

[54] **APPARATUS FOR ATTACHING
TERMINALS TO ELECTRIC CONDUCTORS**

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[22] Filed: **Feb. 25, 1974**

[21] Appl. No.: **445,532**

[52] U.S. Cl. **29/203 DT, 81/9.51, 29/33 M**

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

[58] Field of Search **29/203 DT, 203 DS, 203 D,**
29/33 M, 626; 81/9.51

[56] **References Cited**

UNITED STATES PATENTS

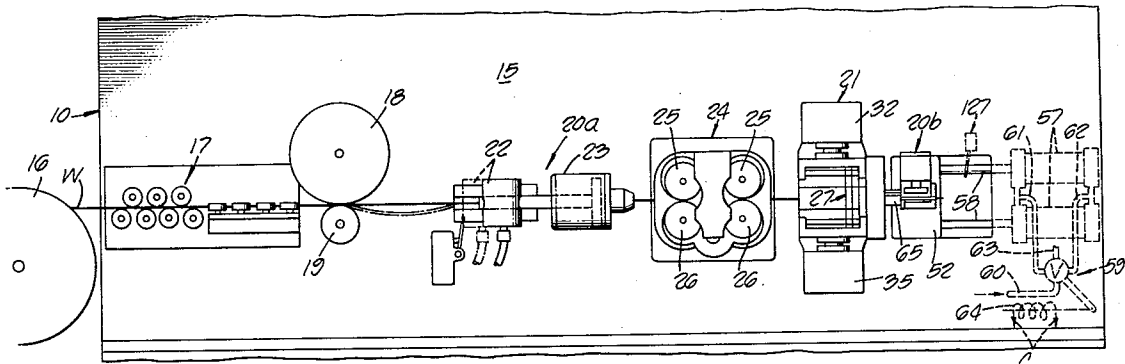
2,934,982	5/1960	Eubanks	81/9.51
3,769,681	11/1973	Eubanks	29/203 DT

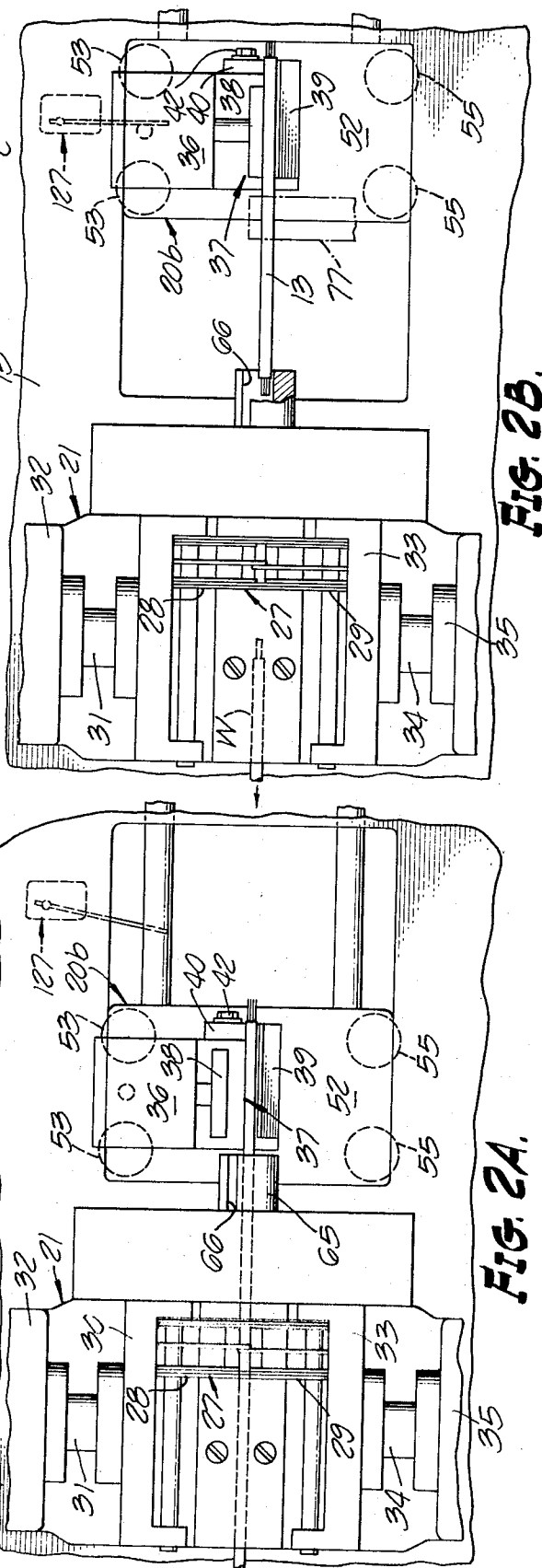
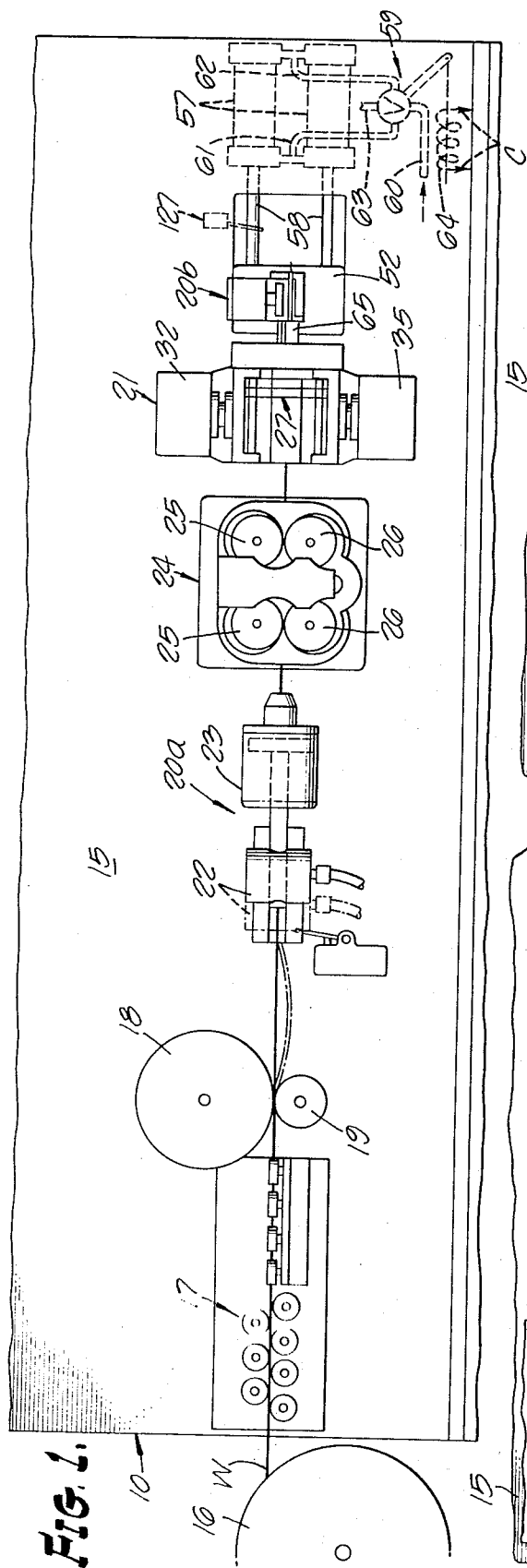
Primary Examiner—Thomas H. Eager
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[57] **ABSTRACT**

