July 4, 1933. G. H. LELAND 1,916,379

PUNCH PRESS MECHANISM AND AUTOMATIC STOP THEREFOR

Filed Nov. 12, 1931 2 Sheets-Sheet 1

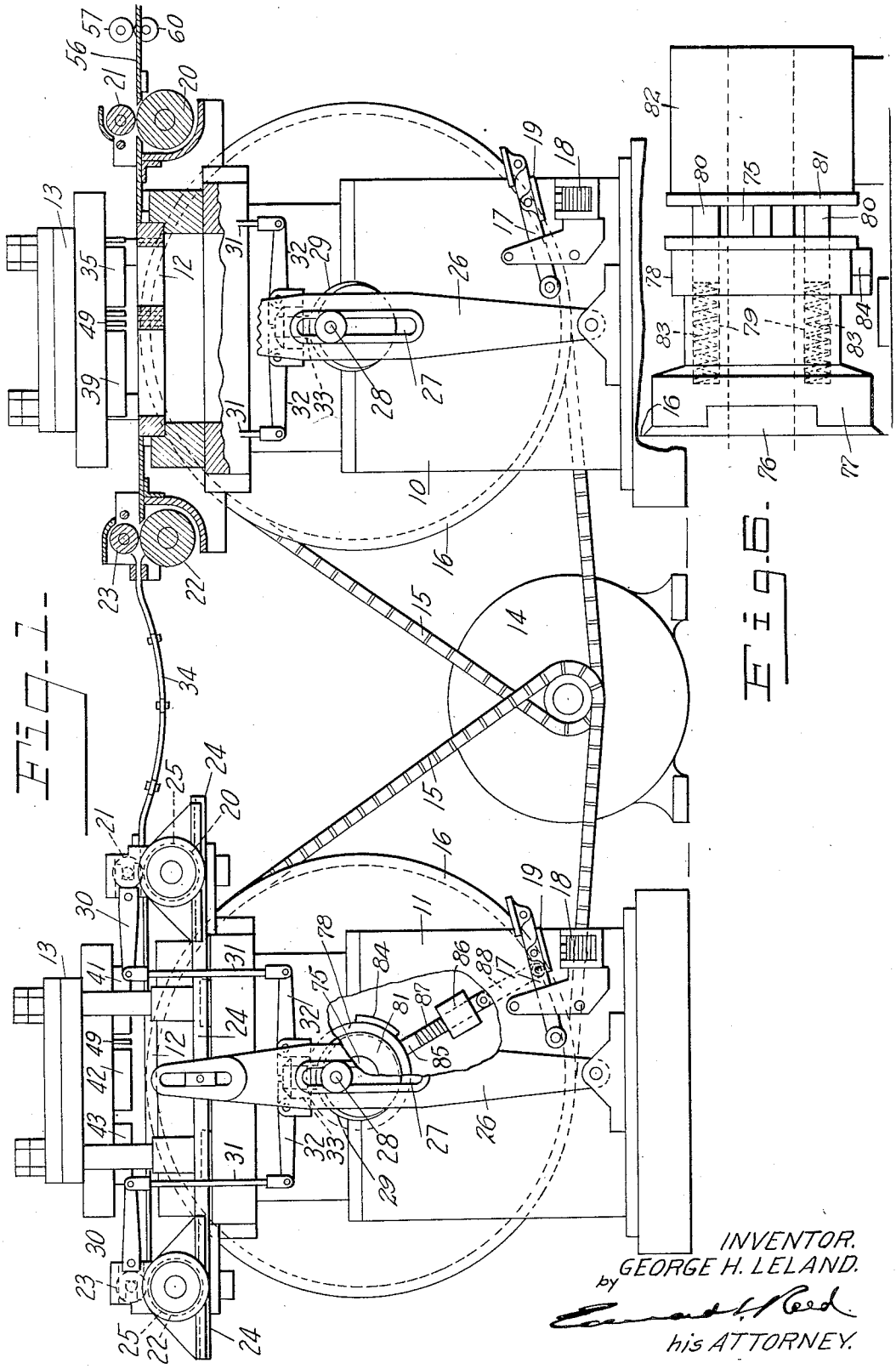


Fig. 1.

