



(51) International Patent Classification:
H01B 7/00 (2006.01) **H01B 7/18** (2006.01)

(21) International Application Number:
PCT/GB2011/050986

(22) International Filing Date:
25 May 2011 (25.05.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1009597.4 9 June 2010 (09.06.2010) GB

(71) Applicant (for all designated States except US): **DYSON TECHNOLOGY LIMITED** [GB/GB]; Tetbury Hill, Malmesbury, Wiltshire SN16 0RP (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DYSON, James** [GB/GB]; c/o Dyson Technology Limited, Tetbury Hill, Malmesbury, Wiltshire SN16 0RP (GB). **LIM, Su Ching** [MY/MY]; c/o Dyson Technology Limited, Intellectual Property, Tetbury Hill, Malmesbury, Wiltshire SN16 0RP (GB). **HARONI, Norzarina** [MY/MY]; c/o Intellectual Property Dept, Dyson Technology Limited, Tetbury Hill, Malmesbury, Wiltshire SN16 0RP (GB).

(74) Agents: **BOOTH, Andrew** et al.; Dyson Technology Limited, Intellectual Property Department, Tetbury Hill, Malmesbury, Wiltshire SN16 0RP (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: POWER CORD COMPRISING MULTIPLE SET OF TINSEL WIRES

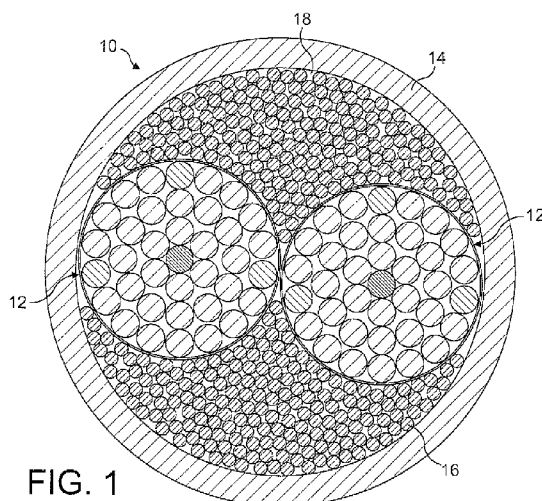


FIG. 1

(57) Abstract: A power cord (10) includes a plurality of electrical conductors (12), with each conductor (12) including a core (20) surrounded by an electrically insulating sleeve (22). The core (20) includes a plurality of electrically conducting wires (28), a first set (26) of tinsel wires and a second set (44) of tinsel wires. Each tinsel wire (26, 44) is formed from at least one electrically conducting ribbon (26a, 44a) braided with a strand or thread (26b, 44b) of textile material. The textile material of the first set of tinsel wires is different from the textile material of the second set of tinsel wires, with the textile materials being selected from a group comprising nylon, polyester and aramid fibre.



POWER CORD COMPRISING MULTIPLE SET OF TINSEL WIRES**FIELD OF THE INVENTION**

The present invention relates to a power cord for providing an electrical coupling between a power source and an article, such as a domestic appliance.

BACKGROUND OF THE INVENTION

A power cord generally comprises a pair of electrical conductors housed within an electrically insulating jacket. Each conductor comprises a plurality of conducting wires, generally formed from copper, which are twisted together and surrounded by an electrically insulating sleeve. Failure of the power cord generally occurs at the part of the power cord which is subject to frequent sharp bending or oscillation. As one of the wires breaks, the cord becomes progressively weaker at the point of failure of that wire as other wires start to break. Abrupt failure can also occur if the cord is compressed, for example between a floor surface and the wheels of a vacuum cleaner, a door or an item of furniture.

SUMMARY OF THE INVENTION

In a first aspect, the present invention provides a power cord comprising a plurality of electrical conductors, each conductor comprising a core surrounded by an electrically insulating sleeve, the core comprising a plurality of electrically conducting wires, a first set of tinsel wires and a second set of tinsel wires, each tinsel wire comprises at least one electrically conducting ribbon braided with a strand or thread of textile material, and wherein the textile material of the first set of tinsel wires is different from the textile material of the second set of tinsel wires, and wherein the textile materials are selected from a group comprising nylon, polyester and aramid fibre.

