Feb. 19, 1963 W. L. OLDS ET AL 3,078,052

CONDUCTOR WRAPPING DEVICE

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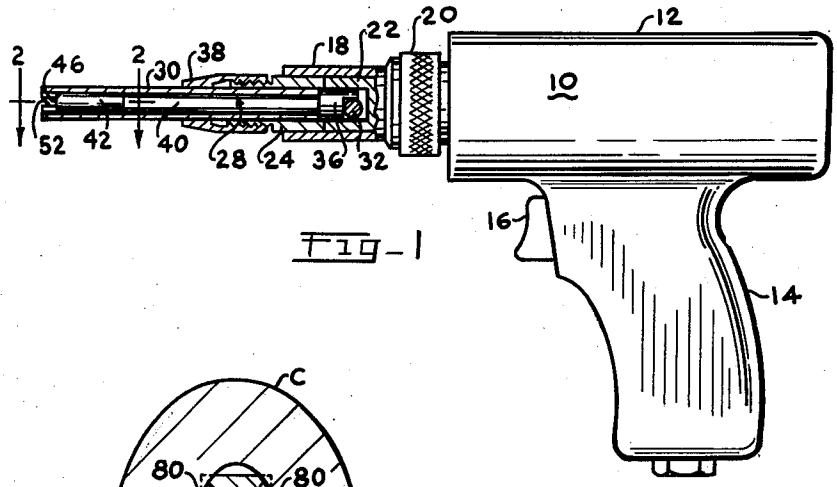

