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[54] **FILLED TELEPHONE CABLE**

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[52] **U.S. Cl.** ..... **174/23 C,** 174/25 C, 174/107, 174/110 PM, 174/116

[51] **Int. Cl.** **H01b 7/18,** H01b 3/30

[58] **Field of Search** ..... 174/23 R, 23 C, 25 C, 174/27, 24, 110 PM, 113 R, 116, 107, 102 R, 36

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[57] **ABSTRACT**

In a filled telephone cable, the core is filled with a composition comprising petroleum jelly in the amount of about 80 percent by weight, polyethylene and/or polybutene-1 in the amount of about 10 percent by weight, and polyisobutylene in the amount also of about 10 percent weight.

6 Claims, 2 Drawing Figures

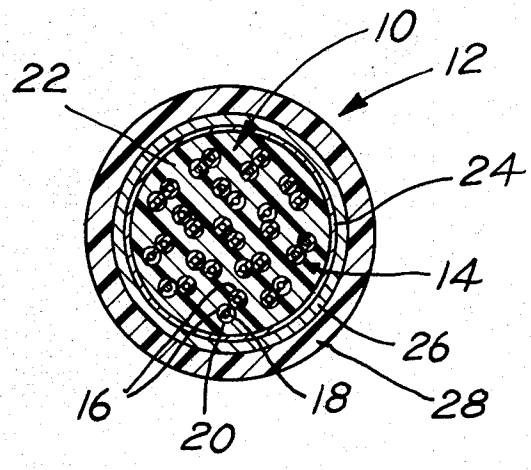


Fig. 1

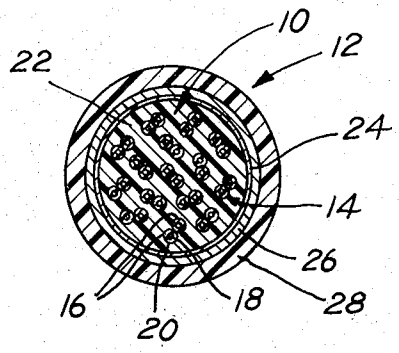
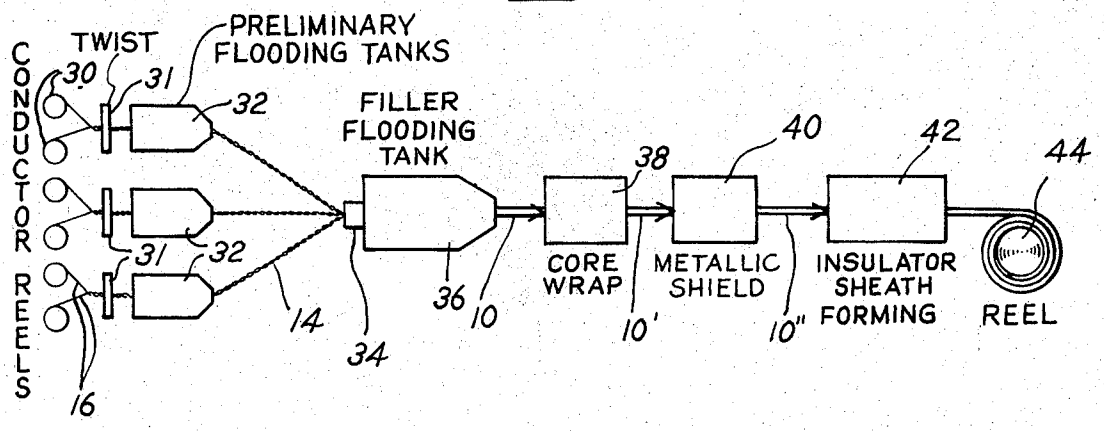

10
12
22
24
14
26
16
20
18
28

Fig. 2


CONDUCTOR REELS
TWIST
30
31
PRELIMINARY FLOODING TANKS
32
FILLER FLOODING TANK
38
40
42
44
CORE WRAP
METALLIC SHIELD
INSULATOR SHEATH FORMING
REEL
36
10
10'
10"
14
34
16

FILLED TELEPHONE CABLE

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to filled telephone cables and a filler composition therefor.

In various underground cable installations, such as multiple conductor telephone cables, water and water vapor must be prevented from entering the cable through punctures in the cable's outer jacket which may result either from lightning, defects in the cable's outer jacket or excavation damage. Entry of water will result in a substantial reduction in the performance of the cable, if not complete destruction for its intended purpose.