Some of the electrically conducting wires are thus replaced with tinsel wires, each preferably comprising at least one electrically conducting ribbon braided with a strand or thread of textile material. The tinsel wires may have a much greater flexibility than

the electrically conducting wires, and so the resistance to failure of the power cord, due to oscillation, frequent bending or compression, can be improved.

The electrically conducting wires are preferably formed from one of copper, a copper alloy, silver, a silver alloy, nickel and a nickel alloy.

The electrically conducting ribbon is preferably formed from one of copper, a copper alloy and a silver alloy.

The plurality of tinsel wires comprises different types of tinsel wire. This can enable tinsel wires having different physical properties to be incorporated into the conductors, for example to optimize the strength or the elasticity of the conductors. In this first aspect of the invention, each conductor comprises a first set of tinsel wires and a second set of tinsel wires, with the textile material of the first set of tinsel wires being different from the textile material of the second set of tinsel wires. The textile materials are selected from a group comprising nylon, polyester and aramid fibre.

For example, the textile material of the first set of tinsel wires may be nylon and the textile material of the second set of tinsel wires may be aramid fibre. Alternatively, the textile material of the first set of tinsel wires may be polyester and the textile material of the second set of tinsel wires may be aramid fibre. It is preferred that each tinsel wire of the first set of tinsel wires is wrapped around a respective tinsel wire of the second set of tinsel wires, as this has been found to increase both the pull force required to break the electrical continuity of the conductor and the number of side-to-side oscillations required to break the electrical continuity. Alternatively, to facilitate manufacture the tinsel wires of both sets may be dispersed, preferably relatively evenly, amongst the electrically conducting wires.

Alternatively, each of the tinsel wires may have the same composition. For example, all of the tinsel wires may comprise a ribbon formed from copper or a copper alloys wrapped around a thread of aramid fibres, and so in a second aspect the present

invention provides a power cord comprising a plurality of electrical conductors, each conductor comprising a core surrounded by an electrically insulating sleeve, the core comprising a plurality of wires formed from copper or a copper alloy, and a plurality of tinsel wires each comprising a copper or copper alloy ribbon wrapped around a thread of aramid fibres.

Each tinsel wire may be twisted or braided with a respective electrically conducting wire. The resulting plurality of composite wires may then be dispersed, preferably relatively evenly, amongst the plurality of conducting wires, with the resulting combination of composite wires and conducting wires twisted or braided to form the core of the electrical conductor.

The core may comprise a central member around which the wires are disposed or wrapped. The material from which the central member is formed can be selected to optimise the tensile strength or the strain to fracture of the conductors. The central member is preferably formed from electrically insulating material, and is preferably in the form of a strand or thread formed from textile material. For example, the central member may be formed from polymeric material such as polyester or aramid fibres depending on the required mechanical behavior of the power cord.

The cord preferably comprises a jacket surrounding the conductors, and filler material located between the conductors and the jacket. The filler material is preferably formed from textile material, and may be formed from at least one of cotton, nylon, polyester and aramid fibres depending on the required mechanical behaviour of the power cord.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic sectional view through a power cable;

Figure 2(a) is a schematic sectional view through a first embodiment of a conductor of the power cable of Figure 1, and Figure 2(b) is a broken-away elevation of the conductor of Figure 2(a);

Figure 3(a) is a schematic sectional view through a second embodiment of a conductor of the power cable of Figure 1, and Figure 3(b) is a broken-away elevation of the conductor of Figure 3(a);

Figure 4(a) is a schematic sectional view through a third embodiment of a conductor of the power cable of Figure 1, and Figure 4(b) is a broken-away elevation of the conductor of Figure 4(a);

Figure 5(a) is a schematic sectional view through a fourth embodiment of a conductor of the power cable of Figure 1; and Figure 5(b) is a broken-away elevation of the conductor of Figure 5(a); and

Figure 6 is a schematic sectional view through a fifth embodiment of a conductor of the power cable of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

With reference first to Figure 1, a power cord 10 for providing an electrical coupling between a power source and an article, such as a domestic appliance, comprises a pair of electrical conductors 12 surrounded by an electrically insulating jacket 14. The jacket 14 is preferably formed from PVC (polyvinylchloride), but alternative materials include modified-polyphenylene ether (MPPE) resin, such as NorylTM resin, siloxane-polyetherimide copolymer, and thermoplastic polyester elastomer (TPE-E) materials. A filler 16 formed from strands or threads of textile material is located between the conductors 12 and the jacket 14. Depending on the desired mechanical properties of the power cord 10, the filler 16 may be formed from one or more of cotton, nylon, polyester and aramid fibres, for example KevlarTM or NomexTM fibres. A cotton paper sleeve 18 may be provided on the internal periphery of the jacket 14. The power cord 10 has a

diameter in the range from 5 to 10 mm, and each conductor 12 preferably has a diameter in the range from 2 to 4 mm.

