(19) Europäisches Patentamt
European Patent Office
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(11) **EP 2 410 534 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.01.2012 Bulletin 2012/04

(51) Int Cl.:
H01B 5/10 *(2006.01)*

(21) Application number: **11174563.4**

(22) Date of filing: **19.07.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **22.07.2010 IT MI20101355**

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(54) **Cord for high voltage overhead electrical lines, with high thermal limit and with 3 load-bearing cables**

(57) Cord for high thermal limit, with low mass and high current capacity, low corona effect and low deformation at high loads, suitable for installation on high voltage overhead lines under extreme climatic conditions (wind and ice) by virtue of its very high ultimate tensile strength. The cord is composed of a core about which at least one ring of quoins of electrically conductive material is wrapped. The core consists of at least three mutually resting twisted-together load-bearing cables, each formed from a plurality of twisted-together wires formed of composite hybrid carbon/glass fibre material and protected by an aluminium sheath (6). At least three aluminium filler elements are provided, twisted together with said load-bearing cables. The load-bearing cables and the filler elements are surrounded by a longitudinally welded second aluminium, or bound with a tape of conductive material.

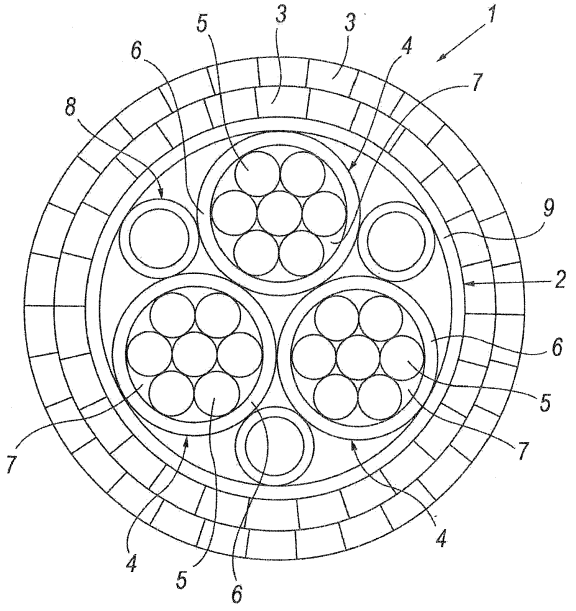


Fig. 1

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Description

[0001] The present invention relates to a cord for overhead electrical lines; the cord is suitable in particular for extreme environmental conditions (cold, ice and wind) and extreme installation conditions (large level differences). Cords of the indicated type are known to be currently produced in the form of a load-bearing cable, usually of steel, which supports wires of conductor material, usually of aluminium or its alloys.

[0002] However these traditional cords (because of the intrinsic characteristics of the steel load-bearing cable) present a considerable weight per unit of length and a high average coefficient of thermal expansion.

[0003] The object of the present invention is to provide cords for electrical lines by which the stated technical drawbacks of the known art are eliminated. This and other objects are attained according to the present invention by a cord in accordance with the technical teachings of the accompanying claims.

[0004] Further characteristics and advantages of the invention will be more apparent from the description of a preferred but non-exclusive embodiment of the invention, illustrated by way of non-limiting in the single figure, which represents a cross-section through the cord.

[0005] The cord 1 presents a core 2 about which one, two or more rings of electrically conductive quoins 3 are wrapped. The electrically conductive quoins are twisted together about the core in known manner. In alternative embodiments they can be formed of aluminium wires of circular cross-section.

[0006] They are preferably formed of Al-Zr alloy, however other materials which can be equally used include annealed aluminium and Al-Mg alloy.

[0007] In the figure the core is formed of three load-bearing cables 4 resting against each other and twisted together.

[0008] Each cable 4 is formed from a plurality of wires 5 also twisted together and made of composite material of hybrid carbon/glass fibres. The wires 5 are covered with a first sheath 6 of aluminium (or other material, for example aluminium zirconium or Al-Mg alloy) hot-extruded directly onto the wires 5.

[0009] In the described embodiment, each cable comprises seven wires. Such a wire number enables the cable to externally assume a nearly circular cross-section, which facilitates extrusion of the first sheath 6. However any number of wires can evidently be used.

[0010] Advantageously, before extruding the sheath, the composite material wires are covered with special infill 7 (preferably silicone or bi-component material with programmed crosslinking) and are then wrapped in a special tape (advantageously of Nomex) which maintains the infill 7 in position during the operations involved in extruding the sheath 6.

