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- (54) Title: ELECTRICAL HIGH POWER CONNECTION ASSEMBLY

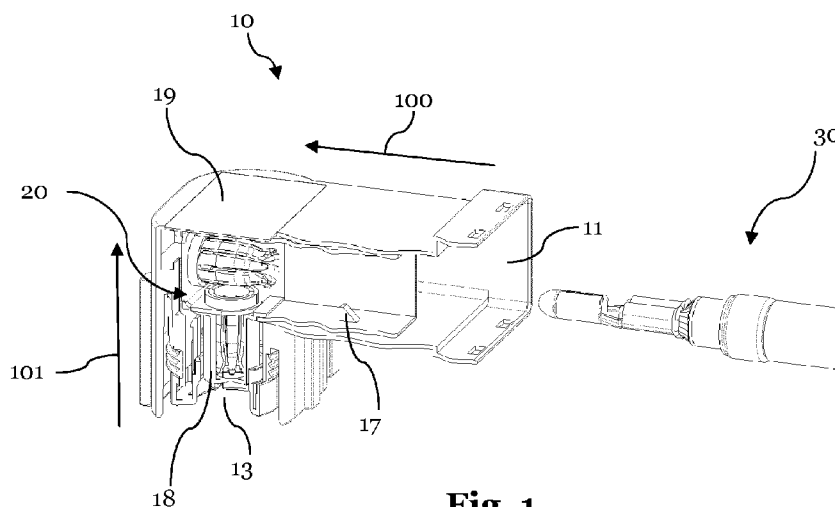


Fig. 1

(57) Abstract: The present invention relates to an electrical high power connection assembly comprising at least : a connector housing (10) with a first reception cavity (11), defining a first insertion direction (100), and a second reception cavity (13), defining a second insertion direction (101), and a connection member (20) arranged in the connector housing (10) when the electrical high power connection assembly is in an assembled condition, The connection member (20) comprises two terminal fastening portions, arranged in to the connector housing (10), in an assembled condition. Figure

Electrical high power connection assembly

The present invention relates to an electrical high power connection assembly, in particular for the connection of high power electrical cables to electrical devices, such as further high power cables or high power batteries, especially in the field of hybrid or electrical vehicles.

The growing field of electrical and hybrid vehicles demands for new solutions for the connection of required electrical devices, such as electrical cables or electrical batteries to further electrical components.

In particular, new high power connection assemblies are needed since the high electrical powers in the range of several to tens of kilowatts, which for example are required for the operation of an electrical engine, translate into currents in the range of hundreds of amperes. Such currents can only be transmitted using relatively thick electrical cables with inner conductor diameters on the order of several millimeters.

A difficulty which arises, for example, upon assembling corresponding wire harnesses is that bending of such cables is relatively difficult.

Thus, to facilitate the installation of such high power electrical cables, specialized 90° connectors are needed. Consequently, a large number of patent applications deal with the task to provide right angle electrical connectors which can be used with such high power electrical cables.

An example of an electrical high power connection assembly is described in the European patent EP 0 858 128 B1. Therein, an electrical high power connection assembly is described comprising one-piece rectangular contact terminals which are placed inside of a connector housing.

According to EP 0 858 128 B1, to be optimally suited for high power applications, the contact terminals described therein are produced as a

single solid piece by means of a die cast procedure. The contact terminals are provided with a female terminal portion with a plurality of contact springs for the reception of a contact pin of an electrical device. On the opposite side, the contact terminal is provided with a press fit portion for the reception of a contact pin of a further electrical device. Upon assembly, since the contact terminal according to EP 0 858 128 B1 is made from a single solid piece, the connector housing which consists of multiple parts has to be assembled around the contact terminal.