Apparatus for attaching terminals to electric conductors, wherein the electric conductors are cut to predetermined length in a wire cutting and stripping device in which stripping jaws of the insulation stripping mechanism, which grip the cut-off length of conductor, are mounted on a rectilinearly movable panel in a conductor supply zone, so that upon being moved, the cut-off conductor will be carried by a translatory movement into a position where it is engaged by the jaws of a pair of conveyor fingers and carried to a terminal attaching zone where an end of the cut-off conductor is positioned in a conductor end receiving portion of the terminal which is then secured to the conductor end by the operation of appropriate dies embodied in an associated terminal attaching device.

17 Claims, 10 Drawing Figures





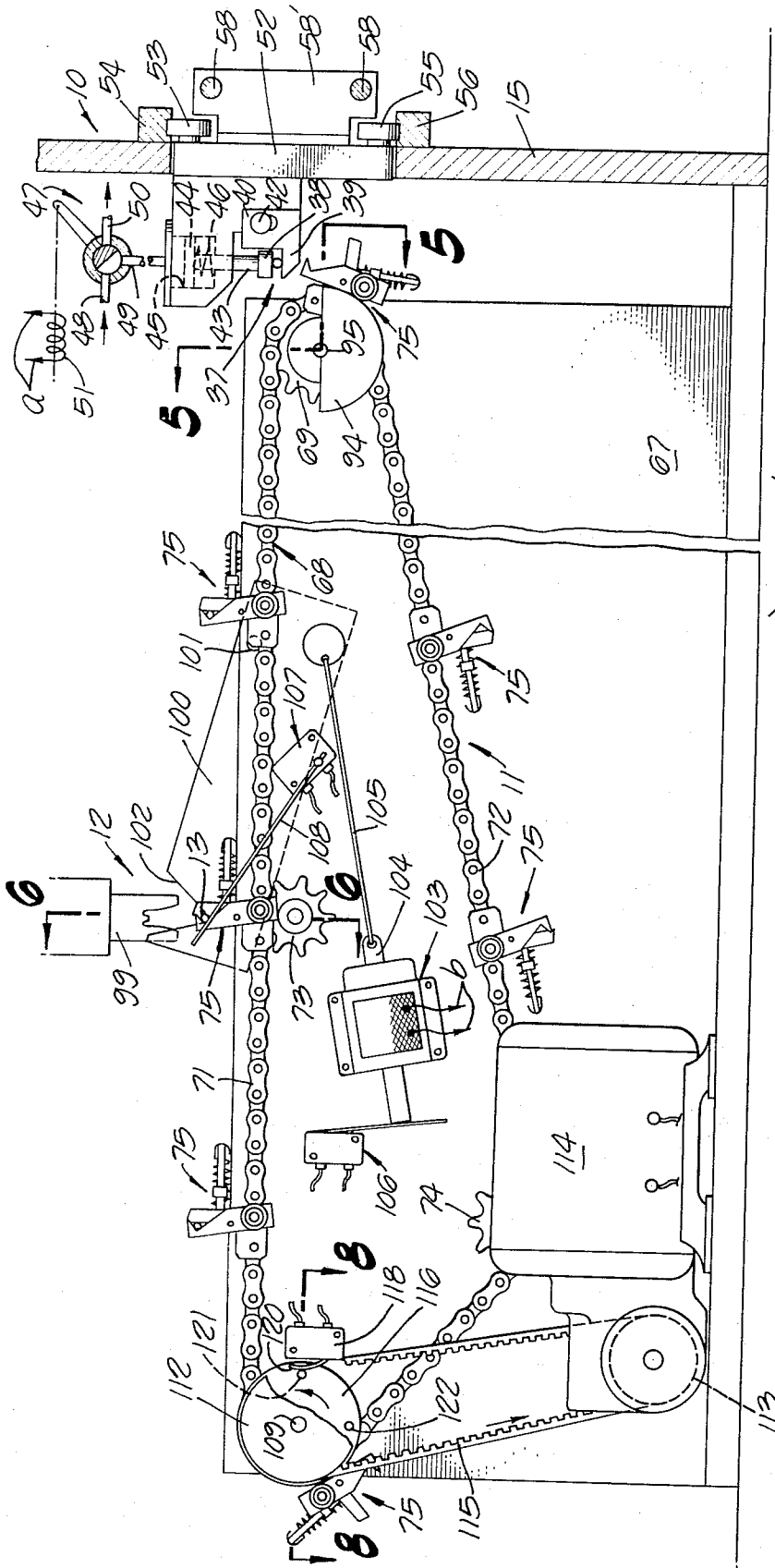


FIG. 3.

FIG. 6.

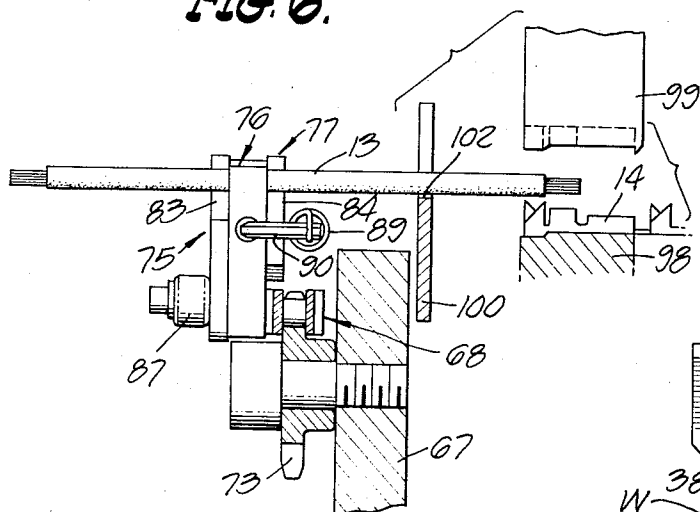


FIG. 4.

