



- (51) **International Patent Classification:**
G02B 6/44 (2006.01) *H02G 7/05* (2006.01)
G02B 6/48 (2006.01)
- (21) **International Application Number:**
PCT/EP2017/000266
- (22) **International Filing Date:**
27 February 2017 (27.02.2017)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
EP16000504.7 2 March 2016 (02.03.2016) EP
- (71) **Applicant:** ING3 BETEILIGUNGS GMBH [AT/AT];
Loudonstraße 25b, 1140 Wien (AT).
- (72) **Inventor:** KATÓ, Imre; 7th Cimer Str., 2100 Gödöllő
(HU).
- (74) **Agent:** PEHAM, Alois; c/o Siemens AG Österreich,
Siemensstraße 90, 1210 Wien (AT).
- (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, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN,
KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,
MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG,
NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS,
RU, RW, SA, 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, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a
patent (Rule 4.17(ii))

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:** SUPPORT STRUCTURE FOR AN OPTICAL FIBER CABLE

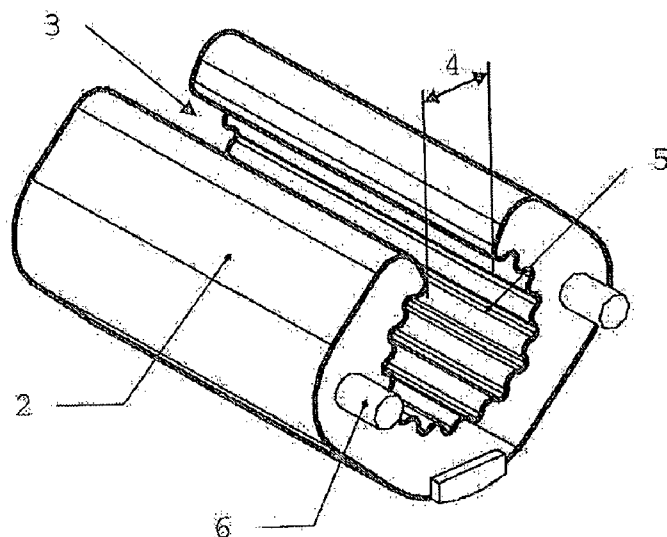


Fig. 4

(57) **Abstract:** The invention relates to a support structure for an optical fiber cable (7) adapted to be aerially installed in a configuration, extending generally horizontally along a series of spaced apart vertical pilots, said support structure comprising: - An approximately c-shaped support element (2) with an open hollow (3), prepared for the incorporation of an optical fiber cable (7); - at least one longitudinal strength member (6) integrated in the c-shaped support element (2); - wherein the optical fiber cable (7) is movably arranged in the hollow (3) of the support element (2).

SUPPORT STRUCTURE FOR AN OPTICAL FIBER CABLE**FIELD OF THE INVENTION**

5 The invention relates to the field of communication cables, and, more particularly, to a support structure for an aerial optical fiber cable.

BACKGROUND OF THE INVENTION

10

Communication cables employing optical fibers are widely used in the telecommunications industry. In particular, multifiber cables are widely used for long distance telephone communications, interexchange telephone applications, and other telephony and data transmission applications. Fiber optic cables are also being incorporated into cable television networks in place of more traditional coaxial cables. Optical fibers may permit long distances between signal repeaters or eliminate the need for such repeaters altogether. In addition, optical fibers offer extremely wide bandwidths and low noise operation.

A traditional used embodiment of fiber optic cables in telecom industry are the so called ADSS (All-Dielectric Self Supporting) cables. They typically include one central element surrounded by several fiber protecting tubes named "loose tube", since the internal diameter of these protective tubes are several times bigger than the diameter of the group of inserted fibers. There is an internal cable sheath placed around the group of loose tubes. Aramid layers are placed between the inner and an outer cable sheath. This aramid layers ensure the necessary tensile strength for the cable to be applicable for aerial implementations.

