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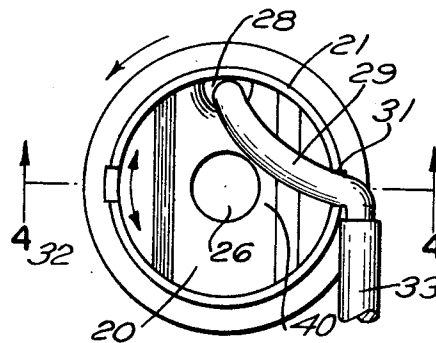
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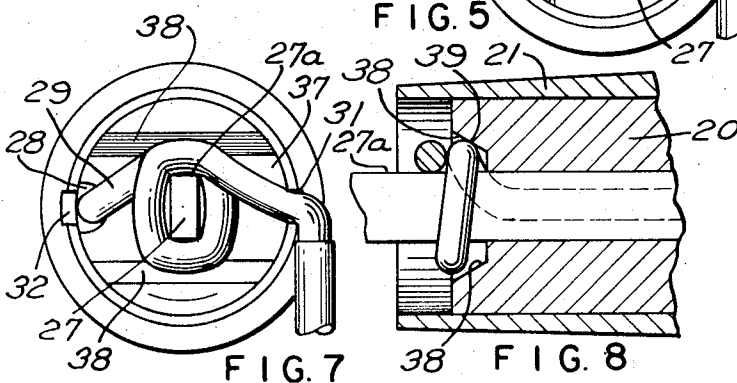
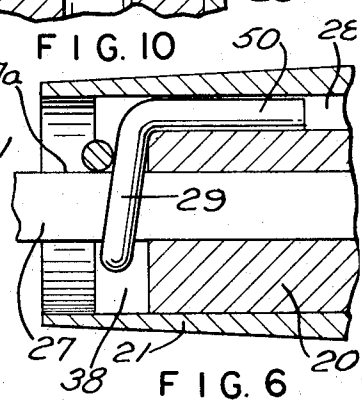
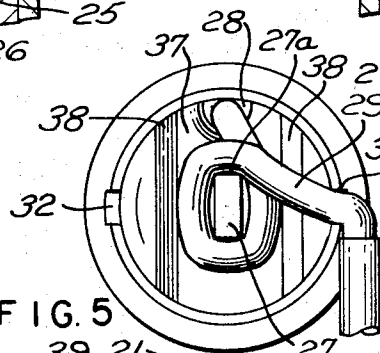
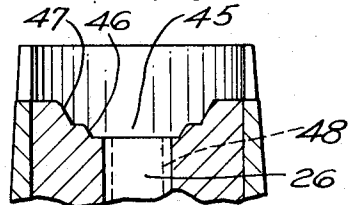
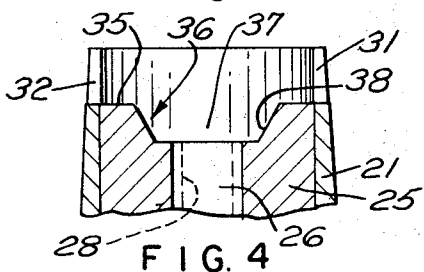
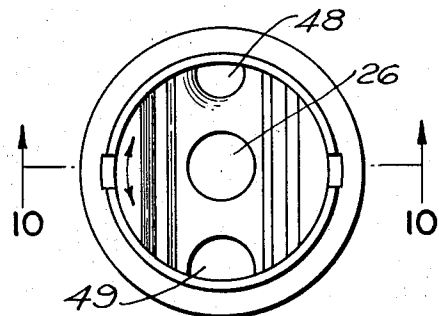
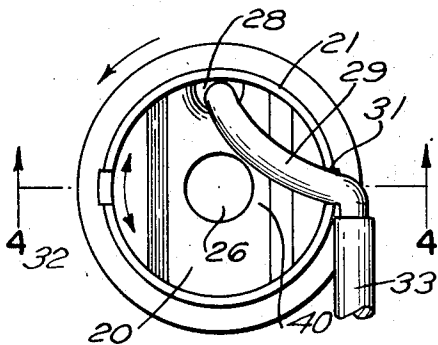
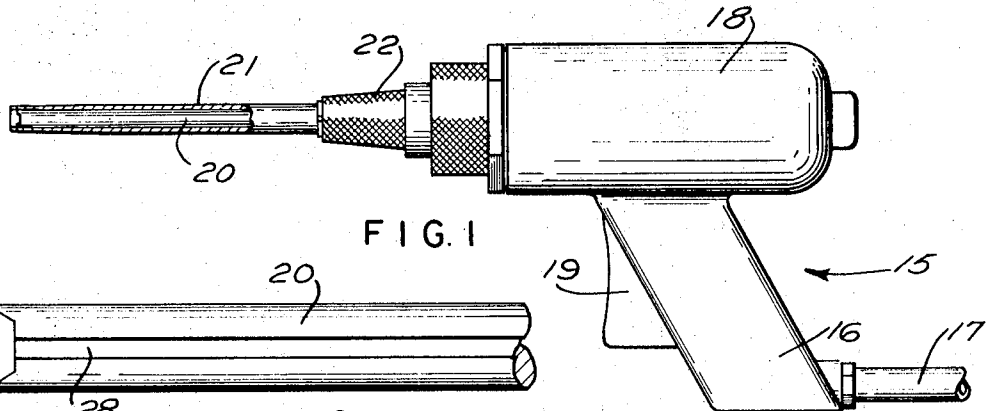
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[54] **CONDUCTOR WRAPPING BIT**  
**3 Claims, 10 Drawing Figs.**

