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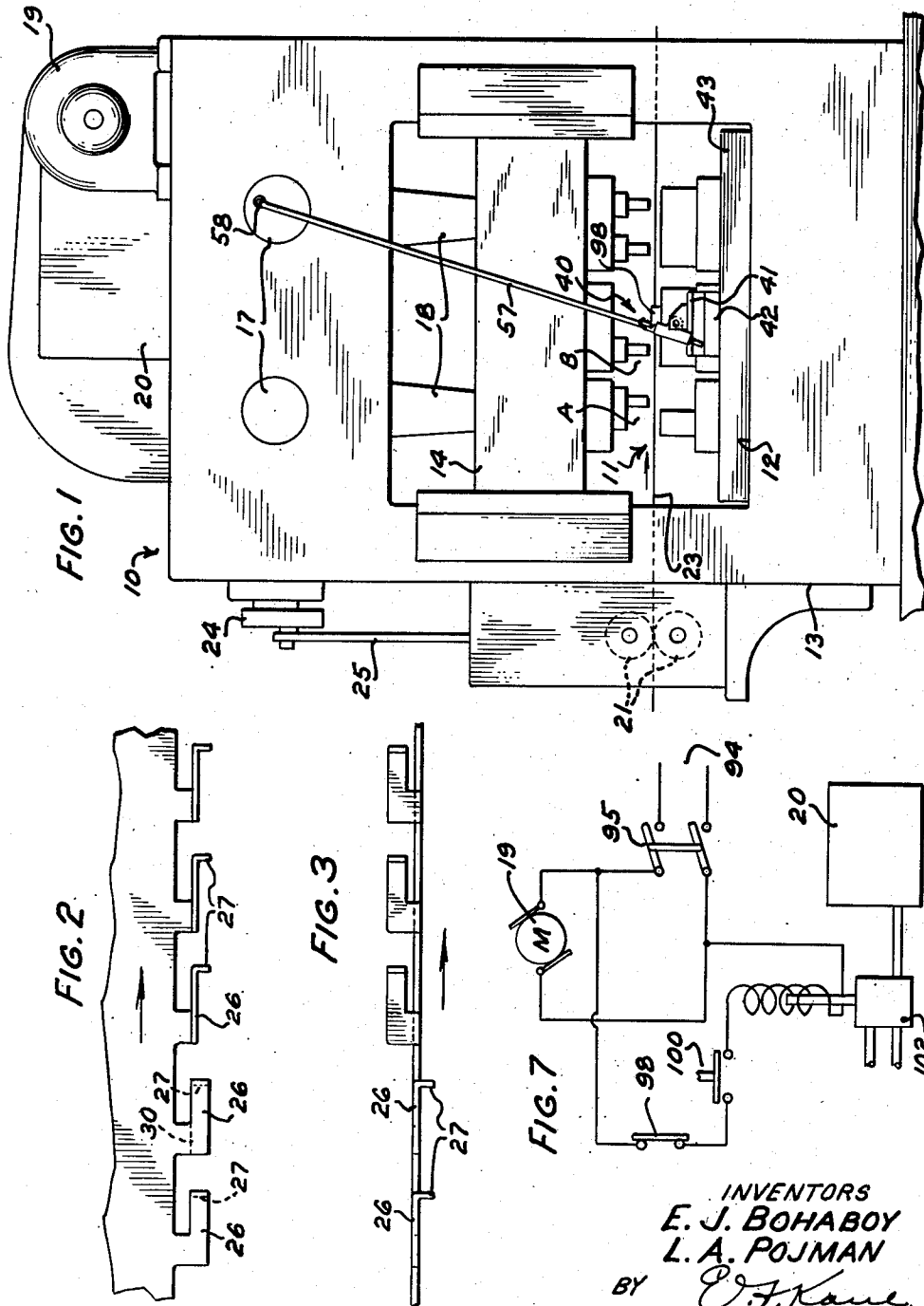
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CONTROL FOR MATERIAL WORKING MACHINES

