

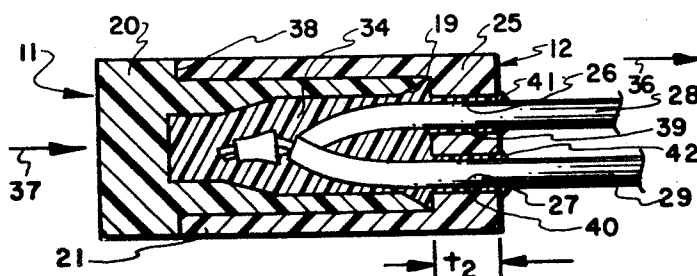
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[21] Appl. No. **869,735**
[22] Filed **Oct. 27, 1969**
[45] Patented **Aug. 3, 1971**
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[56] **References Cited**
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[54] **ELECTRICAL CONNECTOR FOR INSULATING AN ELECTRICAL WIRE JOINT**
5 Claims, 5 Drawing Figs.
[52] U.S. Cl..... 174/87,
29/628, 174/76, 264/272
[51] Int. Cl..... H02g 15/08
[50] Field of Search..... 174/87, 76,
77, 93, 138.4; 264/272; 29/628, 624

ABSTRACT: An electrical connector capable of being used in a process for insulating a wire joint, includes a plastic plug having a tubular insert section and a plastic casing with an open end sized to receive the tubular insert section and a closed end defining a plurality of ports. A plurality of electrical wires are insulated by plastic tubes that extend through corresponding ports to define a series of passages.

Plastic bonding agent is captivated within a space defined by the plug and casing to encapsulate bared electrical wire ends held together a a joint inside the casing. Another portion of the plastic bonding agent is extruded entirely throughout the annular passages in order to bond the casing and plastic tubes together.



