

July 23, 1963

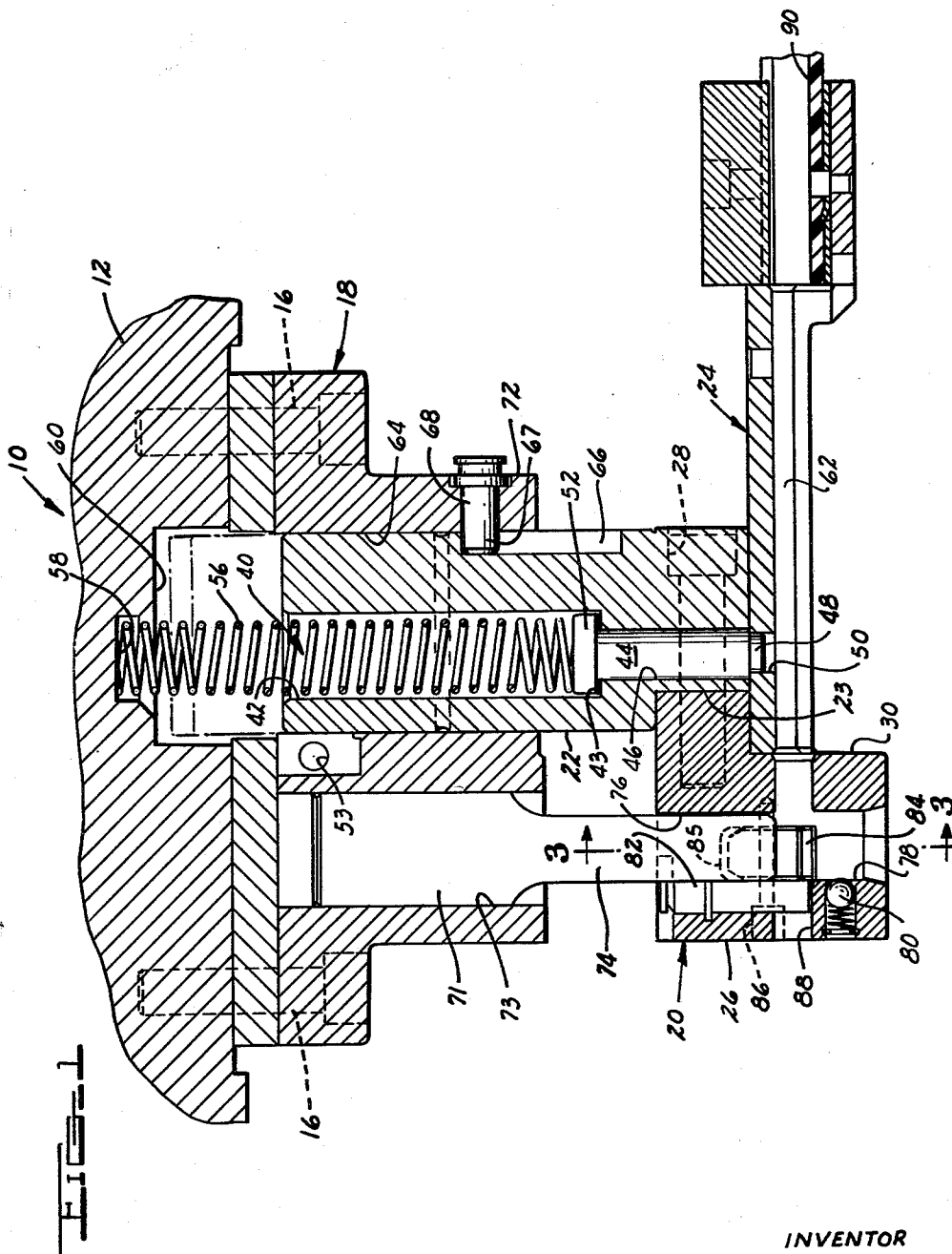
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3,098,576

