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(54) Ropes and the use thereof.

(57) A non-metallic rope has the interstices both within and between its strands filled with a water-blocking material and is enclosed in a close-fitting water-tight sheath of electrically insulating material.

The rope may be made of polyester, polyamide (including aramid) or other conventional, preferably synthetic, fibres and may be of any conventional strand structure.

The water-blocking material may be of any of the three classes conventionally used for this purposes in electric and/or optical cables, namely

1 greasy materials, such as silicone greases, petroleum jellies ;

2 soft polymeric material, such as silicone rubbers ; and

3 materials that swell to form local water blocks on exposure to moisture, such as polyacrylate powders.

The sheath should ideally be moisture-repellent, flame retardant and incombustible, but standard cable-sheathing compositions can be used.

The rope is suitable for use in live-line modifications to and refurbishment of overhead power lines, especially the addition of optical communications circuits by earth-wire replacement or by wrap-on or self-supporting all-dielectric optical cables.

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This invention relates to non-metallic ropes and their use in relation to overhead electric lines.

There is currently much activity in the addition of optical telecommunications circuits to electric high-voltage overhead lines, in most cases either by the replacement of the existing earth wire with one incorporating optical fibers or by adding an optical cable either as a self-supporting element of the line for example an "all dielectric cable, or as a wrapped-on addition to the earth wire or phase conductor. If clearances are adequate, it is possible to install optical cables onto earth wires or to install self supporting cables while the phase conductors are on load, but this requires the use of electrically insulating pulling ropes. Similarly, in systems having two independent three phase circuits, cable can be installed on phase conductors of one circuit while the other circuit is on load.

However, when the electrical power lines are on load, electrical currents may be capacitively induced on the pulling rope due to the distributed capacitance between the rope and the power lines. The voltages on the rope will tend to reach a maximum at mid-way between the points at which it is earthed, while the current flowing along the rope will be greatest at the earthing points. The rope will normally be earthed at the pulling tower and at a minimum of one other place on the earthed conductor. Under dry conditions the induced currents will be relatively small due to the relatively high longitudinal resistance of the rope, but under wet conditions when the resistance of the rope is much lower, much higher currents will be induced. Joule heating of the rope by the induced currents can cause a short length of the rope to become dry, usually in the region of a tower where the current is highest. When this happens the major part of the induced voltage is dropped across the short dry band due to its high longitudinal resistance, and so-called "dry-band arcing" may occur. Such dry band arcing is the same phenomenon as may occur with self supporting all dielectric optical cables, but because ambient water can penetrate ropes, the arcing may occur within the body of the rope rather than on the surface as happens with optical cables. Since the heat generated by arcing within the body is not so readily removed from the arc source, catastrophic failure of the rope may occur by burning.

Greasing of the rope is only partly effective and risks contamination that presents another risk to the electrical properties of the rope.

In accordance with one aspect of the present invention, a non-metallic rope has the interstices both within and between its strands filled with a water-blocking material and is enclosed in a close-fitting water-tight sheath of electrically insulating material.

The rope may be made of polyester, aramid or other polyamide, or other conventional fibres (but synthetic ones are preferred because they have less affinity for moisture than most natural fibres) and may be of any conventional strand structure.

The water-blocking material may be of any of the three classes conventionally used for this purposes in electric and/or optical cables, namely

a) greasy materials, such as silicone greases, petroleum jellies;

b) soft polymeric material, such as silicone rubbers; and

c) materials that swell to form local water blocks on exposure to moisture, such as polyacrylate powders.

Materials of the last group are preferred as they are more convenient to handle, have less effect on the flexibility of the rope and do not tend to facilitate relative movement between the sheath and the body of the rope, as greasy materials may.

The sheath should ideally be hydrophobic, arc-resistant, infusible and incombustible, but substantial departure from the ideal can be tolerated provided the risk of catching fire or of gross melting is negligible since the sheath will not be relied on to contribute to the strength of the rope. Conventional cable-sheathing materials may be used. Preferably the sheath is applied by vacuum extrusion to achieve maximum grip on the underlying part of the rope. For the same reason, rope structures with smooth surfaces are best avoided. In addition, ropes will reduce in diameter significantly under tension are not preferred since this can cause the sheath to separate from the stranding and cause failure of the rope when pulled.

Example 1

A first rope in accordance with the invention comprises a core about 10mm in diameter comprising a plait of 16 strands formed around a core of three strands. All 19 strands are made of aramid fibres coated in water-swellable material, the coated fibres being sold by Akzo Chemie under the trademark *TWARON* as *water-blocked TWARON fibres*. This core is sheathed with 1.5mm radial thickness of the thermoplastic rubber sold by Monsanto Ltd under the trademark SANTOPRENE by vacuum extrusion at a pressure differential of 350kPa.

Example 2

This is substantially the same as Example 1 except that instead of incorporating TWARON tape the fibrous part of the core is fully impregnated with a standard cable-filling grade of petroleum jelly.

Claims

1 A non-metallic rope having the interstices both within and between its strands filled with a water-

blocking material and enclosed in a close-fitting watertight sheath of electrically insulating material.

2 A rope as claimed in claim 1 made of polyester, polyamide or other synthetic fibres.

3 A rope as claimed in claim 1 or claim 2 in which the water-blocking material is selected from

a) greasy materials, such as silicone greases, petroleum jellies;

b) soft polymeric material, such as silicone rubbers; and

c) materials that swell to form local water blocks on exposure to moisture, such as polyacrylate powders.

4 The use of the rope claimed in any one of the preceding claims in work for modification or refurbishment of live power line installations.

5 The use of the rope claimed in any one of claims 1 to 4 in work for installation of communication circuits in live power line installations.

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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 5616

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DATABASE WPI Week 8841, Derwent Publications Ltd., London, GB; AN 88-289141 & JP-A-63 211 392 (HITACHI CABLE KK; NIHON KOUSAKU HANBAI KK) 2 September 1988 * abstract * ---	1-5	D07B1/14 D07B1/16
X	DATABASE WPI Week 8841, Derwent Publications Ltd., London, GB; AN 88-289140 & JP-A-63 211 391 (HITACHI CABLE KK; NIHON KOUSAKU HANBAI KK) 2 September 1988 * abstract * -----	1-5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) D07B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 October 1994	Goodall, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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D : document cited in the application
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