(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 534 465 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.09.2019 Bulletin 2019/36

(51) Int Cl.:
H01R 9/05 *(2006.01)*

(21) Application number: **18159749.3**

(22) Date of filing: **02.03.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Stäubli Electrical Connectors AG**
4123 Allschwil (CH)

(72) Inventors:
- **NURDIN Yannick**
  68130 Walheim (FR)
- **SCHULL Frédéric**
  68210 Hagenbach (FR)

(74) Representative: **Frischknecht, Harry Ralph**
Isler & Pedrazzini AG
Giesshübelstrasse 45
Postfach 1772
8027 Zürich (CH)

(54) SHIELDING ARRANGEMENT

(57) An electromagnetic shielding arrangement (1), comprising
an inner ring (3) extending around a middle axis (M) and having an inner surface (3a) and an outer surface (3b),
an outer ring (4) extending around said middle axis (M) and having an inner surface (4a) and an outer surface (4b), which inner ring (3) is located at least partly within said outer ring (4) wherein a spacing (5) is provided between the inner ring (3) and the outer ring (4), and
an electrically conductive body (6) having a bore (7) with an inner surface (7a), wherein said inner ring (3) and/or said outer ring (4) are at least partly located in said bore (7);
wherein a shielding braid (8) of the cable (2) can be mechanically clamped in said spacing (5) between the inner ring (3) and the outer ring (4) such that an electrical contact is provided between said outer ring (4) and said shielding braid (8), and
wherein an electrical contact element (9) is arranged between the outer ring (4) and the electrically conductive body (6) in order to provide an electrical contact between the outer ring (4) and the electrically conductive body (6).

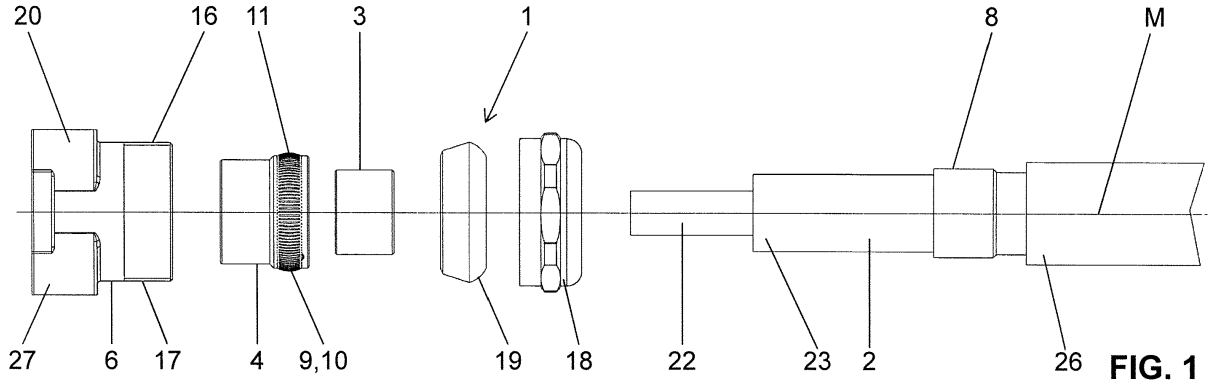

FIG. 1

EP 3 534 465 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a shielding arrangement according to claim 1, a shielding structure according to claim 12 and a method according to claim 14.

PRIOR ART

[0002] From prior art shielded cables are well known. Usually such a cable comprises at least one electrical conductive conductor which is encompassed by means of an insulation, whereby on the outer side of the insulation a metallic shielding braid is arranged in order to provide an electromagnetic shielding.

[0003] At the interface between a cable and a plug or any other electrical part the shielding braid is to be connected to respective shielding elements on the side of the plug or the other electrical element. Providing this connection is usually cumbersome as it requires a rather exact positioning between the end of the shielding braid and the plug.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a shielding arrangement which overcomes the drawbacks as mentioned in prior art. In particular it is a preferred object to provide a shielding arrangement which can be mounted very easily under the provision of a determined electrical contact. In particular it is a further preferred object to provide a shielding arrangement allowing more tolerance for the connection of a shielding braid of a cable.