ELECTRONICALLY CONTROLLED FEED HEAD

Filed Sept. 18, 1958

4 Sheets-Sheet 1



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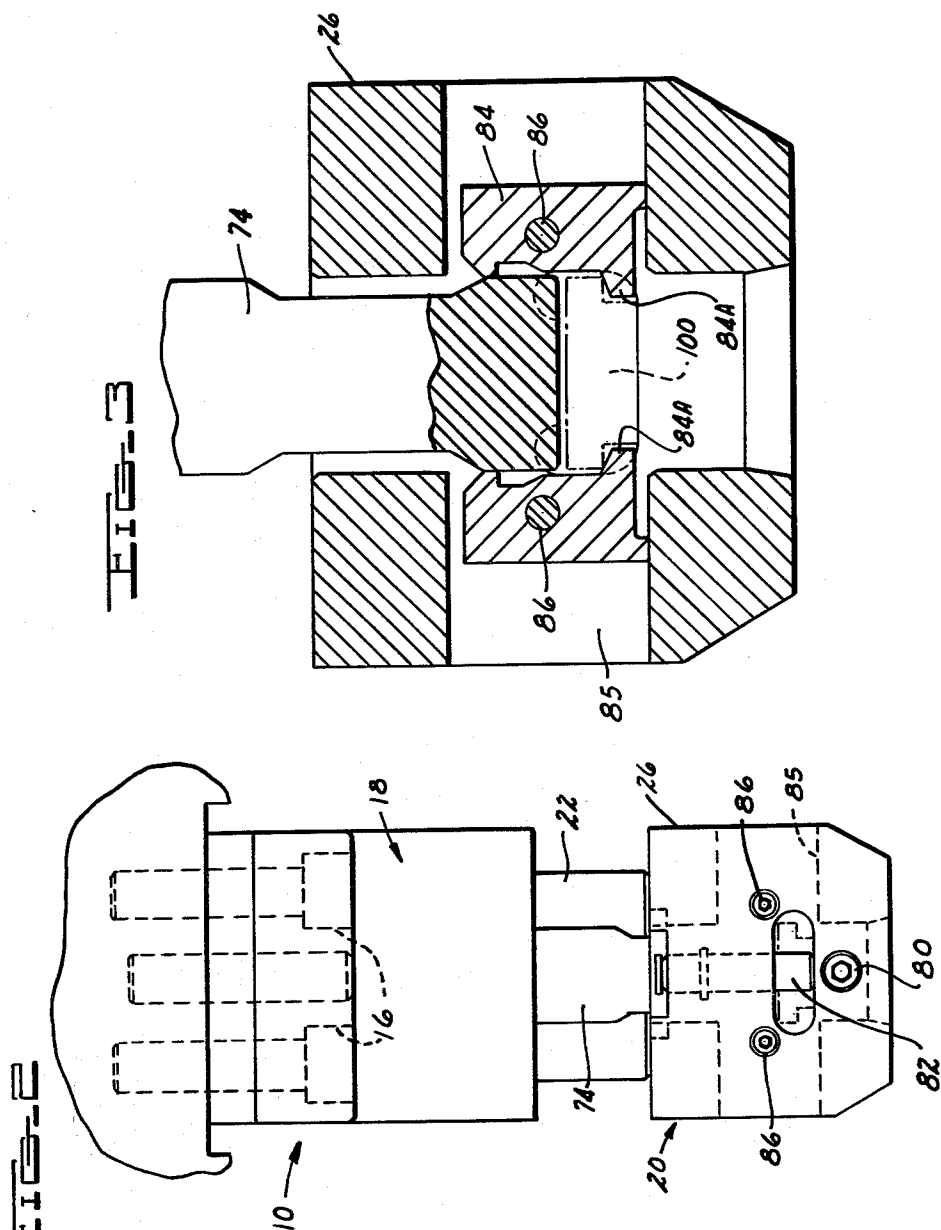
