April 23, 1968 T. C. DORSEY 3,378,906

WIRE WRAPPING TOOL

Filed Oct. 28, 1965 2 Sheets-Sheet 1

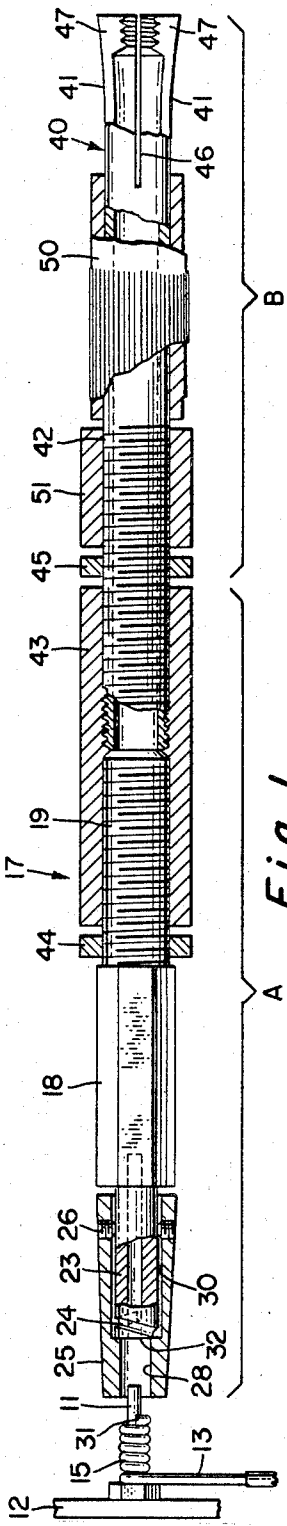


Fig. 1

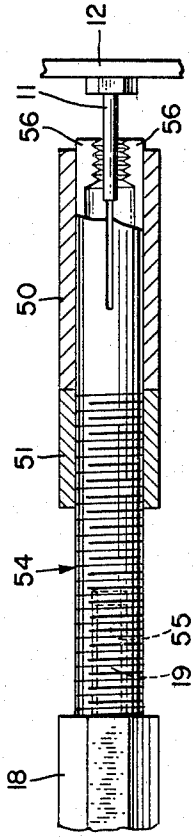


Fig. 2

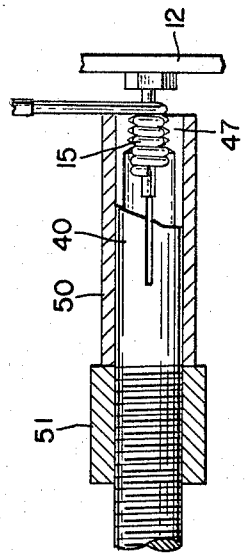


Fig. 4b

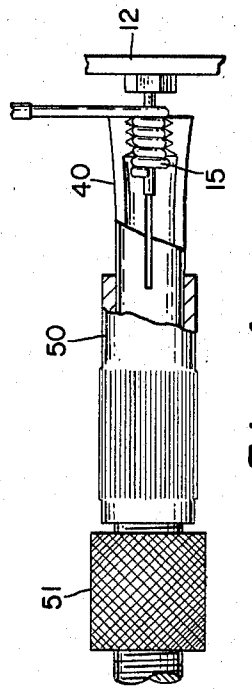


Fig. 4a

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WIRE WRAPPING TOOL

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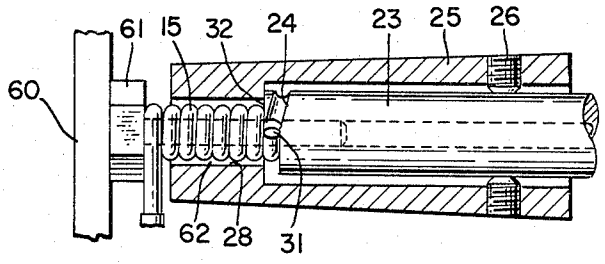