Figures 2(a) and 2(b) illustrate a first embodiment of an electrical conductor 12 for use in the power cord 10. The electrical conductor 12 comprises a core 20 surrounded by a protective electrically insulating sleeve 22. The sleeve 22 is preferably formed from PVC. The core 20 comprises a central member 24 in the form of a strand or thread formed from a bundle of aramid fibres, a plurality of tinsel wires 26 and a plurality of electrically conducting wires 28. The central member 24 is preferably formed from a strand of 200 Denier Kevlar™. Each tinsel wire 26 comprises a ribbon 26a formed from copper or a copper alloy which is braided with a nylon strand 26b. The electrically conducting wires 28 are preferably formed from copper or a copper alloy. Optionally, each tinsel wire 26 may be twisted or braided with a respective electrically conducting wire to form a composite wire. In this example the conductor 12 comprises three tinsel wires 26 but the conductor 12 may comprise any desired number of tinsel wires 26. The conductor 12 comprises around forty to sixty electrically conducting wires 28. The tinsel wires 26 and the electrically conducting wires 28 may be twisted or braided about the central member 24. The tinsel wires 26 preferably have a diameter of around 0.10 to around 0.15 mm, whereas the electrically conducting wires 28 preferably have a diameter of around 0.15 to around 0.20 mm.

Figures 3(a) and Figure 3(b) illustrate a second embodiment of an electrical conductor 30 for use in the power cord 10. The electrical conductor 30 differs from the electrical conductor 12 insofar as the central member 24 of the conductor 12 is replaced by a plurality of strands or threads 32 formed from polyester to increase the strain to fracture of the conductor 30 in comparison to the conductor 12.

Figures 4(a) and Figure 4(b) illustrate a third embodiment of an electrical conductor 40 for use in the power cord 10. The conductor 40 replaces the central member 24 of the conductor 12 with a plurality of additional tinsel wires 44. These additional tinsel wires 44 each comprise a ribbon 44a formed from copper or a copper alloy which is braided

with a strand 44b of aramid fibres. The conductor 40 thus comprises a first set of tinsel wires 26, and a second set of tinsel wires 44. In this conductor 40, each additional tinsel wire 44 is wrapped around a respective one of the tinsel wires 26 to form a composite wire 42.

Figures 5(a) and 5(b) illustrate a fourth embodiment of an electrical conductor 50 for use in the power cord 10. The conductor 50 varies from the conductor 40 in that each additional tinsel wire 44 is arranged amongst the electrically conducting wires 28, preferably so that the tinsel wires 26, 32 are relatively evenly dispersed amongst the electrically conducting wires 28. The resulting combination of tinsel wires 26, 44 and electrically conducting wires 28 is then twisted or braided, and surrounded by sleeve 22.

Finally, the conductor 60 illustrated in Figure 6 omits the tinsel wires 26 of the conductor 50 of Figures 5(a) and 5(b).

The composition of the filler 16 may be varied depending on the composition of the electrical conductor. For example, a power cord comprising a pair of the electrical conductors 12 illustrated in Figure 2 may include filler formed from nylon, such as 2000 Denier nylon. A power cord comprising a pair of the electrical conductors 30 may include filler formed from polyester, whereas a power cord comprising a pair of the electrical conductors 40 may include cotton filler. A power cord comprising a pair of the electrical conductors 50 may include filler formed from aramid fibres.