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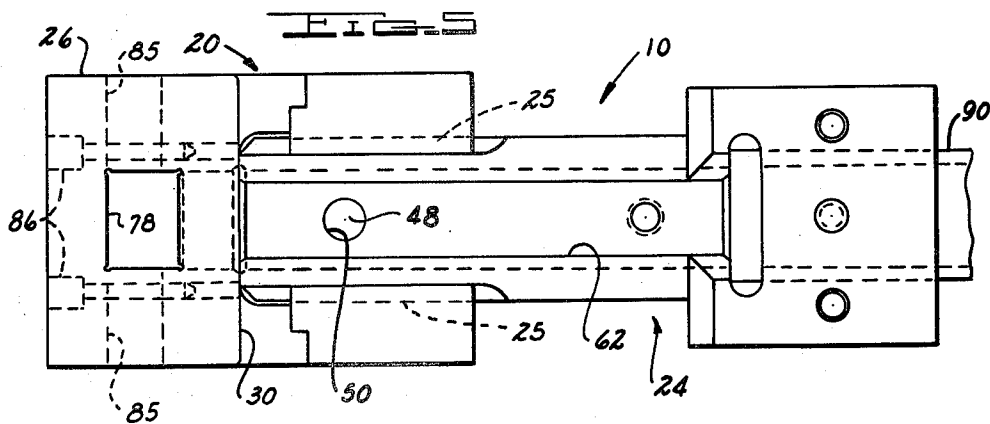
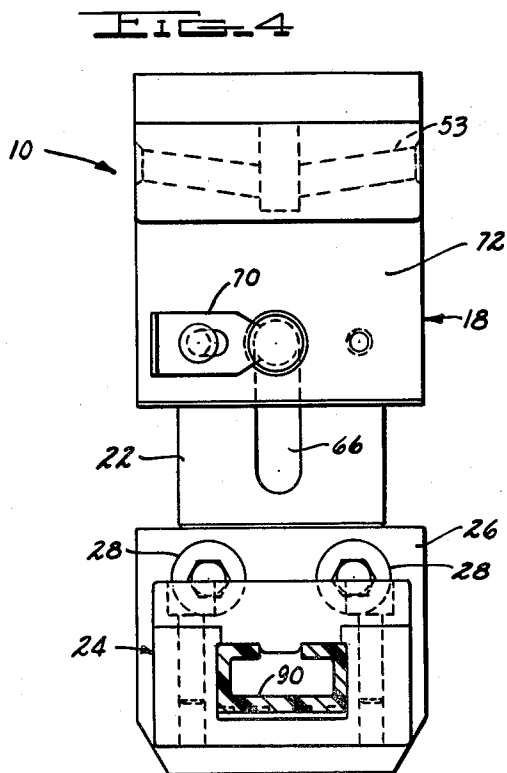
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4 Sheets-Sheet 3



