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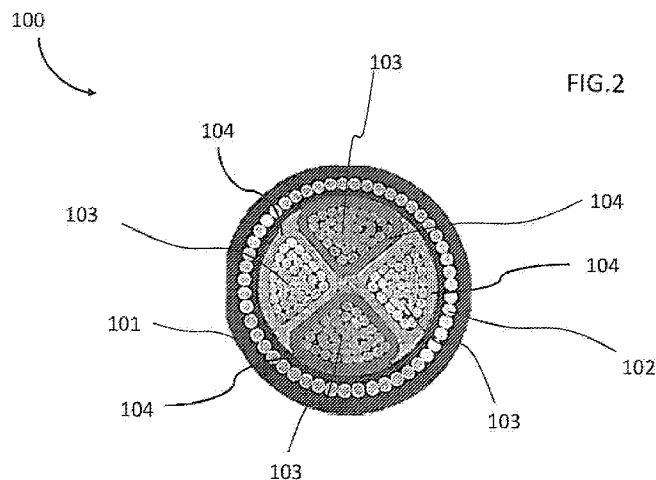
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(54) Title: SECTORIAL ALUMINUM MULTIPOLAR CABLE AND RELATIVE MANUFACTURING PROCESS



(57) Abstract: A sectorial aluminum multipolar cable (100) comprising : - At least one outer insulating sheath (101); - At least two first metal conductors (103) grouped inside insulating sheaths (104). The first conductors (103) have circular sector sections having equal area and the sheaths (104) are adjacent to said outer sheath (101) and between them.

DESCRIPTION

"Sectorial aluminum multipolar cable and relative manufacturing process"

* * *

5 The present invention relates to a sectorial aluminum multipolar cable.

In particular, the present invention relates to a sectorial aluminum multipolar cable, usable as a conductor for the realization of the electrical lines.

10 The present invention is also related to a manufacturing process of a sectorial aluminum multipolar cable.

As it is known, the electric lines are used for transferring electrical energy between two generic points, such as, for example, the point at which it is produced and the point of use. In general, they are realized by means of metallic materials, in the form of cables, which have, among their essential characteristics, a high specific electrical conductivity, i.e. a high ability to conduct electrical current, defined as:

15

20

$$\sigma = \frac{1S}{\rho l}$$

in where ρ is the specific resistivity, S is the section and l is the length of the cable.

5 So it is clear that, for a given section, to have a high conductivity it is essential that the resistivity is as low as possible.

10 Instead, the other main characteristics for the conductors, are the mechanical properties (tensile strength, modulus of elasticity, elongation, hardness, etc.), technological (malleability, ductility) and thermal properties (thermal conductivity, thermal expansion coefficient).

15 The most suitable material for the specific case will be the material which best combines these properties. In particular, the metallic materials, like silver, gold, copper and aluminum, having very specific low resistivity, are the materials that combine the best of these features.

20 Gold and silver, as a result of their lower availability in the ground, have rather high costs which limit the application only to special cases, such as in the aerospace field.

 Instead copper and aluminum are widely most common.

The copper is the material most widely used due to the high electrical conductivity, the excellent technological properties (high drawability even in very thin wires, ease of hot and cold rolling, weldability, etc.), the high mechanical characteristics, the oxidation resistance and ease of reuse. In contrast, however, in recent years there has been an excessive increase of the purchase price due to the increase of proportion of the production costs.

As a result, the market has been moving towards the aluminum, remaining the only real alternative to copper for its qualities of lightness and significantly less cost (greater availability on the earth than copper). Moreover, aluminum has excellent technological properties and resistance to atmospheric actions. The only negative aspect to consider is its electrical resistivity greater than copper (or lesser conductivity) that is generally compensated with an increase of the section.

Technically, the configuration of the electrical conductors provides, in the case of unipolar conductors, a metallic central part formed by copper or aluminum wires and an outer insulating sheath in plastic material, while, in the case of multipolar conductors, more unipolar wires within a protective outer sheath. Multipolar conductors

are, for example, the bipolar, three-pole and four-pole cables.

However, for the latter type of cables, the empty spaces inside them, present both for the geometric configuration and for the manufacturing process used, represent a technological limit reducing the useful section and, consequently, the conductivity.

Purpose of the present invention is to provide a sectorial aluminum multipolar cable and a manufacturing process of a sectorial aluminum multipolar cable, of the flexible type with reduced vacuum internal parts, thus having characteristics such as to overcome the limits that still affect the sectorial aluminum multipolar cable and the manufacturing process previously described with reference to the known technique.

According to the present invention, a sectorial aluminum multipolar cable is provided, as defined in claim 1.

According to the present invention, a process for manufacturing a sectorial aluminum multipolar cable is provided, as defined in claim 6.

For a better understanding of the present invention a preferred embodiment is now described, purely as non-

limiting example, with reference to the accompanying drawings, in which:

- Figure 1 shows a schematic sectional view of a sectorial aluminum multipolar cable, according to the prior art;

- Figure 2 shows a schematic sectional view of a sectorial aluminum multipolar cable, according to the invention.

