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- (54) Title:** ELECTRICAL CONNECTOR AND ELECTRICAL CONNECTOR ASSEMBLY

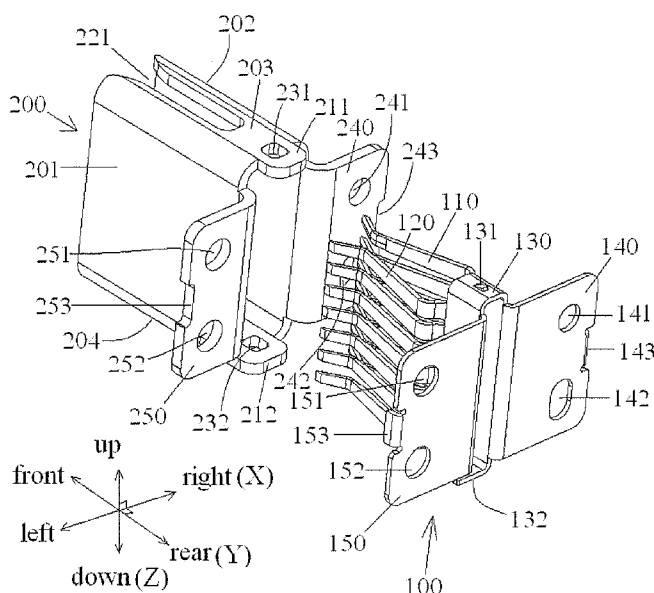


Fig.1

- (57) Abstract:** The present invention discloses an electrical connector comprising a contact member (100) having a row of first contacts (110) and a row of second contacts (120) opposite to the row of first contacts (110); and a housing (200) configured to receive the contact member (100) therein, the housing (200) having a top wall (203) and a bottom wall (204) extending in a first direction (X) and a second direction (Y) and a pair of side walls (201, 202) extending in the second direction (Y) and a third direction (Z), and the first, second and third directions (X, Y, Z) are perpendicular to each other, wherein when the contact member (100) is inserted into the housing (200), the housing (200) holds and positions the contact member (100) therein in the first, second and third directions (X, Y, Z).



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ELECTRICAL CONNECTOR AND ELECTRICAL CONNECTOR ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

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This application claims the benefit of Chinese Patent Application No. 201420143216.9 filed on March 27, 2014 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

15 The embodiments of the present invention relate to an electrical connector and an electrical connector assembly, more particularly, relate to a power supply connector and a power supply connector assembly.

Description of the Related Art

20 Normally a power supply connector comprises a housing and a contact member separated from the housing. The contact member is received in the housing and movable in the housing. As a result, a position of the contact member with respect to the housing is not fixed, and the contact member likely moves relative to the housing during pre-assembling the contact member into the housing. Consequently, it is difficult to pre-assemble the contact
25 member into the housing in a correct position. Thereby, an operator must manually hold the contact member in the correct position with respect to the housing before fastening the power supply connector on a connection plate on site. Thereby, the operator needs to spend a lot of time for correctly positioning the contact member with respect to the housing on site operation. In fact, it is almost impossible to correctly position the contact member with
30 respect to the housing manually on site. As a result, the contact member often shifts from its correct position with respect to the housing, decreasing the position accuracy of the contact member with respect to the housing, and disadvantageously affecting the electrical contact performance between the contact member and the housing.

Accordingly, it is time-consuming and laborious to assembly the existing power supply
35 connector, and the position accuracy between the contact member and the housing after installation is very poor.

In view of the above problems existing in the prior art, it is necessary to provide a power supply connector capable of being quickly mounted in high position accuracy on site.

SUMMARY OF THE INVENTION

The present invention has been made to overcome or alleviate at least one aspect of the above mentioned disadvantages.

It would be advantageous to provide an electrical connector and an electrical connector
5 assembly comprising the electrical connector, wherein a housing and a contact member of the electrical connector are capable of being quickly pre-assembled into an integral component in high relative position accuracy and sold to the user as one integral component, increasing the efficiency of mounting the electrical connector on site.

According to an aspect of the present invention, there is provided an electrical
10 connector, comprising: a contact member having a row of first contacts and a row of second contacts opposite to the row of first contacts; and a housing configured to receive the contact member therein, the housing having a top wall and a bottom wall extending in a first direction and a second direction and a pair of side walls extending in the second direction and a third direction, and the first, second and third directions are perpendicular to each
15 other, wherein when the contact member is inserted into the housing, the housing holds and positions the contact member therein in the first, second and third directions.