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3,098,576

ELECTRONICALLY CONTROLLED FEED HEAD

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1 Claim. (Cl. 218-2)

The present invention relates to an improved feeder mechanism which automatically feeds clinch nut fasteners into a punch press for assembly on a panel member. The operation of the punch press is electronically controlled by the position of said clinch nut fastener in the feeder head.

Other devices of this character have been developed for affixing clinch nut fasteners to a panel member with a minimum of success, since any improper feeding of the fasteners, results in malfunctioning of the tools. Because such tools are installed in high production assembly lines, repair and down time is very costly and undesirable. The fact that malfunctioning of such devices tends to repeat with each cycle, increased inspection time is necessary to prevent complete panel assemblies from becoming scrap, if the feeder mechanism is not functioning properly. If the supply of clinch nut fasteners in the hopper is exhausted, or a jam in the feeder occurs, production runs without benefit of a fastener being installed at any of the several stations. If for some reason a fastener did not advance a sufficient amount, so as to be properly positioned in the piercing pocket of the tool assembly, the finished assembly was not only ruined, but the high production tools were broken. The present invention has been developed to eliminate this condition.

With the above problem in mind, several approaches to the problem were tried. During this experimentation the presence of foreign material, such as grease, oil, and chips were noted. Because of the presence of this foreign material, it was evident that no existing spring loaded, air or fluid control would insure positive and uninterrupted automatic action of the feeder.

It became very evident that in order to control the feeder, an electronic device had to be employed. Although the space limitation is restricted, it was felt that an electronic control would have to be located in the piercing pocket of the tool, since checking the position of the fastener at any other location or time would not insure proper positioning of the fastener in the final assembly. Because the tools used are high production and subjected to repeated shock impact as the press operates, another serious obstacle had to be overcome.

It is therefore an object of the present invention to provide a simplified, self contained, electrically controlled feeder mechanism which is inexpensive, durable, readily accessible and operable under adverse conditions.

Another object of this invention is a provision of a flexible fastener supply chute, which is cooperable with the feeder to automatically feed fasteners without interruption at high speeds.

Another object of the present invention is a provision of an electronic control which will function to stop the press, should a fastener fail to be properly positioned in the piercing pocket.

Still another object of this invention is a provision of an insulated contact, which acts as a stop to limit the forward travel of said fastener in the feeder head piercing pocket, while completing the circuit when properly positioned, to actuate the press.

The foregoing and related objects can be accomplished by the provision of a feed head mechanism for use with a punch press, wherein a flexible feed chute conveys clinch nut fasteners to a clinching mechanism; said clinch nut fasteners of rectangular configuration, having an enlarged body portion and a reduced shank; the forward

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edge of said clinch nut fastener in engagement with an insulated electrical contact in the piercing pocket of said feeder head; said electrical contact forming a stop in the piercing pocket of said feeder head; means for holding said clinch nut fastener under said punch member; the reduced body portion of said nut forming a piercing punch; said feeder being connected to one side of an electric circuit; said clinch nut fastener completing the circuit through said electrical contact in said feeder head, when said fastener is properly positioned, to actuate the punch press.

Other objects of this invention will appear in the following description and appended claim, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIG. 1 is a cross sectional view of the apparatus shown in an elevated position with the die member removed.

FIG. 2 is a left end elevation of FIG. 1.

FIG. 3 is an enlarged cross sectional view taken on lines 3-3 of FIG. 1.

FIG. 4 is a right end elevation of FIG. 1.

FIG. 5 is a bottom plan view of the device illustrated in FIG. 1.

FIG. 6 is a schematic drawing of the electronic circuit embodying the present invention, wherein several feed heads are used.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, FIG. 1 illustrates a cross sectional view of my electronically controlled feed head assembly 10, embodying the present invention. It will be readily understood that the details of the hopper feed and punch press are well known in the art and therefore have been omitted for the purpose of simplicity and clarity.

The feed head 10 of the present invention includes an upper housing assembly 18, fixed to the movable platen 12 of any suitable punch press, by cap screws 16. A lower housing assembly 20 is movably secured to the upper housing assembly 18 by a guide post 22 which is slidable in a vertical recess 64 formed in the upper housing assembly 18 and which is secured to the lower housing by cap screws 28. The lower housing assembly 20 includes a feeder tongue assembly 24 and a nose piece 26.

The guide post 22 is cylindrical in shape and has an undercut 23 on the lower portion thereof. The undercut portion 23 is adapted to receive the nose piece 26 which is secured to the post 22 by cap screws 28. The feeder tongue assembly 24 is positioned in a dovetail groove 25 beneath the guide post 22 and abuts the rear face 30 of the nose piece 26 (see FIGS. 1 and 5). The feeder tongue assembly 24 is held in position by a spring loaded locking pin 44 which extends through an eccentrically positioned bore 40 in the guide post 22. The top portion 42 of bore 40 is somewhat larger in diameter than the lower portion 46, which provides the bearing surface in which the locking pin 44 operates. The lock pin 44 has a reduced diameter 48 beneath the cylindrical body portion, which extends through an opening 50 in the feeder tongue.

