

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 April 2009 (16.04.2009)

PCT

(10) International Publication Number
WO 2009/047589 A1

(51) International Patent Classification:
H01R 13/52 (2006.01)

(21) International Application Number:
PCT/IB2007/055371

(22) International Filing Date: 12 October 2007 (12.10.2007)

(25) Filing Language: English

(26) Publication Language: English

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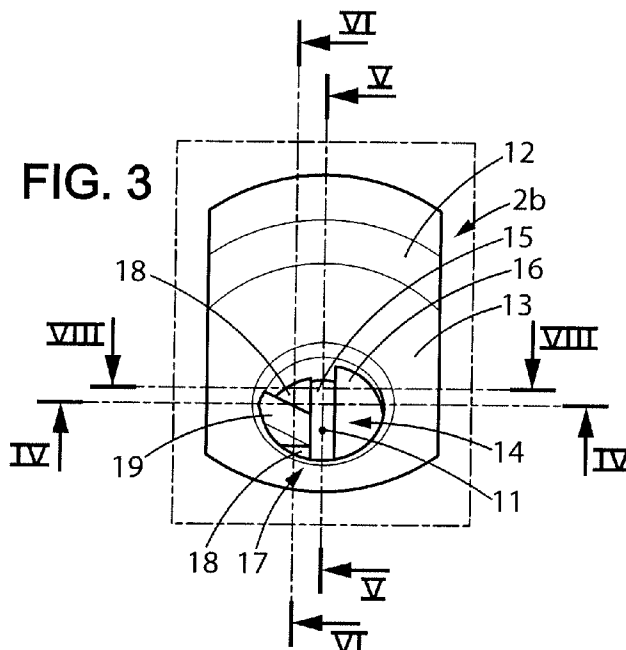
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

(54) Title: MAT SEAL JOINT FOR ELECTRICAL CONNECTOR



(57) Abstract: A mat seal joint (1) for an electrical connector, the joint comprising a body having through channels (2a, 2b) for retention therein of an electrical cable (9), at least one of the channels having a wall and a sealing membrane extending from the wall and sealing the channel against fluids, the membrane comprising a thin portion (15) torn upon insertion of an electrical member, and a thick portion (16), mechanically joining the thin zone to the wall, the membrane comprises an anti-sealant portion (17) whereby, in a failed state, fluids are allowed to flow through the channel.

MAT SEAL JOINT FOR ELECTRICAL CONNECTOR

FIELD OF THE INVENTION

The instant invention relates to mat seal joints
5 for electrical connectors.

BACKGROUND OF THE INVENTION

In automotive applications, electrical connectors comprising a mat sealing joint are used. Mat-type sealing joints (also known as "grommets") commonly used in the art
10 are integrally made of an elastomeric material, to efficiently protect electrical connection members at least from humidity and dust or other elements that could impair the normal behaviour of the connector or its performance. At least one electrical connection member is to be inserted
15 through a channel of the sealing joint. An electrical connection member typically comprises a metallic contact portion for electrical connection to a mating electrical connection element or circuit, and an opposite cable.

Since, in most connectors, not all the channels are
20 meant to receive an electrical connection member, membranes are provided in the channels to avoid the need for separate plugs to seal those of the channels which are unused. The membranes remain not pierced in the unused channels, thus avoiding the sealing of the joint to be impaired.

25 For example, EP 0 625 807 discloses a mat seal joint for an electrical connector, said joint comprising a body having a plurality of through channels each for insertion therein of an electrical cable and the channels being closed by membranes adapted to be torn upon insertion
30 of an electrical connection member.

Such electrical connectors are submitted to extensive testing to make sure that, during assembly, upon insertion of a connection member through the joint, the mechanical integrity of the latter is not impaired, which
35 would be detrimental to the sealing ability of the whole

seal.

Although the above-described mat seal joint is totally satisfactory in normal use, a problem has been encountered when one of the membranes has been erroneously
5 torn by the wrong insertion of an electrical member into a given channel. If this wrong insertion has been detected, and the wrongly inserted electrical member has been removed from the channel, for example for insertion into the proper channel, the membrane remains torn.

