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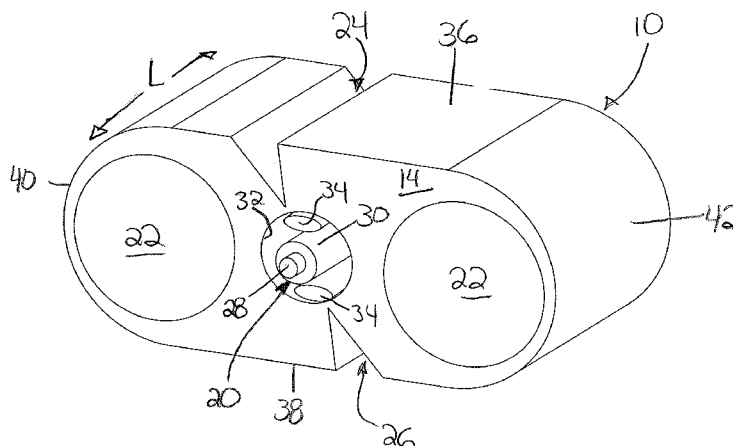
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(54) Title: FLAT DROP CABLE WITH FEATURES FOR ENHANCING STRIPABILITY

FIG. 1



(57) Abstract: A flat drop cable has notches or other structures for enhancing the stripability of the jacket from the a core of the flat drop cable. The notches can have an angled configuration with surfaces that converge as the notch extends into the jacket. Inner edges of the notches can be positioned along a tear path that intersects the core of the flat drop cable. For example, the notches can be offset from a minor axis of the flat drop cable a sufficient distance such that the notches are positioned outside a central boundary region that extends tangent to sides of the core and parallel to the minor axis of the flat drop cable.

FLAT DROP CABLE WITH FEATURES FOR ENHANCING STRIPABILITY

TECHNICAL FIELD

The present disclosure relates generally to fiber optic cables. More
5 particularly, the present disclosure relates to flat drop cables.

BACKGROUND

A fiber optic cable typically includes: (1) an outer jacket; (2) a core
including at least one optical fiber positioned within the jacket; and (3) a plurality of
reinforcing members positioned within or incorporated into the core. The optical fiber
10 functions to carry optical signals. A typical optical fiber includes an inner core
surrounded by a cladding that is protected by a coating layer. The core can also include
a buffer layer that functions to surround and protect the coated optical fiber. In certain
examples, the buffer layer can include a tight buffer layer, a semi-type buffer layer, or a
loose buffer layer. The reinforcing members of the fiber optic cable add mechanical
15 reinforcement to the fiber optic cable to protect the internal optical fiber against stresses
applied to the cable during installation and thereafter. The outer jacket can be
configured to protect the optical fiber by preventing the fiber from being exposed to
outside elements.

Drop cables used in fiber optic networks can be constructed with jackets
20 each having a flat transverse cross-sectional profile. Such cables typically include at
least one central buffer tube containing at least one optical fiber, and reinforcing
members such as rods made of glass reinforced epoxy embedded in the jacket on
opposite sides of the buffer tube. U.S. Patent No. 6,542,674 discloses a drop cable of
the type described above. Flat drop cables of the type described above are designed to
25 be quite robust. However, as a result of such cables being strong and robust, stripping
can be difficult. Improvements are needed in this area.

SUMMARY

One aspect of the present disclosure relates to a flat drop cable having one or more structures for enhancing the stripability of the jacket from the drop cable. In certain examples, the structures for enhancing stripability can include notches. In
5 certain examples, the notches can have an angled configuration with surfaces that converge as the notch extends into the jacket. In certain examples, the flat drop cable can define an elongated transverse cross-sectional profile having a major axis and a minor axis, and one or more notches for enhancing stripability can be offset from the minor axis of the flat drop cable. In certain examples, at least two offset notches are
10 provided at opposite sides of the drop cable with inner edges of the notches being positioned along a plane that intersects an optical fiber of the flat drop cable. In certain examples, the notches are offset from the minor axis a sufficient distance such that the notches are positioned outside a central boundary region defined by spaced lines that are tangent to sides of a core of the fiber optic cable and that are parallel to the minor
15 axis.

A variety of additional aspects will be set forth in the description that follows. These aspects can relate to individual features and to combinations of features. It is to be understood that both the forgoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the
20 broad concepts upon which the examples disclosed herein are based.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a segment of a flat drop cable in accordance with the principles of the present disclosure;

Figure 2 is a transverse cross-sectional view of the flat drop cable of
25 Figure 1;

Figure 3 is a perspective view of a segment of another flat drop cable in accordance with the principles of the present disclosure;

Figure 4 is a transverse cross-sectional view of a further flat drop cable in accordance with the principles of the present disclosure;

Figure 5 is a perspective view showing a segment of still another flat drop cable in accordance with the principles of the present disclosure; and

Figure 6 is a transverse cross-sectional view of a further flat drop cable in accordance with the principles of the present disclosure.

