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(54) **CONNECTOR WITH REDUCED ELECTROMAGNETIC INTERFERENCES**

VERBINDER MIT REDUZIERTEN ELEKTROMAGNETISCHEN STÖRUNGEN

CONNECTEUR À INTERFÉRENCE ÉLECTROMAGNÉTIQUE RÉDUITE

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Description

[0001] The invention relates to an electrical connector comprising a housing for receiving and fixing a housing insert, the housing insert with a wire fixture disposed inside the housing insert, a sealing member disposed at an end of the housing relative to a plug direction and at least one electrical wire received and positioned by the wire fixture and extending through the sealing member.

[0002] Current plastic materials used in connector bodies are not developed for an increased performance with regard to an electromagnetic interference (EMI). They permit the electrical field to radiate out of the connector housing. Hence mutual coupling or cross talk between communication links can be increased.

[0003] WO 2011/061074 A1, US 2011/1365350 A1, US 2015/024629 A1, EP 2 254 199 A1 and EP 1 253 680 A1 teach different embodiments of electrical connectors.

[0004] It is known to provide an electrically conductive shield for reducing cross talk effects between communication links and to improve the EMI performance of a connector. In EP 0 742 683 A1 a flexible conductive sheet as an EMI shield is disclosed. An electronic device is shielded against electromagnetic interference using the flexible conductive sheet forming a shield barrier or enclosure. The sheet is composed of electrically insulating polymer material exposed on the surface of at least one face of the sheet.

[0005] Such devices and connectors have to be initially designed and constructed such that EMI shields can be inserted inside of housings or arranged outside of housings. Hence, retrofitting existing connector designs with improved EMI performance is usually not possible.

[0006] Therefore, the object underlying the invention can be seen as consisting in specifying an electric connector with improved EMI performance and which can be upgraded subsequently without changing the initial design of the connector.

[0007] This object is achieved by means of the respective subject-matter of the independent claim. Advantageous embodiments are subject-matter of respective dependent claims.

[0008] An electrical connector is provided. The electrical connector comprises a housing for receiving and fixing a housing insert inside an inner portion. Furthermore, the electrical connector comprises the housing insert with a wire fixture disposed inside the housing insert. A sealing member is disposed at an end of the housing of the electrical connector relative to a plug direction.

[0009] At least one electrical wire is received and positioned by the wire fixture and is extending through the sealing member, wherein at least one of the components of the electrical connector comprises a material with properties for dampening an electrical field strength created by the at least one electrical wire.

[0010] Due to the materials with properties for dampening an electrical field strength, the EMI performance of the electrical connector can be improved. The already

existing parts of the electrical connector may be replaced by components composed of alternative materials without re-designing corresponding components.

[0011] The EMI may be reduced by increasing the dielectric constant and loss tangent of at least one of the components of the electric connector. Preferably, the dielectric constant is higher than 2. For example the housing, the housing insert, the wire fixture and/or the sealing member may be manufactured with a modified material composition such that the dielectric properties are allowing stronger dampening effects with regard to the electric field.

[0012] Preferably, the electrical connector can be a terminal connector or header, Ethernet connector, high voltage connector, electronics control unit connector and the like. Furthermore, this approach can be implemented in all products those have to consider electromagnetic compatibility (EMC). For example, cable isolation layers and shrinkage tubes may be provided with such materials, too.

[0013] According to one embodiment, the sealing member is composed of a ferrite mixture for dampening the electrical field strength. Thus, ferrite powder may be blended with a polymer for manufacturing an elastic sealing member for sealing the inner portion of the housing and the electrical wires against environmental influences.

[0014] The ferrite powder blended with polymer may be suitable for injection molding in order to enable a fast and reliable manufacturing process of the sealing member.

[0015] As an alternative or an addition, ferrite powder may be added to the materials of the housing, housing insert or to the wire fixture during their manufacturing process in order to improve corresponding EMC abilities of the said components.

[0016] The housing and/or the housing insert are composed of a thermoplastic or a thermoplastic compound comprising a higher permittivity and permeability than Polybutylene terephthalate material (PBT). Since the PBT is frequently used for manufacturing housings of connectors and other electrically insulating components, the EMC of such components may be improved by using materials with a higher permittivity and permeability.