[0011] The infill 7 is advantageously of very viscous bi-component silicone grease. It is crosslinking and tends to solidify in a programmable manner (in the present text, "programmable" means a material the crosslinking rate of which can be decided previously, for example 3 minutes - 24 hours).

[0012] The use of the infill 7 can also be avoided by extruding the sheath 6 about the wires such that the aluminium also penetrates into the stellate areas.

[0013] Twisted together with the load-bearing cables 4 there are also provided at least three tubular filler elements of aluminium (or formed of flat/compact wires). These are internally hollow, i.e. they considerably reduce the weight of the cord compared with the use of solid filler elements. If it is wished to further increase the ultimate tensile strength, the tubular filler elements can be upgraded by a core of composite hybrid carbon/glass wires.

[0014] In concluding the description of the figure, it should be noted that the load-bearing cables 4 and the filler elements 8 are surrounded by and maintained in position by a second aluminium sheath 9 formed from a C-shaped element, inside which the cables and the filler elements are housed and which is then welded longitudinally.

[0015] Welding is preferably by TIG welding, but laser or microplasma welding could also be used.

[0016] The second sheath 9 could be replaced by a binding of electrically conductive material, or alternatively this electrically conductive material could be extruded about the cables and filler elements.

[0017] As can be seen from the aforesaid figure the three load-bearing cables, when viewed in cross-section, are positioned at the vertices of an equilateral triangle, as are also the filler elements.

[0018] In an alternative embodiment the aforedescribed cord has seven bearing cables 4, and six filler elements 8, but in other embodiments a different number of bearing cables and filler elements can be provided.

[0019] The aforedescribed cord has advantageously a high thermal limit (up to 150°C) and is preferably of low mass (less than 4 kg/m).

[0020] The maximum external diameter is preferably about 50 mm, enabling the corona effect to be reduced to a minimum. Given the vast conductive surface formed by the double series of quoins, by the second sheath, the first sheath and by the tubular filler elements, the cord presents high current capacities with consequent low resistance.

[0021] The core of carbon and glass fibre based composite material results in low deformations at high loads. The intrinsic characteristics of the cord make it particularly suitable for installation on high voltage overhead lines under extreme climatic conditions (wind and ice up to 60 mm thick) by virtue of its very high ultimate tensile strength.

[0022] By way of example, it can be installed over level differences of 300 m with spans of about 1000 metres.

Claims

1. A cord (1) for high voltage overhead electrical lines comprising a core about which at least one ring of quoins and/or conductors of circular cross-section and electrically conductive material are wrapped, the core consisting of at least three load-bearing cables (4) twisted together, which are each formed from a plurality of twisted-together wires (5) formed of composite hybrid carbon/glass fibre material and are covered by a hot-extruded first sheath (6) of aluminium or its alloys, at least three filler elements (8) of aluminium or its alloys being twisted together with said load-bearing cables (4), said load-bearing cables (4) and said filler elements being surrounded by a second aluminium sheath or by a binding of aluminium or its alloys, about which the quoins are wrapped.

2. A cord as claimed in the preceding claim, wherein infill is provided between the wires and the first sheath to fill at least the stellate areas defined by the wires.

3. A cord as claimed in the preceding claim, wherein before extruding the first sheath, said infill is maintained in position by a tape preferably of Nomex, wrapped about the cables.

4. A cord as claimed in one or more of the preceding claims, wherein said infill comprises silicone grease and/or bi-component material crosslinkable in a programmable manner.

5. A cord as claimed in one or more of the preceding claims, wherein said twisted-together load-bearing cables are three in number which, when viewed in cross-section are positioned at the vertices of an equilateral triangle, said filler elements being three in number, also twisted together and disposed at the vertices of an equilateral triangle.

6. A cord as claimed in one or more of the preceding claims, wherein each load-bearing cable comprises seven wires of composite hybrid carbon/glass material.

7. A cord as claimed in one or more of the preceding claims, wherein each filler element is formed from an internally hollow tubular element.

8. A cord as claimed in the preceding claim, wherein a core of composite hybrid carbon/glass material is present in the cavity of each tubular element.

9. A cord as claimed in one or more of the preceding claims, wherein said second sheath is welded longitudinally and/or is replaced by a binding of conductive material tape.

10. A cord as claimed in one or more of the preceding claims, wherein said first sheath and/or said second sheath and/or said filler elements are formed of annealed aluminium, Al-Zr alloy or Al-Mg alloy.