35 Another traditional aerial optical cable type, which has been used for trunk and backbone network applications for a long time is the so called "figure 8" type cable, which consists

of a central element, surrounded by fiber protecting loose tubes. Around the loose tubes is a single cable sheath placed. This cable sheath is extruded together with a support element forming a single physical unit. The support element
5 wire can be steel wire, rope or made from dielectric material like FRP (Fiber Reinforced Plastic). This support element wire (rope) ensures the necessary tensile strength for the cable and makes it applicable for aerial networks.

10 A common problem of all cable types is the high effort for their installation, which rises with the number of access closures.

SUMMARY OF THE INVENTION

15

In view of the foregoing background, it is therefore an object of the present invention to provide a support structure for an optical fiber cable that may be easily handled and installed in an aerial configuration.

20

The object of the invention is provided with a support structure for an optical fiber cable adapted to be aerially installed in a configuration extending generally horizontally along a series of spaced apart vertical pilots, said support
25 structure comprising:

- An approximately c-shaped support element with an open hollow, prepared for the incorporation of an optical fiber cable;
- at least one longitudinal strength member integrated in
30 the c-shaped support element
- wherein the optical fiber cable is movable arranged in the hollow of the support element;

The support element may preferably be composed of high-density polyethylene with several additives, and may have the form of a square with rounded edges, a hollow space in the center and a lateral opening on one corner of the square.

5

It is advantageous if the surface of the hollow of the support structure shows longitudinal ribs.

At least one of the longitudinal strength members can be made of fiber reinforced plastic material.

10

In a favourable embodiment two longitudinal strength members are extending along respective opposite sides of the hollow.

The size of the lateral opening of the hollow may be in the range of 65% - 70 % of the outside diameter of the optical fiber cable which has to be incorporated and the diameter of the hollow may be in the range of 125% to 150% of the optical fiber cables outside diameter.

15
20

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic view of an aerial portion of a fiber optic communications system,

25

Fig. 2a, 2b show an exemplary embodiment of an anchoring frame in a separated and a mounted state,

Fig. 3a, 3b show an example for a holding bracket in a separated and a mounted state,

30

Fig. 4 shows an exemplary support element,

Fig. 5 shows the assembly process of support element and optical fiber cable.

35 DETAILED DESCRIPTION OF THE INVENTION

The invention will now be described more detailed with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. However, the invention may be embodied in many different forms and is not limited to the
5 embodiment set forth herein.

As shown in Fig. 1, the inventive support structure is intended to be used in the aerial part of an optical fiber communication network.

10

In such a network, a fiber optic cable 7 has to be aerially installed along a series of vertical supports or poles 1.

It has to resist the forces of nature, in particular the
15 loads of wind or ice.

Self-supporting aerial cables, which meet these demands are relatively stiff and difficult to handle during installation.

20 According to the invention, this problem can be solved by using a support structure, which gives the optical fiber cable the required strength, but simplifies the handling.

The support structure is secured to the end poles of the aerial network line by as shown in fig. 2. The usage of anchoring frames is also recommended at those places, where aerial installation crosses roads or at corners of the line, that is to say, when deviation from the straight line exceeds 10 degrees.

30

On the other poles 1, holding brackets as shown in fig.3 are used for attachment.

Fig.4 shows a part of an inventive support element 2. It is
35 composed of high-density polyethylene with several additives, which ensure resistance and reduce friction coefficient of the material.

Its cross section has approximately the form of a "C", in other words, it has the form of a square with rounded edges, a hollow space 3 in the center and a lateral opening 4 on one corner of the square.

The surface of the hollow 3 shows longitudinal ribs 5.

To increase the stability of the support element 2, a pair of longitudinal strength members 6 extending along respective opposite sides of the hollow 3 is incorporated in its body.

They are made of fiber reinforced plastic material.

