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

(11) **EP 4 254 680 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.10.2023 Bulletin 2023/40

(21) Application number: **22215721.6**

(22) Date of filing: **21.12.2022**

(51) International Patent Classification (IPC):
H01R 13/6582 *(2011.01)* ***H01R 43/16*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01R 13/6582; H01R 43/16

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **22.12.2021 FR 2114294**

(71) Applicant: **Aptiv Technologies Limited**
St. Michael (BB)

(72) Inventors:
- **DEMOMENT, Fabrice**
  28210 NOGENT LE ROI (FR)
- **VENARD, Marine**
  78610 AUFFARGIS (FR)

(74) Representative: **INNOV-GROUP**
310, avenue Berthelot
69372 Lyon Cedex 08 (FR)

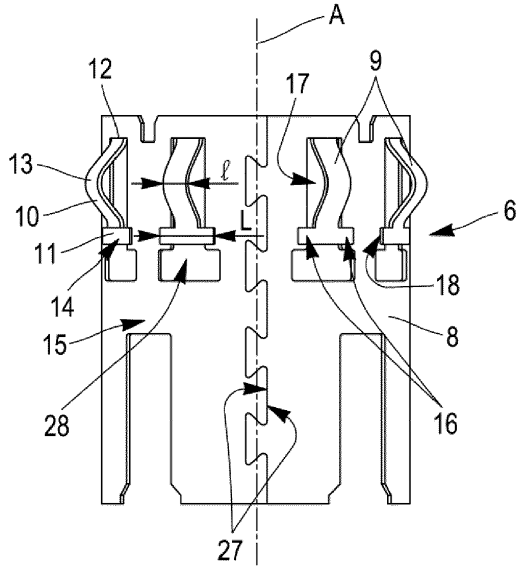
(54) SHIELDED CONNECTION ASSEMBLY, CONNECTOR FOR THIS CONNECTION ASSEMBLY AND METHOD OF MANUFACTURING A SHIELDING ELEMENT FOR THIS CONNECTION ASSEMBLY

(57) Electrical connection assembly for a motor vehicle electrical circuit, comprising a connector and a counter-connector. The connector comprises a first shielding element (6) with a body (8) formed of a sheet metal in which elastic contact tabs (9) are cut out and comprise at least one junction portion (12) and a contact portion (13) protruding on a surface of the body (8) and configured to establish an electrical contact with a shielding element.

Each contact tab (9) comprises an interference portion (14) which is connected to the remainder of the body (8) only via a longitudinal segment (10) which is itself connected to the body (8) only via the junction portion (12). Each contact tab (9) is designed so that the interference portion (14) rests on the body (8).

Connector for this connection assembly and method of manufacturing a shielding element for this connection assembly

[Fig. 5]



EP 4 254 680 A1

Description

Technical field

[0001] The invention relates to the field of connectors for motor vehicles and in particular to the field of connectors shielded against electromagnetic interference.

State of the art

[0002] There are electrical connection assemblies comprising a shielded connector and counter-connector. Each one of these connector and counter-connector comprises a housing in which at least one electrical contact and at least one shielding element are housed. In the case of electrical connection assemblies configured to transmit high currents (for example in electric, hybrid or plug-in hybrid vehicles) the shielding elements are configured to reduce the influence on the environment of potential electromagnetic disturbances generated by these high currents. To this end, electrical continuity is sought between the shielding of the connector and the shielding of the counter-connector. As described in EP3107155A1 contact tabs are then provided on at least one of the shielding elements of the connector, these contact tabs being configured to establish a connection with a shielding element of the counter connector. Each of these contact tabs is in the form of a deformable lamella and comprises a junction portion and a contact portion. The contact tab is connected to the body of the shielding element only via the junction portion and is shaped so that the contact portion projects from a surface of the body.

[0003] This type of contact tabs can cause the shielding of one connector to be incorrectly connected to the shielding of the other connector. For example, it may happen that the contact tabs are deformed during storage between the manufacture of the shielding element comprising these contact tabs and the assembly of this shielding element in a connector. Furthermore, these contact tabs are often very flexible and do not necessarily provide sufficient contact force.

Disclosure of the invention

[0004] A shielded connection assembly, a connector and a method of manufacturing a shielding element for this connection assembly are described below, which contribute at least partially to overcome at least one of the aforementioned drawbacks.

[0005] Thus, an electrical connection assembly for a motor vehicle electrical circuit is described, comprising a connector and a counter-connector. The connector comprises at least one first shielding element and the counter-connector comprises at least one second shielding element. The first shielding element comprises a body formed from a metal sheet from which at least one resilient contact tab is cut out. This contact tab or tongue extends along a longitudinal direction. It comprises at least one junction portion and a contact portion projecting from a surface of the body. This contact tab is connected to the body only by the junction portion. It is configured to make electrical contact with the second shielding element, when the connector is mated with the counter connector.