According to an embodiment of the present invention, the contact member comprises a ring base and a pair of first wings; the row of first contacts and the row of second contacts are connected to a pair of side edges of the ring base, respectively, at one side of the ring
20 base; and the pair of first wings are connected to a pair of side edges of the ring base, respectively, at the other side of the ring base; the housing comprises a pair of elastic pieces and a pair of second wings; the pair of elastic pieces extend outward from the top wall and the bottom wall, respectively, of the housing; and the pair of second wings are connected to a pair of side walls, respectively, of the housing; a first positioning protrusion and a second
25 positioning protrusion are formed on a top and a bottom, respectively, of the ring base; and a first positioning opening and a second positioning opening are formed in the pair of elastic pieces, respectively; a first positioning piece and a second positioning piece are formed on outer edges of the pair of first wings, respectively; and a first positioning notch and a second positioning notch are formed in outer edges of the pair of second wings, respectively; when
30 the contact member is assembled into the housing, the electrical connector is configured so that: (a) the top and the bottom of the ring base are pressed by and positioned between the pair of elastic pieces, so as to limit a movement of the contact member in the third direction; (b) the first positioning protrusion and the second positioning protrusion are snapped by the first positioning opening and the second positioning opening, respectively, so as to limit a
35 movement of the contact member in the second direction; and (c) the first positioning piece and the second positioning piece are inserted into the first positioning notch and the second positioning notch, respectively, so as to limit a movement of the contact member in the first direction.

According to another embodiment of the present invention, the ring base is configured to be an unclosed ring member having two ends disconnected from each other, so that the ring base elastically deforms under the press of the pair of the elastic pieces, to facilitate an operation of inserting the contact member into the housing and increase an elasticity of the entire contact member.

According to another embodiment of the present invention, the row of first contacts or the row of second contacts comprises five or more contacts.

According to another embodiment of the present invention, the row of first contacts or the row of second contacts comprises seven or more contacts.

According to another embodiment of the present invention, the number of the first contacts in the row of first contacts is equal to the number of the second contacts in the row of second contacts.

According to another embodiment of the present invention, the row of first contacts and the row of second contacts are configured to be exactly the same as each other in shape and size.

According to another embodiment of the present invention, each row of the row of first contacts and the row of second contacts is arranged in the third direction; and the row of first contacts and the row of second contacts are staggered from each other by a predetermined distance in the third direction.

According to another embodiment of the present invention, the predetermined distance is equal to or less than a width of one of the contacts.

According to another embodiment of the present invention, the pair of first wings and the pair of second wings extend in the first direction.

According to another embodiment of the present invention, an elongated slot is formed in each of the top wall and the bottom wall of the housing.

According to another embodiment of the present invention, the housing is configured to be an electric conductive member made of electric conductive material.

According to an aspect of the present invention, there is provided an electrical connector assembly, comprising: at least one electrical connector mentioned above; and an electric conductive connection plate, wherein the electrical connector is connected to the electric conductive connection plate, and the pair of first wings of the contact member electrically contact the electric conductive connection plate.

According to an embodiment of the present invention, the pair of first wings of the contact member and the pair of second wings of the housing are fastened on the electric conductive connection plate by means of a connection element, so as to connect the electrical connector on the electric conductive connection plate.

According to another embodiment of the present invention, the electrical connector is perpendicularly mounted on the surface of the electric conductive connection plate.

According to another embodiment of the present invention, a pair of first connecting

holes are formed in each of the pair of first wings; a pair of second connecting holes, corresponding to the pair of first connecting holes, are formed in each of the pair of second wings; and the connection element comprises a bolt passing through the first and second connecting holes and a nut screwed on the bolt.

5 According to another embodiment of the present invention, the electrical connector assembly comprises a plurality of electrical connectors electrically connected to each other through the common electric conductive connection plate.

According to another embodiment of the present invention, the electrical connector is a power supply connector.

10 In the electrical connector according to above various embodiments of the present invention, since the housing holds and positions the contact member therein in the first, second and third directions, the housing and the contact member are capable of being quickly preassembled together in a proper relative position and sold to the user as one integral piece. As a result, the user can quickly and simply mount the preassembled housing
15 and contact member on a conductive connection plate. Furthermore, the number of the contacts of the contact member is increased, it enhances the current carrying capacity of the contact member, and the contact member may support a high current.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The above and other features of the present invention will become more apparent by describing in detail embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 is an illustrative exploded view of an electrical connector according to an
25 embodiment of the present invention;

Fig.2 is an illustrative front perspective view of an assembled electrical connector according to an embodiment of the present invention;

Fig.3 is an illustrative rear perspective view of an assembled electrical connector according to an embodiment of the present invention;

30 Fig.4 is an illustrative front plan view of an assembled electrical connector according to an embodiment of the present invention; and

Fig.5 is an illustrative perspective view of an electrical connector assembly according to an embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Embodiments of the present disclosure will be described hereinafter in detail with reference to the attached drawings, wherein the like reference numerals refer to the like

elements. The present disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiment set forth herein; rather, these embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the concept of the disclosure to those skilled in the art.

5 In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

10 According to a general concept of the present invention, there is provided an electrical connector comprising a contact member and a housing. The contact member has a row of first contacts and a row of second contacts opposite to the row of first contacts. The housing is configured to receive the contact member therein, the housing has a top wall and a bottom wall extending in a first direction and a second direction and a pair of side walls extending
15 in the second direction and a third direction. The first, second and third directions are perpendicular to each other. When the contact member is inserted into the housing, the housing holds and positions the contact member therein in the first, second and third directions.