CLAIMS

1. A power cord comprising a plurality of electrical conductors, each conductor comprising a core surrounded by an electrically insulating sleeve, the core comprising a plurality of electrically conducting wires, a first set of tinsel wires and a second set of tinsel wires, each tinsel wire comprises at least one electrically conducting ribbon braided with a strand or thread of textile material, and wherein the textile material of the first set of tinsel wires is different from the textile material of the second set of tinsel wires, and wherein the textile materials are selected from a group comprising nylon, polyester and aramid fibre.
2. A power cord as claimed in claim 1, wherein the textile material of the first set of tinsel wires is aramid fibre, and the textile material of the second set of tinsel wires is nylon.
3. A power cord as claimed in claim 1 or claim 2, wherein each tinsel wire of the first set of tinsel wires is separate from a tinsel wire of the second set of tinsel wires.
4. A power cord as claimed in any preceding claim, wherein each tinsel wire of the first set of tinsel wires is twisted or braided with a tinsel wire of the second set of tinsel wires.
5. A power cord as claimed in any of the preceding claims, wherein the electrically conducting wires are formed from one of copper, a copper alloy, silver, a silver alloy, nickel and a nickel alloy.
6. A power cord as claimed in any of the preceding claims, comprising a jacket surrounding the conductors, and filler material located between the conductors and the jacket.

7. A power cord as claimed in claim 6, wherein the filler material is formed from textile material.
8. A power cord as claimed in claim 6 or claim 7, wherein the filler material is formed from one of cotton, nylon, polyester and aramid fibres.
9. A power cord substantially as herein described with reference to the accompanying drawings.