10 During the subsequent sealing ability tests, it will not necessarily be detected that the membrane was torn upon the wrong insertion. It is assumed that the compression of the non-occupied channel by the occupied neighbouring channels will compress the material of the
15 membrane, thus leaving its tearing undetected. However, during the life time of the sealing joint, it is likely that the torn membrane will eventually not provide a good sealing ability, for example due to tear propagation or membrane material aging at the tearing. This will result in
20 a lower life time of the joint and of the whole connector.

It is therefore an object of this invention to provide a mat seal joint which will not pass the sealing ability tests when a membrane has been unduly torn.

SUMMARY OF THE INVENTION

25 To this aim, it is provided a mat sealing joint according to claim 1.

With these claimed features, the geometry of the membrane ensures that a gap will be provided, so that the tearing of the membrane will be detected at the sealing
30 ability test.

In some embodiments, one might also use one or more of the features as defined in claims 2-9, considered either in combination or independently.

BRIEF DESCRIPTION OF THE DRAWINGS

35 Other characteristics and advantages of the

invention will readily appear from the following description of five of its embodiments, provided as non-limitative examples, and of the accompanying drawings.

On the drawings :

- 5 - Fig. 1 is an exploded view of a connector shown without any electrical member,
- Fig. 2 is a partial perspective view of an example of an electrical member for the connector of Fig. 1,
- 10 - Fig. 3 is a detailed top view of a membrane according to a first embodiment, in a rest condition,
- Fig. 4 is a sectional view along line IV-IV of Fig. 3, which passes through the protruding portion,
- Fig. 5 is a sectional view along line V-V of
- 15 Fig. 3,
- Fig. 6 is a sectional view along line VI-VI of Fig 3 in a failed state of the joint,
- Fig. 7 is a sectional view identical to Fig. 4 in the failed state,
- 20 - Fig. 8 is a sectional view along line VIII-VIII of Fig. 3, which passes through the base portion, in the failed state,
- Fig. 9, 10, 11, 12 are views identical to Fig. 3 for a second, third, fourth, fifth embodiment respectively.
- 25 On the different figures, the same reference signs designate like or similar elements.

DETAILED DESCRIPTION

Fig. 1 is an exploded view of an electrical connector. This connector comprises a housing 5 made of an

30 electrically insulating material such as glass-fiber reinforced poly-butylène terephthalate (PBT). The housing comprises a front part 6 arranged in columns and rows of passageways 4 for receiving electrical connection members to be described in further details later on. The housing

35 also comprises a back part 3, for receiving a sealing

device 1 and a grid 7 each one of which comprising passageways corresponding to the passageways 4 of the housing.

5 A sealing device such as a mat sealing joint 1 is inserted between the front part 6 of the housing and the grid 7. The mat sealing joint will be described later in more details.

The mat sealing joint 1 is for example made of a soft deformable quasi incompressible material such as
10 Liquid Silicone Rubber. A suitable example could be a material provided by GE-Bayer under reference Silopren 3596/30 (30 Shores A). The above material also has an auto-lubricating property provided by an oil content of 5%, thereby facilitating the contact insertion.

15 Depending on the application requirements, other materials such as Heat Curing Rubbers (HCR), Silicone or Ethylene Propylene Diene Monomers (EPDM), thermoplastic elastomers (ETP), or others, could also be used for the sealing joint 1.

20 The sealing joint 1 comprises an upper face for insertion of the electrical members and an opposing lower face. In the described example, two series of channels 2a, 2b are defined in the mat sealing joint, a first series comprising broad channels 2a of about 1.5 mm minimal
25 diameter for receiving thick electrical connection members for insertion into broad passageways 8a of the housing, an a second series comprising narrow channels 2b of about 1 mm (or less) minimal diameter for receiving thin electrical connection members for insertion into small passageways 8b
30 of the housing. The dimensions of the joint, the number of series and the number, positions and sizes of channels of the joint and of the passageways of the grid are related to the passageways of the housing, depending on the application required for the connector. The dimensions,
35 positions and sizes pictured on Fig. 1 are only exemplary

and could vary from one mat sealing joint to another.