[0005] This object is solved by the electromagnetic shielding arrangement of claim 1. The electromagnetic shielding arrangement comprises

an inner ring extending around a middle axis and having an inner surface and an outer surface,
an outer ring extending around said middle axis and having an inner surface and an outer surface, which inner ring is located at least partly within said outer ring, wherein a spacing is provided between the inner ring and the outer ring, and
an electrically conductive body having a bore with an inner surface, wherein said inner ring and/or said outer ring are at least partly located in said bore. A shielding braid of the cable can be mechanically clamped in said spacing between the inner ring and the outer ring such that an electrical contact is provided between said outer ring and said shielding braid. The arrangement further comprises an electrical contact element that is arranged between the outer ring and the electrically conductive body in order to provide an electrical contact between the outer ring and the electrically conductive body.

[0006] With such a shielding arrangement the electrical contact between the shielding braid and the body can be enhanced whereby the structure is very facile to mount.

[0007] Furthermore the electrical contact between the shielding braid of a cable and body which is part of a plug structure can be enhanced. In particular the electrical contact element serves to provide a determined electrical contact between the outer ring and the body.

[0008] The term "body" refers to structure which is part of a the shielding structure of a plug housing or which can be connected to the shielding structure of a plug housing or which is part of a shielding structure of another element or which can be connected to the shielding structure of another element.

[0009] The term "clamped " is to be understood in that a firm mechanical connection between the two rings and the shielding braid can be achieved.

[0010] Preferably the inner ring is located fully within the outer ring. Preferably the inner ring and the outer ring is arranged fully in said bore.

[0011] Preferably the outer ring and the body are at least partly or fully made out of an electrically conductive material. The same applies preferably also to the inner ring, however, in a further embodiment the inner ring can also be made of a non-conductive material, such as a plastic or fibre-reinforced plastics.

[0012] Preferably the electrical contact element comprises a plurality of resilient contact pieces and extends substantially fully around said middle axis. The resilient contact pieces are resiliently clamped by means of their own spring force in the gap between the outer ring and the bore. The electrical contact element can also be designated as contact lamella.

[0013] Preferably the outer ring comprises a determined contact surface with which said electrical contact element is in electrical contact and/or the bore comprises a contact surface with which said electrical contact element is in electrical contact.

[0014] Preferably at least one of said contact surface extends around said middle axis with a constant cylindrical diameter, wherein said contact surface has a length as seen along the middle axis which is longer than the width of the contact element as seen along the middle axis. This allows positioning the contact element with a larger degree on flexibility based on the position of the cable braid as seen along the middle axis. This is a particular advantage as an accurate positioning of the elements of the shielding arrangement relatively to the end of the shielding braid is no longer necessary.

[0015] Preferably the position of the contact element on said contact surface can variable based on the end of the shielding braid and the location of the inner ring as well as of the outer ring.

[0016] Particularly preferably either the contact surface of the outer ring or the contact surface of the bore is part of a groove extending around the middle axis, wherein the contact element is arranged in said groove. The groove can have different cross-sections. In a first preferred variant the groove has a rectangular cross-section. In a second preferred variant the groove has a dovetail cross-section. Preferably the other contact surface without the groove is cylindrical with a constant diameter.

[0017] In a particularly preferred embodiment the groove is arranged on the outer ring and the cylindrical contact surface with the above mentioned length in relation to the width of the contact element is arranged on the body.

[0018] Preferably the diameter of the inner surface and of the outer surface of the inner ring ist constant over the whole length of the inner ring.

[0019] Preferably the outer ring and/or the inner ring comprises a crimping section which will be mechanically deformed in order to minimize the width of the spacing such that the shielding braid is mechanically clamped or crimped in said spacing. In particular the crimping section of the outer ring will be deformed such that it will be forced towards the inner ring.

[0020] Preferably the inner ring has a length in direction of the middle axis which is shorter or equal or longer to the length of the crimping section of the outer ring in direction of the middle axis.

[0021] Preferably the material thickness of the crimping section is larger than the material thickness of the inner ring. This allows a determined deformation during the crimping process.

[0022] Preferably the crimping section of the inner ring extends over its full length.

[0023] Preferably the crimping is a circular or a hexagonal crimping.

[0024] Preferably the contact surface of the outer ring is arranged at a distance to the crimping section as seen along the middle axis. This has the advantage that the contact surface of the outer ring will not be affected by the deformation of the crimping section and remains in its original shape after the crimping process.

[0025] Preferably the diameter of the contact surface of the outer ring is larger than the diameter of the crimping section.

[0026] Preferably the material thickness of the crimping section of the outer ring remains constant over the whole length as seen along the middle axis.