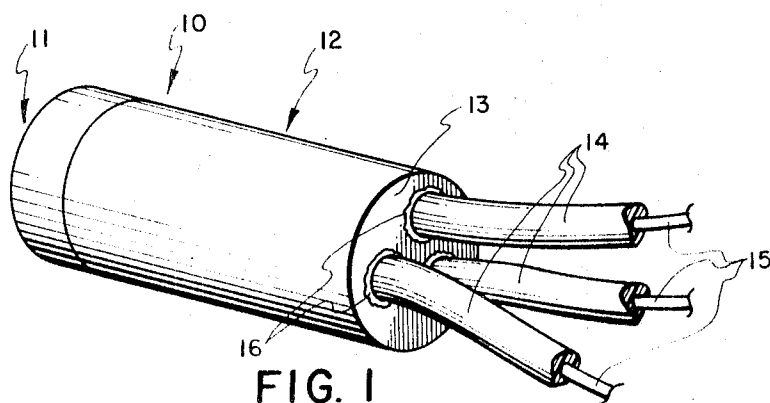


FIG. 1

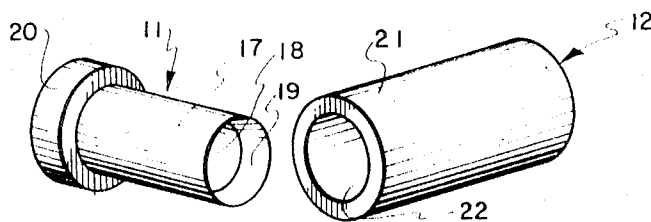


FIG. 2

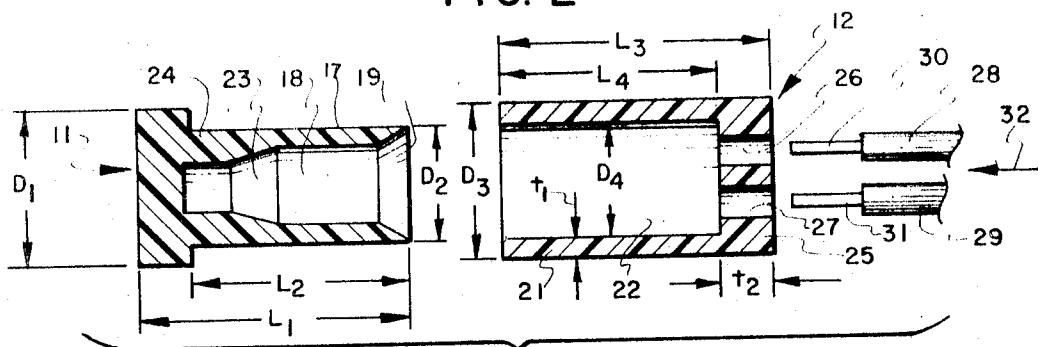


FIG. 3

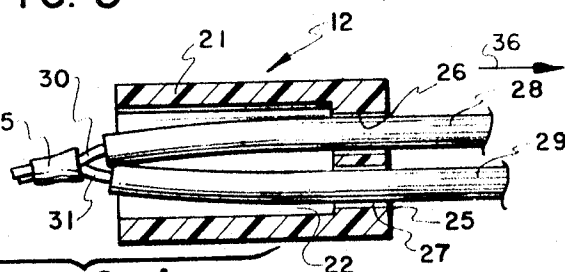
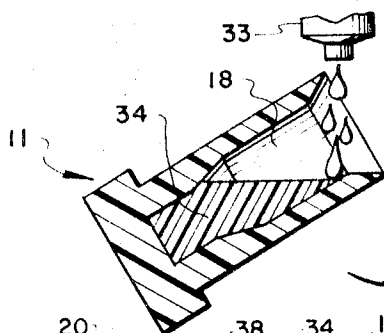


FIG. 4

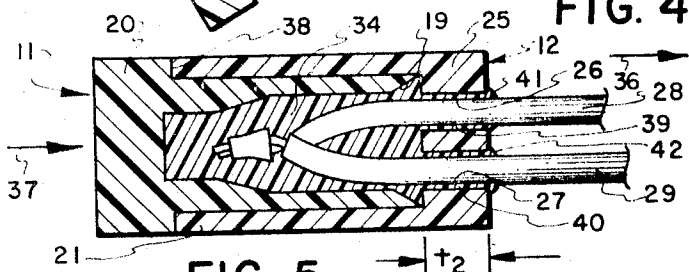


FIG. 5

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ELECTRICAL CONNECTOR FOR INSULATING AN ELECTRICAL WIRE JOINT

BACKGROUND OF THE INVENTION

This invention relates to electrical wire joint connectors and more specifically to an airtight, waterproof, corrosion-resistant electrical wire joint connector that is easy to assemble, inexpensive, sturdy and durable.

There are numerous instances where it becomes important if not crucial to permanently bond two or more electrical conductor wires together. In order to maximize the life of the electrical wire joint and maintain its electrical resistance at a virtually constant value, the mechanical and electrical connection must necessarily be of extremely high quality. As the mechanical components and chemical compositions become more specialized or sophisticated to make the connector airtight, watertight and corrosion resistant, there is a concomitant increase in cost and complexity.

One proposed approach for constructing a connector which the present invention bears some relationship to, is disclosed in U.S. Pat. No. 1,297,614 to Van Viersen (1919). The electrical connector structure includes a metal tube with an open end and a closed end formed with plural ports sized to admit just the stripped wire ends of electrical conductors, and, a cover filled with soldering paste and shaped to telescopically fit over the metal tube. When the metal tube and cover are assembled together the soldering paste is heated to partially flow around and enclose the electrical wire joint. An insulation cap is then adhered to the cover to complete the connector.

The resulting joint is generally impractical, time consuming to assemble and expensive, and, is prone to deterioration by overheating and the influence of extraneous forces.

A similar approach is disclosed in U.S. Pat. No. 997,066 to Krannichfeldt.

BRIEF SUMMARY OF THE INVENTION

Briefly stated this invention comprehends an electrical connector for insulating an electrical wire joint in an airtight, waterproof and corrosion-resistant manner. The connector includes a plastic plug preferably formed with a tubular insert section and a plastic casing having an open end sized to receive the plug insert section and a closed end that defines a plurality of ports.

A plurality of electrical conductor wires are insulated with plastic tubes that extend through associated ports to define therewith a series of annular passages. The inner ends of the electrical wires are stripped and tightened together as a wire joint inside the casing. Plastic bonding agent is captivated within a space defined by the plug in casing and serves to encapsulate the conductors. Another slug of the bonding agent is extruded entirely throughout the annular passages in order to bond the casing and plastic tubes together. Preferably the casing closed end exceeds the casing sidewall thickness so that a greater potential bonding area is constituted between the casing and plastic tubes.

Preferably the plastic casing and plastic plug are constructed from rigid polyvinyl chloride, the plastic tubes are constructed from plasticized polyvinyl chloride and the bonding agent is a suitable thermoplastic polymer adhesive composition.

