

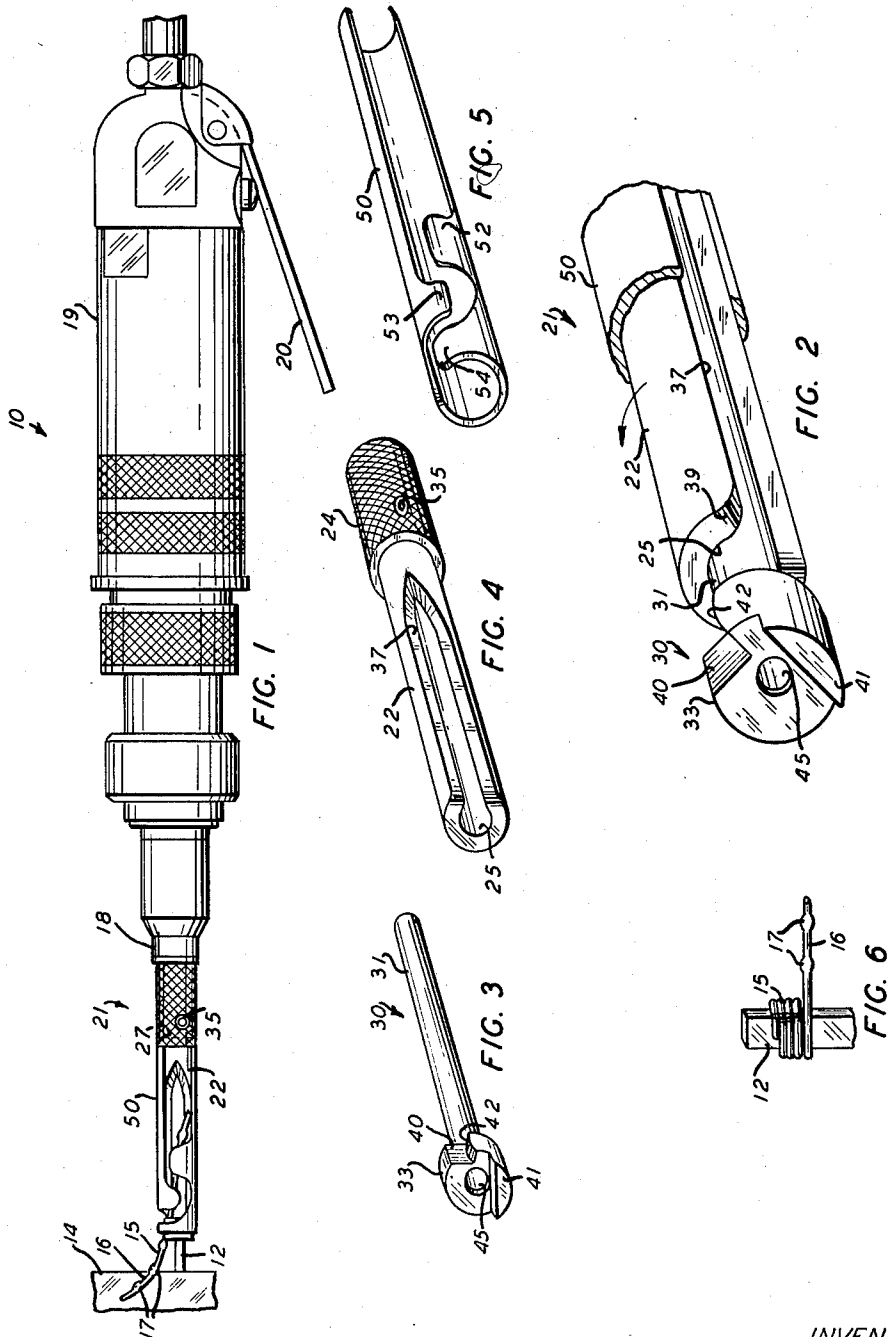
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APPARATUS FOR WRAPPING STRANDS ON ARTICLES

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APPARATUS FOR WRAPPING STRANDS ON ARTICLES

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This invention relates to apparatus for wrapping strands on articles, and more particularly to apparatus for wrapping the leading ends of electrically conductive wires on terminals.