[0006] In this connection assembly, each contact tab comprises an interference portion which is connected to the remainder of the body only via a longitudinal segment, which is itself connected to the body only via the junction portion. In addition, each contact tab is configured so that its interference portion abuts the body of the first shielding element when the connector is mated with the counter connector.

[0007] In other words, each contact tab is integral with the body of the first shielding element. It is therefore rigidly connected to the body via the junction portion located at one of its longitudinal ends. But the other longitudinal end is free. However, an interference portion is provided on the contact tab and this interference portion can come to bear on the body so that the movement of the free end is limited. Thus, pressure on the contact portion pushes the interference portion against the body. This limits the deformation of the contact tabs and allows a greater contact force to be maintained than in prior art connection assemblies in which one end of the contact tab is free. Thus this allows for better electrical contact, between the contact tab of the first shielding element and the second shielding element.

[0008] This connection assembly also optionally comprises one and/or other of the following features, each considered independently of the other or in combination with one or more others:

- the body of the first shielding element comprises an opening arranged under the contact tab, this opening being bordered by two support zones spaced apart, perpendicularly to the longitudinal direction, by a maximum distance which is less than the largest dimension, perpendicularly to the longitudinal direction, of the interference portion;
- the interference portion is formed by a transverse segment extending substantially transversely to the longitudinal segment, this transverse segment comprising two interference tabs; each interference tab rests on the body on either side of an opening in the body and located substantially under the contact tab, when the contact portion makes electrical contact with the second shielding element;
- the first and second shielding elements have a generally cylindrical shape with a circular base,
- the first shielding element has a central longitudinal axis and comprises a plurality of contact tabs distributed in pairs symmetrically with respect to the central axis;
- each tab is oriented from the junction portion to the

interference portion, in a direction corresponding to that of coupling the connector with the counter-connector;

- the body of the first shielding element comprises an open area corresponding to an opening released by the transverse segment of each tab, after cutting of the latter and shaping of the contact portion, this open area being covered by the second shielding element when the connector is mated with the counter-connector.

[0009] Also described below is a connector comprising a housing, a terminal and at least a first shielding element housed in the housing. The first shielding element comprises a body formed of a sheet metal from which at least one resilient contact tab is cut out which extends along a longitudinal direction. The contact tab comprises at least one junction portion and one contact portion. The contact tab is connected to the body only via the junction portion and is curved, bent, in such a way that the contact portion protrudes from a surface of the body.

[0010] Each contact tab further comprises an interference portion configured to be able to interfere with the body of the first shielding element.

[0011] Optionally, in this connector, the body of the first shielding element comprises an opening arranged under the contact tab, this opening being bordered by two support zones spaced apart, perpendicularly to the longitudinal direction, by a maximum distance which is less than the largest dimension, perpendicularly to the longitudinal direction, of the interference portion.

[0012] Also described below is a method of manufacturing a shielding element for a connection assembly. This method comprises

- a cutting operation in a metal sheet of a shape substantially corresponding to the flat shape of a first shielding element, this cutting operation comprising cutting the body of the first shielding element and at least one contact tab in this body, this contact tab extending along a longitudinal direction and comprising a junction portion, a contact portion and an interference portion,
- a first forming operation comprising a bending of the longitudinal segment, to raise the contact portion of the longitudinal segment relative to the body, the cutting of the contact tab and the bending leaving an opening in the body of the first shielding element disposed below the contact tab, this opening being bordered by two support zones, the interference portion also being brought into superposition of the support zones during the first forming operation, and
- a second forming operation consisting of bending the body about a longitudinal axis substantially parallel to the longitudinal segment.

Brief description of the drawings

[0013] Further features and advantages will become apparent in the detailed discussion of various embodiments of the invention, the discussion being accompanied by examples and references to the accompanying drawings.

Figure 1 shows a schematic perspective of an example of a connection assembly, comprising a connector and a counter-connector;

Figure 2 shows a schematic perspective and exploded view of the connection assembly shown in Figure 1 ;

Figure 3 shows a schematic view of a shielding element for a connector of the connection assembly of Figure 1, on which a retention ring is mounted;

Figure 4 shows the shielding element and the retention ring shown in Figure 3 schematically in perspective and in exploded view;

Figure 5 shows a schematic view of a shielding element such as the one shown in Figures 3 and 4 in side elevation;

Figure 6 shows a schematic view of the shielding element in Figure 5;

Figure 7 shows a schematic cross-section of a connecting tab of the shielding element of Figure 5; and

Figure 8 shows a schematic cross-section of a connecting tab of the shielding element of figure 5 in electrical contact with a shielding element of a counter-connector.