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2 Sheets-Sheet 1



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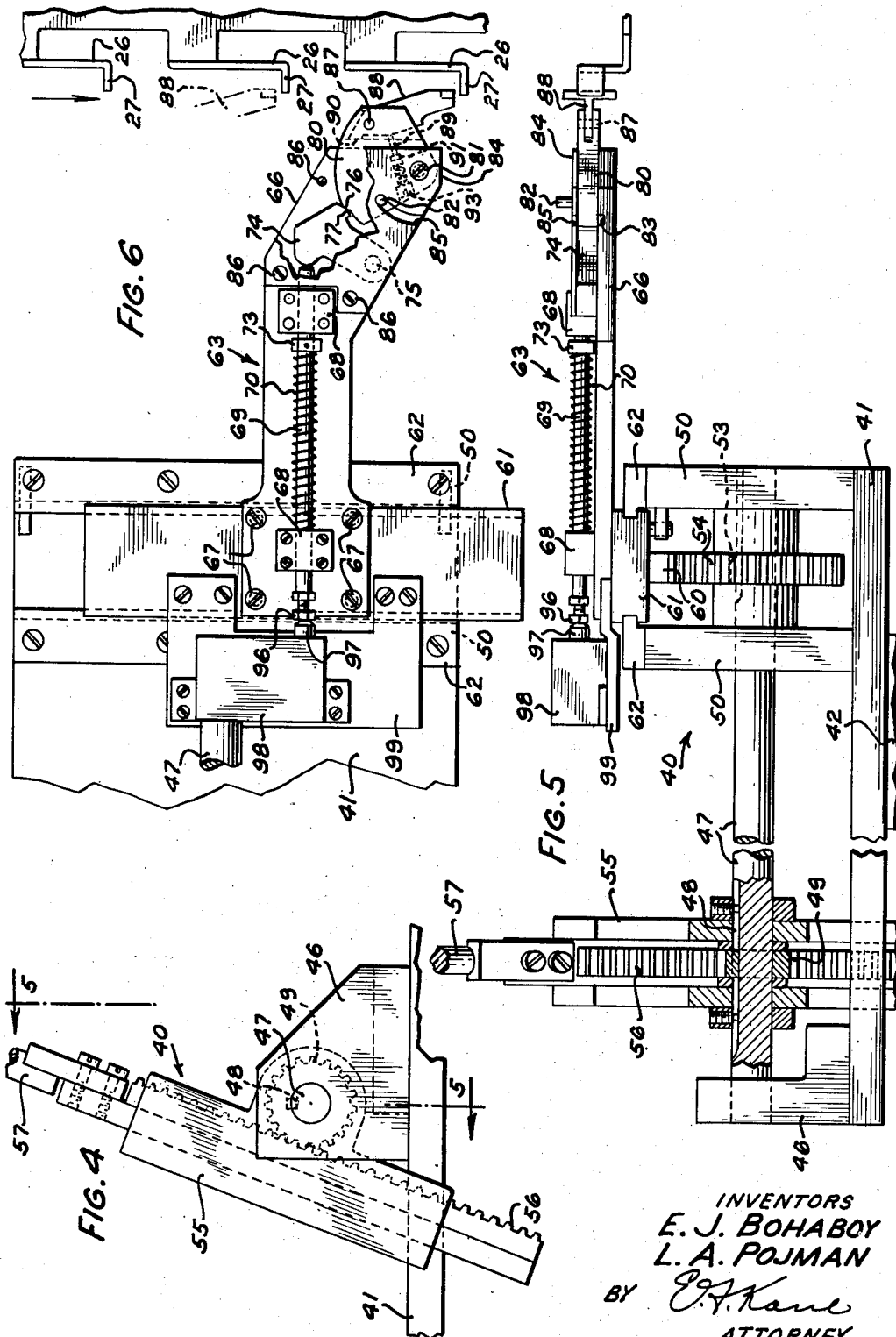
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UNITED STATES PATENT OFFICE

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CONTROL FOR MATERIAL WORKING MACHINES

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This invention relates to controls for material working machines and more particularly to a feed responsive control for a power operated progressive type punching and forming press.

