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(54) **MAT SEAL JOINT FOR ELECTRICAL CONNECTOR**

MATTENABDICHTVERBINDUNG FÜR EINEN ELEKTRISCHEN VERBINDER

JOINT D'ÉTANCHÉITÉ POUR UN CONNECTEUR ÉLECTRIQUE

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US-A- 2 932 685

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Description

FIELD OF THE INVENTION

[0001] The instant invention relates to mat seal joints for electrical connectors.

BACKGROUND OF THE INVENTION

[0002] 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 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 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.

[0003] Since, in most connectors, not all the channels are 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.

[0004] 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 of an electrical connection member. Document FR 2 844 645 discloses a mat seal joint according to the preamble of claim 1.

[0005] 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 would be detrimental to the sealing ability of the whole seal.

[0006] Although the above-described mat seal joint is totally satisfactory in normal use, a problem has be encountered when one of the membranes has been erroneously 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.

[0007] 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 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 a lower life time of the joint and of the whole connector.

[0008] 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

[0009] To this aim, it is provided a mat sealing joint according to claim 1.

[0010] 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 ability test.

[0011] In some embodiments, one might also use one or more of the features as defined in claims 2 to 6.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] 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.

[0013] On the drawings :

- 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,
- 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 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,
- 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.

[0014] On the different figures, the same reference signs designate like or similar elements.

DETAILED DESCRIPTION

[0015] Fig. 1 is an exploded view of an electrical connector. This connector comprises a housing 5 made of an electrically insulating material such as glass-fiber reinforced poly-butylene terephtalate (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 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.

[0016] 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.

[0017] The mat sealing joint 1 is for example made of a soft deformable quasi incompressible material such as 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.

[0018] Depending on the application requirements, other materials such as Heat Curing Rubers (HCR), Silicone or Ethylene Propylene Diene Monomers (EPDM), thermoplastic elastomers (ETP), or others, could also be used for the sealing joint 1.

[0019] 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 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 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, positions and sizes pictured on Fig. 1 are only exemplary and could vary from one mat sealing joint to another.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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 fist 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.

[0024] 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.

[0025] 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 electrical member. The thin portion 15 is for example substantially rectangular and extends along a longitudinal line in the transverse plane.

[0026] On the right side of this longitudinal line on Fig. 3, a thick portion 16 extends with a substantially constant cross-section between the lip 13 and the thin portion 15.

[0027] 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 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 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 portion 18 to the lip 13.

[0028] 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, 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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 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 (19) extending from the wall and sealing 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,
   characterized in that 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.

2. A mat seal joint according to claim 1, wherein the protruding portion (19) has a slanted slope from said thin potion (15) of the membrane toward said wall (12) .

3. A mat seal joint according to claim 1 or 2 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.

4. A mat seal joint according to claim 3, wherein the thick portion (16) and the anti-sealant portion (17) extend on the same side with respect to the transverse plane.

5. A mat seal joint according to any preceding claim wherein the channel (2a) comprises at least a rib (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).

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

Patentansprüche

1. Ein mattenförmiges Dichtungsanschlussstück (1) für einen elektrischen Verbinder, wobei das Anschlussstück einen Körper aufweist, der eine Vielzahl von Durchgangskanälen (2a, 2b) hat, jeder um ein elektrisches Kabel hineinzuführen,
   wobei sich zumindest einer von den Kanälen entlang einer longitudinalen Achse (11) erstreckt, und eine Wand (12) hat und eine Dichtungsmembran (14), die sich von der Wand erstreckt und die den Kanal gegen

Fluide abdichtet,
wobei die Membran einen dünnen Abschnitt (15) aufweist, der geeignet ist, bei besagtem Einführen eines elektrischen Bauteils (21), umfassend das elektrische Kabel, in den Kanal, zu reißen, und einen dicken Abschnitt (16), der dicker als der dünne Abschnitt ist, der den dünnen Abschnitt mechanisch mit der Wand verbindet,
gekennzeichnet dadurch, dass die Membran einen Anti-Abdichtabschnitt (17) aufweist, der einen Basisabschnitt (18) aufweist und einen herausstehenden Abschnitt (19) aufweist, der in Bezug auf den Basisabschnitt heraussteht, wobei im gescheiterten Fall, in welchem die Membran gerissen ist, und in welchem ein elektrisches Kabel nicht in den Kanal eingeführt ist, und in welchem die Wand in einem komprimierten Zustand ist, der dicke Abschnitt (16) der Membran auf dem herausstehenden Abschnitt (19) aufliegt, und beabstandet von dem Basisabschnitt (18) entlang der longitudinalen Achse (11) ist, so dass er eine Lücke (G) definiert durch welche Fluide fließen können.