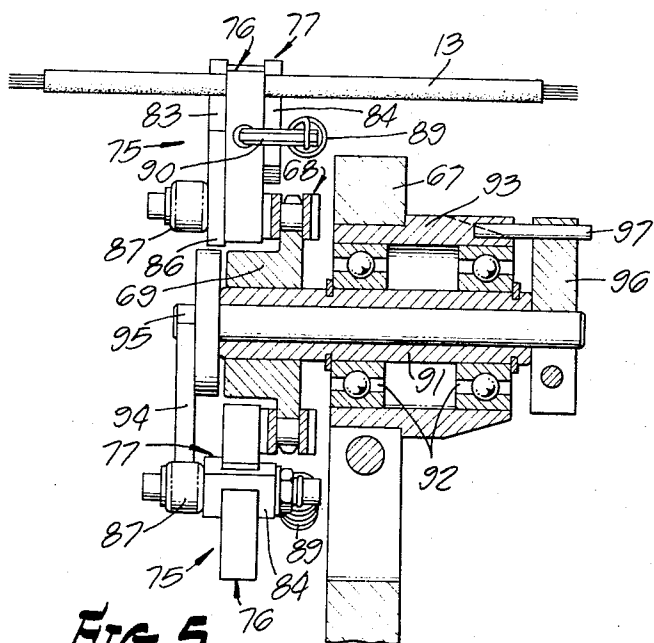
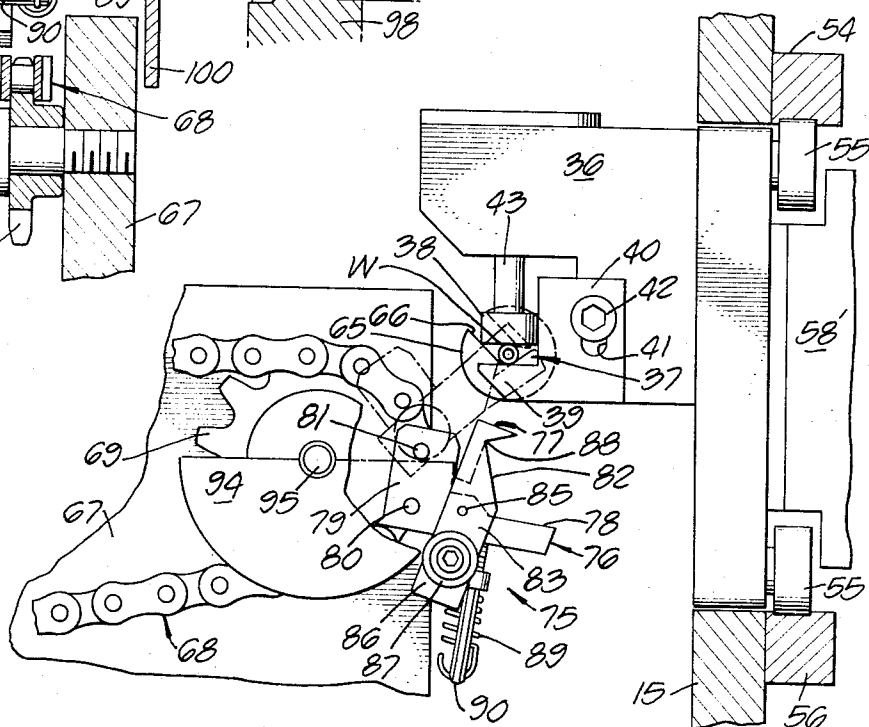


FIG. 5.

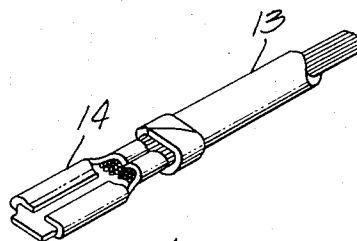


FIG. 7.