One of the objectionable features of conventional wire wrapping tools is the necessity for threading a wire, which is to be wrapped about a terminal, through a restricted opening in the forward end of the tool, prior to each wrapping operation. This manner of loading the wire wrapping tool is time consuming and does not permit the use of such tools with wires which have been dipped in a protective resin compound, since beads of the resin, which are by design formed on the wire, prevent the passage of the wire through the restricted opening in the end of the tool.

It is an object of this invention to provide new and improved apparatus for wrapping strands on articles.

Another object of this invention is to provide a new and improved apparatus for wrapping the leading ends of electrically conductive wires on terminals.

Apparatus illustrating certain features of the invention may include rotatable means designed to be placed adjacent to an article upon which a strand is to be wound, the rotatable means having a strand-receiving channel formed therein of such configuration as to cause a strand positioned in the channel to follow a tortuous path, and means for rotating the rotatable means to cause the strand to be advanced through the channel and wrapped about such article, the strand being tensioned by the snubbing action of the tortuous path it follows, whereby the strand is wrapped tightly on the article.

A complete understanding of the invention may be had from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a side elevation of wire wrapping apparatus embodying features of this invention;

Fig. 2 is an enlarged, fragmentary, perspective view of a wrapping tool forming a part of the apparatus, with parts thereof broken away for clarity;

Fig. 3 is an enlarged, perspective view of an element forming a part of the wrapping tool;

Fig. 4 is an enlarged, perspective view of another element forming a part of the wrapping tool;

Fig. 5 is an enlarged, perspective view of another element forming a part of the wrapping tool, and

Fig. 6 is an enlarged, fragmentary view of a terminal having a wrapped connection made by the use of the wire wrapping apparatus.

Referring now to Fig. 1, a wire wrapping apparatus forming an exemplary embodiment of the invention, is shown in operating position relative to a terminal 12 of an electrical apparatus unit, such as a cable terminal assembly 14, and relative to a wire 15, the leading end of which is to be wrapped in a tight helix about the terminal. The wire 15 is shown coated with a film 16 of a protective resin, such as a polyester-styrene type resin, of which "Selectron" is an example, which has been

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applied to the wire by dipping the wire into a solution of the resin. As a result of this coating process, a plurality of resin beads 17—17 are formed randomly along the wire 15.

The wire wrapping apparatus 10 includes a rotatable shank 18, which is driven by an air motor 19 of a standard commercial design. For the purpose of this description, it will be assumed that the rotation of the shank 18 is unidirectional and that upon actuation of a trigger lever 20 associated with the air motor 19, the shank rotates in the direction of the arrow, as viewed in Fig. 2.

Secured to the forward end of the shank 18 is a wrapping tool, indicated generally at 21. The wrapping tool 21 includes a cylindrical spindle 22 having an enlarged shouldered portion 24. Formed in the spindle 22 is a circular bore 25 extending axially from the forward end thereof into communication with a counterbore 27 provided in the shouldered portion 24. The counterbore 27 is adapted to receive the free end of the rotatable shank 18 which is immovably secured therewithin to permanently attach the wrapping tool 21 to the shank for rotation therewith.

Adjustably positioned within the bore 25 of the spindle 22 is a wrapping member 30, which consists of a cylindrical post 31 having formed integrally on one end thereof a disk-like wrapping head 33. The post 31 is designed to be received snugly within the axial bore 25 and is adjustably positionable both axially and angularly with respect to the spindle 22. A set screw 35 normally retains the post 31 fixedly within the bore 25 in a predetermined position with respect to the spindle 22.

The spindle 22 is provided also with a milled slot 37 opening on the surface of the spindle and on the forward end thereof. The slot 37 is oriented substantially parallel to the longitudinal axis of the bore 25 and extends from its opening on the forward end of the spindle 22 to a point on the spindle adjacent to the shouldered portion 24. In one embodiment of the invention the longitudinal sides of the slot 37 are substantially radial with respect to the bore 25, the vertical angle between the sides subtending an arc of approximately 90° on the periphery of the spindle 22. As shown in Fig. 2, the forward edge 39 of the leading side of the slot 37 (assuming counterclockwise rotation of the wrapping tool 21), is rounded to permit a wire leaving the slot during a wrapping operation to slide thereover without undue frictional resistance.