2. Ein mattenförmiges Dichtungsanschlussstücklk gemäß Anspruch 1, wobei der herausstehende Abschnitt (19) von dem dünnen Abschnitt (15) der Membran hin zu der Wand (12) einen abgeschrägten Anstieg hat.

3. Ein mattenförmiges Dichtungsanschlussstück gemäß den Ansprüchen 1 oder 2, wobei die Membran (14) entlang einer longitudinalen Linie in einer transversalen Ebene transversal zu einer longitudinalen Achse (11) des Kanals reißen soll, und wobei der dicke Abschnitt (16) und der Anti-Dichtungsabschnitt (17) sich beide auf jeweiligen Seiten der longitudinalen Linie erstrecken.

4. Ein mattenförmiges Dichtungsanschlussstück gemäß Anspruch 3, wobei sich der dicke Abschnitt (16) und der Anti-DichtungsAbschnitt (17) auf derselben Seite in Bezug auf die transversale Ebene erstrekken.

5. Ein mattenförmiges Dichtungsanschlussstück gemäß einem der vorhergehenden Ansprüche, wobei der Kanal (2a) zumindest eine Rippe (13) aufweist, die von der Wand heraussteht, wobei die Rippe derart dimensioniert ist, um ein elektrisches Kabel im Anschlussstück gut zu dichten und wobei die Membran (14) von der Rippe (13) getragen wird.

6. Ein elektrischer Verbinder, aufweisend ein mattenförmiges Dichtungsanschlussstück gemäß einem der vorhergehenden Ansprüche, und ein elektrisches Bauteil (21), aufweisend ein elektrisches Kabel (9), wobei das elektrische Kabel sich durch den Kanal erstreckt.

Revendications

1. Joint d'étanchéité (1) pour un connecteur électrique, ledit joint comprenant un corps ayant une pluralité de canaux de passage (2a, 2b) chacun pour l'insertion, à l'intérieur de ces derniers, d'un câble électrique,
au moins un des canaux s'étendant le long d'un axe longitudinal (11) et comportant une paroi (12) et une membrane d'étanchéité (14) s'étendant depuis la paroi et réalisant l'étanchéité du canal contre des fluides,
la membrane comprenant une partie fine (15) adaptée pour être déchirée suite à ladite insertion dans le canal d'un élément électrique (21) comprenant ledit câble électrique, et une partie épaisse (16), plus épaisse que ladite partie fine, reliant mécaniquement la partie fine à la paroi,
caractérisé en ce que la membrane comprend une partie anti-scellante (17) comprenant une partie de base (18) et une partie en saillie (19), faisant saillie par rapport à la partie de base moyennant quoi, dans un état endommagé dans lequel la membrane est déchirée, dans lequel un câble électrique est absent du canal, et dans lequel la paroi est dans un état comprimé, la partie épaisse (16) de la membrane repose sur la partie en saillie (19) et est espacée de la partie de base (18) le long de l'axe longitudinal (11) afin de définir un espace (G) à travers lequel l'écoulement de fluides est autorisé.

2. Joint d'étanchéité selon la revendication 1, dans lequel la partie en saillie (19) a une pente inclinée à partir de ladite partie fine (15) de la membrane vers ladite paroi (12).

3. Joint d'étanchéité selon la revendication 1 ou 2, dans lequel ladite membrane (14) doit être déchirée le long d'une ligne longitudinale dans un plan transverse transversal par rapport à un axe longitudinal (11) du canal, dans lequel la partie épaisse (16) et la partie anti-scellante (17) s'étendent chacune sur un côté respectif de la ligne longitudinale.

4. Joint d'étanchéité selon la revendication 3, dans lequel la partie épaisse (16) et la partie anti-scellante (17) s'étendent du même côté par rapport au plan transverse.

5. Joint d'étanchéité selon l'une quelconque des revendications précédentes, dans lequel le canal (2a) comprend au moins une nervure (13) faisant saillie de ladite paroi, ladite nervure étant dimensionnée pour réaliser l'étanchéité d'un câble électrique dans le joint et ladite membrane (14) étant supportée par ladite nervure (13).

6. Connecteur électrique comprenant un joint d'étan-

chéité selon l'une quelconque des revendications précédentes, et un élément électrique (21) comprenant un câble électrique (9), ledit câble électrique s'étendant à travers ledit canal.