Fig. 3a

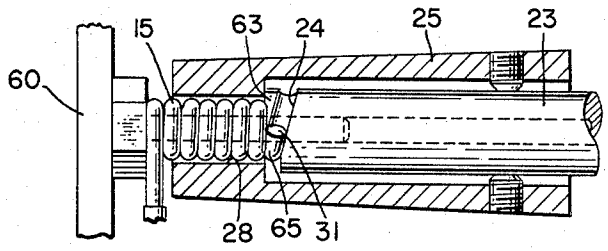


Fig. 3b

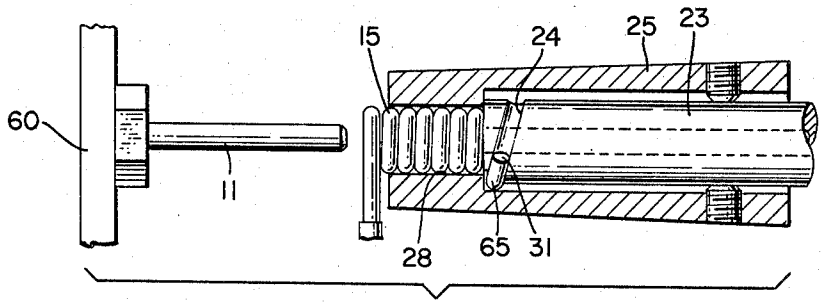


Fig. 3c

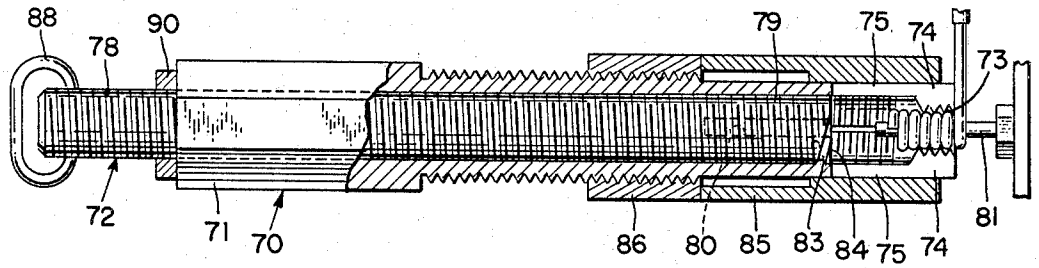


Fig. 5

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WIRE WRAPPING TOOL

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4 Claims. (Cl. 29—203)

ABSTRACT OF THE DISCLOSURE

A hand tool for selectively disengaging and re-engaging a coiled wire wrap electrical connection from a terminal pin by slightly expanding the wire coil so that it may be slipped off the terminal pin around which it is wrapped, and subsequently re-establishing the connection by compressing the expanded coil after it has been slipped over a terminal pin, both the expanding and contracting actions being effected without introducing excessive distortion into the coiled wire or adversely affecting the electrical properties of the connection.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to wire wrapping tools and more particularly to a tool for changing connections on wire wrap terminals.

Wire wrap connections to terminals have replaced soldered connections in many electronic assemblies and installations, particularly in the field of communications. The terminal typically is a square pin and the connecting wire has several turns wrapped tightly around the pin with the corners of the pin cutting into the wire for maximum electrical and physical contact.

Frequently during the process of assembly and installation it is necessary to make a change in the connection. To remove the wire from the pin heretofore required a progressive unwinding until the complete wrap had been removed from the terminal. A special tool was used for this purpose that would peel off the wire as one would peel an orange so as to obtain a spiral peel. However by so unwrapping the wire it becomes weakened at the cut portions and frequently breaks. Reuse is undesirable because of this weakened condition and moreover, there has heretofore been no tool available for properly rewrapping the wire, even if it were permitted.

The principal of the present invention resides in slightly enlarging the circumference of the coiled wire wrap so that it may be slidably disengaged from over the end of the terminal pin in making a disconnection and progressively tightening the wrap again over a pin in making a reconnection. This slight enlargement and reduction of the size of the wire loop does not cause metal fatigue nor weaken nor damage the wire.

In accordance with the principles of the present invention a retainer in the shape of a sleeve is fitted over a wire wrap that has been installed on a terminal pin. This retainer has an inner diameter slightly larger than the outside diameter of the coil of wire and serves to limit the outward or unwinding movement of the coiled wire. Inwardly of the open end of the retainer is a hollow shaft into which is positioned the end of the terminal pin. The end of the shaft has a means for engaging the end of the wire in the wire connector and, as the shaft is rotated it causes expansion or dilation of the coiled wire loops until they uniformly contact the inner wall of the retainer sleeve, freeing the coil from the pin. The shaft and retainer are then withdrawn bodily from the terminal pin, bringing with them the slightly expanded wire wrap connector or coil, and the connection is removed.