Detailed description of embodiments

[0014] An example of an embodiment of a connection assembly 1 is shown in Figures 1 and 2. This connection assembly 1 is used, for example, in an electrical power circuit of a motor vehicle. Such a circuit is used, for example, to interconnect components such as a battery, a charging station, a converter, an electric motor, etc.

[0015] This connection assembly 1 comprises a connector 2 and a counter-connector 3. For example, both the connector 2 and the counter connector 3 comprise a housing 30 with two cavities in each of which a power terminal 4, 5 is housed. The connector 2 and the counter connector 3 are two-way power connectors. In the example shown in Figures 1 and 2, each connecting channel (way) is individually shielded. For example, two female terminals 4 are accommodated in the connector 2 and two male terminals 5 are accommodated in the counter connector 3. Each power terminal 4, 5 is attached and electrically connected to a cable 29 comprising a shielding braid. Within the connector 2 and the counter connector 3 each of the shielding braids is electrically connected to a separate shielding element 6, 7. For example, the connector 2 has two first shielding elements 6 and the counter connector 3 has two second shielding elements 7. The first 6 and second 7 shielding elements

have a generally cylindrical shape with a circular base. They extend longitudinally parallel to a central longitudinal axis A (see Figures 3, 4 and 6).

[0016] As shown more particularly in Figures 3 to 6, each first shielding element 6 comprises a body 8 formed from a sheet of metal from which resilient contact tabs 9 are cut out. Each first shielding element 6 thus comprises a plurality of contact tabs 9. For example, there are eight of these contact tabs 9. These contact tabs 9 are distributed in pairs symmetrically with respect to the central axis A (see figure 6). Thus, the contact force exerted by each of the contact tabs 9 of a first shielding element 6 on a second shielding element 7 is better distributed and balanced as well as more uniform.

[0017] Each of these contact tabs 9 extends along a longitudinal direction parallel to the central axis A. In the embodiment example described herein, each contact tab 9 has a "T" shape and comprises a longitudinal segment 10 and a transverse segment 11. For example, the longitudinal segment 10 extends between a junction portion 12 and the transverse segment 11. For example, the longitudinal segment 10 comprises a contact portion 13 and the transverse segment 11 comprises an interference portion 14. Each contact tab 9 is oriented from the junction area 12 to the interference portion 14 in a direction corresponding to the direction of mating of the connector 2 with the counter connector 3.

[0018] Each contact tab 9 is connected to the body 8 only by the junction portion 12. In other words, each contact tab 9 is cut out from the body 8 along a cutting line which runs all the way around the contact tab 9 (including the transverse segment 11) except at the junction area 12 where the cutting line is interrupted. Each contact tab 9 is thus released from the body 8, except at the junction area 12.

[0019] The longitudinal segment 10 of each contact tab 9 is bent so as to lift the contact portion 13 from the outer surface 15 of the body 8. The contact portion 13 thus protrudes from the outer surface 15 of the body 8. The longitudinal segment 10 has two substantially parallel longitudinal edges, between which the distance defines the width *d* of the longitudinal segment 10.

[0020] The transverse segment 11 extends perpendicular to the longitudinal segment 10 at a free end of the contact tab 9 longitudinally opposite the junction portion 12.

[0021] The transverse segment 11 has a length *L* greater than the width *l* of the longitudinal segment 10. The transverse segment 11 has two interference tabs 16. Each interference tab 16 is configured to rest on the body 8 on either side of an opening 17 in the body 8, which is located substantially below the contact tab 9, when the contact portion 13 makes an electrical contact with the second shielding element 7. In other words, this opening 17 is bordered by two support zones 18, each of the interference tabs 16 being brought into superposition of a respective support zones 18.

[0022] Furthermore, the first shielding element 6 supports a retention ring 20. The retention ring 20 comprises a substantially cylindrical wall 25 extending longitudinally parallel to the central axis A, between a first 21 and a second 22 circular edge. Protrusions 23 are provided in the vicinity of the first edge 21. These protrusions 23 are configured to retain the retention ring 20 on the first shielding member 6 and to orient the retention ring 20 and the first shielding member 6 relative to each other. The second edge 22 comprises a flange 24 the diameter of which is larger than the cylinder forming the wall 25. The cylindrical wall 25 has windows 26, each configured and positioned for the passage of the contact portion 13 of a respective contact tab 9.