[0027] Preferably the front end of the inner ring is tapered towards the outer surface and/or towards the inner surface. This enhances mounting to the inner ring underneath the shielding braid, as the tapered front and allows a radial spreading of the shielding braid.

[0028] Preferably the body comprises on an end section an outer thread via which a threaded sleeve is connectable, which threaded sleeve preferably acts on a sealing element.

[0029] Preferably the body comprises on an end section a connection interface via which the body connectable to an external plug housing or via which a plug housing is integrally formed on the body.

[0030] Preferably the opening of the outer ring comprises a conical section. The conical section allows a facile position of the outer ring. Preferably the conical section is arrange underneath the contact surface with the groove.

[0031] A shielding structure comprises an electromagnetic shielding arrangement according to the description above and a cable having at least one electrically conductive core and an inner insulation which is encompassed by a shielding braid, wherein the inner ring is located between the inner insulation and the shielding braid, wherein the shielding braid extends into said spacing between the inner ring and the outer ring and is clamped in said spacing.

[0032] A method to mount electromagnetic shielding arrangement according to the description above is, characterized in that

the inner ring is mounted under the shielding braid;
the outer ring is mounted over the shielding braid such that the shielding braid is positioned in said spacing between the inner ring and the outer ring,
the outer ring and/or the inner ring is mechanically deformed such that the shielding braid is clamped in said spacing, and
the body is positioned over the outer ring such that an electrical connection between said outer ring and said body is provided by means of the contact element.

[0033] Further embodiments of the invention are laid down in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. In the drawings,

Fig. 1 shows an explosive view of an electromagnetic shielding arrangement according to one embodiment;
Fig. 2 shows an explosive cross-sectional view of the electromagnetic shielding arrangement according figure 1; and
Fig. 3 shows cross-sectional view of the electromagnetic shielding arrangement according figures 1 and 2 in a mounted state.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0035] In the figures an electromagnetic shielding arrangement 1 is shown. The shielding arrangement 1 comprises an inner ring 3 extending around a middle axis M and having an inner surface 3a and outer surface 3b, an outer ring 4 extending a round said middle axis M and having an inner surface 4a and an outer surface 4b, as well as an electrically conductive body 6 having a bore 7 with an inner surface 7a. The inner ring 3 and the outer ring 4 are located concentrically with each other. Additionally the inner ring 3 and the outer ring 4 are located concentrically in said bore 7.

[0036] The inner ring 3 is located at least partly within the outer ring 4. In the present case, the inner ring 3 is located fully in the outer ring 4. Between the inner ring 3 and the outer ring 4, there is a spacing 5 provided. The spacing 5 is provided as the diameter of the inner surface 4a of the outer ring 4 is larger than the diameter of the outer surface 3b of the inner ring 3. Furthermore, with regard to the electrically conductive body 6 the inner ring 3 and the outer ring 4 are located fully in the bore 7.

[0037] A shielding braid 8 of a cable 2 can be mechanically clamped in said spacing 5 between the inner ring 3 and the outer ring 4. This can be seen for example in the cross sectional view of figure 3, in which the shielding braid 8 of the cable 2 extends from the left of the drawing into the spacing 5.

[0038] The cable 2 comprises in the present embodiment a conductive core 22 which is surrounded by an inner insulation 23. The shielding braid 8 encompasses the inner insulation 23 and serves as an electromagnetic shielding element for the cable 2. On the outer side of the shielding braid 8 there is arranged an outer insulation 26 which covers the shielding braid 8. The structure of the cable is shown as an example and it can have a different structure.

[0039] Between the outer ring 4 and the electrically conductive body 6 an electrical contact element 9 is arranged. With the electrical contact element 9 an electrical contact between the outer ring 4 and the electrically conductive body 6 is provided. With regard to figure 3 this means that an electrical contact is provided from the shielding braid 8 via the outer ring 4 and the contact element 9 to the electrically conductive body 6. The electrically conductive body 6 can be part of a shielding structure of a plug housing or it can be part of the plug housing. With this shielding arrangement it is possible to provide a facile structure in terms of its mechanical structure and in terms of proving an efficient shielding structure. Furthermore the electrical contact between the shielding braid 8 and the electrically conductive body 6 can be enhanced.