In the manufacture of the components of such mechanisms as telephone exchange equipment, it frequently becomes desirable to provide progressive type punch and die mechanisms where, in a single punch press, a series of different operations are performed simultaneously upon a strip of stock at various positions in the press to produce a part having the desired configuration, one part being produced for each stroke of the press. In such presses, it is essential that the advancement of the stock from which the part is to be formed be controlled with a high degree of accuracy since the tools at the various stations will simultaneously be performing their respective different operations on a series of parts.

An object of the invention is to provide an efficient, reliable and practicable control mechanism for power operated material working machines.

In accordance with the above object, the invention contemplates the provision of a mechanism for disconnecting the tool actuating portion of the press from its power source when the stock feeding mechanism does not feed the correct amount of stock forward on any given operation thereof.

In one embodiment of the invention there is provided a reciprocable stock follower having a positive travel in each direction equal to the desired amount of stock feeding movement. This follower carries a pivotal member yieldably held in the line of travel of formations or lugs, formed on the stock in one of the punch press positions, and normally spaced from and following the lug or formation during the stock feeding movements. Upon the stock not being fed the desired distance, the follower being moved exactly the desired distance, the follower will engage the lug or formation on the fed stock and will be rocked thereby about a pivot to actuate a normally closed microswitch which is connected in a circuit normally maintaining the connection between the power source and tools and thereby cause the tool operating mechanisms to be disconnected from their power source.

Other objects and advantages of this invention will more fully appear from the following detailed description taken in conjunction with the accompanying drawings, in which

Fig. 1 shows diagrammatically a rear elevational view of a conventional punch press having associated therewith a progressive type punch

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and die mechanism, the press being equipped with a control mechanism embodying the features of the invention;

Figs. 2 and 3 are fragmentary plan and edge views, respectively, of one example of stock being progressively formed and showing equally spaced lugs formed thereon which the control mechanism follows during the step by step advancement of the stock;

Fig. 4 is an enlarged fragmentary view of the control mechanism as it appears in Fig. 1;

Fig. 5 is a side view, partly in section, of the control mechanism, as viewed in Fig. 4, looking in the direction of the arrows, with portions broken away to conserve space;

Fig. 6 is a fragmentary plan view of Fig. 5 showing its operative relation with the stock lugs; and

Fig. 7 is a diagrammatic view illustrating an electric circuit controlled by the press control mechanism for stopping the press in the case of a misfeed of stock.

Referring to the drawing, particularly to Fig. 1, one embodiment of this invention is illustrated as used in connection with a conventional punch press 10 having associated therewith a progressive punch and die mechanism, indicated at 11, which is operatively associated with a punch press bed 12 integral with a frame 13 of the press and a reciprocatory ram or platen 14. The ram 14 is reciprocated in the operation of the press 10 by a pair of crank shafts 17—17 operatively connected to the ram or platen 14 by connecting rods 18—18. A continuously operating electric motor 19, through a clutch and brake unit illustrated diagrammatically at 20 and through suitable trains of gears (not shown), drives the crank shafts 17. The details of the clutch and brake unit 20 have not been shown since any suitable mechanism may be provided for this purpose depending on the type of press to which the invention may be applied. Carried on the press frame 13 is a set of feed rolls 21 by means of which strip material or stock 23 is intermittently advanced from a supply in coil form (not shown) in a horizontal plane through the punch and die mechanism from left to right as viewed in Fig. 1. The feed rolls 21 are driven in timed relation to the reciprocation of the platen 14 from a crank disc 24 and a connecting rod 25 operating suitable driving mechanisms housed above the feed rolls, the crank disc 24 receiving its motion from the left-hand crank shaft 17, as viewed in Fig. 1 by suitable interconnecting gearing (not shown). Since the punch press 10, punch and die mechanism 11 and feed rolls 21 are well known in the

part and conventional, a more complete description thereof is not believed necessary to a full understanding of the present invention. It will be understood, however, that in the operation of the punch press 10 the ram 14 and the feed rolls 21 are operated in timed relation in such a manner that when the ram has completed one-half of its retractive stroke, the feed rolls start feeding the stock 23 forward to position it for the next operative stroke of the ram, and upon the ram having completed one-half of its advance or operative stroke, the rolls cease feeding the stock.