Fig. 2.

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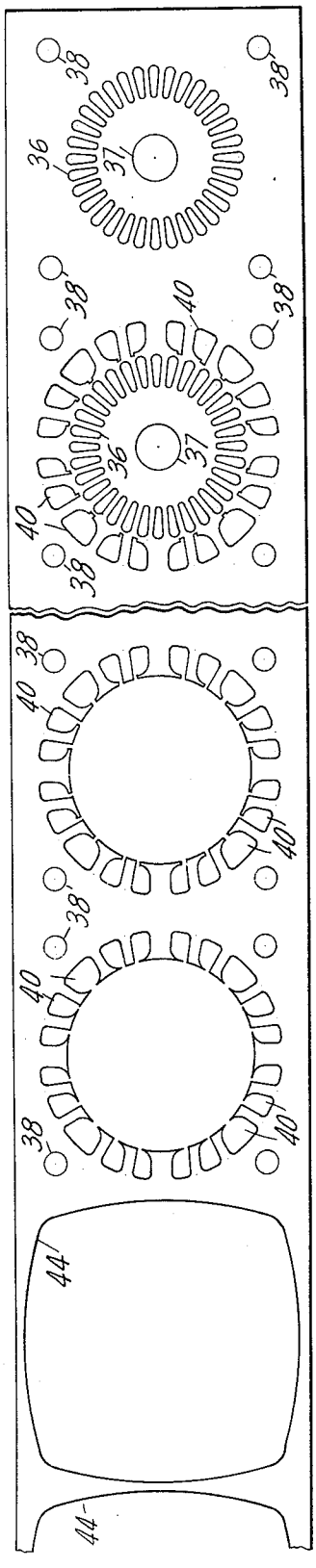


Fig. 2.

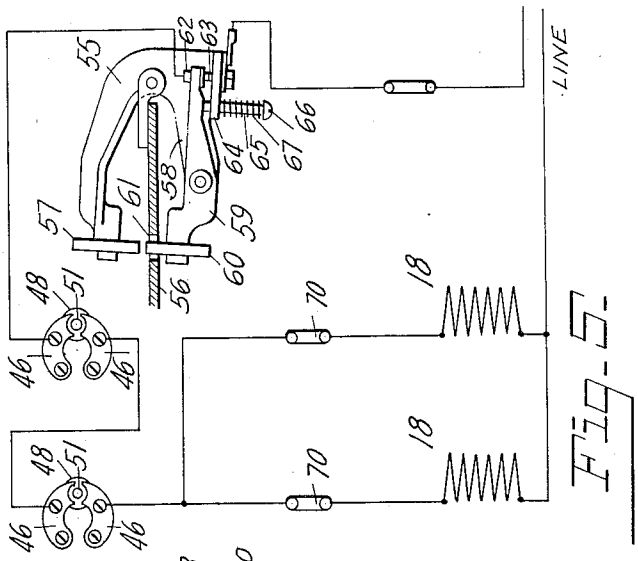


Fig. 5.

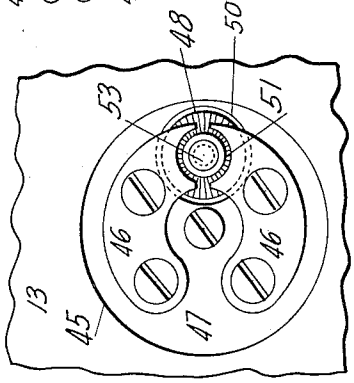


Fig. 4.