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DETAILED DESCRIPTION

Figures 1 and 2 show a fiber optic cable 10 in accordance with the principles of the present disclosure. The fiber optic cable 10 includes a jacket 14, a core 20 disposed within the jacket 14, and cable reinforcing members 22 positioned within the jacket 14. The fiber optic cable 10 further includes structures for enhancing the stripability of the jacket 14 relative to the core 20. In the depicted example, such structures can include notches 24, 26 defined within the jacket 14.

The depicted fiber optic cable 10 is shown as a flat drop cable having a length L, a width W, and a thickness T. The fiber optic cable 10 includes a central longitudinal axis 12 that extends along the length L of the fiber optic cable 10. The jacket 14 of the cable 10 has a transverse cross-sectional profile that is elongated such that the width W is larger than the thickness T. The transverse cross-sectional profile of the jacket 14 defines a minor axis 16 that extends along the thickness T and a major axis 18 that extends along the width W. The minor and major axes 16, 18 are perpendicular relative to one another and intersect at the central longitudinal axis 12 of the fiber optic cable 10.

The core 20 of the fiber optic cable 10 is centered generally along the central longitudinal axis 12. The cable reinforcing members 22 are positioned on opposite sides of the minor axis 16. The notches 24, 26 or other structures for enhancing the stripability of the jacket 14 relative to the core 20 are disposed at locations offset from the minor axis 16.

Referring still to Figures 1 and 2, the core 20 of the fiber optic cable 10 includes an optical fiber 28 and a buffer layer 30 that surrounds the optical fiber 28. In certain examples, the optical fiber 28 can include a core, a cladding layer surrounding the core, and one or more polymeric coatings surrounding the cladding layer. In certain

examples, the buffer layer 30 can include a buffer tube such as a tight buffer tube, a loose buffer tube, or a semi-tight buffer tube. In other examples, the core 20 may include more than one optical fiber 28. In certain examples, the core 20 extends along the entire length L of the fiber optic cable 10.

5 The cable reinforcing members 22 extend along the length L of the fiber optic cable 10 and are aligned along the minor axis 18 of the transverse cross-sectional profile of the fiber optic cable 10. As described above, the cable reinforcing members 22 are positioned on opposite sides of the minor axis 16 of the transverse cross-sectional profile of the fiber optic cable 10. In certain examples, the cable reinforcing members
10 22 can be configured to provide the fiber optic cable 10 with both tensile and compressive reinforcement. In certain examples, cable reinforcing members 22 can have a construction that includes epoxy reinforced with fiberglass. In other examples, the cable reinforcing members 22 can include Aramid yarn, metal rods or other structures.

15 The jacket 14 defines a central passage 32 in which the core 20 is positioned. In certain examples, strength members 34 such as water soluble fiberglass strands can be provided in the central passage 32. In certain examples, the strength members 34 can prevent the core 20 from sticking to or being contacted by the jacket 14. In this way, fiber performance will not be affected by strain applied to the jacket. In
20 certain examples, the jacket 14 includes polyethylene. In certain examples, central passage 32 is larger than the core 20 such that the core is loosely provided within the central passage 32. In certain examples, the strength members 34 assist in centering the core 20 within the central passage 32 and in preventing the core 20 from adhering to the jacket 14 during extrusion. In certain examples, the strength members 34 can include a
25 water soluble material that swells when exposed to water so as to inhibit the intrusion of water along the central passage 32.

 The jacket 14 of the fiber optic cable 10 includes opposite top and bottom sides 36, 38 that extend between opposite rounded ends 40, 42. The thickness T of the fiber optic cable 10 extends between the top and bottom sides 36, 38 while the

width W of the fiber optic cable 10 extends between the rounded ends 40, 42. In the depicted example, the top and bottom sides 36, 38 are generally parallel and flat.

The notches 24, 26 are provided for facilitating stripping the jacket 14 from the core 20. As shown at Figures 1 and 2, the notch 24 is provided at the top side 36 of the jacket 14 and the notch 26 is provided at the bottom side 38 of the jacket 14. The notches 24, 26 have lengths that extend along the length L of the fiber optic cable 10. Each of the notches 24, 26 includes an open end 44 positioned at an exterior boundary 46 of the jacket 14 and a closed end 48 within an interior of the jacket 14. In certain examples, the open end 44 has a cross dimension CD that is larger than a corresponding cross dimension of the closed end 48. In one example, closed end 48 is defined by an edge having a cross dimension of essentially zero. In certain examples, the edge extends along the length L of the fiber optic cable 10 and is parallel to the central longitudinal axis 12. In certain examples, each of the notches 24, 26 has an angled or tapered configuration when viewed in transverse cross-section. For example, each of the notches 24, 26 can be defined by surfaces 50, 52 that converge as the surfaces 50, 52 extend in a direction from the open end 44 to the closed end 48. In certain examples, the closed ends 48 are defined by edges 49.

