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Farrar, Jr.

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[54] **CONNECTOR ENCAPSULATING DEVICE AND METHOD**

[75] Inventor: **John A. Farrar, Jr.**, Atlanta, Ga.

[73] Assignee: **Minnesota Mining and Manufacturing Company**, St. Paul, Minn.

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[52] **U.S. Cl.** ..... **339/116 C;** 339/99 R; 174/138 F

[51] **Int. Cl.** **H01r 7/04;** H01r 13/52

[58] **Field of Search** ..... 339/94, 99, 115, 116, 117, 339/218; 174/138 F

[56] **References Cited**

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3,148,011	9/1964	Brown	339/115 C X
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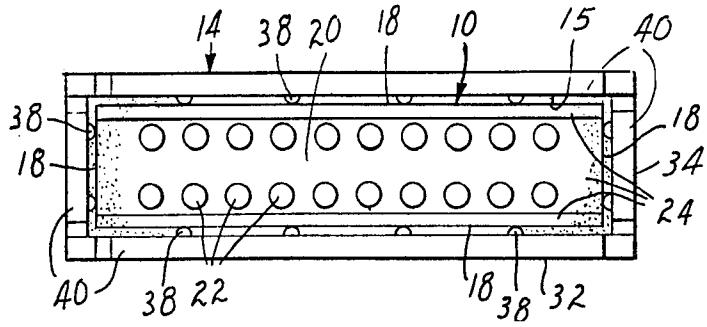
Primary Examiner—Richard E. Moore

Attorney, Agent, or Firm—Alexander, Sell, Steldt & Delahunt

[57] **ABSTRACT**

A method and device are described for encapsulating a multiple wire electrical connector in a viscous encapsulating material. A socket adapted to closely fit around the connector is filled with a predetermined quantity of the encapsulating material. The connector is pressed into the socket so that some of the encapsulating material is forced from the bottom of the socket to the surface of the connector adjacent the opening to the socket through passageways along the sides of the socket. This encapsulating material is then spread over the connector, which spreading may be facilitated by flexing flaps on the housing toward the opening.

