



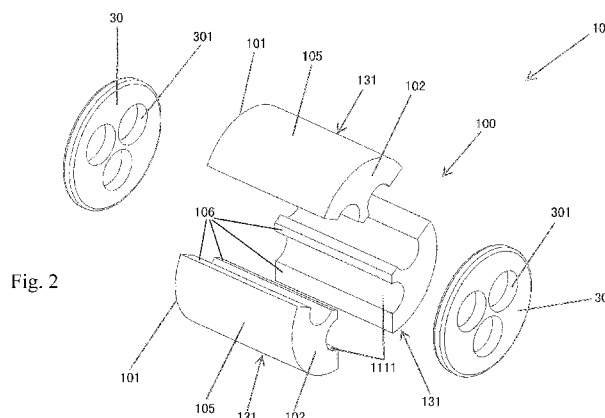
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- (54) Title:** CABLE ENTRANCE PORT ADAPTER AND METHOD OF MOUNTING CABLE IN ENTRANCE PORT OF ENCLOSURE



- (57) Abstract:** A cable entrance port adapter includes a body having a first end, a second end opposite to the first end, and at least one passage extending axially through the body from the first end to the second end and each adapted to receive a cable therein. The body further includes a plurality of separate pieces extending substantially axially from the first end to the second end and formed of a semisolid material, and the pieces are arranged such that each passage is formed by combining at least two pieces together.

CABLE ENTRANCE PORT ADAPTER AND METHOD OF MOUNTING CABLE IN ENTRANCE PORT OF ENCLOSURE

FIELD OF THE INVENTION

5 The present invention relates to a cable entrance port adapter and a method of mounting a cable in an entrance port of an enclosure.

BACKGROUND OF THE INVENTION

As telecommunication cables are routed across data networks, it is
10 necessary to periodically open the cable so that one or more telecommunication lines therein may be spliced or otherwise connected to other cables or “branches” and to be distributed across the telecommunication network. At each point where a telecommunication cable is opened, it is necessary to provide a telecommunication enclosure to protect the exposed interior of the cable. The cable branches may be
15 further distributed until the network reaches individual homes, businesses, offices, and so on. These networks are often referred to as fiber to the X (FTTX) networks which can include fiber to the premise (FTTP), fiber to the home (FTTH) and fiber to the antenna (FTTA) networks.

There is a need to maintain sufficient air tightness of the enclosure when a
20 cable is spliced or processed within the enclosure so that water, dust, even small animals like bugs can be prevented from entering into the enclosure to impact performance of the cable. A conventional cable entrance port adapter such as a grommet cannot maintain sufficient air tightness when a pressure difference is generated between an inside and an outside of the enclosure, e.g. by expansion or
25 contraction of air due to temperature variation.

In addition, a conventional cable entrance port adapter such as a grommet is generally suitable for only accommodating one cable of a fixed dimension and does not have satisfactory sufficient air tightness.

Therefore, there is a need to develop a cable entrance port adapter which
30 can accommodate one or multiple cables therein and maintain sufficient air tightness among the entry port of an enclosure and the cables.

SUMMARY OF THE INVENTION

The present invention has been made to overcome or alleviate at least one of the problems or disadvantages in the prior art.

In one aspect, the invention described herein provides a cable entrance port adapter comprising: a body having a first end, a second end opposite to the first end, and at least one passage extending axially through the body from the first end to the second end and each passage adapted to receive a cable therein, wherein the body comprises at least two separate pieces extending substantially axially from the first end to the second end and formed of a semisolid material, and the pieces are arranged such that each passage is formed by combining at least two pieces together.

In another aspect, the invention described herein also provides a method of mounting a cable in an entrance port of an enclosure comprising the steps of: providing at least two separate pieces formed of a semisolid material, wherein the pieces are configured to form a body having a first end, a second end opposite to the first end, and at least one passage extending axially through the body from the first end to the second end, and each passage has at least two axially-extending wall portions respectively formed on the at least two pieces; sandwiching at least one cable between the respective wall portions of the pieces; and combining the pieces together with the cable located in the passage.

20

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other. Like reference numerals designate corresponding similar parts.

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FIG. 1 is a schematic perspective view of a cable entrance port adapter according to an embodiment of the present invention;

FIG. 2 is an exploded perspective view of the cable entrance port adapter shown in FIG. 1;

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FIG. 3 is a schematic perspective view of the cable entrance port adapter shown in FIG. 1 through which three cables pass;

FIG. 4 is a schematic perspective view of the cable entrance port adapter shown in FIG. 1 which is mounted in a cable entry port of an enclosure;

FIG. 5 is an exploded perspective view of a body of the cable entrance port adapter shown in FIG. 1;

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FIG. 6 is an exploded perspective view of the cable entrance port adapter shown in FIG. 1 through which three cables pass;

FIG. 7 is an exploded perspective view of two plates of the cable entrance port adapter shown in FIG. 1;

5 FIG. 8 is a schematic perspective view of a cable entrance port adapter according to another embodiment of the present invention through which two cables pass; and

FIG. 9 is an exploded perspective view of a body of the cable entrance port adapter shown in FIG. 8.

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DETAILED DESCRIPTION OF THE EMBODIMENTS

A further description of the invention will be made as below with reference to embodiments of the invention taken in conjunction with the accompanying drawings.

15 As illustrated in FIGS. 1-6, an exemplary cable entrance port adapter 10 according to an embodiment of the present application is shown that can be fitted into a cable entry port 501 of an enclosure 50. The entry ports 501 are formed in a wall of the enclosure 50 as shown in FIG. 4.

 As illustrated in FIGS. 1-3 and 5-6, the cable entrance port adapter 10
20 according to the embodiment of the present application includes a body 100. The body 100 has a first end 101, a second end 102 opposite to the first end 101, and at least one passage 111 (FIG. 1) extending axially through the body 100 from the first end 101 to the second end 102 and adapted to receive an optical fiber cable 20 therein. While embodiments of the present disclosure are directed to a cable
25 entrance port adapter for use with an optical fiber cable, use of the present invention with electrical conductor cables and hybrid or composite cables which carry both electrical and optical conductors is considered within the scope of the current invention.