[52] U.S. Cl. .... 242/7.17  
 [51] Int. Cl. .... H01r 43/00  
 [50] Field of Search ..... 242/7.17,  
 7.18, 7.06

**ABSTRACT:** A bit for wrapping a conductor around a terminal in successive convolutions in which the end face of the bit is formed by a channel extending across the face at generally right angles to the axis of the bit, said channel being symmetrical with reference to an opening for receiving the terminal about which the conductor is wound with the sides of the channel providing the camming surfaces for urging the conductor against the terminal and axially along the terminal.





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## CONDUCTOR WRAPPING BIT

## BACKGROUND OF THE INVENTION

Conductor wrapping tools commonly incorporate an elongated bit which is drivingly connected with a rotating power source and journaled in a surrounding stationary sleeve, for example, reference may be made to U.S. Pat. Nos. 2,758,797 and 3,143,307. A bit of the type disclosed in these patents is provided with a bore for receiving an electrical terminal and a radially offset longitudinal recess or groove for receiving and positioning the end portion of a conductor which is to be wound in helical convolutions about the terminal upon rotation of the bit. The surfaces which direct the movement of the conductor about the terminal are camming surfaces of a complicated shape for urging the conductor against the terminal and also for urging the conductor axially along the terminal. These camming surfaces are of such complexity as to require great skill in their execution in a time consuming process with large amount of manual labor of a skilled character.

## SUMMARY OF THE INVENTION

In contrast to the complexity of the camming surfaces above referred to, the present invention provides a simple channel extending across the end of the bit at right angles to its axis symmetrically located with respect to the recess for receiving the terminal with the sidewalls of the channel sloped to provide the camming action desired for movement of the conductor both circularly about the terminal into contact therewith and axially along the terminal. The channel is sufficiently simple so that it may be formed by machine in a milling type operation with gangs of bits lined up so that a plurality of bits may be formed with the desired channel in a single operation.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a wire winding gun with portions thereof in section and showing the wire winding bit in its fixed sleeve;

FIG. 2 is a plan view of the bit showing the head end thereof;

FIG. 3 is an end view of the bit;

FIG. 4 is a sectional view on substantially line 4-4 of FIG. 3;

FIG. 5 is an end view showing the conductor wire as partially wound about a terminal;

FIG. 6 is a sectional view thereof;

FIGS. 7 and 8 are similar to FIGS. 5 and 6 with the bit rotated 90°;

FIG. 9 is an end view of a modified form of bit; and

FIG. 10 is a sectional view similar to FIG. 4 of the bit in its sleeve.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawing, 15 designates a wire-winding tool or gun having a handle 16 to which there is connected a conduit 17 for supplying power to an air or electric motor not shown but located in the housing 18. A movable member 19 serves to control the operation of the motor in the housing 18.

