United States Patent [19]

Baldyga

[11] **3,795,962**

[45] **Mar. 12, 1974**

[54] **TERMINAL SENSOR**

[75] Inventor: **Joseph W. Baldyga,** Mt. Clemens, Mich.

[73] Assignee: **Diamond Die & Mold Co.,** Mt. Clemens, Mich.

[22] Filed: **July 14, 1972**

[21] Appl. No.: **271,836**

[52] **U.S. Cl.** ..... **29/203 D**

[51] **Int. Cl.** **H01r 43/04**

[58] **Field of Search** ..... 29/203 D, 203 DT, 203 S, 29/203 R, 203 P, 200 A

[56] **References Cited**

UNITED STATES PATENTS

2,768,425	10/1956	Andren	29/203 D
3,267,556	8/1966	Scharf	29/203 D
3,428,843	2/1969	Keller	29/203 D

Primary Examiner—Thomas H. Eager

Attorney, Agent, or Firm—Whittemore, Hulbert & Belknap

[57] **ABSTRACT**

An automatic system for severing a length of wire from a supply, stripping insulation from one end, applying a metal terminal to the stripped wire end, attaching a terminal to the end of the wire by crimping in a press, advancing the end of the wire with the terminal attached to a sensor, determining whether or not a terminal has been applied to the wire, and terminating automatic operation of the system if the sensor determines that the wire does not have a terminal attached.

9 Claims, 7 Drawing Figures

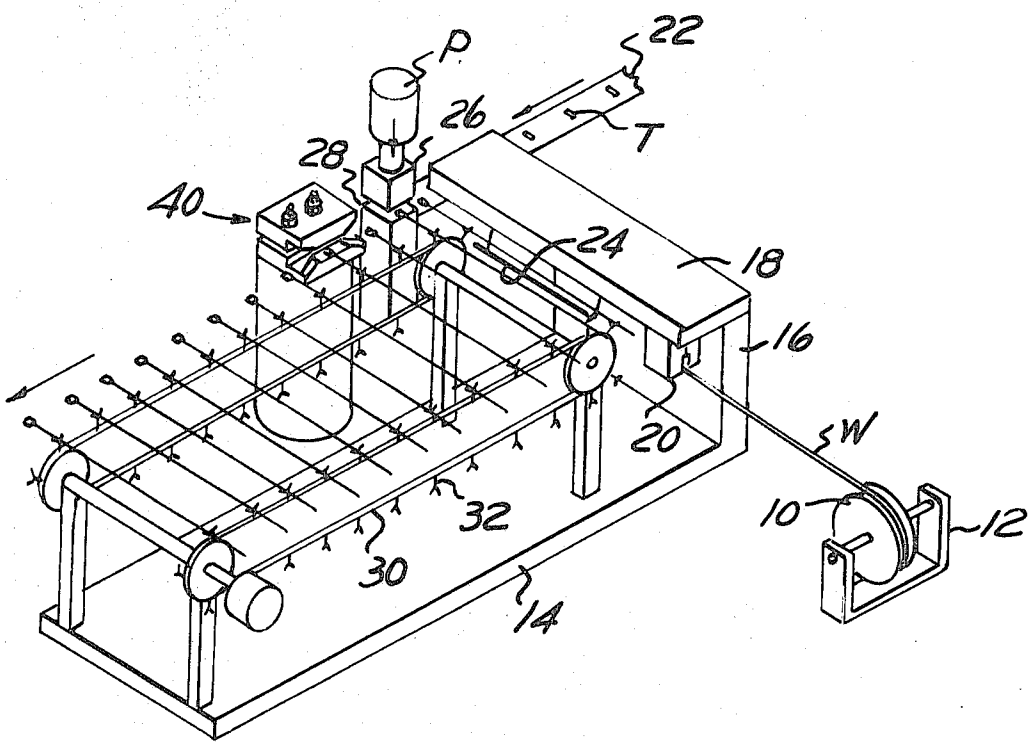
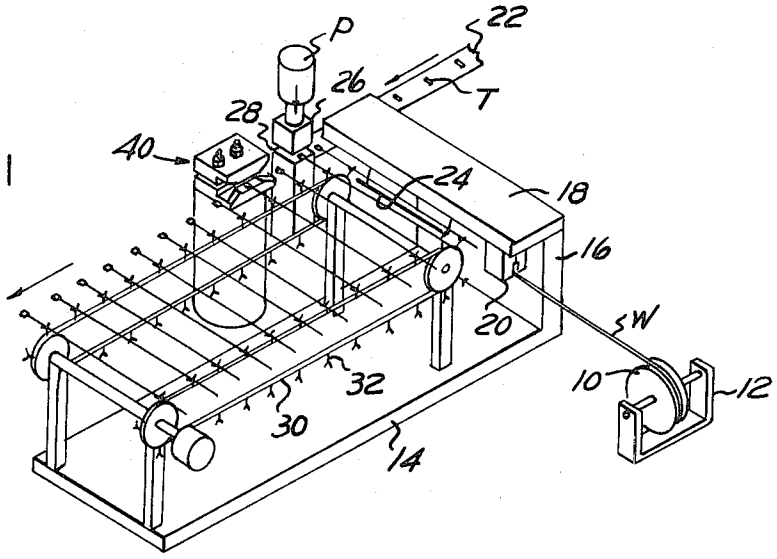


