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Baker et al.

[11] **3,781,932**

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[54] **CUTTING, STRIPPING, AND WRAPPING BIT FOR INSULATED CONDUCTOR WIRE**

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[73] Assignee: **Gardner-Denver Company,** Quincy, Ill.

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[52] **U.S. Cl.** ..... **7/14.1 R,** 81/9.5 R, 140/124, 242/7.17

[51] **Int. Cl.** **B21f 15/00**

[58] **Field of Search** ..... 7/14.1; 81/9.5 R, 81/9.5 A; 140/119, 122, 124; 242/7.17; 29/33 F

[56] **References Cited**

UNITED STATES PATENTS

2,807,810	10/1957	Belek et al.	7/14.1 R
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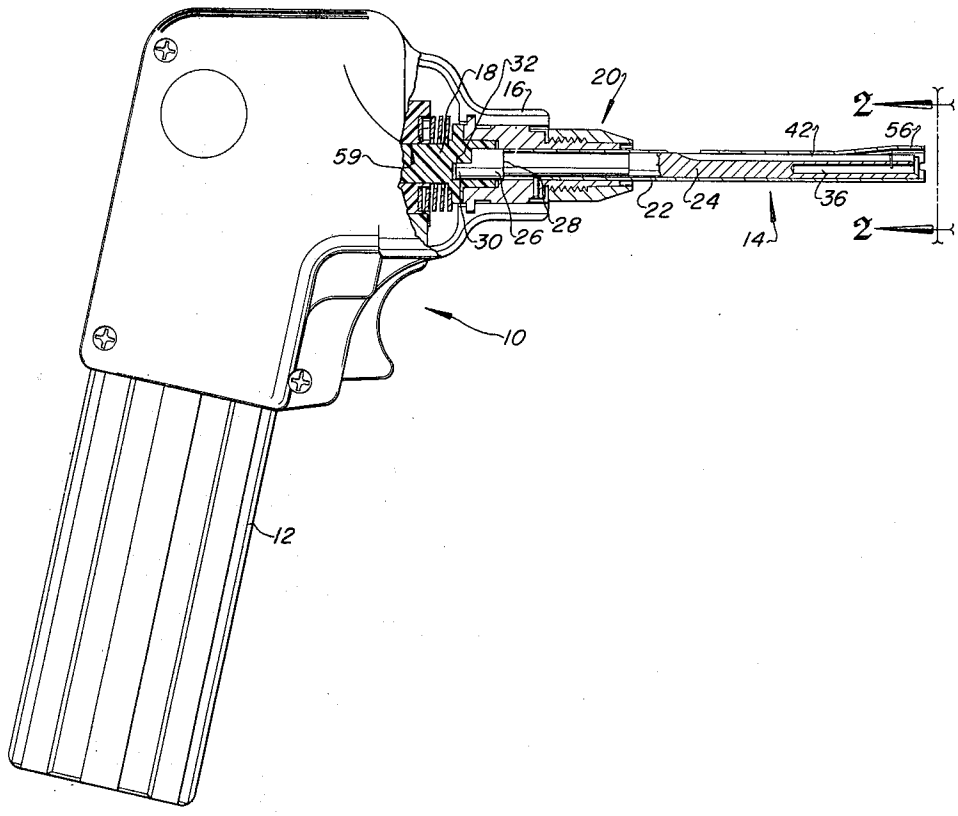
Assistant Examiner—Howard N. Goldberg
Attorney—Michael E. Martin

[57] **ABSTRACT**

A bit and sleeve assembly for cutting, stripping and wrapping an insulated conductor comprising a rotary wrapping bit mounted within a fixed tubular sleeve. The bit includes a longitudinal conductor receiving groove having disposed therein a transverse cutting edge or blade insert cooperable with the sleeve to cut the conductor insulation upon commencement of the wrapping operation. The sleeve includes a radially extended wall portion forming an opening to the bit end face which is alignable with the conductor receiving groove to facilitate loading an insulated conductor into the groove. An opening in the sleeve alignable with the conductor receiving groove defines a cutting edge cooperable with the bit to cut a predetermined length of wire to be wrapped.