A bit 20 is removably held in a chuck (not shown) driven by the motor and rotates in a sheath or sleeve 21 also removably positioned in fixed relation by the knurled member 22.

The bit 20 is essentially a solid member which is provided with a terminal receiving means comprising a bore 26 extending axially of the bit centrally thereof and of a size to receive a terminal 27 which usually is of rectangular shape, although it may be of any cross-sectional shape. The bit is also provided with a conductor receiving means 28 comprising a groove extending axially along the outer surface of the bit and of a size to receive the conductor 29 therein. The sleeve 21 about the bit closes the groove 28 and confines the conductor 29 therein. This sleeve is provided with notches 31 and 32 through which the conductor extends with the insulation on the conductor shown at 33 outside of the sleeve.

The end face 35 of the bit extends in a plane at right angles to the axis of the bit and is provided with a camming means generally designated 36, which comprises a simple channel 37 of uniform shape extending across the bit at right angles to its axis and having a floor or land area 40. This channel provides sloping walls 38 which serve as the camming means for engaging the conductor 29 such as at point 39 shown in FIG. 8 to urge the conductor 29 toward the terminal 27 as the bit 20 is rotated to wind the wire or conductor about the terminal. This camming action forcing the conductor toward the terminal is operative in the positions illustrated in FIGS. 7, 8 and their 180° opposites, where the surface 38 picks up the conductor from the crossed over position of FIG. 3 and forces it into engagement with the edge 27a of the terminal. The camming action is at such an angle as to force the terminal 27 outwardly of the bit as the convolutions are helically wound about the terminal. When the conductor has been fully withdrawn from groove 28, the free end thereof will be cammed into position alongside an adjacent turn by the surface 38.

As has been disclosed, the bit is provided with two camming surfaces 38 which are effectively diametrically opposite each other. In this fashion the bit may be rotated either counterclockwise as has been shown in the illustrative position drawings or alternately may be rotated clockwise. The rotation clockwise would place the conductor 29 on the diametrically opposite side of the sleeve as in opening 32 since it is necessary in order to obtain wrapping of the conductor about a terminal that there be a crossover position of the conductor, and it must be remembered that the groove 28 in this case will be rotating clockwise as viewed in the drawing which means as the groove 28 moves 90° to the 3 o'clock position the conductor will have started its wrap about a terminal such as 27.

Engagement of the cam surface 38 with the conductor is substantially centrally of the cam surface, and this is quite apparent in FIG. 7. By maintaining such a small contact area with the conductor throughout the revolution of the bit about the terminal, very low frictional loads are created, and it has been found that this enhances the accuracy of the wrap of the conductor about the terminal. As is understood in this art, an axial force is usually exerted by the operator upon the tool bit to maintain the bit in proper contact and the pressure exerted by the operator is being resisted by the natural tendency of the bit to move toward the operator during the helical wind process. Should the operator cock or tilt the bit with respect to the terminal which can occur due to sloppy control, the bit of this invention by having such a small contact area will tend to adjust itself and the wire contact point may move up and down the slope of the surface 38 to maintain a helical wrap and prevent an overwrap which occurs at times with tools of the prior art.

One complete revolution of wrap is illustrated in FIG. 5 as being generated with a counterclockwise rotation of the bit as viewed in the drawing. In the position as illustrated in FIGS. 5 and 6, the camming surface 38 is positioning itself against a portion of the conductor as at 40, and then by rotation in a counterclockwise direction 90°, the camming surface 38 will have picked up another portion of the conductor pulling it out of the groove 28 and begin to form it about the edge of the terminal 27 as at 27a. Camming will continue throughout the remainder of the revolutions which repeat themselves from the positions of FIGS. 5 and 7, the camming surface 38 maintaining itself in contact with the conductor 29 continually forcing the conductor about the terminal until the bitter end is reached. Thus the camming surface 38 acts as a complete wrapping member at all times. It has been found, for instance, that the angle of the surface 38 should be in the range of 20 to 40° from the axial line drawn through the bit and in this way the proper function of the bit is well achieved. The camming surface 38 should not run into the terminal-receiving aperture 26 for if it did there would be a tendency for the wire wrapped about the terminal to jam and possibly score the wire. Thus a slight clearance is provided by the land area 40 to prevent this undesirable result.