[0023] According to an embodiment example, a method for manufacturing a first shielding element 6 as described below comprises one or more cutting operations and several forming operations. For example, it comprises an operation of cutting, from a metal sheet, a shape corresponding essentially to the flat shape of the first shielding element 6. This cutting operation thus includes cutting out the body 8 of the first shielding element 6. The contact tabs 9 are then cut out from the body 8. The body 8 also has longitudinal edges 27 cut out in a mortise and tenon shape. After this operation, each contact tab 9 extends flat along a longitudinal direction.

[0024] A first forming operation, by bending the longitudinal segment 10, is therefore carried out to raise the contact portion 13 of each longitudinal segment 10 with respect to the body 8 and to bring the interference portion 14 into alignment and superposition with the support zones 18. This first forming operation results in openings 17, each of which is arranged under a contact portion 9 and bordered by two support zones 18. This also results in open areas 28, each corresponding to an opening resulting from the cut out of the transverse segment 11 of each contact portion 9. The first forming operation is followed by a second forming operation consisting of bending the body 8 about the central longitudinal axis A and bringing the longitudinal edges 27 into engagement with each other.

[0025] As shown in figure 7, after cutting and shaping operations, the interference portion 14 (of each contact tab 9) is in register with a support zone 18, on the outer surface 15 of the first shielding element 6. Thus, as shown in figure 8, when the connector 2 is coupled to the counter-connector 3, the first shielding element 6 is at least partially inserted into the second shielding element 7. The contact portion 13 engages under the second shielding element 7. The bending of the unstressed contact tab 9 is such that the height of the contact tab 9 below the contact portion 13 is greater than the space *E* between the first 6 and second 7 shielding elements. When the connector 2 and the counter connector 3 are mated, the contact portion 13 is therefore pushed towards the outer surface 15 of the body 8 of the first shielding element 6 and the contact tab 9 is flattened. This causes the interference portion 14 to interact with the support zone 18 via the interference tabs 16. However, this interaction of

the interference portion 14 with the support zone 18 limits the deformation of the contact tab 9, which then exerts a greater contact force, by the contact portion 13, on the second shielding element 7.

[0026] Furthermore, the first 6 and second 7 shielding elements are configured in such a way that, when the connector 2 and the counter-connector 3 are mated, the openings 17 and open areas 28 of one are covered by a solid area of the other. In this way, the shielding performance is optimised.

[0027] Particular shapes and positions for the contact tabs 9 have been described above, in particular with regard to the transverse segment 11, the support zones 18, the open areas 28, etc., but other shapes can be envisaged. For example, according to variants, the transverse segment 11 is not located at the free end of the contact tab 9, but at another distance from the junction portion along the longitudinal segment 10. According to other variants, the interference portion 14 may have a rounded shape, etc., the shielding elements 6, 7 may have cross-sections other than circular, each shielding element 6 or 7 may be common to several tracks, each first shielding element 6 may comprise at least one flat zone at which one or more contact tabs 9 are located, etc.

Claims

1. Electrical connection assembly (1) for a motor vehicle electrical circuit, comprising a connector (2) and a counter-connector (3), the connector (2) comprising at least one first shielding element (6) and the counter-connector (3) comprising at least one second shielding element (7), the first shielding element (6) comprising a body (8) formed from a sheet metal from which at least one resilient contact tab (9) is cut out, extends along a longitudinal direction and comprises at least one junction portion (12) and one contact portion (13) protruding from a surface of the body (8) and configured to establish an electrical contact with the second shielding element (7), when the connector (2) is coupled to the counter connector (3),

   wherein each contact tab (9) comprises an interference portion (14) which is connected to the remainder of the body (8) only via a longitudinal segment (10) which is itself connected to the body (8) only via the junction portion (12), and wherein each contact tab (9) is configured so that the interference portion (14) abuts the body (8) of the first shielding element (6) when the connector (2) is mated with the counter connector (3),

   said connection assembly (1) being **characterized by** the fact that the body (8) of the first shielding element (6) has openings (17) arranged under each contact tab (9), said openings (17) each corresponding to an opening resulting from the cut out of the longitudinal segment (10) of each contact tab (9), and each of said openings (17) being bordered by two support zones (18) spaced perpendicularly to the longitudinal direction, by a maximum distance which is less than the largest dimension, perpendicularly to the longitudinal direction, of the interference portion (14).

2. A connection assembly (1) according to claim 1, wherein the interference portion (14) is formed by a transverse segment (11) extending substantially transversely to the longitudinal segment (10), this transverse segment (11) having two interference tabs (16), wherein each interference tab (16) rests on the body (8) on either side of an opening in the body (8) which is located substantially below the contact tab (9) when the contact portion (13) makes electrical contact with the second shielding element (7).