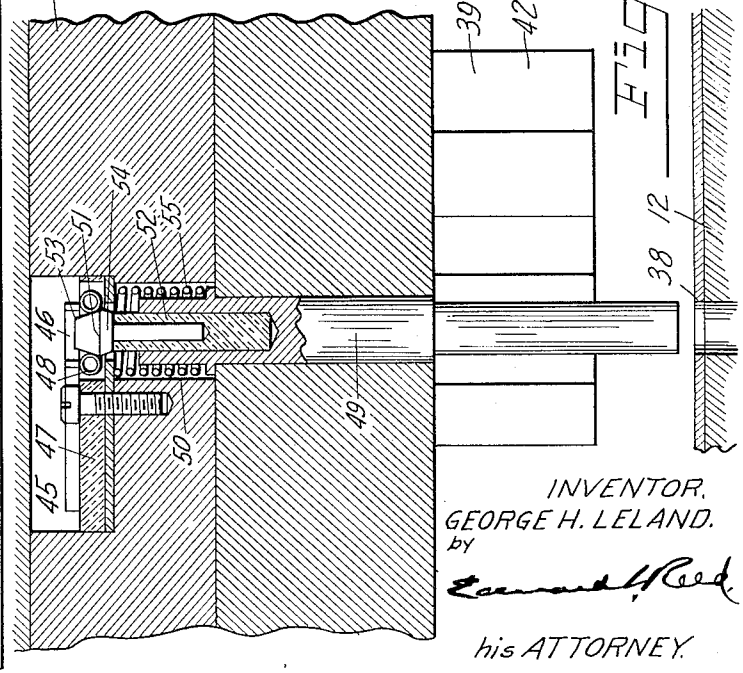


Fig. 3.

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UNITED STATES PATENT OFFICE

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PUNCH PRESS MECHANISM AND AUTOMATIC STOP THEREFOR

Application filed November 12, 1931. Serial No. 574,549.

This invention relates to punch press mechanism and more particularly to such a mechanism employing progressive dies.

One object of the invention is to provide a punch press with means for automatically stopping the press when that portion of the strip which has been operated on by one die is out of line with a succeeding die.

A further object of the invention is to provide such a press with electrically controlled means for stopping the operation thereof, including an improved form of switch.

It is a further object of the invention to provide in connection with a plurality of presses operating in synchronism means for automatically stopping all the presses if a strip is out of line with a die of any one of the presses.

Other objects of the invention will appear as the apparatus is described in detail.

In the accompanying drawings Fig. 1 is a side elevation of a pair of presses connected one with the other for synchronized operation, one of the presses being partly broken away; Fig. 2 is a plan view, partly broken away, of a strip of material showing the operation of the successive dies thereon; Fig. 3 is a sectional detail view of the switch which controls the operation of the press; Fig. 4 is a plan view of the switch; Fig. 5 is a diagram of the circuit for the press controlling device, and Fig. 6 is a detail view of the clutch mechanism.

In these drawings I have illustrated one embodiment of my invention and have shown the same in connection with presses of a well known type but it will be understood that the invention may take various forms and may be applied to presses of various kinds.

The mechanism here illustrated comprises two punch presses, 10 and 11, each of which is complete in itself and consists of a bed plate 12, mounted on the main frame, and a ram 13 movably mounted on that frame for movement toward and from the bed plate, the die members being carried respectively by the bed plate and the ram. The two presses are operated in synchronism from a common electric motor 14 which is connected by belts or chains 15 with drive wheels 16. The drive wheels are connected with the respective rams through the usual driving mechanism, which embodies a spring retracted clutch. This clutch is controlled by a foot lever 17 which, when depressed, serves to connect the driving wheel with the ram and which, when elevated, releases the clutch to permit the separation of the elements thereof to interrupt the connection between the driving wheel and the ram. This connecting member may be of any suitable character and is here shown as comprising a spring operated clutch. In the particular arrangement illustrated the driving wheel 16 is rotatably mounted on the shaft 75 and this wheel carries one member 76 of a jaw clutch. The other member 77 of the clutch is slidably mounted on and splined to the shaft and is provided with an extension 78. The clutch member and its extension are provided with longitudinal bores 79 in which are slidably mounted studs 80 carried by a supporting member 81 mounted on the shaft and held against axial movement, as by contact with a bearing 82 in which the shaft 75 is mounted. Springs 83 mounted in the bore 79 act against the studs 80 to move the clutch member 77 toward the clutch member 76 and thus serve normally to maintain an operative connection between the driving wheel and the operative parts of the machine, with which the shaft 75 is connected. For the purpose of retracting the clutch member 77 the extension 78 of that clutch member is provided with a peripheral cam 84 and a trip device, such as a plunger 85, is mounted for movement into and out of the path of that cam. In the present construction the plunger is slidably mounted in a bearing 86 and is acted upon by a spring 87 which tends to move the same into the path of the cam. The plunger is connected by a link 88 with the foot lever 17. When the foot lever is retained in its depressed or operative position the plunger will be out of the path of the cam 84 and the clutch will be set to establish operative connection in the driving mechanism and operative parts of the machine. When the lever 17 is released the plunger will be moved into the path of the

