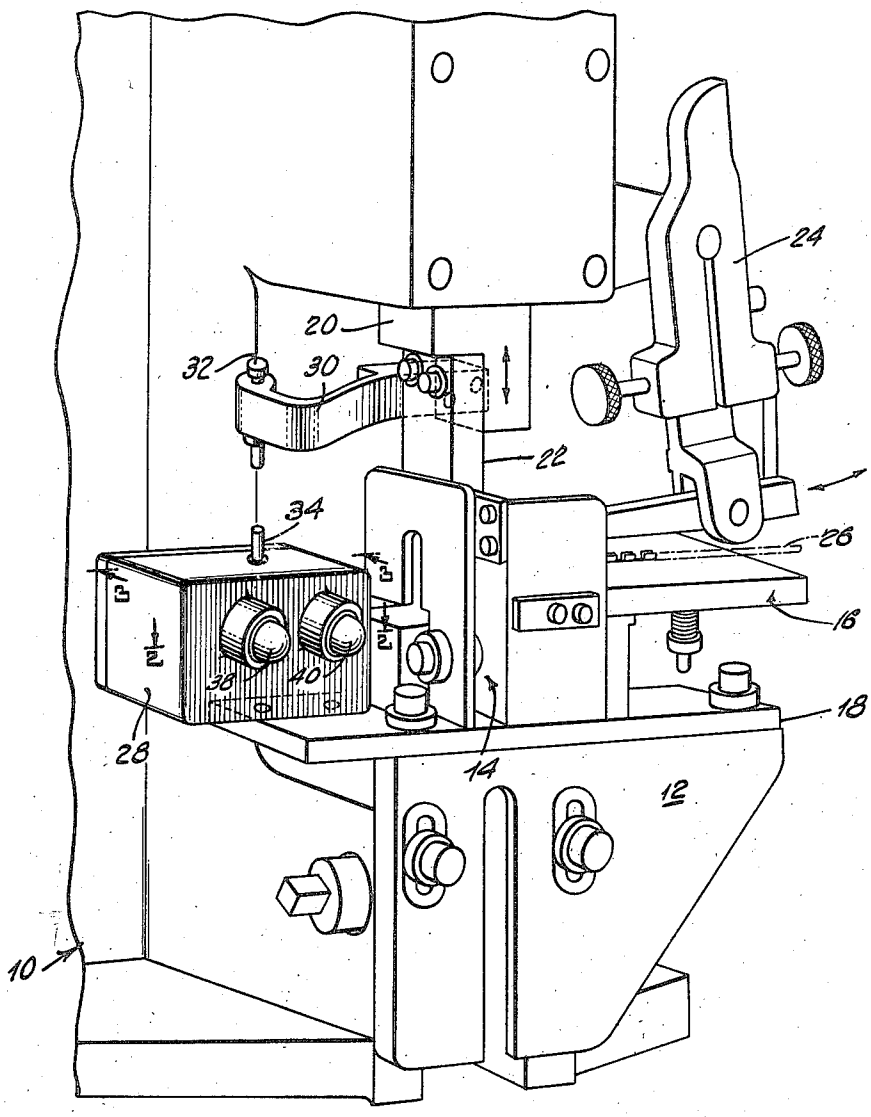
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TERMINAL APPLICATOR WITH AUTOMATIC CYCLE AND QUALITY CONTROL

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Fig. 1.



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Fig. 2.

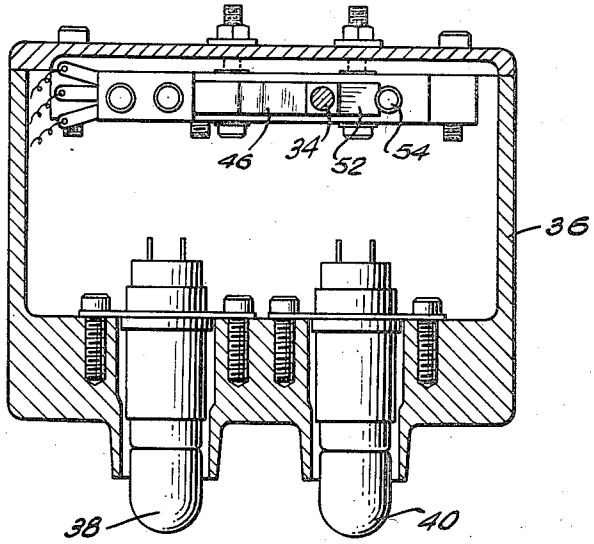


Fig. 3.