3. A connection assembly (1) according to any of the preceding claims, wherein the first (6) and second (7) shielding elements have a generally cylindrical shape with a circular base.

4. A connection assembly (1) according to any of the preceding claims, wherein the first shielding element (6) has a central longitudinal axis (A) and has a plurality of contact tabs (9) distributed in pairs symmetrically with respect to the central axis (A).

5. A connector assembly (1) according to any of the preceding claims, wherein each contact tab (9) is oriented from the junction area (12) to the interference portion (14), in a direction corresponding to that of mating the connector (2) with the counter-connector (3).

6. A connection assembly (1) according to any of the preceding claims, wherein the body (8) of the first shielding element (6) comprises an open area corresponding to an opening resulting from the cut out of the transverse segment (11) of each contact tab (9), after cutting thereof and shaping the contact portion (13), this open area being covered by the second shielding element (7) when the connector (2) is mated with the counter-connector (3).

7. Connector having a housing (30), a terminal and at least one first shielding element (6) which is accommodated in the housing (30), the first shielding element (6) having a body (8) which is formed from a metal sheet and from which at least one resilient contact tab (9) is punched, which tab extends along a longitudinal direction and has at least one junction portion (12) and one contact portion (13), the contact tab (9) being connected to the body (8) only via the junction portion (12) and being curved with the con-

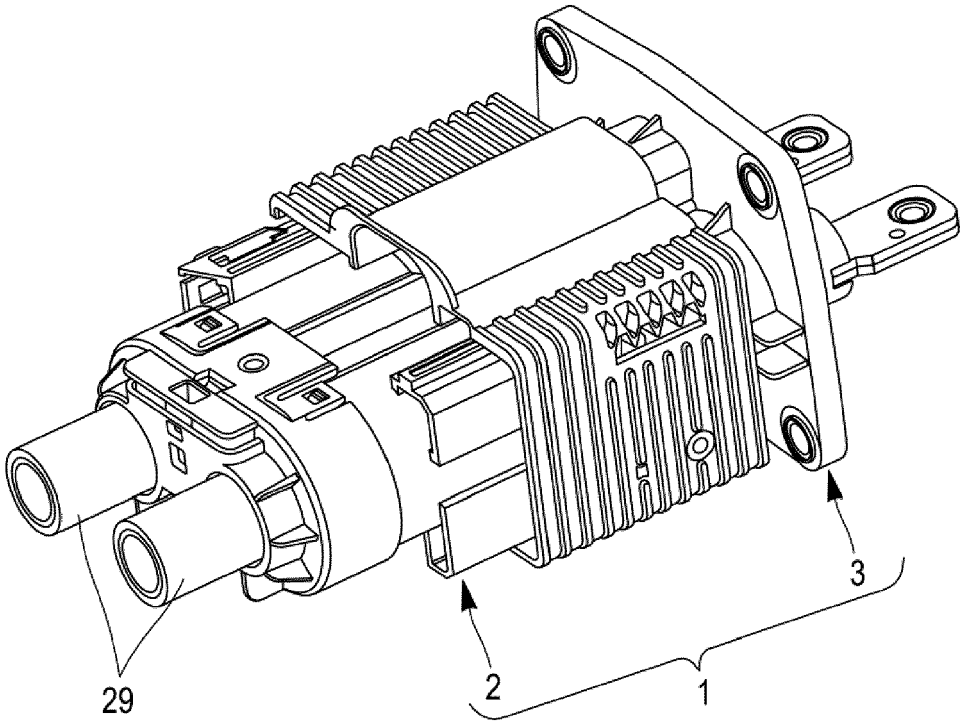
tact portion (13) projecting from a surface of the body (8),

wherein each contact tab (9) further comprises an interference portion (14) configured to be able to interfere with the body (8) of the first shielding member (6),
characterized in that the body (8) of the first shielding element (6) has openings (17) arranged under each contact tab (9), these openings (17) each corresponding to an opening resulting from the cut out of the longitudinal segment (10) of each contact tab (9), and each of these openings (17) being bordered by two spaced-apart support zones (18), perpendicularly to the longitudinal direction, by a maximum distance which is less than the largest dimension, perpendicularly to the longitudinal direction, of the interference portion (14).