Referring to Figure 2, the notches 24, 26 are offset from the minor axis 16 and are positioned on opposite sides of the minor axis 16. For example, the notch 24 is positioned between the minor axis 16 and the rounded end 40 of the jacket 14 while the notch 26 is positioned between the minor axis 16 and the rounded end 42 of the jacket 14. In certain examples, the notches 24, 26 are positioned completely outside of a central boundary 56 defined between a first reference plane 58 (depicted in FIG. 2 as a vertical line) and a second reference plane 60 (depicted in FIG. 2 as a vertical line). The first reference plane 58 is positioned on one side of the minor axis 16 and is tangent to the core 20. The second reference plane 60 is positioned on an opposite side of the minor axis 16 and is tangent to the core 20. In the depicted example, the first and second reference planes 58, 60 are perpendicular relative to the major axis 18.

Suitable positioning of the inner edges 49 of the notches 24, 26 can facilitate stripping the jacket 14 from the core 20 and accessing the core 20 after

stripping. In certain examples, the edges 49 are positioned along a reference plane P that intersects the core 20. In the depicted example, the reference plane P intersects the edges 49 and also intersects the central longitudinal axis 12 of the core 20. The notches 24, 26 form a tear path aligned along the reference plane P.

5 For example, in certain implementations, a diagonal tear path is defined between the edges 49 of the notches 24, 26. The diagonal tear path 49 intersects the core 20. In the depicted example, the jacket 14 is provided with only one diagonal tear path.

10 In certain examples, the notches 24, 26 are laterally offset from one another so that the edges 49 are not positioned along a reference plane that is perpendicular relative to the major axis 18. In the example shown in FIG. 2, only one notch is provided at the top side 36 of the jacket 14 and only one notch is provided at the bottom side 38 of the jacket 14; the notches are provided on opposite sides of the minor axis 16.

15 In certain examples, the surfaces 50, 52 defining the notches 24, 26 are oriented at oblique angles relative to one another and intersect at edges 49. In certain examples, the edges 49 are offset from the minor axis 16. In certain examples, the edges 49 of the notches 24, 26 are offset on opposite sides of the minor axis 16 from one another.

20 Figure 3 shows another fiber optic cable 110 in accordance with the principles of the present disclosure. The fiber optic cable 110 has the same basic configuration as the fiber optic cable 10 except the jacket 14 is tightly extruded about the core 20 and no strength members 34 are provided between the core 20 and the jacket 14.

25 Figure 4 illustrates a further fiber optic cable 210 in accordance with the principles of the present disclosure. The fiber optic cable 210 includes top and bottom notches 24, 26 positioned on the same side of the minor axis 16. The notches 24, 26 are aligned along a reference plane 62 that does not intersect the core 20. The reference plane 62 is perpendicular relative to the major axis 18.

Figure 5 illustrates still another fiber optic cable 310 in accordance with the principles of the present disclosure. The fiber optic cable 310 includes two sets of notches 24, 26 positioned on opposite sides of the minor axis 16. The notches 24, 26 of the first set are positioned along a reference plane 64 that is offset to the left of the
5 minor axis 16 while the notches 24, 26 of the second set of notches is provided along a reference plane 66 that is offset to the right of the minor axis 16. The reference planes 64, 66 do not intersect the core 20 and are perpendicular relative to the major axis 18.

Figure 6 illustrates a further fiber optic cable 410 in accordance with the principles of the present disclosure. The fiber optic cable 410 includes top and bottom
10 notches 24', 26' positioned on opposite sides of a central boundary 56' defined between a first reference plane 58' and a second reference plane 60' positioned on opposite sides of and tangent to the central passage 32. In some implementations, the notches 24', 26' are offset from the central boundary 56'. Each of the notches 24', 26' has a first side 50 that converges with a second side 52' as the sides 50, 52' extend into the jacket 14. In
15 certain implementations, the second side 52' of each notch 24', 26' extends generally parallel with the minor axis 16 of the cable 410. In certain implementations, the second side 52' of each notch 24', 26' extends generally orthogonal with the major axis 18 of the cable 410.

The above specification provides examples of how certain inventive
20 aspects may be put into practice.

WHAT IS CLAIMED IS:

1. A fiber optic cable having a central longitudinal axis, the fiber optic cable comprising:
 - a jacket having a length that extends along the central longitudinal axis of the fiber optic cable, the jacket defining a transverse cross-sectional profile having a thickness and a width, the thickness being smaller than the width, the transverse cross-sectional profile of the jacket defining a major axis that extends across the width of the jacket and a minor axis that extends across the thickness of the jacket, the major and minor axes being perpendicular to one another and also being perpendicular to the central longitudinal axis of the fiber optic cable, and the major axis and the minor axis intersecting each other at the central longitudinal axis;
 - a core positioned within the jacket that extends along the central longitudinal axis, the core including at least one optical fiber; and
 - an open-sided notch defined by the jacket that extends along the length of the jacket, the open-sided notch being positioned at a location offset from the minor axis.
2. The fiber optic cable of claim 1, wherein the open-sided notch is defined by surfaces that are angled relative to one another and that converge as the surfaces extend into the jacket.
3. The fiber optic cable of claim 2, wherein the surfaces meet at an edge.
4. The fiber optic cable of claim 1, wherein the open-sided notch is provided outside of a boundary defined by first and second lines that are tangent to the core and that are perpendicular to the major axis.
5. The fiber optic cable of claim 1, wherein the open-sided notch is a first open-sided notch, wherein the jacket defines a second open-sided notch, and wherein the first

and second open-sided notches are arranged so as to both be intersected by a reference plane that is perpendicular to the major axis.