In the present example of a female connector, an electrical member 21 as shown on Fig. 2 comprises a terminal portion 22 inserted into the passageway 8b of the front part 6 of the housing, for connection with a mating male contact.

This terminal portion extends from a cable element 9 which comprises an insulating sheath 10 which extends through the housing to the outside of the housing. The sheath 10 comprises a first junction portion 10a located proximate to the terminal portion, and a more remote external portion, or sheath body, designed to extend outside of the connector for connection to another electric equipment. Fig. 2 shows an electrical member for insertion through a narrow passageway 8b. Electrical members for insertion through the broad passageways 8a can be of similar construction.

In the example embodiment, the contacts to be inserted into the broad passageways 8a have a somehow rectangular section of 2.40 millimetres (mm) times 2.70 mm.

Fig. 3 is a top perspective view of a part of the sealing joint over a narrow channel 2b. The channel 2b extends for example partly axisymmetrically about a symmetry axis 11 from the insertion face of the sealing joint to the extraction face of the sealing joint. The channel 2b is defined by a partly axisymmetric wall 12, from which projects a first lip 13, and for example one or more other lips (not shown) below the first lip 13. The lips are sized to tightly encircle and maintain the sheath of the electrical member inside the channel in a fluid-tight manner. The words "above" and "below" are used here to describe the connector as shown on Figure 1, with the insertion face of the joint on top, and its extraction face on the bottom, but do not exclude the fact that the connector could be mounted in another orientation in its

operating environment.

A membrane 14 is disposed in the channel 2b, for example carried by the first lip 13. The membrane is adapted to be torn at insertion of the contact member 21.

5 The membrane principally extends in a transverse plane, which is substantially orthogonal to the longitudinal axis 11 of the channel. It comprises a thin portion 15, which is the thinnest portion of the membrane, and is the one adapted to be torn upon insertion of the
10 electrical member. The thin portion 15 is for example substantially rectangular and extends along a longitudinal line in the transverse plane.

 On the right side of this longitudinal line on Fig. 3, a thick portion 16 extends with a substantially constant
15 cross-section between the lip 13 and the thin portion 15.

 On the left side of the thin portion 15 on Fig. 3, the membrane comprises an anti-sealant portion 17. In the present example, the anti-sealant portion 17 comprises a base portion 18 from which a protruding portion 19
20 protrudes upwards. As can be seen in particular on the cross-sectional view of Fig. 4, the base portion 18 itself protrudes both upwards and downwards with respect to the thin portion 15. In the present example, the protruding portion 19 extends centrally, along an axis substantially
25 perpendicular to said longitudinal line, between two symmetrical base portions 18. The protruding portion 19 and the thick portion 16 both extend above the thin portion 15. The protruding portion 19 has a slanted profile which provides a continuous slope substantially from the base
30 portion 18 to the lip 13.

 Below with reference to Fig. 6, 7 and 8, we consider a failed state of the channel, in which the thin portion 15 of the membrane is torn, in which there is no electrical connection member extending inside the channel,
35 and in which some other channels receive electrical

connection members. Such a state could occur when an electrical connection member was wrongly inserted into the channel, thereby tearing the membrane, and was subsequently removed upon detection of the wrong insertion. In this state, the channel is compressed by the neighbouring channels, and by the locking of the grid 7 onto the back part 3 of the housing 5, whereby, as shown in particular on Fig. 7, the thick portion 16 is brought to rest onto the protruding portion 19 of the anti-sealant portion. As will be understood from Fig. 8, the central portion of the thick portion 16 will have its lower face which is supported by the upper slanted face of the protruding portion 19. Yet, at the base portions 18, the thick portion 16 does not rest on the base portion 18, due to the elasticity of the material constituting the membrane. Therefore, a gap G remains between the thick portion 16 and the anti-sealant portion 17 at its base portion 18, thereby allowing a flow of fluid therethrough.

In a later sealing ability test, upon which the sealing ability of the connector is tested, it is thereby ensured that the sealing joint will not erroneously show a sealing ability and pass the test. Indeed, without the slanted shape of the protruding portion 19, the thick portion 16 may rest along its whole length over the base portion 18 and simulate a sealing ability. Unlikely, with the invention ensures that only joints with inviolated membranes (for channels not receiving a cable element), and consequently with lasting sealing ability, will pass the test.