It may be stated at this point that several sets of tools are included in the punch and die mechanism 11 and at suitable distances apart, operate simultaneously on the stock 23 while it is stationary during each operative stroke of the ram 14. Thus in the present disclosure, for example, upon completion of each advance movement of the stock 23, it will be acted upon simultaneously at the positions A and B during each operative stroke of the ram 14. Referring to Figs. 2 and 3, the stock 23 when it reaches position A is already formed with an arm 26, and at this position the end of the arm is turned downwardly to provide a lug 27. At the next position B the arm 26 is turned upwardly along the broken line 30 in which position of the arm the previously formed lug 27 extends forward of the arm instead of downwardly as in the previous position A.

The worked stock 23 after leaving position B is worked upon at other positions (not shown) and is finally sheared laterally along a line extending between adjacent lugs 27 at a last position, also not shown, thus resulting in similar parts with lugs 27 extending therefrom. In order to produce similar parts it will be apparent that the stock 23 should be advanced exactly the same amount during each feeding operation of the rolls 21. Furthermore, the feeding of the stock 23 should be in timed relation with the operative stroke of the ram 14 in order to eliminate tool breakage which would result from misfeeding of the stock. Thus, in case the stock is not advanced a correct or necessary distance within tolerable limits, which may occur at times for various reasons, it is essential that the operation of the punch press should be immediately automatically stopped. It should be understood that, although only the two working positions A and B in which the stock 23 is worked upon have been shown and described, numerous other operations are performed on the stock 23 preceding and following the work described as occurring at positions A and B.

The embodiment of the control mechanism shown herein, referring particularly to Figs. 1, 4, 5 and 6, and which mechanism is indicated in Fig. 1 in general at 40, comprises a base member 41 fixed to a sub-base member 42 secured to the upper surface of a bolster plate 43, in turn secured to the punch press bed 12. As shown in Fig. 1, the mechanism 40 is suitably positioned to the right of the position B, at which position the arm 26 had been turned upwardly to carry the lug 27 thereon forwardly of the edge of the stock 23, as shown clearly in Figs. 2 and 6. Journalled at its forward end in a bearing block 46 (Figs. 4 and 5), fixed to the base member 41, is a rock shaft 47, to which is keyed, at 48, a gear 49. The opposite end of the shaft 47 is journalled in spaced standards 50—50 fixed to the base member 41. Keyed to the latter end of the shaft 47 at 53, intermediate the standards 50—50, is a gear 54. Pivotaly supported on the forward end

of the shaft 47 is a U-shaped saddle member 55, in which is guided for reciprocatory movement a rack bar 56, which meshes with the gear 49. At its upper end (Figs. 1, 4 and 5), the rack bar 56 is fixedly attached to the lower end of a rod 57, which is pivotaly and eccentrically connected at 58 to the end face of the right-hand crankshaft 17. Thus, during each rotation of the crankshaft 17, the rod 57 and the attached rack bar 56 will have imparted thereto reciprocatory up and down motions while rocking together with the saddle member 55 about the shaft 47. This motion of the rack bar 56 imparts rotary motion in one direction and then the other to the gear 48 and thus to the shaft 47 and to the gear 54 fixed to the other end of the shaft.

As shown in Fig. 5, the gear 54 meshes with a rack bar 60 attached to the lower surface of a plate 61 slidably mounted at opposite longitudinal edges, which are grooved, on rails 62—62 fixed to the upper end surfaces of the standards 50—50. The ratio of the gear 54 to the gear 49 is two to one so that the travel of the rack bar 60 effected by the rotation of the gear 54 will be twice that of the rack bar 56. Attached to the upper surface of the plate 61 is a stock position checking device, indicated in general at 63. This device will vary in the arrangement of its elements, their shape and dimensions from one installation to the other, depending on clearances provided for mounting the mechanism, previously described, on the material working apparatus and other factors including the shape of the strip material and the particular type of formations formed thereon.