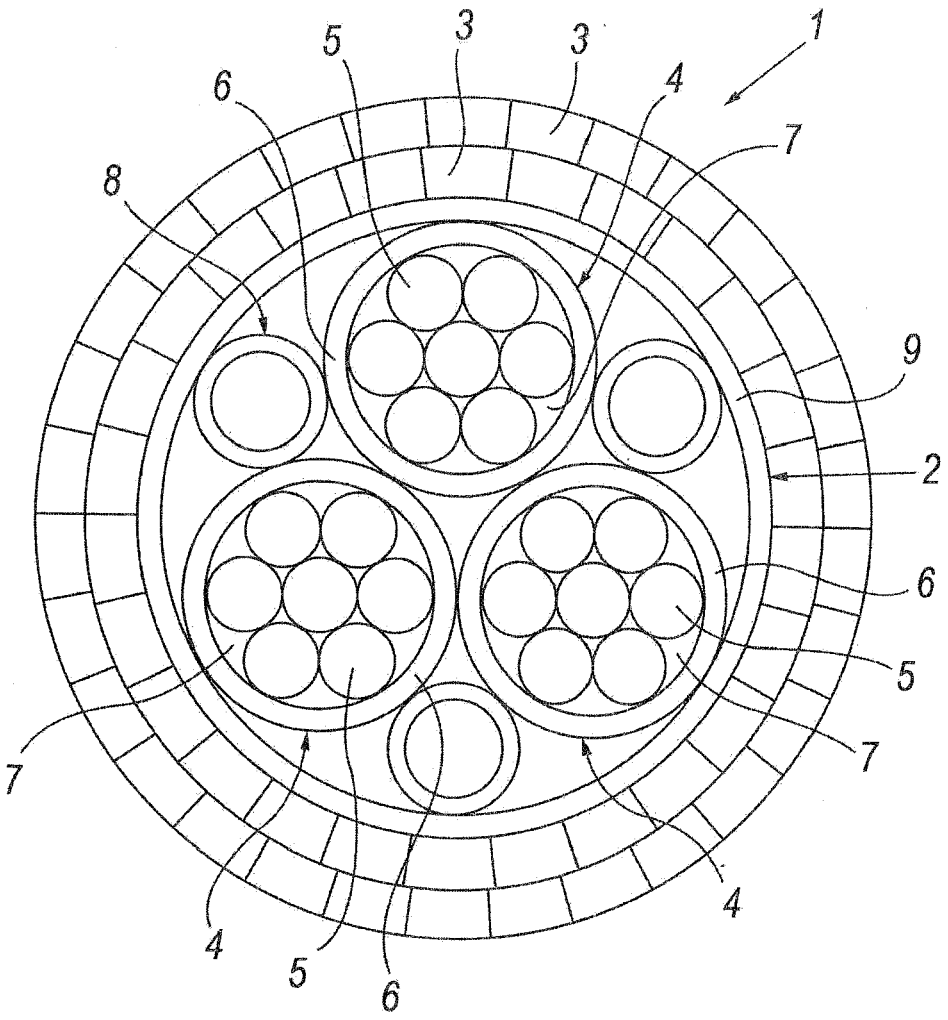


Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 4563

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 821 318 A2 (ANGELI PRODOTTI S R L DE [IT]) 22 August 2007 (2007-08-22) * figure 1 *	1-10	INV. H01B5/10
A	US 2005/181228 A1 (MCCULLOUGH COLIN [US] ET AL) 18 August 2005 (2005-08-18) * figures 1-5 *	1	
A	EP 1 928 001 A1 (NEXANS [FR]) 4 June 2008 (2008-06-04) * figure 1 *	1	
A	JP 3 129606 A (HITACHI CABLE) 3 June 1991 (1991-06-03) * figures 9-11 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 September 2011	Overdijk, Jaco

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 4563

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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07-09-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1821318 A2	22-08-2007	NONE	
US 2005181228 A1	18-08-2005	AT 432131 T	15-06-2009
		BR PI0507625 A	03-07-2007
		CA 2555198 A1	09-09-2005
		CN 1918671 A	21-02-2007
		EP 1711284 A2	18-10-2006
		ES 2326820 T3	20-10-2009
		JP 2007524977 A	30-08-2007
		KR 20060111696 A	27-10-2006
		WO 2005083142 A2	09-09-2005
EP 1928001 A1	04-06-2008	AT 443335 T	15-10-2009
		ES 2333555 T3	23-02-2010
		FR 2909481 A1	06-06-2008
		US 2008128155 A1	05-06-2008
JP 3129606 A	03-06-1991	NONE	

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