Figs. 9 to 12 provide other examples of anti-sealant portions for membranes of sealing mat joints. On Fig. 9, the protruding portion 19 comprises two different portions 19a, 19b of different slopes. For example, the slope of portion 19b is steeper than the slope of the portion 19a.

As can be seen on Fig. 10, in another embodiment, the protruding portion 19 is not provided with a slope at all, but extends as a finger from the rib.

Further, in another embodiment, as shown on Fig. 11, the protruding portion 19 does not necessarily have a straight profile parallel to the longitudinal line of the thin portion 15. It could, for example, be provided with a triangular profile.

As shown on Fig. 12, in another embodiment, further to having a triangular profile, the protruding portion 19 could also have a slope such as in the first embodiment.

In the described embodiments, the membrane 14 is carried by the first lip 13. However, the membrane could extend directly from the external wall 12 of the channel.

Further, the geometry of the thin portion 15, the thick portion 16 and the anti-sealant portion 17 are illustrative only, and are not intended to limit the invention to the described embodiments.

CLAIMS

1. A mat seal joint (1) for an electrical connector, said joint comprising a body having a plurality
5 of through channels (2a, 2b) for insertion therein of an electrical cable (9),

at least one of the channels having a wall (12) and a sealing membrane (14) extending from the wall and sealing the channel against fluids,

10 the membrane comprising a thin portion (15) adapted to be torn upon said insertion in the channel of an electrical member (21) comprising said electrical cable, and a thick portion (16), thicker than said thin portion, mechanically joining the thin portion to the wall,

15 wherein the membrane comprises an anti-sealant portion (17) adapted to maintain a gap (G) through the torn membrane, in a failed state in which the membrane is torn, in which an electrical cable is absent from the channel, and in which the wall is in a compressed state, so as to
20 allow fluids to flow therethrough.

2. A mat seal joint according to claim 1, wherein the anti-sealant portion (17) comprises a base portion (18) and a protruding portion (19), protruding relative to the base portion, and wherein, in the failed state, the thick
25 portion (16) of the membrane rests on the protruding portion (19), and is spaced apart from the base portion (18).

3. A mat seal joint (1) for an electrical connector, said joint comprising a body having a plurality
30 of through channels (2a, 2b) each for insertion therein of an electrical cable,

at least one of the channels extending along a longitudinal axis (11), and having a wall (12) and a sealing membrane (14) extending from the wall and sealing
35 the channel against fluids,

the membrane comprising a thin portion (15) adapted to be torn upon said insertion in the channel of an electrical member (21) comprising said electrical cable, and a thick portion (16), thicker than said thin portion, mechanically joining the thin portion to the wall,

wherein the membrane comprises an anti-sealant portion (17) comprising a base portion (18) and a protruding portion (19), protruding relative to the base portion whereby, in a failed state in which the membrane is torn, in which an electrical cable is absent from the channel, and in which the wall is in a compressed state, the thick portion (16) of the membrane rests on the protruding portion (19), and is spaced apart from the base portion (18) along the longitudinal axis (11) so as to define a gap (G) through which fluids are allowed to flow.

4. A mat seal joint according to claim 2 or 3, wherein the protruding portion (19) has a slanted slope from said thin portion (15) of the membrane toward said wall (12).

5. A mat seal joint according to any preceding claim, wherein said membrane (14) is to be torn along a longitudinal line in a transverse plane transversal to a longitudinal axis (11) of the channel, wherein the thick portion (16) and the anti-sealant portion (17) extend each on a respective side of the longitudinal line.

6. A mat seal joint according to claim 5, wherein the thick portion (16) and the anti-sealant portion (17) extend on the same side with respect to the transverse plane.