6. The fiber optic cable of claim 5, wherein the first and second open-sided notches have closed sides that define edges, and wherein the edges are aligned with the reference plane that is perpendicular to the major axis.

7. The fiber optic cable of claim 1, wherein the open-sided notch is a first open-sided notch, wherein the jacket defines a second open-sided notch, and wherein the first and second open-sided notches are arranged so as to both be intersected by a diagonal reference plane that intersects the core.

8. The fiber optic cable of claim 7, wherein the first and second open-sided notches have closed sides that define edges, and wherein the edges are aligned with the diagonal reference plane.

9. The fiber optic cable of claim 8, wherein the diagonal reference plane intersects the optical fiber.

10. The fiber optic cable of claim 7, wherein the jacket defines first and second sides separated by the thickness and first and second rounded ends separated by the width, wherein the first open-sided notch is defined at the first side of the jacket between the minor axis and the first rounded end of the jacket, wherein the second open-sided notch is defined at the second side of the jacket between the minor axis and the second rounded end, wherein a notch is not provided at the first side of the jacket between the minor axis and the second rounded end of the jacket, and wherein a notch is not provided at the second side of the jacket between the minor axis and the first rounded end of the jacket.

11. The fiber optic cable of claim 1, wherein the jacket is tightly extruded about the core.

12. The fiber optic cable of claim 1, wherein strength members including water swellable material are positioned between the core and the jacket.

13. A fiber optic cable having a central longitudinal axis, the fiber optic cable comprising:

a jacket having a length that extends along the central longitudinal axis of the fiber optic cable, the jacket defining a transverse cross-sectional profile having a thickness and a width, the thickness being smaller than the width, the transverse cross-sectional profile of the jacket defining a major axis that extends across the width of the jacket and a minor axis that extends across the thickness of the jacket, the major and minor axes being perpendicular to one another and also being perpendicular to the central longitudinal axis of the fiber optic cable, and the major axis and the minor axis intersecting each other at the central longitudinal axis;

a core positioned within the jacket that extends along the central longitudinal axis, the core including at least one optical fiber; and

a pre-defined jacket weakening arrangement defining a diagonal tear path aligned along a diagonal reference plane that intersects the core.

14. A fiber optic cable having a central longitudinal axis, the fiber optic cable comprising:

a jacket having a length that extends along the central longitudinal axis of the fiber optic cable, the jacket defining a transverse cross-sectional profile having a thickness and a width, the thickness being smaller than the width, the transverse cross-sectional profile of the jacket defining a major axis that extends across the width of the jacket and a minor axis that extends across the thickness of the jacket, the major and minor axes being perpendicular to one another and also being perpendicular to the central longitudinal axis of the fiber optic cable, the major axis and the minor axis

intersecting each other at the central longitudinal axis, the jacket defining first and second sides separated by the thickness and first and second rounded ends separated by the width;

a core positioned within the jacket that extends along the central longitudinal axis, the core including at least one optical fiber; and

a first weakened region that extends into the jacket from the first side of the jacket at a location between the minor axis and the first rounded end of the jacket and a second weakened region that extends into the jacket from second side of the jacket at a location between the minor axis and the second rounded end of the jacket, the first and second weakened regions including inner portions positioned along a diagonal reference plane that intersects the core.

15. The fiber optic cable of claim 14, wherein the diagonal reference plane intersects the optical fiber.

16. The fiber optic cable of claim 15, wherein the diagonal reference plane defines a tear path along which the jacket can be stripped from the core.