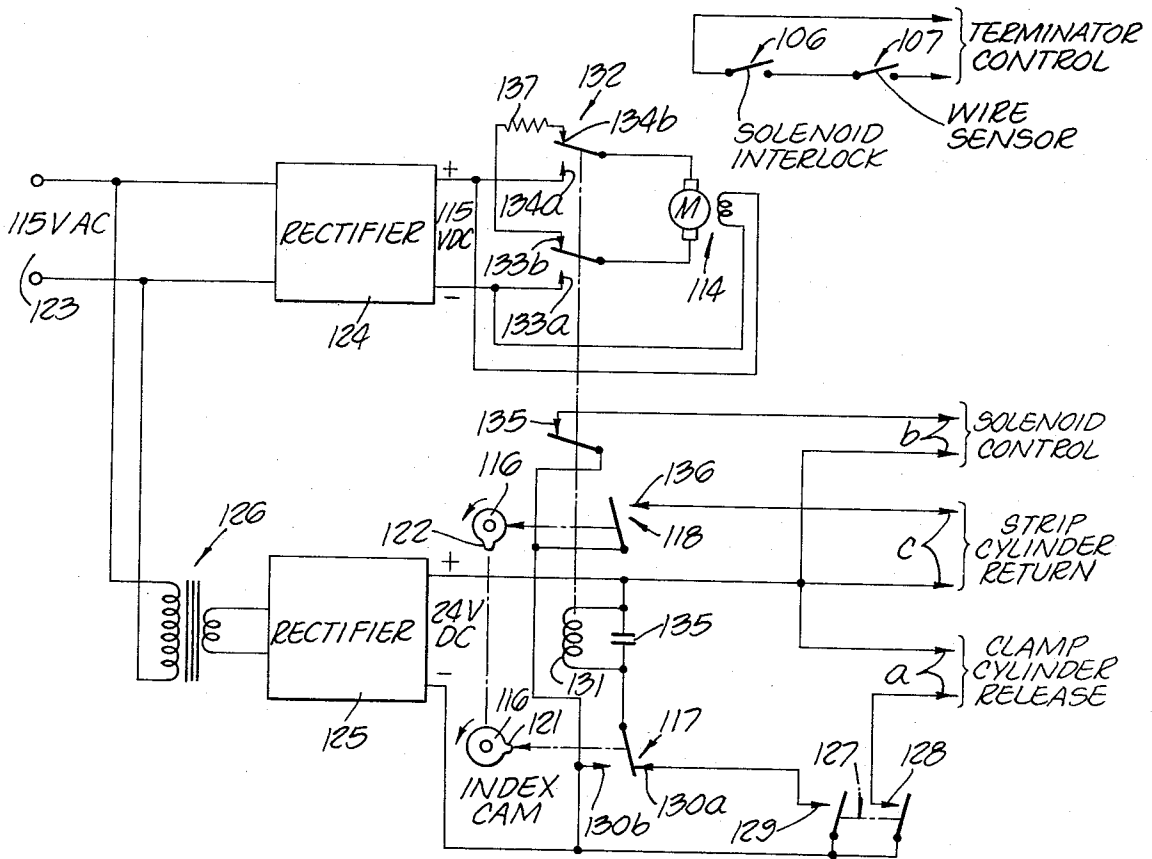


FIG. 9.

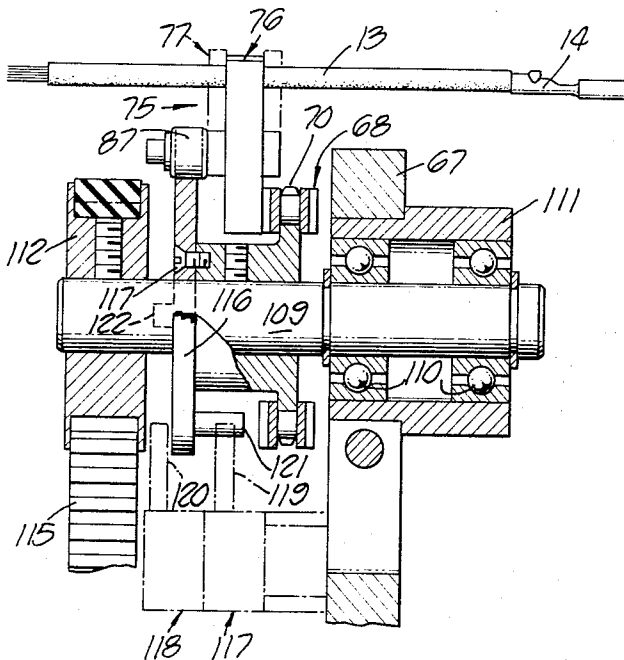


FIG. 8.

APPARATUS FOR ATTACHING TERMINALS TO ELECTRIC CONDUCTORS

BACKGROUND OF THE INVENTION

The present invention relates generally to the art of producing electrical conductors with an attached end terminal.

Heretofore, it has been generally known from U.S. Pat. No. 3,769,681, to provide apparatus for attaching terminals to electric conductors in which high speed wire cutters and insulation stripping apparatus is used to provide conductors of predetermined length having a bare end portion from which the insulation has been removed. These stripped conductors are successively delivered to a receiver supported on a panel which can be tilted so as to carry the receiver through a translatory path of movement into a conductor supply zone where the conductors are successively picked up and transported by finger assemblies on a conveyor to a terminal attaching zone of a terminal attaching device which is operated in synchronized time relation to crimpingly attach the terminals to the stripped ends of the conductors.

The present invention in its broad concept is in general similar to that disclosed in the above noted patent, but differs in that certain components have been modified in a manner which not only simplifies their construction, operation and maintenance, but also results in increased production and reliability. One important feature in this respect resides in the elimination of the tiltable receiver panel. Instead, the receiver is normally maintained at all times in the conductor supply zone. The finger assemblies for picking up the conductors in the conductor supply zone have also been redesigned so as to operate in a different manner to pick-up the conductor, and more securely hold it during transport. Also, instead of actuating the conveyor by reciprocative pneumatic cylinder-piston means, an electric motor is utilized. This motor provides better conveyor driving characteristics, and also permits the use of the motor for dynamic braking to stop the conveyor movement, when the motor is deenergized.

SUMMARY OF THE INVENTION

The present invention relates generally to the production of electric conductors and is more particularly concerned with improved apparatus for attaching terminals at the ends of electric conductors.

Having in mind the prior known structures for this purpose, it is one object of the present invention to provide a more simplified, improved and efficient apparatus having components operable in timed synchronized relation for cutting an electric conductor into predetermined conductor lengths and attaching a terminal to at least one end of each conductor length.

A further object is concerned with the provision in combination with terminal attaching apparatus, improved means for producing at a conductor supply zone predetermined lengths of insulated electric conductors having at least one insulation stripped end, and novel conveyor finger assemblies for picking up and transferring the produced conductor lengths from the supply zone to an associated terminal attaching device.

A further object resides in the provision of improved conveyor means with a plurality of spaced pairs of fingers for successively picking up and transporting conductors with stripped ends from a conductor supply

zone of a wire cutter and insulation stripping apparatus to a terminal attaching zone of a terminal attaching device, and unique means for controlling the pick-up operation of each pair of fingers in the conductor supply zone.

Another object is to provide novel means in terminal attaching apparatus for sensing and positioning an end of an electric conductor with respect to a receiving portion of a terminal which is to be attached thereto.

Still another object is to provide in a combination comprising apparatus for cutting and stripping insulation from the end of a wire, with terminal attaching device, and conveyor means for transporting stripped wires to the terminal attaching device; improved control means for operating the respective components of the combination in synchronously timed relation.