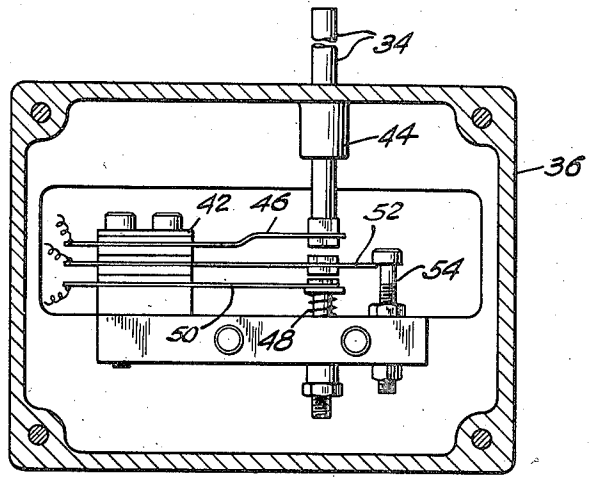
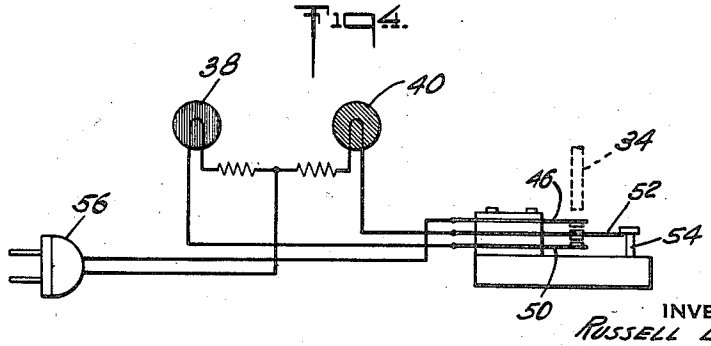


Fig. 4.



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Fig. 5.

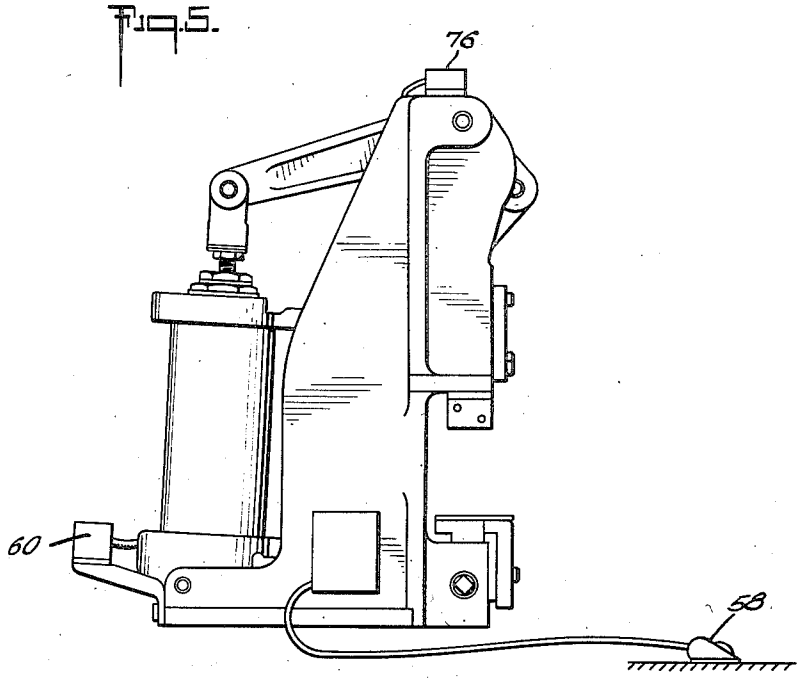
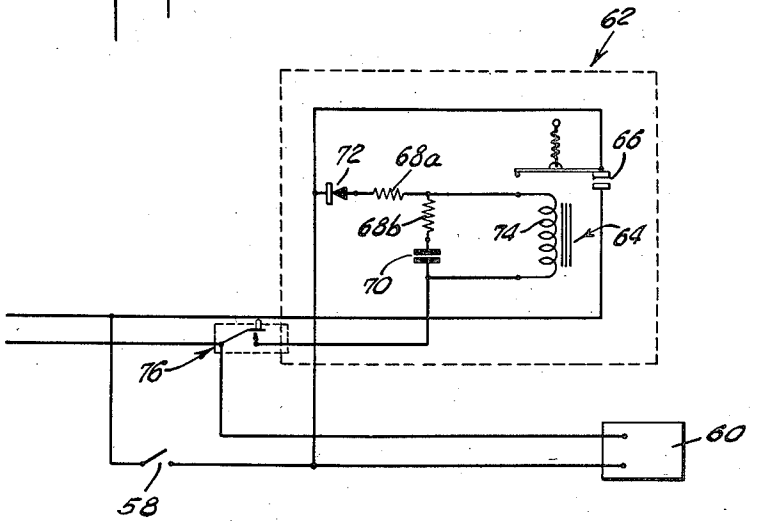