A further example of an electrical high power connection assembly is described in WO 2010/029391 A1. Therein, a rectangular contact terminal for high power applications is described which consists of a connection member and a terminal element, wherein the terminal element can be press-fittingly inserted into an opening of the connection member, thereby forming the rectangular contact terminal. According to WO 2010/029391 A1, the connector housing consists in two housing halves. Upon assembly of the high power connection assembly, in a first step, the rectangular contact terminals are inserted into a first housing half along a first insertion direction. In a further step, the second connector half, including corresponding counter terminal elements, is mated to the first connector housing half, wherein the terminal elements and the counter terminal elements are connected. Due to the insertion of the rectangular contact terminals into the first connector housing half, this connector housing half needs to be of relatively large construction.

Accordingly it is an object of the present invention to provide an electrical high power connection assembly which allows to be assembled more easily and which is less susceptible to incorrect assembly.

It is a further object of the present invention to provide an electrical high power connection assembly which minimizes the required installation space, while, at the same time, it allows to be used for high power electrical applications such as in the field of hybrid or electrical vehicles.

Further, it is an object of the present invention to achieve all the above advantages with an inexpensive product, whereby the electrically conductive components can be preferably made from sheet metal.

5

These and other objects, which become apparent upon reading the following description, are solved by electrical high power assembly according to claim 1.

10 According to the invention, an electrical high power assembly is provided which comprises a connector housing with a first reception cavity which defines a first insertion direction and a second reception cavity which defines a second insertion direction. Preferably, the first insertion direction and the second insertion direction are essentially perpendicular to each
15 other.

As it will be clear to the person skilled in the art, in the context of the present invention, the term "essentially" indicates that expressions, such as perpendicular or 90° , are not to be understood in a strict mathematical
20 sense but within the typical production tolerances. In other words, for example, perpendicular as well as 90° , both, indicate an angle of $90^\circ \pm 20^\circ$, preferably $\pm 10^\circ$, even more preferably $\pm 7,5^\circ$ and most preferably $\pm 5^\circ$.

25 According to the invention, the electrical high power connection assembly further comprises a connection member, which is adapted to be at least partially inserted into one of the reception cavities of the housing. The connection member is preferably an essentially right-angle bracket, or 90° angle bracket, comprising two essentially perpendicular terminal fastening
30 portions, whereby each terminal fastening portion comprises an opening adapted to receive one terminal element, such that each of the terminal elements is oriented essentially along one of the insertion directions of the connector housing, when the terminal elements are received by the

openings of the connection member and the connection member is positioned inside of the connector housing.

5 The two terminal elements are preferably each adapted to be electrically connected to a contact member of an electrical device, such as an electrical power supply or an electro motor as used in electrical or hybrid vehicles.

10 Preferably, at least one of the terminal elements is adapted to be press-fittingly connected to one of the terminal fastening portions.

15 The present invention allows that the connection member may for example be provided already placed in a pre-assembled position, e.g. inside of the connector housing, when the components of the electrical high power connection assembly are delivered to the harness maker. Upon assembly, the harness maker is thus only required to insert the corresponding part of a contact member of an electrical device into the respective reception cavities of the connector housing.

20 In a preferred embodiment, the electrical high power connection assembly is adapted to transmit an electrical power of at least 10 kW, more preferably of at least 50 kW, even more preferably of at least 100 kW, and most preferably of at least 150 kW. Thus, e.g. due to suitable dimensions of the electrically conductive components, the electrical high power
25 connection assembly is for example adapted to transmit a current of 100 ampere at a voltage of 100 volts, and thereby a high electrical power of 10 kW.

30 Of course, different features, alternatives and/or embodiments of the present invention can be combined with each other in various arrangement to the extent that they are not incompatible or mutually exclusive of others.

5 The present invention will be better understood and other features and advantages will become apparent upon reading the following detailed description including embodiments for illustrative purposes with reference to the figures, presented as non-limitative examples, which can be used to complete the understanding of the present invention and the description and, where appropriate, contribute to its definition, in which:

- Fig. 1 shows a partially cross-sectional view of an electrical high power connection assembly according to the present invention,
- 10 • Fig. 2 shows an exploded perspective view of the assembly of Fig. 1, and
- Figs. 3 to 6 show different embodiments of connection members adapted to be used in the assembly of Fig. 1.