The process aspects of this invention are characterized by inserting the plural plastic tubes through the ports and urging them through the casing and beyond the casing open end. After the bared electrical wire ends are tightened together as a wire joint the plastic tubes are pulled in a reverse direction until the wire joint is drawn back inside of the casing. The tubular insert section of the plug is then filled with bonding agent and thrust into the casing so one portion of the bonding agent may encapsulate the electrical joint and conductors while another portion of the bonding agent becomes extruded entirely through the annular passages to bond the casing and plastic tubes together.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous benefits and unique aspects of the present invention will be fully understood when the following detailed description is studied in conjunction with the drawings in which:

FIG. 1 is a perspective view of a first embodiment of this invention, showing the electrical connector structured to firmly hold three electrical conductors together;

FIG. 2 is an exploded view of a second embodiment of this invention, showing the plastic plug and plastic casing components of the electrical connector;

FIG. 3 is an exploded longitudinal sectional view of the plug and casing, showing two electrical conductors positioned for insertion through associated casing ports;

FIG. 4 is an exploded sectional view, showing plastic bonding agent being deposited into the plug and bared electrical wires of the conductors held together as a joint; and,

FIG. 5 is a sectional view showing the plug fully inserted into the casing with the bonding agent encapsulating the wire joint and extruded entirely through the ports to achieve a superior bonding effect.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 a two-component electrical connector 10 is shown constructed from a plastic plug 11 and a plastic casing 12 that coact to securely join multiple electrical conductors together in an airtight, waterproof, and corrosion-resistant joint. The electrical conductors, which are three in number in this embodiment, are constructed from plastic insulating tubes 14 that surround and generally contain associated electrical wires 15. The electrical conductors extend through ports formed in a closed end 13 of casing 12. When the electrical connector 10 is fully assembled to hold the electrical conductors in a manner to be fully described, rings or annular beads 16 of plastic bonding agent are formed between closed end 13 and tubes 14.

FIG. 2 shows that the plug 11 has a relatively elongated insert section 17 that is hollowed to form a recess 18. The plug inner end 19 is tapered towards the edge to constitute a guide for facilitating movement of a wire joint through recess 18, as shall be more fully described. Plug 11 is integrally formed at its other end with an enlarged head or cap 20 that an electrician may grasp to manipulate plug 11 to a desired position. Casing 12 has an open inner end 21 and a cavity 22 dimensioned to receive and snugly interfit with plug insert section 17.

Referring now to FIG. 3, the longitudinal sectional view of plug 11 shows that it has a sidewall of variable thickness characterized in part by a tapered intermediate section 23 and a thick wall intermediate section 24 adjacent cap 20. The overall dimensioning of recess 18 from end-to-end is sufficiently large at the inner plug end to accommodate the electrical conductors and is sufficiently small at the outer end so that bonding agent will not be used inefficiently and wastefully.

The overall end-to-end length of plug 11 and the length of insert section 17 are indicated by letters L_1 and L_2 . The maximum transverse dimensions or diameters of cap 20 and insert section 17 are indicated by letters D_1 and D_2 respectively.

Plastic casing 12 had a closed end wall 25 formed with two ports 26 and 27 that are aligned perpendicularly to wall 25 and parallel to the longitudinal axis of casing 12. Arranged for entrance into cavity 22 through ports 26 and 27 is a pair of electrical conductors 28 and 29 whose leading ends are stripped to present bared wires 30 and 31 respectively. The diameters of the plastic insulating tubes of conductors 28 and 29 are smaller than the diameters of their associated ports 26 and 27 so that when shoved in a direction indicated by directional arrow 32 they will fit loosely within their respective ports.

The end-to-end length of casing 12 and the length of cavity 22 are indicated by numerals L_3 and L_4 respectively. The length L_4 of cavity 22 is equivalent to the length L_2 of plug in-

sert section 17 so that when plug 11 is pressed into casing 12 plug inner end 19 engages and bottoms out against casing end wall 25. When the progress of plug 11 into casing 12 is stopped by wall 25 then the electrician or other person practicing this invention is able to detect that the insulation operation is completed and he can now release the electrical connector.

The thicknesses of the casing sidewall and casing end wall 25 are indicated by letters t_1 and t_2 respectively. The thickness t_2 of end wall 25 exceeds the thickness t_1 of the casing sidewall so that a greater potential bonding area is created between casing 12 and plastic tubes 298 and 29. Preferably thickness t_2 is at least twice as large as sidewall thickness t_1 . By increasing the potential bonding area in this manner there results a corresponding decrease in potential leakage or seepage passages through which the encapsulated electrical joint could be exposed to erosive and deteriorating agents.