Further, in accordance with the principles of the present invention, a pre-coiled wire wrap, or a wire wrap that has been expanded as just explained, may be positioned over a terminal pin and the turns or coils tightened around the pin to complete the connection. This may be done by inserting a threaded chuck over the pin and turns. The chuck is tightened until the threads are set to a desired outer coil diameter and then the chuck is rotated in the direction of wrap to follow the wire connector turns until it is unscrewed therefrom.

It is an object of the present invention to provide an instrument for disconnecting and reconnecting a wire wrap connection to a terminal pin.

Another object is the provision of an instrument for expanding the coil of a wire wrap so that it may be removed from a terminal pin.

Another object is the provision of an instrument for contracting or tightening pre-coiled turns of a wire wrap about a terminal pin.

Another object is the provision of an instrument for removing and reapplying a wire wrap to a terminal pin without causing damage or injury to the wire.

Another object is the provision of a wire wrapping tool that is simple and inexpensive to fabricate, and easy and reliable to operate.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like numerals designate like parts throughout and wherein:

FIG. 1 is a longitudinal section, partially in elevation, of one embodiment of the present invention;

FIG. 2 is a fragmentary longitudinal sectional view of one end of another embodiment;

FIGS. 3*a*, 3*b* and 3*c* are side elevations partly in section showing sequential tool positions in removing a wire wrap;

FIGS. 4*a* and 4*b* are side elevations partially in section illustrating the reconnection operation;

FIG. 5 is a sectional view of another embodiment having common components for both coil loosening and coil tightening functions.

Referring now to FIG. 1 there is shown a conventional terminal pin **11** extending from an electrical component mounting board **12**. A wire **13** has been tightly wrapped around this pin to form a helical coil or wire wrap **15**.

It may be assumed that this initial wrapping was done in a conventional manner known to those skilled in the art and may consist of 6 or 8 turns to have a coil length of approximately ¼" in a typical installation.

In FIG. 1 a double ended wire wrapping tool **17** is shown which consists of a coil loosening portion A and a coil tightening portion B.

The coil loosening portion A includes a hexagonal stem **18** from one end of which projects a threaded stud **19** and from the opposite end of which projects a smaller diameter spindle **23**, axially bored inwardly for a portion of its length. At the end of this spindle is formed a short helical groove **24** adapted to engage the end of a wire coil or wire wrap connection and peel it off of the terminal. Stem **18** and its spindle **23** are of the type heretofore used to peel off a wire wrap in a large spiral upon counterclockwise rotation, however when so used the wire has been so excessively bent and deformed that it is cracked and weakened, destroying its further utility.

According to the present invention there is provided a tubular coil expansion limiting sleeve **25** which lies closely about the spindle **23** and may be secured thereto by screws **26** or other suitable means. With sleeve **25** in place outward expansion of the coil is limited so as to prevent damage thereto. This sleeve **25** has a first bore

28 of sufficient size, i.e. of the order of .010" larger in diameter than the outer diameter of a coil of wire over which it is applied, and a second bore 30 which is slightly larger than the outer diameter of spindle 23 . With this sleeve in place it will be seen that when end 31 of coil 15 is contacted by end 32 of the spindle continued counterclockwise rotation of the tool causes the end of the wire to ride up into groove 24 to expand the coil outwardly along its length against the inside of the bore. With end 32 of coil 15 still engaging groove 24, bodily axial movement of the tool 17 away from the pin 11 also removes the wire coil 15 in undamaged condition from the pin. A slight clockwise rotation of the tool will then free the tool from the coil which remains undamaged.

Referring now to the tightening portion B of tool 17, reinstallation of a wire wrap on a new terminal pin is accomplished by a chuck or collet 40 which may be slit to form four outwardly biased quadrants 41 at the outer end. This collet is externally threaded at its opposite end 42 for union with the threaded bore of a coupling sleeve 43 which in turn is threaded onto stud 19. Lock nuts 44 and 45 may be tightened against the respective ends of coupling sleeve 43 to preclude rotation of the sleeve after the parts have been assembled. Collet slots 46 form the four quadrants 41 each of which has an inwardly directed helically grooved jaw 47. A collet closing sleeve 50 is axially slidable and when shifted forwardly closes the jaws upon a wire connection coil to be reinstalled. Nut 51 is threaded on collet 40 and when turned forces sleeve 50 over sections 41 causing the jaws of the collet to grip the coil.

