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(72) Inventors:
• **KVARME, Hans**
1430 As (NO)
• **LARSEN, Vegar Syrtveit**
1314 Slependen (NO)

(74) Representative: **Feray, Valérie et al**
Ipsilon
Le Centralis
63, avenue du Général Leclerc
92340 Bourg-la-Reine (FR)

(71) Applicant: **Nexans**
92400 Courbevoie (FR)

(54) **THREE CORE POWER CABLES WITH PLASTIC ARMOR**

(57) A three-core power cable is provided. The cable has essentially the components and structure of a traditional three-core power cable. The steel or metallic ar-

moring wires are replaced, however, with elongated plastic members or rods.

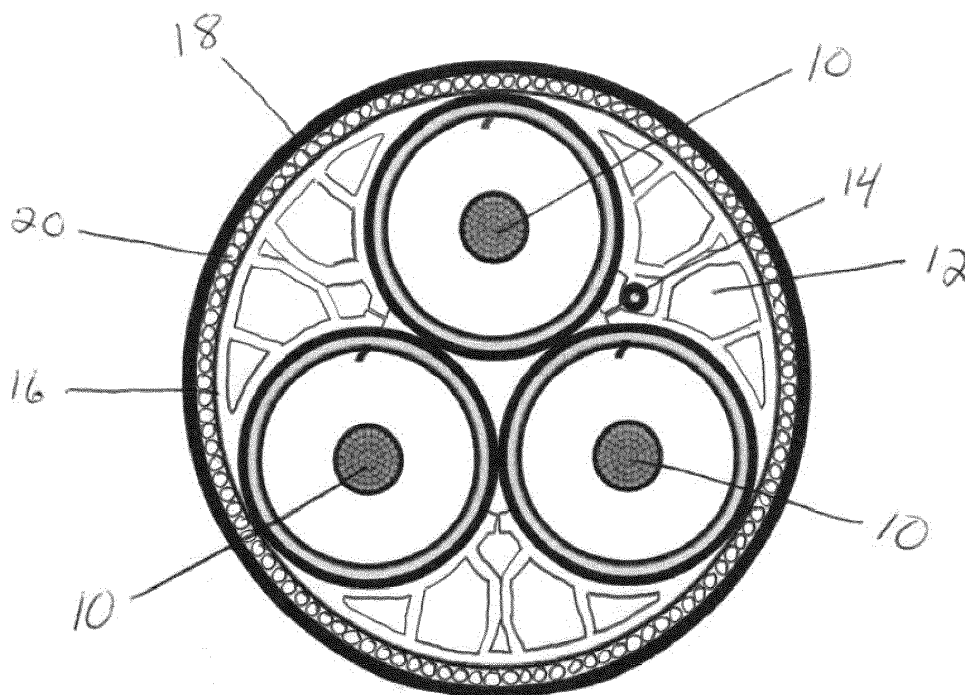


Figure 1

Description

Filed of the invention

[0001] The invention relates to impact resistant power cables, in particular to multipolar power cables, more particularly to three-core power cables.

Background

[0002] Impact resistant multipolar cables are employed in a number of industries. Such cables provide protection against accidental impact to the cable. The cables can provide distribution of low, medium or high voltage electrical power.

[0003] As used herein, "low voltage" means voltage less than about 1 kV.

[0004] As used herein, "medium voltage" means voltage between about 1kV - 36 kV..

[0005] As used herein, "high voltage" means voltage greater than about 36 kV.

[0006] A particular type of cable, known as a "steel wire armored cable" commonly abbreviated "SWA", is a hard wearing power cable designed for the supply of mains electricity. It is one type of a number of armored electrical cables, and is used in underground systems, power networks and subsea applications. A particular type of SWA is an armored three-core power cable, known to one skilled in the art of power cables.

[0007] Traditional three-core power cables comprise three insulated conductors grouped together in the center of the cable, and surrounded by an outer covering or roving. The cable has so-called interstitial zones between any two adjacent cores and the outer covering. As used herein, the term "interstitial zone" refers to the generally triangular shaped area defined by the space between two adjacent cores and the immediately opposing inner surface of the outer layer. By "immediately opposing" is meant the general area of the portion of the outer covering at a point that intersects the shortest segment of a line that is perpendicular to a line bisecting the two cores. The term "triangular" is only meant in a general sense, as the opposing segment of the outer cover is obviously curved, as are the cores themselves.