In order to reduce the likelihood of damage to such underground cables, for example underground telephone cables, various fillers have been employed in the past to prevent exposure of the cable conductors to water. Such filled cables generally take the form of a core in which the multiple conductors of the telephone cable are embedded in a soft resilient filler material during manufacture the purpose of which is to fill all the voids within the cable. This core is then wrapped with a suitable dielectric tape, is covered with a metallic sheath and is coated with the external insulative sheath of the cable. One such filler composition which has been employed in the past comprises a mixture of 85–95 percent petroleum jelly and 5–15 percent polyethylene. During the manufacture of the cable, the filler material is heated to a temperature at which it is a flowable heavy viscous liquid which is coated upon the multiple conductors so as to fill the voids between the conductors. Upon cooling to ambient temperature, the filler composition assumes a non-flowable, pliable, tacky form and is closely contained in the cable core by the external sheathing of the cable.

It has been found that prior petroleum jelly — polyethylene mixtures tend to dry and crack after injection into the cable. As such, when the cable is bent during installation, voids may occur in the cable core which might allow moisture to penetrate the conductor insulation. It is believed that such drying and cracking is due to the absorption of the light ends of the petroleum jelly into the polyvinyl chloride, polyethylene or polypropylene cable insulation and which causes this insulation to swell somewhat. This swelling itself is not critical, but results in a loss of material from the filling mixture causing the mixture to subsequently crack and separate from the conductor insulation and cable sheath.

The present invention is directed to a filling composition for filled cables which substantially reduces the tendency of such cables to dry out and crack and thereby substantially increases the life and operating performance of these cables. Moreover, the composition of the present invention is not appreciably more expensive than the prior filling compositions and may be readily applied during manufacture of the cable by well known processes which were previously employed in the application of the prior filling compositions.

In a principal aspect of the present invention, a composition for filling filled conductive cables comprises a mixture of about 80 weight percent petroleum jelly, about 10 weight percent of either polyethylene and/or polybutene-1 and about 10 weight percent of polyisobutylene.

In another principal aspect of the present invention, a filled communication cable comprises a core having a plurality of insulated conductors therein and a filler composition filling the spaces between and surrounding the conductors. The filler composition comprises a mixture of about 80 weight percent of petroleum jelly, about 10 weight percent polyethylene and/or polybutene-1 and about 10 weight percent polyisobutylene and an exterior sheath covers the core.

These and other objects, features and advantages of the present invention will become evident upon consideration of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

In the course of this detailed description, the drawings will be referred to in which:

FIG. 1 is a cross-sectioned view of a filled telephone cable construction incorporating the principles of the present invention; and

FIG. 2 is a schematic presentation in which a preferred sequence of construction steps are shown for making a filled telephone cable incorporating the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, a filled telephone cable constructed in accordance with the principles of the present invention is shown which comprises a core, generally **10**, which is surrounded by an external sheath, generally **12**. The core **10** includes a plurality of spaced conductor pairs **14** which are twisted together. Each of the conductors **16** in the given pair **14** comprises a suitable conductor wire **18**, such as an aluminum or copper wire, which is surrounded with an insulative coating **20**, such as polyethylene, polypropylene or polyvinyl chloride. Each of the conductor pairs are spaced from each other and the spaces between the pairs are filled with the filler composition **22** of the present invention as shown in FIG. **1**.

The filler composition of the present invention comprises a mixture of petroleum jelly, polyethylene, and polyisobutylene, the latter of which is a tackifying agent. The petroleum jelly is present in the filler in the amount of 80 percent by weight, the polyethylene in the amount of 10 percent by weight, and the polyisobutylene in the amount of 10 percent by weight. It has been found that a mixture of these materials in the above mentioned amounts provides a filler composition which exhibits suitable melting temperatures which are important in the application of the filler composition to the conductors, as will be explained in further detail later. Such composition has also been found to be sufficiently tacky, but not overly tacky, and is capable of relatively easy mixing. Finally and, most importantly, this composition substantially reduces the tendency of the filled cable to dry and crack.