An alternate embodiment of the coil tigthening portion B of the tool is shown in FIG. 2. In this embodiment collet 54 is internally threaded at 55 to be received directly upon the threaded stud 19. The jaws 56 of collet 54 are shown closed by sleeve 50 and nut 51 to the position assumed about a coil when ready for tighening by turning the tool.

In FIGS. 3*a*, 3*b* and 3*c* the steps of removing a wire wrap from a terminal pin are illustrated. In FIG. 3*a* end 32 is shown abutting coil 15 and groove 24 is about to engage the end 31 of the coil. Coil 15 is securely wrapped around pin 11 which is mounted on terminal board 60 by flange 61. Sufficient space is indicated at 62 between coil 15 and the interior surface of bore 28 to permit coil 15 to expand slightly so as to clear terminal pin 11. FIG. 3*b* shows end 31 of coil 15 riding slightly up into groove 24 after a fraction of a turn counterclockwise of tool 17 from the position shown in FIG. 3*a*. It will be appreciated that the material immediately adjacent the end of the groove could protrude slightly to extend wedge 63 beyond the end of the spindle. The turns of coil 15 have not yet expanded into contact with the inner wall of bore 28. In FIG. 3*c* end 31 of coil 15 has entered groove 24 a distance sufficient to provide an upturned portion 65 and expand the turns of coil 15 into contact with bore 28 of retainer 25 permitting the inside of the coil to clear pin 11. After removing the coil from the pin slight clockwise rotation of the tool frees the coil and it can be withdrawn.

FIGS. 4*a* and 4*b* depict the coil tightening portion B of the tool in a rewrap or coil tightening operation. As shown in FIG. 4*a* coil 15 and tool collet 40 are first applied over the terminal pin with the collect in the open position merely holding the coil and thereafter, as shown in FIG. 4*b*, sleeve 50 is moved into collect closing position as by downward threading of collet nut 51. This tightens jaws 47 around the coil. Thereafter by clockwise rotation of the tool the coil is tightened on the terminal pin and at the same time the tool is threaded off from the coil.

In the embodiment of the device shown in FIG. 5 the unwrap and rewrap portions of the tool are combined. As shown collet 70 has an integral enlarged hexagonal portion 71 for gripping and applying rotary force. Collet 70 is internally threaded to receive stem 72 which in turn is externally threaded so that it may be advanced axially through the collet. A coil receiving opening 73 is shown formed by jaws 74 of collet 70 to receive the coil of a wire wrap connector, such opening preferably being formed of four split collet sections 75 arranged similar to the arrangement shown in FIG. 1. Each section 75 includes a helically grooved jaw for receiving turns of the preformed coil of a wire wrap to be either removed or reinstalled.

Stem 72 has an end 78 to which a stem turning movement may be applied and a coil engaging end 79 which corresponds to spindle 23 in FIG. 1 and includes an axial hole 80 to receive terminal pin 81 and a helical wire engaging groove 83 extending around end 84. Sleeve 85 and sleeve adjusting nut 86 have functions similar to sleeve 50 and nut 51 in FIG. 1, and serve to vary the opening 73 required for unwrapping and rewrapping to be accomplished. End 78 may be provided with turning ring 88 to facilitate rotation of stem 72 and lock nut 90 to prevent relative movement of collet 70 and stem 72 when this is desired. Sleeve 85, adjusting nut 86 and lock nut 90 are shown in FIG. 5 in the position for rewrapping a connector.

To effect unwrapping, lock nut 90, adjusting nut 86 and sleeve 85 are backed off to permit stem 72 to be inserted further within collet 70 into substantial abutment of end 84 with jaws 74 so as to form a chamber similar to bore 28 in FIG. 1.

It will be appreciated that stem 72 need not be threaded and, if desired, a smooth axial sliding fit may be provided between the stem and its surrounding collet 70. In this event two hands may be required in order to hold the parts in desired operating position during tool manipulation.