[0017] By increasing the permittivity or permeability dielectric losses can be created inside the electrical connector. The dielectric losses can be adjusted with regard to the loss angle or a loss tangent.

[0018] In order to increase the dielectric losses, the components of the electric connector dielectric loss materials such as Barium Strontium Titanate (BST) ceramics can be utilized as addition to the materials for manufacturing.

[0019] In another embodiment, the housing and/or the housing insert are composed of a conductive plastic or conductive plastic compound. Thus, the components surrounding the electrical wires may act as a Faraday shield blocking electromagnetic fields. Preferably, the

parts composed of the conductive plastic may be grounded by electrical connection with corresponding electrical wires.

[0020] By using conductive plastics for EMI shielding, a uniform shielding capability may be provided. Moreover, the shielding can be applied to components with complex geometries. For example, the electrical connector may comprise an additional metal shield which may not necessarily cover the whole connector without affecting the EMI performance.

[0021] A ferrite core is disposed inside the housing or inside the housing insert for reducing the electrical field strength. Thus, it is possible to take advantage of the available space inside the inner portion of the housing or inside the housing insert.

[0022] Preferably, the ferrite core may be shaped to fit the available space. Moreover, dependent on the design of the electrical connector a plurality of ferrite cores may be disposed inside the connector housing and/or the housing insert. Thus, it is possible to provide individual ferrite cores for each electrical wire, for example.

[0023] The ferrite core is fixed inside the housing or the housing insert by a circumferential portion of the wire fixture. The ferrite core may encompass the wire fixture at least partially.

[0024] The wire fixture may comprise structural shaping such as recesses or grooves for receiving the ferrite core positively. Thus, the ferrite core may be fixed inside the housing or the housing insert preventing impacts or damage to the ferrite core during assembly.

[0025] According to another embodiment, the housing comprises at least one latch disposed at an external face of the housing. Thus, the electrical connector may be plugged into a corresponding terminal and fixed inside the terminal preventing unintentional disconnection. Preferably, the housing insert is positively attached to the housing of the electrical connector. The wire fixture may be positively connected to the housing insert.

[0026] In a further embodiment, the housing insert comprises a length extending the housing single-sided against the plug direction of the electrical connector. Hence, the haptic of the electrical connector may be improved due to increased overall length. Moreover, since the length of the housing insert is increased, the housing insert may comprise additional space for receiving a ferrite core.

[0027] In another embodiment, the sealing member is a ferrite core. Application dependent the elastically formed sealing member may be replaced by a static ferrite mixture. Additionally or alternatively, the sealing member may comprise a lower thickness enabling additional space for arranging a ferrite core beside the sealing member.

[0028] The above-described characteristics, features and advantages of this invention and the way in which these are achieved will be more clearly comprehensible in connection with the description below of exemplary embodiments which are explained in detail in relation to

the drawings, in which:

Fig. 1 shows an electrical connector according to one embodiment of the invention,

Fig. 2 shows a sectional view through the electrical connector shown in Fig. 1 and

Fig. 3 shows an electrical connector according to a further embodiment of the invention.

[0029] Fig. 1 shows an electric connector 1 according to one embodiment of the invention.

[0030] The electrical connector 1 comprises a housing 2 with a latch 4 disposed at one external face of the housing 2 for fixing the electrical connector 1 in a plugged state inside a terminal. For the sake of simplicity, the terminal is not shown in the figures.

[0031] Inside an inner portion of the housing 2 a housing insert 6 is positively arranged. Thus, the housing 2 and the insert 6 are forming one unit and a basic shape of the electrical connector 1. According to the shown embodiment, the housing insert 6 is extending the housing 6 opposite to a plug direction P.

[0032] On a side of the housing 2 opposite to the extending housing insert 6 a sealing member 8 is provided. The sealing member 8 is composed of an elastic material and is suitable for sealing the electrical wires 10 against dust and humidity.

[0033] The electrical wires 10 are disposed centrally inside a joint insulation 12 and are protruding the sealing member 8.

[0034] According the embodiment, the electrical connector 1 comprises a ferrite core 14 inside the housing insert 6. The ferrite core 14 comprises a shape corresponding to a basic shape of an inner portion of the housing insert 6. The shape of the ferrite core 14 is toroidal with four straight sections arranged in a rectangular manner.