1 / 6

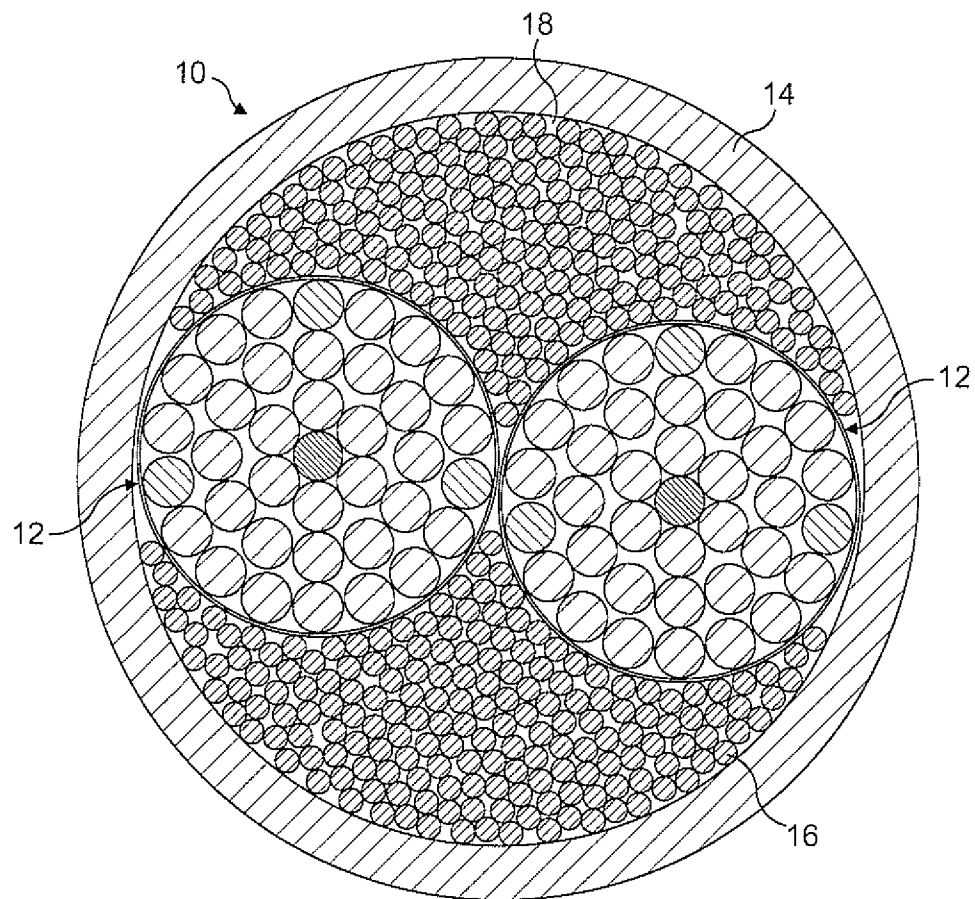


FIG. 1

2 / 6

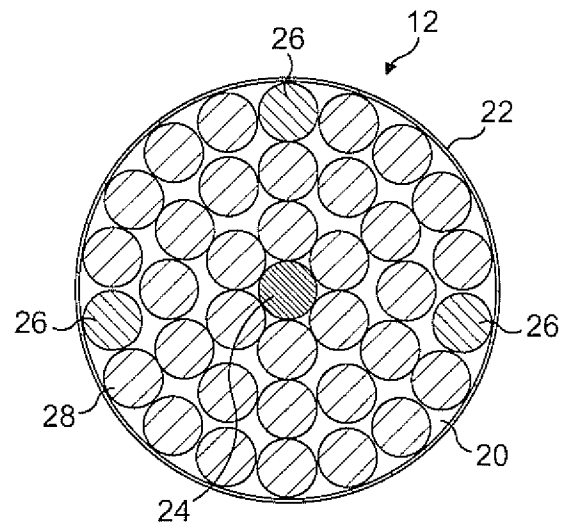


FIG. 2(a)

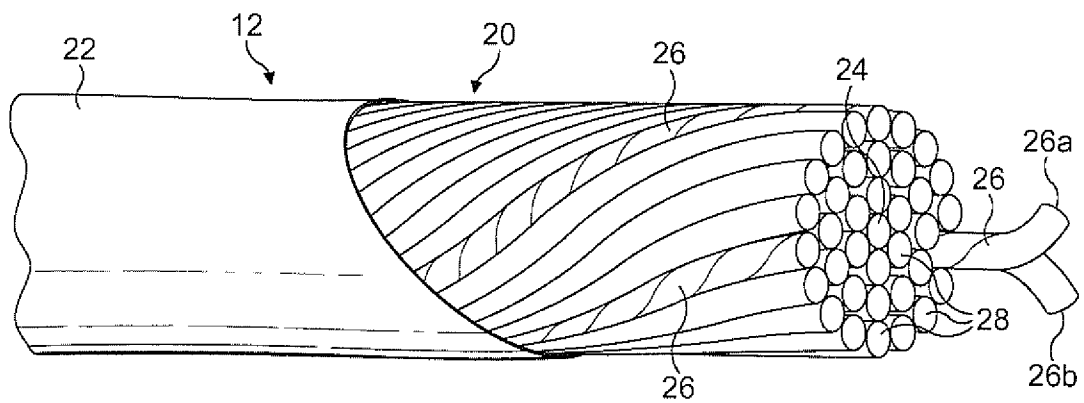


FIG. 2(b)

3 / 6

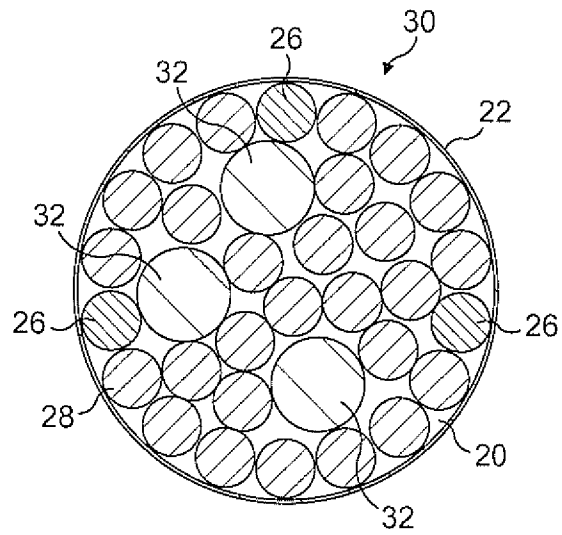


FIG. 3(a)