[0040] The electrical contact element 9 comprises a plurality of resilient contact pieces 10. With the resilient contact pieces 10 it is possible to provide the electrical contact between the outer ring 4 and the electrically conductive body 6. Thereby the resilient contact pieces 10 are clamped or braced within a gap between the bore 7 and the outer ring 4. The gap is designated with the reference number 25. The resilient contact pieces 10 are provided such that they contact the outer surface 4b of the outer ring 4 as well as the inner surface 7a of the bore 7. Furthermore they are resiliently located in this gap 25 such that they are always in contact with the respective surfaces 7a and 4b. The electrical contact element 9 extends substantially fully around said middle axis M, such that a circular contact between the electrically conductive body 9 and the outer ring 4 can be achieved.

[0041] In the present case, the outer ring 4 comprises a contact surface 11, which is part of the outer surface 4b. Thereby the electrical contact element 9 is in an electrical contact with this contact surface 11. Furthermore the bore 7 comprises also a contact surface 12, which is part of the inner surface 7a of the bore 7. Again the electrical contact element 9 is in an electrical contact with the contact surface 12. In the present case, the contact surface 12 arranged in the bore 6 has a cylindrical shape. Thereby it has a constant cylindrical diameter D. Furthermore, the contact surface 12 has a length L which extends along the middle axis M. The length L is preferably longer the width W of the contact element 9 as seen along the middle axis M. This means that the contact element 9 can be positioned on the contact surface 12 at any position and it can be moved along the contact surface 12, which has the advantage that tolerances of the end of the shielding braid 8 can be compensated very efficiently.

[0042] The contact surface of the outer ring 4 comprises a groove 13 which extends around the middle axis M and in which the electrical contact element 9 is placed. The groove has in the present embodiment the cross action of a dovetail. Thereby the electrical contact element is arranged firmly in this structure. However, the groove can also have any other

shape.

[0043] Additionally, the outer ring 4 comprises in the present embodiment a crimping section 14. The crimping section 14 is arranged at a distance with regard to the contact surface 11. The crimping section 14 will be mechanically deformed. Thereby its diameter will be decreased such that the width of the spacing 5 is minimized in order to crimp the shielding braid 8 in said spacing 5. Alternatively it may also be possible to crimp the inner ring 3 against the outer ring 4.

[0044] The crimping can be a circular or a hexagonal crimping.

[0045] As it can be seen from figure 3, the inner ring 3 has a length L13 in direction of the middle axis M. This length L13 is in the present case a bit longer then the length L14 of the crimping section 14 of the outer ring 4. The length L13 could also be equal or shorter than the crimping section 14.

[0046] The contact surface 11 of the outer ring 4 is arranged at a distance in direction of the middle axis M to the crimping section 14. In the embodiment as shown in the figures the contact surface 11 is provided by the groove 13. In the present case, the contact surface 12 is oriented towards the cable 2 and the crimping section 14 is oriented towards a plug or the end of the cable. The arrangement of the crimping section 14 with a distance to the contact surface 11 has the advantage that the contact surface 11 is not affected by the crimping procedure which will mechanically deform the crimping section 14. Therefore the contact surface 11 will 1not be mechanically influenced, once the crimping section 14 is deformed. Hence, the two functions "crimping" and "electrical contact" are separated from each other.

[0047] In the embodiment as shown in the figures, the diameter of the crimping section 14 is larger than the diameter of the contact surface 11.

[0048] As it can be seen in figure 3, the front end 15 of the inner ring 3 is tapered towards the outer surface 3a and towards the inner surface 3b. This has the advantage that the inner ring 3 can be easily moved on the inner insulation 23 of the cable 2 as well as within the shielding braid 8.

[0049] Additionally the body 6 comprises on an end section 16 an outer thread 17 via which a threaded sleeve 18 is connectable. The threaded sleeve 18 is preferably arranged such that it acts on a sealing element 19, which can be in an elastic manner pushed towards to the outer insulation 26 of the cable 2 as well as against the body 6 in order to seal the gap between the outer insulation 26 and the bore 7 of the body so that it is not possible that moisture enters into this gap.

[0050] Furthermore, on the other side of the outer thread 17 the body 6 comprises on the end section 27 a connection interface 20, via which the body is connectable to an external plug housing in an electrical conductive manner.

[0051] Alternatively it may also be possible that the plug housing is integrally formed on the body 6 in the region of the connection interface 20.

[0052] The opening of the outer ring 4 comprises also a conical section 21 which allows an easy mounting of the outer ring 4 over the inner ring 3 and the shielding braid 8.