The cylindrical body portion of lock pin 44 has a flanged section 52, the underside of which seats against the square bottom 43 of bore 42 so as to limit the extension of the locking pin. The lock pin 44 is positioned

by a compression spring 56 which seats against the top of flange 52. The other end of compression spring 56 is seated in spring seat 58 located in a recess 60, cut from the platen 12 of the punch press 14. Should it be desirable to disconnect the feeder tongue assembly 24 from the lower housing assembly 20, one merely inserts a rod into opening 50, through the longitudinal slot 62 in the tongue member 24 and exerts enough force to compress spring 56. When the reduced diameter 48 has been moved up sufficiently to disengage the tongue the entire tongue assembly is moved to the right. The top flange 52 on the lock pin 44 prevents the escape of the pin. Reassembly of the feeder tongue 24 is accomplished in the reverse manner.

The cylindrical pilot post 22, which is secured to the nose piece 26, is slideably mounted in a bore 64 in the upper housing 18. A vertical key slot 66 is cut in the circumference of the guide post 22 and has positioned therein the end 67 of a cylindrical locator pin 68, which extends at right angles to the guide post 22 and through the upper housing 18. The cylindrical locator pin 68 is held in position by a forked finger member 70 (FIG. 4) mounted on face 72 of the upper housing 18. Thus the stationary lower housing assembly 20 is connected by the guide post or pilot post 22 to the upper housing assembly which can move up and down with respect to the lower housing assembly 20 and the work supporting die (not shown).

In the forward portion of the upper housing 18, is a punch member 71 rigidly mounted in an opening 73. The lower portion 74 of the punch 71 is rectangular in shape and of the same general configuration as the body of the fastener which is used. The rectangular lower section 74 of the punch 71 fits into a similar rectangular opening 76 in the nose piece 26. A ball detent device 80 is located on the forward wall 78 of the rectangular punch opening 76, to prevent the rectangular fastener, which has been fed to the punch, from becoming turned or otherwise misplaced before piercing. Also located on the forward wall 78 of opening 76, and above the ball detent 80, is an insulated electric contact 82 which acts as a stop member to limit the forward travel of the fasteners as they are fed into the piercing pocket.

Mounted in the sidewalls of the nose piece 26 are two cam finger members 84 mounted on pivot members 86 (see FIGS. 1 and 3), which laterally positions the fastener 100, prior to piercing. Intermediate the pivots 86, and intersecting the forward wall of the rectangular opening 78, is a cleanout and access opening 88 which makes accessible the insulated contact stop member 82. The insulated contact member 82 can be readily raised to eliminate jams in the nose piece 26 should they occur in the otherwise non-accessible portion.

Having thus described the general arrangement of parts, the device functions as follows:

With the flexible plastic chute 90 secured at one end to a feed hopper and at the other end to the feeder tongue assembly 24 in the manner shown, clinch fasteners 100 (shown in phantom in FIGURE 3) will flow through the plastic chute and into the feeder tongue 24. Since the feed hopper (not shown) is mounted above the feeder, the force of gravity causes the fasteners to move through the flexible plastic chute and feeder tongue to a position beneath the end 74 of punch 71. A plastic feed chute is used because it is low in friction, inexpensive, and because it will stand up longer under the flexing condition under which it operates. Further, when the plastic chute fatigues to a point where failure occurs, a minimum amount of machine down time results. The broken section of the chute is removed and the ragged end squared up with a pocket knife and reassembled. This is not possible with a metal chute. The fastener 100 is positioned (as shown in FIG. 3) on two fingers 84A of the pivotal members 84. The forward movement of fastener 100 is limited by stop member 82, which is also an insulated

electrical contact. All of the stop contact 82 is insulated from the head assembly, a small portion facing the feed chute in the piercing pocket being exposed to contact a fastener when the fastener is in proper position in the pocket.