7. A mat seal joint for an electrical connector, said joint comprising a body having a plurality of through channels (2a, 2b) each for insertion therein of an electrical cable (19),

At least one of the channels having a wall (12) and a sealing membrane (14) extending from the wall in a

transverse plane and sealing the channel against fluids,

the membrane comprising a thin portion (15) adapted to be torn along a longitudinal line upon insertion in the channel of an electrical member (21) comprising said
5 electrical cable (9), and a thick portion (16), thicker than said thin portion, mechanically joining the thin portion (15) to the wall (12),

wherein the membrane (14) comprises an anti-sealant portion (17), the thick portion and the anti-sealant
10 portion extending each on a respective side of the longitudinal line, and on the same side with respect to the transverse plane, whereby, in a failed state in which the membrane is torn, in which an electrical cable is absent from the channel, and in which the wall is in a compressed
15 state, a gap (G) is maintained through said torn membrane by the anti-sealant portion, so as to allow fluids to flow therethrough.

8. A mat seal joint according to any preceding claim wherein the channel (2a) comprises at least a rib
20 (13) protruding from said wall, said rib being sized to tightly seal an electrical cable in the joint and said membrane (14) being carried by said rib (13).

9. An electrical connector comprising a mat seal joint according to any preceding claim, and an electrical
25 member (21) comprising an electrical cable (9), said electrical cable extending through said channel.