[0008] An extruded plastic profile known as a "filler" is arranged to fill the interstitial zones and hold the three conductors in a relative position so as to maintain the cable's circular cross section. A binder layer is often arranged about the filler, and a layer of wound metallic armoring wires is arranged between the binder and the outer covering. The primary purpose of the metallic armoring wires in SWA cables is to provide impact resistance for the power cable.

[0009] While the metallic armoring provides a benefit in terms of impact protection, the armoring has drawbacks. The metallic armoring adds weight to the cable, as well as cost. In addition, the metallic armoring causes a condition known as "armor loss", that can decrease the

current rating of the cable. Armor loss occurs due to circulating currents in the armoring due to fluctuating electrical fields and due to charging current. The current rating and current loss of three-core power cables is calculated using the IEC 60287 standard.

[0010] GB1497737 describes electrical conduits (ten «quads» 7) surrounded by plastic sheath 8. The exterior has a metal sheath 9. This is surrounded by high tensile layer 10, which may comprise bundles of or untwisted yarns of high tensile plastic filaments. The "high tensile" plastic filaments are not intended as impact resistant armoring, however, and the disclosed cable is not a three-core power cable.

[0011] DE2516472 describes a single cable core surrounded by strands of high tensile strength plastic reinforcement 7. Again, the "high tensile" plastic filaments are not arranged as impact-resistant armoring and the referenced does not disclose a three-core power cable.

Summary of the invention

[0012] The present invention has as its object to overcome the deficiencies of the prior art, in particular the disadvantages caused by metallic armoring wires, while providing a simple and cost effective arrangement for impact-resistant armoring in three-core power cables.

[0013] According to one aspect of the invention, a three-core power cable is provided. The cable has essentially the components and structure of a traditional three-core power cable. The steel or metallic armoring wires are replaced, however, with elongated plastic members or rods. As used herein the term "elongated plastic member" or "plastic rods" are meant to describe an elongated plastic member, similar in structure to a metallic armoring wire, albeit made from a plastic material. The plastic rods are arranged along the length of the cable, in a twisted fashion similar to the manner in which metal armor wires are arranged about a SWA cable.

[0014] According to one aspect, the cable comprises a plurality of elongated plastic fillers. The fillers are preferably an extruded plastic material. The plastic fillers have an interstices-filling portion and a curved outer surface, the curvature of the outer surface corresponding to the curvature of the cable. The interstices-filling portion has two inner, curved surfaces. The inner curved surfaces of adjacent fillers cooperate to form a semi-circular channel in which is arranged a core. In one embodiment, the fillers have a plurality of internal walls forming a honey-combed, cellular structure. The honey-combed structure reduces weight and provides structural integrity for the filler.

[0015] According to one aspect, the binder layer surrounds the fillers, and the plastic rods are arranged intermediate the binder layer and the outer covering of the cable.

Brief description of the drawings

[0016] The invention will be described in detail with reference to the following figures, wherein:

Figure 1 is a cross sectional view of an embodiment of the invention

Figure 2 is a perspective view of an embodiment of the invention

Detailed description

[0017] Figures 1 and 2 illustrate an embodiment of a cable according to the invention. According to one aspect, the cable is a three core power cable, for transmitting, high, medium or low voltage electrical power. The cable comprises three cores 10 that comprise a conductor, insulation layers and the like, in a manner well known to one skilled in the art of power cables. While particular arrangement of the cores of a three-core power cable is illustrated, the arrangement of the cores may comprise different types and numbers of insulating and functional layers, known to one skilled in the art of power cables

[0018] The three cores 10 are arranged in the center of the cable, and the interstitial zones are filled by plastic fillers 12. The fillers help, inter alia, to maintain the circular cross section of the cable. As seen in figure 1, the plastic fillers have an interstices-filling portion and a curved outer surface, the curvature of the outer surface corresponding to the curvature of the cable. The interstices-filling portion has two inner, curved surfaces. The inner curved surfaces of adjacent fillers cooperate to form a semi-circular channel in which is arranged a core. In one embodiment, the fillers have a plurality of internal walls forming a honey-combed, cellular structure. The honey-combed structure reduces weight and provides structural integrity for the filler. One skilled in the art of three-core power cables will recognize that different arrangements of fillers may be employed.

[0019] An auxiliary cable 14, for example a fiber optic cable, may be arranged at the interior of the cable.