 As illustrated in FIGS. 1-3, and 5-6, the body 100 comprises a plurality of
30 separate pieces 131 (e.g. three pieces shown in Fig.2) extending substantially axially from the first end 101 to the second end 102 and formed of a semisolid material such as a thermoplastic semi-solid material, and the pieces 131 are arranged such that each passage 111 is formed by combining at least two pieces 131 together. The pieces 131 may be moulded from the semisolid material, for example by a tool such
35 as a portable manual tool, and then combined to form the body 100. Alternatively, the

separate pieces 131 may be molded in a factory and retain their shape even after several months at elevated temperatures like at 60°C. Thus, the pieces 131 can be assembled together to enclose the cables on site.

Each of the pieces 131 has an outer surface 105 constituting portion of an
5 outer peripheral surface 103 of the body 100 that is adapted to be in direct contact with an inner wall surface of the entry port 501 of the enclosure 50, and at least one internal or abutment surface 106. When the pieces 131 are combined together, the abutment surfaces 106 of the adjacent pieces 131 are in direct contact with each other. In addition, each of the pieces 131 has at least one axially-extending wall
10 portions 1111. The wall portion 1111 extends from the first end 101 to the second end 102. When the pieces 131 are combined together, the wall portions 1111 of the pieces 131 form the passages 111, and each of the wall portions 1111 of the pieces 131 has a surface adapted to be in direct contact with the corresponding cable 20. The semisolid material may have adhesive characteristic or self-adhesive
15 characteristic so that in use, the outer surfaces 105 of the pieces 131 adhere to the inner wall surface of the entry port 501 of the enclosure 50, the abutment surfaces 106 of the adjacent pieces 131 are adhere to each other, and the surfaces of the wall portions 1111 of the pieces 131 adhere to the corresponding cable 20.

For example, the semisolid material may be a jelly-like material or a gel-like
20 material. The semisolid material may have adhesive characteristic or self-adhesive characteristic. Preferably, the semisolid material has a peel adhesion of at least 0.3 N/mm. Alternatively, the semisolid material has a density of 1.0 to 1.5 g/cm³. Regarding pressurized sealing property, the semisolid material has almost no air leakage under the environment. For example, under a test of eight hour circles at 40
25 KPa, -40°C to 60°C, no air leakage can be detected. An example of the semisolid material is an adhesive non-vulcanized rubber or mastic material, for example a tape of adhesive non-vulcanized rubber, or a bar of adhesive non-vulcanized rubber. As an example, GSTM 125D re-enterable splice case sealant from General Sealants Company can be used in this disclosure as the semisolid material to prepare the
30 pieces 131.

The passage 111 can have an elliptical or circular cross sectional profiles although other profiles like polygon can be used that corresponds to the cross-section of the cable.

For example, when the body 100 has a shape of a circular cylinder, the
35 passages 111 can be disposed such that the centres of the passages 111 are

arranged on a circle. In this case, the planes for dividing the body 100 into the pieces 131 can be those that pass through the axis of the body 100 and the axes of the passages 111.

As illustrated in FIGS. 1-3, and 6-7, the cable entrance port adapter 10 may further comprise two plates 30 respectively disposed at the first and second ends 101, 102 to axially bound the body 100. Each plate 30 has a plurality of through holes 301 each corresponding to one of the passages 111 of the body 100. Plates 30 may have substantially the same shape as the body 100 when viewed in the axial direction. In addition, a diameter or cross section of the through hole 301 of the plate 30 may be substantially equal to or slightly less than that of passage 111 of the body 100, and the diameter or cross section of the through hole 301 of the plate 30 may be substantially equal to or slightly less than that of the cable 20. The plate 30 can keep the spacing between the cables 20 and maintain the body 100 in place.

Alternatively, the plates 30 of the cable entrance port adapter 10 according to the embodiment can be formed as plate portions (not shown) in the port 501 of enclosure 50. For example, when the body 100 has two passages 111, or the passages 111 are arranged in one row, and enclosure 50 comprises upper and lower enclosure portions, each of upper and lower enclosures can comprise projections at both ends of the port. When the upper and lower enclosure portions are connected to each other, the projections of the ports of the upper and lower enclosure portions form the plate portions corresponding to the plates 30.

Although the drawings show 3 passages 111, there may be one or two or more passages 111 according to practical needs. Accordingly, the body 100 may comprise two or more separate pieces 131. Thus, this cable entrance port adapter can accommodate one or multiple cables therein, consequently it enables one entry port of an enclosure to receive at least one cable to pass through. Meanwhile, as the semisolid material of the pieces is configured to be in direct contact with the inner wall surface of the entry port 501 of the enclosure and with the corresponding cable 20, sufficient air tightness among the entry port of an enclosure and the cables can be achieved accordingly.

As illustrated in FIGS 8-9, a cable entrance port adapter 10A according to an exemplary embodiment of the present invention includes a body 200 and two plates 30A. The body 200 comprises two separate pieces 231. Each of the pieces 231 has two axially-extending wall portions 2111 and an outer surface 205 constituting a portion of an outer peripheral surface 203 of the body 200. The two

pieces 231 can be assembled together to form two passages each accommodating one cable 20 there through.

As illustrated in FIG. 4, the cable entrance port adapter 10 according to the embodiment may be applied to any appropriate enclosure such as, 2178C, 2178CS
5 and 2178CE enclosures that are commercially available from 3M China Ltd.

A method of mounting a cable 20 in an entrance port 501 of an enclosure 50 according to an embodiment of the present invention will be described hereinafter.

Referring to FIGS. 1-6, a plurality of separate pieces 131 formed of a semisolid material is provided. A plurality of axially-extending wall portions 1111 are
10 formed on the respective pieces 131 in a way that when the pieces 131 are combined together, at least one passage 111 can be formed by the wall portions 1111. The wall portions 1111 extend from the first end 101 to the second end 102 of the separate pieces.

At least one cable 20, e.g. three cables 20 or two cables 20 and a plug, is
15 placed in the respective wall portions 1111 of the pieces 131 in the port adapter shown in Figs. 1-7, and next, the pieces 131 are combined together with the cable 20 so that the cables are sandwiched between the wall portions of adjacent separate pieces such that each cable is located and enclosed in one passage 111. In an exemplary aspect, when the pieces 131 are combined together, the abutment
20 surfaces 106 of the adjacent pieces 131 are in direct contact with each other, and optionally the surface of the wall portions 1111 of the pieces 131 are in direct contact with the cable 20.