Fig-1

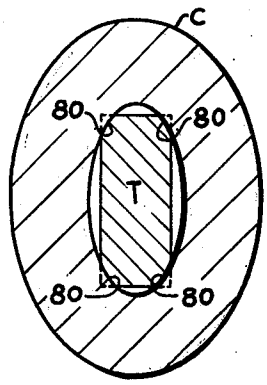

Fig-11

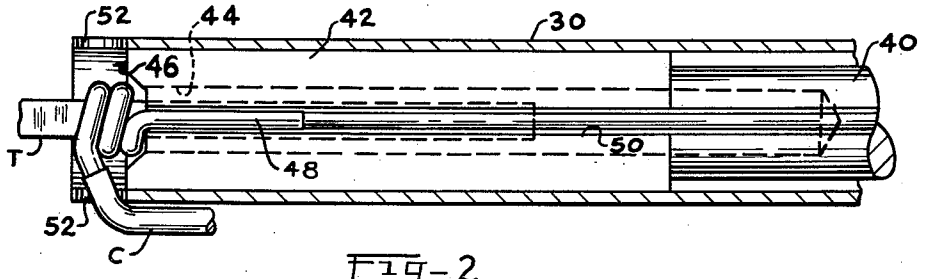

Fig-2

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Fig-3

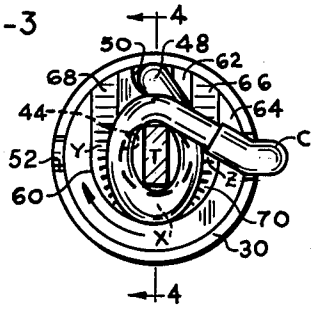


Fig-4

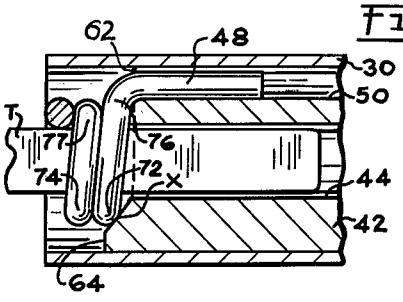


Fig-5

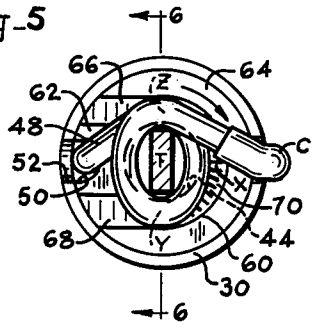


Fig-6

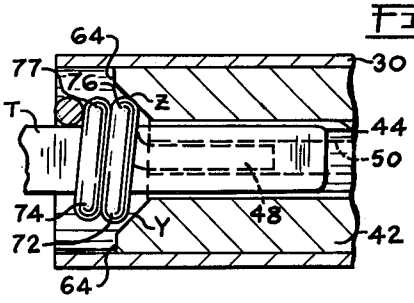


Fig-7

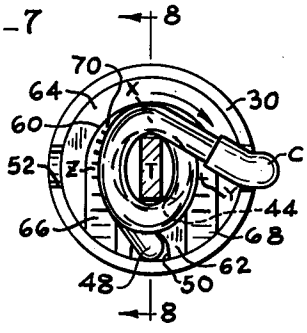


Fig-8

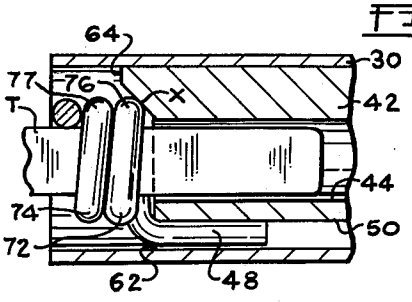


Fig-9

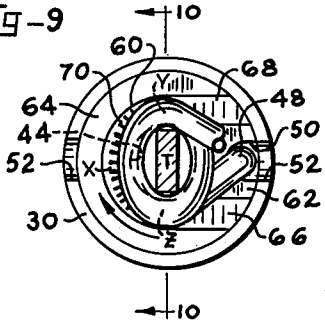
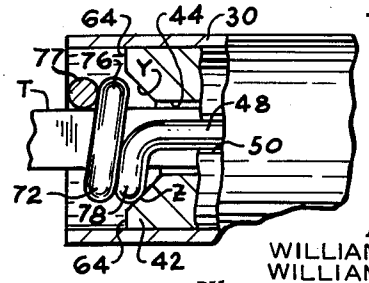


Fig-10



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CONDUCTOR WRAPPING DEVICE

Filed June 30, 1960 3 Sheets-Sheet 3

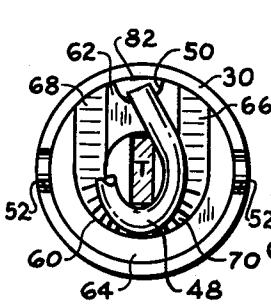


Fig-12

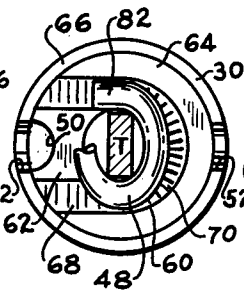


Fig-13

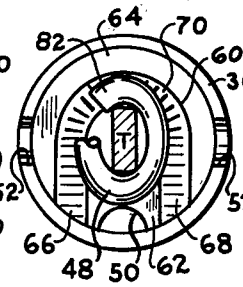


Fig-14

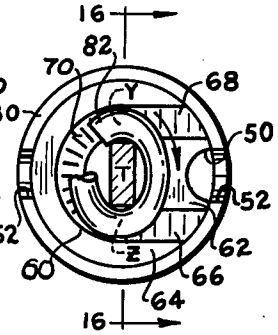
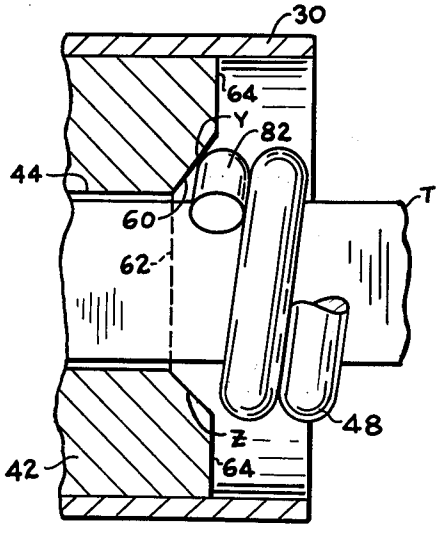


Fig-15

Fig-16



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3,078,052

CONDUCTOR WRAPPING DEVICE

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Filed June 30, 1960, Ser. No. 40,106
5 Claims. (Cl. 242—7)

This invention relates generally to devices for wrapping a conductor about a terminal in helical convolutions, and more particularly to improved wrapping bit means for such devices.

