June 5, 1956 A. F. PITYO 2,749,420

METHOD OF AND APPARATUS FOR ATTACHING TERMINALS TO THE ENDS OF WIRES

Filed April 6, 1954 2 Sheets-Sheet 1

FIG. 1.

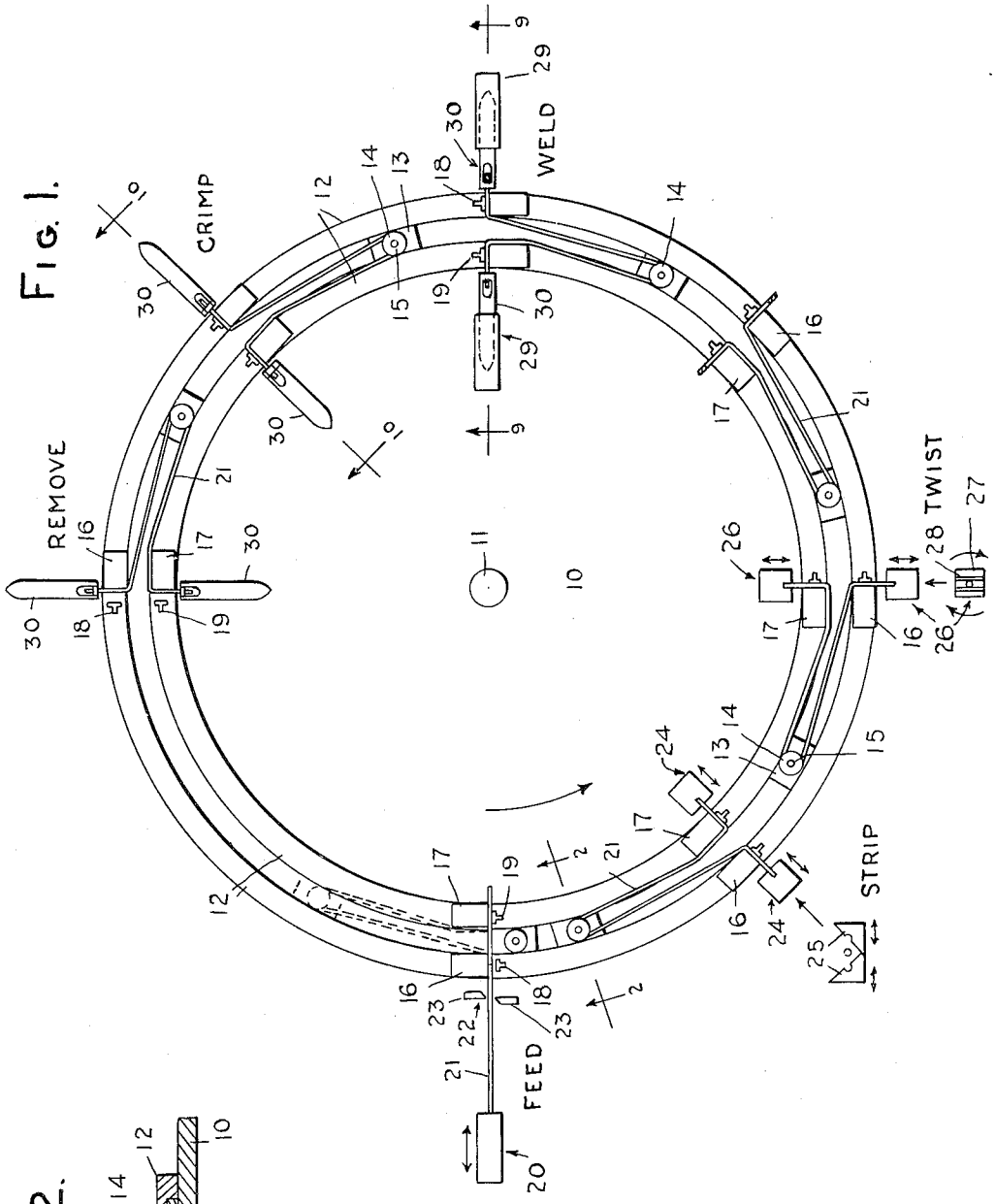
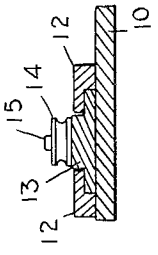


FIG. 2.