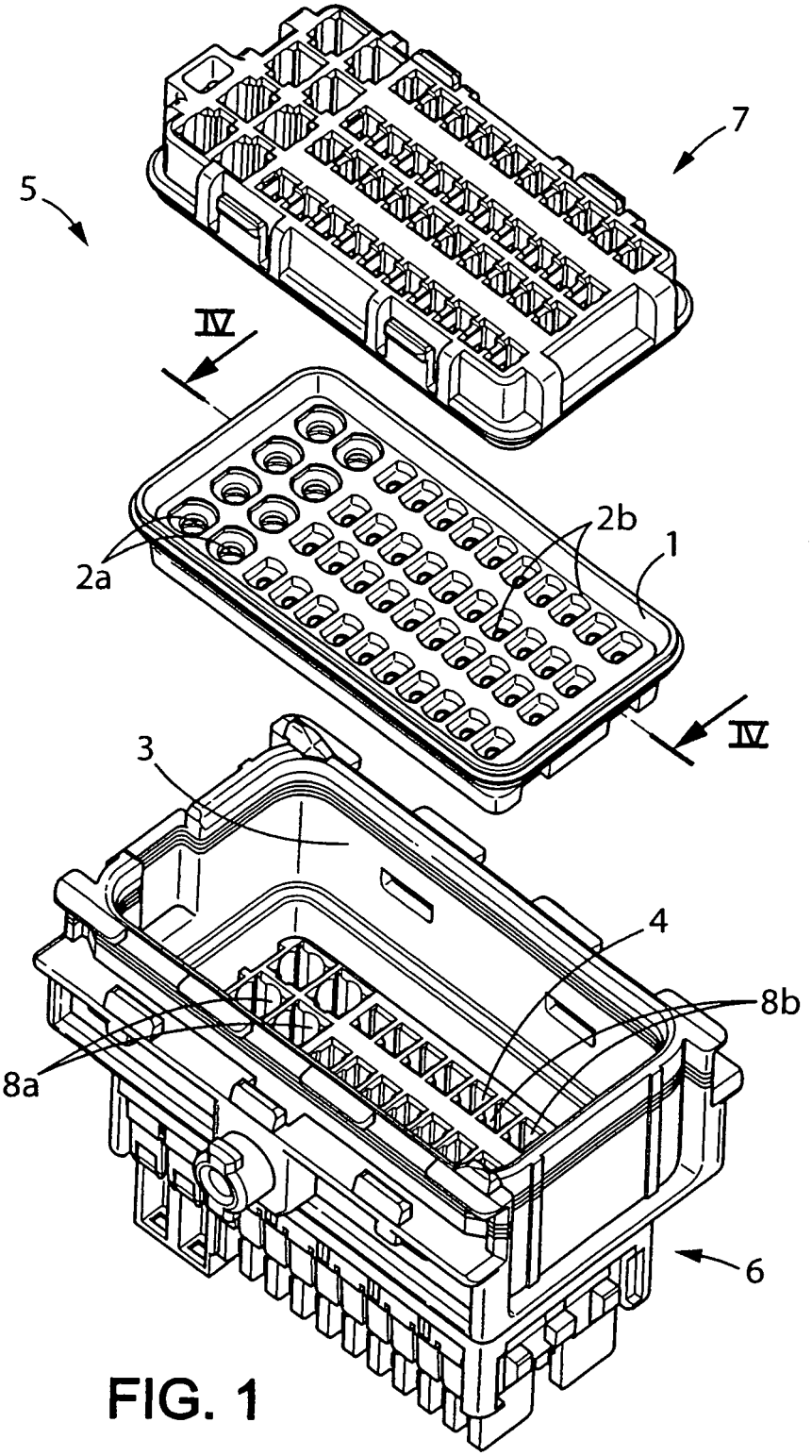


FIG. 1

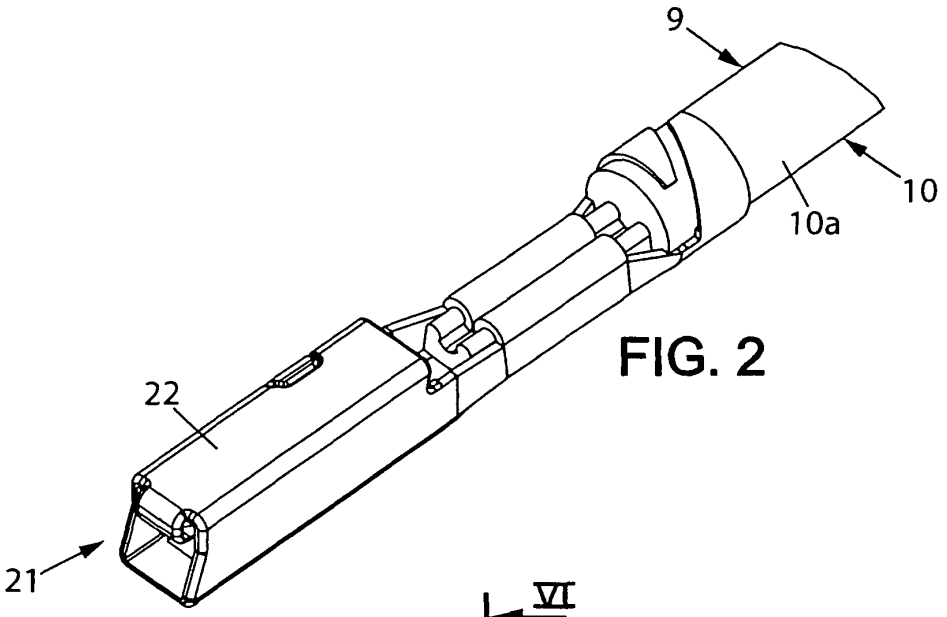


FIG. 2

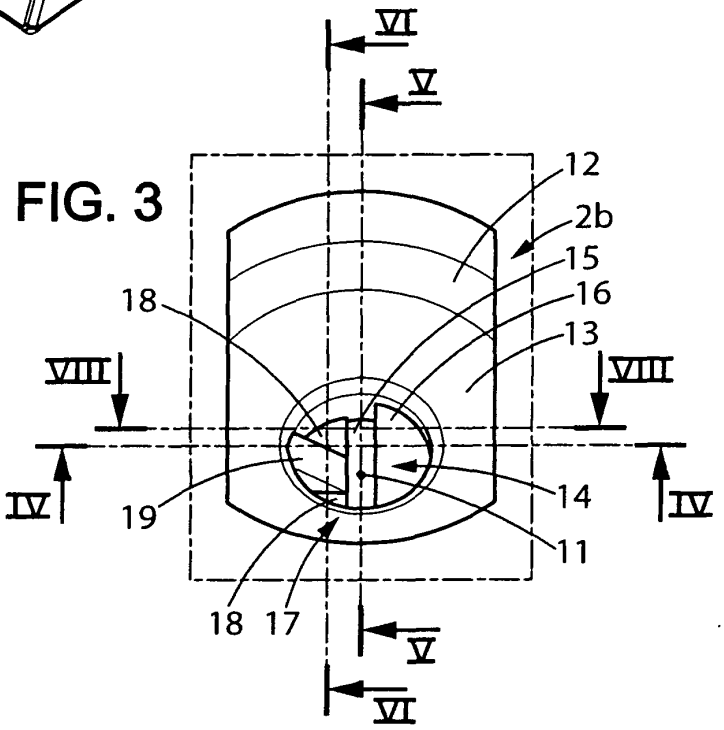


FIG. 3

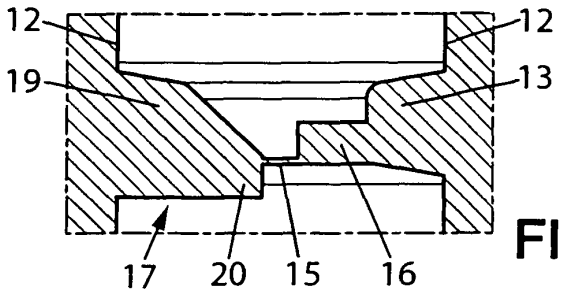


FIG. 4

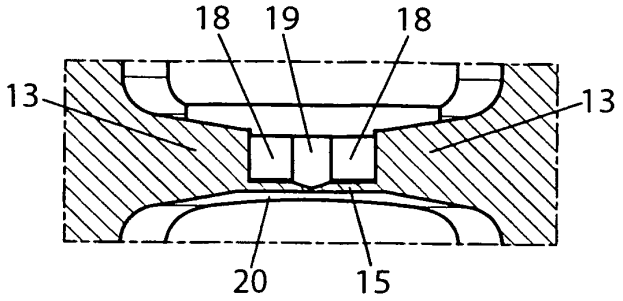