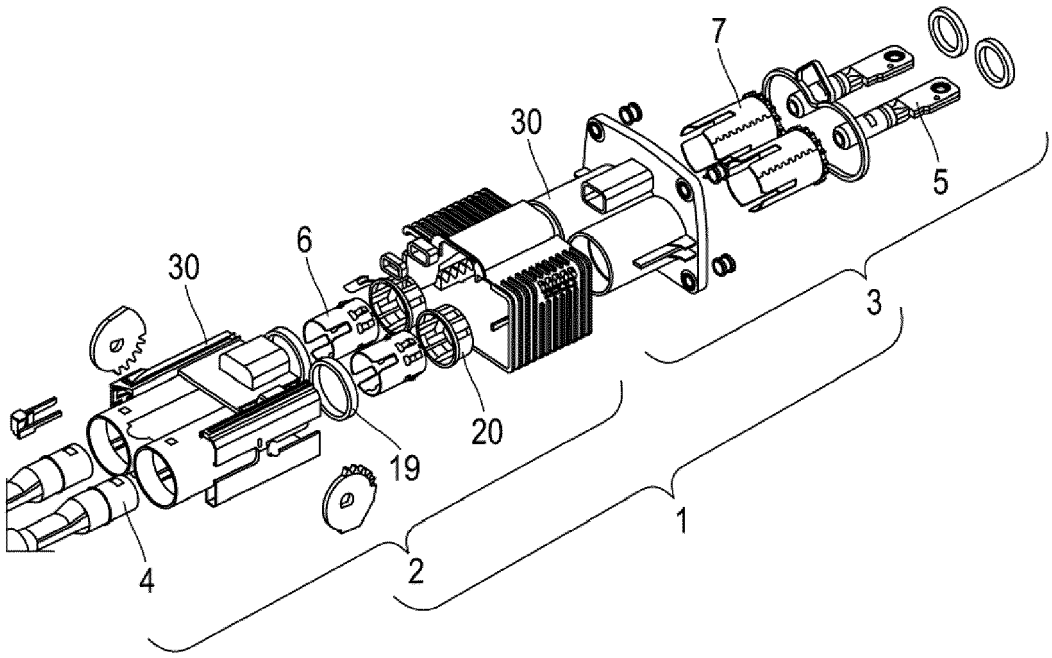
8. A method of manufacturing a shielding element for a connection assembly (1) according to any of claims 1 to 6, comprising

- a cutting operation in a metal sheet of a shape substantially corresponding to the flat shape of the first shielding element (6), said cutting operation comprising cutting the body (8) of the first shielding element (6) and at least one contact tab (9) in said body (8), this contact tab (9) extending along a longitudinal direction and comprising a junction portion (12), a contact portion (13) and an interference portion (14), and the operation of cutting the contact tab (9) leaving an opening in the body (8) of the first shielding element (6), this opening corresponding to an opening freed by the longitudinal segment (10) cut out of each contact tab (9) and comprising a support zone (18) the smallest dimension of which, perpendicular to the longitudinal direction, is smaller than the largest dimension, perpendicular to the longitudinal direction, of the interference portion (14),
- a first forming operation comprising a bending of the longitudinal segment (10), in order to raise the contact portion (13) of the longitudinal segment (10) with respect to the body (8), the operation of cutting out the contact tab (9) and the bending leaving the contact portion (13) free, resulting in an opening in the body (8) of the first shielding element (6) which is arranged below the contact strip and which is bordered by two support zones (18), the interference region (14) also being brought into alignment with the support zones (18) during the first forming operation,
and
- a second forming operation, in which the body (8) is bent about a longitudinal axis which is essentially parallel to the longitudinal segment (10).

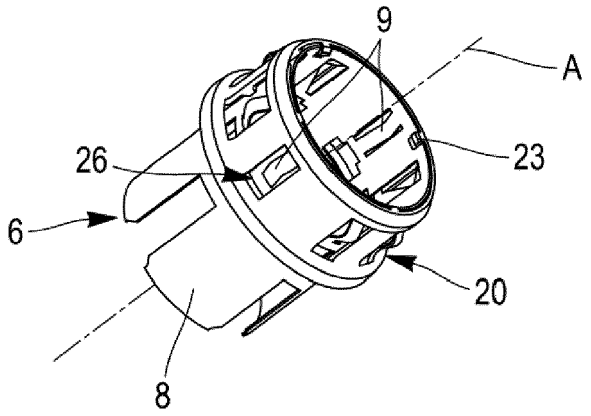
[Fig. 1]