It should be noted that the coils which are to be removed and reinstalled by the present invention have previously been removed by existing devices which comprise only a spindle such as spindle 23 of the embodiment shown in FIG. 1. Removal by such a device results in an eratic "peeling off" of the wire wrap turn-by-turn thereby so distorting the shape of the coil that removed wire wraps have heretofore generally been discarded. Applicant has found that by surrounding the spindle of existing wire wrap removal devices with a retainer having an end opening only slightly larger than the overall diameter of the coil to be removed, he can reuse such removed wire wraps. The retainer when secured in position encloses both the coil and the end of the prior removal device forming a cylindrical chamber just large enough to permit slight enlarging of the coil so that it may slip from the terminal pin.

During reinstallation of a removed wrap the coil tightening portion of the tool is employed. The coil is inserted within the open jaws of the collet, the jaws are closed, and the tool rotated in a clockwise direction.

There is thus provided a device for removing and reinstalling wire wrap terminal coils in which the wrap is not straightened or unwound to such a degree as would preclude its reuse since the turns of the wrap have their diameter increased sufficiently to merely relax all tension of the wrap about the terminal or pin. An insulation covering, not shown, may be provided over part or all of the tool or it may be formed of non-conducting materials to permit use thereof without shorting between terminals while removing wiring.

It will be recognized that many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A hand tool for selectively disengaging and re-engaging a coiled wire wrap electrical conection from a terminal pin by slightly enlarging the diameter of the

wire coil so that it may be slipped off the terminal pin around which it is wrapped, and by compressing the expanded coil after it has been subsequently slid over a terminal pin in order to re-establish an electrical connection, said tool comprising:

an elongated stem having an axial opening in one end thereof for receiving said terminal pin, said stem having a wire-receiving groove in the outer surface thereof adjacent said axial opening, said groove being adapted to receive the end portion of said coiled wire when the terminal pin around which said wire is wrapped is received in the axial opening of said stem, said groove being configured to limit the length of wire received therein;

a coil-expansion-limiting sleeve encircling the pin-receiving end of said stem and having a portion extending outwardly therefrom designed to receive said coiled wire;

means securing and positioning said sleeve to said stem in co-axial relationship thereto;

whereupon reception of said coiled wire within the outwardly-extending portion of said sleeve and concurrent reception of said terminal pin in the axial opening in said stem will result in the end of said coiled wire entering said groove upon a manually-induced rotation of said tool through a limited angle, such rotation causing the turns of said wire coil to expand away from said terminal pin and contact the inner surface of said sleeve, the amount of such expansion of said wire coil being limited by the internal diameter of said sleeve, the loosening of said wire coil from said terminal pin permitting a ready disengagement therebetween when said coil is withdrawn from within said sleeve; and

a re-engaging assembly for securing to a terminal pin a wire coil which has been so expanded and slipped over such terminal pin, said re-engaging assembly comprising:

an assembling chuck having a plurality of longitudinal slits on one end thereof, such slits in effect dividing

that end of said chuck into a plurality of outwardly-biased segments each of which is provided with an inwardly-directed helically-grooved jaw designed to overlie one portion of the outer surface of said expanded wire coil when the latter is received within said chuck, said chuck being further threaded on the outer surface of that end thereof opposite to the end which has the slits formed therein,

a manually-rotatable compression sleeve encircling the end of said chuck remote from said slits and having an internally-threaded surface engaging the outer threaded surface portion of said chuck,

whereupon manual rotation of said compression sleeve will cause the latter to move axially toward said outwardly-biased jaws to force said jaws inwardly to a point where they engage the outer surface of said wire coil, further axial movement of said compression sleeve relative to said chuck causing a contraction of said wire coil into tight electrical engagement with the terminal pin encircled thereby.

2. A hand tool according to claim **1** in which the means for securing and positioning said sleeve to said stem in coaxial relationship thereto comprises a pair of diametrically-disposed screws respectively receivable in openings formed in said sleeve and projecting inwardly to contact the outer surface of said stem.

3. A hand tool according to claim **2**, in which the wire-receiving groove in the outer surface of said stem decreases in depth toward the terminus thereof so as to limit the length of wire receivable therein.

4. A hand tool according to claim **3** in which the longitudinal slits in said chuck effectively divide the latter into four outwardly-biased quadrants.

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THOMAS H. EAGER, *Primary Examiner.*