It is also a further object to provide an improved electric motor driven conveyor means for transporting conductors with a stripped end from a wire cutting and insulation stripping apparatus to a terminal attaching device, in which the motor is intermittently energized and deenergized, and when deenergized is connected with a resistor to effect dynamic braking to stop the conveyor movement.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a front elevational view of wire cutter and insulation stripping apparatus as embodied in the present invention;

FIG. 2A is an enlarged fragmentary elevational view of the cutter mechanism and the stripping mechanism at the conductor supply zone, prior to performing a stripping operation;

FIG. 2B is a similar view in which the relative position of the cutter mechanism and stripping mechanism is shown, with the stripping mechanism shifted away from the cutter mechanism as the result of a stripping operation;

FIG. 3 is a transverse side elevational view of the stripping mechanism at the conductor supply zone, showing its operative relationship with respect to a conveyor mechanism for transporting electric conductors from the conductor supply zone to the terminal attaching zone;

FIG. 4 is an enlarged fragmentary elevational view showing the operation of the finger assemblies for picking up a conductor length in the conductor supply zone of the stripping mechanism;

FIG. 5 is an enlarged sectional view taken substantially on line 5—5 of FIG. 3;

FIG. 6 is an enlarged fragmentary transverse sectional view taken substantially on line 6—6 of FIG. 3, and showing the operative relationship of the components of the terminal attaching mechanism at the terminal attaching zone;

FIG. 7 is a perspective view showing a terminal attached to an electric conductor in the terminal attaching zone;

FIG. 8 is an enlarged fragmentary transverse sectional view taken substantially on line 8—8 of FIG. 3,

and showing details of the conveyor driving components and their operative relationship; and

FIG. 9 is a schematic wiring diagram of the control circuitry.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more specifically to the drawings, the apparatus of the present invention utilizes wire cutter and insulation stripping apparatus as generally indicated at 10, in association with a conveyor mechanism, as generally indicated at 11, and terminal attaching mechanism, as generally indicated at 12, these components being operatively interconnected and synchronized to produce an electric conductor 13 of predetermined length, having a terminal 14 attached to one end, as shown in FIG. 7.

The wire cutter and stripping apparatus 10 is of the type disclosed in U.S. Pat. No. 2,934,982, issued May 3, 1960, and in its broad concept utilizes similar components which are operative generally in the same manner as described in this patent. Although it is believed that specific details will not be necessary in the description, a brief description will manifestly be helpful in understanding the cooperative relationship of the wire cutter and stripping apparatus in respect to the associated components. As in the above noted patent, in the present embodiment the wire cutter and stripping apparatus embodies a main panel 15 upon which the various components are supported. As best shown in FIG. 1, a wire W is fed from the left end of panel 15 from a reel 16 or other suitable source into a wire straightening device 17 of conventional construction, and thence to a length measuring mechanism which includes a measuring wheel 18 against which the wire is held by means of a presser wheel 19. This measuring wheel is associated with a cycling control for determining the sequence of operation of the cutter and stripping mechanisms.

From the measuring wheel, the wire passes through a first stripping mechanism 20a which is positioned on the feed side of a wire cutting mechanism 21 and includes pneumatically operable means 22 for controlled gripping of the wire W during a stripping operation in response to movement by means of pneumatically energizable cylinder-piston actuator 23 in a manner well known in the art, and as disclosed in the above noted patent.

From the stripping mechanism 21a, the wire W passes through a feeding mechanism 24 between a set of upper rollers 25 and lower rollers 26 arranged for actuation in a well known manner into a wire feeding position in engagement with the wire, and a slightly separated position so that the feeding of the wire will be terminated.

The wire is then conducted from the feed mechanism through an appropriate guide into the cutter mechanism 21.

As best shown in FIG. 2A, the cutter mechanism comprises three sets of blades 27, each set comprising an upper blade 28 and lower blade 29. These sets of blades have cooperatively associated cutting edges which operate in a manner well known in the art of wire cutting and stripping.

Briefly, however, the central set of cutting blades has cutting edges adapted to cut through the wire and completely sever it, whereas the sets of cutting blades on

each side of the central set are arranged to cut through the insulation only. The spacing between the sets of blades, and the consequent length of insulated portion which is to be severed is determined by the mounted spacing of the blades in their supporting actuating head structure. The upper blades 28 are carried by a head member 30 connected with a stem 31 arranged to be reciprocally actuated by movement of a connected piston within an air cylinder 32. In a similar manner, the lower blades 29 are supported in a head member 33 connected with a stem 34 operatively associated with the air cylinder 35.

A second stripping mechanism 20b is shown as being positioned on the discharge side of the cutting mechanism. The second stripping mechanism is constructed to provide an inverted L-shaped body member 36 which forms a support for a set of clamping jaw members 37 which consists of an upper jaw member 38 and a lower jaw member 39. The lower jaw member is fixed, but is arranged for adjustment in a vertical direction. For this purpose, the jaw 39 is provided with a side flange 40, as best seen in FIGS. 2A and 2B, this flange extending over a side face of the body member 36 and being provided with a vertical slot 41 for receiving a threaded retaining stud 42. The upper jaw member 38 is carried by the lowermost end of a stem 43 having its uppermost end connected with a piston 44 (FIG. 3) which is operably reciprocable with a cylinder 45 formed in the body member 36. The piston 44 is normally urged in an upward direction by means of a coiled spring 46 so as to activate the clamping jaw members to opened position. Movement of the clamping jaw members to closed position is accomplished by supplying a pressurized fluid to the uppermost end of the cylinder 45 through an electrically controlled valve 47 as schematically illustrated in FIG. 3. This valve has a fluid input connection 48, a cylinder connection 49 and a vent connection 50. The valve is normally urged to a position in which the fluid input connection communicates with the cylinder connection so as to supply pressurized fluid to the cylinder for actuating the clamping members to closed position. Electromagnetic means including an actuating coil 51 is energizable to actuate the valve to a position connecting the cylinder connection 49 with the vent connection 50, whereupon the pressure in the cylinder is released and the piston permitted to move the clamping jaws to an open position.

In order to provide for lateral shifting movement of the second stripping mechanism 20b so as to perform a stripping operation, this stripping mechanism is mounted as a unit assembly on a back panel 52 provided with a set of upper supporting wheels 53 associated with a guide track 54, and a set of roller supporting wheels 55 associated with a guide track 56. Lateral shifting of the stripping mechanism 20b is accomplished by a pair of double acting pneumatic actuators, each comprising a cylinder 57 and a piston rod 58, the piston rods being connected with a common crosshead 58' secured to the rear face of the back panel 52.

The cylinders 57, 57, are arranged for parallel operation by means of an electrically controlled valve 59 as schematically illustrated in FIG. 1. This valve has a fluid input connection 60, cylinder connections 61 and 62 leading respectively to the opposite ends of the cylinders 57, 57, and a vent connection 63. The valve is so arranged that it is normally urged to a position con-

necting the inlet connection 60 with the valve connection 61 so as to shift the stripping mechanism 20b from the position shown in FIG. 2A to the position shown in FIG. 2B. Electro-magnetic means including an actuating coil 64 is energizable to actuate the valve to a position connecting the inlet connection 60 with the valve connection 62 so as to return the stripping mechanism 20b to its normal position as shown in FIG. 2A.