5 Claims, 5 Drawing Figures



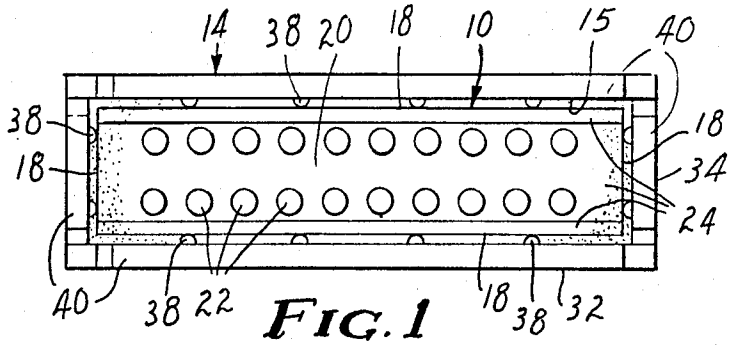


FIG. 1

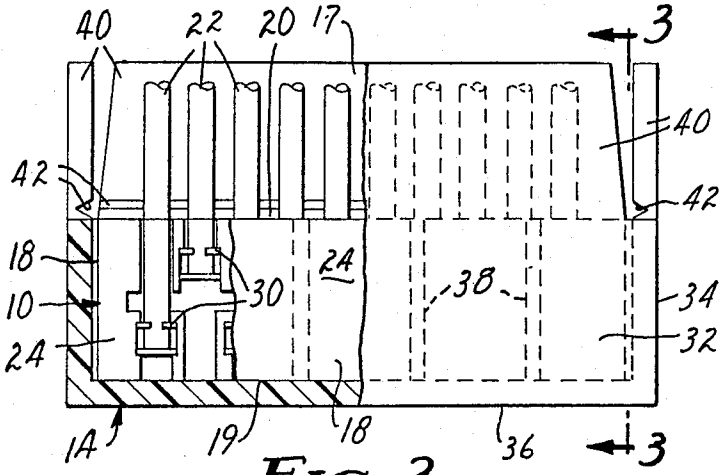


FIG. 2

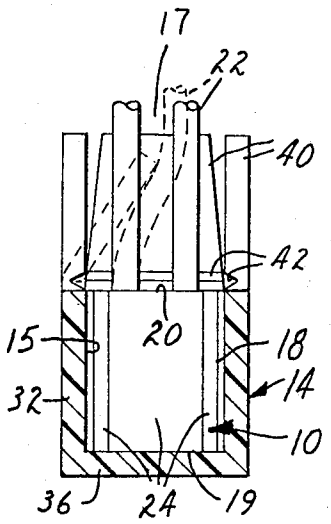


FIG. 3

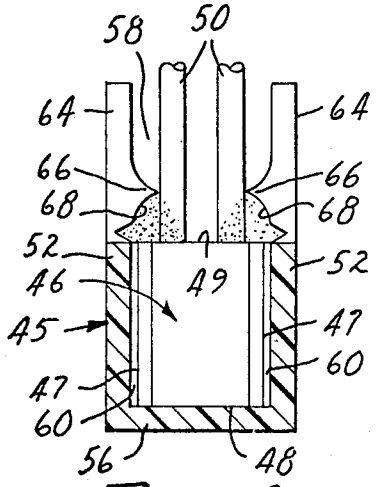


FIG. 4

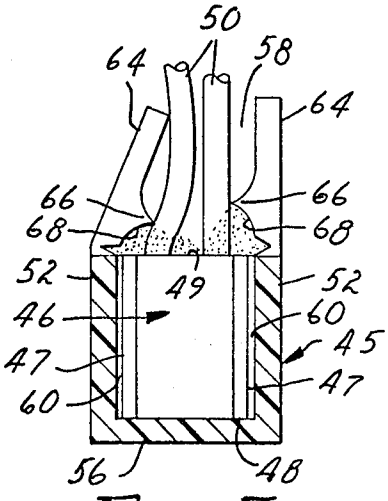


FIG. 5

CONNECTOR ENCAPSULATING DEVICE AND METHOD

BACKGROUND OF THE INVENTION

This invention relates to the encapsulation of electrical connectors, and in one aspect to encapsulating telephone circuit wire connectors in a viscous encapsulating material.

The plurality of connectors used to interconnect wires of a telephone circuit such as in a pressurized or non-pressurized splice case, or a telephone pedestal, must be protected from corrosion caused by moisture which may enter the splice case or pedestal. This protection cannot be conveniently provided by encapsulation in a self-curing encapsulating material within an enclosure as is taught in U.S. Pat. Nos. 2,862,042, 2,908,744, 2,967,795 and 3,419,669 for use in splicing underground cables, because of the bulk of the enclosure and the virtual impossibility of re-entry to change a connection. While encapsulation of such connectors in a removable encapsulating material within an enclosure as is taught in U.S. Pat. application No. 376,285 would afford re-entry, such encapsulation is also not desirable because of the bulk of the enclosure and because re-entry to a single connector within the enclosure requires opening of the entire housing, and disturbing and repairing of the encapsulating material around connectors adjacent the one in which the change is to be made. Such connectors have been individually encapsulated in a viscous encapsulating material by placing the encapsulating material and wired connector into a flexible bag, working the encapsulating material around the connector, and securing the open end of the bag about the wires leading to the connector which are formed into a bundle. This system, however, requires a large amount of the encapsulating material relative to the volume of the connector, and sufficient length in each of the spliced wires to form the bundle. Also, the proper distribution of the encapsulating material around the connector is dependent on the operator's skill, and the resulting encapsulated connector is large compared to the size of the connector so that it fills valuable space within the splice case or pedestal.

SUMMARY OF THE INVENTION

According to the present invention there is provided a simple, efficient and dependable method for individually encapsulating connectors in a splice case or pedestal. A connector encapsulated by this method is efficiently protected from moisture while it may be easily re-entered and re-encapsulated without disturbing adjacent connectors. The amount of the expensive encapsulating material required to encapsulate a connector is small compared to encapsulating the connector in a grease bag (e.g., the same connector may be encapsulated in 20 grams of encapsulating material with the present invention compared to about 110 grams of encapsulating material when a grease bag is used). Also, the wires entering the connector need not be formed into a bundle, and the size of the encapsulated connector is small which allows a given size of splice case or pedestal to contain a larger amount of connectors.

An encapsulated connector according to the present invention is enclosed on five sides within a close fitting socket in a housing, with the wires electrically interconnected by the connector projecting through the opening to the socket (i.e., by close fitting we mean having less than about 1/16 inch clearance around the connector inside the housing). A quantity of viscous electrically insulating encapsulating material surrounds the connector within the socket to protect the connector from moisture.