15 It should be noted that, on figures, structural and/or functional elements which are common to different embodiments may have the same reference sign. Thus, unless otherwise stated, these elements have structural, dimensional and material properties which are identical.

20 Figs. 1 and 2 illustrate a preferred embodiment of an electrical high power connection assembly.

25 The electrical high power connection assembly comprises a connector housing 10 with a first reception cavity 11, which defines a first insertion direction 100, and a second reception cavity 13, which defines a second insertion direction 101, which is preferably essentially perpendicular to the first insertion direction 100.

30 Further, the electrical high power connection assembly comprises a connection member 20 which is adapted to be mounted inside of connector housing 10 when the electrical high power connection assembly is in an assembled condition.

As illustrated in Fig. 2, for this purpose, the electrical high power connection assembly preferably comprises an opening for the mounting of the connection member 20. Such opening can be closed by a lid element 19.

5

As may be derived, in particular from Fig. 2, the connection member 20 is preferably an essentially right-angle bracket, or 90° angle bracket, comprising two essentially perpendicular terminal fastening portions 23 and 24. Each terminal fastening portion 23 and 24 comprises an opening adapted to receive respectively a terminal element 21 and 22, which are adapted to be electrically connected to a contact member 30 of an electrical device.

10

Due to this construction, each of the terminal elements 21 and 22 is oriented essentially along the first insertion direction 100, respectively the second insertion direction 101, of the connector housing 10, when the connection member 20 is positioned inside of the connector housing 10.

15

As shown in Fig. 2, the connector housing 10 further comprises an inner terminal support 18, which is adapted to receive at least one of two terminal elements 21 and 22, when the connection member 20 is positioned inside of the connector housing 10. Moreover, the connector housing 10 comprises a fastening member 17, preferably a latch member 17 or a stop protrusion 17, to allow a fixation of the contact member 30. For this purpose, the fastening member 17 cooperates with fastening means of the contact member 30.

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The connection member 20 and the terminal elements 21 and 22 are shown in more detail in Fig. 3.

30

It should be noted that, in order to facilitate the understanding of the present invention, in Figs. 3 to 6, the different connection members are shown twice :

- in an exploded condition, on the left side of the figure and
- in an assembled condition, on the right side of the figure.

5 As may be derived from Fig. 3, the terminal elements 21 and 22 are preferably adapted to be press-fittingly connected to one of the terminal fastening portions 23 and 24, which, for this purpose, are provided with corresponding openings. Alternatively or in addition, the terminal elements 21 and 22 may also be welded to one of the terminal fastening portions 23 and 24.

10

As further shown in Fig. 3, in a preferred embodiment, both terminal elements 21 and 22 are female terminals which are adapted to respectively receive a contact member of an electrical device.

15

In Figs. 1 and 3, exemplarily, only one contact member 30 of an electrical device is depicted. The electrical device is for example an electrical power supply or an electrical motor or similar.

20

The contact member 30 is provided with an insulated cable 32, and a contact pin 31, preferably a male contact pin 31, which is attached to the cable 32 by means of a crimping portion 33. The contact pin 31 can be inserted into the terminal element 21.

25

To this end, according to the described embodiment, the terminal element 21 comprises a plurality of spring arms 25, preferably arranged essentially parallel to each other and may be in a circular arrangement. Thereby, a firm reception of the contact member 30 is provided, i.e. of the contact pin 31. Due to the elastic properties of the spring arms 25, a particularly secure electrical connection is achieved.

30

The skilled person will recognize that the connection member 20 offers a very compact and robust construction.

The terminal element 22, which is preferably arranged essentially perpendicular to the terminal element 21, is, in the embodiment shown on Fig. 3, identical to the other terminal element 22. Thus, the skilled person will recognize that the other terminal element 22 is adapted to receive a contact pin as e.g. the contact pin 31 shown in the figures.