During a cutting operation, the stripping mechanisms 20a and 20b will initially occupy positions as shown in full lines in FIG. 1. However, at the conclusion of the cutting operation, the stripping mechanisms are moved laterally away from the cutting mechanisms in opposite directions. This stripping movement removes the severed insulation portions at the contiguous ends of the cut wire so that in the shifted position of the stripping mechanism 20b, as shown in FIG. 2B, the stripping mechanism 20b constitutes a receiver means for a predetermined length of electric conductor 13 which is supported and held between the clamping jaws 37 and 38 of the stripping mechanism 20b. It will be observed that the conductor is guidingly supported in the space between the wire cutting mechanism 21 and the stripping mechanism 20b by a projecting member 65 on the cutting mechanism, this member having an axially extending upwardly opening groove 66 for the passage of the wire W. As shown in FIG. 4, the groove 66 is forwardly inclined to facilitate lateral movement of the wire when picked up by the conveyor means for transport to the terminal attaching device, as will hereinafter be more fully explained.

With each operation of the wire cutter and stripping apparatus, the movement of the stripping mechanism 20b to its stripping position, as shown in FIG. 2B, will provide a conductor 13 with stripped ends at a position which has been termed a conductor supply zone. Each conductor is successively picked up by the conveyor mechanism 11 and transported to the terminal attaching mechanism 12 where the terminals are secured to an end of the conductor at a terminal attaching zone. As best shown in FIG. 3, the conveyor mechanism 11 is supported upon an upstanding frame plate member 67 which extends forwardly of the main panel 15 in a generally normal direction thereto. On one side of the plate member 67 there is provided a conveyor chain 68 which is looped around an idler sprocket 69 at the inner end of the loop, and around a driving sprocket 70 at the outer end of the loop so as to provide upper and lower chain runs 71 and 72. The upper chain run 71 at the terminal attaching mechanism 12 location is supported against downward deflection by an idler sprocket 73, and towards the outer end of the loop the distance between the upper and lower chain runs is widened by passing the chain lower run over an idler sprocket 74 so that the portion of the lower chain run between the idler sprocket 74 and idler sprocket 69 will be upwardly inclined.

The chain carries a plurality of conductor gripping finger assemblies 75 which are supported at spaced intervals along the chain. Each finger assembly comprises a pair of relatively movable fingers 76 and 77 as best shown in FIGS. 4 and 5. The finger 76 is of uniform width and has a projecting straight portion 78 extending in right angled relation to a base portion 79 supported upon laterally extending pivot pins 80 and 81 at the opposite ends of a chain link. The finger 77 has a generally channel-shaped outer end portion 82 with

spaced sidewalls 83, 84, for receiving the outer straight portion 78 of the finger 76 therebetween when the fingers are in closed position. The fingers are pivoted for relative swinging movement on a pivot 85. The sidewall 83 is extended inwardly beyond the pivot 85 to provide an extension 86 upon which there is mounted a rotatable roller 87. The outer end portion of the finger 77 is constructed with transversely aligned V-notches 88 in the sidewalls for grippingly receiving and holding a picked-up conductor in the closed position of the outer ends of the fingers. The fingers are normally urged to a closed position by means of a coiled spring 89, one end of this spring being attached to the finger 77, and the other end of the spring being attached to the outermost end of a fixed bracket 90 having its innermost end secured to the finger 76. As thus arranged, the fingers at their outermost ends provide coacting jaws for grippingly engaging and picking up conductors in the supply zone and transporting them to the terminal attaching zone.

Mechanism is provided at the idler sprocket 69 end of the conveyor chain for opening and closing the assembly fingers to pick up a conductor in the conductor supply zone in timed relation to the movement of the stripping mechanism 20b to its position as shown in FIG. 2B. As will be seen in FIG. 5, the idler sprocket is supported at one end of a tubular shaft 91 which is rotatably supported in axially spaced anti-friction bearing 92, 92, contained within a fixed bearing housing 93 supported on the frame plate member 67. A cam plate 94 of sector configuration is positioned outwardly of the idler sprocket 69 and supported at one end of a stationary shaft which extends through the bore of the tubular shaft 91 where it is embraced by a releasable split clamp member 96 which is retained against rotative movement by means of an anchor pin 97, one end of this pin being supported in the fixed bearing housing 93. It will be apparent that this arrangement permits adjustment of the cam plate orientation circumferentially with respect to the axis of the shaft 95. The cam plate 94 is in the path of movement of the roller 87 when the fingers of the finger assembly are in closed relation, and as the finger assembly approaches the cam member 94, the roller 87 will engage the circular periphery of the cam and operate to swing the finger 77 into a finger-opened position as shown in full lines in FIG. 4. Continued movement of the opened fingers will bring the finger 76 into engagement with the wire length which is held by the clamping jaws of the receiver means. Concurrently, the roller 87 will disengage the circular periphery of the cam and permit the finger 77 to move into a closed wire gripping position with the finger 76 as shown in phantom lines. Continued movement of the finger assembly carries the picked-up wire out of the slot 66 and thence along the route to the terminal attaching zone. It will be apparent that the point of disengagement of the roller 87 from the circular periphery of the cam can be adjusted by the circumferential adjusting means previously described. As shown in FIG. 2B, the fingers as shown in phantom lines engage the trailing end of the wire 13.

As thus far described, it will be apparent that the finger assemblies with the conductors held in the jaws thereof will traverse the upper run of the conveyor so that after the proper number of intermittent movements in a manner hereinafter described more fully, the conductor will be brought to a terminal attaching posi-

tion in the terminal attaching zone, and at this position the synchronized timed actuation of the terminal attaching mechanism will be motivated.

The terminal attaching mechanism or lugger is of conventional construction and contains components which are common to several commercially available terminal attaching devices. These devices, as shown in FIG. 6, usually contain an anvil 98 which is adapted to have terminals 14 successively fed thereto by conventional means to place a terminal in a position for attachment to an end of the conductor as it is brought into the terminal attaching position. An appropriate die 99 is positioned for reciprocable movement into engaged and non-engaged positions with respect to the anvil 98, the die being appropriately configured on its active end to deform conductor receiving portions of the terminal into clamped position around the conductor. As shown in FIG. 6, the conveyor carries the conductor 13 to the terminal attaching position, the conductor at this position having its stripped end positioned above the terminal which is to be attached thereto. At this point, the die 99 is motivated to move towards the anvil, and as the movement of the die continues it will deflect the end of the conductor into the terminal and fold the securing portions of the terminal around the conductor.