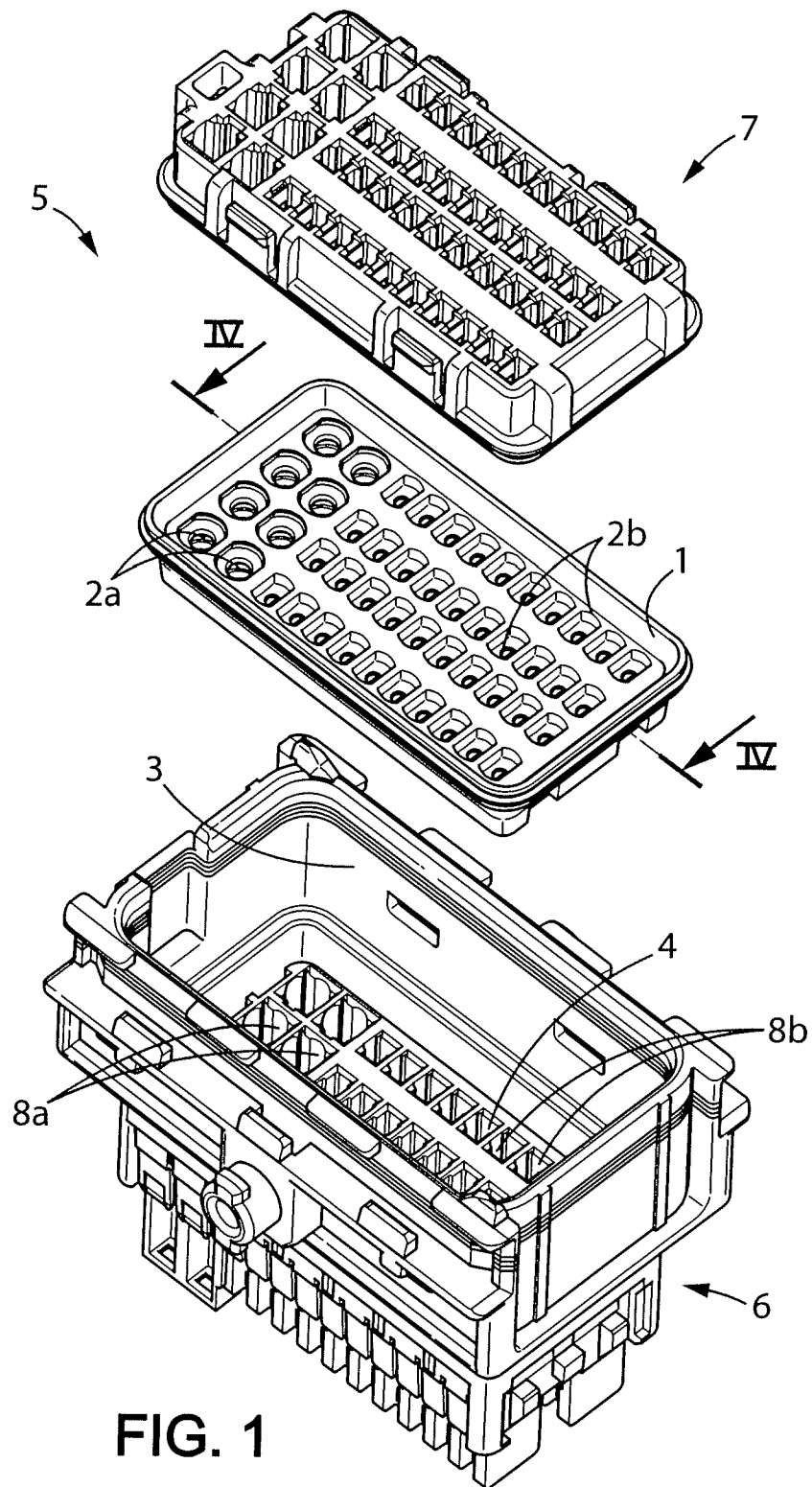
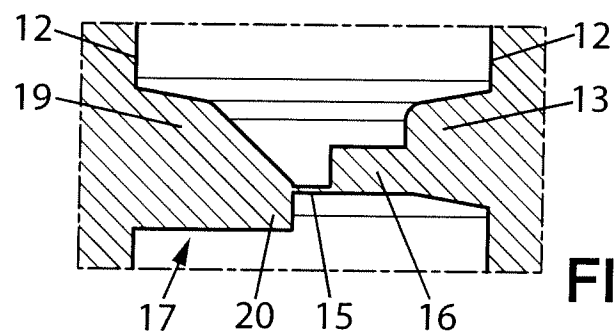
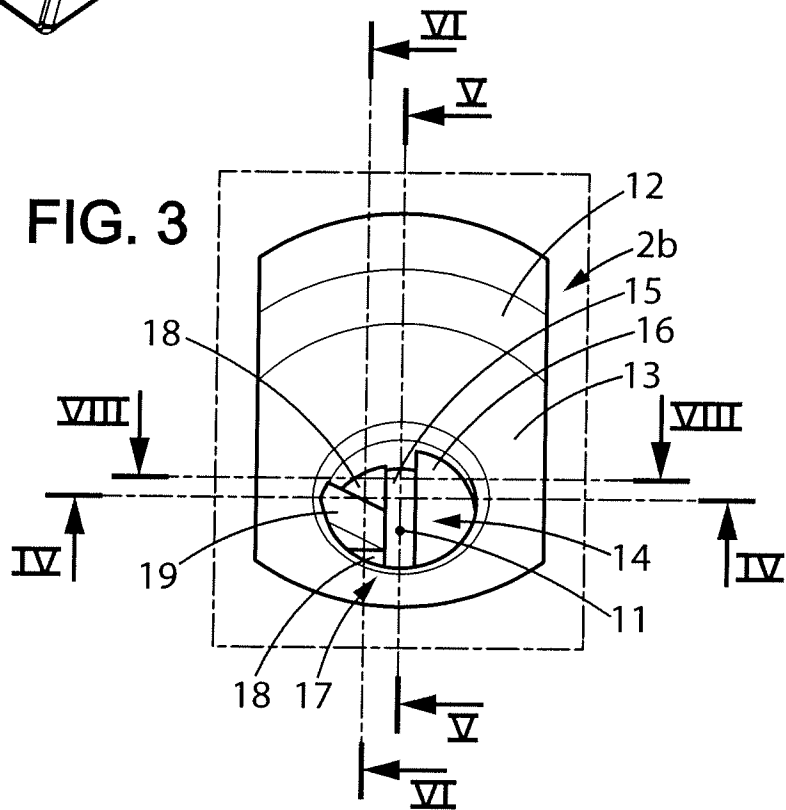
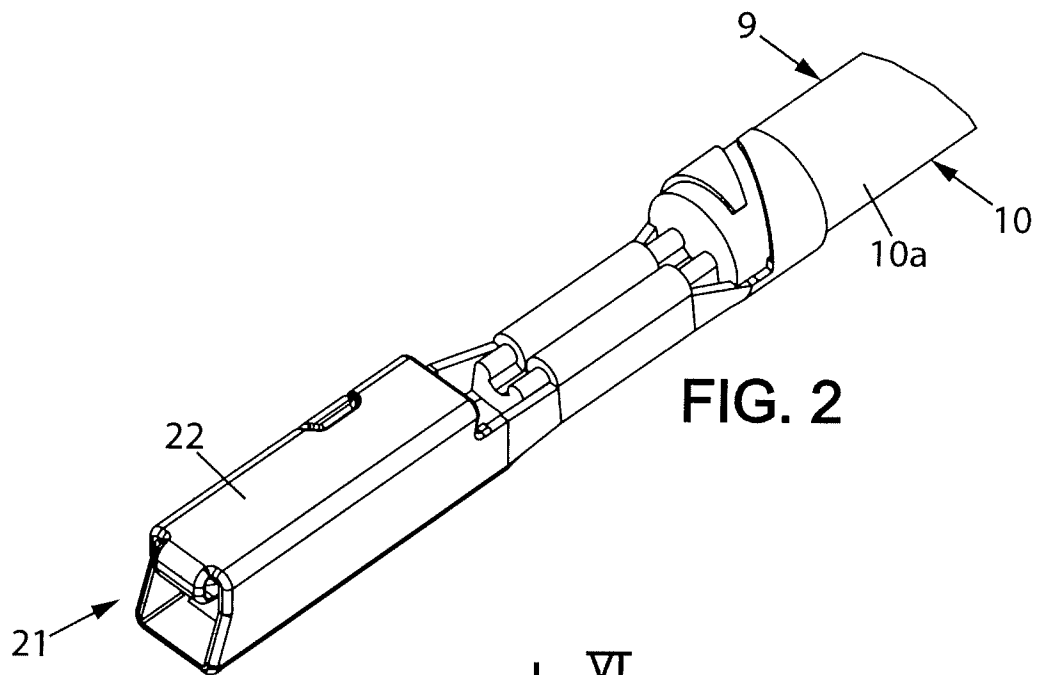


