Dec. 9, 1969 D. E. KRUP 3,483,310

CONNECTOR INSULATOR

Filed April 23, 1968 2 Sheets-Sheet 1

Fig. 1.

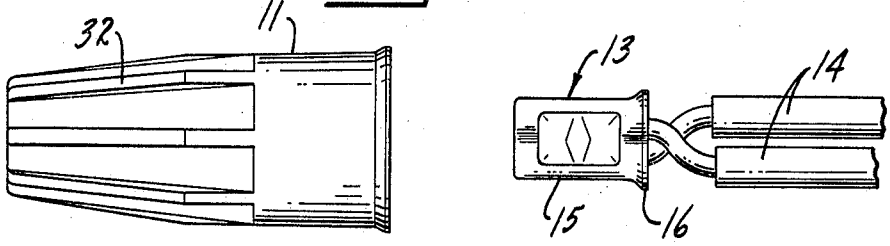


Fig. 2.

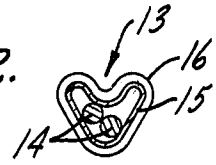
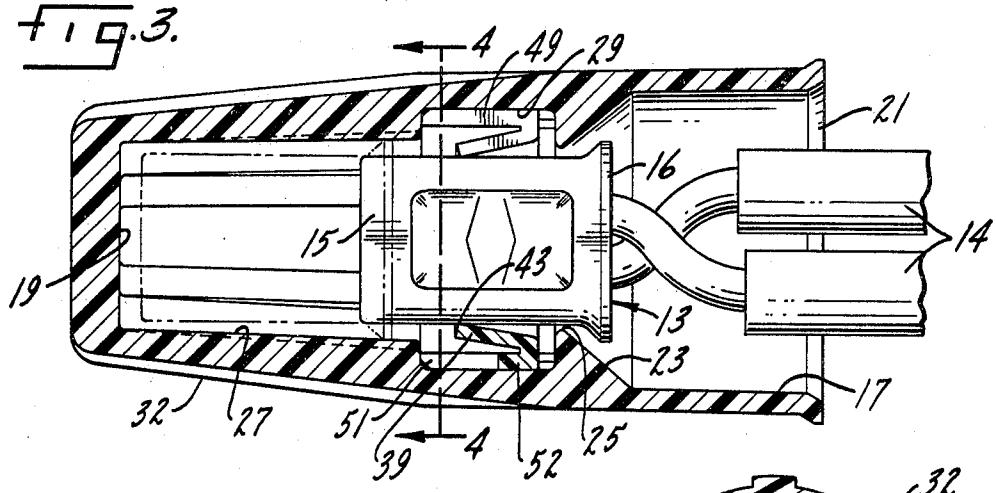


Fig. 3.



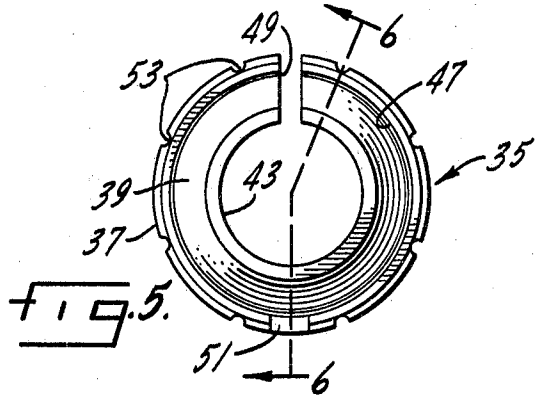


Fig. 5.

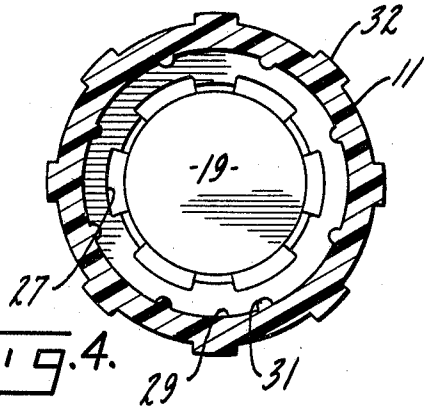


Fig. 4.

INVENTOR.
Donald E. Krup,
BY Parker & Carter
Attorneys.

Dec. 9, 1969 D. E. KRUP 3,483,310

CONNECTOR INSULATOR

Filed April 23, 1968 2 Sheets-Sheet 2

Fig. 6.

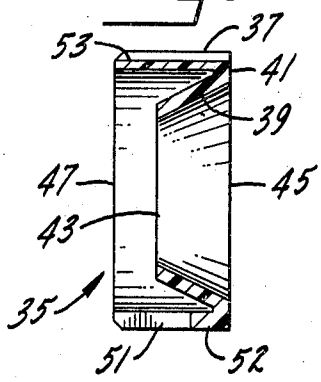


Fig. 7.