The combined body 100 is placed in the entry port 501 of the enclosure 50 such that an outer peripheral surface 103 of the body 100 is in direct contact with an
25 inner wall surface of the entry port 501 of the enclosure 50.

In an exemplary aspect, before the pieces 131 are provided, the semisolid material is moulded into the pieces 131 to form the wall portions therein that will form the passages 111 when the separate pieces are assembled together. In another exemplary aspect, before the cable 20 is sandwiched between the respective wall
30 portions 1111 of the pieces 131, two plates 30 are provided and then the cable 20 is passed into the holes 301 of the plates 30. The pieces 131 are placed between the two plates 30 when the cable 20 is sandwiched between the respective wall portions 1111 of the pieces 131. If the plates 30 of the cable entrance port adapter 10 is formed as plate portions (not shown) in the port 501 of the enclosure 50, and for

example, the body 100 is divided into two separate pieces 131, it is not necessary to pass the cable 20 into the holes 301 of the plates 30.

5 The cable entrance port adapter 10 according to the embodiment utilizes the separate pieces 131 formed of the semisolid material. In an exemplary aspect, the semi-solid material can have a degree of compliance that allows it to readily wet and adhere to the surface of the cables as well as filling any gaps or voids in the port of the enclosure. As a result, the cable entrance port adapter 10 has a stable air tightness performance upon aging.

10 With the cable entrance port adapter 10 according to the embodiments of the present invention, the cable entrance port adapter 10 may have multiple passages and each can accommodate one cable, consequently one entry port of the enclosure can receive multiple cables, and thus a high density entry can be achieved. In addition, the cable entrance port adapter 10 has a low cost and can be easily mounted.

15 Furthermore, since the pieces 131 of the body 100 of the cable entrance port adapter 10 according to the embodiment of the present invention can be easily shaped in any size and can have excellent plasticity, the cable entrance port adapter 10 according to the embodiment of the present invention is suitable for cables of various sizes.

20 Although some embodiments for the general concept of the present disclosure have been shown and explained, the skilled person in the art will appreciate that modifications to the above embodiments can be carried out without departing from the spirit and principle of the present general inventive concept. The scope of the present disclosure should be defined by the appended claims and
25 equivalents thereof.

CLAIMS

1. A cable entrance port adapter (10) comprising:

a body (100) having a first end (101), a second end (102) opposite to the first end (101), and at least one passage (111) extending axially through the body (100) from the first end (101) to the second end (102) and adapted to receive a cable (20) therein,

wherein the body (100) comprises at least two separate pieces (131) extending substantially axially from the first end (101) to the second end (102) and formed of a semisolid material, and the pieces (131) are arranged such that each passage (111) is formed by combining at least two pieces (131) together.

2. The cable entrance port adapter (10) of claim 1, wherein the semisolid material is a jelly-like material or a gel-like material.

3. The cable entrance port adapter (10) of claim 1, wherein the semisolid material has adhesive characteristic or self-adhesive characteristic.

4. The cable entrance port adapter (10) of claim 1, wherein the semisolid material is an adhesive non-vulcanized rubber.

5. The cable entrance port adapter (10) of claim 1, wherein the semisolid material has a peel adhesion of at least 0.3 N/mm.

6. The cable entrance port adapter (10) of claim 1, further comprising two plates (30) respectively disposed at the first and second ends (101, 102) to axially bound the body (100), the plate (30) having at least one through hole (301) each corresponding to one passage (111) of the body (100).

7. The cable entrance port adapter (10) of claim 1, wherein the pieces (131) are moulded from the semisolid material and then combined to form the body (100)

8. The cable entrance port adapter (10) of claim 1, wherein each of the piece (131) has an outer surface (105) constituting an outer peripheral surface (103) of the body (100) and adapted to be in direct contact with an inner wall surface of an entry port (501) of an enclosure (50), and an abutment surface (106), wherein when the pieces (131) are combined together, the abutment surfaces (106) of the adjacent pieces (131) are in direct contact with each other.

9. The cable entrance port adapter (10) of claim 1 or 8, wherein each of the pieces (131) has an axially-extending wall portion (1111), and when the pieces (131)

are combined together, the wall portions (1111) of the pieces (131) form the at least one passage (111), and each of the wall portions (1111) of the pieces (131) has a surface adapted to be in direct contact with a cable (20).

10. A method of mounting a cable (20) in an entrance port (501) of an enclosure (50) comprising the steps of:

providing a plurality of separate pieces (131) formed of a semisolid material, wherein the pieces (131) are configured to combine to form a body (100) having a first end (101), a second end (102) opposite to the first end (101), and at least one passage (111) extending axially through the body (100) from the first end (101) to the second end (102), and each passage (111) has a plurality of axially-extending wall portions (1111) respectively formed on the at least two pieces (131);

sandwiching at least one cable (20) between the respective wall portions (1111) of the pieces (131); and

combining the pieces (131) together with the cable (20) located in the passage (111).

11. The method of claim 10, further comprising the step of:

moulding the semisolid material into the pieces (131) before the step of providing.

12. The method of claim 10, further comprising the step of:

providing two plates (30) each having at least one through hole (301) each corresponding to one of the passages (111) of the body (100), and then passing the cable (20) into the holes (301) of the plates (30), and

wherein in the step of sandwiching, the pieces (131) are placed between the two plates (30).

