



(51) International Patent Classification:
H01R 12/24 (2006.01)

(21) International Application Number:
PCT/IB2010/051255

(22) International Filing Date:
23 March 2010 (23.03.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
200910132928.4 31 March 2009 (31.03.2009) CN

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: TERMINAL UNIT, ELECTRIC CONNECTOR ASSEMBLY AND MOUNTING METHOD

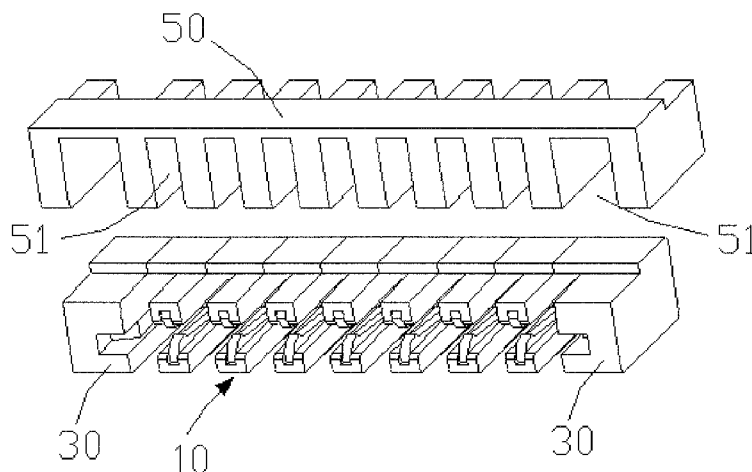


Fig. 2

(57) Abstract: The present invention relates to a field of electric connector. In an preferred embodiment, an electric connector assembly comprises a plurality of terminal units separate from each other and arranged in a row at a predetermined pitch and two holders provided at both ends of the terminal units respectively in the direction and adapted to lock the cable to terminal units. Further, the present invention provides a mounting method for the electric connector assembly and an electric connector mounting assembly.



Published:

— *with international search report (Art. 21(3))*

TERMINAL UNIT, ELECTRIC CONNECTOR ASSEMBLY AND MOUNTING METHOD

CROSS-REFERENCE TO RELATED APPLICATION

- 5 This application claims the benefit of Chinese Patent Application No. 200910132928.4 filed on March 31, 2009 in the State Intellectual Property Office of China, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION10 Field of the Invention

The present invention relates to a field of electric connector, and in particular, to a flexible electric connector assembly. More particularly, the present invention relates to a terminal unit, an electric connector assembly, an electric connector mounting assembly and the mounting method thereof.

15 Description of the Related Art

- In the field of electric connectors, especially in the field of electric connectors for Flexible Printed Circuit or Cable (FPC), a FPC electrical connector generally includes a housing made of plastic material and terminals made of metal disposed in the housing. Usually, the FPC electric connectors are used in electronic products such as mobile
20 telephone, PDA, etc. When in use, the FPC electric connectors are usually soldered onto a printed circuit board (PCB) by means of an Anisotropic Conductive Film (ACF) technology. The ACF technology involves extra processes and occupies considerable space of the PCB. Further, by adopting the ACF technology, the FPC electric connector and the printed circuit board are not separable and detachable after the soldering operation is carried out.
25 Nowadays, the FPC electric connectors as above have been widely applied to the electric appliances and electronic products.

- With the development of technology in the electronic engineering, more and more electronic products have flexibility function. For example, some popular LCD screens are designed to be flexible so as to display pictures or photos in an optimal manner. As another
30 example, some electronic readings are constructed to be compact and flexible. In such kinds

- 2 -

of electronic products, flexible PCBs are adopted, and necessarily, FPCs and some similar flexible connecting cables are needed.

However, the conventional FPC electric connector generally has an integral and rigid construction and can not be flexibly deflected. Specifically, the conventional FPC electric connector is generally configured to be an entire rigid device as the conventional FPC electric connector has an integral and rigid housing. Hence, if the conventional FPC electric connector is applied to a flexible PCB, it cannot be used in electronic product where flexibility of the product is required.

Accordingly, it is desirable in the art to provide a flexible electric connector which can be used in a flexible electronic product.

SUMMARY OF THE INVENTION

The present invention has been made to overcome or alleviate the above mentioned drawbacks or disadvantages in the art. Accordingly, it is an object of the present invention to provide a flexible electric connector assembly which can be used in a flexible PCB.

A further object of the present invention is to provide an electric connector assembly which facilitates production and assembly thereof.

Another object of the present invention is to provide a terminal unit adopted in a flexible electric connector assembly.

According to an aspect of the present invention, there is provided a terminal unit. The terminal unit comprises: a housing unit; and a metal terminal accommodated in the housing unit and adapted for electrically connecting a flexible PCB and a cable, wherein the metal terminal comprises: a cable receiving portion at one end thereof for electrically connecting the cable, and a connecting portion at the other end thereof for electrically connecting with the flexible PCB; wherein the connecting portion extends out of the bottom side of the housing unit.