[0035] In Fig. 2 a sectional view through the electrical connector 1 shown in Fig. 1 is illustrated. In particular, the arrangement of the ferrite core 14 inside the housing insert 6 is elucidated.

[0036] Furthermore, the wire fixture 16 is visible in the sectional view. The wire fixture 16 receives the electrical wires 10 and fixes the wires 10 relative to the housing insert 6. The wire fixture 16 comprises a groove 18 for inserting and positioning the ferrite core 14 inside the housing insert 6 and inside the housing 2.

[0037] Fig. 3 illustrates an electrical connector 1 according to a further embodiment of the invention. The electrical connector 1 comprises a sealing member 8 which is accomplished as a ferrite core 14. Thus, the sealing member 8 serves as a dampening material for the electrical field generated by the electrical wires 10.

[0038] The said sealing member 8, 14 may be provided for applications where it is not required to establish extensive sealing capabilities. The ferrite core sealing

member 8, 14 may act as a cover while improving EMI performance of the electrical connector 1.

Reference signs

[0039]

1	electrical connector
2	housing
4	latch of the housing
6	housing insert
8	sealing member + MATenet ferrite cover (mixed ferrite powder with plastic)
10	electrical wires
12	insulation of wires
14	ferrite core
16	wire fixture
18	groove
P	plug direction

Claims

1. An electrical connector (1) comprising:

- a housing (2) receiving and fixing a housing insert (6),
- the housing insert (6) with a wire fixture (16) disposed inside the housing insert (6),
- a sealing member (8) disposed at an end of the housing (2) in plug direction (P),
- at least one electrical wire (10) received and positioned by the wire fixture (16) and extending through the sealing member (8),
- wherein at least one of the following components (2, 6, 8, 16): the housing (2), the housing insert (6), the sealing member (8) and the wire fixture (16) of the electrical connector (1) comprises a material made by blending a polymer with a ferrite powder, said material with properties for dampening an electrical field strength created by the at least one electrical wire (10),

characterized in that

- the housing (2) and/or the housing insert (6) are composed of a thermoplastic or a thermoplastic compound comprising a higher electromagnetic permittivity and permeability than Polybutylene terephthalate material,
- wherein a ferrite core (14) is disposed inside the housing (2) or inside the housing insert (6) for reducing the electrical field strength,
- wherein the ferrite core (14) is fixed inside the housing (2) or the housing insert (6) by a circumferential portion of the wire fixture (16).

2. Electrical connector according to claim 1, wherein the sealing member (8) is composed of a ferrite mixture for dampening the electrical field strength.

3. Electrical connector according to anyone of the claims 1 to 2, wherein the housing (2) and/or the housing insert (6) are composed of a conductive plastic or conductive plastic compound.

4. Electrical connector according to anyone of the claims 1 to 3, wherein the housing (2) comprises at least one latch (4), disposed at an external face of the housing (2).

5. Electrical connector according to anyone of the claims 1 to 4, wherein the housing insert (6) comprises a length extending the housing (2) single-sided against the plug direction (P) of the electrical connector (1).

Patentansprüche

1. Elektrischer Verbinder (1), Folgendes umfassend:

- ein Gehäuse (2) zum Aufnehmen und Befestigen eines Gehäuseeinsatzes (6),
- wobei der Gehäuseeinsatz (6) eine Drathalterung (16) aufweist, die in dem Gehäuseeinsatz (6) angeordnet ist,
- ein Dichtungselement (8), das an einem Ende des Gehäuses (2) in Steckrichtung (P) angeordnet ist,
- mindestens einen elektrischen Draht (10), der durch die Drathalterung (16) aufgenommen und positioniert wird und der sich durch das Dichtungselement (8) erstreckt,
- wobei mindestens eine der folgenden Komponenten (2, 6, 8, 16): das Gehäuse (2), der Gehäuseeinsatz (6), das Dichtungselement (8) und die Drathalterung (16) des elektrischen Verbinders (1) ein Material umfasst, das durch Vermischen eines Polymers mit einem Ferrit-Pulver angefertigt ist, wobei das Material Eigenschaften zum Dämpfen einer elektrischen Feldstärke aufweist, die durch den mindestens einen elektrischen Draht (10) erzeugt wird,

dadurch gekennzeichnet, dass

- das Gehäuse (2) und/oder der Gehäuseeinsatz (6) aus einem Thermoplast oder einer thermoplastischen Verbindung zusammengesetzt sind, die eine höhere elektromagnetische Dielektrizitätskonstante und Permeabilitätskonstante als Polybutylenterephthalat-Material umfassen,
- wobei ein Ferrit-Kern (14) zum Reduzieren der