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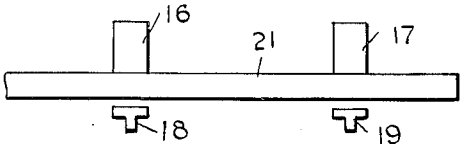
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METHOD OF AND APPARATUS FOR ATTACHING TERMINALS TO THE ENDS OF WIRES

Filed April 6, 1954 2 Sheets-Sheet 2

FIG. 3.



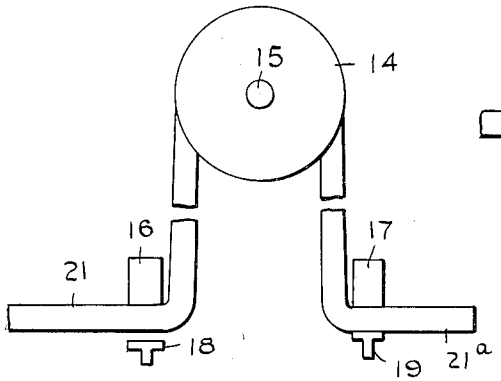


FIG. 4.

FIG. 5.

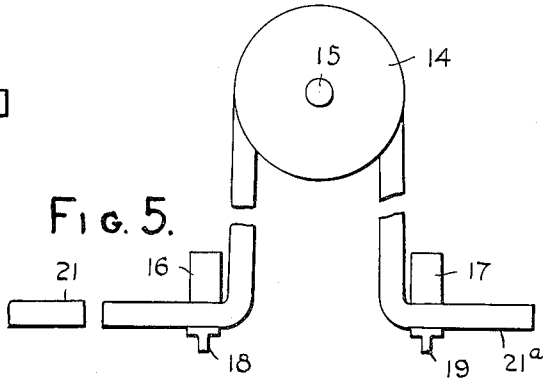


FIG. 6.

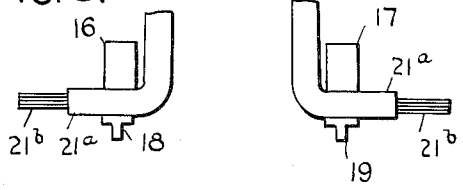


FIG. 7.

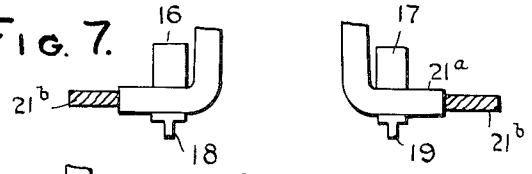
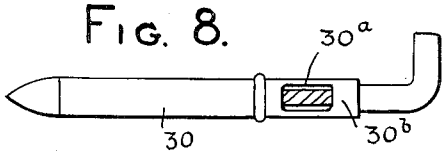


FIG. 8.



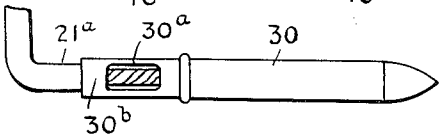


FIG. 9.

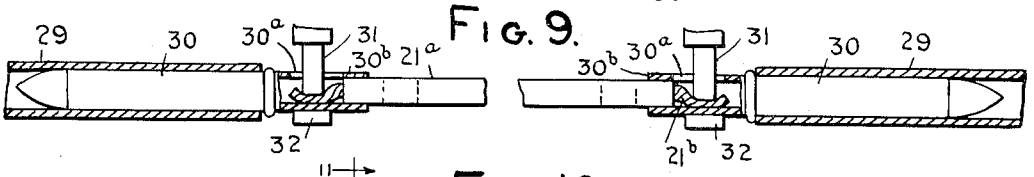


FIG. 10.