FIG. 1



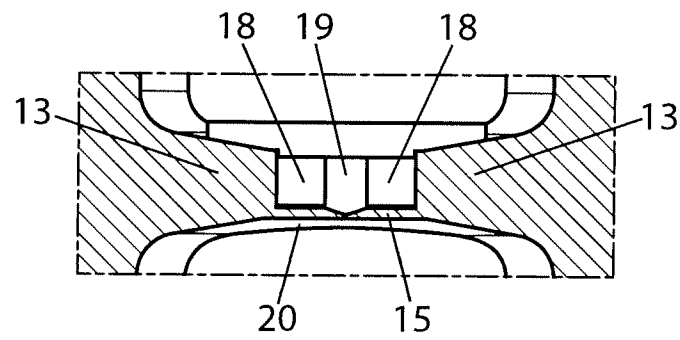


FIG. 5

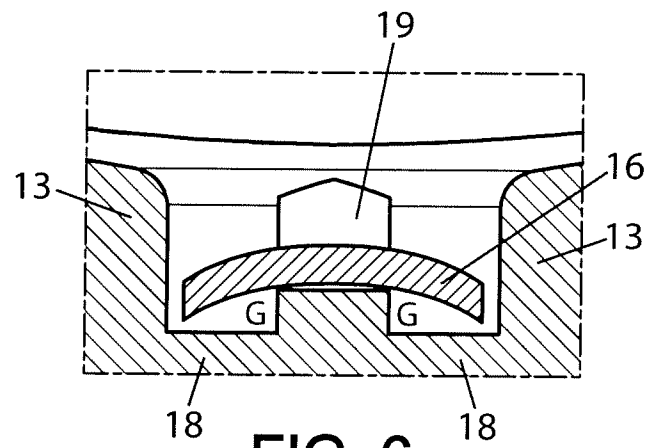
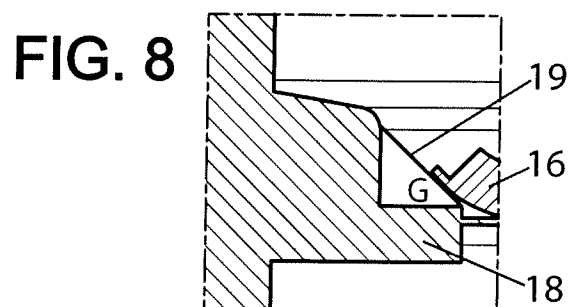
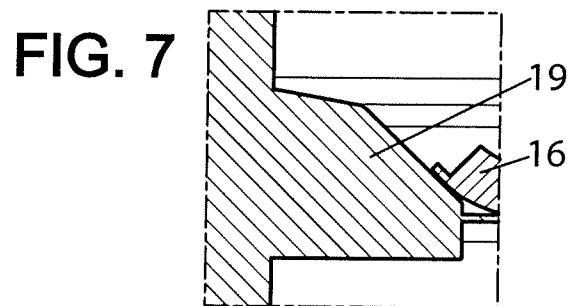