cam which will engage the same and retract the movable clutch member and thus interrupt the operative connection between the driving mechanism and the operative parts of the machine. Ordinarily the clutch controlling lever 17 is held in its depressed position, to maintain the connection between the driving wheel and the ram, by means of a manually operated latch but, in the present device, I have substituted for the latch an electro-magnet 18 the armature 19 of which is carried by the lever 17 and will, when the magnet is energized, retain the lever in its depressed position, after it has once been moved to that position, thereby permitting the automatic control of the press.

Each press is provided with a feeding-in device which in the present instance comprises a lower roller 20 and an upper roller 21, and a feeding-out or ejecting device which is shown as consisting of a lower roller 22 and an upper roller 23. These feed rollers are actuated by a rack bar 24, the respective end portions of which mesh with pinions 25 secured, respectively, to the lower rollers 20 and 22 by means of pawl and ratchet mechanism, not shown, which will cause the rollers to be actuated when the rack bar is moved in one direction but will permit the same to remain stationary when the rack bar moves in the other direction. The rack bar is actuated by a rock arm 26 having a slot 27 through which extends a crank pin 28 driven from the operating mechanism and, in the present instance, carried by a cam disk 29. In order that the strip may be shifted to aline the same with the dies the upper rollers of each pair are mounted for movement into and out of engagement with the strip, this movement being so controlled that the rollers will be moved to their inoperative positions as the ram moves downwardly and will be moved into their operative positions if the ram moves upwardly. As here shown, each upper roller is supported in the ends of a pair of arms 30, one only of which is shown, and these arms are pivotally mounted between their ends and are connected by links 31 with levers 32 pivotally mounted between their ends on the frame of the press above the cam disk 29. The inner ends of the levers are arranged for engagement by a plunger 33 which is actuated by the cam 29, the cam being arranged to impart movement to the rollers at the proper time with relation to the movements of the ram. The feeding rollers and their operating mechanism are of a well known type and form no part of the present invention. The strips may be delivered to the feeding rollers, and the operation of the rollers thereon controlled, in any suitable manner but the present mechanism is well adapted for use with the automatic strip delivery mechanism shown in my copending application filed November 9, 1931, Serial No. 573,785, and with the feed roller controlling mechanism shown in my copending application filed November 16, 1931, Serial No. 575,324.

In the construction here illustrated each press is provided with two or more progressive dies, the several dies being adapted to operate successively on the same portion of a strip of material. After the dies of the first press operate on the strip it is conducted through a chute 34 to the second press and the portion which has been operated upon is alined successively with the dies of that press, so that the strips are fed progressively through the two presses and the several operations completed, the arrangement and operation of the synchronously operating presses corresponding substantially to those shown in my co-pending application filed November 19, 1931, Serial No. 576,025.

The presses of the present mechanism are equipped with dies for performing five operations. The first press having a two stage die and the second press having a three stage die. These particular dies are designed to strike from a strip of metal the armature laminations and the stator laminations or rings for an electric motor, the stator lamination being formed from that part of the strip which surrounds the portion from which the armature lamination is formed. In Fig. 3 I have shown a strip in the condition in which it would be at the end of any operative movement of the ram after the strip had been fully inserted in both presses, it being understood that the several dies will operate simultaneously upon different portions of a long strip, when the latter is in an intermediate position. When the strip is first inserted into the first press the first stage die 35 will punch the slots 36 and shaft opening 37 of an armature lamination in a portion of the strip lying approximately midway between the lateral edges thereof. It will also punch the bolt holes 38 for the stator lamination or ring. The strip is then advanced to the second stage die 39 and is properly alined therewith, this being preferably accomplished by the usual pilot pins carried by the ram and entering two diagonally opposite bolt holes 38 which have been previously formed in the strip. This alining operation takes place during the initial movement of the ram and the further movement of the same will cause the second stage die 39 to form the slots 40 for the stator laminations in that part of the strip which surrounds the slots 36. The strip is then advanced through the chute 34 to the second press and that part thereof which has been operated upon by preceding dies is properly alined with the first stage die 41 of the second press and this die punches out the armature lamination and causes the same to be delivered from the press. The strip is then advanced to the second stage die 42 of