Fig.1 is an illustrative exploded view of an electrical connector 10 according to an
20 embodiment of the present invention; Fig.2 is an illustrative front perspective view of an assembled electrical connector 10 according to an embodiment of the present invention; Fig.3 is an illustrative rear perspective view of an assembled electrical connector 10 according to an embodiment of the present invention.

In an embodiment of the present invention, there is disclosed an electrical connector.
25 As shown in Figs.1-3, the electrical connector mainly comprises a contact member 100 and a housing 200. The contact member 100 is received in the housing 200.

As shown in Figs.1-3, the contact member 100 has a row of first contacts 110 and a row of second contacts 120 opposite to the row of first contacts 110. The housing 200 is configured to receive the contact member 100 therein. The housing 200 has a top wall 203
30 and a bottom wall 204 extending in a first direction (right-left direction) X and a second direction (front-rear direction) Y and a pair of side walls 201, 202 extending in the second direction Y and a third direction (up-down direction) Z. The first direction X, the second direction Y and the third direction Z are perpendicular to each other.

Referring to Figs.1-3 again, the contact member 100 comprises a ring base 130 and a
35 pair of first wings 140, 150. The row of first contacts 110 and the row of second contacts 120 are connected to a pair of side edges of the ring base 130, respectively, at one side of the ring base 130. The pair of first wings 140, 150 are connected to a pair of side edges of the ring base 130, respectively, at the other side of the ring base 130.

Referring to Figs.1-3 again, the housing 200 comprises a pair of elastic pieces 211, 212

and a pair of second wings 240, 250. The pair of elastic pieces 211, 212 extend outward from the top wall 203 and the bottom wall 204, respectively, of the housing 200. The pair of second wings 240, 250 are connected to a pair of side walls 201, 202, respectively, of the housing 200.

5 As shown in Figs.1-3, a first positioning protrusion 131 and a second positioning protrusion 132 are formed on a top 111 and a bottom 112, respectively, of the ring base 130. A first positioning opening 231 and a second positioning opening 232 are formed in the pair of elastic pieces 211, 212, respectively.

10 As shown in Figs.1-3, a first positioning piece 143 and a second positioning piece 153 are formed on outer edges of the pair of first wings 140, 150, respectively. A first positioning notch 243 and a second positioning notch 253 are formed in outer edges of the pair of second wings 240, 250, respectively.

As clearly shown in Figs.2-3, when the contact member 100 is assembled into the housing 200, the electrical connector 10 is configured so that:

15 (a) the top 111 and the bottom 112 of the ring base 130 are pressed by and positioned between the pair of elastic pieces 211, 212, so as to limit a movement of the contact member 100 in the third direction Z;

(b) the first positioning protrusion 131 and the second positioning protrusion 132 are snapped by the first positioning opening 231 and the second positioning opening 232, 20 respectively, so as to limit a movement of the contact member 100 in the second direction Y; and

(c) the first positioning piece 143 and the second positioning piece 153 are inserted into the first positioning notch 243 and the second positioning notch 253, respectively, so as to limit a movement of the contact member 100 in the first direction X.

25 In this way, when the contact member 100 is assembled into the housing 200, the housing 200 directly holds and positions the contact member 100, so as to limit any movement of the contact member 100 in any direction among of the first direction X, the second direction Y and the third direction Z. Thereby, the contact member 100 is correctly and reliably positioned in the housing in various directions, that is, the housing 200 and the 30 contact member 100 are capable of being quickly preassembled together in a proper relative position and sold to the user as one integral piece. As a result, the user can quickly and simply mount the preassembled housing 200 and contact member 100 on a conductive connection plate 20 (see Fig.5).

Fig.4 is an illustrative front plan view of an assembled electrical connector 10 35 according to an embodiment of the present invention.

As shown in Fig.4, the ring base 130 is configured to be an unclosed ring member having two ends 133, 134 disconnected from each other and movable relative to each other. In this way, the ring base 130 may elastically deform under the press of the pair of the elastic pieces 211, 212, to facilitate an operation of inserting the contact member 100 into the

housing 200 and increase an elasticity of the entire contact member 100.

In an embodiment of the present invention, the row of first contacts 110 or the row of second contacts 120 comprises five or more contacts. In the illustrated embodiment of Fig.4, the row of first contacts 110 or the row of second contacts 120 comprises seven contacts.

5 But the present invention is not limited to this, the row of first contacts or the row of second contacts may comprise eight or more contacts.

In the illustrated embodiment of Fig.4, the number of the first contacts in the row of first contacts 110 is equal to the number of the second contacts in the row of second contacts 120, and the row of first contacts 110 and the row of second contacts 120 are configured to
10 be exactly the same as each other in shape and size.

Referring to Fig.4 again, each row of the row of first contacts 110 and the row of second contacts 120 is arranged in the third direction Z. The row of first contacts 110 and the row of second contacts 120 are staggered from each other by a predetermined distance in the third direction Z. The predetermined distance may be equal to or less than a width of one
15 of the contacts. In this way, it may enhance the current carrying capacity of the contact member 100 by increasing the number of the contacts of the contact member 100, and the contact member 100 may support a high current.

Referring to Figs.1-4, the pair of first wings 140, 150 and the pair of second wings 240, 250 extend in the first direction X and the third direction Z.