The device 63 comprises a mounting plate 66 attached at 67—67 to the slidable plate 61, which extends rearwardly, as viewed in Fig. 1, between and out of the path of adjacent tools comprising the punch and die mechanism 11. Slidable in spaced bearing blocks 68—68, mounted upon the plate 66, is a slidable spring-pressed rod 69, a coiled compression 70 surrounding the rod between the left-hand bearing block 68 and a collar 73 attached to the rod, normally urging the rod to the right, as viewed in Figs. 5 and 6. At its right end, the rod 69 normally presses against an edge surface of a pivotal member 74 fulcrumed at 75 on the plate 66 to urge it in a clockwise direction. The pivotal member 74 is provided with a cam surface 76 formed on an edge thereof opposed to the edge engaged by the rod 69 and engaging a cam surface 77 formed on the edge of a pivotal member 80 fulcrumed at 81 on the plate 66. A pin 82 extending downwardly from the pivotal member 80 and engaged in an arcuate shaped slot 83 formed in the plate 66 serves to limit the movement of the member 80 in a clockwise direction. The pivotal members 74 and 80 move upon opposed surfaces of the plate 66 and a cover plate 84, provided with a slot 85 in alignment with the slot 83 of the plate 66 and through which the pin 82 extends, the plate 84 being attached to the plate 66 by spacers and screws 86. Pivotaly mounted in a forked right-hand end of the pivotal member 80 at 87 is a trigger member 88, which is T-shaped (Fig. 5). A spring-pressed pin 89 extending from the member 80 and between the furcations of its forked end and engaging the left-hand edge surface of the trigger member 88 constantly urges the latter member in a counter-clockwise direction about its pivot 87 limited by a projection 90 on the trigger member engaging the pivotal member 80. A compression spring 91 housed within the member 80 between the pin 89

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and a screw 93 threaded into the member 80 constantly urges the pin against the trigger member 88 and thus normally maintains the members 80 and 88 in the positions shown with the projection 90 abutting the member 80.

With this arrangement, it will be apparent that in a counterclockwise movement of the pivotal member 80 about its pivot 81, the trigger member 88 will move therewith as a unit. It will also be obvious that the trigger member 88 may move clockwise about its pivot 81 without effecting the normal position of the pivotal member 80, as shown in Fig. 6.

By reference to Fig. 7, it will be seen that the motor 19 may be connected to a voltage source 94 by closing a switch 95 thus preparing the press for operation.

The slidable rod 69, at its left-hand end, supports an adjustable microswitch actuator 96, which bears at all times against a plunger 97 of a normally closed microswitch 98 (Figs. 5 and 6) supported on the slidable plate 61 by means of a bracket 99. As shown in Fig. 7, the microswitch 98 is included in a control circuit of the clutch and brake unit 20 and upon closure of a locking type push button switch 100 will supply power from source 94 to a solenoid actuated air valve 102 which in turn will supply air from a source (not shown) to hold the clutch of clutch and brake unit 20 operative and cause the press to operate repeatedly. During operation of the punch press, the clutch is held closed by maintaining the switches 98 and 100 closed, thus completing the drive to the platen 14 from the motor 19 and through the clutch, the brake being inoperative. Upon the contacts of the microswitch 98 being opened, in the manner previously described, the clutch is opened, thus breaking the driving connection from the motor through the clutch to the platen and the brake of clutch and brake unit 20 is applied while the motor 19 continues to operate.

In the operation of the above described control mechanism as applied to a continuously operating punch press 10 having associated therewith the progressive type punch and die mechanism 11, it will be assumed that the reciprocable platen 14, as shown in Fig. 1, has completed its retractive or upward stroke after a working stroke and is moving downward again, having completed one-half of its downward or working stroke. At this point, the feed rolls 21, by means of the crank disc 24, driven from the left-hand crank shaft 17, the connecting rod 25 and the feed roll driving mechanism receiving motion from the connecting rod, have completed their forward feeding of the stock 23, the feeding of the stock having started when the platen 14 had completed one-half of its retractive stroke. Also, at this point in the operation of the press, with the platen 14 having completed one-half of its working stroke, it will be assumed, referring now to Figs. 5 and 6, that the stock 23 has been accurately advanced one feeding step in the direction of the arrow (Fig. 6) and at this time is stationary and remains so until the platen 14 has completed its working stroke and one-half of its retractive stroke. At this point in the cycle of the press, and as shown in Fig. 6, the pivotal trigger member 88 of the device 63 is spaced a predetermined tolerable distance from the formation 27 on the stock 23, which it had followed in unison during the feeding movement of the stock. While the stock 23 is stationary and the platen 14 is com-