FIG. 5

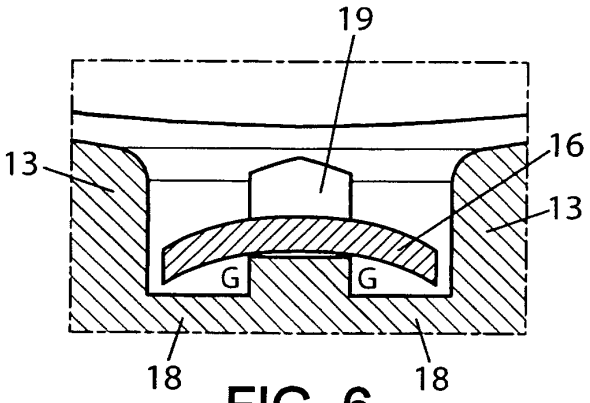


FIG. 6

FIG. 7

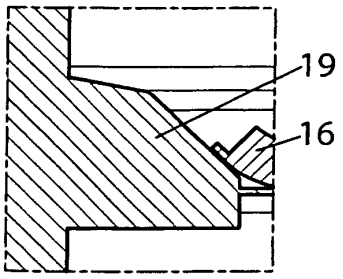
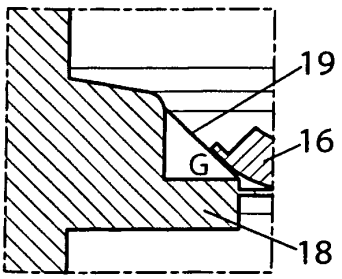


FIG. 8



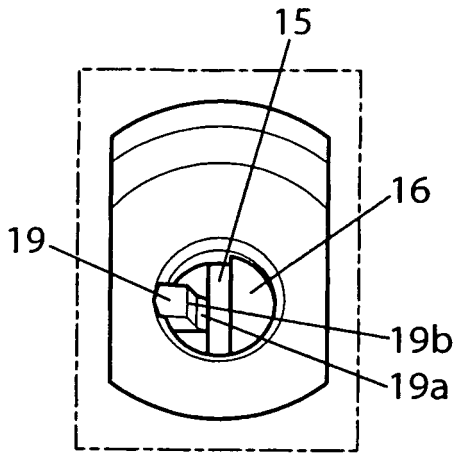


FIG. 9

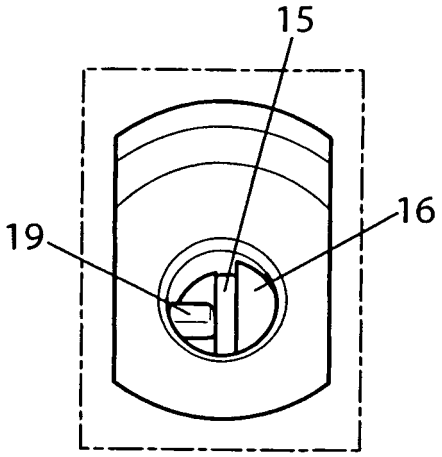