The symmetrical design is an important feature of the support element 2; it helps to maintain the straight form of the extruded element during manufacturing and during the cooling and crystallization process.

The longitudinal ribs 5 in the surface of the hollow 3 ensure lower dragging forces for pulling the inserted cable 7 by reducing friction surfaces.

It is advantageous to mark the back side of the support element 2 with an embedded strip extruded using different color of material. It is to signalize twisting of the supporting element between neighboring poles 1. In order to maximize cable pulling performance of the system, a 360° twisting is required between poles 1. Back side color strip makes it easily controllable also for installers and for supervising staff.

The physical size of the support element 2 is determined by the outside diameter of the applied optical fiber cable 7. There are two critical parameters. One is the size of lateral opening 4 of the hollow 3, which should be in the range of 65% - 70 % of the outside diameter of the cable 7.

The second critical parameter is the diameter of the hollow 3, which should be between 125% and 150% of the cables 7 outside diameter.

- 5 The outer dimension of the support element 2 is derived from these parameters and the necessary wall thickness to reach the pre-defined values for the stability of the element.

10 As shown in fig. 2 a, the anchoring frame for attaching the support element to vertical poles comprises three major components; a frame body 8 which guides the support element 2 with some hook-like forms at each side; a support element 2 specific clamping wedge 9 with a bottom surface which has the negative form of the upper part of the support element 2, so
15 it fits perfectly to the support element 2 when the clamping wedge 9 is inserted into the body 8 of the anchoring frame right over the support element 2.

20 The way of insertion during an installation process is from the front to the back of the frame body 8. While the clamping wedge 9 is moved backward, hooks at the side press the clamping wedge down towards the support element 2 until the desired clamp force is reached.

- 25 The third basic component of the anchoring frame is a bridging arm 10, which connects the frame body 8 to a pole 1.

Fig 2 b shows the anchoring frame in a mounted state.

- 30 The inventive system allows different movements of the support element 2 but not twisting. So the opening of the support element 2 will always face upward.

35 It is recommendable to manufacture the whole anchoring frame from dielectric materials, because it avoids any needs for grounding, when the aerial network is realized on 0,4kV energy poles.

As described in the foregoing, the application of the anchoring frame is only recommended at certain poles 1. On the other poles 1, holding brackets as shown in fig.3a in a separated state and in fig. 3b in a mounted state are used for attachment.

These holding brackets comprise 3 components, a bracket base 11 and two turnable side plates 12. The side plates 12 are identical to each other, any of them can be used at the left or right side as well.

Fig. 3b shows the mounted holding bracket with the support structure 2 and the optical fiber cable 7 inside.

The installation process comprises the following steps:

At first the support element 2 with the inserted optical fiber cable 7 is placed into the holding bracket base 11 whereby the open side of the support element 2 faces upward

While the side plates 12 are turned up, profile blocks located at the lower section of the side plates 12 push down the inserted support element 2 into the holding bracket base 11. It fastens the support element 2 into the holding bracket.

The process of inserting an optical fiber cable 7 into a support element 2 is described in context with fig. 5.

The cable 7 is pressed through the lateral opening 4 into the hollow 3 of the support element 2 by help of some rollers 13, 14.

A first type of rollers 13 is designed to position and hold the support element 2 in a fixed position while a second type of rollers 14 presses the cable 7 into the support element 2.