FIG. 1



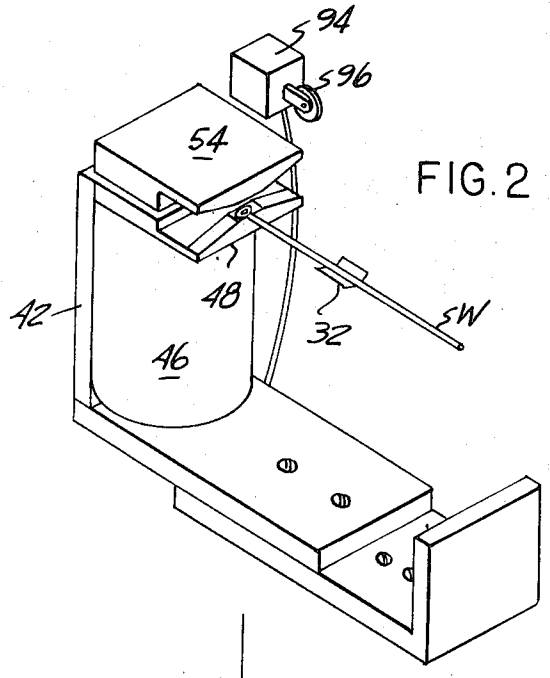


FIG. 2

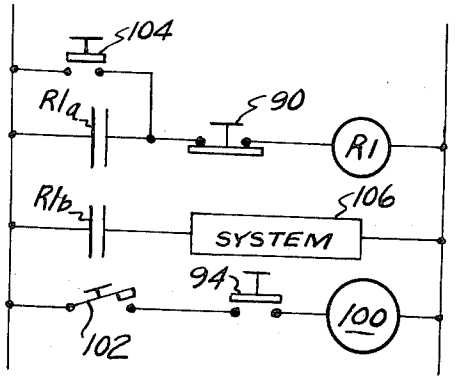


FIG. 7

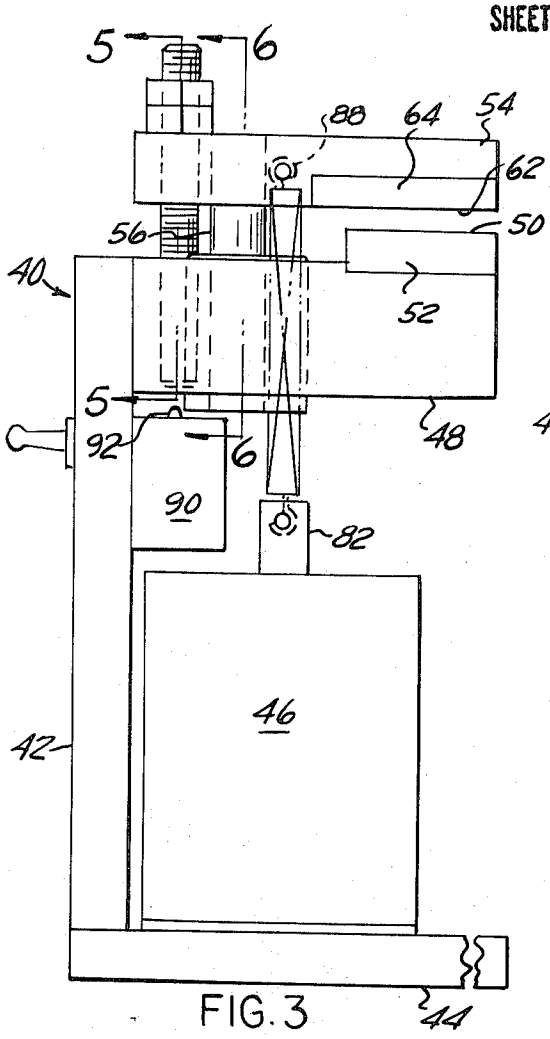


FIG. 3

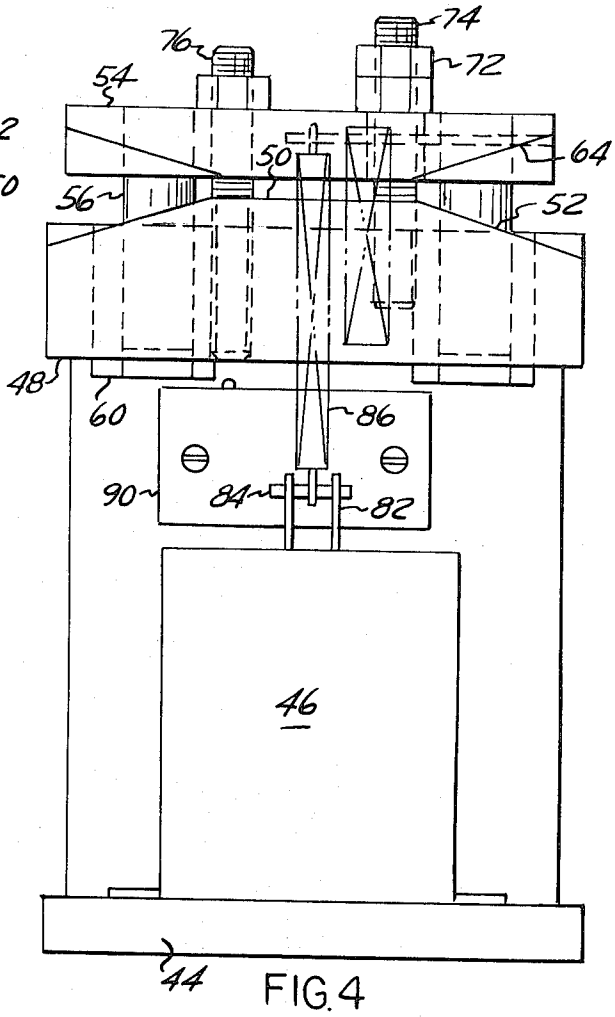


FIG. 4

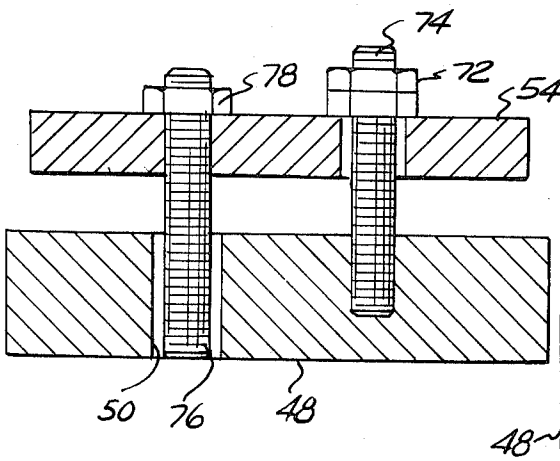


FIG. 5

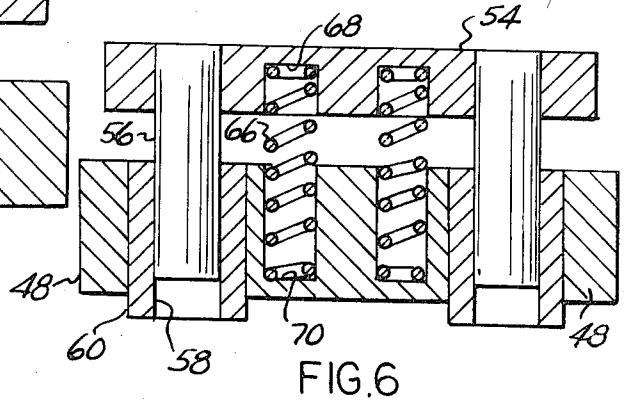


FIG. 6

TERMINAL SENSOR

BRIEF SUMMARY OF THE INVENTION

The present invention relates to the combination of automatic mechanism for preparing wire sections for the application of terminals and the automatic attachment of terminals to a bared wire end by means of a crimping press, and means for sensing each completed wirre section supplied with a terminal to determine if a terminal has been properly applied. If no terminal has been applied the sensor terminates automatic operation of the mechanism. More particularly, the mechanism draws a length of wire from a reel, cuts it to the proper length, strips insulation from the forward end of the wire, advances the bared end of the wire into an open terminal, and advances the wire and loosely applied terminal to a crimping press which operates to crimp the terminal permanently in place on the bared end of the wire. So long as the operation is being performed satisfactorily, it continues in a fully automatic manner, terminals being supplied to the press by suitable terminal advancing means in which the terminals may be separately applied to a tape or the like.