Upon arrival of the conductor 13 at the terminal attaching position, the end of the conductor to which the terminal is to be attached is positively centered with respect to the terminal by means of an elongate arm member 100 which is supported on a pivot 101 for swinging movement between a lowered substantially horizontal position and a raised inclined position as shown in full lines in FIG. 3. At its outermost end, the arm is provided with a V-notch 102 in its upper edge margin, this notch in the raised position of the arm acting to receive and guidingly center the wire 13 into a proper position. The lever is normally urged towards a lowered position, and is arranged to be motivated into raised position by means of a solenoid 103 having a movable core structure 104 which is coupled with the arm member 100 by means of a link member 105 in a manner such that when the solenoid is energized, the arm member will be moved to its raised position. The solenoid core structure is also arranged to activate an operatively associated interlocking switch 106 in a manner to close its normally open contacts when the solenoid is energized.

In order to prevent the activation of a terminal attaching operation, in the event that for some reason the finger assembly did not deliver a conductor to the terminal attaching zone, a wire sensing micro-switch 107 is mounted in a suitable position so that a feeler actuating arm 108 thereof will be positioned in the path of movement of the conductor and engaged thereby as the conductor is moved to the terminal attaching position. The actuating arm is so arranged that it will operate to move the normally open contacts of the switch into closed position upon being engaged by the arrival of the wire 13 at the terminal attaching position.

At the driving end of the conveyor chain, as shown in FIG. 8, the driving sprocket 70 is secured to a driving shaft 109, one end of this shaft being rotatably mounted in axially spaced anti-friction bearings 110, 110, supported within a fixed bearing housing 111 secured to the frame plate member 67. The opposite end of the shaft 109 carries a toothed pulley 112 which is

driven from a toothed driving pulley 113 of a driving electric motor 114 by means of an interconnecting toothed timing belt 115. A circular cam plate 116 is secured by appropriate means such as screws 117 to the driving sprocket 70 for rotation therewith. This cam plate is positioned in the path of travel of the roller 87 of each finger assembly 75, and as a finger assembly carrying a wire 13 with the attached terminal 14 is moved around the end of a conveyor, the engagement of the roller 87 with the periphery of the cam plate will activate the fingers of the finger assembly to opened position and permit the discharge of the wire and connected terminal into a collecting receptacle or other means.

The cam plate 116 also serves as an index cam for the sequential operation of control switches 117 and 118 with actuator elements 119 and 120, respectively, which are in the path of movement of pins 121 and 122 carried by the cam plate 116. As shown in FIG. 3, the pin 122 lags the pin 121 by an angle of 90° so that the switch 118 will be actuated after the switch 117 during the rotation of the cam 116.

The intermittent advancing movements of the conveyor chain and the actuation of the terminal attaching device are synchronously coordinated with the operation of the wire cutter and stripping apparatus by means of the sequencing and interlocking control as schematically illustrated in FIG. 9. A main electric power source 123 is connected with a rectifier 124 which produces a 115 volts DC terminal output which is utilized for the driving motor 114. A second rectifier 125 is connected to the electric source through a step-down transformer 126 and produces an output terminal voltage of the order of 24 volts DC for the control components.

When the stripping operation is completed and the stripping mechanism 20b moved to the position shown in FIG. 2B, a double-pole switch 127 will be actuated to close its normally open contacts 128 and 129. Closure of contacts 128 completes an energizing circuit *a* to the actuating coil of valve 47 which will operate to a position venting the cylinder 45 so as to release the clamping jaw members 37 which hold the stripped wire in position. Concurrently with this operation, closure of contacts 129 will complete an energizing circuit through the closed contacts 130a of switch 117 to the actuating coil 131 of a relay 132 which will now operate. Actuation of this relay connects the energizing circuit of the armature of motor 114 through contact 133a and 134a to the output of rectifier 124, whereupon the motor will begin the movement of the conveyor chain and a finger assembly 75 through the wire pick-up position in the wire supply zone. As the cam 116 continues to rotate, the switch 117 is activated to engage contact 130b which connects the relay coil 131 directly to the negative side of the control circuit. The relay is prevented from chattering or dropping out during this shift of connections due to the action of the capacitor 135 connected across the coil terminals.

Actuation of the relay 132 also operates to open its contacts 135 to deenergize an energizing circuit *b* for the solenoid 103, whereupon the arm member 100 will move to its lowered position. In the deenergized position of the solenoid, the solenoid interlock switch 106 will be moved to open contact position.

As the motor continues to drive the chain the pin 122 of the index cam 116 will operate to close contacts 136 of control switch 118 to complete an energizing circuit

c to the actuating coil 64 of the control valve 59 which will now operate to return the stripping mechanism 20b to the position shown in FIG. 2A. The contacts 129 and 128 of switch 127 will now be restored to their normally open position. As the motor continues to drive the chain, the pin 122 will release switch 118 for movement of its contacts to open position, and when the index cam 116 completes its cycling revolution, the pin 121 will operate switch 117 to disengage contact 130b and engage contact 130a; whereupon the coil 131 will be deenergized and close its contacts 133b and 134b to complete an armature circuit through a resistor 137 to effect dynamic braking to stop the chain movement. Deenergization of the relay 132 also closes contact 135 which will energize the solenoid 103 which will now operate to raise the arm 100 for the purpose of centering a conductor 13 which may have arrived at the terminal attaching position. Energization of the solenoid will activate the contacts of switch 106 to closed position. Also, if a conductor 13 has arrived at the terminal attaching position, the wire sensing switch 107 will operate to close its contact. If the contacts of both switches 106 and 107 are closed, then the control circuit to the terminator will be completed and the terminal attaching device will operate to complete the terminal attaching operation. However, if the contacts of either switch 106 or 107 are open, the terminal attaching device will not operate. The cycle of operation as explained above will be intermittently repeated automatically as conductors are picked up in the conductor supply zone and transported to the terminal attaching zone.

From the foregoing description, it is believed that it will be appreciated that the heretofore outlined objects of the invention will be attained, and that the apparatus embodying the described features provides inherent advantages in the production of electric conductors with affixed terminals.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of our invention, and, hence, we do not wish to be restricted to a specific form shown or uses mentioned, except to the extent indicated in the appended claims.