Devices of this general character may comprise a rotative power source and a shaft or bit connected to said power source and rotatably journaled in a stationary guide or sleeve. At its free end, the bit may be provided with a longitudinal recess for receiving an electrical terminal and a radially-offset, longitudinally-extending groove for receiving and positioning the end portion of a conductor which is wound about the terminal upon rotation of the bit.

The principal object of the present invention is the provision of an improved conductor wrapping bit having a conductor engaging end face constructed to produce electrical connections having good electrical characteristics and mechanical stability. This object is generally attained by the provision of a wrapping bit end face having surface portions which continuously engage and forcibly cam successive convolutions of the conductor into high pressure contact with the terminal.

In wire wrapping devices of this type, the last portion of the wire to be withdrawn from the wire-receiving groove may not be pressed inwardly toward the terminal unless a special wipe-down surface is provided on the bit face. Unless such a wipe-down surface is provided, undesirable interterminal shorting may occur between wire ends extending laterally from closely spaced terminals. Therefore, another object is to provide an end face construction for a wire wrapping bit which positively and smoothly urges the end portion of the wire into intimate contact with the terminal.

Conductor wrapping devices sometimes employ bits having more or less irregular end faces which, when rotated, contact the conductor in such a manner as to produce axial movement of the bit face with respect to the coils of the conductor wound upon the terminal. With certain conventional end face designs, such axial movement produces impacting of the connection during the wrapping operation, the wipe down operation and the usual post-wrapping turns of the bit. Such impacting may cause embrittlement of the wrapped convolutions of the conductor and tends to impair the electrical and mechanical integrity of the connection. Therefore, in carrying out another object of this invention, the bit face construction performs the aforementioned wrapping operations without deleterious axial impacting of the connection. More particularly, the end surface of a bit constructed in accordance with this invention is free from sharply offset portions or other acute surface irregularities which may produce such impacting.

Yet another object of the present invention is to overcome certain difficulties present in conventional wrapping bits by providing a bit face construction which effectively prevents piling up or overlaying of successive conductor convolutions one upon the other. In the wrapping operation, the conductor is coiled about the terminal in a helix. Axial force is conventionally applied to the bit and through the bit to the conductor to insure that the convolutions of the helix are contiguous to each other. It has been observed that excessive axial thrust applied to some conventional bits tends to produce conductor-

pile-up and results in a defective connection. However, in the construction according to the present invention, that portion of each conductor convolution which receives the aforementioned axial thrust from the bit face is laid closely about the terminal and is securely positioned in axial alinement with the preceding convolution before axial force tending to produce pile-up is applied thereto.

A still further object is the provision of a conductor wrapping bit which provides the foregoing objects and advantages upon rotation of the bit in either direction. To attain this object the bit face is symmetrically constructed about a rectilinear prolongation of a diameter of the terminal receiving recess. Such flexibility in operation is particularly advantageous in multi-bit wiring devices.

A general object is to provide a replaceable wrapping bit characterized by ease of manufacture and low cost.

Further objects and advantages will be apparent from the following specification and claims read in conjunction with the accompanying drawings, in which:

FIGURE 1 is a view, partly in section, illustrating a rotary tool which includes a wrapping bit constructed in accordance with the present invention;

FIG. 2 is a fragmentary sectional view taken substantially along lines 2—2 of FIG. 1 and illustrating a terminal disposed in the bit member in proper relationship for wrapping;

FIG. 3 is a plan view illustrating the end face of the bit member;

FIG. 4 is a fragmentary sectional view taken substantially along lines 4—4 of FIG. 3;

FIG. 5 is a view similar to FIG. 3 showing the relative positions of the parts following 90° of counter-clockwise rotation of the bit member;

FIG. 6 is a fragmentary sectional view taken substantially along lines 6—6 of FIGURE 5;

FIG. 7 is a view similar to FIG. 3 showing the relative positions of the parts following 180° of counter-clockwise rotation of the bit member;

FIG. 8 is a fragmentary sectional view taken substantially along lines 8—8 of FIG. 7;

FIG. 9 is a view similar to FIG. 3 showing the relative positions of the parts after 270° of counter-clockwise rotation of the bit member;

FIG. 10 is a fragmentary sectional view taken substantially along lines 10—10 of FIG. 9.