Immediately adjacent the press, in accordance with the present invention, there is applied a terminal sensor. The operation of the mechanism is intermittent and after a terminal has been applied to a wire in the press, the completed unit is advanced one step in which it may be received in the sensor. Alternatively, the sensor may be spaced somewhat further from the press so that a small number of units may be positioned intermediate the press and the sensor.

In general terms, the sensor comprises an anvil and a head movable through the medium of a relatively light spring actuated by a solenoid. If a satisfactorily applied terminal is on the anvil, movement of the head is arrested, the solenoid is de-energized, and the operation continues in a fully automatic manner. If however, a satisfactorily completed terminal is not present in the sensor upon any single operation thereof, the head continues downwardly and actuates a micro-switch which is effective to terminate automatic cycling of the mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view of the complete apparatus.

FIG. 2 is an enlarged perspective view of the terminal sensor.

FIG. 3 is a side elevation of the terminal sensor.

FIG. 4 is a front elevation of the terminal sensor.

FIG. 5 is a fragmentary sectional view on the line 5—5, FIG. 3.

FIG. 6 is a fragmentary sectional view on the line 6—6, FIG. 3.

FIG. 7 is a diagrammatic showing of the control circuit for the system.

DETAILED DESCRIPTION

Referring first to FIG. 1 the entire system is illustrated more or less diagrammatically in perspective. A supply of insulated wire W is provided on a reel **10** which is shown as supported on a bracket **12.** The system includes a frame **14** made up of an end plate **16** and a top plate **18** carrying at its underside mechanism diagrammatically indicated at **20** which withdraws a measured length of wire from the reel **10,** strips insulation from at least its forward end, advances the bared end of the wire into an open terminal T preferably carried by a tape **22** which is intermittently advanced by the machine, and deposits the length of wire in an open topped tray indicated at **24.**

The press is diagrammatically indicated at P and includes a vertically movable ram **26** normally spaced from a base **28.**