the second press and this die removes a narrow portion of the metal from the inner edge of the stator lamination to provide the clearance or air gap between the stator and armature in the finished motor. The strip is then again advanced and alined with the third stage die 43 of the second press which strikes out the completed stator lamination, which, in the present instance, is approximately rectangular in shape as shown by the opening 44 which is thus formed in the strip. Ordinarily the strips are of such length that at one time during the progress of a strip through the two presses it will be simultaneously acted upon by all the dies, but this is not essential as the strips follow one another through the press and during other periods of operation one press will be operating on one strip and another press on another strip.

It sometimes happens, even when proper alining devices are employed, that the openings formed in the strip by a preceding operation will not be correctly alined with a succeeding stage die. If the strip is substantially out of line with the die those portions thereof which are in line with the die will be stamped out and the blank ruined but if a wall of an opening in the strip projects very slightly beyond the edge of the die the die will not sever this portion but it will be bent into the lower die and the upper die will be slightly displaced, thus causing its opposite edge to engage the lower die, which engagement may result in a serious injury to the dies. To avoid the possibility of this injury to the dies, generally known as shearing, I have provided means for automatically stopping the press whenever the strip is out of proper alinement with a succeeding die. The mechanism for thus controlling the operation of the press may take various forms but it is preferably electrically operated and includes a switch which is controlled by the position of the strip with relation to the die. As has been above explained the connection between the driving mechanism and the ram is controlled by the magnet 18 which, when energized, holds the clutch operating lever 17 in its depressed or operative position, and I have connected in circuit with this magnet a switch which is provided with a strip controlled actuating device, this actuating device being of such a character and so arranged that when a previously formed opening in the strip is in line therewith the actuating device will move through that opening without disturbing the switch but if the opening is slightly out of line with the actuating device it will be engaged by the latter and the switch operated to break the circuit through the magnet. The switch may be of any suitable character and may be arranged in any suitable location. Preferably both the switch and its actuating device are carried by the ram and, as here shown, the ram is provided with a recess 45 in which the switch is located. The switch comprises two stationary contact members 46 secured to a plate of insulating material 47 arranged within the recess 45. The movable contact member of the switch consists of a contractile band of conducting material, such as a coiled spring 48, which is movable into and out of engagement with the fixed contact members 46. The actuating device for the switch is shown as a plunger 49 which, in the present instance, extends through the die which is carried by the ram and into an opening 50 formed in the ram beneath the recess 45 and in line with the movable contact member 48. This plunger is provided with a head 51, connected therewith by a stem of insulating material 52, and having tapered end portions. The smaller ends of the tapered portions of the head are of a diameter less than the normal interior diameter of the contact spring 48 and will pass freely through the same but the intermediate portion of the head is of greater diameter than the normal internal diameter of the contact spring. The head is so connected with the plunger when the latter is in its lowermost position the upper portion of the tapered end 53 will be pressed into the annular spring, which will be slightly expanded and will be supported by the head in engagement with the contact members 46, thus maintaining the circuit closed through the magnet so long as the plunger is in its normal position. When the plunger is moved upwardly the intermediate portion of the head, that is, the portion of greatest diameter, is forced through the spring, the adjacent ends of the fixed contact member 40 being shaped to permit the passage of the head, and the spring will contract about the lower tapered end portion 54 of the head and will thus be forced downwardly out of engagement with the fixed contact members, thereby breaking the circuit and deenergizing the magnet. It will be apparent that the shape of the head is such as to positively retain the contact spring in the position to which it has been moved until movement has been imparted to the plunger. The lower end of the plunger extends normally below the die which is carried by the ram and, as has been stated, is of such size and so arranged that it will enter the opening previously formed in the strip when the latter is properly positioned with relation to the die. This opening may be one of the openings 38 formed by the first stage die or it may be a specially formed opening. The plunger fits snugly in this opening but will move freely therethrough when the strip is properly positioned but if the strip is not properly positioned and the opening is even slightly out of line with the plunger the latter will engage the edge of the opening and will be forced upwardly with relation to the ram