In Fig. 4, another embodiment of a connection member 40 is shown, which is similar to the embodiment of the connection member 20 shown in Figs. 1 to 3. In the embodiment of Fig. 4, terminal fastening portions 43 and 44 still preferably form a right-angle bracket or 90° angle bracket.

However, the insertion direction of the terminal element 41 is different, namely opposite, of the insertion direction of the terminal element 21 of the embodiment of Figs. 1 to 3. However, the principle function of connection member 40 is identical to the function of the connection member 20.

In this alternative embodiment, another terminal element 42 is provided which is similar to the other terminal element 22 described in relation with Figs. 1 to 3.

In Figure 5, another embodiment of a connection member 50 is shown. In the embodiment of Figure 5, a terminal element 51 in form of a contact pin is provided, i.e. a male contact terminal. Accordingly, the contact member 30 comprises a female contact 34, instead of a male contact pin. In the embodiment of Fig. 5, terminal fastening portions 53 and 54 still preferably form a right-angle bracket or 90° angle bracket.

In this alternative embodiment, another terminal element 52 is provided which is similar to the other terminal element 22 described in relation with Figs. 1 to 3.

Thus, the present invention offers a large flexibility with regard to male and female terminal elements, which can be attached to the terminal fastening portions of the connection member.

5 Another alternative embodiment of a connection member 60 is shown in Fig. 6. In the embodiment of Fig. 6, a contact pin 62, preferably a male contact pin 62, is provided instead of a female contact terminal. The contact member 30 is identical to the one shown in Figs. 3 and 4 and comprises a contact pin 31 which is inserted into a female terminal
10 element 61.

Obviously, the present invention is not limited to embodiments which are here above described and provided only as examples. It also includes different modifications, and alternatives that may be considered by the
15 person skill in the art as part of the present invention, including all combinations of different embodiments here above described, taken alone or in combination.

Claims

1. Electrical high power connection assembly comprising:
- 5
- a connector housing (10) with a first reception cavity (11), defining a first insertion direction (100), and a second reception cavity (13), defining a second insertion direction (101),
 - a connection member (20) arranged in the connector housing (10) when the electrical high power connection assembly is in an assembled condition,
 - 10 • two terminal elements (21, 22) electrically connected to a respective contact member (30) of an electrical device,
- characterized in that** the connection member (20) comprises two terminal fastening portions (23, 24), each comprising an opening suitable to respectively receive one of the terminal elements (21, 22), such that each
- 15 terminal elements (21, 22) is oriented essentially along the first insertion direction (100), respectively along the second insertion direction (101), in an assembled condition.
2. Electrical high power connection assembly according to claim 1,
- 20 **characterized in that** at least one of the terminal elements (21, 22) is adapted to be press-fittingly connected to one of the terminal fastening portions (23, 24) and/or be welded to one of the terminal fastening portions (23, 24).
- 25 3. Electrical high power connection assembly according to any one of claims 1 or 2, **characterized in that** at least one of the terminal elements (21, 22) is a female terminal, suitable to receive a contact pin (31) of the contact member (30) .
- 30 4. Electrical high power connection assembly according to claim 3, **characterized in that** both of the terminal elements (21, 22) are female terminals, suitable to receive the respective contact pin (31) of the contact member (30).

5. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** the connector housing (10) comprises at least one fastening member (17), suitable to cooperate with fastening means of the contact member (30).

6. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** it comprises a lit element (19), suitable to be mounted onto the connector housing (10).