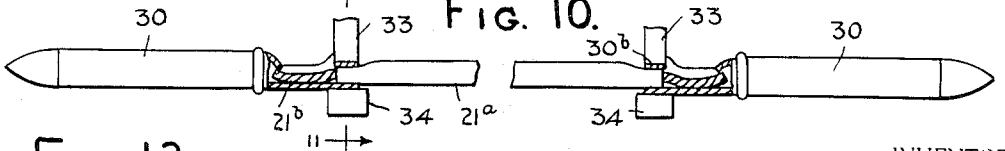


FIG. 12.

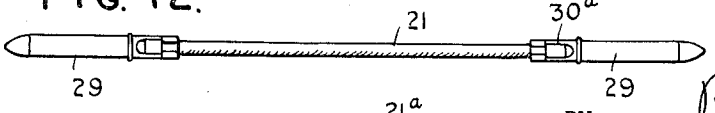
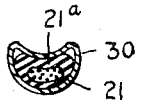


FIG. 11.



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2,749,420

METHOD OF AND APPARATUS FOR ATTACHING TERMINALS TO THE ENDS OF WIRES

Albert F. Pityo, Cedar Grove, N. J.

Application April 6, 1954, Serial No. 421,263

12 Claims. (Cl. 219—4)

My invention relates to a method of and apparatus for attaching terminals to the ends of wires.

An important object of the invention is to provide a method and apparatus which will perform the various steps in proper order and quickly and accurately.

A further object of the invention is to provide a method and apparatus which will permit of the handling of long sections of wire, without unduly increasing the size of the apparatus.

A further object of the invention is to provide a method and apparatus which will fold or loop the wire in a direction longitudinally of its travel, and clamp the ends of the folded wire for effecting its travel to the various stations.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout same,

Figure 1 is a plan view, partly diagrammatic, of apparatus embodying my invention,

Figure 2 is a transverse section taken on line 2—2 of Figure 1, parts omitted.

Figure 3 is a diagrammatic view showing the first step in the method,

Figure 4 is a diagrammatic plan view illustrating the second step occurring at the "feed" station,

Figure 5 is a diagrammatic plan view showing the next step occurring at the "feed" station,

Figure 6 is a similar view showing the next step occurring at the "strip" station,

Figure 7 is a similar view showing a step occurring at the "twist" station,

Figure 8 is a similar view showing a step occurring at the "weld" station,

Figure 9 is a diagrammatic side elevation showing the next step at the "weld" station, taken on line 9—9 of Figure 1,

Figure 10 is a side elevation showing the next step at the "crimp" station, taken on line 10—10 of Figure 1,

Figure 11 is a transverse section taken on line 11—11 of Figure 10, and,

Figure 12 is a plan view of the completed product.

The apparatus comprises a circular horizontal table 10, turning about a vertical axis 11. Rigidly mounted upon the table 10 are annular tracks 12, inverted L-shaped in cross section, and carriages 13 are arranged between these tracks and are shiftable longitudinally thereof. The carriages have grooved wheels 14, secured thereto by vertical pins 15. The carriages have sufficient frictional engagement with the tracks so that they will not improperly shift longitudinally of the tracks, but these carriages slide longitudinally of the tracks when slight pressure is applied thereto. The numerals 16 and 17 designate pairs of stationary clamps which are rigidly mounted upon the tops of the tracks 12. These pairs of stationary clamps are equidistantly spaced circumferentially of the tracks. Coacting with each stationary

clamp 16 is a movable clamp 18, which is movable horizontally toward and from the stationary clamp 16. Coacting with each stationary clamp 17 is a movable clamp 19, which is movable horizontally toward and from the stationary clamp 17.

Arranged at the "feed" station is a wire feeding device 20, which is horizontally disposed at substantially the elevation of the tops of the tracks 12, and is radial with the respect to these tracks, to feed an insulated wire 21 across the leading ends of the stationary clamps 16 and 17 and across the trailing ends of the clamps 18 and 19, Figures 1 and 3. Any suitable means may be employed to shift the clamps 18 and 19 and hold the same in the selected shifted position.

Arranged at the "feed" station is severing means 22, including blades 23, which may be shifted horizontally by any suitable means to sever the wire.