FIG. 11 is a transverse sectional view taken through a completed conductor convolution wrapped about a terminal in accordance with the present invention;

FIG. 12 is a plan view illustrating the wipe-down of the extreme end portion of the conductor;

FIG. 13 is a view similar to FIG. 12 showing the relative positions of the parts following 90° of counter-clockwise rotation of the bit;

FIG. 14 is a view similar to FIG. 12 showing the relative positions of the parts following 180° of counter-clockwise rotation of the bit;

FIG. 15 is a view similar to FIG. 12 showing the relative positions of the parts following 270° of counter-clockwise rotation of the bit; and,

FIG. 16 is a sectional view taken substantially along lines 16—16 of FIG. 15.

SPECIFICATION

In the illustrative construction according to the invention, the numeral 10 generally indicates a rotary tool including a housing 12 for a conventional rotatable power source, such as an electric or pressure fluid motor; an integrally formed handle extension 14; and, an operator controlled trigger element 16 for manually actuating the tool. A guide sleeve 18 is detachably secured to a forwardly projected portion of housing 12 by a nut 20. A

rotatable bit driving member 22 is coaxially carried within guide sleeve 18 and engages a mating rotatable element (not shown) which is operatively connected to the motor disposed in housing 12. A collet 24 extends into the forward end of guide sleeve 18 and is secured against relative rotational and axial movement. A conductor wrapping bit 28 is insertable into a tubular bit sleeve 30 in a forwardly direction. In properly assembled relation with collet 24 and bit driving member 22, as shown in FIG. 1, the bit 28 is held against relative rotation with respect to the bit driving member 22 by interlocking engagement of a pin 32, transversely carried by member 22, and a notch in an enlarged, integral shank portion 36 of bit 28. The bit sleeve 30 is held against relative rotational movement with respect to collet 24 by a collet nut 38 which compressively engages the bit sleeve 30 at its forward end and threadedly engages the forwardly extending portion of collet 24. While abutment of the extreme inner end of bit sleeve 30 and the front face of shank 36 of the bit prevents axial displacement of the bit 28 with respect to sleeve 30, the shaft 40 and the integral head 42 of the bit 28 are freely rotatable within the surrounding sleeve 30 in response to actuation of the motor.

As shown in FIG. 2, a bore 44 extends axially into the forward end of bit 28. The bore 44 has a diameter and length sufficiently great to freely receive an electrical terminal T about which conductor C is to be wound. For purposes of illustration, the terminal T is shown as a generally rectangular metallic post; however, in practice, the configuration and dimensions of the terminal will vary to suit particular wiring applications. The terminal may be fixed to a terminal board (not shown) which carries a number of closely spaced terminals.

To position the stripped portion 48 of conductor C for application to the terminal T in contiguous helical convolutions upon rotation of bit 28, the bit is provided with a conductor receiving groove 50 which is closed by the overlying bit sleeve 30. The groove is longitudinally relieved in the peripheral surface of the bit to open axially to the end face 46 of bit 28 and is disposed in radially offset relation to the terminal receiving bore or recess 44. In operation the stripped end 48 of conductor C is withdrawn from groove 50 as it is wound about terminal T. In the illustrated embodiment, a portion of bit sleeve 30 which longitudinally projects beyond bit head 42 of the bit 28 is provided with a pair of radially opposed slots 52, 52. A selected one of these slots receives a portion of conductor C which is first positioned in the slot and is preferably bent rearwardly along bit sleeve 30.

In accordance with the present invention, the illustrative wrapping bit 28 is provided with an improved construction of the bit face 46 which facilitates production of wrapped connections characterized by increased, uniform compression between conductor C and terminal T. Such improved connections are made possible by a continuous camming action exerted upon the conductor C to successively urge each convolution into tight engagement with the terminal T and with the next preceding completed convolution. As will be hereinafter described in detail, this improved camming action is provided by a generally U-shaped cam surface 60 which, during the entire winding operation, continuously urges successive portions of conductor C radially inwardly toward terminal T and axially forwardly from the end face 46 of the bit.

