

- [54] **FILLED TELEPHONE CABLE WITH BONDED SCREENING LAYER**
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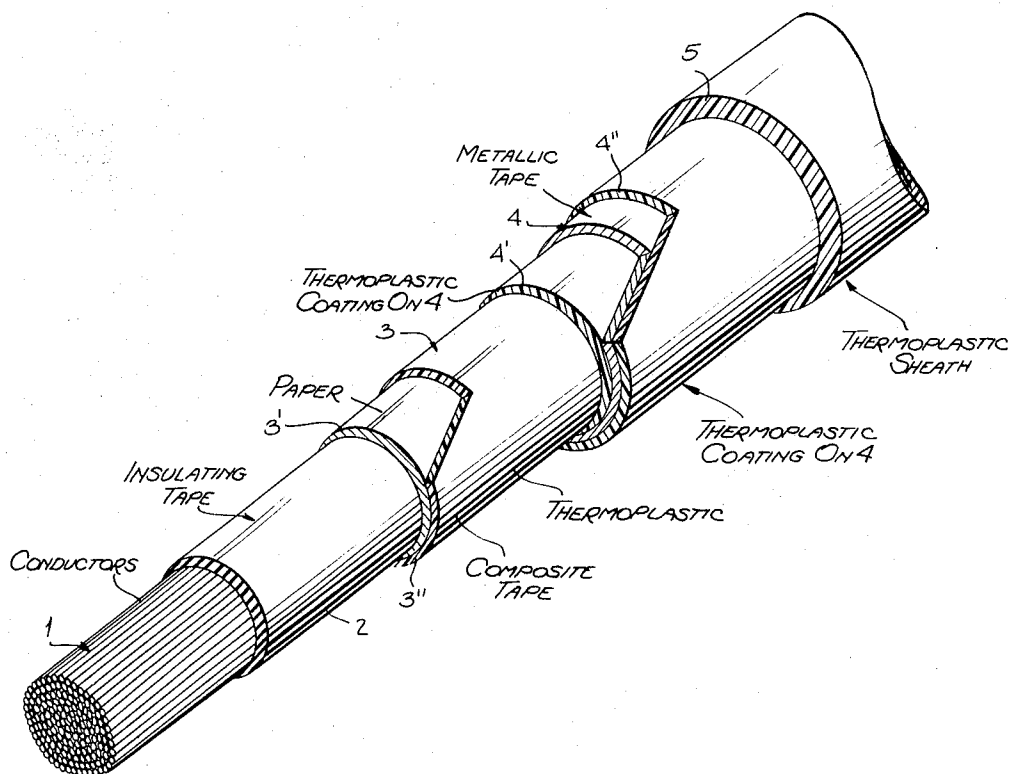
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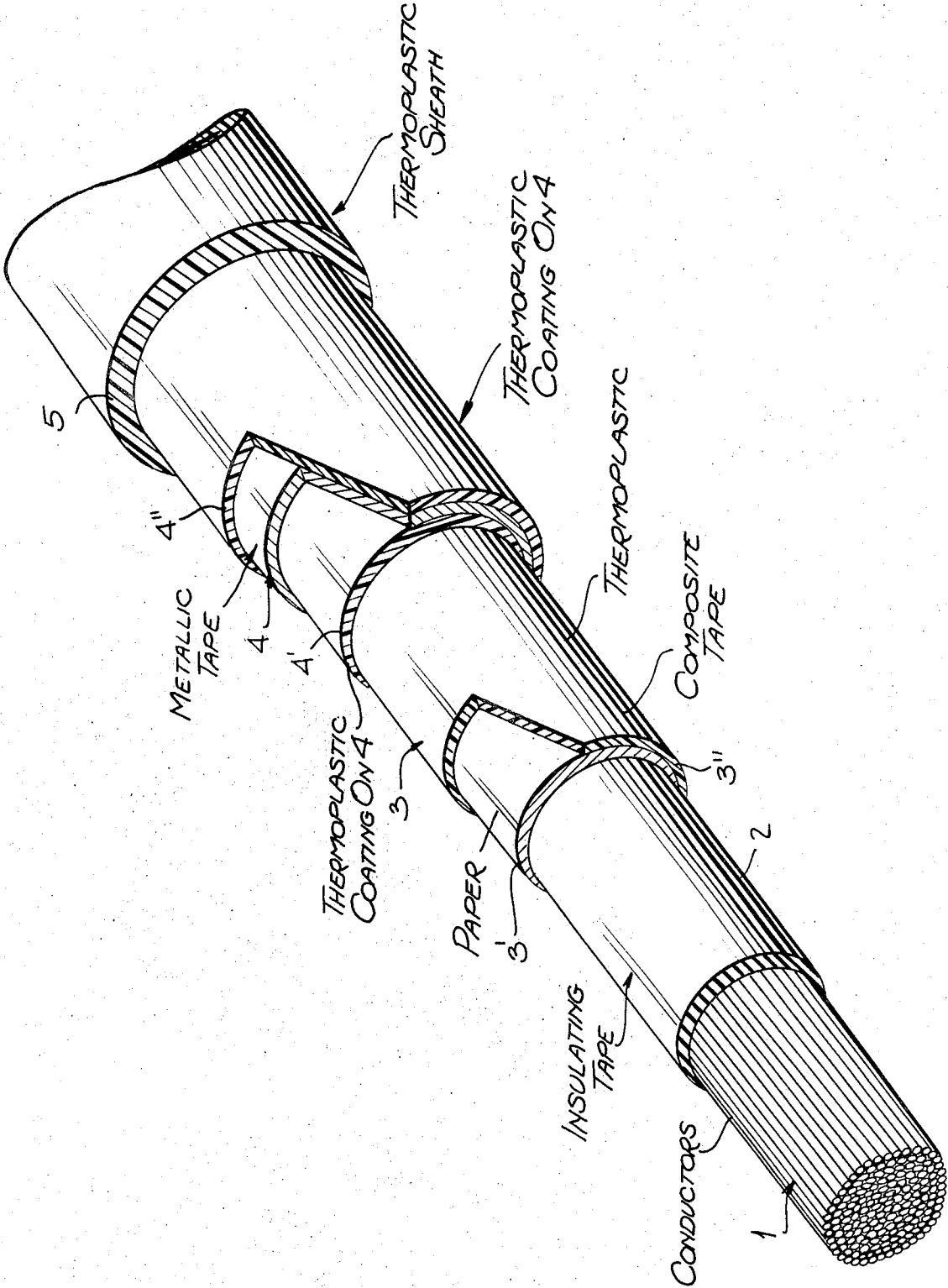
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[57] **ABSTRACT**