- elektrischen Feldstärke in dem Gehäuse (2) oder in dem Gehäuseeinsatz (6) angeordnet ist, - wobei der Ferrit-Kern (14) durch einen peripheren Abschnitt der Drahthalterung (16) in dem Gehäuse (2) oder dem Gehäuseeinsatz (6) befestigt ist. 5
2. Elektrischer Verbinder nach Anspruch 1, wobei das Dichtungselement (8) aus einer Ferrit-Mischung zum Dämpfen der elektrischen Feldstärke besteht. 10
3. Elektrischer Verbinder nach einem der Ansprüche 1 bis 2, wobei das Gehäuse (2) und/oder der Gehäuseeinsatz (6) aus einem leitenden Kunststoff oder einer leitenden Kunststoffverbindung zusammengesetzt sind. 15
4. Elektrischer Verbinder nach einem der Ansprüche 1 bis 3, wobei das Gehäuse (2) mindestens eine Raste (4) umfasst, die an einer Außenfläche des Gehäuses (2) angeordnet ist. 20
5. Elektrischer Verbinder nach einem der Ansprüche 1 bis 4, wobei der Gehäuseeinsatz (6) eine Länge umfasst, die das Gehäuse (2) einseitig gegen die Steckrichtung (P) des elektrischen Verbinders (1) erweitert. 25
- Revendications** 30
1. Connecteur électrique (1) comprenant :
- un corps (2) recevant et fixant un insert de corps (6), 35
 - l'insert de corps (6) avec un dispositif de fixation de fil (16) disposé à l'intérieur de l'insert de corps (6),
 - un élément d'étanchéité (8) disposé à une extrémité du corps (2) dans une direction de branchement (P), 40
 - au moins un fil électrique (10) reçu et positionné par le dispositif de fixation de fil (16) et s'étendant à travers l'élément d'étanchéité (8),
 - dans lequel au moins un des composants suivants (2, 6, 8, 16) : le corps (2), l'insert de corps (6), l'élément d'étanchéité (8) et le dispositif de fixation de fil (16) du connecteur électrique (1) comprend un matériau élaboré par mélange d'un polymère avec une poudre de ferrite, ledit matériau ayant des propriétés permettant de modérer une intensité de champ électrique créée par l'au moins un fil électrique (10), 50
- caractérisé en ce que** 55
- le corps (2) et/ou l'insert de corps (6) sont constitués d'un thermoplastique ou d'un composé
- thermoplastique présentant une plus grande permittivité et perméabilité électromagnétique qu'un matériau à base de téréphtalate de polybutylène,
- dans lequel un noyau de ferrite (14) est disposé à l'intérieur du corps (2) ou à l'intérieur de l'insert de corps (6) pour réduire l'intensité de champ électrique,
 - dans lequel le noyau de ferrite (14) est fixé à l'intérieur du corps (2) ou de l'insert de corps (6) par une partie circonférentielle du dispositif de fixation de fil (16).
2. Connecteur électrique selon la revendication 1, dans lequel l'élément d'étanchéité (8) est constitué d'un mélange de ferrite destiné à modérer l'intensité de champ électrique.
3. Connecteur électrique selon l'une quelconque des revendications 1 à 2, dans lequel le corps (2) et/ou l'insert de corps (6) sont constitués d'un plastique conducteur ou d'un composé plastique conducteur.
4. Connecteur électrique selon l'une quelconque des revendications 1 à 3, dans lequel le corps (2) comprend au moins un verrou (4), disposé sur une face externe du corps (2).
5. Connecteur électrique selon l'une quelconque des revendications 1 à 4, dans lequel l'insert de corps (6) comprend une longueur allongeant le corps (2) d'un seul côté à l'opposé de la direction de branchement (P) du