FIG. 6 shows schematically one form of control system for operating the press. The control system includes a circuit which controls the operation of the press, which circuit can be completed only when all fasteners are properly positioned in the feeder heads. As shown in this figure the lines L-1 and L-2 designate any suitable source of alternating current of suitable voltage. The broken lines marked CR-1, CR-2 and CR-3 respectively designate relays in each of which a primary element 104 is constantly connected across the power source by a line 201, 205, or 209, respectively. Also each relay includes a secondary element 103 which can have its opposite ends electrically connected together by the wire 102, housing 20, the fastener 100, contact 82 and ground. In each relay the elements 103 and 104 are electrically interlocked, as is well known and as is indicated by the angled broken line 105. Everything marked CR-1 is part of the same relay C-1; everything marked CR-2 is part of another relay CR-2 and everything marked CR-3 is part of still another relay CR-3. The normally closed contacts 107 of CR-1 at location 203 are actuated by the elements 103 and 104 of CR-1, as will be more fully explained, and this is disclosed in FIG. 6 by the broken line 106 connecting the contacts 107 at location 203 to the broken line designating relay CR-1 and surrounding the elements 103 and 104 of that relay. Similarly the broken line 108 connecting the normally open contacts 110 of the CR-1 relay at location 214 of FIG. 6 to the contacts 107 at location 203 and through the broken line 106 to the elements 104 and 103 indicates that the CR-1 contacts 110 at location 214 are also actuated by the elements simultaneously with the actuation of the contacts 107 at location 203 of the CR-1 relay, one set of contacts being opened when the other is closed.

FIG. 6 shows that when any element 103 has its opposite ends electrically connected or grounded by a fastener 100 in position, and the power is on the lines L-1 and L-2, the corresponding contacts 107 are opened and the corresponding contacts 110 are closed. It also indicates that when any element 103 has its ends disconnected by absence of a fastener in the corresponding head, the corresponding relay is in normal condition with its contacts 107 closed and its contacts 110 open.

FIG. 6 shows that a plurality of feed head assemblies are used, for example three on one punch press, as is represented by a contact 82, a lower housing assembly 20 (which acts as a nut-positioning assembly) and a fastener 100 at each of positions PT-1 or PT-2 and PT-3. Each head assembly is constructed as illustrated in FIGS. 1 to 5 and all are operated by the single platen 12. As shown in those figures pierce nuts 100 are feed through the chute 24 of each lower housing assembly 20, the fasteners being fed into the nose piece opening 76 until stopped and positioned by the contact 82 and detents 84. Thereafter when the punches move down, by actuation of the movable platen by controls to be explained, each fastener 100, momentarily held in position by the spring detents 84, is pushed down toward stationary work to pierce the work in a conventional pierce nut operation as disclosed and claimed in the patent to W. E. Strain, et al. 2,707,322, assigned to the assignee of this application.

Each nut or fastener 100, when positioned in a bore 76, contacts the electric contact member 82 in such bore. Each such contact 82 therefore assists in showing that a nut is in position. Each contact 82 is connected to ground by a conductor 101. In addition each of the lower feed housing assemblies 20 is connected to ground independently of its contact member 82 by a conductor 102 through

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the corresponding secondary element 103. The electrical interlocking of the elements 104 and 103 is such that if the power is on, and if there is no fastener 100 between a pair of lines 101 and 102, a normally closed pair of contacts 107 remains closed and normally open contacts 110 remain open. When a fastener 100 touches a contact 82, a current flows in corresponding secondary element 103 because its ends are electrically connected by being connected directly to ground and because element 103 is interlocked with element 104. When this current flows in element 103 the relay is actuated to open the corresponding contacts 107 and close the corresponding contacts 110.

