

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO TELECOMMUNICATION CABLES

- (71) We, BRITISH INSULATED CABLES LIMITED, a British Company, of 21 Bloomsbury Street, London, W.C.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to telecommunication cables of the kind comprising a multiplicity of plastics insulated conductors enclosed within a waterproof sheath and, filling the interstices between the insulated
- 15 conductors and between them and the waterproof sheath from end to end of the cable length, a water-impermeable medium which will not drain under the influence of gravity or such hydrostatic pressure as may arise in the event of damage to the cable sheath but which will permit relative sliding movement of the plastics insulated conductors over one another during such bending of the cable as occurs during manufacture and installation of the cable.
- 25 The non-draining water-impermeable medium generally preferred is petroleum jelly. The material used for the sheath is generally polyethylene. However as polyethylene is pervious to petroleum jelly the possibility exists, especially when such fully-filled, plastics sheathed telecommunication cables are laid in the vicinity of heavy current power cables whose continuous conductor temperature may be as high as 85°C and hence where the ambient temperature is high, of filling material migrating into and under certain conditions through the polyethylene sheath, thus creating an incompletely filled cable along which moisture may travel.

- 45 In the Complete Specification of our Patent No. 1,154,886 we describe and claim an improved form of fully-filled plastics sheathed telecommunication cable in which

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the risk of migration of the filling medium through the cable sheath is substantially eliminated and which comprises a multiplicity of plastics insulated conductors forming a core enclosed within a sheath of plastics material pervious to petroleum jelly and like oil/wax mixtures at certain ambient temperatures, the interstices between the individual conductors of the core and between the core and the sheath being filled with petroleum jelly or a like oil/wax mixture, wherein there is present between the core and sheath a separating layer which will serve both as a heat barrier and a barrier to the passage of the material with which the interstices are filled and which will bond to the sheath at or below the temperature at which the sheath is extruded on the core. Where the cable sheath is of polyethylene the separating layer may consist of a layer or coating of polyvinyl diethylene copolymer on a carrier layer which will bond, or which carries a layer which will bond, to polyethylene at temperatures of about 200°C., which temperatures are the temperatures at which a polyethylene sheath is generally extruded on a cable core.

The present invention is a modification of or an improvement in the telecommunication cable of the aforesaid patent and provides an improved form of fully-filled plastics sheathed telecommunication cable in which the risk of migration of the filling medium through the cable sheath is substantially eliminated by a separating layer that has a high thermal resistance and that is substantially non-hygroscopic.

According to the invention in the improved telecommunication cable the separating layer comprises a layer of a linear polyester which carries a layer or coating that will bond to the plastics material of the sheath at the temperatures at which the plastics sheath is generally extruded on a cable core. Where the cable sheath is of

polyethylene the layer of linear polyester preferably carries a layer or coating of a low density polyethylene. Preferred linear polyesters for use in the separating layer include those sold under the Registered Trade Marks "Melinex S" and "Mylar".

The separating layer is preferably formed by longitudinally applying to, or helically lapping on, the cable core a tape of the separating layer in such a way that the polyethylene layer or coating is on the outside and contiguous margins of the tape overlap one another to form a complete envelope. The necessary adhesion to the polyethylene sheath is preferably obtained by extruding the sheath at a temperature and under conditions which ensure that the exposed parts of the surface of the polyethylene layer or coating become bonded to the polyethylene sheath.

Preferably the layer of a linear polyester carries a layer or coating of low density polyethylene on each of its faces. Use of a tape of this triple laminate form as the separating layer further ensures that a bond is obtained between the overlapping margins of the tape when the polyethylene sheath is extruded on the core. Moreover, since the tape has a layer or coating of polyethylene on each of its faces, the tape can be applied to the cable core with either of its polyethylene layers on the outside. A preferred tape for use as a separating layer comprises a triple laminate of polyethylene/Melinex S/polyethylene tapes having thicknesses of $5\mu\text{m}/1.25\mu\text{m}/5\mu\text{m}$.