Arranged at the "strip" station are stripping devices 24, disposed inwardly and outwardly of the tracks 12, as shown. Each stripping device 24 reciprocates radially with relation to the tracks, and each stripping device includes a pair of blades 25, movable toward and from each other, and having notches to receive the ends of the insulated wire.

Arranged at the "twist" station are twisting devices 26, disposed radially inwardly and outwardly of the tracks 12, as shown. Each twisting device 26 is reciprocated radially toward and from its adjacent track. Each twisting device is also turned upon its horizontal axis. Each twisting device includes a pair of blocks 27, having inner faces 28 of rubber. The pairs of blocks in each device are moved toward each other so that the rubber faces 28 engage with the stripped end of the wire.

Arranged at the "weld" station are pairs of horizontal tubular holders 29 for receiving tubular terminals 30. The holders 29 are disposed radially outwardly and inwardly of the tracks 12, and are reciprocated in horizontal lines toward and from these tracks. The tubular terminals project inwardly beyond the holders, as shown. Arranged at the "weld" station are vertical electrodes 31, to engage with the ends of the wire and press the same against the inner surface of the terminals and to press the terminals against stationary electrodes 32, Figures 1 and 9. The electrodes 31 and 32 are connected with the opposite sides of a welding circuit, which is opened and closed by any suitable means.

Arranged at the "crimp" station are vertical crimping punches 33, to engage with the tops of the inner ends of the terminals 30. Arranged beneath the inner ends of the terminals 30 are stationary blocks 34. The punches crimp the inner ends of the terminals and clamp the same to the insulation 21*a* of the wire 21.

The practice of the method in connection with the apparatus shown and described is as follows:

The table 10 is indexed to bring each pair of stationary clamps 16 and 17 to the "feed" station and the table is stopped. When at the "feed" station, both clamps 18 and 19 are originally in the leading or open position, Figure 3. The feeding device 20 now feeds the wire a selected distance between the clamps 16 and 18 and the clamps 17 and 19, and the leading end of the wire 21 extends inwardly beyond the clamp 17 for a selected distance. The clamp 19 is now shifted rearwardly toward the clamp 17 and clamps the forward portion of the wire to the stationary clamp 17, while the clamp 18 remains in the open position. The inner portion of the wire is thereby held against movement and the carriage 13 at the "feed" station is now shifted in a trailing direction with respect to the movement of the table 10 and the wheel 14 moves in this trailing direction and the wheel draws the wire 21 through the feeding device which has now been returned to the starting position. The wire is