With reference to these figures, and in particular to figure 2, a sectorial aluminum multipolar cable 100 is shown, according to the invention. The sectorial aluminum multipolar cable 100 comprises an outer insulating sheath 101, a ring 102 comprising conductive wires, and internally four conductor unipolar wires 103 adjacent to each other and grouped inside insulating sheaths 104.

According to an aspect of the invention, each conductor 103 is arranged at 90° with respect to the adjacent conductor 103.

Advantageously according to the invention, the ring 102 is embedded within the outer sheath 101.

Advantageously according to the invention, the section of each conductor 103 is a circular sector having the same area.

Advantageously according to the invention, the sheaths 104 of each conductor 103 are perfectly adjacent to one another and to the outer sheath 101.

Advantageously according to the invention, the
5 conductors 103 and the sheaths 104 are compacted so as to reduce the empty spaces visible in the multipolar cable of Figure 1.

According to an aspect of the invention, the conductors 103 and the ring 102 are made of aluminum.

10 According to a second embodiment of the invention, not shown in the figure, the sectorial aluminum multipolar cable comprises three conductors 103 provided with sheaths 104, arranged at 120° from each other.

15 According to a third embodiment of the invention, not shown in the figures, the sectorial aluminum multipolar cable comprises two conductors 103 provided with sheaths 104, arranged at 180° from each other.

As stated above, the present invention is also related to a process for manufacturing a sectorial aluminum
20 multipolar cable.

In particular, the process for manufacturing a cable 100 comprising a step of forming at least one outer insulating sheath 101 and a step of forming at least two metal conductors 103 grouped inside insulating sheaths 104,

also comprises a step of forming the first conductors 103 having equal circular sector sections and a step of forming said sheaths 104 adjacent to the outer sheath 101 and between them.

5 According to an aspect of the invention, the step of forming the conductor 103 having equal circular sector sections comprises using prespirraling head suitable to the formation of a group of conductors 103 arranged at 90° or 120° or 180° from the adjacent group, depending on whether
10 the multipolar cable is quadripolar or tripolar or bipolar.

 Advantageously according to the invention, the prespirraling heads are equipped with materials, such as thermoplastic polymers or elastomers, suitable to compact the material in production without stressing it.

15 According to an aspect of the invention, the step of forming the conductors 103 having equal circular sector sections comprises completely eliminating the empty points between the conductors 103.

20 According to another aspect of the invention, the step of forming the conductors 103 having equal circular sector sections comprises adhering the insulating material to the conductor in order do not create air bubbles inside that cause gaps on the insulator itself.

According to another aspect of the invention, the process for manufacturing the cable 10 comprises wrapping the insulated core in order to avoid the decomposition in the final stage of forming the reel.

5 Therefore, the sectorial aluminum multipolar cable and the relative manufacturing process according to the invention allow to reduce the gaps between the internal conductors.

10 Another advantage of the sectorial aluminum multipolar cable and the relative manufacturing process according to the invention is the presence of the ring of conductors in the outer sheath which increases the surface area of the conductors thereby increasing the electrical conductivity.

15 Finally, the sectorial aluminum multipolar cable and the relative manufacturing process according to the invention are simply and effective.

20 Finally it is clear that the system and method for aligning intramedullary nails sectorial aluminum multipolar cable and the relative manufacturing process described and illustrated here can be modified and varied without departing from the protective scope of the present invention, as defined in the appended claims.

CLAIMS

1. A sectorial aluminum multipolar cable (100) comprising:

- At least one outer insulating sheath (101);

5 - At least two first metal conductors (103) grouped inside insulating sheaths (104);

characterized in that said first conductors (103) have circular sector sections having equal area and in that said sheaths (104) are adjacent to said outer sheath (101) and
10 between them.

2. A sectorial aluminum multipolar cable (100) according to claim 1, characterized in that said outer sheath (101) comprises inside it at least one ring (102) of second metal conductors.

15 3. A sectorial aluminum multipolar cable (100) according to claim 1, characterized in that said first metal conductors (103) are arranged at 90° or 120° or 180° between them.

20 4. A sectorial aluminum multipolar cable according to claim 1, characterized in that said first conductors (103) are made of aluminum.

5. A sectorial aluminum multipolar cable according to claim 2, characterized in that said ring (102) is made of aluminum.

6. Process for manufacturing a sectorial aluminum multipolar cable comprising a step of forming at least one outer insulating sheath (101) and a step of forming at least two first metal conductors (103) grouped inside insulating sheaths (104), characterized in comprising a step of forming said first conductor (103) having circular sector sections having equal area and a step of forming said sheaths (104) adjacent to said outer sheath (101) and between them.

7. Process according to claim 6, characterized in that said step of forming the conductors (103) having circular sector sections having equal area comprises using "prespiralling heads" suitable for the formation of a group of conductors (103) arranged at 90° or 120° or 180° from an adjacent group of conductors (103), depending on whether the multipolar cable is three-pole or four-pole or bipolar.

8. Process according to claim 7, characterized in that the "prespiralling heads" are equipped with materials, chosen among thermoplastic polymers or elastomers, suitable for compacting the material in production without stressing it.