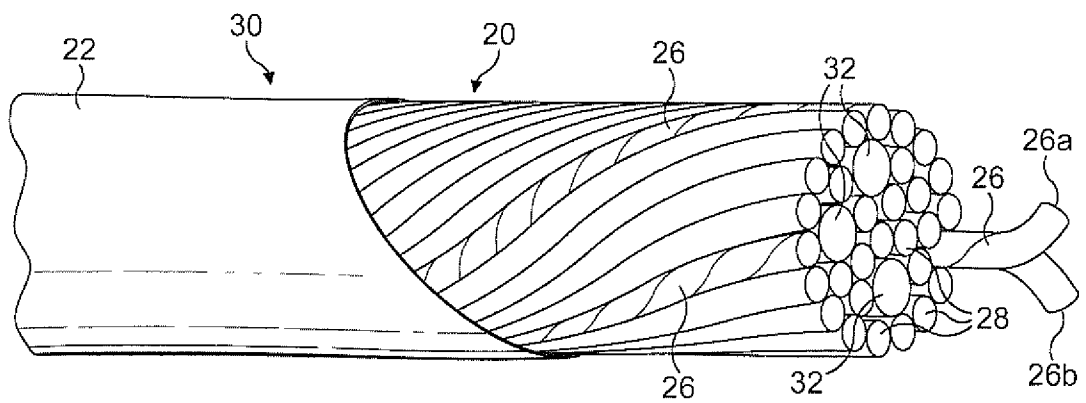


FIG. 3(b)

4 / 6

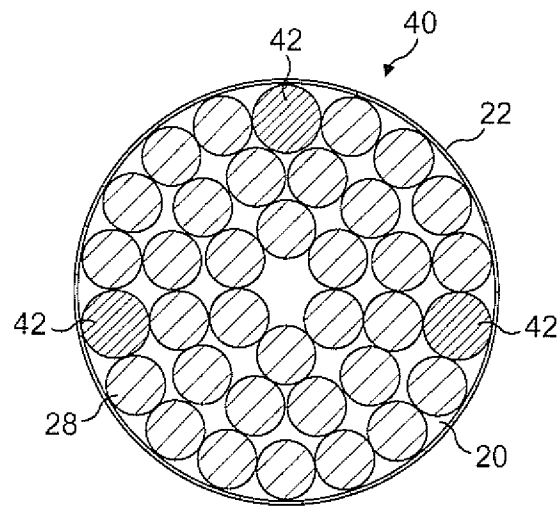


FIG. 4(a)

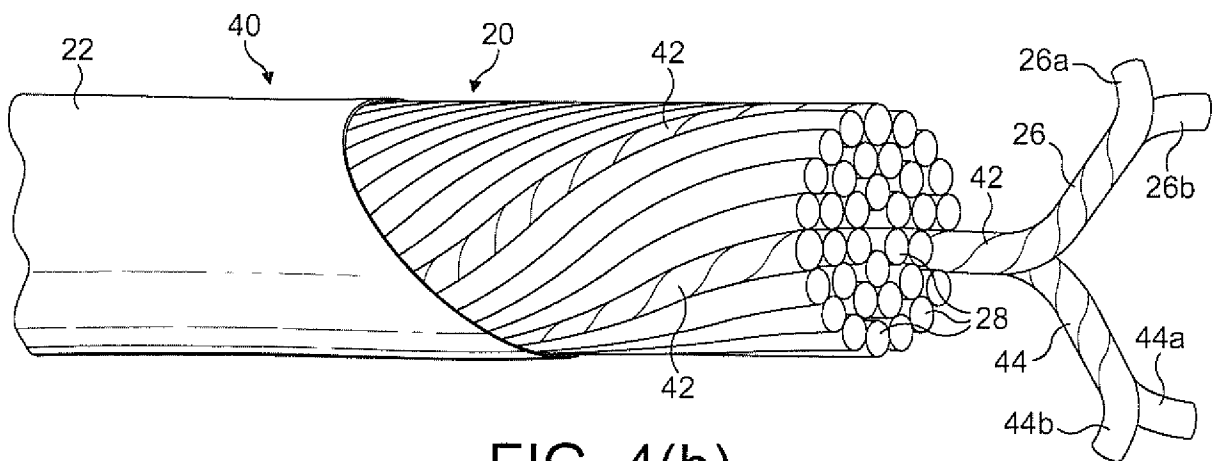


FIG. 4(b)