drawn between the stationary clamps 16 and 17 and is looped or folded upon itself in a trailing direction extending in the direction of the feed of the clamps 16 and 17. The looped portion of the wire extends generally circumferentially of the tracks 12, and this is important, as it enables the apparatus to handle sections of wire of considerable length, without necessitating spacing the clamps 16 and 17 a corresponding distance apart, which would greatly increase the size of the apparatus. The wheel 14 is moved in a trailing direction to the desired extent, to form the wire section in the selected length, and it is obvious that this length may be varied by shifting the wheel 14 for different distances. When the wheel 14 is brought to rest at the trailing distance from the stationary clamps, the clamp 18 is moved toward the stationary clamp 16 to clamp the wire 21 to the stationary clamp. The blades 23 are now operated to sever the wire. It is thus seen that the ends of the severed wire section extend beyond the clamps 16 and 17 for equal distances. The clamps 18 and 19 continue to clamp the end portions of the severed wire section to the stationary clamps 16 and 17 until the severed wire section has reached the "remove" station. The table 10 is now indexed to bring each pair of clamps 16 and 17 to the "strip" position and the table is then stopped. At the "strip" position, the stripping devices 24 move inwardly to receive the ends of the wire section 21 and its insulation 21*a*, and the blades 25 are shifted inwardly to contact with the insulation of the wire section, which is now held in the notches. The stripping devices are now moved horizontally from the stationary clamps 16 and 17 while the blades are in the closed position, and these blades strip the insulation 21*a* from the wire section leaving uncovered wire end portions 21*b*. The wire is formed of parallel strands. The stripping devices are shifted radially from the stationary clamps 16 and 17, from the position shown in Figure 1, to disengage the uncovered end portions 21*b*. The blades 25 are then returned to the open position. The stripping being completed, the table 10 is indexed to bring each pair of stationary clamps 16 and 17 to the "twist" station and is again stopped. At the "twist" station, the twisting devices 26 are then shifted radially inwardly to receive the uncovered end portions 21*b* of the wire section. The blocks 27 which are now open to receive the wire end portions 21*b* are now moved toward each other so that their rubber faces firmly contact with the uncovered wire end portions 21*b*, and while contacting with these end portions 21*b*, the twisting devices 26 are turned upon their horizontal axes and moved radially from the stationary clamps 16 and 17, until they slide from the uncovered end portions 21*b*. The rubber blocks 28 therefore firmly press against the uncovered end portions 21*b* while they are being rotated upon horizontal axes and slide longitudinally upon the end portions 21*b*, with the result that they spirally twist the end portions 21*b*, Figure 7. After the twisting devices move radially outwardly sufficiently to disengage the twisted end portions 21*b*, the table 10 will be indexed twice, stopping at each index position, to bring each pair of stationary clamps to the "weld" position. At the "weld" station, the operator inserts two terminals 30 in the tubular holders 29, with the open inner ends of the terminals 30 next to the stationary clamps 16 and 17. The tubular holders 29 are now moved inwardly toward the stationary clamps 16 and 17 and the twisted end portions 21*b* of the wire section will be inserted into the inner ends of the tubular terminals 30, Figures 8 and 9. The tubular terminals have elongated openings 30*a* in their upper portions, which are spaced from the inner ends of the terminals forming continuous end portions 30*b*. The insulation 21*a* of the wire section passes into the end portion 30*b*, and the twisted wire end portions 21*b* are arranged within the tubular terminals, opposite the openings 30*a*. The electrodes 31 at the "weld" station now move downwardly and pass through the openings 30*a* and press against the twisted wire end portions 21*b* to firmly press them against the surface of the terminals, which are pressed against the stationary stops 32. The welding circuit is closed and the twisted wire end portions 21*b* are welded to the inner surfaces of the tubular terminals, and the electrodes 31 are now raised to be moved out of the openings 30*a*. After the welding operation has been completed, the table 10 is indexed to bring each pair of stationary clamps 16 and 17 to the "crimp" station. At the "crimp" station, the crimp punches 33 move downwardly to engage the continuous end portions 30*b* to crimp the same and clamp them to the ends of the insulation 21*a*, so that the insulation cannot pull out of the tubular terminals 30. The crimping is transversely of the end portions 30*b*. After the crimping operation, the table 10 is indexed to bring each pair of stationary clamps 16 and 17 to the "remove" station. It should be stated that the tubular holders 29 are moved radially from the stationary clamps 16 and 17, after the completion of the welding operation, at the "weld" station, and the terminals 30 at the "crimp" station are supported entirely by the ends 21*b* of the wire section. When the stationary clamps 16 and 17 and the finished product reach the "remove" station, the clamps 18 and 19 are shifted from the stationary clamps and the ends of the wire section are freed from clamping engagement, and the finished product is removed by the operator. The table 10 is indexed twice to bring the leading pair of stationary clamps from the "remove" station to the "feed" station, the clamps 18 and 19 being first in the open position, at the "feed" station, Figure 3. The various steps are now repeated at the "feed" station and the succeeding stations.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that changes may be made in the shape, size and arrangement of parts of the apparatus, and that certain modifications may be made in the steps of the method and the order of such steps, without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. The method of securing terminals to the ends of a section of insulated wire, comprising holding the wire near one end, drawing the wire while holding the same near its end and looping the wire upon itself, holding the wire at a second point, severing the wire at a point near and spaced from the second point, removing the insulating material from the end portions of the wire to form uncovered metallic portions, twisting the uncovered end portions, inserting the uncovered twisted end portions into tubular terminals, and welding the twisted end portions to the inner portions of the tubular terminals.