20 As shown in Figs.1-3, an elongated slot 221 is formed in each of the top wall 203 and the bottom wall 204 of the housing 200. In this way, it may reduce the material to manufacture the housing 200, and reduce the weight and cost of the housing 200.

In order to further enhance the current carrying capacity of the electrical connector 10, in an embodiment, the housing 200 may be made of electric conductive material. In this
25 condition, when the housing 200 directly contacts the contact member 100, the housing 200 may carry a part of the current, further enhancing the current carrying capacity of the electrical connector 10. As a result, the electrical connector 10 may carry higher current.

Fig.5 is an illustrative perspective view of an electrical connector assembly according to an embodiment of the present invention.

30 As shown in Fig.5, the electrical connector assembly comprises at least one electrical connector 10 described above and an electric conductive connection plate 20. The electrical connector 10 is connected to the electric conductive connection plate 20, and the pair of first wings 140, 150 of the contact member 100 electrically contact the electric conductive connection plate 20.

35 In the illustrated embodiment shown in Fig.5, the pair of first wings 140, 150 of the contact member 100 and the pair of second wings 240, 250 of the housing 200 are fastened on the electric conductive connection plate 20 by means of connection elements 301, 302, so as to connect the electrical connector 10 on the electric conductive connection plate 20.

As shown in Figs.1-5, a pair of first connecting holes 141, 142, 151, 152 are formed in

each of the pair of first wings 140, 150. A pair of second connecting holes 241, 242, 251, 252, corresponding to the pair of first connecting holes 141, 142, 151, 152, are formed in each of the pair of second wings 240, 250.

As shown in Fig.5, the connection element 301, 302 comprises a bolt 302 passing through the first and second connecting holes and a nut 301 screwed on the bolt 302. In this way, the pair of first wings 140, 150 of the contact member 100 and the pair of second wings 240, 250 of the housing 200 are fastened on the electric conductive connection plate 20.

As shown in Figs.1-2, four first connecting holes 141, 142, 151, 152 comprise three circle holes 141, 151, 152 and an oval hole 142 having a length larger than a diameter of the three circle holes 141, 151, 152. Correspondingly, as shown in Figs.1-2, four second connecting holes 241, 242, 251, 252 comprise three circle holes 241, 251, 252 and an oval hole 242 having a length larger than a diameter of the three circle holes 241, 251, 252. In this embodiment, with the oval holes 142, 242, the electrical connector 10 may be more easily mounted on the electric conductive connection plate 20.

As shown in Fig.5, the electrical connector 10 is perpendicularly mounted on the surface of the electric conductive connection plate 20.

In an embodiment, the electrical connector assembly comprises a plurality of electrical connectors 10 electrically connected to each other through the common electric conductive connection plate 20. For example, as shown in Fig.5, the electrical connector assembly comprises two electrical connectors 10 electrically connected to each other through the common electric conductive connection plate 20. But the present invention is not limited to this, the electrical connector assembly may comprise three or more electrical connectors.

In an embodiment of the present invention, the electrical connector 10 is a power supply connector.

It should be appreciated for those skilled in this art that the above embodiments are intended to be illustrated, and not restrictive. For example, many modifications may be made to the above embodiments by those skilled in this art, and various features described in different embodiments may be freely combined with each other without conflicting in configuration or principle.

Although several embodiments have been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

As used herein, an element recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of said elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" of the present invention are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements

having a particular property may include additional such elements not having that property.

What is claimed is,

1. An electrical connector comprising:

a contact member (100) having a row of first contacts (110) and a row of second
5 contacts (120) opposite to the row of first contacts (110); and

a housing (200) configured to receive the contact member (100) therein, the housing
(200) having a top wall (203) and a bottom wall (204) extending in a first direction (X) and
a second direction (Y) and a pair of side walls (201, 202) extending in the second direction
(Y) and a third direction (Z), and the first, second and third directions (X, Y, Z) are
10 perpendicular to each other,

wherein when the contact member (100) is inserted into the housing (200), the housing
(200) holds and positions the contact member (100) therein in the first, second and third
directions (X, Y, Z).

2. The electrical connector according to claim 1,

wherein the contact member (100) comprises a ring base (130) and a pair of first wings
(140, 150); the row of first contacts (110) and the row of second contacts (120) are
connected to a pair of side edges of the ring base (130), respectively, at one side of the ring
base (130); and the pair of first wings (140, 150) are connected to a pair of side edges of the
20 ring base (130), respectively, at the other side of the ring base (130);

wherein the housing (200) comprises a pair of elastic pieces (211, 212) and a pair of
second wings (240, 250); the pair of elastic pieces (211, 212) extend outward from the top
wall (203) and the bottom wall (204), respectively, of the housing (200); and the pair of
second wings (240, 250) are connected to a pair of side walls (201, 202), respectively, of the
25 housing (200);

wherein a first positioning protrusion (131) and a second positioning protrusion (132)
are formed on a top (111) and a bottom (112), respectively, of the ring base (130); and a first
positioning opening (231) and a second positioning opening (232) are formed in the pair of
elastic pieces (211, 212), respectively;

wherein a first positioning piece (143) and a second positioning piece (153) are formed
on outer edges of the pair of first wings (140, 150), respectively; and a first positioning
notch (243) and a second positioning notch (253) are formed in outer edges of the pair of
second wings (240, 250), respectively;

wherein when the contact member (100) is assembled into the housing (200), the
35 electrical connector is configured so that:

(a) the top (111) and the bottom (112) of the ring base (130) are pressed by and
positioned between the pair of elastic pieces (211, 212), so as to limit a movement of the
contact member (100) in the third direction (Z);

(b) the first positioning protrusion (131) and the second positioning protrusion

(132) are snapped by the first positioning opening (231) and the second positioning opening (232), respectively, so as to limit a movement of the contact member (100) in the second direction (Y); and

(c) the first positioning piece (143) and the second positioning piece (153) are inserted into the first positioning notch (243) and the second positioning notch (253), respectively, so as to limit a movement of the contact member (100) in the first direction (X).

3. The electrical connector according to claim 2,
wherein the ring base (130) is configured to be an unclosed ring member having two ends (133, 134) disconnected from each other, so that the ring base (130) elastically deforms under the press of the pair of the elastic pieces (211, 212), to facilitate an operation of inserting the contact member (100) into the housing (200) and increase an elasticity of the entire contact member (100).

4. The electrical connector according to claim 3,
wherein the row of first contacts (110) or the row of second contacts (120) comprises five or more contacts.

5. The electrical connector according to claim 4,
wherein the row of first contacts (110) or the row of second contacts (120) comprises seven or more contacts.

6. The electrical connector according to claim 5,
wherein the number of the first contacts in the row of first contacts (110) is equal to the number of the second contacts in the row of second contacts (120).

7. The electrical connector according to claim 6,
wherein the row of first contacts (110) and the row of second contacts (120) are configured to be exactly the same as each other in shape and size.

8. The electrical connector according to claim 7,
wherein each row of the row of first contacts (110) and the row of second contacts (120) is arranged in the third direction (Z); and

wherein the row of first contacts (110) and the row of second contacts (120) are staggered from each other by a predetermined distance in the third direction (Z).

9. The electrical connector according to claim 8,
wherein the predetermined distance is equal to or less than a width of one of the

contacts.

10. The electrical connector according to claim 2,
wherein the pair of first wings (140, 150) and the pair of second wings (240, 250)
5 extend in the first direction (X).

11. The electrical connector according to claim 2,
wherein an elongated slot (221) is formed in each of the top wall (203) and the bottom
wall (204) of the housing (200).

12. The electrical connector according to claim 1,
wherein the housing (200) is configured to be an electric conductive member made of
electric conductive material.

13. An electrical connector assembly comprising:
at least one electrical connector (10) according to claim 1; and
an electric conductive connection plate (20),
wherein the electrical connector (10) is connected to the electric conductive connection
plate (20), and the pair of first wings (140, 150) of the contact member (100) electrically
20 contact the electric conductive connection plate (20).

14. The electrical connector assembly according to claim 13,
wherein the pair of first wings (140, 150) of the contact member (100) and the pair of
second wings (240, 250) of the housing (200) are fastened on the electric conductive
25 connection plate (20) by means of a connection element (301, 302), so as to connect the
electrical connector (10) on the electric conductive connection plate (20).

15. The electrical connector assembly according to claim 14,
wherein the electrical connector (10) is perpendicularly mounted on the surface of the
30 electric conductive connection plate (20).

16. The electrical connector assembly according to claim 15,
wherein a pair of first connecting holes (141, 142, 151, 152) are formed in each of the
pair of first wings (140, 150);

35 wherein a pair of second connecting holes (241, 242, 251, 252), corresponding to the
pair of first connecting holes (141, 142, 151, 152), are formed in each of the pair of second
wings (240, 250); and

wherein the connection element (301, 302) comprises a bolt (302) passing through the
first and second connecting holes and a nut (301) screwed on the bolt (302).

17. The electrical connector assembly according to claim 16,
wherein the electrical connector assembly comprises a plurality of electrical connectors
(10) electrically connected to each other through the common electric conductive connection
5 plate (20).

18. The electrical connector assembly according to claim 13,
wherein the electrical connector (10) is a power supply connector.