The housing for receiving the connector has a plurality of projections defining passageways extending from the bottom of the socket to its open end. To encapsulate a connector, viscous, water insoluble, electrically insulating encapsulating material is placed in the socket in a quantity at least sufficient to fill the socket for a predetermined distance over a connector fully enclosed therein. The connector is pressed into the socket with sufficient pressure to force a portion of the encapsulating material through the passageways to the exposed end of the connector, after which that portion of the encapsulating material is spread around the wires and over the first end of the connector.

Viscous, water insoluble electrically insulating encapsulating materials which are particularly suitable include those having a high dielectric strength and thixotropic properties, with a static viscosity in about the 1 to 1½ million centipoise range, and a penetrometer reading in the range of 200 to 300. Examples include a silicone grease sold under the designation "DC-2" by Dow Corning, Inc.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be further described with reference to the accompanying drawing wherein like numbers refer to like parts in the several views, and wherein:

FIG. **1** is a plan view of a connector encapsulated in a housing according to the present invention;

FIG. **2** is an elevational side view, partially in section, of the present invention as illustrated in FIG. **1**;

FIG. **3** is a sectional view taken along line **3—3** of FIG. **2** illustrating movement (in phantom) of a flap on the housing; and

FIGS. **4** and **5** are end views of the present invention partially in section, illustrating an alternate embodiment of the housing, with FIG. **5** illustrating movement of a flap on the housing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1** through **3** there is illustrated a connector **10** encapsulated in a viscous encapsulating material (illustrated by stippling in FIG. **1**) within a housing **14.** The housing **14** has a socket **15** with a bottom opposite an unrestricted open end **17.** The socket **15** fully receives and closely fits around four planar side walls **18** and an inner or second end **19** of the rectangular connector **10,** while a first or exposed end **20** of the connector **10** faces the open end **17** of the socket **15.** A plurality of wires **22** electrically interconnected by the connector **10** project through the open end **17** of the socket **15.** A quantity of viscous, electrically insulating, water restricting encapsulating material surrounds the connector **10** within the socket **15,** including a layer of the encapsulating material over its first end **20** and around the projecting wires **22.**

The connector **10** is of the type disclosed in U.S. Pat. No. 3,708,779, the disclosure whereof is incorporated by reference herein. Briefly the connector **10** has sepa-

rable insulative body portions **24** defining (when assembled) a plurality of internal wire receiving channels. A plurality of conductive contact elements **30** which are slotted to define resilient wire receiving fingers are mounted in one of the body portions with the slots aligned with the channels. The wires **22** to be elecrically interconnected are positioned within the part of the channels defined in one of the body portions **24** and the connector **10** is assembled to resiliently engage the fingers of the contact elements **30** with the wires to electrically interconnect them in a predetermined pattern.

The housing **14** is a one piece molding of a polymeric material, preferably polypropylene. The housing **14** includes rectangularly disposed side walls **32**, end walls **34** and a bottom wall **36**, the inner surfaces of which define the socket **15**. The side and end walls **32** and **34** have inwardly extending projections or ribs **38** which extend longitudinally at right angles to the bottom wall **36** and define, when a connector **10** is in the socket **15**, passageways between the connector **10** and walls **32** and **34** extending from the bottom to the open end **17** of the socket **15**.

To encapsulate the connector **10** the craftsman selects the housing **14** which is adapted to accept the connector **10**. The socket **15** contains a quantity of viscous encapsulating material sufficient to at least fill the socket to a predetermined distance over the connector **10** after the connector is fully enclosed within the socket **15** with its second end **19** contacting or closely spaced from the bottom wall **36**. The connector **10** is then positioned in the socket **15** with its second end **19** adjacent the bottom wall **36** and in contact with the encapsulating material. The craftsman presses the connector **10** into the open end **17** of the socket **15** with sufficient pressure to force the encapsulating material into and through the passageways and deposit a portion thereof at the first end **20** of the connector **10**. The craftsman then spreads the portion of encapsulating material between the connector **10** and the open end **17** of the socket **15** around the wires and over the first end **20** of the connector **10** to complete the encapsulation thereof.

The housing **14** includes flaps **40** hingedly mounted along one edge in opposed relationship at the open end **17** of the socket **15**. The flaps **40** are integrally formed with the walls **32** and **34** and hinged thereto via a thin strip of the housing material at the base of a generally V-shaped groove **42**. As the connector is pressed into the socket **15** the portion of the encapsulating material extruded through the passageways will be deposited adjacent the flaps **40**. The craftsman may then flex the flaps **40** inwardly to the position illustrated in FIG. **3** to help spread that portion of the encapsulating material around the wires **22** and over the first end **20** of the connector **10**.