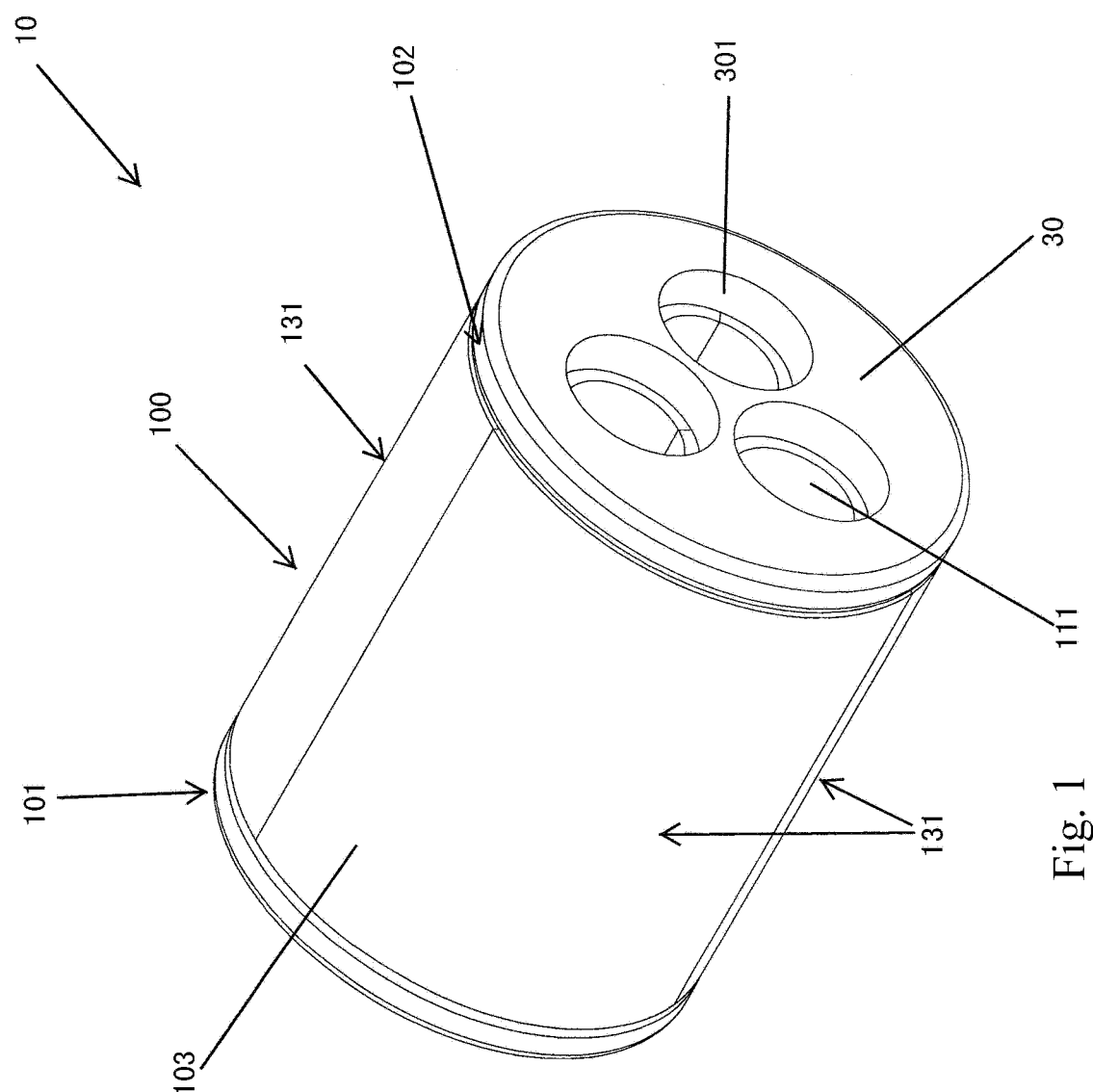
13. The method of claim 10, further comprising:

placing the combined body (100) in the entry port (501) of the enclosure (50) such that an outer peripheral surface (103) of the body (100) is in direct contact with an inner wall surface of the entry port (501) of the enclosure (50).

14. The method of claim 10, wherein each of the pieces (131) has an abutment surface (106), and in the step of combining, the abutment surfaces (106) of the adjacent pieces (131) are in direct contact with each other.

15. The method of claim 10 or 14, wherein each of the wall portions (1111) of the pieces (131) has a surface, and in the step of combining, the surface of the wall portions (1111) of the pieces (131) are in direct contact with the cable (20).