Fig. 6.



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TERMINAL APPLICATOR WITH AUTOMATIC CYCLE AND QUALITY CONTROL

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Application July 17, 1953, Serial No. 368,746

5 Claims. (Cl. 1—177)

This invention relates to automatic machines for crimping connectors one at a time to wires and more particularly to an indicator mechanism for continually determining and indicating whether or not the degree of crimping is within acceptable limits and for automatically controlling the degree of crimping.

In the precision application of connectors to wires by pressure forming the degree of crimping is often highly important if not critical to the proper formation of a good electrical connection. A machine that is set for one size connector will not operate satisfactorily upon another and often after a period of use the dies or adjustments of a particular machine may become sufficiently worn so as to produce inferior crimped connections that will fail in tensile or other tests. In addition under certain conditions and with certain machines, it has been found that a full cycle of operation was not being obtained with the result that the connections were incompletely formed.

It is accordingly an object of the present invention to provide an indicating mechanism for indicating when an automatic terminal applying machine is operating within the desired limits of crimping. Another object of the present invention is to provide a depth of crimp indicator mechanism by which the operator can tell continuously and instantaneously whether an acceptable crimp has been made on a particular connector and wire. It is another object of the present invention to provide a crimp height indicator that may be readily applied to an automatic connector applying machine. It is another object to provide a depth of crimp indicator that is simple and easy to manufacture economically and that may be simply and easily adjusted and operated. It is another object of the present invention to provide an indicator mechanism that will show whether the crimping is too great or too little in addition to whether or not it is within acceptable limits. It is another object to provide an automatic uniform cycler mechanism that insures complete cycles of operation under all conditions and with all machines. It is a still further object to provide a mechanism for automatically determining the cycle of operation of an automatic machine independently of the control of the operator of the machine. These and other and further objects will be in part apparent and in part pointed out as the specification proceeds.

In the drawings:

Figure 1 is a fragmentary perspective view of the die assembly and applicator portions of an automatic connector applying machine showing an indicating mechanism according to the present invention applied thereto;

Figure 2 is a sectional view of line 2—2 of the indicator mechanism of Figure 1;

Figure 3 is a sectional view on line 3—3 of the indicator mechanism of Figure 1;

Figure 4 is a schematic wiring diagram of the indicator mechanism of Figures 1 through 3;

Figure 5 is a simplified view of a connector applicator embodying the invention; and

Figure 6 is a schematic wiring diagram of the automatic uniform cycler mechanism.

Referring now to Figure 1, there is shown a portion of an automatic terminal applying machine 10 which has a base assembly 12 which carries the lower die assembly 14 and the applicator mechanism 16 on a plate 18 fixed thereto. Above base assembly 12 is positioned the ram 20 which carries thereon the upper die assembly 22 and which is mounted for reciprocal movement to and from a position closely adjacent the lower die assembly 14. The machine 10 is provided with a strip feeding mechanism 24 of any suitable type for feeding connectors of the strip 26 one at a time into position between the die assemblies 22 and 14. The base assembly 12 may have mounted thereon an automatic uniform cycler mechanism, Figure 5, and/or a crimp height indicator 28, Figure 1, which is connected on plate 18 and shown in detail in Figures 2 and 3. With indicator 28 ram 20 has mounted thereon indicator actuating arm 30 which carries in the end thereof an adjustably positioned pin 32 to contact a corresponding pin 34 in the indicator mechanism itself.