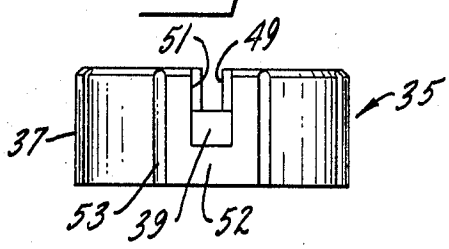


Fig. 8.

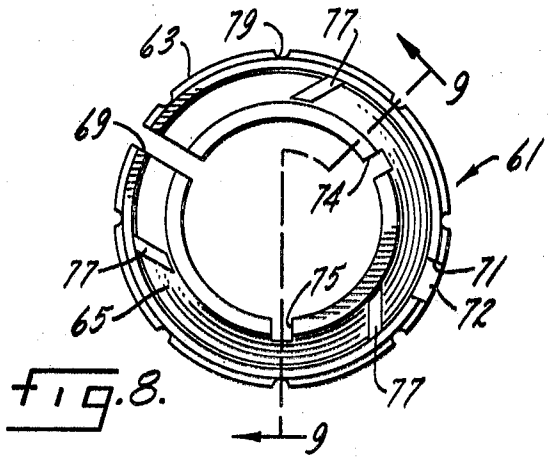
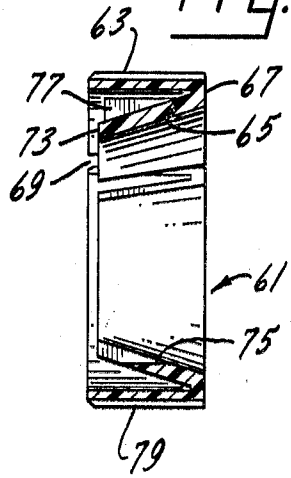


Fig. 9.



INVENTOR.
Donald E. Krup,
BY Parker & Carter
Attorneys.

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3,483,310

CONNECTOR INSULATOR

Donald E. Krup, Elgin, Ill., assignor to Ideal Industries, Inc., Sycamore, Ill., a corporation of Delaware

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Int. Cl. H02g 15/08; H01b 17/00
U.S. Cl. 174—87 8 Claims

ABSTRACT OF THE DISCLOSURE

A connector assembly for joining the stripped ends of insulated electrical wires including a sleeve to fit over and be fastened to the ends of the wires and a connector cap of flexible insulating material having a sleeve retaining member. The sleeve retaining member is made of a tough, elastic plastic. It is tubular in shape and has an outer cylindrical portion which seats in the connector cap and an inner frusto-conical portion which spreads when the sleeve is forced into the cap and contracts to engage the sleeve to prevent it from being readily removed from the cap.

SUMMARY OF THE INVENTION

This invention is concerned with a connector assembly for joining the stripped ends of insulated electrical wires and more particularly with a connector assembly in which wires held together by a sleeve are pushed into locking engagement with a connector cap.

An object of this invention is a connector assembly in which the connector cap is made of a flexible plastic material.

Another object is a connector assembly in which all of the components of the connector cap are electrically nonconductive.

Another object is a retaining member for a connector cap which is made of a tough, elastic plastic.

Another object is a connector cap which can be easily assembled.

Another object is a connector cap which permits easy insertion of wires and sleeve into the cap but resists pull out of the wires and sleeve.

Another object is a connector cap which is reusable, at least to a limited extent.

Other objects may 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:

FIGURE 1 is a plan view of the connector assembly showing the connector cap and wires before insertion of the wires into the cap;

FIGURE 2 is a cross-sectional view through a crimped portion of the sleeve of FIGURE 1;

FIGURE 3 is an enlarged longitudinal cross-section view of the connector cap of FIGURE 1 showing the sleeve and wires being inserted through the retaining member and showing the fully connected position of the wires and sleeve in phantom;

FIGURE 4 is a view taken along the line 4—4 of FIGURE 3 with the sleeve retaining member, sleeve, and wires omitted for clarity;

FIGURE 5 is an end elevational view of a sleeve retaining member of FIGURE 3;

FIGURE 6 is a view taken along line 6—6 of FIGURE 5;

FIGURE 7 is a side elevational view of the sleeve retaining member of FIGURE 3;

FIGURE 8 is an end elevational view of a modified form of sleeve retaining member; and