A limit switch LS-1 at location 207 of FIG. 6 includes a normally closed switch or contact arm 112 connected by a mechanical connection 114 to a normally open switch or contact arm 116. The switch LS-1 is in the closed position shown in FIG. 6 when the punch press platen is at the top of its stroke. When the punch press platen has moved a predetermined distance toward the lower end of its stroke it opens the switch 112 and closes the switch 116.

When the contacts 107 of relay CR-1 at location 203 are closed a lamp A associated with that relay is lighted, being supplied with current from line L-1, switch 112 and contacts 107 of relay CR-1 at location 203. This indicates that there is no fastener 100 in proper position at PT-1 and that the platen is up. When any contacts 107 of any relay are closed, as they normally are, and the corresponding lamp is therefore lighted, the corresponding contacts 110 at location 214 are necessarily open. This prevents current from energizing an element 118 of an additional safety relay CR-4 (which must be energized for the press to operate). De-energized element 118 permits normally closed contacts 120 in line 215 of the relay CR-4 to remain closed. Consequently a solenoid 99 is energized from L-1 by line 215 to prevent operation of the press.

The explanation given above for contacts 107 forming part of the relay CR-1 with respect to lamp A applies to contacts 107 at location 207 and forming part of relay CR-2 with respect to lamp B, and to contacts 107 at location 211 and forming part of relay CR-3 with respect to lamp C. When and only when all fasteners are in proper position at PT-1, PT-2 and PT-3, all of relays CR-1, CR-2 and CR-3 are operated to open all normally closed contacts 107, extinguishing all lamps A, B and C, and to close all normally open contacts 110. This supplies current to coil 118 of relay CR-4 which then opens contacts 120 to deenergize solenoid 99 to permit operation of the press to apply all fasteners 100 to the work. One such operation of the press is accomplished by closing the power circuit to the press (not shown) by any suitable known means when such closing is permitted by the de-energized solenoid 99.

However, if a fastener is not properly at any position PT-1, PT-2 or PT-3 (which disables secondary relay element 103 from responding to and interlocking impulse from primary element 104 so that normally closed contacts 107 remains closed) the corresponding contacts 110 remain open, the relay CR-4 remains de-energized, the normally closed contacts 120 remain closed, the solenoid 99 remains energized and the press cannot operate. Also, since the corresponding contacts 107 remain closed one or more lamps light, thus indicating where the trouble is.

It is contemplated that the invention will be used with any suitable conventional punch press of known construction. As is known in the art, such presses frequently operate one cycle and stop automatically upon being set into operation by a manual control. That is the platen is normally up or at the upper limit of its stroke. When the manual control is operated the press makes a complete downstroke, and returns to its up position, where it stops. The disclosure of such press operation in detail

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is unnecessary to an explanation of this invention which is concerned only with preventing or permitting operation of a conventional punch press.

As the punches start to come down the fasteners 100 are first moved out of contact with the contacts 82 before they can be transferred to the work at the end of the downstroke. This disconnects each of the secondary elements 103 from its ground connection at 101. This immediately restores each of the relays CR-1, CR-2 and CR-3 to its normal condition which would open contacts 110 at location 214. Unless means is provided to prevent it, this would de-energize the element 118 of the relay CR-4 and this would let normally closed contacts 120 at location 215 close again and this would energize solenoid 99 to prevent operation of the press. Such means for preventing this is included in the limit switch LS-1.

As the platen starts to descend, that is as the punches come down, a mechanical connection (not shown) between the platen and limit switch LS-1 operates this switch to open switch 112 at location 207 and close contacts 116 at location 213. Opening of switches 112 keeps the lamps A, B, C out. Closing of switch 116 by-passes the series of contacts 110 to supply current to coil 118 of relay CR-4 to open normally closed contacts CR-4 at location 215, which de-energizes solenoid 99 which insures completion of the cycle of the press after the fasteners have been pushed out of contact with the contacts 82.