1

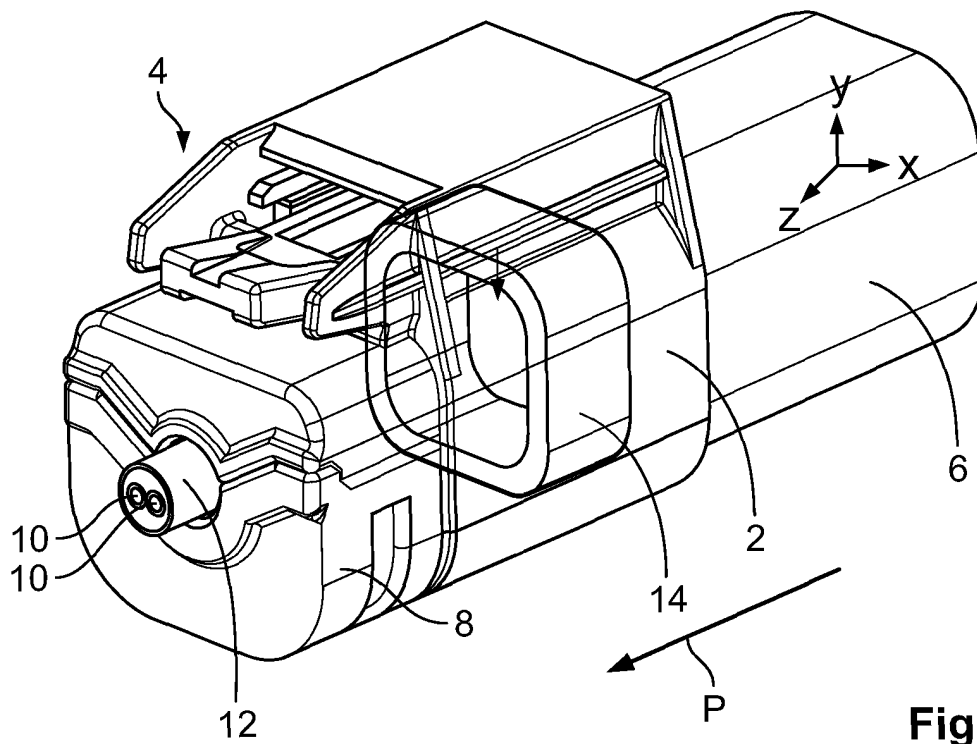


Fig. 1

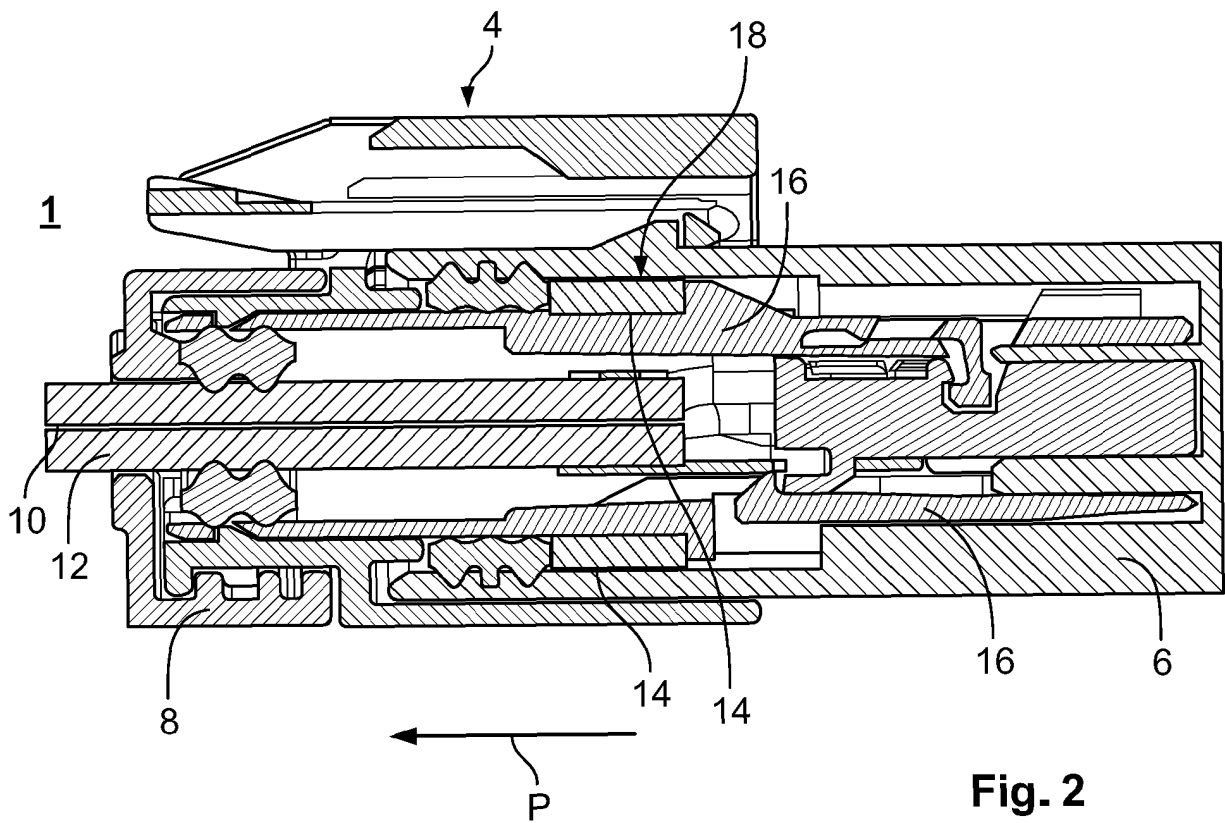


Fig. 2

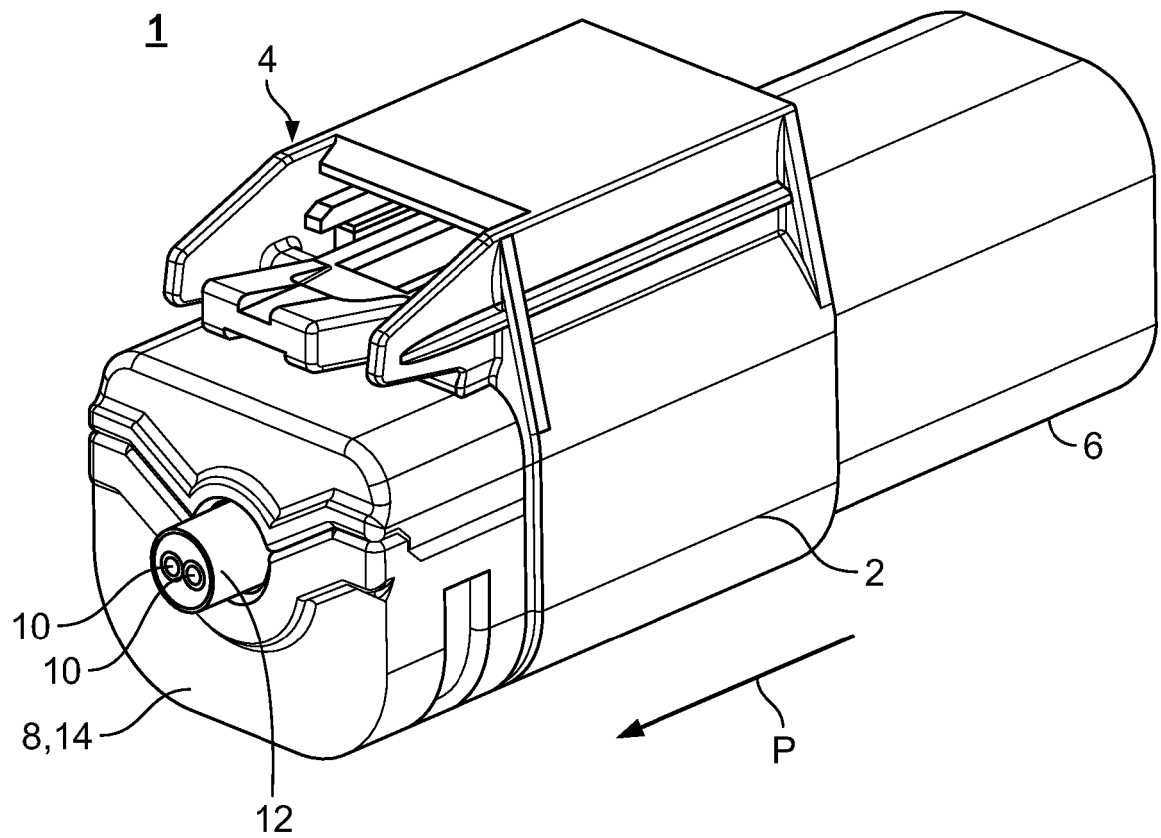


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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