die 3 with the result that great resistance is offered to its motion. The increased resistance causes speed decrease of the press. If the press is not stopped immediately, the sheet metal continues to accumulate in the die and is chewed into a tangled mass. The shearing surfaces of the disc and punches become worn and damaged and failure of the press is possible.

The flywheel 12 is driven by a belt 13 which, in turn, is driven by a suitable source of power, not shown, such as a line shaft or a motor. The flywheel 12 revolves freely upon shaft 8′ which may be integral with crank shaft 8. The speed responsive device, which is represented by an ordinary fly ball engine governor, is driven by belt 14 which, in turn, is driven by the hub portion 15 of flywheel 12.

In order that the operation of the invention may be more readily understood, a detailed description of the clutch will be given. Referring to Figs. 5 and 6, the flywheel 12, as heretofore stated, revolves freely upon shaft 8′. On one side of hub 15 of flywheel 12 is hub-plate 16 in the face of which, removed from hub 15, there is a slot 17. The hub-plate may be omitted and a slot provided in the hub directly. The slotted hub or hub-plate constitutes the driving section of the clutch. The driven clutch section 18 is provided with a transverse slot 19 in which a key 20 is adapted to slide. This key is constantly urged toward the slot 17 in the hub-plate 16 by a spring 21. As shown in Fig. 5, key 20 and slot 17 are engaged when the clutch is in its normally engaged position. A rod 22 is connected, by means of link 23, to a wedge 24. Wedge 24 is urged upwardly into contact with clutch section 18 by a spring 25. As this clutch section revolves wedge 24 enters cut-out 26 in key 20 and the key is caused to slide back against the tension of spring 21. The key is thus withdrawn from the slot 17 in hub-plate 16 and the clutch sections are disengaged. Friction brake 27 is in constant engagement with driven clutch section 18 and is adjusted to stop the press in slightly less than a single revolution. Rod 22 is connected at its lower end to clutch lever 28, (see Fig. 1). To effect engagement of the clutch sections, lever 28 is pulled down to disengage wedge 24 from key 20. The flywheel continues to revolve and, upon engagement of key 20 with slot 17 in hub-plate 16, clutch section 18 will revolve. Clutch lever 28 may be held in its lower position by engaging it beneath latch 29 (see Figs. 3 and 7) which may be any projection from the framework of the press. This is the normal operating position of the clutch lever.

My automatic stop arrangement, as shown in Fig. 7, comprises an arm 30, pivoted at 31 and connected at one end to armature 32 of solenoid 33. The opposite end of arm 30 contacts with the side of clutch lever 28. Energization of the solenoid operates the armature 32 to the left on Fig. 7, in which event the arm 30 is adapted to disengage clutch lever 28 from beneath latch 29. Thereupon spring 25, Fig. 5, forces wedge 24 into cut-out 26 to disengage the clutch sections as heretofore described.

The solenoid energization circuit comprises a suitable source of electric energy as indicated at 34, which is illustrated as being an

ordinary two wire circuit. One wire 35 of the circuit is connected directly to one end of the solenoid 33, (see Figs. 7 and 8). The other wire 36 is solidly connected to contacts 37 and 38 of switches 39 and 40 respectively. The cooperating contacts 41 and 42 of switches 39 and 40 respectively are connected to the other end of solenoid 33 by wire 43. As illustrated in Fig. 8, the switches 39 and 40 are connected in parallel electrical arrangement while each is in series connection between the source of energy 34 and the solenoid 33. Closure of either switch 39 or 40 completes the circuit between the source of energy 34, and the solenoid 33 and causes energization of the latter.

An important feature of the invention is the manner of securing selective closure of switches 39 and 40 upon the occurrence of predetermined conditions, namely, speed decrease of the press and exhaustion of unpunched stock. To accomplish the former, a speed responsive device, which may be an ordinary fly-ball engine governor as illustrated, or any other suitable speed responsive device, is arranged to close switch 39 upon predetermined speed decrease of the press.

In the construction illustrated in Figs. 1 and 7, belt 14 drives pulley 44 and the motion is transmitted, by means of bevel gears 45 to arm balls 46. At normal operating speed the balls 46 are raised to the position shown in solid lines in Fig. 7. In such position arms 47 depress spindle 48 against the supporting action of lever 49, due to the counter weight 50. In the normal operating position fiber cam 51, is below the contact 37 of switch 39 as shown in Fig. 7. Any speed decrease of the press causes arm balls 46 to drop a proportionate distance with a corresponding rise of spindle 48 and fiber cam 51. With proper care, an adjustment may be made whereby failure of one disc of punched stock to be removed from the punching dies will cause fiber cam 51 to be raised from the lower position to the higher position, in which position switch contact 37 is moved into closed relation with contact 41 as shown in Fig. 1.

