United States Patent

[11] **3,566,006**

[72] Inventor **Irving R. Metcalf**
St. Charles, Ill.

[21] Appl. No. **839,398**
[22] Filed **July 7, 1969**
[45] Patented **Feb. 23, 1971**

[73] Assignee **Ideal Industries, Inc.**
Sycamore, Ill.

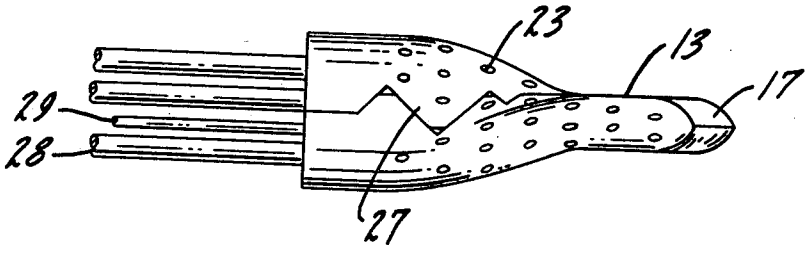
[54] **WIRE CONNECTOR AND METHOD OF USING SAID CONNECTOR**
4 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **174/84,** 29/628, 174/87, 339/95, 339/276
[51] **Int. Cl.** **H01r 9/06,** H02g 15/08
[50] **Field of Search** ..... 174/84.1, 87. 88. 94: 339/276 (All), 95, 97; 29/624, 628, 629

[56] **References Cited**
UNITED STATES PATENTS
3,064,072 11/1962 Graff et al. 174/87

Primary Examiner—Darrell L. Clay
Attorney—Parker, Carter & Markey

ABSTRACT: A connector and a method of using the connector to join insulated wires and particularly insulated wires of the magnet type without prestripping the insulation from the wires. The connector has internal barbs which abrade the insulation on the wires as the connector is twisted into contact with the wires. The connection formed is not susceptible to release due to spring back.



PATENTED FEB 23 1971

3,566,006

fig. 1.

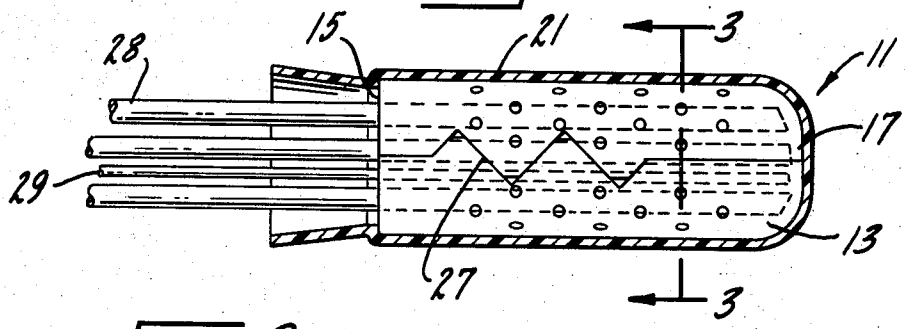


fig. 2.

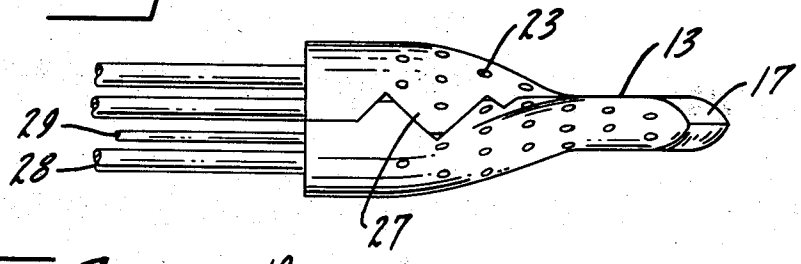


fig. 3.

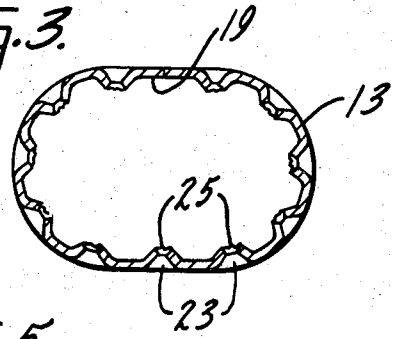


fig. 4.

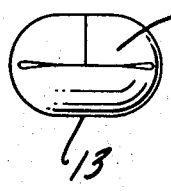


fig. 5.

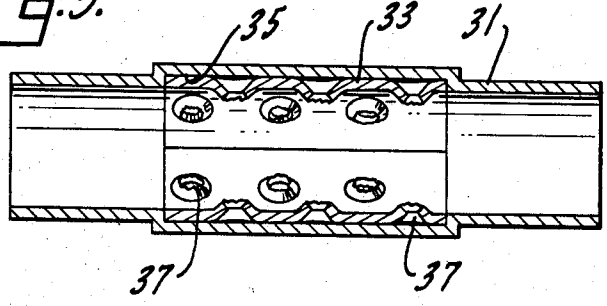


fig. 7.