2. The method of securing terminals to the ends of a section of insulated wire, comprising feeding the wire to a selected position and then holding the wire at a point arranged near and spaced from its free end, drawing the wire while holding the same near its end and looping the wire upon itself, holding the looped wire at a second point, severing the wire at a point near and spaced from the second holding point, removing the insulating material from the end portions of the wire to form uncovered metallic portions, inserting the uncovered end portions into metallic tubular terminals, and welding the uncovered end portions to the inner portions of the tubular terminals.

3. The method of securing terminals to the ends of a section of insulated wire, comprising holding the wire near one end, drawing upon the wire in a direction generally of the path of travel of the wire during subsequent steps to form a loop including opposite sides, one side being near the first point of holding, holding the wire at a second point near the other side of the loop, severing the wire at a point near and spaced from the second point of holding, indexing the wire while being held at the two points to a strip station and removing the insulation from the ends

of the wire at the strip station to form uncovered metallic end portions, indexing the wire while being held at the two points from the strip station to a twist station and twisting the uncovered end portions at the twist station, indexing the wire while being held at the two points from the twist station to a weld station and applying tubular terminals to the twisted end portions which enter the tubular terminals and welding the twisted end portions to the interior of the tubular terminals, indexing the wire while being held at the two points from the weld station to a crimp station and crimping the terminals to the ends of the insulation, and then releasing the holding action at the two points.

4. The method of securing terminals to the ends of a section of insulated wire, comprising holding the wire near one end, drawing upon the wire in a direction generally longitudinally of the path of travel of the wire during its subsequent indexing and thereby forming a loop including opposite sides, one side being near the point of holding, holding the wire at a second point near the opposite side of the loop, severing the wire at a point near and spaced from the second point of holding, indexing the wire while being held at the two points to a strip station and removing the insulation from the ends of the wire at the strip station to form uncovered metallic end portions, indexing the wire while being held at the two points from the strip station to a twist station and twisting the uncovered end portions at the twist station, indexing the wire while being held at the two points from the twist station to a weld station and inserting the twisted end portions and the ends of the insulation into metallic tubular terminals and welding the twitsed end portions to the interior of the tubular terminals while at the welding station, indexing the wire while held at the two points from the welding station to a crimp station, applying pressure to the ends of the tubular terminals to clamp the same to the ends of the insulation, and then releasing the holding action at the two points.

5. The method of securing terminals to the ends of a relatively long section of insulated wire, comprising supporting the wire and holding the wire near its free end, drawing the wire in a direction generally longitudinally of the subsequent indexing of the wire and forming a loop including opposite sides, one side being near the point of holding, holding the wire at a second point near the opposite side of the loop, severing the wire near the second point of holding, indexing the looped wire while being held at the two points to a strip station and removing the insulation from the ends of the wire at the strip station to form uncovered metallic end portions, again indexing the wire while being held at the two points and after the stripping operation from the strip station to a second station, bringing terminals into contact with the uncovered metallic end portions at the second station, and welding the terminals to the uncovered metallic end portions.

6. The method of securing a terminal to the end of an insulated wire, comprising removing the insulation from the wire at its end to provide an uncovered end portion, inserting the uncovered end portion and the end of the insulation into an initially tubular metallic terminal having a side opening, welding the uncovered end portion through the side opening to the interior of the tubular terminal, and clamping the tubular terminal to the end of the insulation.

7. The method of securing a metallic tubular terminal to an insulated wire, comprising forming an opening in the side of the metallic tubular terminal near and spaced from its end to form a continuous end portion, removing the insulation from the end of the wire for providing an uncovered metallic end portion, arranging the uncovered metallic end portion within the tubular terminal opposite the side opening and the end of the insulation within the continuous end portion of the terminal, passing an electrode through the side opening into engagement with the uncovered metallic end portion and welding the metallic uncovered end portion to the interior of the tubular terminal through the medium of said electrode, and applying pressure to the continuous end portion of the terminal to clamp the same to the end of the insulation.