We claim:

1. Apparatus for attaching terminals to the ends of electric conductors, comprising:

- a. means for axially delivering predetermined lengths of electric conductors endwise into a conductor supply zone;
- b. a terminal attaching zone spaced from said conductor supply zone, including cooperable terminal attaching die means;
- c. means for feeding a supply of terminals to said die means, each of said terminals having a portion adapted to receive an end of said conductor;
- d. means for successively picking up and transporting the conductor lengths laterally from the conductor supply zone to a position in said terminal attaching zone, in which said end of the conductor is disposed for reception by said terminal portion; and
- e. means including said die means for crimping said terminal portion on the received conductor end.

2. Apparatus according to claim 1, wherein the conductor has an insulation covering and is delivered with a stripped end portion from an insulation stripping mechanism to receiver means in the supply zone, said receiver means being supported for rectilinear move-

ment in the supply zone between a normal conductor receiving position and a conductor pick-up position.

3. Apparatus according to claim 1, wherein the means for successively picking up and transporting the conductor lengths include a movable conveyor having spaced finger assemblies for successively picking up the conductors delivered to said supply zone, each of said finger assemblies comprising a pair of fingers, one of said fingers being a generally straight member anchored at its inner end on the conveyer, the other of said fingers having a generally channel shaped outer end portion for receiving the outer end portion of said one of said fingers longitudinally therein between side walls of the channel; a pivot interconnecting said fingers for relative swinging movements of their outer ends to opened and closed positions; and transversely aligned V-notches in said side walls at the outer end of said other of said fingers for grippingly receiving and holding a picked up conductor in the closed position of the outer ends of said fingers.

4. Apparatus according to claim 3, wherein one of said side walls projects inwardly of said pivot to form an extension; a roller mounted on said extension; and spring means interconnecting said fingers to normally urge the outer ends thereof towards said closed position.

5. Apparatus according to claim 1, wherein the means for successively picking up and transporting the conductor lengths includes a movable conveyor having spaced finger assemblies for successively picking up the conductors delivered to said supply zone, each of said finger assemblies including a pair of relatively movable finger members having coacting jaws normally urged to a closed position and in an opened position being operative to receive a conductor length therebetween; and means for opening said jaws to admit a conductor length therebetween, and thereafter release the jaws for movement to a closed position gripping the conductor length.

6. Apparatus according to claim 5, wherein the means for opening and releasing said jaws comprises a fixed cam member, and a cam follower projection on one of said fingers adapted to engage and disengage the cam member at spaced points.

7. Apparatus according to claim 6, wherein the cam comprises a plate member having a sector configuration.

8. Apparatus according to claim 7, in which the cam plate member is adjustably positionable circumferentially with respect to a right-angle axis to vary the position of the point of disengagement of said follower.

9. Apparatus according to claim 6, wherein the conveyor comprises a link chain looped between a driving sprocket at one end and an idler sprocket at the other end affixed to a rotatably supported tubular shaft; and in which the cam member is secured to an end of a stationary shaft supported within said tubular shaft; and including means for adjusting the position of the stationary shaft in a circumferential direction to vary an operating effect of the cam member.

10. Apparatus according to claim 1, including means sequentially operable to positively center said end of the conductor with respect to said terminal portion.

11. Apparatus according to claim 10, wherein the means to center said conductor end comprises an arm pivoted for limited swinging movement, said arm having a V-notch at an outer end thereof for receiving and

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guidingly centering said conductor end, when said outer end of the arm is moved from a lowered position to a raised position; means normally urging the outer end of said arm towards said lowered position; and an actuating solenoid connected with said arm and being energizable to move said outer end towards said raised position.

12. Apparatus according to claim 1, wherein the means for crimping said terminal portion on the received conductor end are actuated by power means coupled with an electric control circuit; and in which switching means in said circuit initiates actuation of said power means when the conductor end is in said position in the terminal attaching zone, said switching means including a wire sensor switch having an actuator member positioned in the path of movement of said conductor to said terminal attaching zone.

13. Apparatus according to claim 10, wherein the means for crimping said terminal portion on the received conductor end are actuated by power means coupled with an electric control circuit; and in which switching means in said circuit initiates actuation of said power means when the conductor end is in said position in the terminal attaching zone, said switching means including a switch having contacts operable to a closed position in response to the operation of said means to center said end of the conductor with respect to said terminal portion.

14. Apparatus according to claim 5, wherein the conductor has an insulation covering and is delivered with a stripped end portion from an insulation stripping mechanism to receiver means in the supply zone; said receiver means having a pair of clamping members for receiving the delivered conductor therebetween; cylinder-piston means for actuating said clamping members to closed position; spring means urging said clamping member to an opened position; valve means normally urged to one position for supplying a pressurized fluid to said cylinder-piston means and to another position for venting said cylinder-piston means to effect movement of said clamping members to said opened position and release a conductor length held therebetween; actuator means for said valve means including electro-magnetic means energizable to move said valve means to said another position; electric power means having

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a driving connection with said conveyor, said power means having an electric supply circuit; and control means for intermittently energizing and deenergizing said supply circuit to successively advance the finger assemblies with the picked up conductors from the supply zone to the terminal attaching zone, said control means including switching elements operative to energize said electro-magnetic means concurrently with the energization of the supply circuit of said electric power means.

15. Apparatus according to claim 5, wherein the conveyor comprises a link chain looped between a driving sprocket at one end and an idler sprocket at the other end; an electric motor having a driving connection with said driving sprocket, said motor having an electric supply circuit; control means for intermittently energizing and deenergizing said circuit to successively advance the finger assemblies with the picked up conductors from the supply zone to the terminal attaching zone, said control means including a first switching means; and an indexing cam for actuating said first switching means in response to the movement of said driving sprocket.

16. Apparatus according to claim 15, which includes a resistor element, and in which said control means includes switching elements operative upon deenergization of said circuit to connect said resistor across said circuit so as to effect dynamic braking.

17. Apparatus according to claim 15, wherein the conductor has an insulation covering and is delivered with a stripped end portion from an insulation stripping mechanism to receiver means in the supply zone supported for rectilinear movement between a first conductor receiving position and a second conductor pick-up position; pneumatic means selectively energizable to move said receiver between said positions; electrically operable valve means for controlling the energization of said pneumatic means; and in which said control means includes a second switching means operable by said indexing cam for energizing said valve means so as to effect movement of the receiver means from said second position to said first position in time delayed relation with respect to the operation of said first switching means.

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