As seen in FIGS. 3 and 4, for example, the end face of the bit comprises two axially offset, parallel flat surfaces 62 and 64 which will hereinafter be respectively referred to as the inner surface and the outer surface of the bit end face. The inner surface 62 is defined by the peripheral edge of bit head 42, the end edge of the opening of conductor receiving groove 50, a portion of the end edge of the opening of terminal receiving bore 44, and the inner edges of laterally spaced surfaces 66 and 68 of cam 60. Preferably, the terminal receiving bore 44 and the conductor receiving groove 50 have their entire end edges in the plane of the inner surface 62. The outer surface 64 of the bit face is defined by the major portion of the peripheral edge of bit head 42 and the outer edge of cam 60. The U-shaped cam 60 is interposed between surfaces 62 and 64 and slopingly connects these surfaces by means of the spaced surfaces 66 and 68 of the cam. A semicircular portion of the opening of bore 44 has disposed thereabout a curved portion 70 of cam 60 which connects cam surfaces 66 and 68 and slopingly intersects the plane of the inner flat surface 62. The slope and width of all surfaces of cam 60 are preferably uniform with respect to the plane of the inner bit face surface 62.

The aforementioned continuous camming of conductor C against terminal T by the cam 60 will be better understood from the following description of a preferred mode of operation of the tool 10. In the usual manner, the end portion 48 of conductor C is prepared and inserted a predetermined distance into groove 50; and, an adjacent insulated portion of the conductor is bent into anchored position within a selected slot 52 and manually held along bit sleeve 30. The tool 10 is then moved forwardly to insert the free end of terminal T into bore 44. The rotative power source housed in tool 10 is then energized for rotating bit 28 by manually depressing trigger 16. From the foregoing description of the parts of tool 10 and their operational relationships, it will be understood that the bit 28 and its end face 46 will rotate within the bit sleeve 30 and about the stationary terminal T. Looking at FIGS. 3 through 10 and assuming counter-clockwise rotation of bit 28, the stripped portion 48 of conductor C will be withdrawn from groove 50, and successive convolutions thereof will be wrapped around terminal T until the extreme end of the conductor C is withdrawn and wiped down as shown in FIGS. 12 through 16.

As thus far described, the winding operation is somewhat similar to the operation of prior art devices for applying a conductor to a terminal. However, the following detailed description of the action of cam 60 in camming conductor C tightly against terminal T will point out certain essential features of the invention unattainable in prior art devices. FIGS. 3 through 10 clearly illustrate the continuous camming action exerted against conductor C during the wrapping operation. These figures show progressive angular positions of cam 60, with respect to a single convolution of conductor C, at 90 degree increments of counterclockwise movement of bit 28. Spaced points, indicated by letters X, Y and Z and located centrally and at opposite ends of the semicircular portion 70 of cam 60, are included in the drawings to clearly indicate the position of the operative camming point of cam 60 at each illustrated interval of revolution of bit 28 and to facilitate description of the direction of movement of this point along the cam surface 60. In FIGS. 3 through 10 the conductor C is illustrated as having been wound around terminal T approximately two complete convolutions; however, it will be apparent that the hereinafter described camming action occurs during each wrapping revolution of the bit.

FIGS. 3 and 4 show that the stripped portion 48 of conductor C is being drawn from groove 50 downwardly around and to the right-hand side of terminal T. As shown in FIG. 4, a point on the surface of stripped portion 48 engages the sloping surface of semicircular portion 70 substantially at point X. Thus at this particular rotative position of cam 60, the bottom portion 72 of the engaged convolution is being urged radially inwardly toward the bottom surface of terminal T. At the same time, cam 60 is urging this same portion of the convolution axially outwardly against the corresponding bottom