[0020] Surrounding the three cores is a binder layer 16, and an outer protective layer 18. Arranged between the binder layer and the outer layer is arranged a plurality of elongated armor elements 20. According to one aspect of the invention, the armor elements 20 are elongated plastic filaments or rods, twisted about the cores as shown in figure 2. The plastic rods are arranged adjacent to one another, such that a protective barrier is formed about the cores. The material and dimensions of the plastic rods are chosen so as to provide impact resistance to the cable for a given application.

comprising a conducting element, a binder layer (16) surrounding the cores, an outer protective layer (18) arranged outside the binder layer, and a twisted layer of elongated plastic rods (20) arranged intermediate the binder layer and the outer layer, the plastic rods forming an impact-resistant armoring layer.

2. A power cable according to claim 1, wherein the cable is a three-core power cable.

3. A power cable according to claims 1 or 2, wherein the cores are arranged at the center of the cable thereby forming interstitial zones between the cores and the outer covering, the cable further comprising a plurality of filler members (12) arranged in the interstitial zones.

4. A power cable according to claim 3, wherein the filler members are elongated plastic elements having an interstice-filling portion and a curved outer surface, the curvature of the outer surface corresponding to the curvature of the cable.

5. A power cable according to claim 4, wherein the interstices-filling portions of the filler members have curved inner surfaces, and wherein the curved inner surfaces of adjacent filler members cooperate to form a semi-circular channel in which is arranged a core.

6. A power cable according to one of the preceding claims, wherein the filler members have internal walls forming a plurality of cells.

7. A power cable according to one of the preceding claims, wherein the cable is a high voltage cable.

8. A power cable according to one of the preceding claims, wherein the cable is a medium voltage cable.

9. A power cable according to one of the preceding claims, wherein the cable is a low voltage cable.

10. A power cable according to one of the preceding claims, wherein the plastic rods are arranged immediately adjacent to one another so as to form a protective barrier.