Referring now to Fig. 3, wherein the wrapping member 30 is shown in enlarged detail, a notch 40 is formed in the periphery of the wrapping head 33, the edges of the notch being disposed at substantially right angles with respect to each other. A rear edge 42 of the notch 40 is rounded to reduce the frictional resistance on a wire passing from the slot 37 and around this edge.

A circular, axial bore 45 is formed in the wrapping head 33, opening on the forward face of the wrapping head and extending partially into the post 31. The bore 45 is chamfered at its opening and is adapted to receive the terminal 12 about which the wire 15 is to be wrapped. Provided additionally on the forward face of the wrapping head 33, is a projecting segmental lug 41, a straight chordal edge portion of which is spaced from the tip of the opening of the bore 45 by a distance somewhat greater than the diameter of the wire 15, and is aligned in parallel relationship with respect to the rounded edge 42 of the wrapping head.

In the assembled wrapping tool 21 (Fig. 2), the rear face of the wrapping head 33 is spaced axially from the forward end of the spindle 22 so as to permit the passage of the wire 15 therebetween. The notch 40 is positioned angularly with respect to the forward edge 39 of the slot

37, the rear edge 42 of the notch, in one embodiment being displaced counterclockwise from the forward edge of the slot by an angle of approximately 45°.

Partially surrounding the assembled spindle 22 and the wrapping member 30, is a resilient split shield 50, made preferably of clock spring steel sheet (Fig. 5). In forming the split shield 50 into its generally cylindrical shape, it is slightly overformed so that when slid over the assembled spindle 22 and wrapping element 30, it is self-retaining. The opposed longitudinal edges of the shield 50 along the split are spaced apart to permit the leading end of the wire 15 to be placed lengthwise into the slot 37 and the tortuous extension of the slot formed by the forward end of the spindle 22 and the rear face of the wrapping head 33.

The edges of the shield 50 are provided with a plurality of lobes 52, 53 and 54, designed to prevent the portion of the wire 15, positioned in the slot 37 and the tortuous extension of the slot between the forward end of the spindle 22 and the rear face of the wrapping head 33, from being thrown outwardly by centrifugal force and the tendency of the wire to stay straight as the wrapping tool 21 is rotated during a wrapping operation. The lobe 54, which is positioned adjacent to the wrapping head 33, likewise prevents the wire 15 from slipping off the rounded rear edge 42 of the notch 40.

Operation

In utilizing the wire wrapping apparatus, the end of the wire 15 to be wrapped about the terminal 12 is placed adjacent to the free end of the wrapping tool 21, and then in the notch 40 provided in the wrapping head 33. The wire 15 is next laid sidewise around the rear edge 42 of the wrapping head 33, between the forward end of the spindle 22 and the rear face of the wrapping head, around the forward edge 39 and into the slot 37 beneath the lobes 53 and 54 of the shield 50.

With the wire 15 so inserted in the wrapping tool 21, the end of the wrapping tool 21 is placed over the terminal 12 (Fig. 1), the end of which is received within the axial bore 45 formed in the wrapping head 33. The trigger lever 20 is then actuated manually to energize the air motor 19, which imparts counterclockwise rotary motion to the shank 18 and the attached wrapping tool 21.

As the wrapping tool 21 rotates, the wire 15 is pulled from the slot 37 and slides through the notch 40 over the rear edge 42 to be wrapped in a tight helix about the terminal 12. The wire 15, as it slides from the slot 37, is forced to follow a tortuous path around the forward edge 39 in the slot between the forward end of the spindle 22 and the rear face of the wrapping head and then through the notch 40 in the wrapping head 33 over the rounded edge 42. This tortuous path, which the wire 15 must follow, exerts a snubbing action on the wire, which prevents the leading end of the wire 15 from issuing too rapidly from the slot 37 and serves to tension the wire to insure the formation of a tight helical wrapping on the terminal 12. The wrapping operation continues until the free extremity of the wire 15 passes over the rear edge 42 of the notch 40, whereupon it is caught by the flat edge of the projecting segmental lug 41 on the lower face of the wrapping head 33, which forms the wire end tightly into a final convolution about the terminal 12. Without the lug 41, the extreme leading end of the wire 15 would not be wrapped tightly about the terminal 12.