During automatic cycling of the machine the wire carrying an open terminal into which the bared end of the wire W has been inserted, is intermittently advanced to position the open terminal between the base **28** and the ram **26** of the press P. This may conveniently be accomplished by an endless conveyor comprising belts **30** carrying a sequence of supports **32,** the supports including upwardly extending arms adapted to engage severed portions of the wire W to lift them from the open tray **24** and convey them into operative relation to the press P. In some cases the severed length of wire may be moved into registration with the open terminal and moved into the terminal while the terminal is in position beneath the ram **26** of the press. At this time the press is actuated, the ram moves downwardly to crimp the terminal permanently onto the bared end of the wire and returns upwardly. Upward movement of the ram **26** may be arranged to time advance of the tape and to initiate operation of the wire withdrawing, severing, and stripping mechanism diagrammatically indicated at **20.**

The foregoing apparatus is of known construction and has not been shown in detail.

The present invention comprises the addition of a sensor **40** which is positioned as close as practical to the press P so as to reduce to a minimum wires advanced by the conveyor belts **30** and located intermediate the press P and the sensor **40.**

Referring now more particularly to FIGS. **2–6,** the sensor comprises a stand **42** including a base **44** on which is mounted a housing **46** containing a solenoid, and forwardly extending arm **48.** The forward end of the arm **48** is provided with an anvil surface **50** and inclined guide surfaces **52.**

Carried by the sensor **40** is a sensing bar or head **54** mounted for vertical movement by means of guide pins **56** movable in guide openings **58** provided in sleeves **60** carried in openings in the arm **48.** The sensing bar or head **54** includes a sensing surface **62** and inclined surfaces **64** which cooperate with surfaces **52** to provide tapering entrance and exit paths for the end of the conductor provided with the crimped terminals.

As best seen in FIG. **6,** compression springs **66** are provided in recesses **68** and **70** formed in the confronting surfaces of the head **54** and arm **48** respectively. These springs are selected to provide sufficient force to bias the head **54** upwardly but to permit downward movement thereof as will subsequently be described.

Upward movement of the head **54** is limited by stop nuts **72** carried by a stud **74** projecting upwardly from the arm **48.** The head **54** also carries an adjustable switch actuating stud **76** threaded into an opening in the head **54** and locked in place by a lock nut **78.** The lower end of the stud **76** is movable in an opening **80** which extends through the arm **48.**

The housing **46** contains a solenoid including a plunger connected to an upwardly extending connection **82** including a pin **84** by means of which a light

tension spring **86** is connected to a pin **88** carried by the head **54.**

Directly beneath the arm **48** there is provided a micro-switch **90** having an upwardly extending actuating button **92** adapted to be engaged by the lower end of the actuating stud **76** upon predetermined downward movement of the head.

In general terms a control system for the complete apparatus is provided which is effective to cause continuous repeated cycles of the machine so long as a supply of wire W remains on the reel **10** and so long as terminals T are supplied to the press P. Each time the press head moves downwardly a circuit is completed energizing the solenoid within the housing **46** and urging the movable sensor head **54** downwardly. This is timed to occur at an interval during which the conveyor **30** is at rest and while, if the apparatus is operating satisfactorily, a completed assembly of terminal and wire end is located in the space between the anvil surface **50** and the surface **62** of the sensor head. Downward movement of the head **54** in response to energization of the solenoid is arrested before the lower surface of the stud **76** engages the button **92** of the microswitch **90.** If however, a properly finished terminal end of wire is not present in the sensor, the head **54** is permitted to move further downwardly so that the microswitch **90** is actuated by the stud **76.** This is effective to shut down operation of the entire apparatus until the supply of wire or terminals is renewed or until whatever difficulty caused the lack of a properly finished terminal in the sensor is corrected.