8. The method of securing terminals to the ends of an insulated wire comprising holding the wire near one end, pulling the wire generally transversely of its line of feed to form a loop in the wire longitudinally of its path of travel during subsequent steps, holding the wire at a second point substantially opposite the first point of holding, severing the wire near the second point of holding, advancing the looped wire while it is held at the two points to a strip station and stripping the insulation from the ends of the wire generally transversely of the loop to form uncovered metallic end portions, advancing the wire while it is held at the two points from the strip station to a twist station and twisting the uncovered end portions, advancing the wire while it is held at the two points to a weld station and applying tubular terminals to the twisted end portions and welding the twisted end portions within the tubular terminals, advancing the wire while it is held at the two points to a crimp station and crimping the tubular terminals to the ends of the insulation, and then releasing the holding action on the wire at the two points.

9. Apparatus for securing terminals to the ends of relatively long sections of wire, comprising endless track means, a support carrying the endless track means and to be turned for indexing the endless track means, a plurality of spaced pairs of inner and outer devices arranged adjacent to the endless track means and connected with the endless track means to travel therewith, said pairs being spaced circumferentially of the endless track means, a wire feed device disposed at a feed station and arranged adjacent to the endless track means and serving to feed the wire transversely of the endless track means and adjacent to the inner and outer devices indexed to the feed station, the inner device at the feed station serving for clamping holding engagement with the free end portion of the wire, a carriage arranged adjacent to each pair of devices at the feed station, an element secured to the carriage to engage the wire between the inner and outer devices at the feed station, said carriage being shiftable with relation to the pair of devices at the feed station and circumferentially of the track means to draw the wire circumferentially of the track means and thereby forming the wire into a loop, the outer device at the feed station serving to guide the wire during the drawing operation and subsequently having clamping holding engagement with the wire, means arranged at the feed station to sever the wire near and outwardly of the outer device at said feed station, a pair of stripping devices arranged at a strip station which is spaced circumferentially of the endless track means from the feed station, said stripping devices serving to engage the ends of the looped wire while being clamped and removing the insulation therefrom, terminal holding devices arranged at a weld station which is spaced circumferentially of the track means from the strip station and serving to hold terminals in contact with the stripped ends of said wire while being clamped, and means for welding the terminals to the stripped ends of the wire.

10. Apparatus for securing terminals to the ends of relatively long sections of wire, comprising endless track means, a support carrying the endless track means and to be turned for indexing the endless track means, a plurality of spaced pairs of devices arranged adjacent to the endless track means and connected with the endless track means to travel therewith, said pairs being spaced circumferentially of the endless track means, a wire feed device disposed at a feed station and arranged adjacent to the endless track means and serving to feed the wire transversely of the endless track means and adjacent to the pair of devices indexed to the feed station, the one device at the feed station serving for clamping holding

engagement with the free end portion of the wire, a member arranged adjacent to the pair of devices at the feed station and including an element to engage the wire between the devices at the feed station, said member being shiftable with relation to the pair of devices at the feed station and circumferentially of the endless track means to draw the wire circumferentially of the endless track means and thereby forming the wire into a loop, the other device at the feed station serving to guide the wire during the drawing operation and subsequently having holding engagement with the wire, means arranged at the feed station to sever the wire near said other device at the feed station, and means spaced circumferentially of the track from the feed station to attach terminals to the free ends of each looped wire section when brought into cooperative relation to such means by the indexing of the clamped looped wire section, said last-named means including devices for holding the terminals in contacting relation with the free ends of the looped wire, and electrical devices for welding the contacting terminals and free ends together.

11. The method of securing terminals to the ends of relatively long sections of insulated wire, comprising forming relatively long sections of insulated wire in succession into loops and arranging the loops in spaced end-to-end relation, indexing the loops longitudinally to bring the ends of each loop in succession to a strip station and then a second station, stripping the insulation from the ends of each loop at the strip station, bringing the terminals into contact with the stripped ends of each loop at the second station, and welding the terminals to the stripped ends of each loop.

12. The method of securing terminals to the ends of relatively long sections of insulated wire, comprising forming relatively long sections of insulated wire in succession into loops and arranging the loops in end-to-end relation with their open ends arranged in a leading position with respect to the direction of subsequent indexing, indexing the loops longitudinally in an endless path to bring the open ends of each loop in succession to a strip station and then a second station, stripping the insulation from the free ends of each loop at the strip station, bringing the terminals into contact with the stripped ends of each loop at the second station, and welding the terminals to the stripped ends of each loop.

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