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pleting its working stroke and one-half of its retractive stroke, as previously described, the device 63 is moved, by means of its operative connections, previously described, upwardly, as viewed in Fig. 6, until the trigger member 88 is in the position shown fragmentarily in broken outline above and predeterminedly spaced from the following or intermediate stock formation 27 shown. During this retractive movement of the device 63, the trigger member 88, it will be understood, will idly rock about its pivot 81, as it engages and moves past the intermediate stock formation 27.

In the next feeding movement of the stock 23, which commences when the platen 14 has completed one-half of its retractive stroke or upon completion of the movement of the device 63 to the last described position, the intermediate stock formation 27 and the trigger member 88, shown in broken outline, (Fig. 6) will normally advance in unison, but if, for any reason the stock 23 mis-feeds, such as being slowed up during its advance or stop short of the desired feed distance, the forward end of the pivotal trigger member 88 will, in its positive continued forward movement, engage the stock formation 27 and this interference will cause a rocking of the trigger member and the pivotal cam member 80 as a unit about the pivot 81 of the member 80 in a counterclockwise direction due to the arrangement previously described between these members. This rocking movement of the members 80 and 88 as a unit will cause, by means of the cooperating cam surfaces 76 and 77 on the pivotal members 74 and 80, respectively, a counter-clockwise movement of the member 74 about its pivot 75 and thus, due to the engagement of the latter member with the spring pressed slidable rod 69, a movement of the latter towards the left, as viewed in Fig. 6. The adjustable microswitch actuator 96 on the end of the moved rod 69 and bearing on the plunger 97 of the microswitch 98 will cause the plunger to open the contacts of the microswitch, thus breaking the normally closed circuit to the solenoid actuated air valve 102. By opening the normally closed microswitch 98, the solenoid actuated valve 102 will be de-energized and the clutch of the clutch and brake unit 20 will be disengaged and the brake will be applied to stop operation of the press, the main driving motor 19 continuing to operate.

When the stock position checking device 63 is tripped as described above, the operator immediately opens the switch 100 to cut off the power source 94 from the solenoid actuated air valve 102. The device 63 is left in its tripped condition with the control circuit through the microswitch 98 open and the tool operating mechanisms disconnected from their power source until the trouble which caused the device 63 to trip has been overcome. Thereafter, the operator grasps the upper end of the pin 82 (Fig. 5) which extends upwardly from the pivoted member 80 to which it is fixed and rocks the member 80 in a clockwise direction to its normal position as shown in Fig. 6 which permits the other elements of the mechanism to return to their normal positions. The microswitch 98 is thereby returned to its normally closed condition and upon the switch 100 being closed again the press will again operate.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily

devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a power operated strip material working machine having means for feeding strip material step by step to a tool operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory element for following the material during its step by step feed, means operatively connected to said driving means for causing said element to move back and forth along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, and movable means on said element in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding, said means on the element being responsive to an engagement thereof with a formation upon a misfeed of the material occurring for actuating said control switch to effect an actuation of the control mechanism to stop the machine.

2. In a power operated strip material working machine having means for feeding strip material step by step to a tool operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory member for following the material during its step by step feed, means operatively connected to said driving means for causing said member to reciprocate along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, and a yieldable element on said member in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding, said yieldable element being responsive to a predetermined movement effected by its engagement with a formation upon a misfeed of the material occurring for actuating said control switch and thereby actuating the control mechanism to stop the machine.

3. In a power operated strip material working machine having means for feeding strip material step by step to a tool operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a normally closed control switch for said circuit, a reciprocatory carrier mounted for movement longitudinally and following the material during its step by step feed, said switch being mounted on said carrier plate, means operatively connected to said driving means for reciprocating said carrier along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, a follower arm pivotally mounted on said carrier in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance therefrom and following the same during the

material feeding, and means on said carrier operatively connecting said control switch and arm responsive to a predetermined pivotal movement of said arm effected by its engagement with a formation upon a misfeed of the material occurring for opening said control switch to effect an actuation of the control mechanism to stop the machine.