by the continued downward movement of the ram, thereby causing the head 51 to open the switch. If desired, a light spring 55 may be provided to hold the plunger normally in its lowermost position but when used this spring will be so light that it will not appreciably retard the movement of the plunger. When two presses are operated in synchronism as above described each is provided with an automatic switch and the two switches are connected in series with the controlling magnets for both presses, as shown in Fig. 5, so that when either switch is open both magnets will be deenergized and both presses stopped.

I have also provided means for automatically stopping the press if superimposed strips, or a strip of excessive thickness, are presented to the first press. This is accomplished by connecting in the magnet circuit, in series with the above described switches, a third switch and providing means controlled by the thickness of the strip to open the third switch. The strip controlled mechanism for opening this third switch may take various forms but I have here shown a device similar in construction and operation to the strip controlled device illustrated in connection with the automatic feeding mechanism shown and described in my application for patent Serial No. 575,324, filed November 16, 1931. This device comprises a bracket 55 pivotally mounted at one edge of a feed table 56 over which strips are delivered to the feeding-in rollers 20 and 21. The bracket has an upper portion extending above the table and provided with a roller 57, and a lower portion 58 extending below the table. An arm 59 is pivotally mounted between its ends on the lower portion 58 of the bracket and carries at one end a roller 60 which extends through an opening 61 formed in the table directly beneath the roller 57. The other end of the arm 59 carries a contact member 62 which is held normally in engagement with a second contact member 63 carried by a plate 64 secured to the bracket 55, and these two contact members are connected in circuit with the magnet. A rod 65 is secured to the arm 59 adjacent to the contact member 62, extends through an opening in the plate 64 and is provided at its lower end with a head 66. A spring 67 coiled about the rod is confined between the head 66 and the plate 64, holds the contact member 62 normally in engagement with the contact member 63 and when these contact members are in engagement the rollers 67 and 60 will be spaced apart a distance sufficient to permit the passage of a strip of ordinary thickness. The spring 67 is of sufficient strength to hold the arm 59 normally against movement with relation to the bracket. In the normal operation of the device the arm and the bracket will move in unison without separating the contacts 62 and 63. Should two superimposed strips or a strip of excessive thickness be introduced betwen the rollers 57 and 60 the bracket 55 will be moved upwardly about its axis, the lower roller 60 will fulcrum on the lower surface of the strip and the upward movement of the lower part of the bracket will cause the arm 59 to move about its axis and thus separate the contacts 62 and 63 and break the circuit through the magnet. As a matter of convenience I have inserted in the magnet circuit of each press a manually operated switch 70, whereby either or both presses may be stopped independently of the automatic mechanism.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, and means to interrupt the operation of said ram; a plunger yieldably mounted on said ram and arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and to be actuated thereby when said strip is improperly positioned with relation to said die, and means controlled by the movement of said plunger to operate said interrupting means.

2. In a punch press having a die to operate on a strip of material having a previously formed opening therein, electrically operated means to control the operation of said press, a switch in circuit with said electrically operated means, and an actuating device for said switch mounted for movement with said die and having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and actuate said switch when said strip is improperly positioned with relation to said die.

3. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, electrically operated means to control the operation of said ram, a switch carried by said ram and connected in circuit with said electrically operated means, and an actuating device for said switch supported by said ram for movement therewith and for movement with relation thereto, said actuating device having a part to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and cause said switch to be actuated when said strip

is improperly positioned with relation to said die.