A fully-filled telephone cable having a central core of insulated wires bunched together and held together by a layer of an insulating tape, both the spaces between the wires and the tape being filled with a solid or semi-solid gel derived from a paraffin, vaseline or mineral oil. The layer of tape is surrounded by a helically wrapped or longitudinally extending composite tape having an inner layer of paper filled by said gel and having an outer layer of a thermoplastic material. The layer of composite tape is surrounded by a helically wrapped or longitudinally extending screen comprising a metal tape coated on its inner and outer surfaces with a thermoplastic material, the inner surface coating being bonded to the outer layer of the composite tape by fusion. The screen is surrounded by a sheath of thermoplastic material having its inner surface bonded by fusion to the outer surface coating of the metal tape.

10 Claims, 1 Drawing Figure





FILLED TELEPHONE CABLE WITH BONDED SCREENING LAYER

The present invention relates to an improvement in a telephone cable of the type known to those skilled in the art as a "fully-filled cable."

A fully-filled cable provides a reliable tightness with respect to the longitudinal migration of water which may penetrate into the inside of the cable as a result of a failure of the sheath to prevent the entrance of moisture. Said tightness is obtained by filling the empty spaces between the elements of the group of conductors, or "cord", with a filling material which usually is a solid or semi-solid gel derived from mineral oil.

The word "cord", as used herein, means the bunch or group of conductors obtained by bunching together individual conductors, appropriately insulated, or by bunching together pairs, quads, etc., constituted by the stranding of individually insulated wires.