9. Process according to claim 6, characterized in that the step of forming the conductors (103) having circular sector sections having equal area comprises

completely eliminating the points of vacuum between the conductors (103).

10. Process according to claim 6, characterized in that the step of forming the conductors comprises adhering the insulator material to the conductor.

11. Process according to claim 6, characterized in comprising the step of wrapping the insulated core.

AMENDED CLAIMS

received by the International Bureau on 28 April 2017 (28.04.2017)

1. A sectorial aluminum multipolar cable (100) comprising:

- At least one outer insulating sheath (101); and

- At least two first aluminum conductors (103) grouped inside insulating sheaths (104), said first conductors (103) having circular sector sections having equal area and said sheaths (104) being adjacent to said outer sheath (101) and between them;

characterized in that said first aluminum conductors (103) are arranged at an angle comprised between 90° and 180° between them.

2. A sectorial aluminum multipolar cable according to claim 1, characterized in that said outer sheath (101) comprises inside it at least one ring (102) of second conductors and in that said ring (102) is made of aluminum.

3. Process for manufacturing a sectorial aluminum multipolar cable comprising:

- a step of forming at least one outer insulating sheath (101);

- a step of forming at least two first aluminum conductors (103) grouped inside insulating sheaths (104); and

- a step of forming said first conductor (103) having circular sector sections having equal area and a step of forming said sheaths (104) adjacent to said outer sheath (101) and between them;

5 characterized in that the step of forming the conductors (103) having circular sector sections having equal area comprises completely eliminating the points of vacuum between the conductors (103).

10 4. Process according to claim 3, characterized in that the step of forming the conductors comprises adhering the insulator material to the conductor.

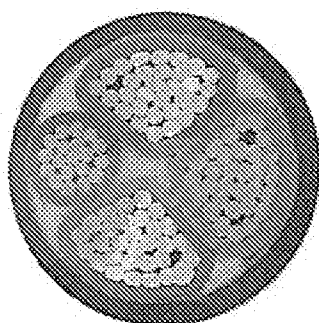


FIG.1
(PRIOR ART)

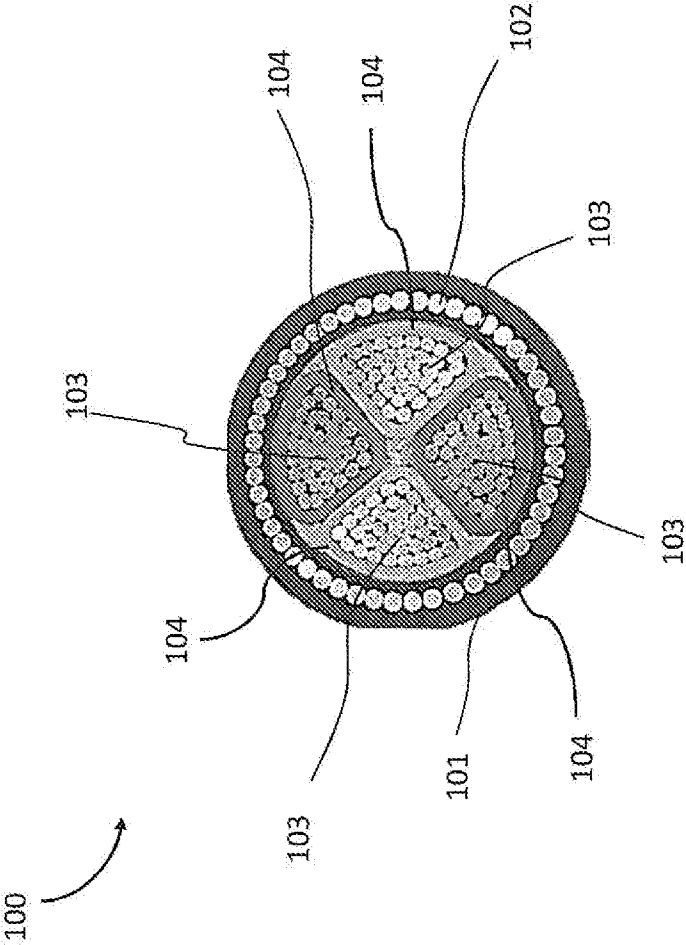


FIG.2

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. H01B1/02 H01B3/18 H01B9/00 H01B9/02 H01B13/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 936 638 A (BRITISH INSULATED CALLENDERS [GB]; ICI LTD [GB]) 6 November 1973 (1973-11-06) page 29, lines 18-26; figures 4-7 -----	1-5
X	US 5 732 875 A (ZIEMEK GERHARD [DE] ET AL) 31 March 1998 (1998-03-31) column 2, lines 38-55; claim 1; figures 1,2 -----	1,3,4
X	GB 1 296 147 A (KABELWERK RHEYDT AKTIENGESELLSCHAFT) 15 November 1972 (1972-11-15) page 1, columns 58-87; claim 1; figure 1 ----- -/--	1,3,4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/060052

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	column 1, lines 9-16; claim 12 column 2, lines 58-71, 89-96 -----	9-11
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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