References

- | | | |
|----|----|-------------------------------|
| | 1 | poles |
| 5 | 2 | support element |
| | 3 | hollow |
| | 4 | lateral opening |
| | 5 | longitudinal ribs |
| | 6 | longitudinal strength members |
| 10 | 7 | cable |
| | 8 | frame body |
| | 9 | clamping wedge |
| | 10 | bridging arm |
| | 11 | bracket base |
| 15 | 12 | side plates |
| | 13 | first type of rollers |
| | 14 | second type of rollers |

Claims

1. A support structure for an optical fiber cable (7)
adapted to be aerially installed in a configuration
5 extending generally horizontally along a series of
spaced apart vertical pilots (1), said support structure
comprising:

- An approximately c-shaped support element (2) with
an open hollow (3), prepared for the incorporation
10 of an optical fiber cable (7);
- at least one longitudinal strength member (6)
integrated in the c-shaped support element (2);
- wherein the optical fiber cable (7) is movable
arranged in the hollow (3) of the support element
15 (2);

2. A support structure according to claim 1, wherein the
support element is composed of high-density polyeth-
ylene with several additives.

3. A support structure according to claim 1 or 2, wherein
the support element (2) has the form of a square with
rounded edges, a hollow space (3) in the center and a
lateral opening (4) on one corner of the square.

4. A support structure according to one of claims 1 to 3,
wherein the surface of the hollow (3) shows longitudi-
nal ribs (5).

5. A support structure according to one of claims 1 to 4,
wherein the at least one longitudinal strength member
30 (6) is made of fiber reinforced plastic material.

- 5 6. A support structure according to one of claims 1 to 5,
wherein two longitudinal strength members (6) are ex-
tending along respective opposite sides of the hollow
(3).
- 10 7. A support structure according to one of claims 1 to 6,
wherein the size of the lateral opening (4) of the hol-
low (3) is in the range of 65% ~ 70 % of the outside
diameter of the optical fiber cable (7) which has to be
incorporated.
- 15 8. A support structure according to one of claims 1 to 7,
wherein the diameter of the hollow (3) is in the range
of 125% to 150% of the optical fiber cables (7) outside
diameter.