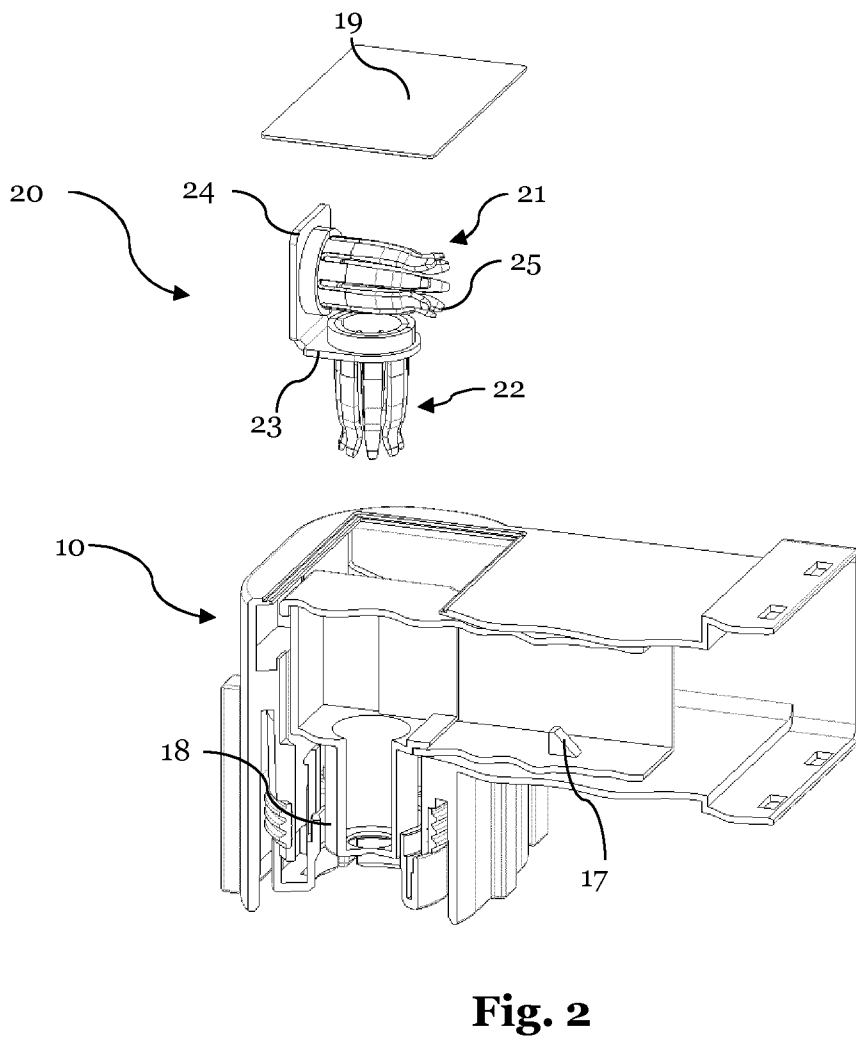
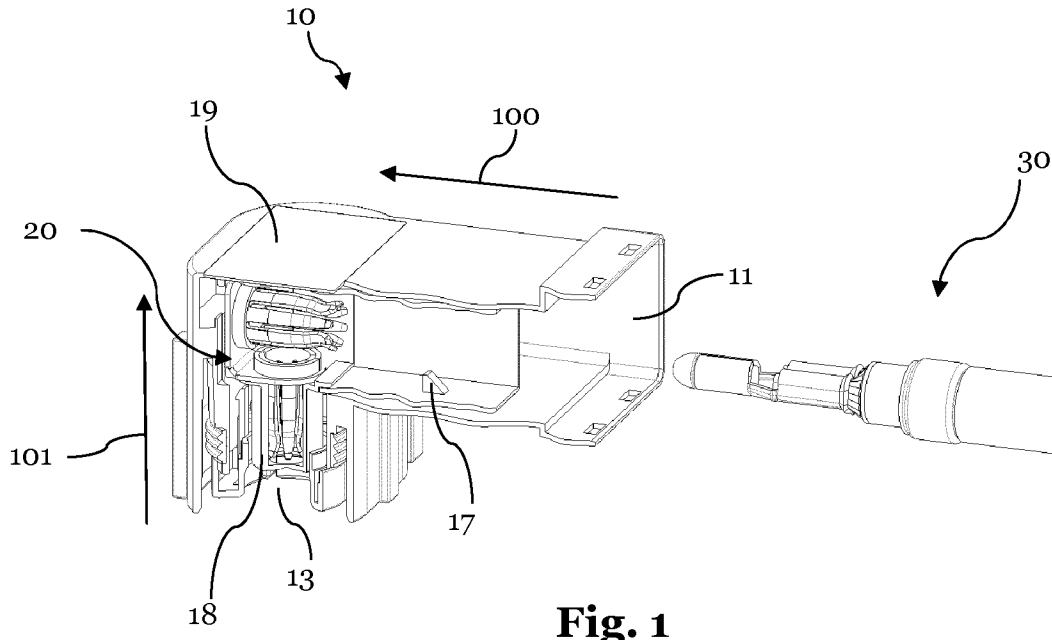
7. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** the connector housing (10) comprises an inner terminal support (18), suitable to receive at least one of the two terminal elements (21, 22).

8. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** the connection member (20) is made of metal.

9. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** the terminal elements (21, 22) comprise a plurality of spring arms (25), preferably arranged essentially parallel to each other, for a reception of a part of a contact member (30).

10. Electrical high power connection assembly according to any one of the preceding claims, **characterized in that** the electrical high power connection assembly is adapted to transmit an electrical power of at least 10 kW, more preferably of at least 50 kW, even more preferably of at least 100 kW, and most preferably of at least 150 kW.

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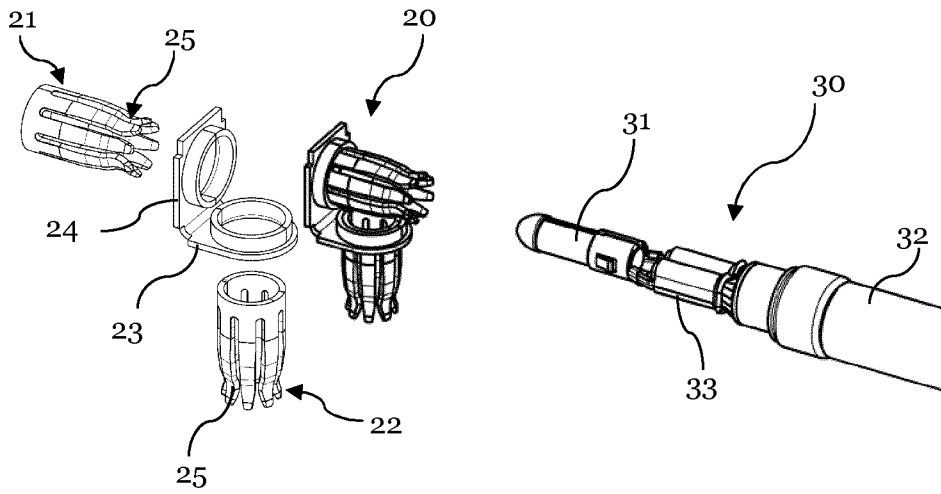