6 Claims, 5 Drawing Figures



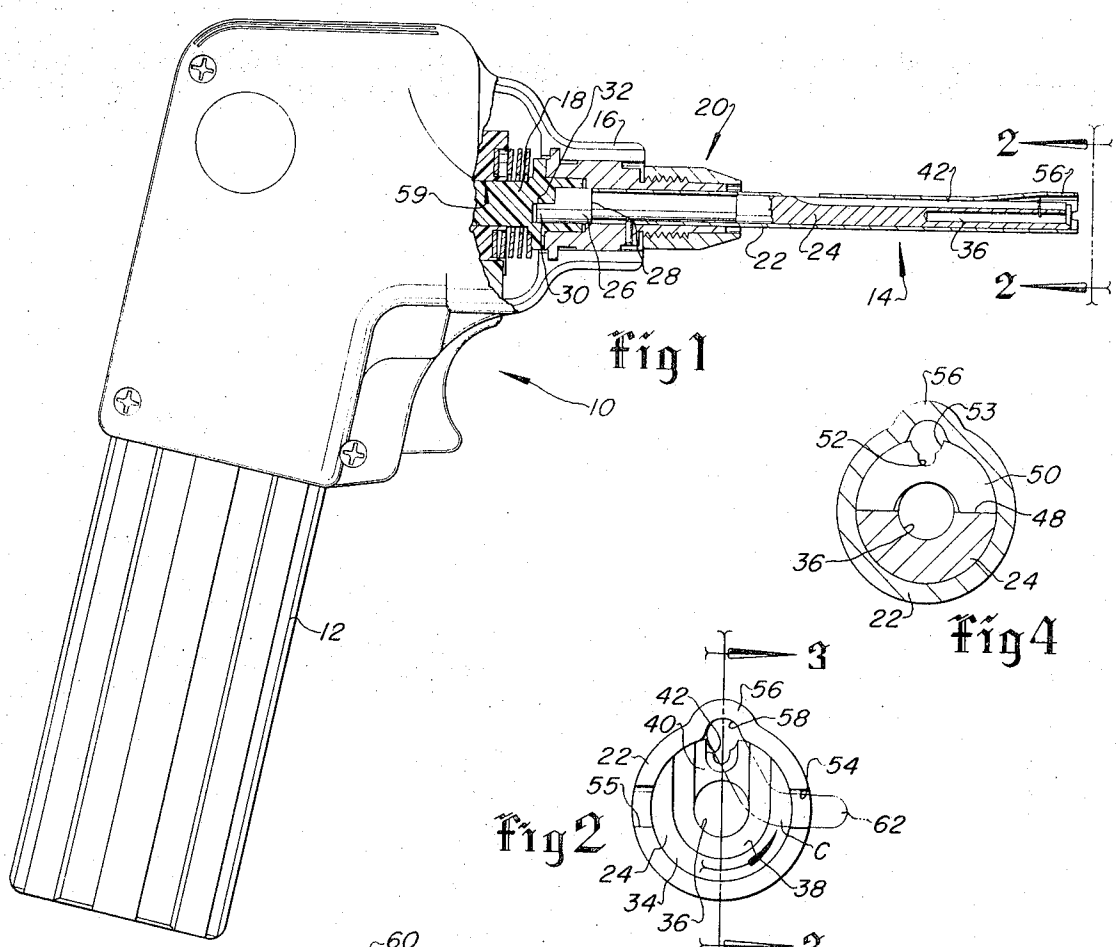


Fig 1

Fig 4

Fig 2

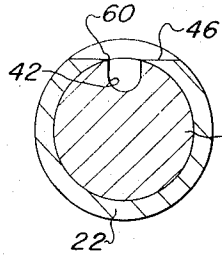


Fig 5

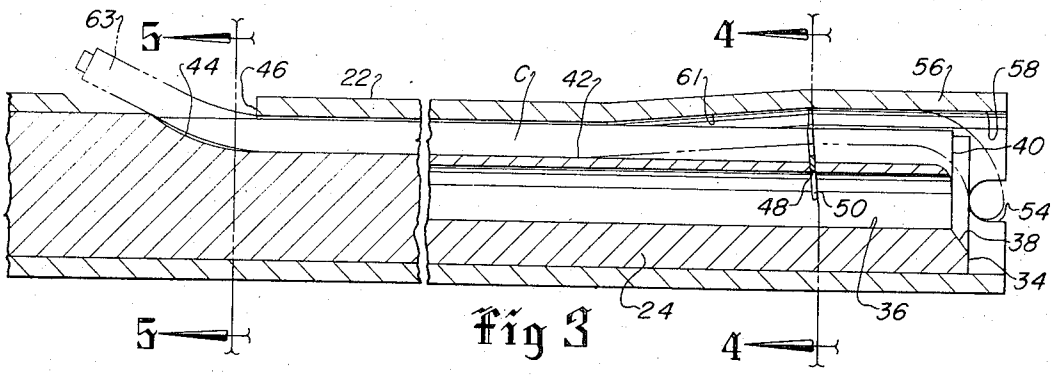


Fig 3

CUTTING, STRIPPING, AND WRAPPING BIT FOR INSULATED CONDUCTOR WIRE

BACKGROUND OF THE INVENTION

In the art of making solderless electrical connections by wrapping a flexible conductor wire about a terminal in a series of helical convolutions, devices are known which are operable to cut a predetermined wire length to be wrapped, strip the insulation, and wrap the bare conductor on the terminal. Such devices are commonly known as combination wrapping bits or tools and they are particularly advantageous for use in making wrapped connections in field installation and repair of communications equipment because they eliminate the need for separate tools to perform each operation. Combination cutting, stripping and wrapping bits are disclosed in U.S. Pats. Nos. 2,682,063 to H.A. Miloche; 2,807,810 to E. Belek et al; 3,393,715 to F.G. Finn; and 3,544,243 to R.A. DeRose et al.

A deficiency realized with certain prior art stripping and wrapping tools includes the provision of a sleeve which only partially surrounds a rotatable bit device. These bit and sleeve combinations are designed to provide for loading the conductor wire into the bit device by substantially transverse movement of the wire with respect to the longitudinal axis of the bit to lay the wire into the receiving portions of the bit and sleeve. Partial sleeves whether fixed or rotatable do not provide for suitable containment or support of the wire prior to and during the stripping and wrapping operations nor do they suitably retain the stripped piece of insulation to prevent entanglement of same in the bit as it rotates. It has been determined that containment of the conductor portion which is to be stripped and wrapped to prevent any kinking or bending is important to providing wrapped connections which are consistently tight on the terminal within close tolerances. Also, it has been determined that stripping and wrapping devices having rotating sleeves and devices having bits without sleeves have proven to be troublesome in use with hand-held conductor wrapping tools because they usually catch and entangle the length of wire leading away from the end portion being wrapped.

Prior art stripping and wrapping bits are also characterized for the most part by integrally formed cutting edges for cutting through the insulation to be stripped. Integral cutting notches or edges are disadvantageous in that damage to or dulling of the cutting edge requires costly repair work on the bit or replacement of the complete bit.

Another longstanding problem in the art of combination conductor wrapping bits concerns the provision of a bit and sleeve construction which does not require the sleeve to be axially movable with respect to the bit but which still provides for rapid and easy insertion of the conductor end to be stripped and wrapped into the conductor receiving groove in the bit without bending or kinking the conductor itself. Particular care must be taken not to kink or bend the conductor before wrapping because such action will increase the extraction force required to withdraw the wire from the conductor receiving groove and will, accordingly, result in overstressed wrapped connections.