4. In a power operated strip material working machine for progressively forming articles from strip material having means for feeding strip material step by step to a plurality of work stations, a tool at one station operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory material follower element, means operatively connected to said driving means for reciprocating said element along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, a movable member on said element in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding, and means movable with said element and member responsive to a predetermined movement of said member effected by its engagement with a formation in the case of a slow-up in the feeding of the material for actuating said control switch to effect an actuation of the control mechanism to stop the machine.

5. In a power operated strip material working machine having means for feeding strip material step by step to a tool driven by a crank shaft, the tool being operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory carrier for following the material during its step by step feed, said switch being mounted on said carrier, means operatively connecting said crankshaft to said carrier for reciprocating said carrier along the material a distance equal to each normal feeding movement and in unison with the material during its feeding, a yieldable arm on said carrier in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding and connections between said control switch and arm responsive to a movement of said arm upon an engagement thereof with a formation upon a misfeed of the material occurring for actuating said control switch to effect an actuation of the control mechanism to stop the machine.

6. In a power operated strip material working machine having means for feeding strip material step by step to a tool driven by a crank shaft, the tool being operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory carrier for following the material during its step by step feed, means operatively connecting said crankshaft to said carrier comprising a rack driven by said crankshaft, a sec-

ond rack connected to said carrier and a train of gears operatively connecting said racks effective for reciprocating said carrier along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, a yieldable arm on said carrier in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding and connections between said control switch and arm responsive to a movement of said arm upon an engagement thereof with a formation upon a misfeed of the material occurring for actuating said control switch to effect an actuation of the control mechanism to stop the machine.

7. In a power operated strip material working machine having means for feeding strip material step by step to a tool driven by a crank shaft, the tool being operable in timed relation to the feeding means for forming equally spaced formations on the material and means for driving the machine, the combination of a control mechanism for said driving means comprising an electric circuit, a control switch for said circuit, a reciprocatory carrier for following the material during its step by step feed, means operatively connecting said crankshaft to said carrier comprising a rack connected to said crankshaft, a shaft, a gear fixed to said shaft meshing with said rack, a second gear fixed to said shaft and a second rack connected to said carrier meshing with said second gear for reciprocating said carrier along the material a distance equal to each normal material feeding movement and in unison with the material during its feeding, a yieldable arm on said carrier in the line of travel of each successive formation on the material and normally spaced a predetermined tolerable distance from a formation and following the same during the material feeding and connections between said control switch and arm responsive to a movement of said arm upon an engagement thereof with a formation upon a misfeed of the material occurring for actuating said control switch to effect an actuation of the control mechanism to stop the machine.

8. A strip-working machine, which comprises opposed strip-working elements for forming projections on the strip, means for moving said elements into and out of engagement with the strip, means tending to advance the strip when said elements are out of engagement with the strip to position another portion of the strip between said elements, an escapement feeler, means moving the feeler with the strip in synchronization with the strip-advancing means in a position just behind one of the projections so that if the strip misfeeds with respect to the strip-advancing means the projection presses the feeler, and means responsive to pressing of the feeler by one of the projections for stopping the element-moving means.

9. A strip-working machine, which comprises means for forming projections on a strip, means moving said projection-forming means into and out of engagement with a strip, means driven in synchronism with the moving means for advancing the strip in a predetermined direction past the projection-forming means when the projection-forming means is moved out of engagement with the strip and tending to advance it at a predetermined rate of speed, a trigger, means for reciprocating the trigger along the strip in such synchronism with the strip-advancing means that the trigger moves with the strip at said predetermined rate when the strip-advancing means is operative, an escapement pawl carried by the trigger in a normal position just behind one of the projections for actuating the trigger when the strip lags with respect to the trigger, and means operable by actuation of the trigger for stopping the moving means.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,555,596	Miller	Sept. 29, 1925
2,221,464	Zahodiakin	Nov. 12, 1940
2,366,960	England	Jan. 9, 1945
2,425,438	O'Neal	Aug. 12, 1947