[0053] A preferred embodiment of shielding structure comprises an electromagnetic shielding arrangement according to the description above and a cable 2 having at least one electrically conductive core 22 and an inner insulation 23 which is encompassed by a shielding braid 8, wherein the inner ring 3 is located between the inner insulation 23 and the shielding braid 8, wherein the shielding braid 8 extends into said spacing between the inner ring 3 and the outer ring 4 and is clamped in said spacing 5.

[0054] A method to mount electromagnetic shielding arrangement according to the description above is characterized in that

- the inner ring 3 is mounted under the shielding braid 8;
- the outer ring 4 is mounted over the shielding braid 8 such that the shielding braid 8 is positioned in said spacing 5 between the inner ring 3 and the outer ring 4,
- the outer ring 4 and/or the inner ring 3 is mechanically deformed such that the shielding braid 8 is clamped in said spacing 5, and
- the body 6 is positioned over the outer ring 4 such that an electrical connection between said outer ring 4 and said body 6 is provided by means of the contact element 9.

LIST OF REFERENCE SIGNS

1	shielding arrangement	17	outer thread
2	cable	18	threaded sleeve
3	inner ring	19	sealing element
3a	inner surface	20	connection interface
3b	outer surface	21	conical section
4	outer ring	22	conductive core
4a	inner surface	23	inner insulation
4b	outer surface	25	gap

(continued)

5	spacing	26	outer insulation
6	body	27	end section
7	bore		
7a	inner surface	M	middle axis
8	shielding braid	L	length
9	electrical contact element	W	width
10	resilient contact pieces	D	Diameter
11	contact surface		
12	contact surface		
13	groove		
14	crimping section		
15	front end		
16	end section		

Claims

1. Electromagnetic shielding arrangement (1), comprising
an inner ring (3) extending around a middle axis (M) and having an inner surface (3a) and an outer surface (3b),
an outer ring (4) extending around said middle axis (M) and having an inner surface (4a) and an outer surface (4b),
which inner ring (3) is located at least partly within said outer ring (4) wherein a spacing (5) is provided between the inner ring (3) and the outer ring (4), and
an electrically conductive body (6) having a bore (7) with an inner surface (7a), wherein said inner ring (3) and/or said outer ring (4) are at least partly located in said bore (7);
wherein a shielding braid (8) of the cable (2) can be mechanically clamped in said spacing (5) between the inner ring (3) and the outer ring (4) such that an electrical contact is provided between said outer ring (4) and said shielding braid (8), and
wherein an electrical contact element (9) is arranged between the outer ring (4) and the electrically conductive body (6) in order to provide an electrical contact between the outer ring (4) and the electrically conductive body (6).

2. Electromagnetic shielding arrangement (1) according to claim 1, **characterized in that** the electrical contact element (9) comprises a plurality of resilient contact pieces (10) and extends substantially fully around said middle axis (M).

3. Electromagnetic shielding arrangement (1) according to one of the preceding claims, **characterized in that** the outer ring (4) comprises a contact surface (11) with which said electrical contact element (9) is in electrical contact and/or **in that** the bore (7) comprises a contact surface (12) with which said electrical contact element (9) is in electrical contact.

4. Electromagnetic shielding arrangement (1) according to claim 3, **characterized in that** at least one of said contact surface (11, 12) extends around said middle axis (M) with a constant cylindrical diameter (D), wherein said contact surface (11, 12) has a length (L) as seen along the middle axis (M) which is longer than the width (W) of the contact element (9) as seen along the middle axis (M); and/or wherein the position of the contact element (9) on said contact surface can variable.

5. Electromagnetic shielding arrangement (1) according to claim 3 or 4, **characterized in that** either the contact surface (11) of the outer ring (4) or the contact surface (12) of the bore (7) is part of a groove (13) extending around the middle axis (M), wherein the contact element (9) is arranged in said groove (13), which groove (13) has preferably a rectangular cross-section or a dovetail cross-section and **in that** the other contact surface (11, 12) without the groove (13) is cylindrical with a constant diameter.

6. Electromagnetic shielding arrangement (1) according to one of the preceding claims, **characterized in that** the outer ring (4) and/or the inner ring (3) comprises a crimping section (14) which can be mechanically deformed in order to minimize the width of the spacing (5) such that the shielding braid (8) is crimped in said spacing (5).

7. Electromagnetic shielding arrangement (1) according to claim 6, **characterized in that** the inner ring (3) has a length

(L3) in direction of the middle axis (M) which is shorter or equal or longer to the length (L14) of the crimping section (14) of the outer ring (4) in direction of the middle axis (M).