SUMMARY OF THE INVENTION

The present invention provides improved means for cutting, stripping and wrapping insulated conductor wire whereby a single rotary tool of simple construction and requiring a minimum of operator skill may be used to prepare and wrap insulated conductors.

The present invention also provides a combination bit for cutting a predetermined length of conductor to be wrapped, stripping a predetermined length of insulation from the conductor end, and wrapping the stripped conductor end portion about a terminal in one continuous operation. With the stripping and wrapping bit of the present invention superior containment of the conductor portion to be stripped and wrapped is provided to prevent bending and entanglement of the conductor or insulation. Furthermore, with the present invention entanglement or damage to the conductor portion leading away from the stripped end portion is also prevented.

The present invention further provides a combination stripping and wrapping bit for insulated conductor wire in which the stripped insulation portion is retained in the conductor-receiving groove during the wrapping operation and is automatically ejected by inserting the next piece of insulated conductor preparatory to a stripping and wrapping operation. Moreover, the present invention provides for a stripping and wrapping bit for insulated conductor wire which is easily loaded with a conductor end portion without bending or jamming the conductor itself.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view of a portable rotary tool including the combination conductor wrapping bit and sleeve assembly of the present invention;

FIG. 2 is a transverse view of the end face of the conductor wrapping bit and sleeve assembly of the present invention;

FIG. 3 is a longitudinal section view taken along the line 3—3 of FIG. 2;

FIG. 4 is a transverse section view taken along the line 4—4 of FIG. 3;

FIG. 5 is a transverse section view taken along the line 5—5 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing a rotary power tool is illustrated in FIG. 1 and generally designated by the numeral **10**. The tool **10** illustrated is of the self-contained electric type having a battery contained within the handle portion **12** for driving a suitable motor, not shown, disposed within the tool housing. The tool **10** is intended to be exemplary of a type of tool which may suitably be used with the present invention. Those skilled in the art will recognize that other types of tools including fluid operated as well as manually actuated types may also be used.

The tool **10** is adapted to support and drive an improved device, generally designated by the numeral **14**, for cutting, stripping, and wrapping an insulated conductor on a terminal. The tool **10** includes a hollow nose portion **16** in which is journaled a rotary spindle **18** suitably connected to the aforementioned motor. The nose portion **16** also includes a stationary cylindrical collet and nut assembly **20** comprising means for removably retaining an elongated tubular sleeve **22** nonrotatably with respect to the tool **10**. Rotatably disposed within the tubular sleeve **22** is an elongated cylindrical member **24** comprising a bit which is cooper-

able with the sleeve to operate on a flexible insulated conductor wire by cutting and stripping a predetermined length of insulation from the conductor end portion and wrapping the stripped end portion on a suitable terminal. The bit **24** includes a cylindrical end portion **26** having a transverse surface **28** and a projection **30** which is in driving engagement with a complementary projection **32** on the spindle **18.** As shown in FIG. **1** the transverse surface **28** is engaged with one end of the sleeve **22** within the collet **20** to prevent unintentional displacement of the bit from the sleeve.

Referring to FIGS. **2** through **5,** the bit **24** includes at its opposite end a transverse end face **34.** A terminal receiving bore **36** is disposed in the bit and opens to the end face **34.** Disposed about the bore **36** is a generally U-shaped axially sloping surface **38** which intersects the transverse end face **34** and a parallel transverse surface **40.** The surface **38** is provided for camming a flexible conductor wire onto a terminal post in a known way and disclosed in detail in U.S. Pat. No. 3,078,052 to W.L. Olds et al. The end face configuration of the bit **24** is intended to be exemplary and it will be understood that the novel features of the improved stripping and wrapping device **14** may be used with other wrapping bit end face configurations.