4. In a punch press, a ram, a plurality of die members carried by said ram to operate successively on a given portion of a strip of material, electrically operated means to control the operation of said ram, a switch in circuit with said electrically operated means, and an actuating device for said switch carried by said ram and arranged to pass through an opening formed in said strip by a preceding die member when said opening is in a predetermined position with relation to a succeeding die member and to engage said strip and cause said switch to be actuated when said opening is not in said predetermined position.

5. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, means including an electro-magnet to control the operation of said ram, a switch in circuit with said magnet, and an actuating device for said switch supported by said ram for movement therewith and for movement with relation thereto, said actuating device having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and cause said switch to be actuated when said strip is improperly positioned with relation to said die.

6. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, and means including a lever to control the operation of said ram; an electro-magnet to hold said lever normally in its operative position, a normally closed switch in circuit with said magnet, an actuating device for said switch supported by said ram for movement therewith and for movement with relation thereto, said actuating device having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and cause said switch to be actuated when said strip is improperly positioned with relation to said die.

7. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, electrically operated means to control the operation of said ram, a switch carried by said ram and comprising fixed contact members connected in circuit with said electrically operated means, and a contact member movable into and out of engagement with said fixed contact members, a plunger carried by said ram and having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and to be actuated thereby when said strip is improperly positioned with relation to said die, and a part connected with said plunger to control the position of said movable contact member.

8. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, electrically-operated means to control the operation of said ram, a switch carried by said ram and comprising fixed contact members connected in circuit with said electrically operated means, an expansible contact member having an opening therethrough and movable bodily into and out of engagement with said fixed contact members, a plunger carried by said ram and having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and to be actuated thereby when said strip is improperly positioned with relation to said die, and a member connected with said plunger for movement thereby and arranged to engage said expansible contact member and hold the same in engagement with said fixed contact members when said plunger is in its normal position and to expand said expansible contact member and cause the same to move out of engagement with said contact members when said plunger is actuated by contact with said strip.

9. In a punch press comprising a ram having means to support a die member for operation on a strip of material having a previously formed opening therein, electrically operated means to control the operation of said ram, a switch carried by said ram and comprising fixed contact members connected in circuit with said electrically operated means, a contractile band of conducting material movable into and out of engagement with said fixed contact members, a plunger carried by said ram and having a part arranged to pass through said opening when said strip is properly positioned with relation to said die and to engage said strip and to be actuated thereby when said strip is improperly positioned with relation to said die, and a head connected with said plunger and having its upper and lower portions tapered in opposite directions, the intermediate portion of said head being of a diameter greater than the normal internal diameter of said contractile band, said head being so arranged that when said plunger is in its normal position the upper tapered portion of said head will enter said contractile band and support the same in engagement with said fixed contact members and when upward movement is imparted to said plunger the intermediate portion of said head will be forced through said band and the band caused to engage the lower tapered portion

of said head and to be moved out of engagement with said fixed contact members.

10. A punch press mechanism comprising a plurality of presses having dies to act progressively on strips of material fed successively thereto, means for operating said presses in synchronism, means for transferring said strip from one press to another, and strip controlled means to stop both presses when a strip is out of line with the die of either press.

11. A punch press mechanism comprising a plurality of presses having dies to act progressively on strips of material fed successively thereto, means for operating said presses in synchronism, means for transferring said strip from one press to another, electrically operated means to control the operation of the respective presses, switches mounted on the respective presses and connected in series with the electrically operated controlling means of both presses, and strip controlled actuating devices for said switches mounted on the respective presses.

12. A punch press mechanism comprising two presses each having a ram, die members mounted on the respective rams to operate successively on a given portion of a strip of material, means to operate said rams in synchronism, means to advance the strip from one press to the other, separate electrically operated means to control the operation of the respective rams, switches carried by the respective presses and connected in series one with the other and with both electrically operated means, and actuating devices for said switches carried by the respective rams, each actuating device having a part arranged to pass through an opening previously formed in said strip when said portion of said strip is properly positioned with relation to the die of the press on which that actuating device is mounted and to engage said strip and to be actuated thereby when said portion of said strip is improperly positioned with relation to said die.

In testimony whereof, I affix my signature hereto.

GEORGE H. LELAND.