FIG. 10

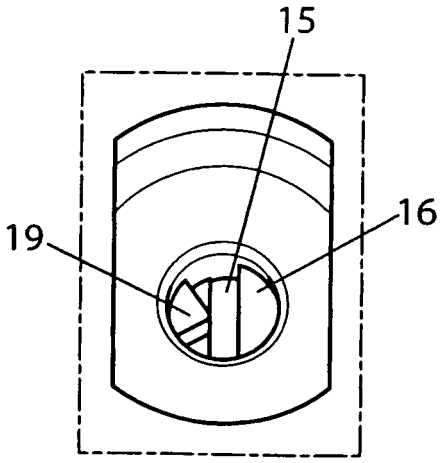


FIG. 11

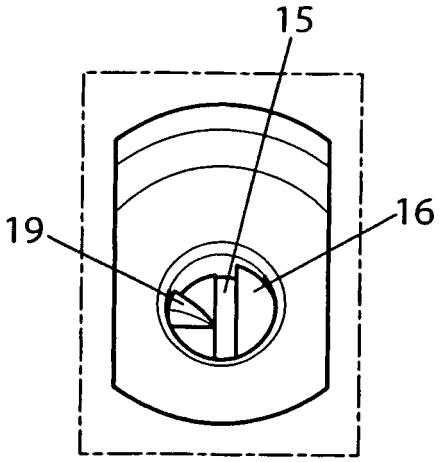


FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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- FR 2844645 **[0004]**