The bit **24** is further characterized by an elongated conductor receiving groove **42** parallel to and radially offset from the terminal receiving bore **36.** The groove **42** has a generally U-shaped cross sectional configuration and opens to the periphery of the bit. The groove **42** also opens at one end to the end face **34** of the bit. The opposite end of the groove **42** is characterized by a sloping surface portion **44** which is adjacent an opening **46** in the wall of the tubular sleeve **22.** The bit **24** also includes a substantially transverse slot **48** spaced a predetermined distance from the end face **34** in which is removably disposed a thin metal blade **50** having a notch forming an insulation cutting edge **52.** The spacing of the blade **50** from the end face **34** provides for at least a partial convolution of insulated conductor to be wrapped on a terminal. The slot **48** is formed at a slight angle, about five degrees, with respect to a plane perpendicular to the longitudinal axis of the bit **24** to facilitate the cutting action of the edge **52.** The cutting blade **50** is retained in the slot **48** by the surrounding sleeve **22.** The cutting edge **52** may also be formed integral with the bit **24,** however, the removable blade **50** provides for rapid and economical replacement of the cutting edge without replacing the entire bit. As may be appreciated from viewing the drawing, the conductor receiving groove **42** is dimensioned to accommodate an insulated conductor and the notch forming the cutting edge **52** is dimensioned to be slightly greater in width than the diameter of the conductor wire. Accordingly, when an insulated conductor is forced radially, with respect to the bit axis, into the groove **42** the edge **52** makes at least a partial circumferential cut through the conductor insulation.

The tubular sleeve **22** substantially surrounds the bit **24** in close fitting relationship and encloses a major portion of the groove **42.** The sleeve **22** includes a pair of notches **54** and **55** opening to the end of the sleeve adjacent the end face **34** and disposed diametrically opposite each other. The sleeve **22** further includes a radially outwardly relieved tubular wall portion **56** which also extends axially away from the end of the sleeve and beyond the insulation cutting blade **50.** The wall portion **56** forms a guide surface **58** having a portion **61** which slopes radially inwardly with respect to the longitudinal axis of the bit. The guide surface **58** provides means for inserting an insulated conductor longitudinally from the open end of the sleeve past the cutting blade **50,** into the groove **42,** and toward the opening **46** in the sleeve. As shown in FIGS. **2** and **4** the blade **50** includes relieved portions **53** which provide clearance for inserting a conductor along the guide surface **58** and past the blade. The guide surface **58** may be formed by a suitable metal forming process by displacement of the tubular sleeve wall.

As shown in FIGS. **2** through **5** the guide surface **58** and opening **46** in the sleeve are disposed in alignment with the conductor receiving groove **42** prior to insertion of a conductor to be stripped and wrapped. A suitable indexing mechanism **59** in the tool **10** provides for indexing the rotatable bit **24** to the position shown at the termination of the previous operating cycle of the tool. An insulated conductor C, shown by dashed lines in FIGS. **2** and **3,** may be manually inserted from the open end of the sleeve **22** through the opening formed by the extended wall portion **56** and guided into the groove **42** by the guide surface **58.** The conductor C is inserted into the groove until a small portion **63** extends out through the opening **46** in the sleeve to assure that a predetermined length of stripped conductor portion will be provided for wrapping. When the conductor C is inserted in the groove the tool operator trains the conductor through the notch **54,** FIG. **2,** and holds the portion **62** leading away from the inserted end along the exterior of the sleeve. The direction of bit rotation is indicated by the arrow in FIG. **2.** If it was desired to rotate the bit in the opposite direction, the notch **55** would be used.

After insertion of the conductor in the bit **24,** the tool is placed over a terminal, not shown, in a known way and the tool motor is energized to rotate the bit. Almost immediately on commencing rotation the conductor end portion **63** is severed by the cutting edge **60** formed by the longitudinal side of opening **46** in the sleeve as the groove **42** moves past the opening. The conductor C, held stationary with respect to the sleeve **22** at the notch **54,** is pulled down into the notch in the insulation cutting blade **50** due to the rotational movement of the bit whereby a partial cut through the insulation is made without nicking the conductor wire. The forcing of the conductor C into the notch forming the cutting edge **52** is assisted by engagement of the conductor by the inner wall surface of the sleeve as the groove **42** rotates away from the opening formed by the wall portion **56.** Many types of insulation require only a partial transverse cut to provide for total severance by tearing the remaining uncut portion without extruding the insulation remaining on the conductor. Accordingly, with the bit and sleeve assembly disclosed, continued rotation of the bit **24** will cause complete severance of the insulation at the blade **50** as the conductor is withdrawn from the groove **42** and wrapped around a terminal.