FIGURE 9 is a view taken along line 9—9 of FIGURE 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The connector assembly, shown in FIGURE 1, includes a connector shell or cap **11** and a sleeve **13** with the sleeve adapted to fit over and contain the stripped ends of insulated wires **14**. The sleeve **13** has a cylindrical portion **15** and a bell-shaped flange portion **16**. The shall or cap **11** may be molded of a flexible plastic having high dielectric characteristics, such as are exhibited by the thermoplastic materials, and is formed with a central bore **17** extending therethrough as seen in FIGURE 3. One end of the bore is closed by a wall **19** and the other end has an opening **21**. Inwardly of the opening **21**, the bore is tapered at **23** to a throat **25** of reduced cross-section. A portion **27** of the bore, located inwardly of the throat, is formed with a cross section larger than that of the throat but smaller than that of the main portion of the bore **17**. An annular channel or groove **29** is formed in the portion **27** of the bore. A plurality of longitudinally extending, inwardly projecting and circumferentially spaced ribs **31** are formed in the annular channel **29** (FIG. 4). Ribs **32** may also be formed on the exterior of the cap **11** to facilitate handling and use thereof.

A sleeve retaining member **35**, shown separately in FIGURES 5, 6, and 7, is seated in the annular channel **29** in the manner shown in FIGURE 3. The channel is slightly longer than the retaining member for ease of assembly of the retaining member with the cap. Longitudinal movement of the sleeve retaining member relative to the bore is limited by engagement of the member with the end walls of channel **29**. The sleeve retaining member, which is molded of a tough, elastic plastic such as nylon, is tubular in shape and includes an outer cylindrical portion **37** and an inner frusto-conical portion **39**. The inner portion **39** is cantileverly attached to one end **41** of the outer cylindrical portion. The opening **43** of the smaller end of the frusto-conical inner portion **39** is located between the openings **45** and **57** at opposite ends of the sleeve retaining memebr **35**.

The sleeve retaining member **35** is split by a longitudinally extending slot **49**, most clearly shown in FIGURE 5. Another longitudinally extending slot **51** is formed in the outer cylindrical portion **37** at a location spaced approximately 180° from the slot **49**. The slot **51** extends less than the length of the outer cylindrical portion to form a hinge **52** adjacent the cantilever connection of the inner and outer portions. Grooves **53**, which mate with the ribs **31** formed in the channel **29** of the shell **11**, are formed in the outer surface of the outer cylindrical portion **37** of the retaining member to prevent rotation of the sleeve retaining member when it is positioned in the cap.

A modified form of sleeve retaining member **61** is shown in FIGURES 8 and 9. This member has an outer cylindrical portion **63** and an inner frusto-conical portion **65** cantileverly attached to one end **67** of the outer cylindrical portion. The member **61** is split by a slot **69** extending longitudinally therethrough and the outer cylindrical portion **63** is slotted at **71** longitudinally for a distance less than its length to form a hinge **72** similar to hinge **52**. It should be noted that the notch **71** is not located diametrically opposite to slot **69**. The free and smaller end **73** of the inner frusto-conical member **65** is notched at **74** and **75** to divide this end into three segments. A gusset or web **77** is provided to extend between each one of these segments and the outer cylindrical portion **63** to function as reinforcements. The gussets or webs **77** extend non-radially as shown in FIGURE 8. Grooves

79 are formed in the outer surface of the outer cylindrical portion 63 to mate with the ribs 31 of the channel 29 of the cap 11 to prevent rotation of the sleeve retaining member relative to the cap.

The spacings between the ends 43 and 73 of the frusto-conical portions of the retaining member and the end wall 19 of the cap are sufficient to permit the sleeve 13 to fit therebetween with its flange 16 inwardly thereof.

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

In using a connector assembly of the type shown herein, the insulation is stripped from the ends of the wires 14 and these ends are placed alongside one another. A sleeve 13 is slipped over the ends of the wires and is forced into engagement with and secured to the wires by means of a crimping tool. One or two crimps may be needed to secure the sleeve to the wires. After the sleeve is secured to the wires, the free end of the wires extending beyond the sleeve may be cut off adjacent the end of the sleeve.

The crimping operation changes the cross-sectional shapes of both the cylindrical portion 15 of the sleeve 13 and the bell-shaped flange 16 from the circular shapes shown in FIGURE 1 to the triangular or kidney-shapes shown in FIGURE 2. The maximum transverse dimension of the crimped sleeve generally is greater than the inside diameter of the opening 43 of the inner frusto-conical portion 39 of the sleeve retaining member 35. Therefore, when the wires and attached sleeve are inserted into the sleeve retaining member located in the bore 17 of the connector cap 11, the cylindrical portion 15 of the sleeve 13 will engage the inner frusto-conical portion 39 of the retaining member and spread this portion outwardly as seen in FIGURE 3. Additional spreading of the frusto-conical portion 39 occurs when the flange 16 is forced through the opening 43 thereof. Expansion or spreading of the inner portion 39 of the sleeve retaining member is facilitated by the provision of the slots 49 and 51 and the hinge 52 of the outer cylindrical portion. When the modified sleeve retaining member 61 is used, the spreading of the inner frusto-conical portion 65 is aided by the slots 73 and 75 in this portion in addition to the spreading afforded by the slots 69 and 71 and hinge 72 of the outer cylindrical portion. The non-radial positioning of the gussets 77 permit them to flex or flatten against the outer cylinder portion 63 when the frusto-conical portion is spread thus presenting minimum resistance to this spreading.