The cord is generally wrapped with tapes impregnated with filling material, and is covered with an outer sheath of extruded thermoplastic material.

The sheath, after the extrusion and during the cooling process, shrinks, which reduces the diameter of its cross section, exerting in this way on the underlying filled and wrapped cord a contracting action which ensures tightness against the longitudinal propagation of water between the sheath and the cord.

However, for electric reasons, for example, in telephone cables, it is often necessary to apply a metallic screen, made, for example, of aluminum, beneath the outer sheath of thermoplastic material and between it and the cord. The contracting effect of the thermoplastic sheath can, in such case, become insufficient, especially when the screen is in the form of a longitudinal tape. The latter is generally a smooth tape, coated on its outer surface with a thermoplastic material the same as that of the outer thermoplastic sheath and adhering to the tape. In the present specification, the term "outer" will indicate the elements more remote from the cable axis, and "inner," the elements nearer said axis.

During the extrusion of the sheath, the thermoplastic coating of the screen melts, bonding said screen, by means of the coating thereon, to the outer thermoplastic sheath being formed.

However, if a considerable amount of the filling material is applied on the wrapping of the cord, on the inner surface of the screen there may be a poor adhesion of the filling material to the metallic tape. This causes insufficient sealing conditions which can give rise to migration of water along the cord if, as stated, the outer thermoplastic sheath should become damaged.

The present invention aims at eliminating the hereinbefore indicated problems by providing an improved fully-filled telephone cable in which any infiltration of water, in particular between the metallic screen and the cord, is prevented.

More precisely, one object of the present invention is an improved telephone cable of the fully-filled type, which comprises a cord and a first wrapping of insulating material, both dipped in, or impregnated with, filling material, a screen constituted by a metallic tape having its outer surface coated with thermoplastic material, and an outer thermoplastic sheath, the material coating the outer surface of the screen being bonded by

fusion with the material of the outer sheath during the extrusion of said sheath, characterized in that a second wrapping, constituted by a composite tape made of two layers is included between said metallic screen and said first wrapping. The composite tape comprises an inner layer which can be impregnated with said filling material and an outer layer of thermoplastic material which can be bonded by fusion to a coating of thermoplastic material provided on the inner surface of said metallic screen.

The single FIGURE of the attached sheet of drawing illustrates in perspective, and partially cut away, a preferred embodiment of the improved fully-filled cable of the invention.

The illustrated fully-filled telephone cable comprises a cord 1 of a plurality of insulated wires covered with a first helical wrapping constituted by a tape 2 of insulating material. The tape 2 is preferably made of paper or of thermoplastic material. In the drawing, the thickness of the tape 2 wrapping the cord 1 is purposely exaggerated for illustration purposes.

The cord 1 and the tape 2 are dipped in, or impregnated with, a filling material, preferably a gel in solid or semi-solid state and derived from mineral oil, for instance, a paraffin or vaseline.

A second helical wrapping of a composite tape 3 constituted by two layers 3' and 3'' is wound around the tape 2. The inner layer 3' of the tape 3, directed towards the tape 2, is made of a material which can be impregnated with the filling material, for example, paper. The outer layer 3'' is made of thermoplastic material which, preferably, is bonded to the inner layer 3' such as by a suitable adhesive or by reason of the nature of the material used for the layer 3'' or by any other known means.

Instead of being wound helically, the tape 3 could be wrapped longitudinally around the layer of tape 2 with overlapped edges and with the overlapped edges thereof on top of the first helical wrapping 2. The overlapping edges of the composite tape 3 preferably are diametrically opposite to the position of the longitudinal edges of the metallic screen, which, preferably, also is longitudinally wound.

On the second wrapping 3, a screen 4 in the form of a metallic tape, for example, an aluminum tape, is wrapped longitudinally. This is a preferred embodiment, but a screen formed by a helically wound tape can also be used.