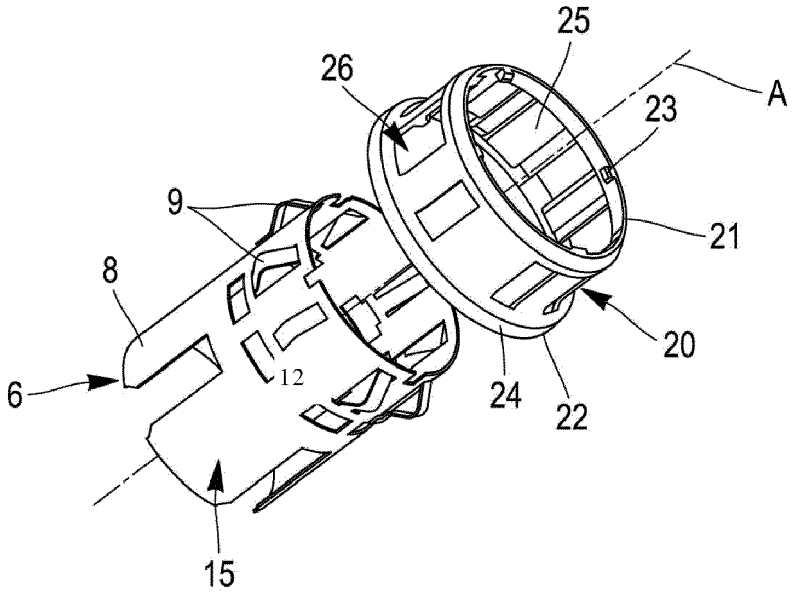
[Fig. 2]



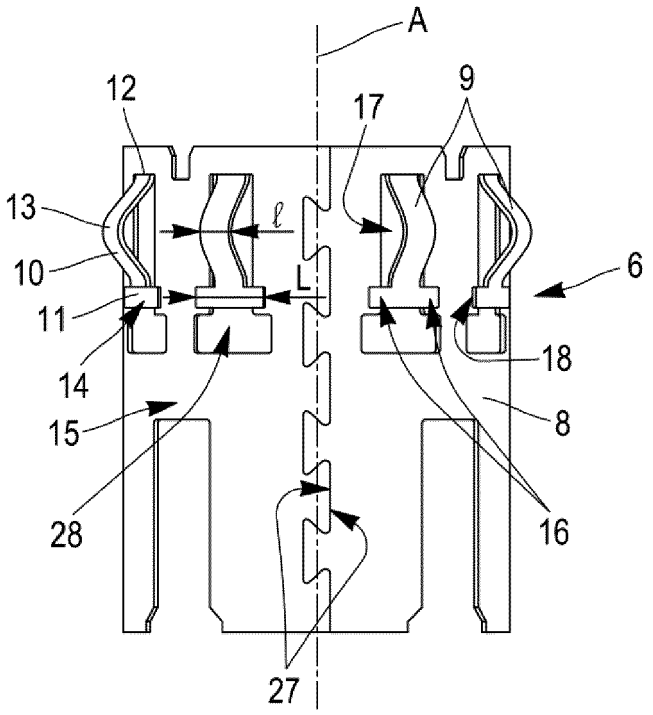
[Fig. 3]



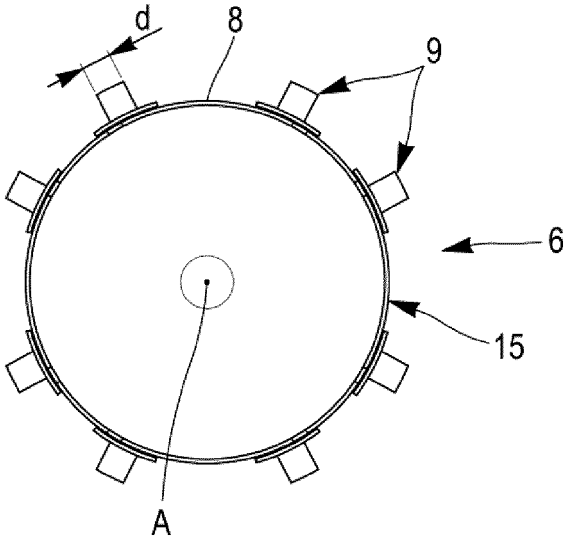
[Fig. 4]



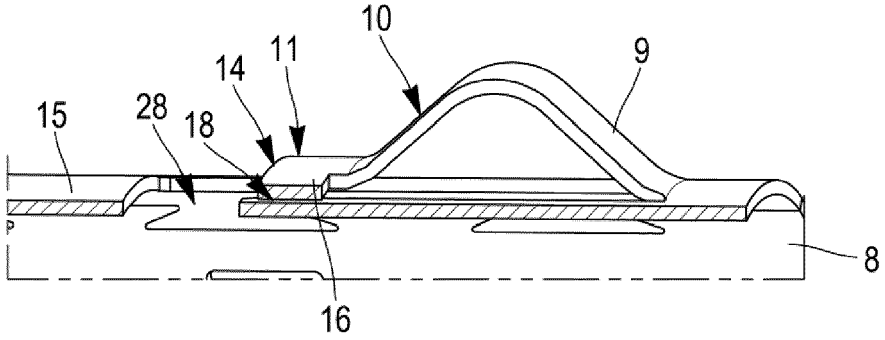
[Fig. 5]