8. Electromagnetic shielding arrangement (1) according to one of the preceding claims 6 or 7, **characterized in that** the crimping (14) is a circular or a hexagonal crimping.

9. Electromagnetic shielding arrangement (1) according to one of the preceding claims 3 to 8, **characterized in that** the contact surface (12) of the outer ring (4) is arranged at a distance to the crimping section (14) as seen along the middle axis (M) and/or **in that** the diameter of the contact surface (12) of the outer ring (4) is larger than the diameter of the crimping section (14).

10. Electromagnetic shielding arrangement (1) according to one of the preceding claims, **characterized in that** the front end (15) of the inner ring (3) is tapered towards the outer surface (3b) and/or towards the inner surface (3a).

11. Electromagnetic shielding arrangement (1) according to one of the preceding claims, **characterized in that** the body (6) comprises on an end section (16) an outer thread (17) via which a threaded sleeve (18) is connectable, which threaded sleeve (18) preferably acts on a sealing element (19); and/or **in that** the body (6) comprises on an end section (27) a connection interface (20) via which the body (6) is connectable to an external plug housing or via which a plug housing is integrally formed on the body (6).

12. Electromagnetic shielding arrangement (1) according to one of the preceding claims, **characterized in that** the opening of the outer ring (4) comprises a conical section (21).

13. Shielding structure comprising an electromagnetic shielding arrangement (1) according to one of the preceding claims and a cable (2) having at least one electrically conductive core (22) and an inner insulation (23) which is encompassed by a shielding braid (8), wherein the inner ring (3) is located between the inner insulation (23) and the shielding braid (8), wherein the shielding braid (8) extends into said spacing between the inner ring (3) and the outer ring (4) and is clamped in said spacing (5).

14. Method to mount an electromagnetic shielding arrangement (1) according to one of the preceding claims 1 to 12, **characterized in that**
the inner ring (3) is mounted under the shielding braid (8);
the outer ring (4) is mounted over the shielding braid (8) such that the shielding braid (8) is positioned in said spacing (5) between the inner ring (3) and the outer ring (4),
the outer ring (4) and/or the inner ring (3) is mechanically deformed such that the shielding braid (8) is clamped in said spacing (5), and
the body (6) is positioned over the outer ring (4) such that an electrical connection between said outer ring (4) and said body (6) is provided by means of the contact element (9).

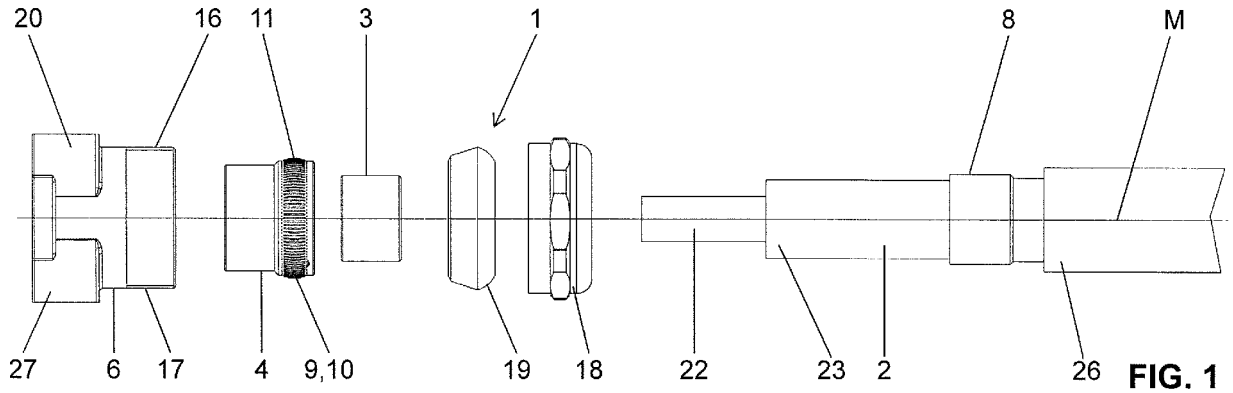
20
16
11
3
1
8
M
27
6
17
4
9,10
19
18
22
23
2
26