17. The fiber optic cable of claim 14, wherein the first and second weakened regions include open-sided notches.

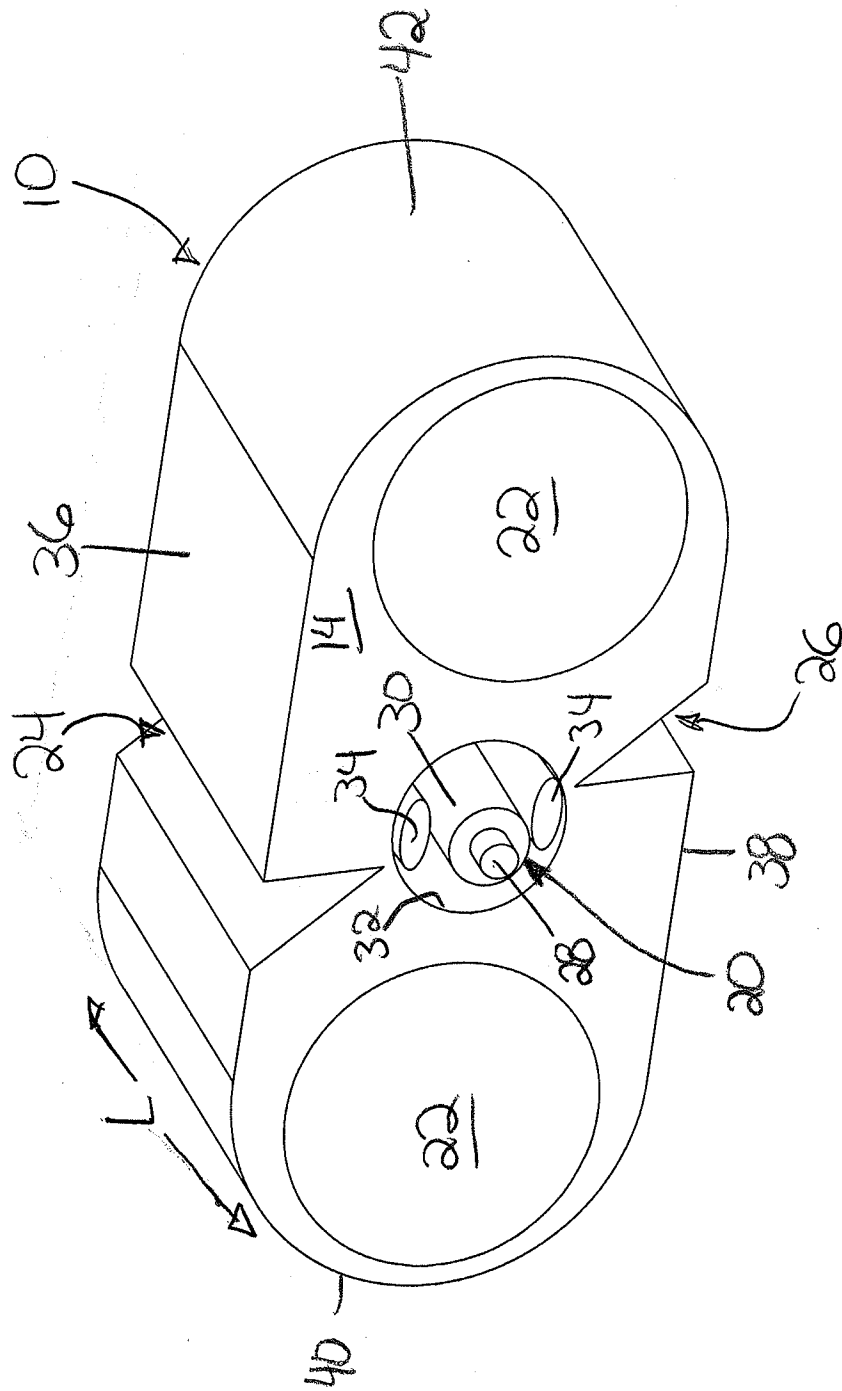
18. The fiber optic cable of claim 16, wherein the open-sided notches are defined by surfaces that are angled relative to one another and that converge toward each other as the surfaces extend into the jacket.

19. The fiber optic cable of claim 18, wherein the surfaces intersect at inner edges that form the inner portions of the first and second weakened regions.

20. The fiber optic cable of claim 14, wherein a weakened region is not provided at the first side of the jacket between the minor axis and the second rounded end of the

jacket, and wherein a weakened region is not provided at the second side of the jacket between the minor axis and the first rounded end of the jacket.