Referring to Figures 2 and 3, the indicator mechanism 28 comprises an outer casing 36 which carries in one side thereof light bulbs 38 and 40 mounted to project outwardly thereof so that upon energization thereof they may be readily seen by the operator of the machine. Mounted on the opposite side of casing 36 is a three element finger contact switch 42 and mounted in the top of the casing 36, in sleeve 44, is the plunger 34 which contacts the switch 42 and is positioned to be contacted by the pin 32 of the arm 30 as the ram 20 moves to its downward position. Pin or rod 34 rests on the upper finger 46 of the switch 42 in its normal position. The lower spring finger 50 of switch 42 is positioned on stop 48 while the middle finger 52 is spaced between fingers 46 and 50, its upward limit of movement being determined by adjustable stop 54.

In operation, as the ram moves downward the pin 32 contacts rod 34 to first close the contacts of fingers 46 and 52 and then to close, if necessary, the contacts of fingers 50 and 52. As may be seen from Figure 4, the closing of the contacts of switch fingers 46 and 52 closes the circuit from the power source represented by the plug 56 through the light 40 which is colored green in any suitable manner to indicate that the press is operating within the desired degree of crimping. If the ram 20 continues down further so as to cause the pins 32 and 34 to close the contact between fingers 50 and 52, the light 38 will be energized. This light is normally colored red to indicate that the assembled connector and wire have been crimped excessively so as to be likely to cause a weak or defective connection.

Thus in operation the pin 32 and the stops 48 and 54 are adjusted so that for the desired degree of crimping only the contacts of the arm 46 and 52 are closed. The limits of the acceptable range can be controlled by varying the position of the stops 54 and 48 and of the pin 32 so that the indicator may be made to have a wide or a narrow range of crimp height or depth as desired.

After the indicator mechanism has been once adjusted, flash of the green light 40 indicates that the machine is operating properly and that the desired degree of crimping is being obtained. A flash of green light followed by a flash of red light indicates that the ram 20 has descended too far and that the dies are crimping the assembled connector and conductor excessively so that defective connections that may break under tensile stress are likely to be formed. Conversely no light flash at all indicates that the crimping has not been carried far enough so that an inferior connection is being formed that may likely pull apart under tensile stress.

The operator may thus at a glance determine whether or not the particular connector has been properly crimped to the wire in question. As the dies and adjustments begin to wear, or where for some reason a particular connector is damaged or defective, the inferior product can be spotted immediately and discarded before costly waste can occur. In addition, complicated and expensive inspection procedures may be eliminated by the use of this device.

There is thus provided a simple, dependable and economical indicating mechanism for automatic connector-applying presses that will continuously and instantaneously indicate the degree of crimping of each connector as it is crimped about a wire.

Referring now to Figures 5 and 6, the automatic uniform cycler mechanism comprises generally a foot control switch **58**, a press actuating switch **60** and a relay box **62** in which are positioned the various circuit components. These components comprise generally a relay **64** with its associated contacts **66**, time delay resistors **68** and capacitor **70** and rectifier **72**. These elements are connected together with the foot switch **58** and the press actuating control **60** as shown across a 110 volt alternating current line or other suitable power source, to provide an operation as follows: with the master switch of the machine in the "on" position and a terminal properly positioned in the crimping dies the operator steps on the foot switch **58** closing its contacts. This completes an energizing circuit for relay **64** which may be traced from the switch **58** through the rectifier **72**, the resistor **68***a*, and the relay coil **74** to the other side of the A. C. line. Closing of switch **58** also simultaneously energizes the press actuating control **60** which control may be a solenoid operated air valve or an electrically operated contactor mechanism for applying power to an electrically operated press mechanism.

Energization of relay **64** closes contacts **66** which provide a holding circuit across the foot pedal **58** so that if the operator should remove his foot prior to the completion of the cycle of operation of the press the press will not be disabled but the operating cycle will be fully completed. This circuit may be traced from the side of the line to which switch **58** is connected through the contacts **66** through the control **60** to the other side of the A. C. line. This also provides a holding circuit for the relay **64** from the contacts **66** through the rectifier **72**, coils **74** and to the other side of the line at switch **76** which typically may be a normally closed microswitch that is mounted on the press mechanism in a position so as to be opened by any convenient portion of the stroking mechanism of the press when the press ram substantially complees its connector crimping stroke toward the press bed. Contacts **66** remain closed and maintain this holding circuit until switch **76** is mechanically opened by the driving linkage of the press mechanism as it reaches the end of its cycle of operation. The resistors **68** and the capacitor **70** form a time delay circuit of approximately one quarter of a second so that the contacts **66** will be maintained in the closed position for approximately one quarter of a second after switch **76** is opened. Thus once the cycle of operation of the press is initiated by the operator the press will complete one cycle of operation whether or not the operator removes his foot from the foot pedal switch **58** prematurely. Uniformly high quality crimps are consequently assured. Also in an air actuated type press, if the air pressure falls below the limit necessary to perform the specific job, this uniform cycler will not allow the air piston to return until sufficient pressure builds up to complete the cycle.