When the sleeve 13 is inserted to its fully seated position (shown in phantom in FIGURE 3), the inner frusto-conical portion of the retaining member will snap back to its position shown in FIGURE 6 and will contact the flange 16 of the sleeve 13 to resist disengagement of the sleeve and wires from the cap 11. When the modified form 61 of retaining member is used, reverse bending of the inner frusto-conical portion 65 is also resisted by the webs or gussets 77.

Although both forms of retaining member shown in this application will resist disengagement or "pullout" of the sleeve and wires from the connector cap at least to an extent sufficient to meet the standards set by organizations such as the Underwriters Laboratories, Inc., these retaining members will permit "pullout" upon the application of forces beyond a predetermined amount without causing serious permanent damage to the retaining member. Therefore, the connector assembly of this invention is reusable, at least to a limited extent. However, continuous connection and removal of the sleeve and wires relative to the retaining member will ultimately cause permanent damage to the retaining member and render the connector assembly unsuitable for further use. Modification of the connector so that it cannot be reused may be accomplished by forming the retaining member of a material stiffer and slightly more brittle than the nylon suggested in this application. The substitute material should be such that it will be destroyed or permanently deformed upon removal of the sleeve and wires so that the connector assembly cannot be reused.

The slots 49 and 69 and the hinge portions 52 and 72 of the retaining member 35 and 61 respectively permit limited compression of the retaining member. This design facilitates installation of the retaining member in the cap 11.

The provision of a relatively long outer cylindrical portion (37, 63) on the sleeve retaining member and a relatively wide channel 29 for receiving this outer cylindrical portion permits the retention of the sleeve retaining member in a connector cap such as cap 11 which is made of a flexible plastic. A sleeve retainer having a relatively short outer cylindrical portion in engagement with the cap might not remain in position in a flexible cap.

What is claimed is:

1. An insulating connector for receiving and covering the ends of a plurality of electrical wires held together by a sleeve,
   - a shell of flexible insulating material having a generally central bore open at one end and enclosed at the other end by a wall,
   - a sleeve retaining member of axially elongated tubular shape and having a length greater than its thickness and positioned in said bore and spaced from the ends of the bore with said retaining member limited in longitudinal movement in the bore,
   - said sleeve retaining member having an annular generally cylindrical outer portion and an annular generally frusto-conical inner portion cantileverly connected to said outer portion with said retaining member positioned in said bore so that said inner portion converges towards said end wall,
   - said inner portion having a minimum inner diameter smaller than the outer dimension of said sleeve,
   - means to permit said inner portion to expand so that a sleeve and wires may be moved through said sleeve retaining member into said bore and to allow such inner portion to contact said sleeve to resist removal of said sleeve and wires from said bore,
   - said free end of said inner portion being spaced from said end wall of the shell a sufficient distance to permit said sleeve to be positioned in said bore inwardly of said free end.

2. The structure of claim 1 further characterized in that said sleeve retaining member is made of a tough elastic plastic.

3. The structure of claim 1 further characterized in that said means to permit said inner portion to expand to permit a sleeve and wires to be moved therethrough includes a longitudinal interruption formed in the cylindrical outer and frusto-conical portions of the tubular retaining member.

4. The structure of claim 3 further characterized in that a longitudinally extending notch is formed in said cylindrical outer member at a location approximately 180° away from said longitudinally extending interruption.

5. The structure of claim 1 further characterized in that a plurality of longitudinally extending notches are formed in said inner frusto-conical portion extending from the free end thereof for a distance less than the length thereof to thereby divide said frusto-conical inner portion into a number of projections.

6. The structure of claim 5 further characterized in that a reinforcing web is provided between each of said projections and the outer cylindrical member.

7. The structure of claim 6 further characterized in that said webs are aligned non-radially with said retaining member.

8. The structure of claim 1 further characterized in that said sleeve retaining member is made of a brittle material formed and adapted to break upon removal of said sleeve and wires from said sleeve retaining member.

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5

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DARRELL L. CLAY, Primary Examiner

U.S. Cl. X.R.

174—138; 287—75