portion 74 of the next preceding convolution. As the cam 60 moves counter-clockwise from the position illustrated in FIGS. 3 and 4 toward the position illustrated in FIGS. 5 and 6, the operative camming point on cam portion 70 will move in a clockwise direction from point X toward point Y as indicated by the directional arrow in FIG. 3. Continued counter-clockwise rotation of cam 60 causes additional withdrawal of conductor C from groove 50 and, as shown in FIGS. 5 and 6, places camming point Z in contact with the upper portion 76 of the instant convolution just as the bottom portion 72 thereof moves axially away from the radially opposed point Y. The directional arrow in FIG. 5 indicates the clockwise direction of movement of the operating camming point between points Z and X on sloping surface 70. The upper portion of the instant convolution is continuously cammed radially inwardly and axially outwardly in the manner hereinbefore described with reference to the action of cam 60 against the lower portion 72 during the preceding 90 degree increment of revolution. After the cam 60 has rotated from the angular position illustrated in FIGS. 5 and 6 to the position shown in FIGS. 7 and 8, the operative camming point once again becomes point X. During the next 90 degrees of rotation of bit 28, the operative camming point will move progressively around sloping surface 70 from point X to point Y continuously camming the upper portion 76 of the instant convolution against the upper surface of terminal T, as indicated in FIGS. 7 and 8. Just as point Y becomes inoperative for camming conductor portion 76, as shown in FIGS. 9 and 10, the operative camming point shifts from point Y to point Z. Point Z then engages the last formed bottom conductor portion 78 camming the same radially inwardly toward the lower surface of terminal T and axially outwardly into intimate contact with portion 72 of the next preceding convolution. As the cam 60 rotates 90 degrees in a counter-clockwise direction from the position shown in FIGS. 9 and 10 to that shown in FIGS. 3 and 4, the camming point operating upon lower conductor portion 78 will travel clockwise from point Z to point X to complete one cycle of camming action.

From the foregoing description it will be apparent that during each complete revolution of the bit, the upper and lower portions of a convolution of conductor C are alternately cammed into high pressure contact with terminal T for 180 degree intervals of rotation. It will also be apparent that the operative camming points operating upon both upper and lower portions of each convolution move progressively along the entire length of sloping semicircular cam surface 70 during each 180° camming period.

The importance of continuously camming the conductor C into high-pressure contact with terminal T, in accordance with the hereinbefore described operation of the invention, will be apparent to those familiar with so-called solderless wrapped connections. A standard industrial test employed to determine the mechanical and electrical efficiency of wrapped connections is that of applying and measuring the force required to axially strip the wrapped convolutions of the conductor from the terminal in a direction toward the free end of the terminal. This is commonly called the "strip force test." An important advantage of this invention is the provision of a wrapping bit which enables tighter wrapping of a conductor about a terminal thereby increasing the force required to strip the helically wound conductor from the terminal.

The above-described wrapping operation of the bit 28 which has a wrapping face 46 constructed to continuously and uniformly cam the conductor radially inwardly into high pressure contact with terminal T at the upper and lower portions of each wrap, is particularly well adapted to produce wrapped connections requiring a greater force to strip the terminal as aforedescribed. A viewed in FIG. 11, the contacting surfaces 80, which provide electrical conductivity and mechanical stability between conductor C and the rectangular terminal T, occur generally at upper and lower portions of each convolution of the conductor. The contacting surfaces 80 comprises mating indentations at the sharp corners of terminal T and at spaced intervals along conductor C. Such mutual deformation is created by tensile and compressive forces operating upon conductor C as it is drawn around and forcibly compressed against terminal T by the improved wrapping bit 28. As previously shown, the semicircular cam portion 70 provides an operative camming point which is continuously in contact with a portion of conductor C drawn either around the top or the bottom surface of terminal T. Thus the critical contacting areas 80 are compressively formed by the uniformly sloping, continuously rotating cam surface 70 as the latter alternately operates on the upper and lower portions of each convolution of a wrapped connection. Therefore, the instant bit provides wrapped connections between electrical conductors and terminals having a higher contacting pressure and larger total contacting area than can be obtained from bits which are constructed to provide intermittent or irregular camming action or from non-camming bits which depend solely upon tensile forces created by drawing the conductor around the terminal to provide contact pressure.