In some cases it may be desirable to wrap two sizes of wires or conductors. In this case I may provide a more complicated channel as shown at 45 in FIGS. 9 and 10 where there are two sloping sides 46 and 47 radially spaced from each other so that should a very small wire be wound it may be engaged by the camming surface 46, whereas if a larger wire is used which will not fit in the space provided between the sloping surface 46 and the terminal then the sloping surface 47 may be used as the camming means for urging the conductor toward the terminal and also axially thereof or axially of the bit as the winding occurs. In this case there may be provided a recess 48 similar to the recess 28 as shown in FIG. 3 and a larger recess 49 may be provided diametrically across for the reception of the larger conductor. The action, however, will be the same. It may be further pointed out that in operation the wire which is to be wound upon the terminal 27 is inserted in the recess 28 and then bent so that the wire will extend out through the notch 31 in the sleeve. The bit may then be rotated to cause the camming surface 38 to engage the conductor and wind it about the terminal 27 into tight relation therewith and at the same time causing a relative movement of the bit and the terminal as the helical winding terminal until the length of wire which extends along the groove 28 is entirely wrapped about the terminal. The bore 26 is preferably located off the central axis of the bit but symmetrical with respect to the surfaces 46, 47. In general, it has been found that a relationship of tightness of wind exists which is attributable to the distance the bottom of the recess 28, 49, or 49 lies from the terminal or bore 26. To achieve even wraps with two gauge wires according dictates the offset position for bore 26.

By providing a channel symmetrical with respect to the opening for the terminal, the bit may be utilized by rotating the same in either direction and so far as FIG. 3 is concerned, it would be merely necessary to put the conduit in the notch 32 instead of the notch 31 for a rotation of the bit in the opposite direction.

I claim:

1. In a device for wrapping a conductor around a terminal in successive convolutions:
  - a. a rotatable wrapping bit having an end face;
  - b. said bit defining terminal-receiving means and conduc-

tor-receiving means with both means opening to said end face;

- c. said end face defining a first surface means sloping with respect to the axis of the terminal-receiving means for camming a conductor convolution radially toward a terminal disposed in said terminal-receiving means and axially forwardly into engagement with a next preceding convolution wrapped around the terminal;
  - d. said sloping means being defined by a channel extending completely across the end face of said bit and symmetrical with reference to said terminal-receiving means; and
  - e. said channel having a land in a plane at right angles to the axis of said bit extending radially 360° from the terminal-receiving means and said sloping surface extending from said land.
2. In a device for wrapping a conductor around a terminal in successive convolutions:
    - a. a rotatable wrapping bit having an end face;
    - b. said bit defining terminal-receiving means and conductor-receiving means with both means opening to said end face;
    - c. said end face defining a first surface means sloping with respect to the axis of the terminal-receiving means for camming a conductor convolution radially toward a terminal disposed in said terminal-receiving means and axially forwardly into engagement with a next preceding convolution wrapped around the terminal
    - d. said sloping means being defined by a channel extending completely across the end face of said bit and symmetrical with reference to said terminal-receiving means;
    - e. said channel having a land in a plane at right angles to the axis of said bit extending radially from the terminal-receiving means and said sloping surface extending from said land;
    - f. said channel has two axially spaced lands in a plane at right angles to the axis of said bit extending radially from the terminal-receiving means, and two radially spaced sloping surfaces extending from said lands.
  3. A device as in claim 2 wherein
    - g. two conductor receiving means are provided diametrically opposed to each other and axially parallel.