FIG. 1



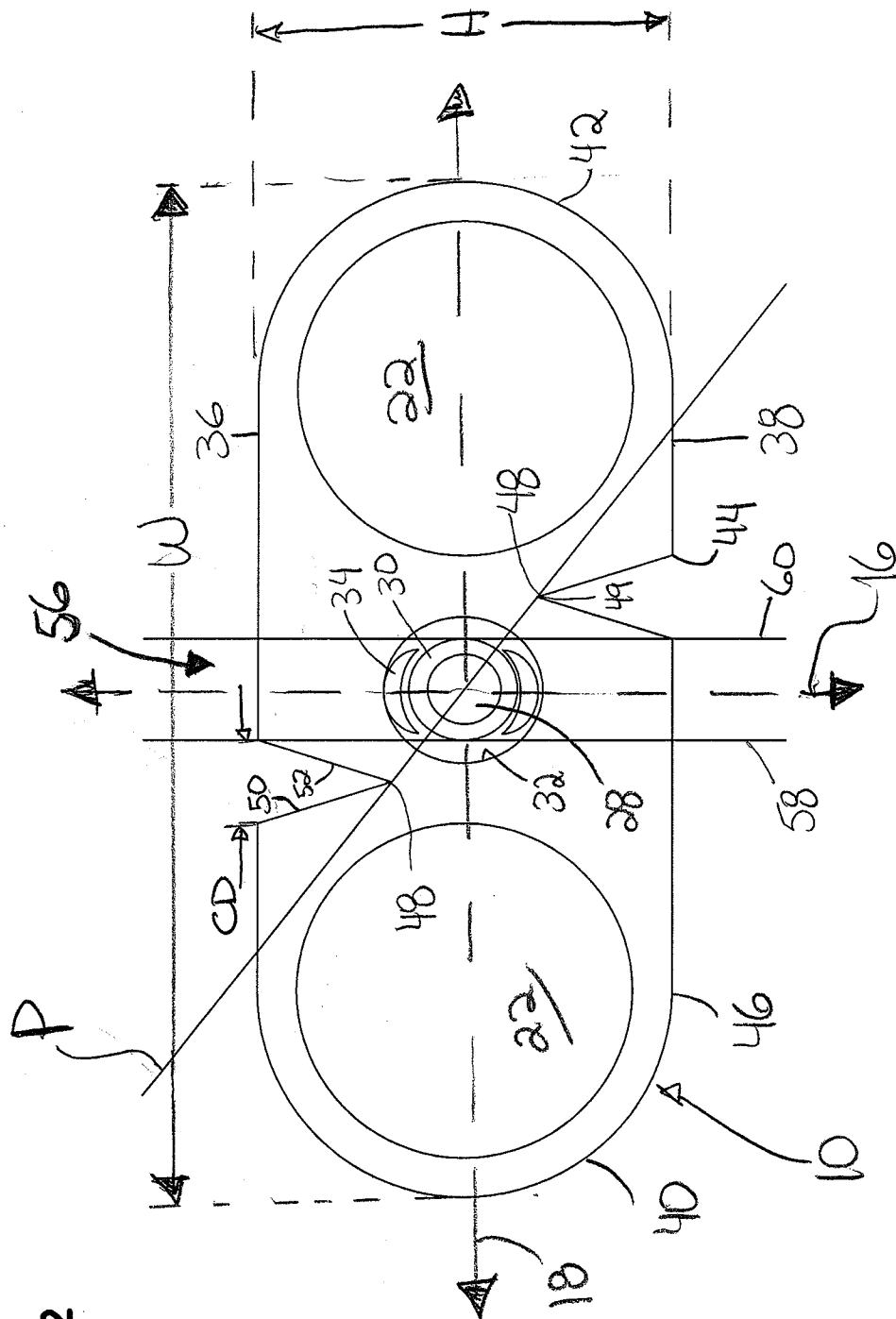


FIG. 2