In addition to serving as a barrier to the flow of heat from heavy current power cables when a telecommunication cable in accordance with the invention is laid in the vicinity of such cables, the separating layer also serves as a thermal barrier to prevent overheating of the conductor insulation during the operation of extruding the sheath.

The invention will be further illustrated, by way of example, by a description of a preferred form of telecommunication cable constructed according to the present invention.

The cable comprises a multiplicity of copper conductors each having a dielectric of solid polyethylene. Helically lapped about the multiplicity of conductors in such a way that its contiguous margins overlap one another to form a complete separating envelope is a tape of a triple laminate consisting of polyethylene/Melinex S/polyethylene tapes having thicknesses of $5\mu\text{m}/1.25\mu\text{m}/5\mu\text{m}$. A polyethylene sheath is extruded on and bonded to the outer polyethylene layer of the helically lapped tape, the overlapping contiguous margins of the tape also being bonded together. The interstices between the individual conductors and between them and the separating envelope are filled with water-

impermeable medium consisting of petroleum jelly. If required, the cable may be provided with armouring comprising galvanised steel wires laid helically over the sheathed cable and protected against corrosion by an extruded oversheath of polyvinyl chloride.

The separating layer of the telecommunication cable of the present invention is especially, but not exclusively, suitable for use in pilot and telephone cables in which the conductor insulation is solid plastics material but it may be used in the fully-filled cellular plastics insulated telecommunication cables described and claimed in our Patent Nos. 995,582, 1,095,639, 1,104,450 and 1,175,850.

WHAT WE CLAIM IS:

1. A telecommunication cable comprising a multiplicity of plastics insulated conductors forming a core enclosed within a sheath of plastics material pervious to petroleum jelly and like oil/wax mixtures at certain ambient temperatures, the interstices between the individual insulated conductors of the core and between the core and the sheath being filled with petroleum jelly or a like oil/wax mixture, wherein there is present between the core and the sheath a separating layer which is substantially non-hygroscopic, which will serve both as a heat barrier and a barrier to the passage of the material with which the interstices are filled and which comprises a layer of a linear polyester carrying a layer or coating that will bond to the plastics material of the sheath at the temperatures at which the plastics sheath is generally extruded on a cable core.

2. A telecommunication cable comprising a multiplicity of plastics insulated conductors forming a core enclosed within a sheath of polyethylene pervious to petroleum jelly and like oil/wax mixtures at certain ambient temperatures, the interstices between the individual insulated conductors of the core and between the core and the sheath being filled with petroleum jelly or a like oil/wax mixture, wherein there is present between the core and the sheath a separating layer which is substantially non-hygroscopic, which will serve both as a heat barrier and a barrier to the passage of the material with which the interstices are filled and which comprises a layer of a linear polyester carrying a layer or coating of a low density polyethylene that will bond to the polyethylene of the sheath at the temperatures at which the polyethylene sheath is generally extruded on a cable core.

3. A telecommunication cable as claimed in Claim 1 or 2, wherein the separating layer is formed by longitudinally applying to, or helically lapping on, the cable core a tape of the linear polyester in such a way

polyethylene the layer of linear polyester preferably carries a layer or coating of a low density polyethylene. Preferred linear polyesters for use in the separating layer include those sold under the Registered Trade Marks "Melinex S" and "Mylar".

The separating layer is preferably formed by longitudinally applying to, or helically lapping on, the cable core a tape of the separating layer in such a way that the polyethylene layer or coating is on the outside and contiguous margins of the tape overlap one another to form a complete envelope. The necessary adhesion to the polyethylene sheath is preferably obtained by extruding the sheath at a temperature and under conditions which ensure that the exposed parts of the surface of the polyethylene layer or coating become bonded to the polyethylene sheath.

Preferably the layer of a linear polyester carries a layer or coating of low density polyethylene on each of its faces. Use of a tape of this triple laminate form as the separating layer further ensures that a bond is obtained between the overlapping margins of the tape when the polyethylene sheath is extruded on the core. Moreover, since the tape has a layer or coating of polyethylene on each of its faces, the tape can be applied to the cable core with either of its polyethylene layers on the outside. A preferred tape for use as a separating layer comprises a triple laminate of polyethylene/Melinex S/polyethylene tapes having thicknesses of $5\mu\text{m}/1.25\mu\text{m}/5\mu\text{m}$.