The bending and flexing of the wire 15, as it traverses the previously described tortuous path from the slot 37 to the point of application of the helical wrapping on the terminal 12, causes substantially all of the resin film 16, including the resin beads 17—17 to become crushed, whereupon the resin flakes off to bare the wire immediately before it is wrapped about the terminal. This feature, in addition to the tensioning effect resulting from the snubbing action, insures a tight solderless electrical

connection between the wire 15 and the terminal 12 which has a low contact resistance.

The previously mentioned snubbing action may be increased or decreased by adjusting the position of the cylindrical post 31 of the wrapping member 30 axially with respect to the spindle 22, and also by rotating the wrapping member about its axis to change the angular relationship between the forward edge 39 of the slot 37 and the rear edge 42 of the notch 40 in the wrapping head, thereby altering the path followed by the wire as it leaves the wrapping tool to make it more or less tortuous.

It will be understood that this invention is not limited to the hereinabove described embodiment thereof. It is manifest that various modifications may be made within the spirit and scope of the invention.

What is claimed is:

1. Apparatus for wrapping strands on articles, which comprises rotatable means designed to be placed adjacent to an article upon which a strand is to be wound, said means having a strand-receiving channel formed therein adjacent to the outer periphery on the forward end thereof, extending longitudinally and circumferentially of said rotatable means, being completely accessible laterally thereof and throughout the entire length of the channel for lateral insertion of the strand and being of such configuration as to cause a strand positioned in the channel to follow a tortuous path within said channel, said rotatable means having at least one lobe extending over the tortuous channel circumferentially of the rotatable means and adjacent to the outer periphery thereof for preventing the strand from being removed unintentionally laterally from the channel by inherent forces such as gravitational or centrifugal forces exerted thereon, and means for rotating the rotatable means about the longitudinal axis thereof to cause a strand so positioned to be advanced through said tortuous channel and wrapped about such article, the strand being tensioned by a snubbing action resulting from its following the tortuous path while advancing through said channel whereby the strand is wrapped tightly on the article.

2. Apparatus for wrapping strands on articles, which comprises a rotatable member designed to be placed adjacent to an article upon which a strand is to be wound, said member having formed therein a longitudinal slot, a second longitudinal slot offset from the first slot, and a third slot connecting the two longitudinal slots whereby the three slots provide a tortuous channel for the reception of a strand, means for rotating said member about the longitudinal axis thereof to cause the strand positioned in said tortuous channel to be advanced through said channel and wrapped about such article, the strand being tensioned by a snubbing action resulting from its following the tortuous path while advancing through said channel whereby the strand is wrapped tightly on the article, and means for varying the relative angular positions of the longitudinal slots to alter the tortuous channel and thereby vary the snubbing action on the strand.

3. Apparatus for wrapping the ends of electrically conductive wires on terminals, which comprises a rotatable spindle having a longitudinally extending slot formed in the forward portion thereof and opening on the surface of the spindle and on the forward end thereof to receive an end of a wire, a wrapping head attached to and spaced from the forward end of the spindle and having a notch formed therein out of alignment with the opening of the slot on the forward end of the spindle so as to cause a wire inserted in said slot and said notch to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal upon which the wire is to be wrapped, and means for rotating the spindle to cause the end of the

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wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on the terminal inserted in the axial opening, the wire being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping thereof on the terminal.

4. Apparatus for wrapping the ends of electrically conductive wires on terminals, which comprises a rotatable spindle having a longitudinally extending slot formed in the forward portion thereof and opening on the surface of the spindle and on the forward end thereof to receive an end of a wire, a wrapping head attached to and spaced from the forward end of the spindle and having a notch formed therein out of alignment with the opening of the slot on the forward end of the spindle so as to cause a wire inserted in said slot and said notch to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal upon which the wire is to be wrapped, means for rotating the spindle to cause the end of the wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on the terminal inserted in the axial opening, the wire being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping thereof on the terminal, and a shield partially encompassing the wrapping head and the spindle, said shield being designed to permit the wire to be inserted laterally into the slot in the spindle and the notch in the wrapping head and to be retained therein as the spindle rotates.