FIG. 1

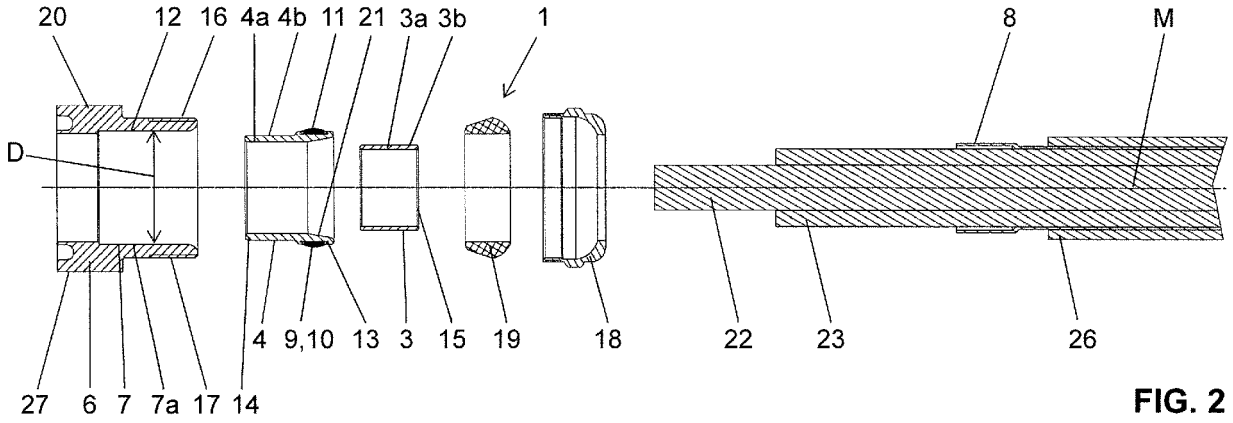
20
12
16
4a
4b
11
21
3a
3b
1
8
M
D
27
6
7
7a
17
14
4
9,10
13
3
15
19
18
22
23
26

FIG. 2

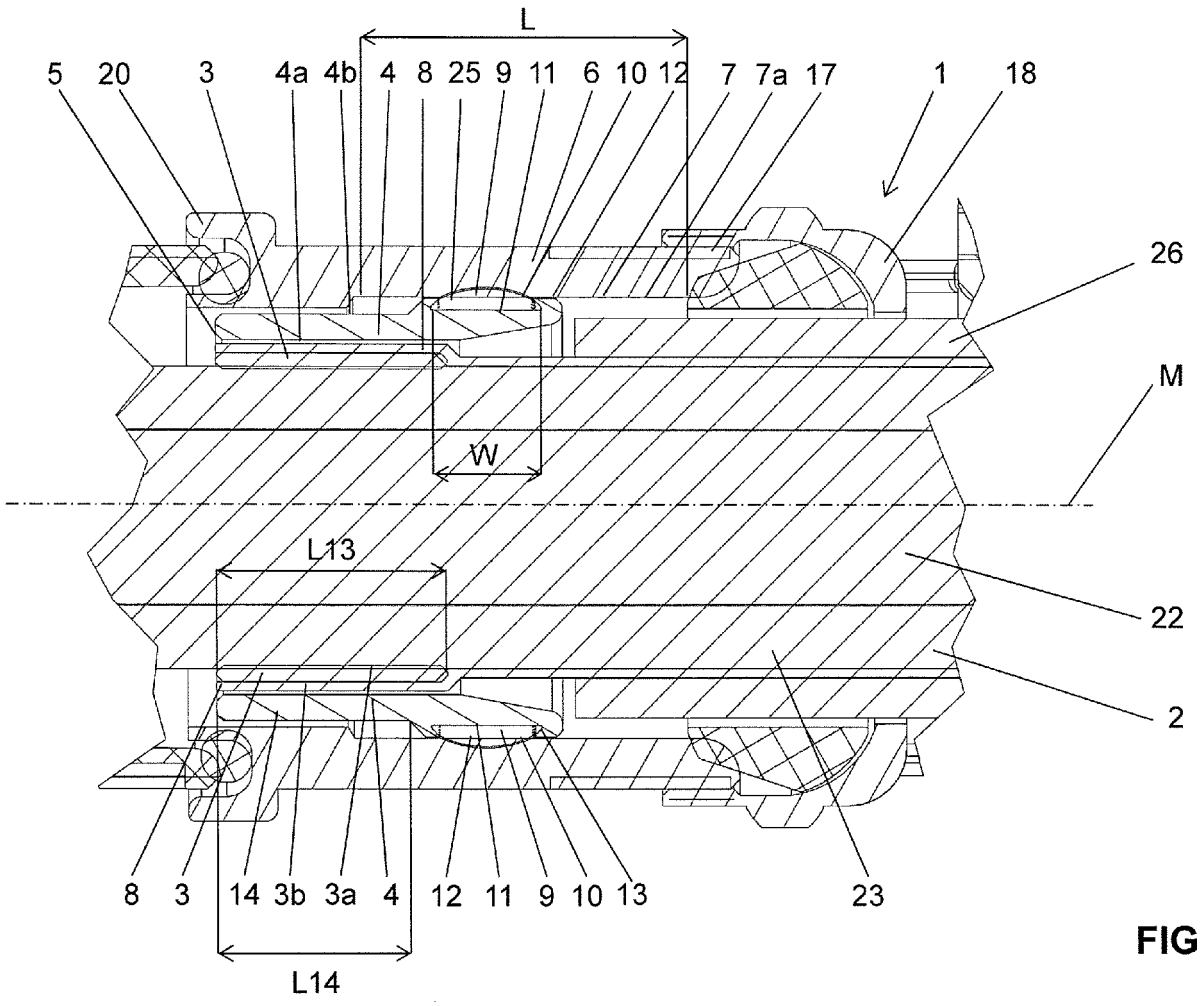
L
5
20
3
4a
4b
4
8
25
9
11
6
10
12
7
7a
17
1
18
26
M
W
L13
22
2
8
3
14
3b
3a
4
12
11
9
10
13
23
L14