1/4

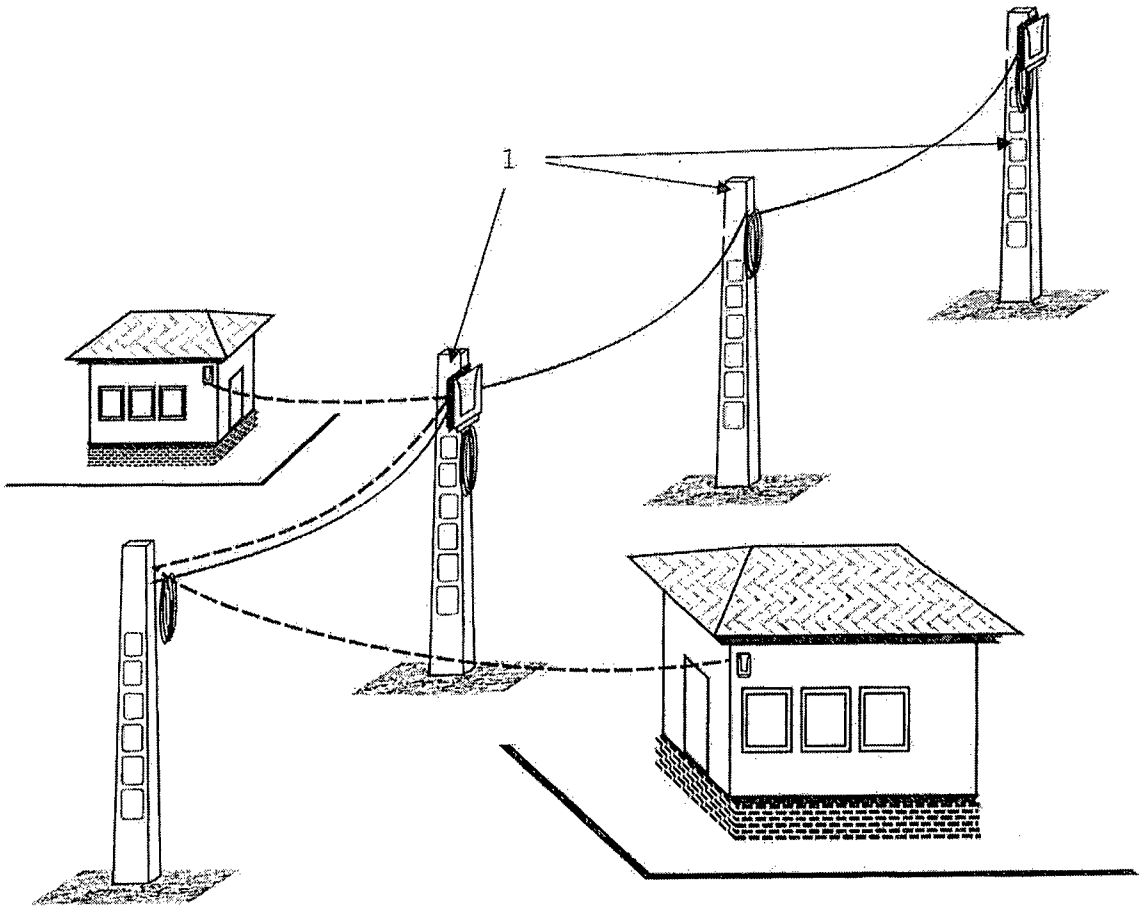


Fig.1

2/4

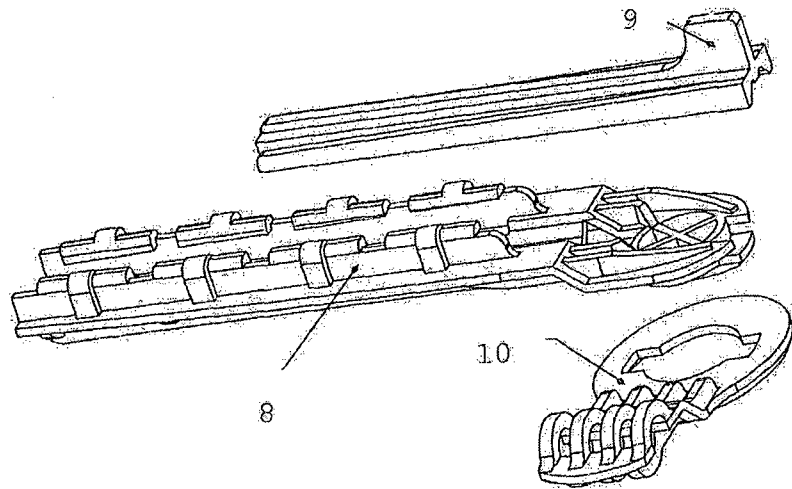


Fig. 2a

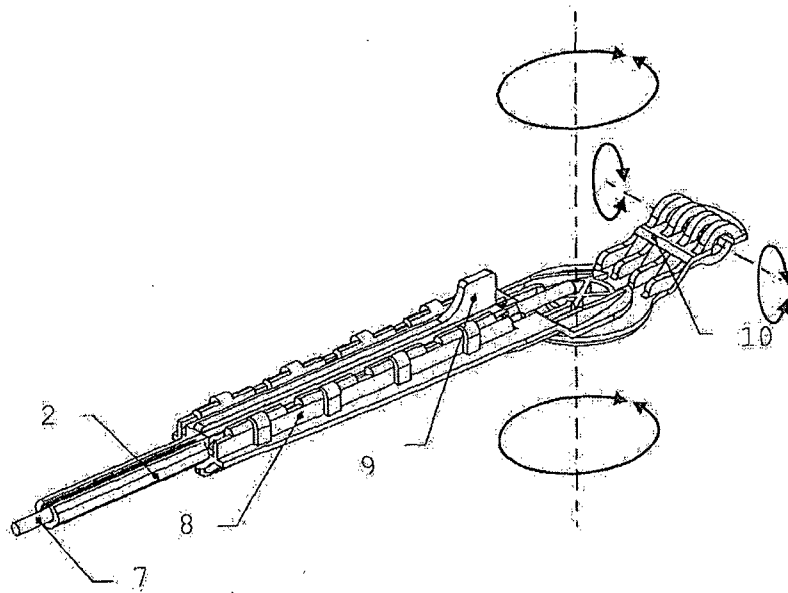


Fig. 2b

3/4

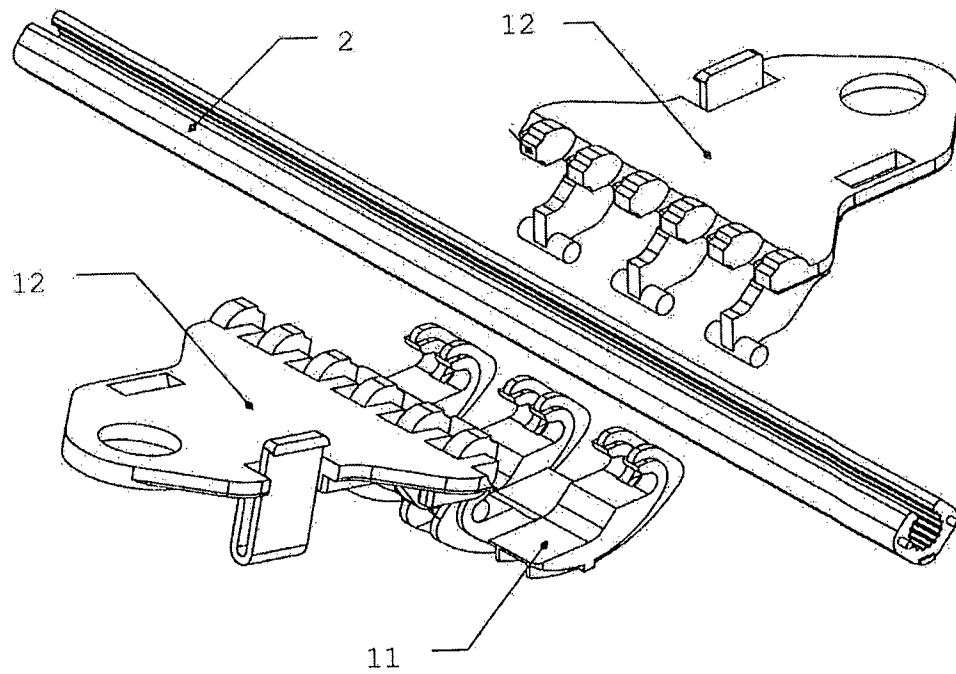


Fig. 3a

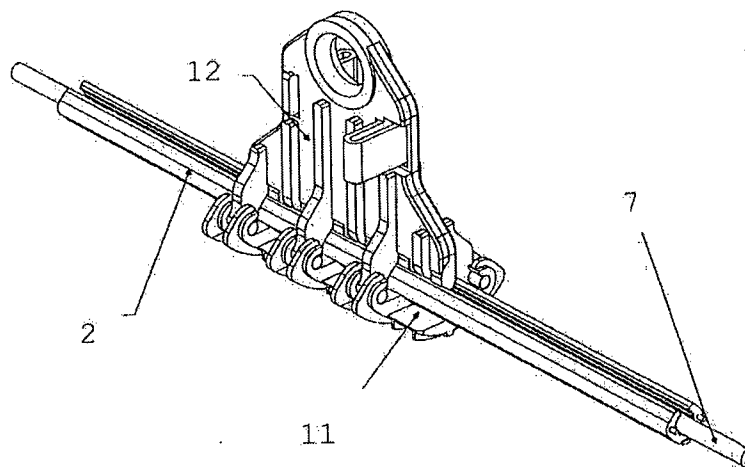


Fig. 3b

4/4

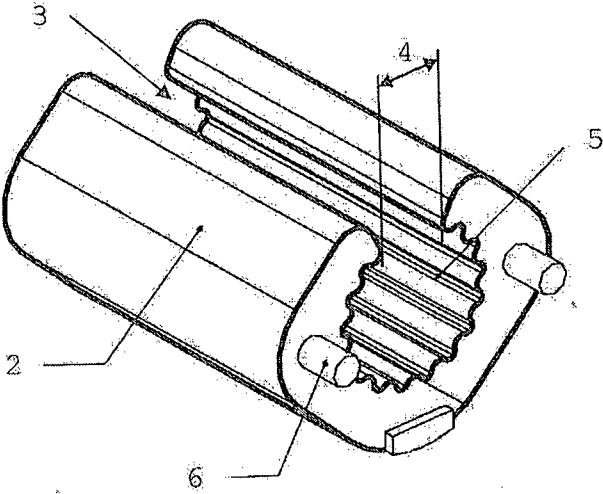


Fig. 4

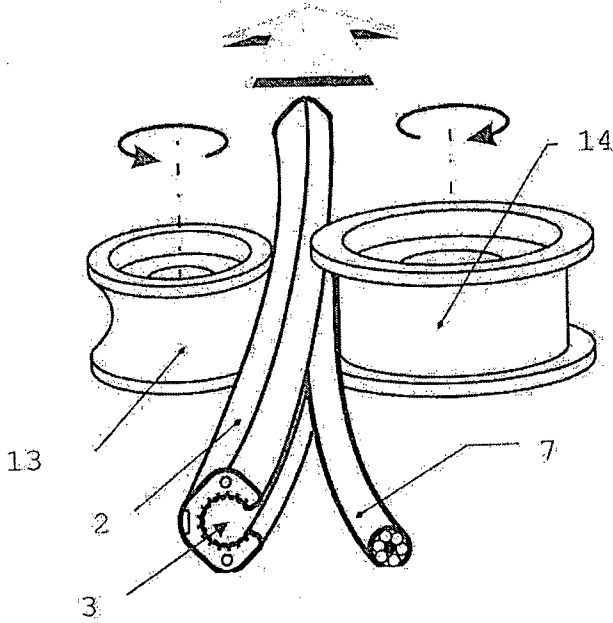


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/000266

A. CLASSIFICATION OF SUBJECT MATTER

INV. G02B6/44 G02B6/48 H02G7/05
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)

G02B H02G

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2008 129168 A (ADVANCED CABLE SYSTEMS CORP) 5 June 2008 (2008-06-05) figures 1, 2, 3 paragraphs [0001], [0012], [0013], [0019] - [0021], [0026], [0027] claim 1	1-8
A	----- US 5 678 609 A (WASHBURN ROBERT B [US]) 21 October 1997 (1997-10-21) figures 5, 6 column 6, line 61 - line 65 claim 1	4
A	----- GB 2 470 284 A (DRAKA COMTEQ BV [NL]) 17 November 2010 (2010-11-17) figure 2 page 6, line 1 - line 5 ----- -/-	5



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 application or patent 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 considered 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

14 July 2017

Date of mailing of the international search report

21/07/2017

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

Zakynthinos, P

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/000266

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 515 628 A (A 2 SEA SOLUTIONS LTD [GB]) 31 December 2014 (2014-12-31) page 16, line 11 - page 18, line 15; figure 7 -----	1-8
A	US 2005/199415 A1 (GLEW CHARLES A [US]) 15 September 2005 (2005-09-15) figure 3a -----	1-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/000266

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2008129168	A	05-06-2008	NONE	
US 5678609	A	21-10-1997	NONE	
GB 2470284	A	17-11-2010	NONE	
GB 2515628	A	31-12-2014	NONE	
US 2005199415	A1	15-09-2005	US 2005199415 A1	15-09-2005
			US 2007209825 A1	13-09-2007
			US 2011284287 A1	24-11-2011
			US 2013146329 A1	13-06-2013