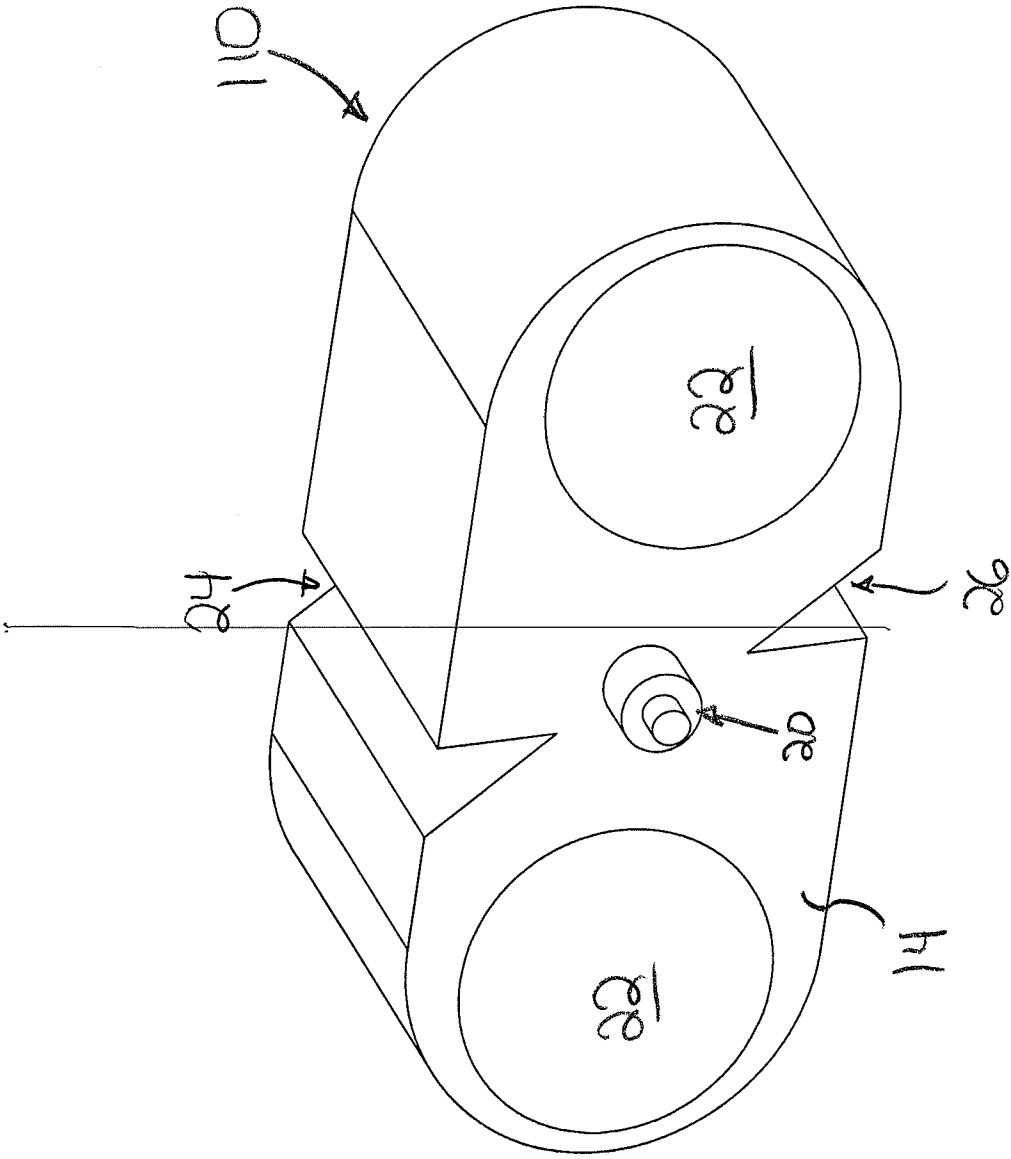
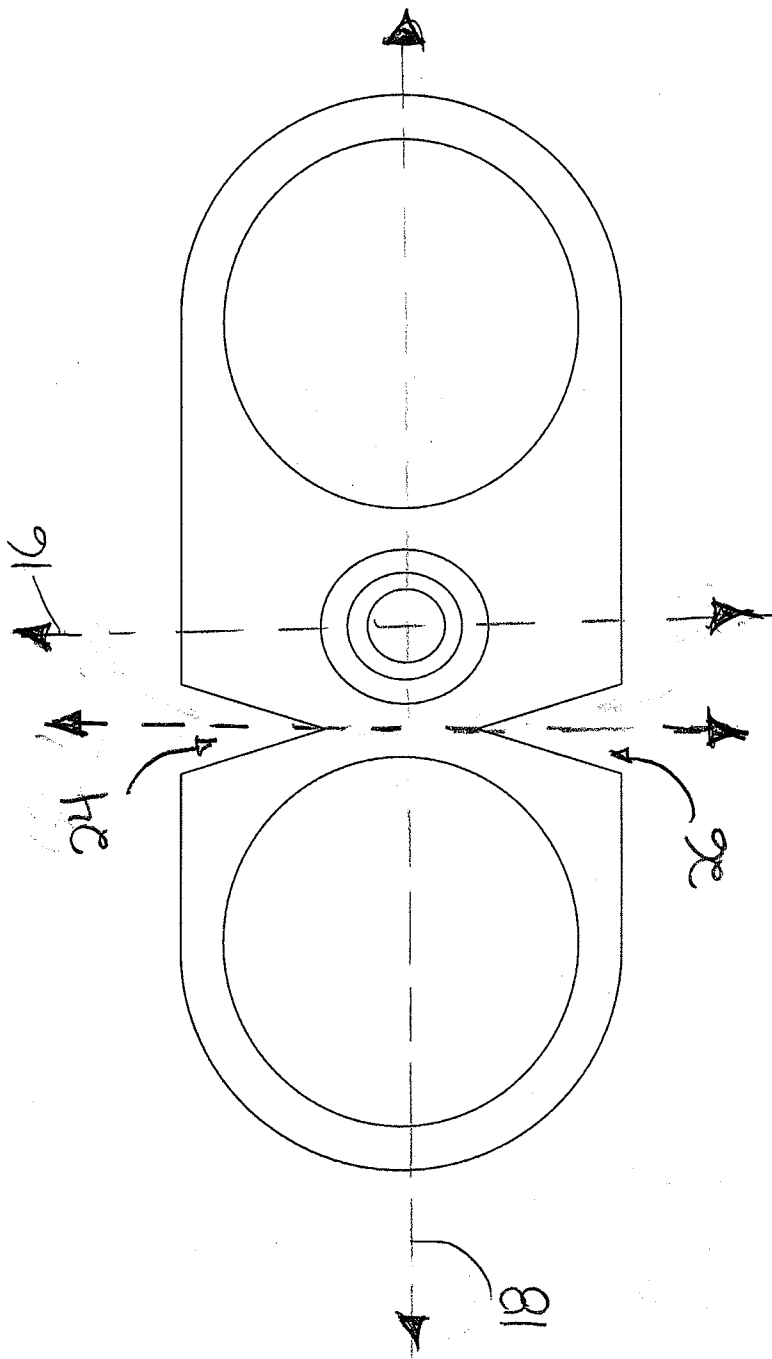