In addition to serving as a barrier to the flow of heat from heavy current power cables when a telecommunication cable in accordance with the invention is laid in the vicinity of such cables, the separating layer also serves as a thermal barrier to prevent overheating of the conductor insulation during the operation of extruding the sheath.

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The cable comprises a multiplicity of copper conductors each having a dielectric of solid polyethylene. Helically lapped about the multiplicity of conductors in such a way that its contiguous margins overlap one another to form a complete separating envelope is a tape of a triple laminate consisting of polyethylene/Melinex S/polyethylene tapes having thicknesses of $5\mu\text{m}/1.25\mu\text{m}/5\mu\text{m}$. A polyethylene sheath is extruded on and bonded to the outer polyethylene layer of the helically lapped tape, the overlapping contiguous margins of the tape also being bonded together. The interstices between the individual conductors and between them and the separating envelope are filled with water-

impermeable medium consisting of petroleum jelly. If required, the cable may be provided with armouring comprising galvanised steel wires laid helically over the sheathed cable and protected against corrosion by an extruded oversheath of polyvinyl chloride..

The separating layer of the telecommunication cable of the present invention is especially, but not exclusively, suitable for use in pilot and telephone cables in which the conductor insulation is solid plastics material, but it may be used in the fully-filled cellular plastics insulated telecommunication cables described and claimed in our Patent Nos. 995,582, 1,095,639, 1,104,450 and 1,175,850.

WHAT WE CLAIM IS:

1. A telecommunication cable comprising a multiplicity of plastics insulated conductors forming a core enclosed within a sheath of plastics material pervious to petroleum jelly and like oil/wax mixtures at certain ambient temperatures, the interstices between the individual insulated conductors of the core and between the core and the sheath being filled with petroleum jelly or a like oil/wax mixture, wherein there is present between the core and the sheath a separating layer which is substantially non-hygroscopic, which will serve both as a heat barrier and a barrier to the passage of the material with which the interstices are filled and which comprises a layer of a linear polyester carrying a layer or coating that will bond to the plastics material of the sheath at the temperatures at which the plastics sheath is generally extruded on a cable core.

2. A telecommunication cable comprising a multiplicity of plastics insulated conductors forming a core enclosed within a sheath of polyethylene pervious to petroleum jelly and like oil/wax mixtures at certain ambient temperatures, the interstices between the individual insulated conductors of the core and between the core and the sheath being filled with petroleum jelly or a like oil/wax mixture, wherein there is present between the core and the sheath a separating layer which is substantially non-hygroscopic, which will serve both as a heat barrier and a barrier to the passage of the material with which the interstices are filled and which comprises a layer of a linear polyester carrying a layer or coating of a low density polyethylene that will bond to the polyethylene of the sheath at the temperatures at which the polyethylene sheath is generally extruded on a cable core.

3. A telecommunication cable as claimed in Claim 1 or 2, wherein the separating layer is formed by longitudinally applying to, or helically lapping on, the cable core a tape of the linear polyester in such a way



that the layer or coating of polyethylene or other material is on the outside and contiguous margins of the tape overlap one another to form a complete envelope on to which the sheath is extruded.

4. A telecommunication cable as claimed in Claim 1 or 2, wherein the separating layer comprises a laminate consisting of a layer of a linear polyester carrying on each of its faces a low density polyethylene or other material that will bond to the polyethylene or other plastics material of the sheath at the temperatures at which the plastics sheath is generally extruded on a cable core.

5. A telecommunication cable as

claimed in Claim 4, wherein the separating layer is formed by longitudinally applying to, or helically lapping on, the cable core a tape of the laminate in such a way that contiguous margins of the tape overlap one another to form a complete envelope on to which the sheath is extruded.

6. A telecommunication cable substantially as hereinbefore described with reference to the Example.

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