The mechanism for closing switch 40 upon exhaustion of unpunched stock is as follows. A pivoted arm 52′ rests upon strip 2 of unpunched stock as it is fed to the die. This arm is connected to a spindle 52. The spindle is guided against lateral movement by suitable guideways in switch box 53 mounted on the frame of the press. Fibre cam 54 is arranged on the spindle, and in normal operating position, it is above contact 42 of switch 40 as shown in solid lines in Fig. 7. Upon exhaustion of the strip 2, spindle 52 drops to its lower position where it rests upon the bottom of switch box 53. During its descent, cam 54 causes momentary closure of switch 40.

Closure of either of switches 39 or 40 causes energization of solenoid 33 with resulting disengagement of the press clutch sections as heretofore described.

Where the press or other machine is driven directly by a motor or steam engine or other prime mover without the use of a clutch, the electromagnetic solenoid may be adapted, upon occurrence of predetermined conditions, to open the electric power supply switch of the motor, or shut off the steam supply to the engine, or shut off the power supply of such other type of prime mover as may be employed.

While I have described my invention by the aid of a single example and in connection with a power operated press, it is understood that the invention has other fields of application and that it is confined in scope only as limited in the following claims.

I claim:

1. In a punch press, the combination with means for blanking and drawing shapes from sheet material, of means responsive to undesired accumulation of said material in the blanking and drawing means for interrupting the operation of the blanking and drawing means, said interrupting means comprising a speed responsive device operable upon predetermined speed decrease of said blanking and drawing means to interrupt the power supply of said blanking and drawing means.

2. In a punch press, the combination with means for blanking and drawing shapes from sheet material, of means responsive to undesired accumulation of said material in the blanking and drawing means for interrupting the operation of the blanking and drawing means, said interrupting means comprising a device responsive to predetermined speed decrease of said blanking and drawing means to disengage a clutch in the power supply system of said blanking and drawing means.

3. In a punch press, the combination with means for blanking and drawing shapes from sheet material, of means responsive to undesired accumulation of said material, in the blanking and drawing means for interrupting the operation of the blanking and drawing means, said interrupting means comprising a fly ball engine governor responsive to predetermined speed decrease of said blanking and drawing means to disengage a clutch in the power supply system of said blanking and drawing means.

4. In a punch press, the combination with means for blanking and drawing shapes from sheet material, of means responsive to undesired accumulation of said material in the blanking and drawing means for interrupting the operation of the blanking and drawing means, said interrupting means comprising, in combination, a clutch in the power input system of said blanking and

drawing means, electromagnetic means adapted upon energization to disengage said clutch, and means responsive to speed decrease of said blanking and drawing means to energize said electromagnetic clutch disengaging means.

5. In a punch press, the combination with means for blanking and drawing shapes from sheet material, of means responsive to undesired accumulation of said material in the blanking and drawing means for interrupting the operation of the blanking and drawing means, said interrupting means comprising, in combination, a clutch in the power input system of said blanking and drawing means, an electromagnetic solenoid adapted, upon energization, to disengage said clutch, an energizing circuit in series with said solenoid, a normally open switch in said energizing circuit, and means responsive to speed decrease of said blanking and drawing means to close said switch.

6. In a power driven punch press, an automatic clutch disengaging mechanism comprising, in combination, a clutch in the power input system of said press, an electromagnetically operated solenoid mounted upon said press and adapted, upon energization, to disengage said clutch, an energizing circuit in series with said solenoid, two normally open, parallel connected switches in said energizing circuit, means responsive to predetermined speed variation of said press to close one of said switches, and means responsive to exhaustion of unpunched stock to close the other of said switches.

7. In a power driven punch press, an automatic clutch disengaging mechanism comprising, in combination, a clutch in the power input system of said press, an electromagnetically operated solenoid mounted upon said press and adapted, upon energization, to disengage said clutch, an energizing circuit in series with said solenoid, two normally open, parallel connected switches in said energizing circuit, a fly ball engine governor responsive to predetermined speed decrease of said press to close one of said switches, and a member, normally supported by the strip of unpunched stock being fed to said press, adapted to close the other of said switches upon exhaustion of said unpunched stock.

8. In a power driven punch press for blanking shapes from sheet metal, an automatic stop mechanism comprising, in combination, driving and driven clutch sections in the power input system of said press, one being engageable and disengageable relatively to the other, means to engage and disengage said clutch sections, an electromagnetic solenoid adapted, upon energization, to actuate said clutch operating means to disengage said clutch sections, a normally deenergized electrical circuit in series with said solenoid, and separate means operable respectively upon speed decrease of said punch press and upon exhaustion of said unpunched stock to energize said circuit.

9. In a power driven punch press for blanking shapes from the sheet metal having driving and driven clutch sections in the power input system thereof, one being engageable and disengageable relatively to the other, an automatic clutch disengaging mechanism comprising, in combination, means comprising a clutch lever adapted to engage and disengage said clutch sections, an electromagnetic solenoid adapted, upon energization, to actuate said clutch lever to disengage said clutch sections, an energizing circuit in series with said solenoid, two normally open, parallel connected switches in said energizing circuit, means responsive to speed decrease of said punch press to close one of said switches, and means responsive to exhaustion of unpunched stock to close the other of said switches.

In testimony whereof I affix my signature.

DAVID B. REESE.