FIG. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 15 9749

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 99/08343 A1 (THOMAS & BETTS INT [US]) 18 February 1999 (1999-02-18) * page 3, line 19 - page 4, line 7; figures 1,8,9 * * page 6, line 8 - page 8, line 32 *	1-14	INV. H01R9/05
A	WO 2015/189289 A1 (DELPHI INTERNAT OPERATIONS LUXEMBOURG S À R L [LU]) 17 December 2015 (2015-12-17) * paragraph [0016] - paragraph [0025]; figures 2-4 *	1-14	
A	US 2010/297875 A1 (PURDY ERIC [US] ET AL) 25 November 2010 (2010-11-25) * paragraph [0072] - paragraph [0077]; figures 2-7 *	1-14	
A	DE 71 25 761 U (SPINNER, GEORG) 2 August 1973 (1973-08-02) * page 3, line 13 - line 28; figure 1 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC) H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 September 2018	Bouhana, Emmanuel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 9749

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9908343 A1	18-02-1999	AU 737577 B2	23-08-2001
		EP 0929917 A1	21-07-1999
		US 6102738 A	15-08-2000
		WO 9908343 A1	18-02-1999
WO 2015189289 A1	17-12-2015	CN 106463850 A	22-02-2017
		EP 3155692 A1	19-04-2017
		FR 3022410 A1	18-12-2015
		KR 20170013392 A	06-02-2017
		US 2017187150 A1	29-06-2017
		WO 2015189289 A1	17-12-2015
US 2010297875 A1	25-11-2010	AR 076791 A1	06-07-2011
		AR 100947 A2	09-11-2016
		AU 2010249855 A1	02-02-2012
		CA 2762283 A1	25-11-2010
		CA 2895030 A1	25-11-2010
		CA 2998613 A1	25-11-2010
		CN 101944688 A	12-01-2011
		CN 105119067 A	02-12-2015
		CN 201904508 U	20-07-2011
		DK 2436088 T3	10-08-2015
		EP 2436088 A2	04-04-2012
		EP 2797178 A1	29-10-2014
		GB 2477479 A	03-08-2011
		HK 1218189 A1	03-02-2017
		JP 2012527730 A	08-11-2012
		KR 20120030448 A	28-03-2012
		KR 20150080630 A	09-07-2015
		KR 20170055563 A	19-05-2017
		TW 201042852 A	01-12-2010
		US 2010297875 A1	25-11-2010
		US 2011143567 A1	16-06-2011
		US 2012222302 A1	06-09-2012
		US 2012270428 A1	25-10-2012
		US 2013034983 A1	07-02-2013
		US 2013065435 A1	14-03-2013
		US 2013072059 A1	21-03-2013
		US 2014030916 A1	30-01-2014
		US 2014099814 A1	10-04-2014
		US 2014106592 A1	17-04-2014
		US 2014106615 A1	17-04-2014
		US 2014220807 A1	07-08-2014
		US 2014322967 A1	30-10-2014
		US 2017358894 A1	14-12-2017
		WO 2010135181 A2	25-11-2010

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 9749

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 7125761 U	02-08-1973	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82