5 / 6

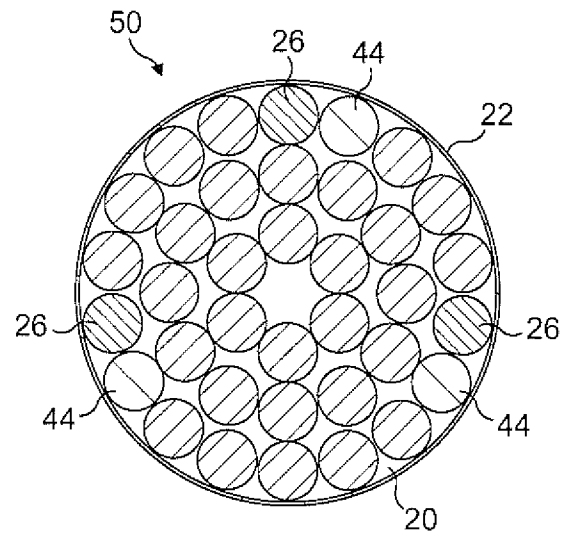


FIG. 5(a)

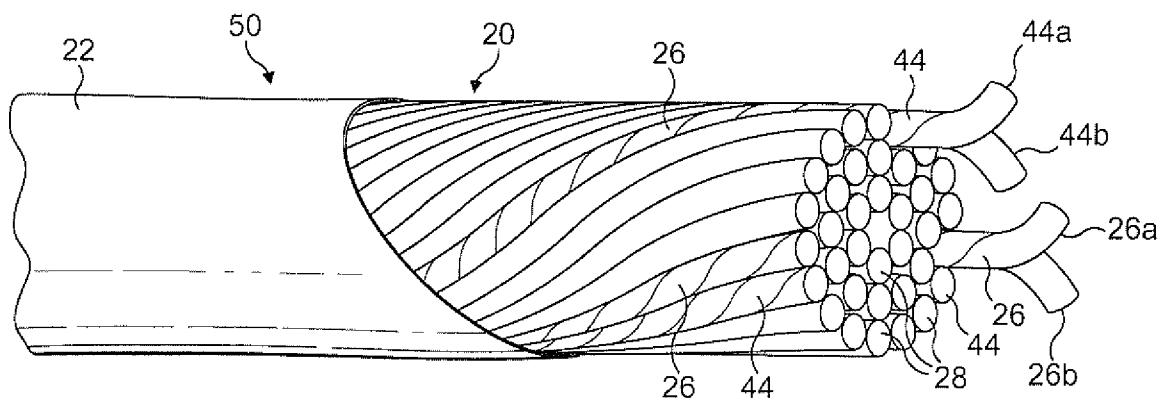


FIG. 5(b)

6 / 6

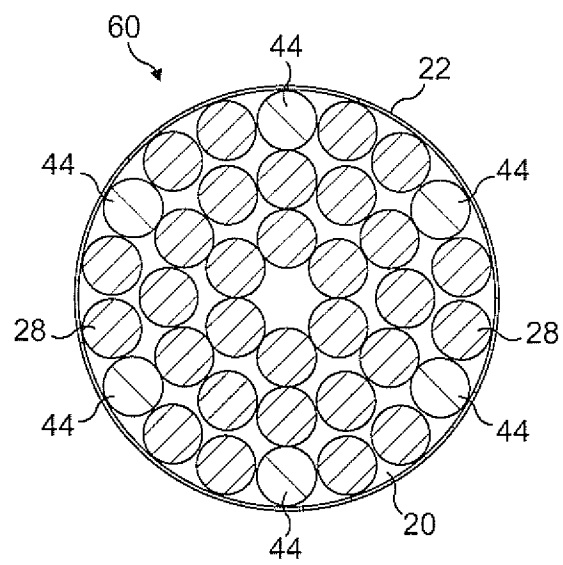


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2011/050986

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01B7/00 H01B7/18
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 practical, 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	US 2005/011667 A1 (LEE CHANG-CHI [TW] ET AL) 20 January 2005 (2005-01-20)	9
A	paragraphs [0015], [0016]; figure 1	1-8
A	US 3 037 068 A (WESSEL HUBERT L) 29 May 1962 (1962-05-29)	1
A	columns 3,4; figure 3	
A	DE 41 36 227 A1 (KABELWERKE REINSHAGEN GMBH) 6 May 1993 (1993-05-06)	1
	column 3; figures 1,2	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

10 November 2011

Date of mailing of the international search report

17/11/2011

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Colombo, Alessandro

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2011/050986

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2005011667	A1	20-01-2005	US 2005011667 A1	20-01-2005
			US 2006027392 A1	09-02-2006
			US 2006076156 A1	13-04-2006

US 3037068	A	29-05-1962	NONE	

DE 4136227	A1	06-05-1993	NONE	