FIG. 6



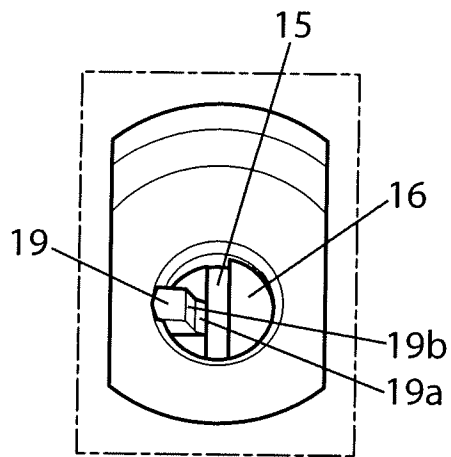


FIG. 9

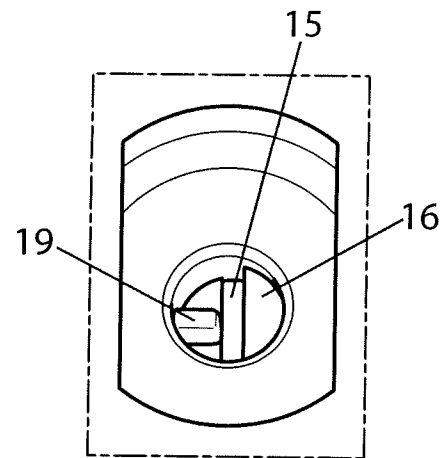


FIG. 10

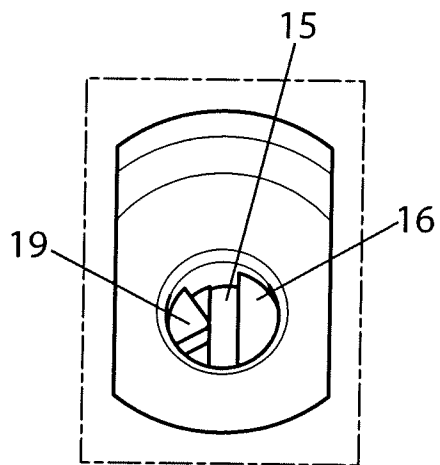


FIG. 11

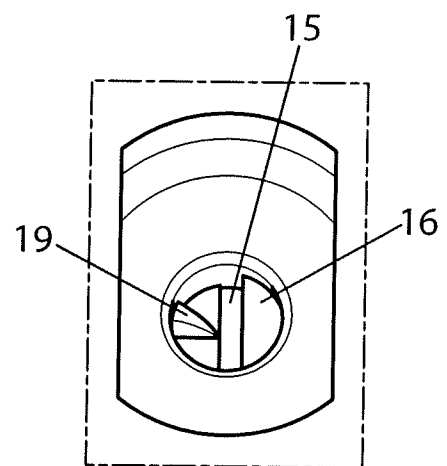


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2007/055371

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R13/52

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)

H01R 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 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	FR 2 844 645 A (CINCH CONNECTEURS SA [FR]) 19 March 2004 (2004-03-19) the whole document	1,7-9
A	US 2 932 685 A (RAILA EDWARD S ET AL) 12 April 1960 (1960-04-12) the whole document	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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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

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Date of the actual completion of the international search

26 June 2008

Date of mailing of the international search report

04/07/2008

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2007/055371

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2844645	A	19-03-2004	NONE	
US 2932685	A	12-04-1960	BE GB	585159 A1 913491 A
				16-03-1960 19-12-1962