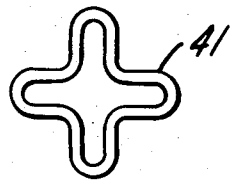
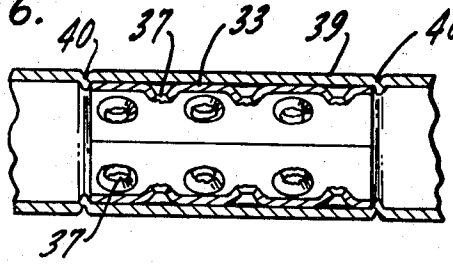


fig. 6.



INVENTOR.
Irving R. Metcalf
BY Parker, Carter & Markey
Attorneys.

WIRE CONNECTOR AND METHOD OF USING SAID CONNECTOR

SUMMARY OF THE INVENTION

This invention is concerned with a connector and a method of using the connector to join unstripped insulated wires and particularly insulated wires of the magnet type.

An object of this invention is a connector and a method of using the connector to join insulated wires in an electrical connection without prestripping the insulation from the wires.

Another object is a method of using a connector having internal barbs so as to abrade the insulation of the wires when the connection is made.

Another object is a method of connecting wires located in a sleeve having a number of inwardly projecting barbs by twisting the sleeve so that a portion thereof is flattened or collapsed causing the barbs to abrade the insulation of the wires located therein.

Another object is a method of connecting insulated wires located in a sleeve having a number of inwardly projecting barbs by twisting the sleeve so as to cause the wires located in the sleeve to rearrange their positions in the sleeve with respect to one another and with respect to the barbs so that the barbs in the portion of the sleeve which is flattened by the twisting will come into contact with all of the wires located in the sleeve.

Another object is an electrical connection which is not susceptible to deterioration caused by spring back of the connector sleeve.

Another object is a method of making an electrical connection between insulated wires and a sleeve in which the insulation is scraped from the wires by the action of attaching the sleeve to the wires.

Other objects will be found in the following specification, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated more or less diagrammatically in the following drawings wherein:

FIG. 1 is a plan view of one form of the connector of this invention showing the wires inserted in the connector before twisting of the connector and with an insulating cap on the connector cut away for clarity of illustration;

FIG. 2 is a plan view of the completed connection made with the connector of FIG. 1 with the insulating cap removed for clarity;

FIG. 3 is a cross-sectional view taken along line 3–3 of FIG. 1 with the wires and insulating cap omitted;

FIG. 4 is an end view of the sleeve of FIG. 1 with the insulating cap removed;

FIG. 5 is a longitudinal cross-sectional view taken through another form of connector of this invention;

FIG. 6 is a partial longitudinal cross-sectional view taken through yet another form of connector; and

FIG. 7 is an end view of a twisted sleeve, with the wires omitted for clarity of illustration, showing the deformation of the ends caused by jaws which grip the ends of the sleeve during twisting of the sleeve.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One form of connector 11 of this invention is shown in FIGS. 1 through 4. This connector includes an elongated tubular sleeve 13 formed of a conductive material such as a copper alloy. Alternatively, the sleeve may be formed of a composite material such as copper plated or copper clad steel. The sleeve may have an open end 15 and a closed end 17 with the sleeve defining a bore 19. The sleeve may be covered by an insulating cap 21 made of a suitable plastic material. For example, if the connector is to be used for connecting magnet wire, the insulation should be able to withstand the temperatures to which magnet wire may be subjected. The material of the cap should also be tough, thin and flexible in order to permit the sleeve to be twisted.

Sleeve 13 is formed by punching holes 23 through a flat sheet of conductive material to tear the metal and thereby form ragged barbs 25 in an irregular pattern surrounding the hole. The resultant barbs are shaped like frustums of cones or pyramids with jagged fractures along the top edges thereof. The holes are located as close together as possible so as to provide the maximum number of barbs in each sleeve.

The edges of the flat piece of conductive material are cut or otherwise formed into a sawtooth pattern as indicated at 27. The piece of conductive material is then bent upon itself so that the sawtooth portions 27 interfit to form a sleeve having a closed end 17 with the barbs pointing inwardly toward the longitudinal axis of the sleeve. The sawtooth seam will normally be brazed or welded so that the integrity of the sleeve is continuous. This is done because a sleeve having an axial seam will not transmit torsion without shearing along the seam even though the interengagement of its sawtooth seam is complete. It should be understood that other forms of sawtooth seam may be utilized in the sleeve and the form shown in the drawings is merely illustrative of one form that may be used. It should further be understood that while the sleeve shown in the drawings has a cross-section of generally oval shape, the sleeve may be made in other cross-sectional shapes such as circular or the like.