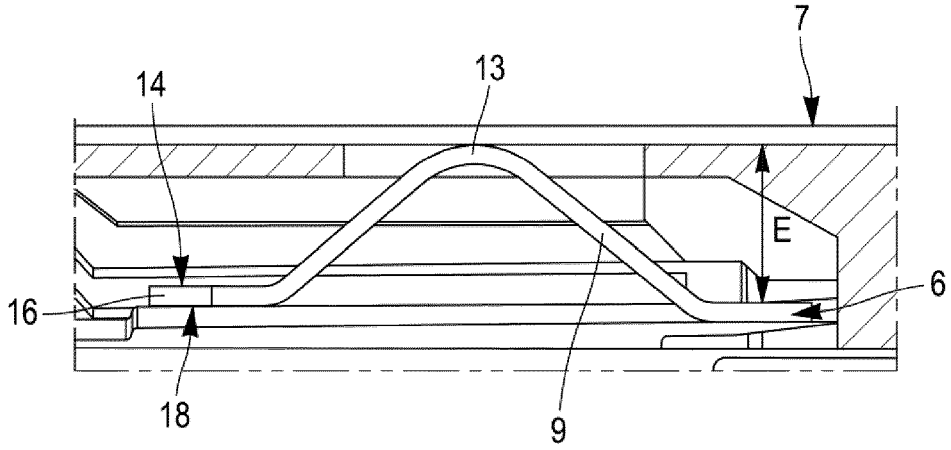
[Fig. 6]



[Fig. 7]



[Fig. 8]



Europäisches Patentamt
European Patent Office
Office européen des brevets

PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 22 21 5721

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 6 299 489 B1 (PHILLIPS KEVIN PAUL [US] ET AL) 9 October 2001 (2001-10-09) * figures 1-13 *	1,8	INV. H01R13/6582 H01R43/16
A,D	EP 3 107 155 A1 (DELPHI INT OPERATIONS LUXEMBOURG SARL [LU]) 21 December 2016 (2016-12-21) * figure 4 *	1-6,8	
A	EP 2 200 130 A1 (TYCO ELEKTRONICS AMP GMBH [DE]) 23 June 2010 (2010-06-23) * figure 14 *	1	
A	EP 3 540 865 A1 (ROSENBERGER HOCHFREQUENZTECHNIK GMBH & CO KG [DE]) 18 September 2019 (2019-09-18) * figures 1,2 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
The Hague	24 August 2023	Hugueny, Bertrand

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 (P04E07)

Europäisches Patentamt
European Patent Office
Office européen des brevets

INCOMPLETE SEARCH
SHEET C

Application Number
EP 22 21 5721

Claim(s) completely searchable:
1-6, 8

Claim(s) not searched:
7

Reason for the limitation of the search:

The present application comprises three independent claims, device claims 1 and 7 and method claim 8. On 15/05/2023, the examiner issued a communication pursuant to Rule 62a EPC detailing that claims 1 and 7 were not complying with the requirements of Rule 43(2) EPC. After calling the examiner on 15/06/2023, the applicant filed a written reply to this communication on 06/07/2023.
The applicant replied that each of the connector of the connector assembly of claim 1, necessarily has a housing and at least one terminal. The examiner would like to draw the attention on the title of the CPC class H01R12/718: "Contact members provided on the PCB without an insulating housing". This evidences already that the terminology connector does not necessarily implies a housing. Further, the CPC class B60L53/12 includes charging connectors for vehicle providing "inductive energy transfer" (Title of the class). This means that those connector do not comprise terminals but inductive elements. Therefore none of the elements, terminal or housing, are considered as implied by the use of the word connector. The objection on Rule 43(2) EPC is therefore maintained and claim 7 will be excluded from the search.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 21 5721

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.

24-08-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6299489 B1	09-10-2001	NONE	
EP 3107155 A1	21-12-2016	NONE	
EP 2200130 A1	23-06-2010	NONE	
EP 3540865 A1	18-09-2019	CN 114649704 A	21-06-2022
		EP 3540865 A1	18-09-2019
		EP 3907830 A1	10-11-2021

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 3107155 A1 **[0002]**