In carrying out another important aspect of the invention; namely, prevention of conductor pile up during the wrapping operation, the axial thrust of the bit 28 against the conductor convolution being formed is imparted to a portion of the conductor C only after the latter is drawn against the terminal T into axial alinement with a like portion of the next preceding convolution. This objective is achieved by continuously providing a space along terminal T to receive a stripped wire portion, such as portion 76 in FIG. 4, as it emerges from groove 50, but before it is contacted by the relatively movable camming surface 70. The space along the upper edge of terminal T into which conductor portion 76 is received, as seen in FIG. 4, is provided in the following manner; in response to rotation of the bit, conductor portion 72 at the bottom edge of terminal T coacts with the inclined plane of cam surface 70 to axially move the bit toward the free end of terminal T. Preferably the slope of cam surface 70 and the diameter of the stripped conductor portion 48 are so related that the axial displacement of terminal T outwardly from bore 44 per revolution of the bit is at least one wire diameter. As the bit rotates from the position illustrated in FIG. 3 to that shown in FIG. 5, the above described space will receive conductor portion 76 in intimate contact with the upper edge of terminal T. It will be apparent that conductor portion 76 is positioned about terminal T, as shown in FIG. 5, before it is acted upon by the operating camming point of cam surface 70. Therefore, no axial camming of portion 76 occurs until that portion is wrapped closely about terminal T in direct alinement with portion 77 of the next preceding wrapped convolution. FIGS. 3 through 10 illustrate that the axial thrust against the conductor convolution being wrapped is imparted by the semicircular camming surface 70 at a point along the convolution which is remote from the opening of groove 50. It will be seen that the inner surface 62 of the face of bit 28 does not produce axial camming of the stripped conductor portion 48. Instead the axial camming action is delayed until the cam surface 70 overrides the conductor at a point angularly remote from the opening of groove 50, such as point Z in FIGS. 5 and 6. Such delay in application of the full axial thrust of the bit 28 against conductor C allows that portion of the convolution which later receives the axial thrust to be laid tightly against terminal T and in axial alinement with previously completed convolutions before any pile-up producing thrust can be applied. It will also be apparent that the radial thrust of cam 70 against the

conductor also tends to prevent pile-up since the radially directed thrust component produced by cam 70 holds the convolution tightly against terminal T in opposition to axially directed forces tending to lift the convolution from terminal T or to otherwise cause the cammed convolution to override the previously formed convolutions.

Another important aspect of the invention is the provision of an improved bit face construction for turning down the extreme end 82 of the stripped portion 48 tightly against terminal T to prevent inter-terminal shorting between laterally extending conductor end portions wrapped on closely spaced terminals. Although various means have been devised for turning down or wiping down the end of the conductor as it emerges from the conductor receiving groove 50, the hereinafter described wipe-down means comprises an improved bit face which is especially constructed to eliminate impacting upon the completed convolutions of the connection during the wipe-down operation and during post-wrapping rotations of the bit.

The improved wipe-down operation of this invention will be clearly understood by referring to FIGS. 12 through 16 wherein the extreme end 82 of conductor C is contacted by portions of cam 60 to neatly and firmly lay end 82 against terminal T. As the bit rotates in a counter-clockwise direction, end 82 is withdrawn from groove 50 and slides over the inner surface 62 of the bit face into engagement with a portion 66 of sloping cam 60 as shown in FIG. 13. As camming points along portion 66 and semicircular portion 70 of cam 60 progressively override end 82, the latter is cammed radially inwardly against terminal T until the end is laid against terminal T as shown in FIG. 14. Continued counter-clockwise rotation of the bit to the position shown in FIG. 15 places the end 82 substantially at the conjunction of the semicircular portion 70 and the straight portion 68 of the U-shaped cam 60. Here the curved surface of end portion 82 is in moving contact with cam 60 substantially at the aforementioned point Y as seen in FIGS. 15 and 16. The dimensions of conductor C, terminal T and cam 60 are so related that point Y occurs intermediate the width of the sloping surface of cam 60, and is, therefore, intermediate the axially offset surfaces 64 and 62 of the bit face. As the cam 60 rotates counter-clockwise from the position shown in FIGS. 15 and 16, the moving point of contact between cam 60 and the end 82 of conductor C will travel generally diagonally down cam portion 68 in the direction of the arrow, shown in FIG. 15, until the end 82 contacts the inner surface 62 of the bit face. During each of the usual follow-up turns of the bit applied after the wrapping operation has been completed, the end 82 will slide down cam portion 68 in the afore-described manner, engage and slide over the inner surface 62, and then engage and slide upwardly along cam portion 66 to a point axially intermediate the inner surface 62 and the outer surface 64. As the bit rotates, the described upward and downward sliding of the end 82 as it travels between points Y and Z produces axial reciprocation of the bit face with respect to the stationary terminal. However, such reciprocation of the bit face will not produce any great degree of axial impacting against the completed connection due to the smooth travel of the bit face as it intermittently overrides the completed connection along cam portions 66 and 68 of the gradually sloping cam surface 60. The resulting decrease in post-wrapping, axial impacting upon the connection tends to preserve the original level of mechanical stability between conductor C and terminal T. As thus described, the configuration of the bit face not only provides high pressure contact during the formation of the connection; but also substantially eliminates post winding impacting of the completed connection tending to destroy its mechanical and electrical integrity. Such improved operation is particularly advantageous in wrapping applications wherein plural connections are wrapped on a single terminal.