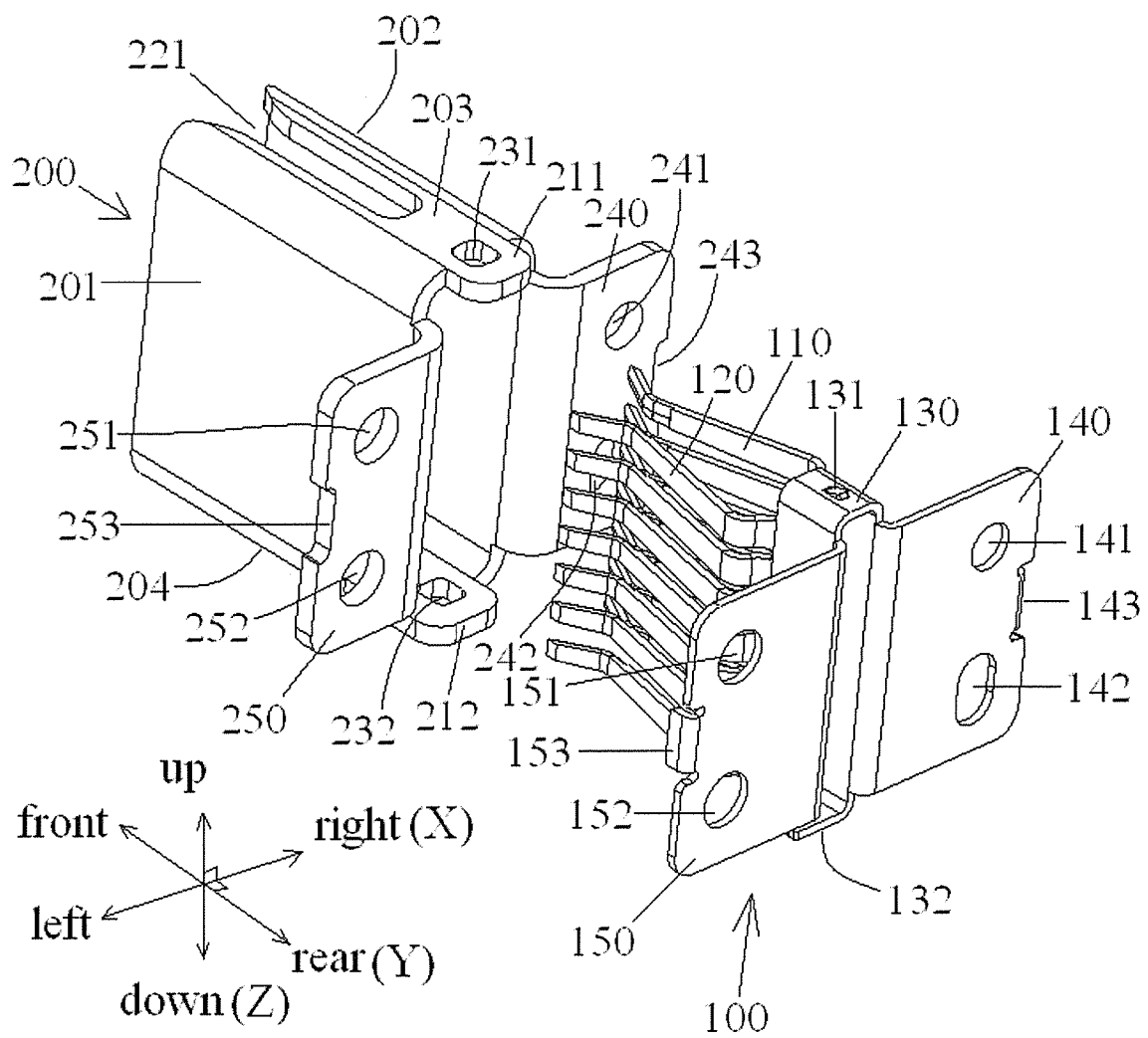


Fig.1

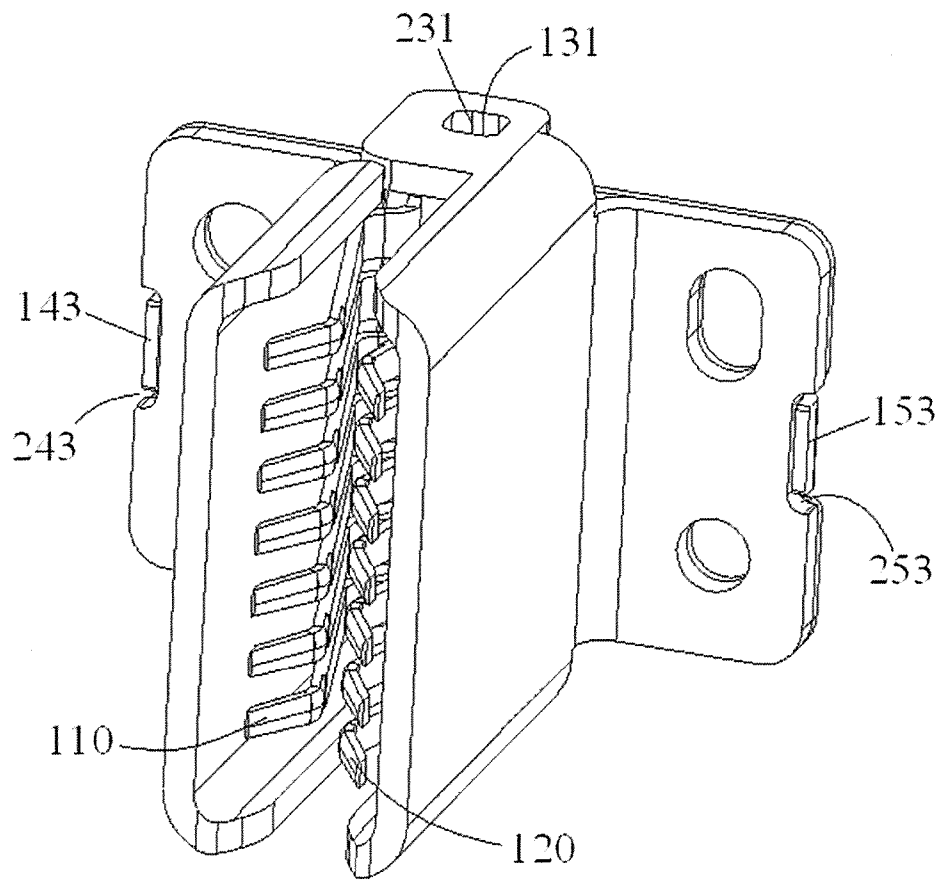


Fig.2

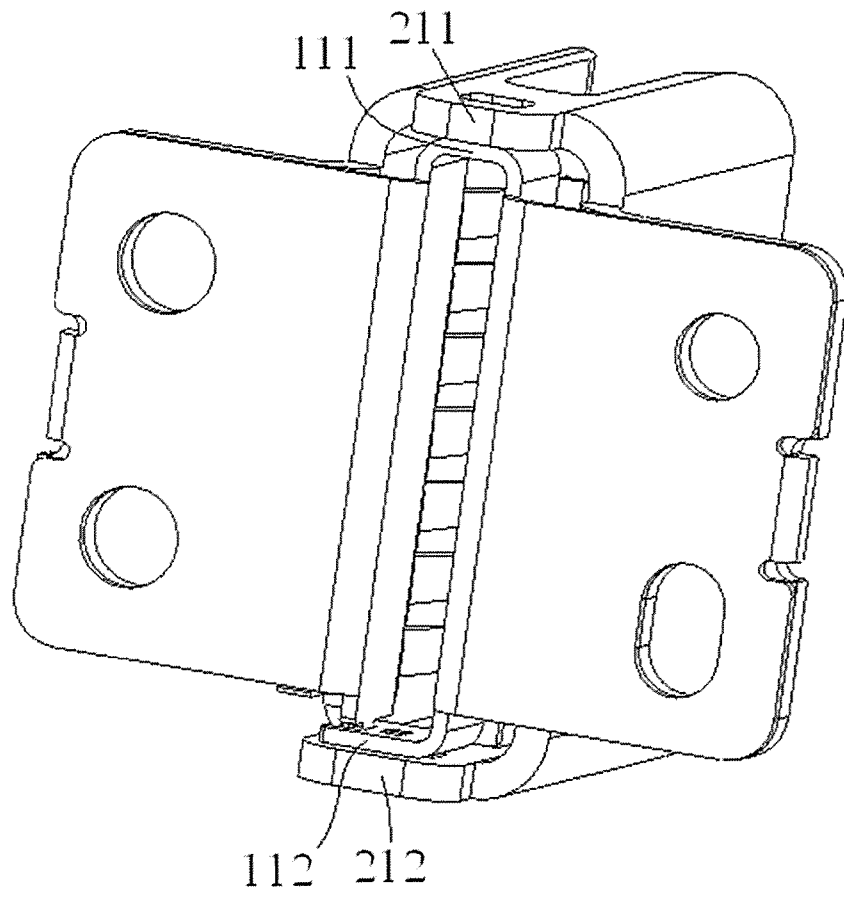


Fig.3

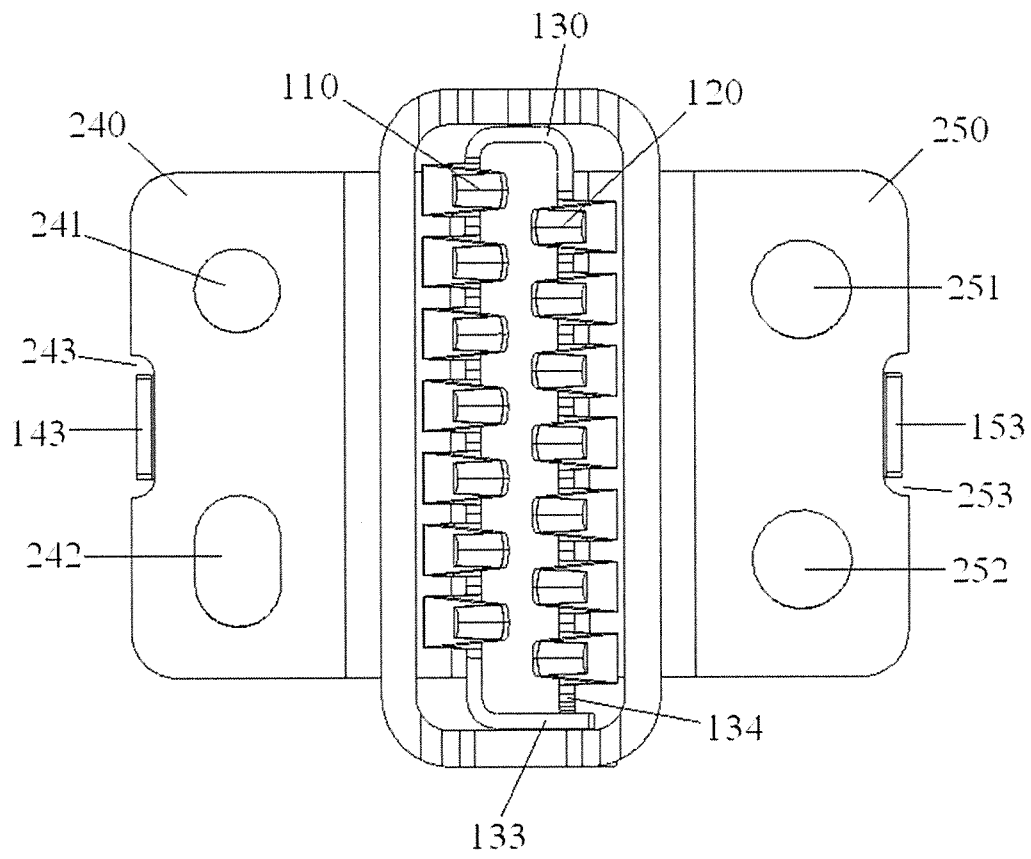


Fig.4

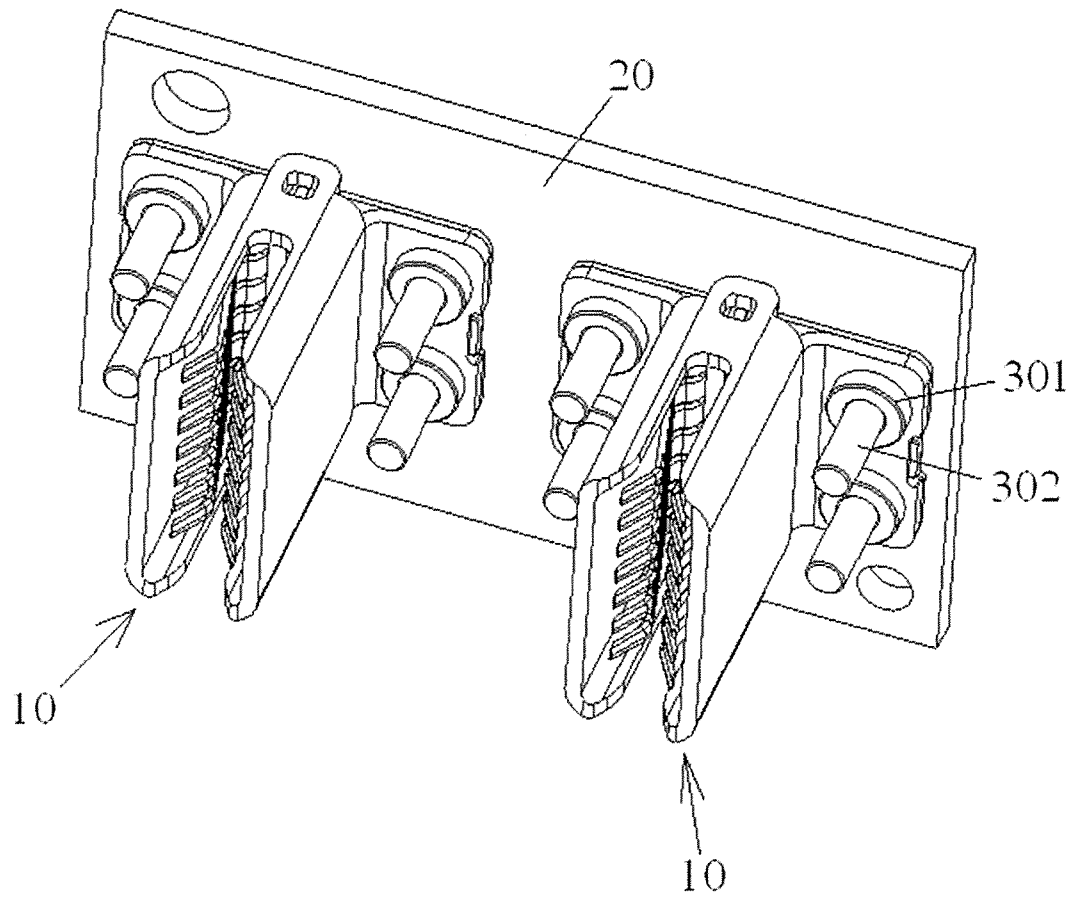


Fig.5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/051585

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/187 H01R13/11 H01R13/422 H01R13/73 H01R4/30
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.
X	US 2005/233644 A1 (BOGIEL STEVEN B [US] ET AL) 20 October 2005 (2005-10-20) paragraph [0026] - paragraph [0033]; figures 1-3 -----	1,12,13
X	US 5 431 576 A (MATTHEWS RUSSELL H [US]) 11 July 1995 (1995-07-11) column 4 - column 8; figures 3-6,10 -----	1,12-18
A	US 2012/171889 A1 (GONG JINLONG [CN] ET AL) 5 July 2012 (2012-07-05) figure 1A -----	1,17



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

12 May 2015

Date of mailing of the international search report

20/05/2015

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Vautrin, Florent

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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