While there are given above certain specific examples of this invention and its application in practical use and also certain modifications and alternatives, it should be understood that these are not intended to be exhaustive or to be limiting of the invention. On the contrary, these

illustrations and the explanations herein are given in order to acquaint others skilled in the art with this invention and the principles thereof and a suitable manner of its application in practical use, so that others skilled in the art may be enabled to modify the invention and to adapt and apply it in numerous forms, each as may be best suited to the requirements of a particular use.

What is claimed is:

1. In a machine for automatically pressure forming electrical connectors one at a time about conductors and having a ram and crimping die structure movable toward and away from the crimping position of the connectors in each cycle of crimping operation, power means for driving the ram, power control means for energizing said power means and operable to initiate a crimping cycle, holding means automatically operative upon initiation of a crimping cycle to maintain said control means effective to energize said power means, means activated in response to substantial completion of the forward crimping stroke of the ram to disable said holding means thereby to de-energize said power means, and time delay means for maintaining effective said holding means for a predetermined time after actuation of said last-named means.

2. In a machine for automatically pressure forming electrical connectors one at a time about conductors and having a ram and crimping die structure movable toward and away from the crimping position of the connectors in each cycle of crimping operation, power means for driving the ram, power control means for energizing said power means including a starting switch manually operative to initiate a crimping cycle, a full stroke compelling means for assuring uniform cycles of ram operation upon successive operations of said manual switch respectively including bypass means for said starting switch operative upon initiation of a crimping cycle to maintain said control means effective to energize said power means regardless of starting switch position, switch means operative upon the ram substantially completing its forward crimping stroke to disable said bypass means, and timing means for maintaining effective said bypass means for a predetermined time after actuation of said switch means.

3. In a machine for automatically pressure forming electrical connectors one at a time about conductors and having a ram and crimping die structure movable toward and away from the crimping position of the connectors in each cycle of crimping operation, power means for driving the ram, power control means for energizing said power means including a starting switch manually operative to initiate a crimping cycle, a full stroke compelling means for assuring uniform cycles of ram operation upon successive operations of said manual switch respectively including means operative upon initiation of a crimping cycle to bypass said manual switch to maintain said control means effective to energize said power means, a holding circuit for maintaining the bypass means effective, regardless of starting switch position, switch means operative upon the ram substantially completing its forward crimping stroke to open said holding circuit, and timing means for delaying the disabling of said bypass means upon opening of the holding circuit therefor.

4. In a machine for automatically crimping electrical connectors one at a time about conductors of a type having a master press control for the primary driving mechanism of the machine and a secondary operator-actuated switch for initiating each cycle of operation, an automatic uniform cycler circuit coupled to said press control and said secondary switch including holding means automatically operative upon initiation of a crimping cycle to maintain said press control effective to energize the driving mechanism, means actuated in response to substantial completion of the crimping stroke of the machine to disable said holding means thereby to de-energize said driving mechanism, and time delay means

for maintaining effective said holding means for a predetermined time after actuation of said last-named means.

5. In a machine for automatically crimping electrical connectors one at a time about conductors of the type having a master press control for the primary driving mechanism of the machine and a secondary operator-actuated switch for initiating each cycle of the operation, an automatic uniform cycler circuit including a power source, a relay coupled in series with said source and having a pair of contacts adapted to provide a bypass circuit for said secondary switch upon energization of the relay, a holding circuit for said relay and including said contacts and adapted to maintain said relay and said press control energized after initiation of a cycle of operation, a normally closed switch in said holding circuit and adapted to be opened by the crimping-stroke

upon substantial completion of the crimping stroke of the machine thereby to disable said holding circuit, and time delay means including a resistor and capacitor network in said holding circuit for maintaining said relay energized for a predetermined time subsequent to the opening of said normally closed switch.

References Cited in the file of this patent

UNITED STATES PATENTS

1,873,125	Holmes	Aug. 23, 1932
2,208,819	Smith	July 23, 1940
2,324,080	Haunty	July 13, 1943
2,433,585	Warner	Dec. 30, 1947
2,474,482	Lovick	June 28, 1949
2,577,907	Miller	Dec. 11, 1951