Claims

1. A power cable, comprising one or more cores (10)

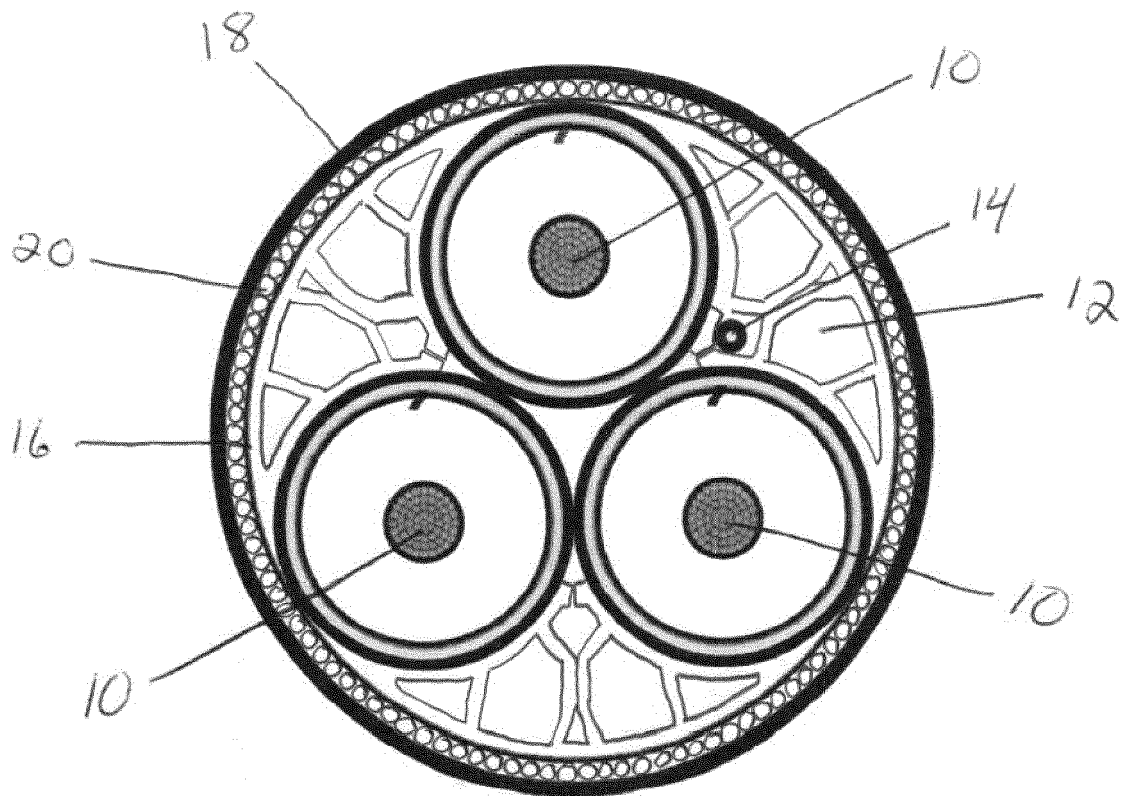


Figure 1

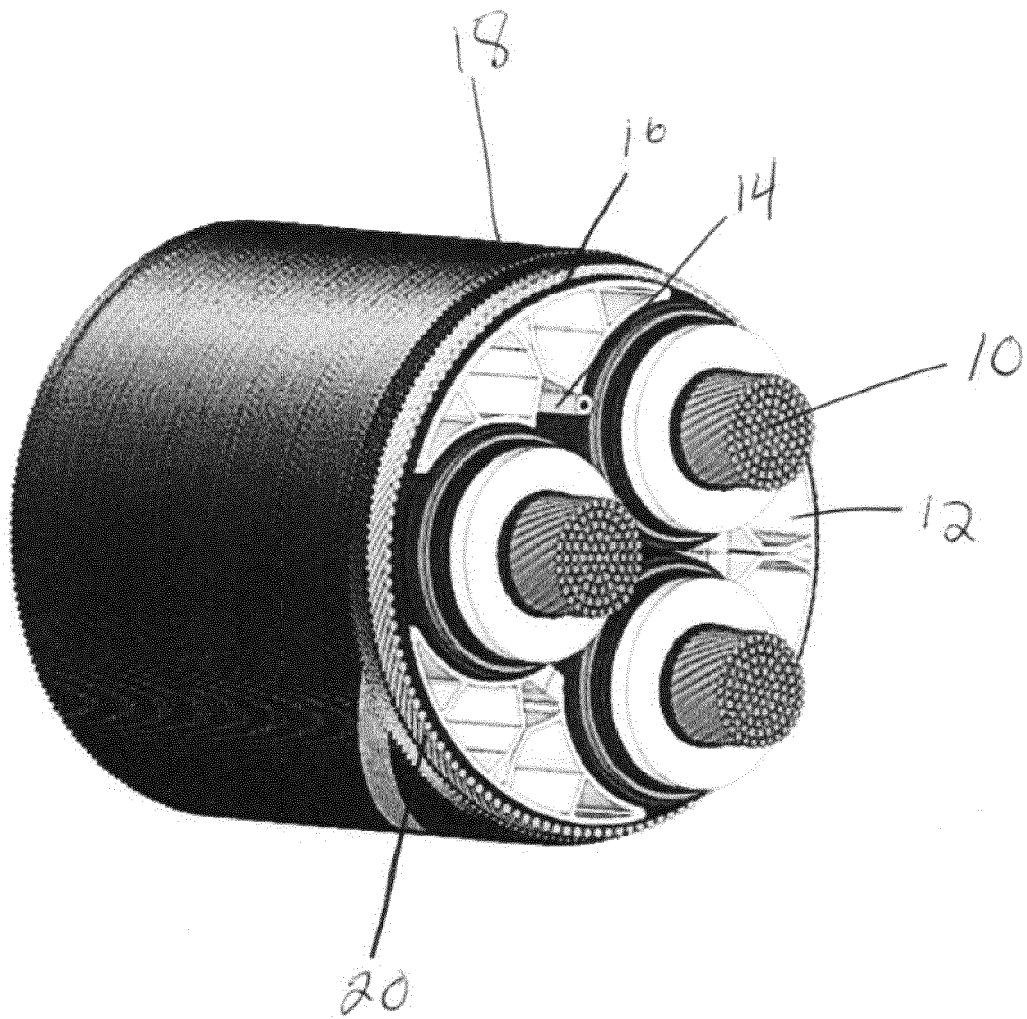


Figure 2



EUROPEAN SEARCH REPORT

Application Number
EP 16 30 5547

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Y	WO 2014/202141 A1 (ABB TECHNOLOGY LTD [CH]) 24 December 2014 (2014-12-24) * abstract *	3-6	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 October 2016	Examiner Salm, Robert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 16 30 5547

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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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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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