Fig. 3

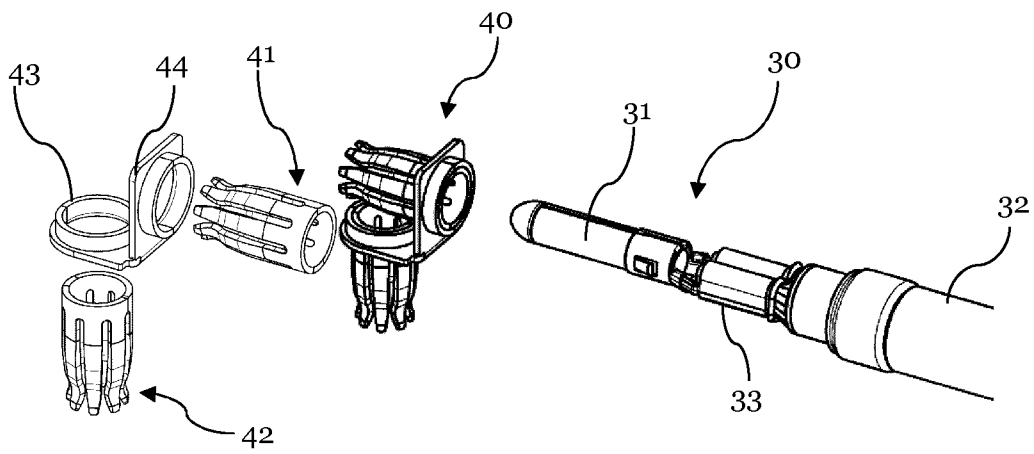


Fig. 4

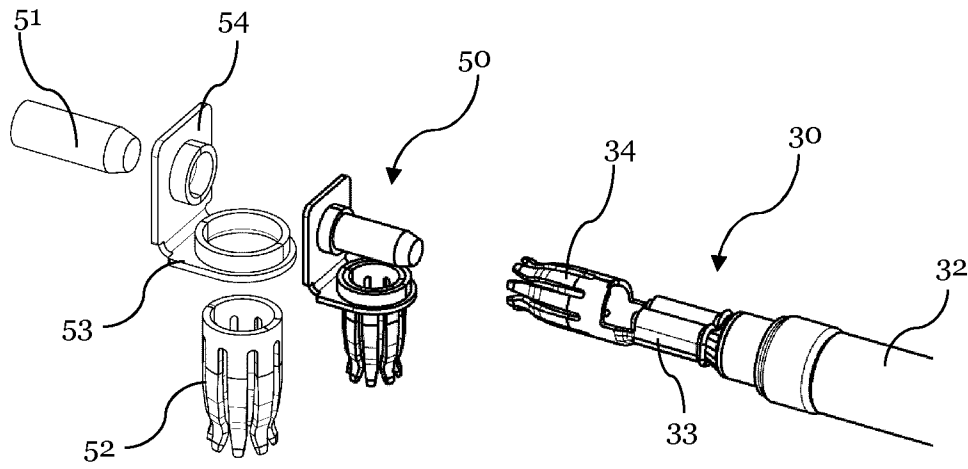


Fig. 5

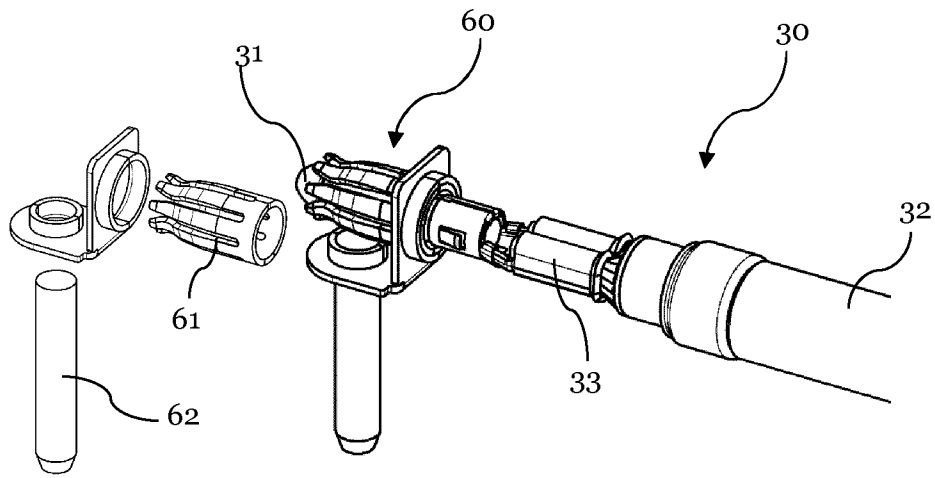


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/051140

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/11
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| Y | pages 4,8; figures 1-5 | 5-7 |
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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| Date of the actual completion of the international search 18 September 2013 | Date of mailing of the international search report 26/09/2013 |
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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|---|
| International application No PCT/EP2013/051140 |
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