Modified forms of the connector are show in FIGS. 5 and 6. The modified form of FIG. 5 includes an outer sleeve 31 of drawn seamless or welded steel and an inner sleeve 33 which may be formed of a copper alloy or copper-plated or clad steel. The inner sleeve 33 fits into an enlarged portion 35 formed in the outer sleeve. The inner sleeve is made from a flat strip of metal in which a plurality of barbs 37 are formed in the manner previously described for forming barbs 25. A section or length of this strip is rolled into a sleeve with the barbs pointing inwardly and this sleeve is inserted into the enlarged portion 35 of the sleeve 31.

Another form of double-sleeve connector is shown in FIG 6. This connector has an outer sleeve 39 with a uniform internal diameter and an inner sleeve 33 having a slightly smaller external diameter. The inner sleeve is held in position in the outer sleeve by stakes, indentations or annular restraints which may be pressed, rolled or otherwise formed in the outer sleeve. In the drawing, annular restraints in the form of grooves 40 are provided in the outer sleeve to secure the inner sleeve in position.

FIG 7 shows the end of a sleeve 41 after the sleeve has been twisted onto wires. The wires have been omitted for clarity of illustration. The cruciform shape of the end of the sleeve is obtained through the use of four jaws which engage each end of the sleeve and are used to twist the sleeve. It should be understood that other types of jaws may be used which will result in the ends of the sleeves being compressed into other shapes. It may also be desirable in some applications to use a tool which grips the sleeves in such a manner that the ends of the sleeves are not distorted from their original shapes during twisting of the sleeves.

The use, operation and function of this invention are as follows:

The connectors and method of this invention are particularly suitable for forming electrical connections between insulated wires and particularly magnet wires without prestripping the insulation from the ends of the wires. As is well known, the insulation on magnet wires consists of a thin, tough, flexible film of enamel, varnish or other equally hard material.

A connection may be made according to the method of this invention by inserting the wires 28 and 29 which, as shown in the drawings, may be of different diameters and may have insulation of different types and thicknesses, into the bore 19 of one of the sleeves 13. With the wires so inserted, the ends of the sleeve are engaged by suitable tools, such as jaws, and the sleeve is twisted into a generally helical form as shown in FIG. 2. The bore of the sleeve is closed or collapsed by this twisting, and the barbs 25 are moved into contact with the insulation of the wires in a manner which scrapes the insulation from the

wires. As a result, the barbs are forced into contact with the conductive metal of the wires.

The collapse of the sleeve due to twisting not only causes the barbs to abrade and remove the insulation of the wires but also causes the wires to rearrange their positions in the sleeve with respect to one another and with respect to the barbs so that electrical contact is obtained between the barbs and all the wires located in the sleeve.

The collapse of the sleeve due to twisting of the sleeve into a helical shape produces a different type of action than that achieved by merely squeezing the walls of the sleeve to collapse the sleeve. A mere squeezing of the sleeve will not produce the abrading action of the barbs on the insulation of the wires which is necessary to remove thin, hard insulation of the magnet type from the wires.

The connectors shown in FIGS. 5 and 6 operate in the same manner as the previously described connector, twisting in a manner characteristic of a single tube, with the twisting of the outer sleeves 31 and 39 causing a twisting and collapsing of the inner sleeve 33. The collapsing of the inner sleeve moves the barbs 37 into abrading contact with the insulation on wires located therein. This construction permits the use of an inner sleeve 33 formed with a seam which does not have to be welded or brazed. The outer sleeve prevents shear separation along the seam of the inner tube.

The twisting of the sleeve into a generally helical shape and the consequential collapse of the twisted portion thereof minimizes the loss of electrical conductivity of the connection due to spring back as often occurs in a crimped connector. In a twisted connector, spring back is confined to the ends of the sleeve and the collapsed portion where contact is made is relatively unaffected by the spring back of the ends of the sleeve.

I claim:

1. A method of connecting insulated wires including the steps of:

placing said wires alongside one another in a tubular sleeve of a conductive material having a plurality of barbs projecting inwardly therefrom; and

twisting said tubular sleeve and the wires contained therein about the longitudinal axis of the sleeve into a generally helical form to collapse a portion of said tube onto said wires and thereby move said barbs relative to said wires to abrade the insulation from the wires and provide electrical contact between the sleeve and the wires.

2. The method of claim 1 further characterized in that said barbs of said sleeve are moved against the insulation of the wires in directions transverse of the wires during twisting of said sleeve into a generally helical form.

3. The method of claim 1 further characterized in that the engagement of the barbs of the portion of the sleeve which collapses during twisting with the wires rearranges the wires in the sleeve with respect to one another and to the barbs so that intimate contact between the barbs of the sleeve and the wires contained therein is assured.

4. An electrical connection between insulated wires extending side-by-side including an elongated sleeve of conductive material surrounding a portion of said wires, said sleeve with said wires therein being twisted generally about the longitudinal axis of the sleeve in the shape of a helix with the twisted portion of the sleeve having a plurality of barbs contacting the metal portions of the wires from which the insulation has been abraded.