The screen 4 is coated with thermoplastic material on both of its surfaces, the coatings preferably being bonded thereto either by an adhesive or by reason of the nature of the material used for the layers 4' and 4''. On its inner surface, the coating 4' can be bonded, such as by fusion, to the outer layer 3'' of the composite tape 3, and preferably it is made of the same material constituting said outer layer 3'' of the tape 3, such as, for example, polyethylene, polypropylene, ethylene-propylene copolymers or polyvinylchloride. On the outer surface of the screen 4, said coating 4'' is made of a thermoplastic material capable of being bonded, such as by fusion, to the sheath 5. Preferably, the material of the coating 4'' is the same as that of the outer thermoplastic sheath 5, e.g., polyethylene, polypropylene, ethylene-propylene copolymers or polyvinylchloride.

The operation of applying the thermoplastic sheath 5 by extrusion generates heat, and this gives rise to the

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bonding by melting of the outer layer 3'' of the composite tape 3 to the inner coating 4' of the screen 4.

The action of heat improves the impregnation with the filling material of the part 3' of the composite tape 3 and which is made of paper, so that no zones remain within the layer of the tape 3 which may form a passage for water.

Of course, during the extrusion of the thermoplastic sheath 5, the melting of the outer coating 4'' of the screen 4 also causes the adhesion of the latter to the sheath 5.

If desired, the bonding of the tape 3 to the screen 4 can also be carried out by means of a heat treatment separate from that produced by the extrusion of the thermoplastic sheath 5.

In the cable construction described, it is possible to obtain a compact, fully-filled cable without any voids between one layer and the other, and the passage of water, in particular, in the zone in contact with the metallic screen 4, is prevented.

Although a preferred embodiment of the present invention has been described and illustrated, it will be understood by those skilled in the art that various modifications may be made without departing from the principles of the invention.

What is claimed is:

1. A fully-filled telephone cable comprising a plurality of central conductors grouped together to form a cord, a layer of insulating material surrounding said cord, a filling material filling the spaces between said conductors, said layer of insulating material also being impregnated with said filling material, a sheath of thermoplastic material surrounding but spaced from said layer, a composite tape surrounding said layer and intermediate said layer and said sheath, said tape comprising an inner layer of insulation impregnated with said filling material and an outer layer of thermoplastic material, a screen surrounding said tape and intermediate said tape and said sheath, said screen comprising a metal tape having a coating of thermoplastic material on the inner surface thereof which is bonded to said outer layer of said composite tape and having a coating of thermoplastic material on the outer surface thereof

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which is bonded to the inner surface of said sheath.

2. A telephone cable as set forth in claim 1, wherein said outer layer of said composite tape is bonded to said coating on said inner surface of said metal tape by fusion of said outer layer with said last-mentioned coating and said coating on said outer surface of said metal tape is bonded to said inner surface of said sheath by fusion of said last-mentioned coating with said sheath.

3. A telephone cable as set forth in claim 2, wherein said coating on said inner surface of said metal tape and said coating on said outer surface of said metal tape are adhesively bonded to said metal tape.

4. A telephone cable as set forth in claim 2, wherein said inner layer of said composite tape is paper.

5. A telephone cable as set forth in claim 4, wherein said inner layer is adhesively bonded to said outer layer of said composite tape.

6. A telephone cable as set forth in claim 2, wherein said composite tape is helically wrapped around said layer of insulating material.

7. A telephone cable as set forth in claim 2, wherein said composite tape extends longitudinally of said cable and has overlapping edges which extend longitudinally of said cable.

8. A telephone cable as set forth in claim 7, wherein said screen extends longitudinally of said cable and has overlapping edges which extend longitudinally of said cable and wherein said last-mentioned edges are disposed on the side of said insulating layer which is substantially diametrically opposite to the side thereof at which said overlapping edges of said composite tape are disposed.

9. A telephone cable as set forth in claim 2, wherein at least one of said thermoplastic materials is a thermoplastic material selected from the group consisting of polyethylene, polypropylene, ethylene-propylene copolymers and polyvinylchloride.

10. A telephone cable as set forth in claim 9, wherein said thermoplastic material forms at least one of said outer layer and said coating on said inner surface of said metal tape.

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