16. The method of claim 10, wherein the semisolid material is an adhesive
5 non-vulcanized rubber.



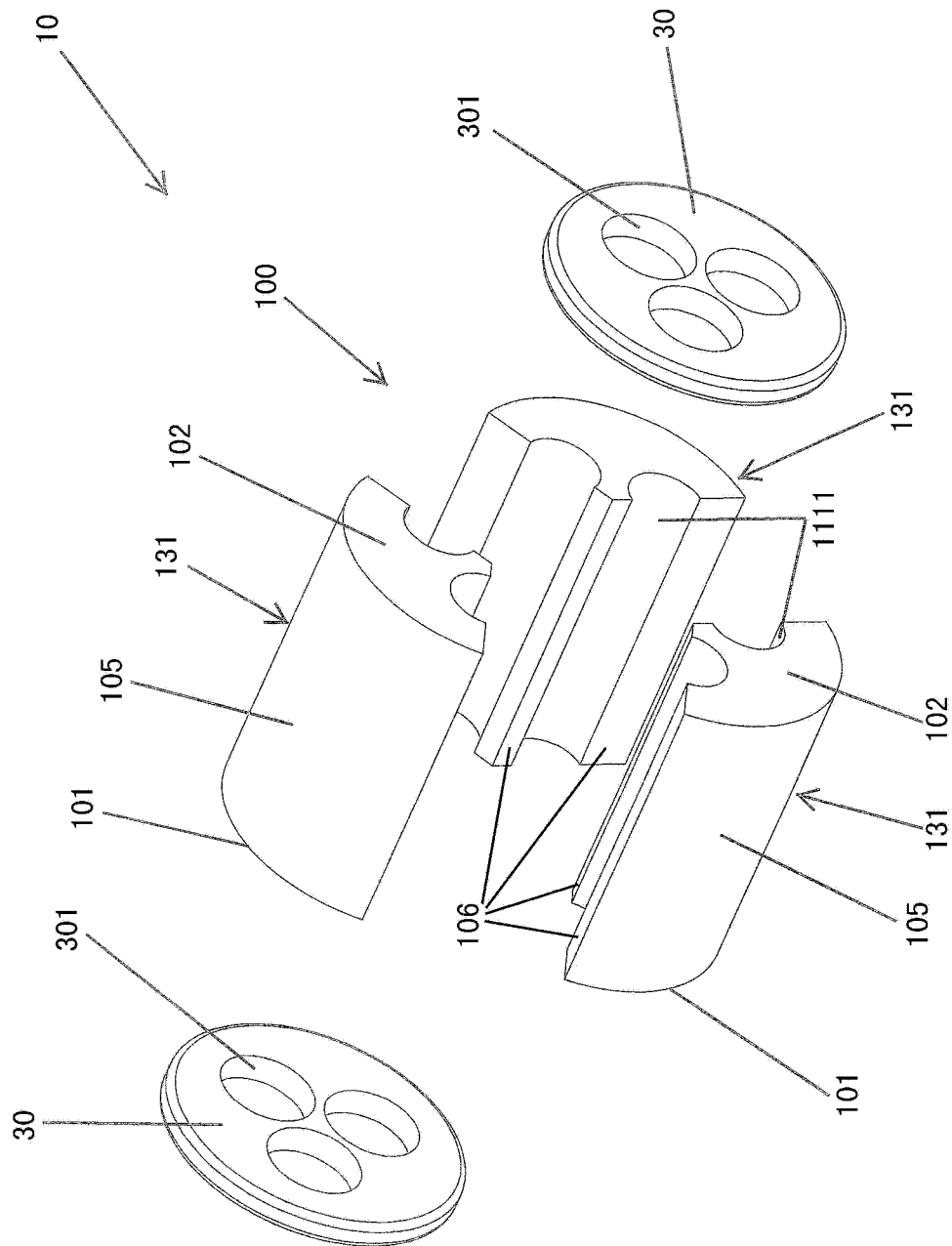


Fig. 2

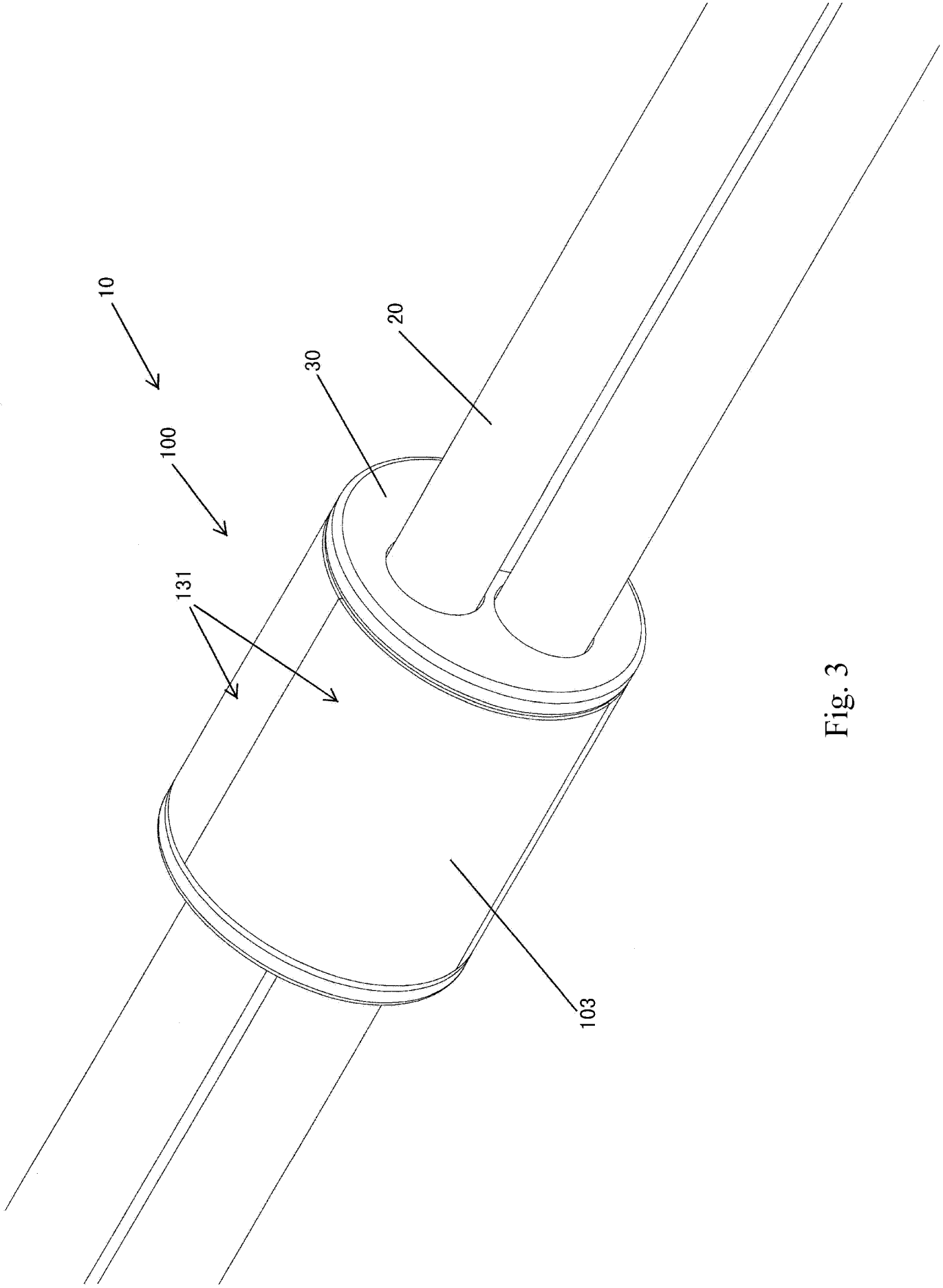


Fig. 3

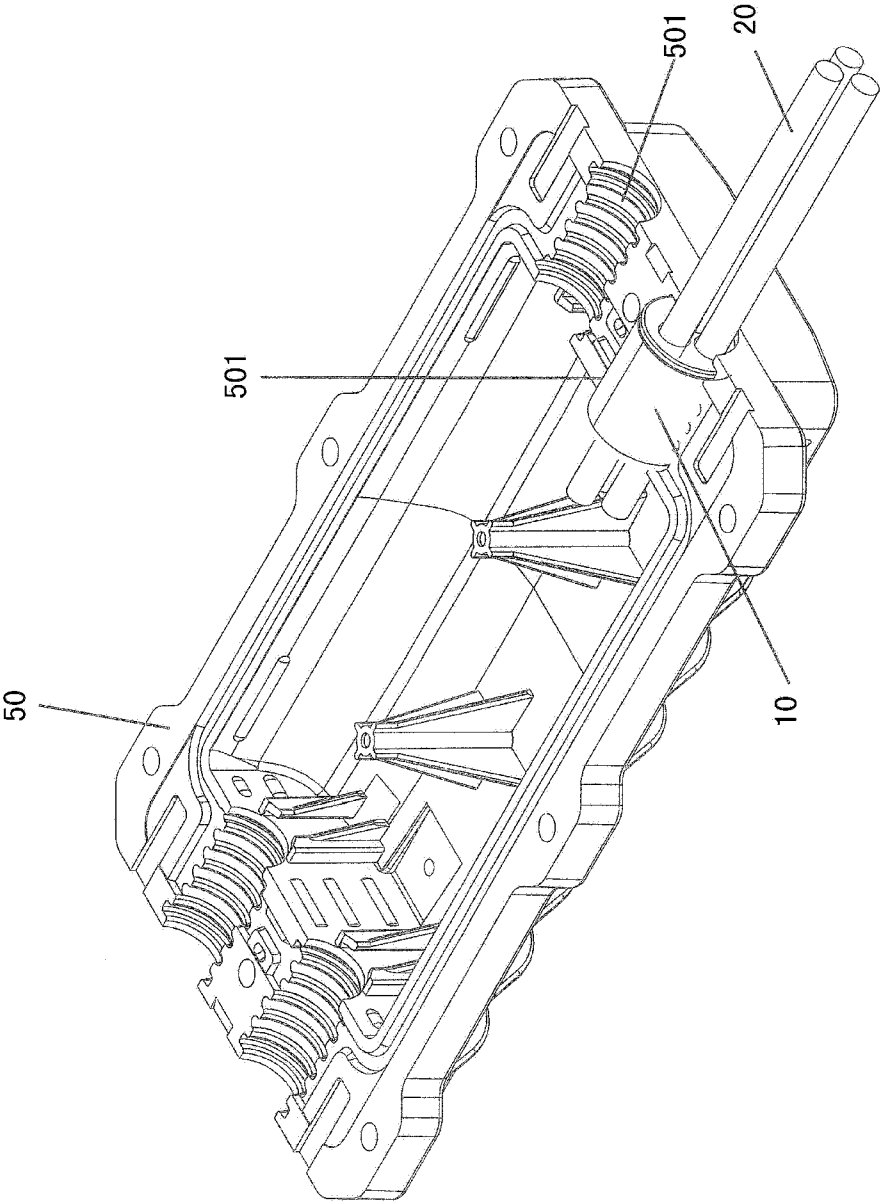


Fig. 4

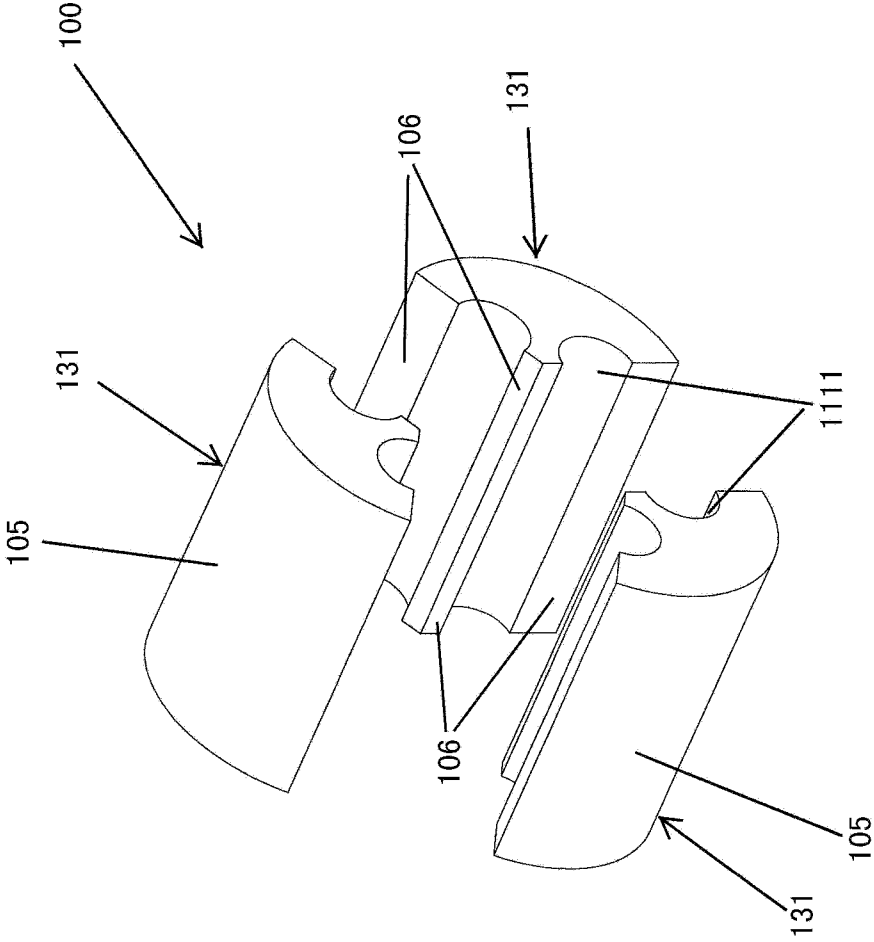


Fig. 5

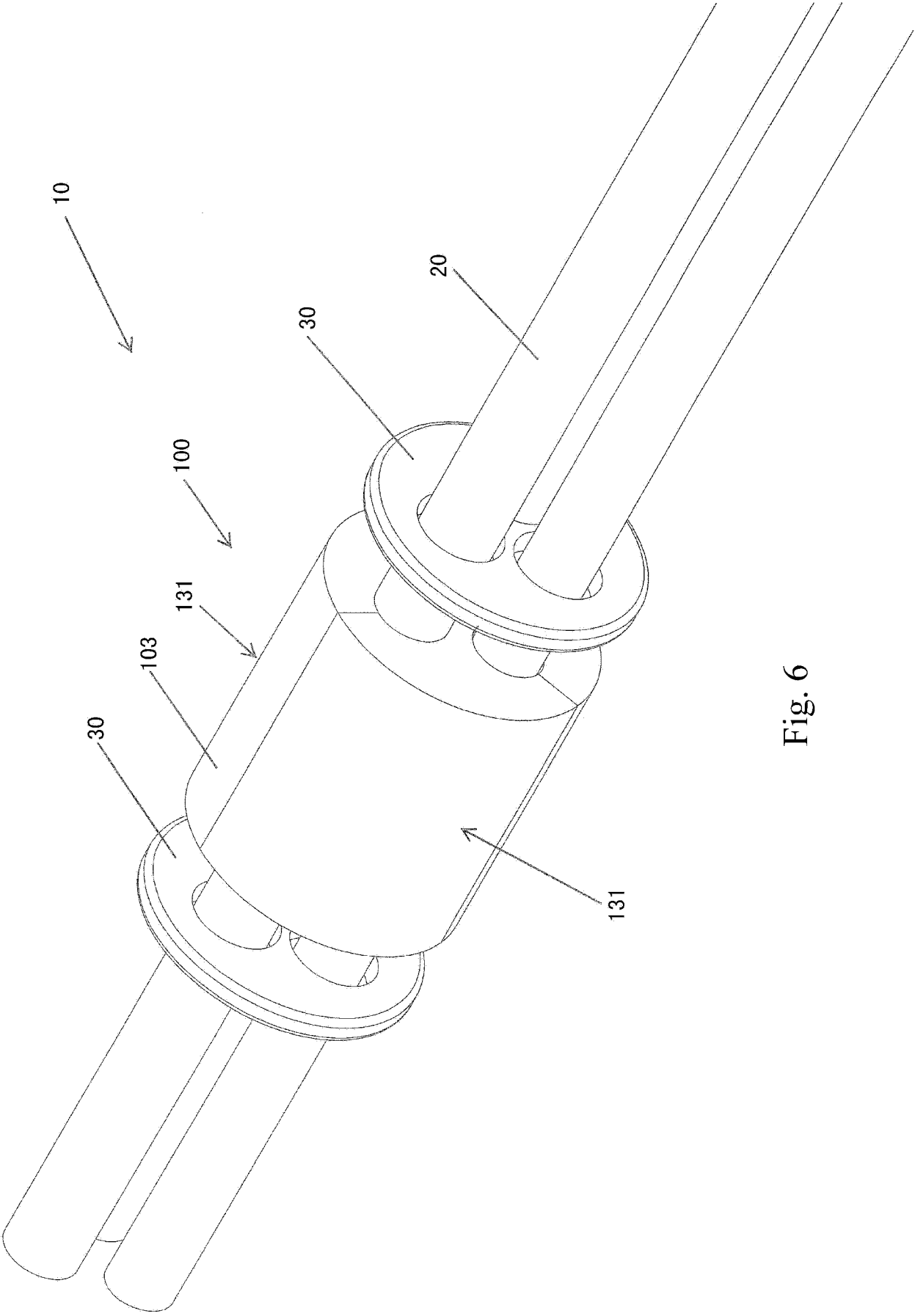


Fig. 6

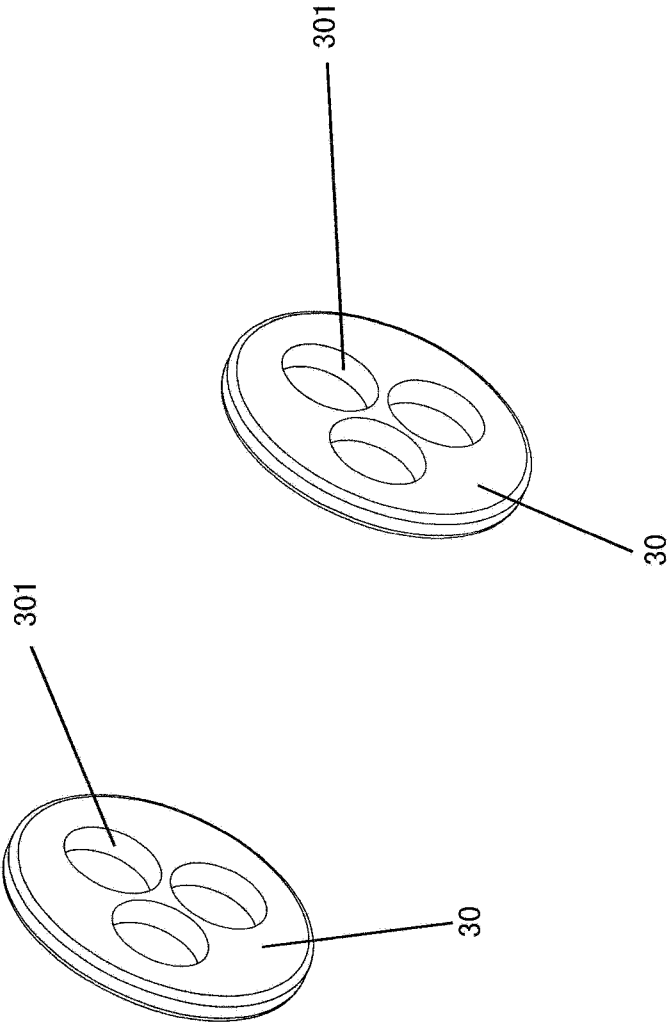