In FIG. **2** there is shown a switch **94** having an actuating arm **96** adapted to be engaged by a part of the apparatus movable downwardly with the ram **26** of the press. Thus, the switch **94** will be closed for a brief interval coinciding with the lowermost position of the press, at which time the conveyor **30** is of course stationary. The switch actuating stud **76** may be very accurately adjusted so that actuation of the micro-switch **90** will be prevented only if a complete crimped terminal is provided on a wire end. If no terminal were applied to the stripped end of the wire, as would be the case if the supply of terminals were exhausted, the bared wire end will not prevent actuation of the microswitch **90.** On the other hand, if the supply of wire on the reel **10** were exhausted, it will be appreciated that subsequent advance of the conveyor **30** would not advance a wire section to the sensor. Thus, if either the supply of wire or terminals is exhausted, the system will automatically shut down.

The control circuit for carrying out the desired operation is shown in FIG. **7** in which the winding of the solenoid contained in housing **46** is seen at **100,** in series with a manually on-off switch **102,** controlling operation of the solenoid. Also in series with manual switch **102** is the solenoid activation switch **94** which times operation of the solenoid with cycling of the entire system. Thus, whenever the ram **26** descends, solenoid **100** is energized to activate the sensor **40.**

Operation of the entire system, including the wire cutter and stripper, the means for inserting the wire end into an open terminal, and timed actuation of the press P and ocnveyor **30,** is controlled by a manual start-stop switch **104,** the system being diagrammatically represented in its entirety at **106.** Switch **104** energizes relay **R1,** in series with normally open contacts **R1***a* and normally closed switch **90.** Energization of relay R1 closes contacts **R1***a* in the holding by-pass, and closes contacts **R1***b*, starting operation of the system.

When the sensor is activated by closure of switch **102,** and operation of the entire apparatus initiated by momentary closure of start-stop switch **104,** the intermittent press operation energizes solenoid **100** at each cycle, and so long as properly finished terminals are sensed at the sensor **40,** the operation continues in a fully automatic manner. When the sensor senses as improperly finished piece, or the absence of a piece, the micro-switch **90** opens momentarily, opening the holding circuit relay **R1,** and terminating operation of the system.

I claim:

1. Apparatus comprising a system for continuous, automatic production of insulated wire elements having terminals crimped to bared conductors at one end thereof comprising an intermittently operated crimping press, means for intermittently advancing a length of insulated wire having its conductor bared at one end and having a terminal loosely applied thereto into the press, and for advancing a finished piece away from the press between press operations, the combination therewith of a sensor adjacent the press to receive the end portion of a wire element with a terminal crimped thereto, said sensor comprising means to determine whether a preceding press operation has produced a crimped terminal on a wire end, and means responsive to said sensor to shut down operation of the system in the absence at the sensor of a crimped terminal thereat.

2. Apparatus as defined in claim **1** in which the sensor comprises an anvil, a sensing head movable toward and away form the anvil, and a switch operable to terminate system operation actuated by predetermined approach to the anvil of the head.

3. Apparatus as defined in claim **2** comprising a solenoid, resilient means connecting the solenoid to said head to provide a non-positive force effective to move said head toward said anvil until its movement is arrested by engagement with the terminal wire end on said anvil.

4. Apparatus as defined in claim **3** in which said solenoid is energized through a switch closed intermittently by movement of a part of said system.

5. Apparatus as defined in claim **3** in which said sensor includes switch means including normally closed contacts in a holding circuit including a relay which when energized continues operation of the system.

6. Apparatus as defined in claim **2** in which said anvil and sensing head have inclined surfaces defining a tapered guide-way, and parallel sensing surfaces between which the terminal wire end is positioned after movement through said guide-way.

7. Apparatus as defined in claim **3** comprising spring means effective to move said head away from said anvil, and in which the resilient means connecting the head to the solenoid is effective to overcome said spring means to produce a resultant force urging said head toward said anvil.

8. Terminal applying apparatus comprising a press for crimping terminals to wire ends, a sensor, means for advancing a crimped terminal from said press to said sensor, said sensor comprising means engageable with a terminal operable to prevent further operation of said press in absence at said sensor of a properly applied terminal.

9. Apparatus as defined in claim **8** in which said sensor comprises a pair of relatively movable elements engageable with a terminal, and means operated in timed relation to operation of said press to effect relative movement of said elements to engage opposite sides of a terminal at each operation of said press.

* * * * *