FIG. 3

FIG. 4



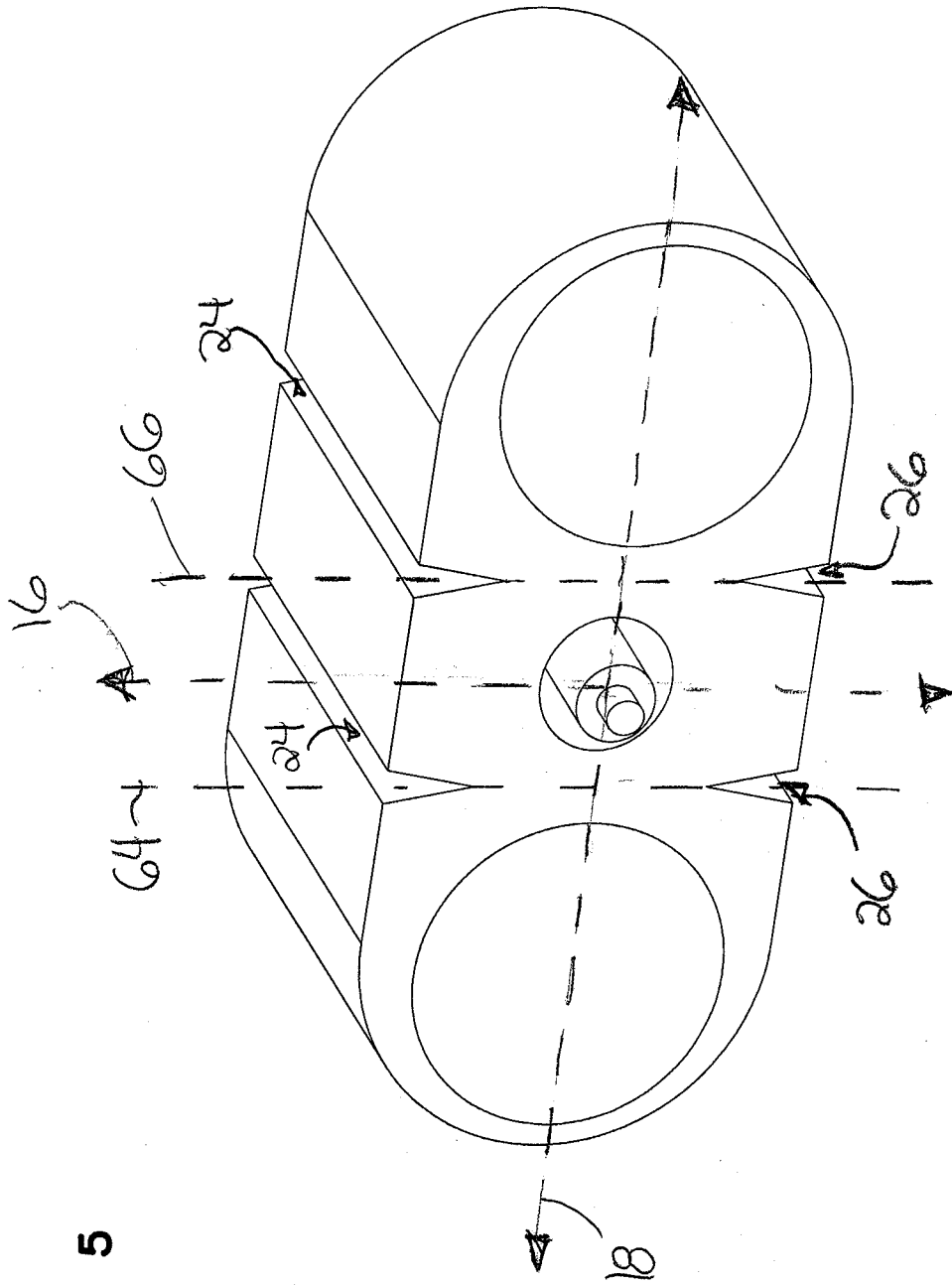


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/071119

A. CLASSIFICATION OF SUBJECT MATTER

G02B 6/44(2006.01)i

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 6/-

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)

CPRSABS;CNABS;VEN: fiber optical cable, jacket, sheath, notch, flat, drop, tear, stripping, wire

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 203025396U (FUTONG ZHUDIAN SPECIAL FIBER OPTIC CABLE) 26 June 2013 (2013-06-26) description, paragraphs 8 to 14, 24 to 27, figures 1, 2	1-4, 7-9, 11-13
Y	CN 203025396U (FUTONG ZHUDIAN SPECIAL FIBER OPTIC CABLE) 26 June 2013 (2013-06-26) description, paragraphs 8 to 14, 24 to 27, figures 1, 2	5, 6, 10, 14-20
Y	CN 202258546U (SHENZHEN NAISILONG OPTICAL FIBRE&CABLE CO LTD) 30 May 2012 (2012-05-30) description, paragraph 14, figure 1	5, 6, 10, 14-20
A	CN 202393952U (SHENZHEN SDGI OPTICAL NETWORK TECHNOLOGIES CO LTD) 22 August 2012 (2012-08-22) the whole document	1-20
A	CN 202522741U (JIANGSU TONGDING PHOTOELECTRIC CABLE GRO) 07 November 2012 (2012-11-07) the whole document	1-20

☐ 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	“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
“E”	earlier application or patent but published on or after the international filing date	“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
“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)	“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
“O”	document referring to an oral disclosure, use, exhibition or other means	“&”	document member of the same patent family
“P”	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

10 July 2014

Date of mailing of the international search report

29 July 2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report		Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	203025396U	26 June 2013	None	
CN	202258546U	30 May 2012	None	
CN	202393952U	22 August 2012	None	
CN	202522741U	07 November 2012	None	