Another aspect of the invention is the provision of a bit productive of the aforedescribed advantageous operational characteristics which may be rotated in either direction to wrap a conductor about a terminal. Advanced wrapping tools equipped with reversible motor means and intended for industrial applications requiring wrapping in either direction are becoming more common. Therefore, a reversible wrapping bit which performs the wrapping operation equally well in either rotational direction is obviously more desirable than a conventional unidirectional bit which must be replaced when reverse rotation is required. This object is accomplished by providing a bit face which is symmetrical about a rectilinear prolongation of a diameter of the terminal receiving bore 44. The symmetry of the bit face is clearly shown in FIG. 3 for example. While the foregoing operational description of the bit has assumed counter-clockwise rotation of the bit, it will be apparent that the camming action of the U-shaped cam 60 with respect to conductor C would be identical in principle if the bit were rotated in a clockwise direction.

From the foregoing description of the novel bit face construction, it will be apparent to bit users that the instant bit provides improved wrapping features; and, it will also be appreciated by bit fabricators that such bits may be manufactured entirely by simple machining operations. The symmetry and uniform slope of the previously described cam surface 60, for example, eliminate costly manufacturing operations which have characterized prior wrapping bits having asymmetric cams, protruding wipe-down lugs and the like.

While the bit device has been shown and described as having particular utility when employed in hand-held, motor-actuated tools, it will be appreciated that the invention is not limited to any particular type of wiring device. Wrapping bits of the described type are well suited for use in automatic multi-bit wiring machines as well as in manually rotated tools. Since the invention resides primarily in the novel bit face configuration, many different types of special wrapping bits may be constructed in accordance with this invention without interfering with such known special features as lateral loading of the conductor into the bit, combined insulation stripping and wire wrapping operations, et cetera. Moreover, it will be understood that the above description and accompanying drawings comprehend only the general and preferred embodiment of the bit face and that various changes in the construction, proportion and arrangement of the various bit face camming surfaces may be made without sacrificing any of the enumerated advantages of the invention.

Having fully described the invention, we claim:

1. A device for wrapping a conductor around a terminal comprising: a wrapping bit having an end face including a flat surface and camming means projecting forwardly from the plane of said flat surface; said bit having means defining a terminal receiving opening and a conductor receiving opening both communicating with said end face and both having their entire end edges in the plane of said flat surface; and said camming means including a curved portion disposed about said terminal receiving opening and slopingly intersecting the plane of said flat surface.

2. The invention according to claim 1, wherein said curved portion intersects said terminal receiving opening in the plane of said flat surface.

3. A device for wrapping a conductor around a terminal comprising: a wrapping bit having an end face including a flat surface and camming means projecting forwardly from the plane of said flat surface; said bit having means defining a terminal receiving opening and a conductor receiving opening both communicating with said end face and both having their end edges in the plane of said flat surface; said camming means being generally U-shaped and comprising laterally spaced surfaces joined

by a curved surface disposed about said terminal receiving opening; said spaced surfaces slopingly intersecting said flat surface, and said curved surface slopingly intersecting said plane.

4. The invention according to claim 3, wherein said curved portion and said surfaces of said camming means are uniformly sloped relative to said plane.

5. The invention according to claim 3, wherein said camming means is symmetrical about a prolonged diameter of said terminal receiving opening.

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