Referring to FIG. 4, the electrical conductors 28 and 29 are shown manually pulled through ports 26 and 27 and through cavity 22 so that bared electrical wire ends 30 and 31 lie beyond open end 21. Plug 11 is tilted so that a squeeze tube 33 or other conventional container can be used to deposit a plastic bonding agent 34 into recess 18. The bonding agent 34 is supplied until it substantially fills recess 18. After a conventional sleeve or collar 35 has been slipped over wire ends 30 and 31 and crimped the resulting wire joint is pulled back into cavity 22 as indicated by directional arrow 36.

Referring to FIG. 5, when the wire joint has been displaced along direction 36 to the ideal position within casing 12 the plug insert section 17 is forced in direction 37 into casing 12 until inner end 19 bottoms out against casing end wall 25. As insert section 17 traverses its last small increment of displacement (the final 5 percent of its movement into casing 12 for example) excess bonding agent under compression is caused to form tubular extrusions 39 and 40.

Tubular extrusions 39 and 40 are formed by bonding agent 34 squeezed through annular passages defined by ports 26 and 27 with plastic tubes 28 and 29 respectively. If the electrician holds plug 11 and casing 12 vertically during this operation with plug 11 on the bottom then annular beads 41 and 42 will form at the exit ends of ports 26 and 27 to assist in achieving additional bonding between casing 12 and tubes 28 and 29.

Preferably plug 11 and casing 12 are constructed from conventional unplasticized or rigid polyvinyl chloride, and, the plastic tubes 28 and 29 are constructed from conventional plasticized polyvinyl chloride. Bonding agent 34 is a suitable thermoplastic polymer adhesive composition such as a commercially available solvent cement IPS No. 795 produced by Industrial Polychemical Service of Gardena, Cal., which cement is characterized by high tensile strength and inherent flexibility.

OPERATION

Keeping the above constructions and process in mind it can be understood how previously described disadvantages of conventional structures and techniques for insulating electrical wire joints are overcome or substantially eliminated by the present invention.

Initially an electrician selects a casing such as those shown in FIG. 1 and FIG. 3 that has a sufficient number of adequately sized ports for accommodating the electrical conductors to be

united in an electrical wire joint. After selecting a casing 12 such as that shown in FIG. 3 and an associated plug 11 the electrician forces electrical conductors 28 and 29 through the associated ports 26 and 27 until the bared wire ends 30 and 31 shown in FIG. 4 can be crimped together by a sleeve 35 to constitute a wire joint.

The wire joint is pulled back into casing 12 along direction 36 and after bonding agent 34 has been deposited into recess 18 of plug 11, plug 11 is shoved into casing 12. Just before inner end 19 bottoms out against wall 25 and cap 20 engages casing end 21 at interface 38, excess bonding agent 34 becomes squeezed in the form of extrusions through associated annular passages within ports 26 and 27. The lengths of ports 26 and 27 are sufficiently large in comparison with the sidewall thickness of casing 12 so that a greater potential bonding area is provided.

The wire joint becomes immersed within and encapsulated by bonding agent 39, and, the extrusions 39 and 40 assist in bonding electrical conductors 28 and 29 to casing 12 to constitute the completed joint.

From the foregoing it will be evident that the present invention has provided an electrical connector and process for insulating an electrical wire joint in which all of the various advantages are fully realized.

What we claim is:

1. An electrical connection comprising:

- a plastic casing having a sidewall, an open end and a closed end with plural ports therethrough, the casing closed end thickness being at least twice as thick as the casing sidewall thickness;
- a plastic plug having a tubular insert section fitting snugly within the casing and engaging the casing closed end, and, having an enlarged cap engaging the casing open end;
- a plurality of plastic insulated electrical wires extending through said ports that are larger than the plastic insulated electrical wires to define therewith plural annular passages, the electrical wires having inner ends joined together inside the casing; and,
- a bonding agent captivated within and totally occupying the space defined by the plug and casing encapsulating the wire joint, the bonding agent being extruded entirely through the annular passages and bonding the casing and plastic insulated electrical wires together.

2. The structure according to claim 1 wherein:

the ports are perpendicular to the casing closed end and parallel to the casing axis.

3. The structure according to claim 1, wherein;

the plastic casing and plug are constructed from rigid polyvinyl chloride, the plastic of the plastic insulated electrical wires is plasticized polyvinyl chloride and the bonding agent is a suitable thermoplastic polymer adhesive composition compatible with polyvinyl chloride.

4. The structure according to claim 1, wherein;

the electrical wires are joined together by a sleeve crimped over their inner ends.

5. The structure according to claim 1, wherein;

the end of the tubular insert section which engages the casing closed end is tapered towards its edge from inside to outside to constitute a guide for facilitating movement of the wires into the tubular insert section.