FIGS. **4** and **5** illustrate an alternate structure for the housing **14** generally designated by the numeral **45** in which is positioned a rectangular connector **46** similar to the connector **10** and having side walls **47**, a second or inner end **48** and a first or exposed end **49** from which project a plurality of electrically interconnected wires **50**. Like the housing **14**, the housing **45** has rectangularly disposed side walls **52**, end walls (not shown) and a bottom wall **56**, the inner surfaces of which define a socket **58** fully enclosing the connector **46**. The side walls **52** and the end walls each have inwardly extending projections or ribs **60** which extend longitudinally at right angles to the bottom wall **56**, and define, when a connector is in the socket **58**, passageways extending from the bottom to the open end of the socket **58**. Like the housing **14**, the housing **45** has hinged flaps **64** for spreading encapsulating material over a connector which has been pressed into the socket **58**. Unlike the flaps **40**, however, the flaps **64** attached to the side walls **52** have generally triangular projections **66** with generally cylindrically concave arcuate surfaces **68** adjacent the open end of the socket **58**. One edge of the surface **68** on each projection **66** is aligned with the outer extreme of the surface defining the socket **58** or inner surface of the adjacent side wall **52**, and from this edge the surface **68** tends through an arc of about **90** degrees. As the portion of the encapsulating material displaced by the connector **46** is extruded through the passageways toward the opening of the socket **58**, it will contact and be deflected by the surfaces **68** on the projections **66** over the first end **49** of the connector **46**. The craftsman may then flex the flaps **64** inwardly as illustrated in FIG. **5** to further spread the encapsulating material around wires **50** projecting from the first end **49** of the connector **46**.

Having thus described the present invention with reference to two illustrated embodiments, what is claimed is:

1. A method for encapsulating a connector having side walls extending between first and second ends which connector electrically interconnects a plurality of wires projecting from its first end, said method including the steps of:

providing a housing having a socket with a bottom opposite an unrestricted open end, the socket being adapted to closely fit around and completely receive the side walls and second end of the connector with its first end facing the open end of the socket and the wires extending therethrough, said housing having a plurality of projections defining, when a connector is within the socket, passageways extending from the bottom of the socket to the open end, and having a quantity of viscous, water restricting electrically insulating encapsulating material in the socket, the quantity being at least sufficient to fill the socket for a predetermined distance over the connector after the second end of the connector is positioned at the bottom of the socket;

positioning the connector in the socket with its second end adjacent the bottom thereof and in contact with the encapsulating material;

pressing the positioned connector into the open end of the socket with sufficient pressure to force the encapsulating material into and through the passageways to deposit a portion of the encapsulating material at the first end of the connector; and

spreading the portion of the encapsulating material at the first end of the connector around the wires and over the first end of the connector.

2. The method of claim **1** wherein the housing has a pair of flaps hingedly mounted along one edge in opposed relationship to the housing on opposite sides of the open end of the socket, and said spreading step includes the step of pressing the flaps toward the open end to help in spreading the potting compound across the first end of the connector.

3. In combination, a connector including an insulative body having side walls extending between first and

second ends and a plurality of internal wire receiving channels, a plurality of wires in said channels and a plurality of conductive contact elements mounted in said body member, said contact elements having spaced fingers in resilient engagement with the wires to electrically interconnect wires in the channel in a predetermined pattern; a housing having a socket with a bottom opposite an unrestricted open end, the socket closely fitting around and completely receiving the side walls and second end of the connector with its first end facing the open end and the wires extending therethrough; and a quantity of viscous electrically insulating water restricting encapsulating material within the socket around said connector.

4. A device for encapsulating an electrical connector having side walls extending between first and second ends and electrically interconnecting a plurality of wires projecting from its first end, said device comprising a housing having a socket with a bottom opposite an unrestricted open end, the socket being adapted to closely fit around and completely receive the side walls and second end of a said connector with the first end of the connector facing the open end and the wires projecting therethrough, said housing having a plurality of projections defining, when a said connector is positioned within the socket, channels extending from the bottom of the socket to the open end, and a pair of flaps hingedly mounted along one end in opposed relationship at the open end of the housing.

5. The device of claim **4** wherein each of said flaps has a projection defining a generally cylindrically concave arcuate surface adjacent the open end of the socket with one edge of the surface being aligned with the outer extreme of the surface defining the socket and the surface extending through an arc of about 90° over the open end.

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