The completion of the downstroke and the consequent upstroke or return of the punch press is accomplished inherently and automatically by the construction of the press itself including its power circuit as is known, as long as power is supplied to the punch press. The limit switch LS-1 assures the continuity of the cycle, that is the completion of the down stroke and subsequent return, after the stroke is begun, by maintaining current in the element 118 of relay CR-4 through closed switch 116. This maintains the normally closed contacts 120 open and maintains the solenoid 99 de-energized so as to permit continued operation of the press.

After the completion of the downstroke the platen returns to its up position in the customary and known way due to the inherent operation of the press. The upstroke closes switch 112, opens switch 116, and withdraws the punches from in front of the feeder assemblies 24. Then the fasteners are again fed by gravity into their various positions against contacts 82 as described above. When all of the fasteners are in position the control circuit is energized as before described to actuate all of the relays CR-1, CR-2 and CR-3 to extinguish the lights, and close contacts 110. The press is now in condition to be operated again by closing its power circuit with the known manual controls as described above.

Each lamp A, B and C may be provided with a switch 122 which normally connects the lamp with the appropriate contacts 107. These switches may be connected to a line 124 at location 204 or 208 or 212 to light the lamp when desired, for example, when someone is working on the control system.

I claim:

In an apparatus for simultaneously installing a plurality of pierce nuts in a panel and including a press, a plurality of press-actuated feed heads each having a nut-locating bore, means for supplying nuts one after another to an initial position in each of said bores and a punch movable by said press in each of said bores respectively, between a first retracted position at which a nut is in said initial position in bore between the punch and the panel and an extended position at which the nut located in each bore is displaced from said initial position toward said panel, the improvements of a control system for preventing actuation of the press in response to the absence of a nut in any one of said bores and for indicating such

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bore, comprising means connecting each of said heads, respectively, to one side of a separate relay element corresponding to such head, a contact means located in each of said bores, each of said contact means being insulated from its feed head and being connected to the other side of said relay elements, each of said contact means being adapted to be touched by a nut in its bore so that when a nut is in such bore and in contact with its feed head both sides of the corresponding relay element are connected together, each of said relay elements being operative in response to connection of its sides to open a set of normally closed contacts and to close a set of normally open contacts, a limit switch responsive to the position of the press and having a first contact arm closed when the press is open and said punches are in their retracted positions and having a second contact arm closed in response to predetermined movement of the punches away from said retracted position, a separate warning light supplied with current when each of said contact means in said bores is touched by a nut, said lights being connected in parallel to one side of a source of electrical current and connected to the other side of said source by said normally closed contacts and through the first contact arm of said limit switch, an additional safety relay connected to one side of said source of current and connected to the other side of said source through all of said sets of normally open contacts in series when such contacts are closed by said relay elements, said safety relay having a pair of normally closed contacts, said second switch arm of said limit switch also connecting said additional safety relay to the other side of said source

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of current to by-pass said normally open contacts of said relay elements, a press trip solenoid energizable to prevent actuation of said press, said solenoid being connected to one side of said source of current and being connected to the other side of said source by said normally closed contacts of said safety relay, whereby said relay elements are each controlled by the presence of a pierce nut in the bore of the corresponding feed head to prevent supply of current to said warning lights from the first contact arm of the limit switch when said punches are in their retracted positions and whereby said additional safety relay is conditioned by the closure of all the normally open contacts of said relay elements to de-energize said trip solenoid when said nuts are in position, said additional safety relay being maintained in said de-energizing condition by the second contact arm of said limit switch as the press is actuated to thereby maintain de-energized said solenoid despite displacement of said nuts and consequent disconnection of the sides of the relay elements, and whereby the absence of a nut in any one of said feed heads prior to actuation of said press will light the corresponding warning light and will energize said solenoid to prevent press actuation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,745,873	Stoltz	Feb. 4, 1930
2,186,841	Rylander	Jan. 9, 1940
2,652,942	Muchy	Sept. 22, 1953
2,731,124	Kaplanowski	Jan. 17, 1956
2,896,213	Alderman et al.	July 28, 1959