The percentages of the filler mixture components are important in achieving a filler composition which is both readily workable and which reduces drying and cracking of the filler in the cable. Where the percentage of petroleum jelly is reduced to 78 percent and the percentage of polyisobutylene is increased to 17 percent, the resulting mixture becomes too tacky and the melt temperature of the filler material is increased by an unacceptable amount. Conversely, a mixture of 86 percent petroleum jelly — 10 percent polyethylene —

4 percent polyisobutylene was found to be not sufficiently tacky. When the amount of polyethylene is reduced to 2 percent, the melting temperature of the mixture is not sufficiently high to prevent loss of the filler from the end of the cable at temperatures which might be experienced in installations in hot geographic regions, e.g. 160°F.

Although, polyethylene is preferred, it is contemplated that polybutene-1 may also be substituted in whole or in part for the polyethylene. Where polyethylene is employed, the low density form is preferred and polyethylenes having average molecular weights in the range of from 3,000 to 400,000 have been found to be suitable. A suitable polyisobutylene is Vistanex, available from Enjay Chemical Co.

Referring again to FIG. **1**, the sheath **12** surrounds the core **10** and comprises a wrapped layer of a suitable dielectric tape **24**, such as a polyester type. This tape layer is also preferably impregnated with the filler mixture. Surrounding the tape layer **24** of the cable, is a suitable metallic sheath **26**, such as aluminum and, finally, the cable is covered with an exterior flexible insulative layer **28**, such as polypropylene or polyvinyl chloride.

Although it is believed that the foregoing description of the filled cable is ample for a full understanding of the principles of the invention, a brief description of a suitable method for making such cable follows.

Referring to FIG. **2**, the already insulated individual conductors **16** are drawn from individual reels **30** and a pair of these conductors are twisted together at **31** to form pairs **14**. These pairs **14** are then passed through filler flooding tanks **32** in which each of the respective pairs is saturated and coated with the filler mixture earlier described. The heated filler is introduced to the flooding tanks **32** at a temperature of approximately 210° F at which temperature, the filler mixture takes the form of a heavy, viscous liquid and readily flows between and coats the conductor pairs. Since the conductor pairs **16** enter tanks **32** at substantially ambient temperature, the temperature of the filler mixture which is coated upon the pairs will be reduced such that the filler on the pairs will become tacky and grease-like and will therefore adhere to the pairs as they leave tanks **32**.

A plurality of these coated pairs **14** are then brought into proximity to each other at **34** and enter a second flooding tank **36** to which additional filler mixture has also been introduced in the liquid state. In this flooding tank **36**, the filler will now flow between the conductor pairs **14** to fill the spaces between the pairs and will surround the entire conductor bundle as shown in FIG. **1**. Again contact with the proximate conductor pairs will result in a reduction in the temperature of the filler mixture, causing it to become greasy and tacky in consistency as previously described.

The core **10** which has now been formed will then pass to a core wrap station **38** where the core is wrapped with the polyester tape **24**. The wrapped core **10'** then proceeds to a metallic sheath application station **40** in which the metallic sheath **26** is applied. Finally, this sheathed bundle **10''** passes to an insulator sheath forming station **42** where the external insulative sheath is applied and cured. From this station, the filled final cable product may be stored on reels **44**.

It will be understood that the embodiment of the present invention which has been described is merely illustrative of one of the applications of the principles of the invention. Numerous modifications may be made by those skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is

1. A composition for filling communication cables, said composition comprising a mixture of:

petroleum jelly in the amount of about 80 weight percent of said composition,

a polymer selected from the group consisting of polyethylene, polybutene-1 and mixtures thereof in the amount of about 10 weight percent of said composition, and

polyisobutylene in the amount of about 10 weight percent of said composition.

2. The composition of claim **1** wherein said polyethylene is low density polyethylene.

3. A filled communication cable comprising,

a core including a plurality of insulated conductors and a filler composition filling the spaces between and surrounding said conductors, said composition comprising a mixture of:

petroleum jelly in the amount of about 80 weight percent of said composition,

a polymer selected from the group consisting of polyethylene, polybutene-1 and mixtures thereof in the amount of about 10 weight percent of said composition, and

polyisobutylene in the amount of about **10** weight percent of said composition, and

an exterior sheath covering said core.

4. The cable of claim **3** wherein said polyethylene is low density polyethylene.

5. The cable of claim **3** wherein said exterior sheath includes a tape wrapped about said core, said tape being impregnated with said filler composition.

6. The cable of claim **5** wherein said exterior sheath also includes an insulative coating surrounding said tape.

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