5. Apparatus for wrapping the ends of electrically conductive wires on terminals, which comprises a rotatable spindle having a longitudinally extending slot formed in the forward portion thereof and opening on the surface of the spindle and on the forward end thereof to receive an end of a wire, a wrapping head attached to and spaced from the forward end of the spindle and having a notch formed therein out of alignment with the opening of the slot on the forward end of the spindle so as to cause a wire inserted in said slot and said notch to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal upon which the wire is to be wrapped, means for rotating the spindle to cause the end of the wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on the terminal inserted in the axial opening, the wire being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping thereof on the terminal, and a split sleeve partially surrounding the wrapping head and the spindle circumferentially, the opposed longitudinal edges of the sleeve forming the split being separated sufficiently to permit the wire to be inserted sidewise into the slot and the notch and being provided with lobe portions extending partially over the slot and the notch to retain the wire therewithin.

6. Apparatus for wrapping the ends of electrically conductive wires on terminals, which comprises a rotatable spindle having a longitudinally extending slot formed in the forward portion thereof and opening on the surface of the spindle and on the forward end thereof to receive an end of a wire, a wrapping head attached to and spaced from the forward end of the spindle and having a notch formed therein normally out of alignment with respect to the opening of the slot on the forward end of the spindle so as to cause the end of a wire inserted in said slot and said notch to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal upon which the wire is to be wrapped, means for rotating the

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spindle to cause the end of the wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on the terminal inserted in the axial opening, the wire being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping thereof on the terminal, and means for adjustably positioning the wrapping head with respect to the spindle to alter the tortuous path followed by the wire and thereby to vary the tension on the wire being wrapped on the terminal.

7. Apparatus for wrapping the ends of electrically conductive wires on electrical terminals, which comprises a spindle having an axial bore formed therein and a slot provided in its periphery, said slot opening on the forward end of the spindle and being oriented substantially parallel to the axial bore, a post received within said axial bore and having its forward end protruding therefrom, a disk-like wrapping head attached to the forward end of the post and having a notch formed in the periphery thereof for slidably engaging a wire, the notch being normally positioned angularly out of alignment with the opening of the slot on the forward end of the spindle so as to cause the leading end of a wire positioned in said slot to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal upon which the wire is to be wrapped, means for rotating the spindle to cause the end of the wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on the terminal inserted in the axial opening, the strand being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping on the article, and means for adjusting the axial and angular position of the post within the bore in the spindle thereby altering the tortuous path followed by the wire to vary the tension on the wire being wrapped on the terminal.

8. Apparatus for wrapping the ends of electrically conductive wires on electrical terminals, which comprises a spindle having an axial bore formed therein and a slot provided in its periphery opening on the forward end of the spindle and oriented substantially parallel to the axial bore, a cylindrical post received within the axial bore and having its forward end protruding therefrom, a disk-like wrapping head secured concentrically to the forward end of the post and having formed in its periphery a notch positioned angularly out of alignment with the opening of the slot on the forward end of the spindle so as to cause the end of the wire inserted in the slot and the notch to follow a tortuous path when advancing through the slot and the notch, said wrapping head being also provided with an axial opening for receiving therein one end of an electrical terminal about which the wire is to be wrapped, a projecting lug provided on the forward face of the wrapping head adjacent to the axial opening, means for rotating the spindle to cause the end of the wire to slide out of the slot and through the notch in the wrapping head while being wrapped helically on a terminal inserted in the axial opening, the wire being subjected to a snubbing action resulting from its following the tortuous path whereby the wire is tensioned to insure a tight wrapping thereof on the terminal, and a split sleeve partially surrounding the wrapping head and the spindle circumferentially to prevent the wire from being thrown outwardly therefrom by centrifugal force during the rotation of the spindle.

9. A tool for connecting the end of a wire to a post-like terminal to form a solderless wrapped connection, which comprises an elongated, rotatable tool member provided with an axial bore at the forward end thereof to receive such a terminal and having formed in its outer periphery a tortuously configured, generally longitudinally and circumferentially extending slot extending to

said forward end and completely accessible laterally of the member into which a portion of a wire may be inserted sidewise, drive means for rotating the tool member about a terminal received within the axial bore to wrap a wire positioned in the slot about the terminal, whereby a snubbing action on the wire results from its following of the tortuous path in the slot serving to tension the wire sufficiently to insure a tight wrapping about and effective electrical contact with the terminal, and means having at least one lobe positioned stationarily with respect to the sides of the slot for preventing the wire from being removed unintentionally laterally from the slot by

inherent forces such as gravitational and centrifugal forces exerted thereon.

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