Fig. 7

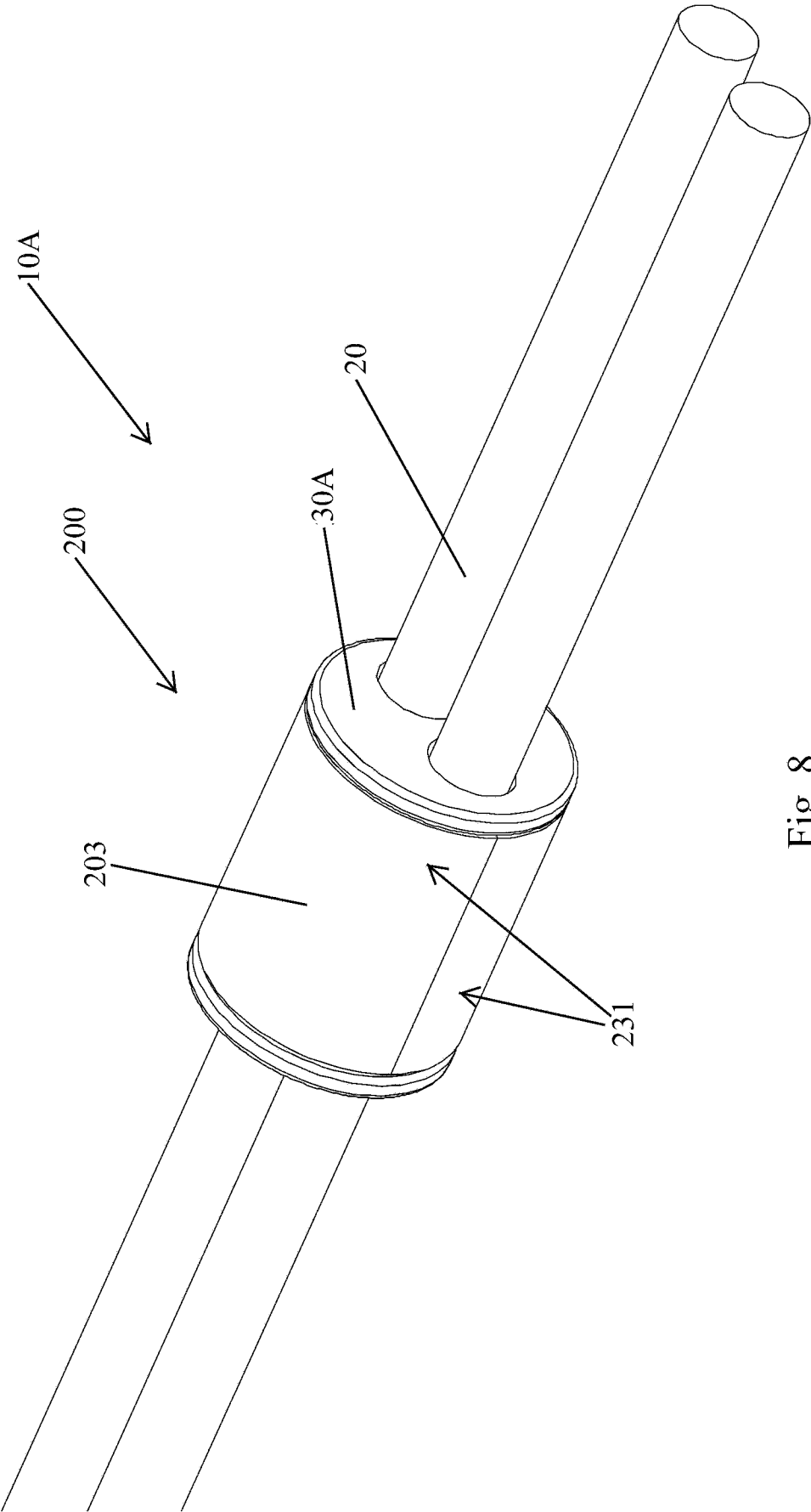


Fig. 8

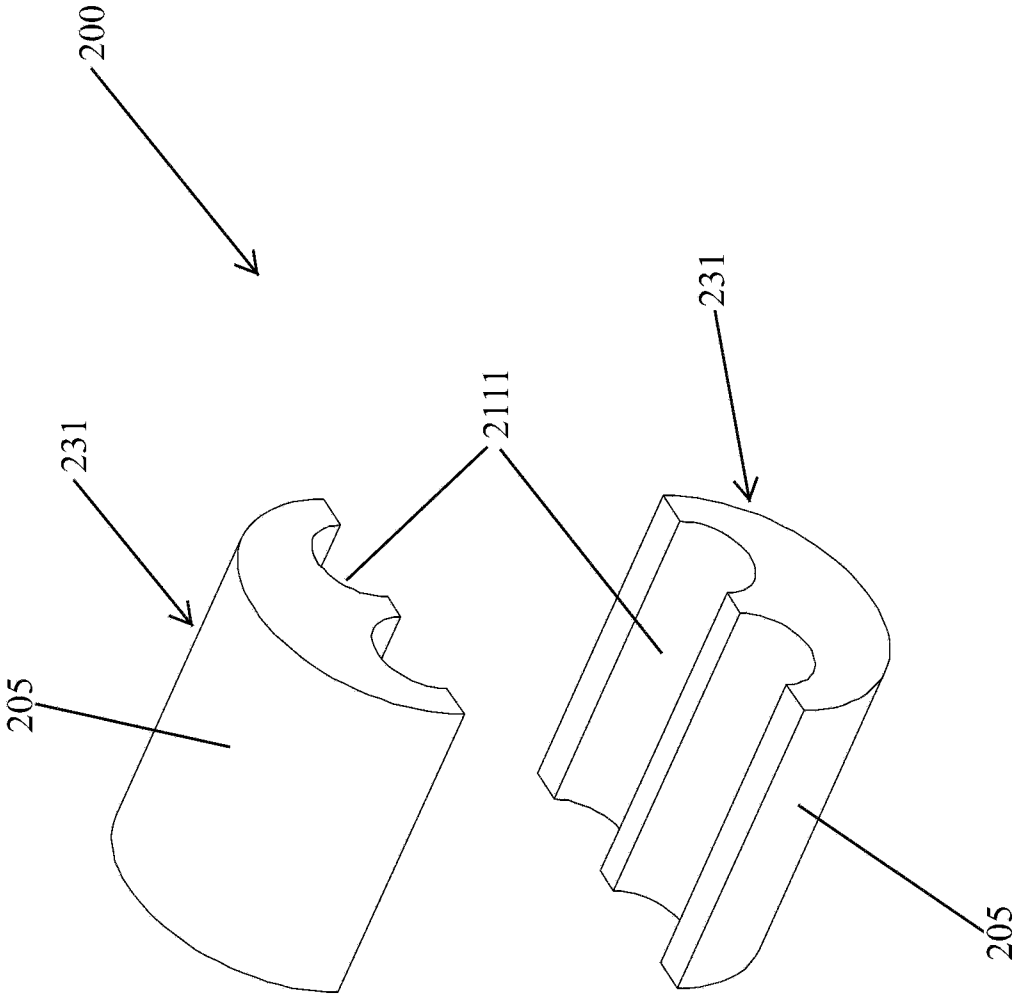


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2013/081653

A. CLASSIFICATION OF SUBJECT MATTER

H02G 15/013(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)

H02G;G02B

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)

WPI, EPODOC, CNPAT, CNKI: cable, adapter, end, body, passage, piece?, entrance, entry, axially, enclosure, semisolid, material, jelly, gel, adhesive

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1502156 A ((3M INNOVATIVE PROPERTIES COMPANY)) 02 June 2004 (2004-06-02) description, page 5, paragraph 12 to page 10, paragraph 4 and figures 1-10B	1-16
A	CN 101421894 A ((CCS TECHNOLOGY, INC.)) 29 April 2009 (2009-04-29) the whole document	1-16
A	US 2004/0256138 A1 ((PREFORMED LINE PRODUCTS COMPANY)) 23 December 2004 (2004-12-23) the whole document	1-16

☐ 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

16 April 2014

Date of mailing of the international search report

07 May 2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2013/081653

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