As the conductor C is withdrawn from the groove **42** by continued rotation of the bit the severed insulation will be retained in the groove by the completely circumferential tubular sleeve and the blade **50** and will be prevented from becoming entangled in the bit or sleeve. Moreover, due to the fact that the sleeve **22** is stationary there is no danger of entangling the conductor portion **62** leading away from the bit end face **34.**

The severed insulation portion will remain in the groove **42** and will be ejected through the opening **46** by insertion of an insulated conductor in preparation for a succeeding operation of the tool **10.**

As may be appreciated from the foregoing description, the improved bit and sleeve combination disclosed herein provides for a relatively simple operation to load an insulated conductor into the groove **42** without bending or kinking the conductor wire thanks to the guide surface **58** formed by the extended wall portion **56.** Moreover, the superior containment characteristics of the bit and sleeve prevent accidental displacement and entanglement of the conductor or the insulation portion being stripped during the stripping and wrapping process. It is particularly significant that the stripped insulation portion is retained in the groove **42** until completion of the operating cycle of the tool whereby the insulation portion is not free to fall into the work area or become entangled in the conductor during routing of same to the next terminal.

We claim:

1. In a device for stripping insulation from a flexible conductor wire and wrapping said wire on a terminal in a series of helical convolutions:

a rotatable wrapping bit comprising;

a bit end face;

a terminal receiving bore opening to said end face;

a longitudinal wire receiving groove disposed on the periphery of said bit and radially offset from said terminal receiving bore and opening at one end to said end face; and

a cutting edge disposed in said groove for cutting the insulation of a wire disposed in said groove; and,

an elongated tubular sleeve fixed substantially axially with respect to said bit and disposed around said bit to substantially enclose a major portion of said groove, one end of said sleeve being disposed adjacent said end fae, said sleeve including means comprising a radially outwardly relieved tubular wall portion extending axially from said one end of said sleeve toward said cutting edge and forming an opening to provide for inserting said wire longitudinally with respect to said bit past said cutting edge and into said groove.

2. In a device for stripping insulation from a portion of a flexible conductor wire and wrapping said portion on a terminal in a series of helical convolutions:

a rotatable wrapping bit comprising;

a bit end face;

a terminal receiving bore opening to said end face;

a conductor receiving groove disposed on the periphery of sad bit parallel to and radially offset from said terminal receiving bore and opening at one end to said end face; and

a cutting edge disposed in said groove for cutting the insulation of an insulated conductor wire disposed in said groove; said cutting edge being formed on a cutting blade removably retained in a transverse slot formed in said bit and intersecting said groove; and,

an elongated tubular sleeve fixed axially with respect to said bit and disposed around said bit to substantially enclose a major portion of said groove.

3. The invention set forth in claim **2** wherein: said cutting blade is retained in said groove by said sleeve.

4. The invention set forth in claim **1** wherein:

said radially outwardly relieved wall portion forms a guide surface extending from said one end of said sleeve to said cutting edge.

5. The invention set forth in claim **4** wherein:

said sleeve includes an opening disposed adjacent the end of said groove opposite said one end and forming a cutting edge for severing an end portion of a wire disposed in said groove in response to rotation of said bit.

6. The invention set forth in claim **5** wherein: said guide surface is axially aligned with said opening forming a cutting edge for severing an end portion of a wire.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,781,932

DATED : January 1, 1974

INVENTOR(S) : William J. Baker, et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 38 "fae" should be -- face --.

Column 6, line 12 "sad" should be -- said --.

Signed and Sealed this

Sixth Day of February 1979

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

DONALD W. BANNER
Commissioner of Patents and Trademarks