Specifically, the cable receiving portion comprises: a chamber for accommodating the cable therein, and a neck part formed adjacent to the opening of the chamber to elastically retain the cable so as to achieve electric connection.

Further, the housing unit has a groove formed therein, into which the cable receiving portion of the metal terminal is embedded, and the opening of the cable receiving portion is oriented to the same direction as the longitudinal direction of the groove, wherein the

- 3 -

connecting portion of the metal terminal extends out of the groove through an opening disposed in the bottom side of the housing unit.

Particularly, a transversely through passage for receiving the cable is formed in the housing unit,.

5 Preferably, the housing unit is made of plastic material.

According to another aspect of the present invention, there is provided an electrical connector assembly composed of a plurality of terminal units. The electrical connector assembly comprises: a plurality of terminal units that are separate from each other and arranged in a row at a predetermined pitch; and two holders provided respectively at both
10 ends of the row of terminal units and adapted to lock the cable to the row of terminal units.

Furthermore, each of the holders includes a locking groove, and the locking groove has a projecting portion that engages with a recessed portion of the cable so as to lock the cable.

According to a further aspect of the present invention, there is provided a mounting
15 method for the electrical connector assembly, comprising the steps of:

molding a plurality of housing units and two folders;

press forming a plurality of metal terminals, and embedding one metal terminal into each of the housing units so as to form a plurality of separate terminal units;

providing an outside housing for positioning the terminal units, wherein the outside
20 housing includes a plurality of positioning slots arranged in a row at a predetermined pitch; and placing each of the terminal units into each of the positioning slots of the outside housing respectively;

placing the two holders into two positioning slots which are located at the two ends of the outside housing respectively to form an integrated electrical connector assembly;

25 soldering the connecting portion of each of the metal terminals in the electrical connector assembly to a flexible PCB so as to mount the terminal units onto the flexible PCB; and

removing the outside housing from the row of terminal units, so as to enable the terminal units to deflect along with the deflection of the flexible PCB.

30 According to another further aspect of the present invention, there is provided an electrical connector mounting assembly, comprising:

a plurality of separate terminal units arranged in a row at a predetermined pitch, wherein each of the terminal units comprises a housing unit and a metal terminal embedded in

- 4 -

the housing unit and adapted for electrically connecting a flexible PCB and a cable; wherein the metal terminal comprises a cable receiving portion at one end thereof for electrically connecting the cable, and a connecting portion at the other end thereof for electrically connecting with the flexible PCB; wherein the connecting portion extends out of the bottom
5 side of the housing unit;

two holders provided respectively at both ends of the row of terminal units and adapted to lock the cable to the row of terminal units; and

an outside housing for temporarily integrating the terminal units and the holders together, wherein the terminal units are able to deflect along with the deflection of the
10 flexible PCB when the outside housing is removed from the terminal units and the holders.

Preferably, the outside housing includes a plurality of positioning slots arranged in a row at a predetermined pitch; wherein the terminal units and the holders are detachably positioned in the positioning slots of the outside housing respectively.

As apparent from the above, the present invention has at least the following
15 advantages: the present invention provides a flexible electric connector assembly with deflection capability. In order to achieve the above object, the concepts of the present invention are proposed: firstly, to separate the terminals in an entire electric connector housing into a plurality of individual terminal unit and to temporarily integrate these terminal units into a whole electric connector assembly by an outside housing; and then, to remove the
20 outside housing from these terminal units after the metal terminals of terminal units are soldered to the PCB. By this way, these terminal units are separate from each other in the flexible PCB and the electric connector assembly composing of these terminal units is able to deflect along with the deflection of the flexible PCB. Therefore, the electric connector assembly of the present invention may be applied in some electronic products where
25 deflection capability of the product is required. Further, because these terminals are temporarily integrated into a relatively rigid assembly by the outside housing, the electric connector assembly has advantages in facilitating soldering operation and assembling operation during the manufacturing process. Accordingly, the present invention further provides a mounting method for the electric connector assembly and an electric connector
30 mounting assembly. By adopting this mounting method for the electric connector assembly and this electric connector mounting assembly, the electric connector assembly is mounted on a flexible PCB in a simple way.

- 5 -

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

5 Fig. 1 is a schematic view of an electric connector assembly according to a preferred embodiment of the present invention, illustrating a condition that the terminal units are integrated by the outside housing.

 Fig. 2 is another schematic view of the electric connector assembly according to above preferred embodiment of the present invention, illustrating a condition that the terminal
10 units are detached from the outside housing.

 Fig. 3 is a schematic view of a single terminal unit of the electric connector assembly according to above preferred embodiment of the present invention.

 Fig. 4 is a sectional view of the single terminal unit in Fig.3.

 Fig. 5 and Fig. 6 are structure schematic views of holders of the electric connector
15 assembly according to above preferred embodiment of the present invention, respectively.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Exemplary embodiments of the present disclosure will be described hereinafter in detail with reference to the attached drawings. The present disclosure may, however, be
20 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.

 The scope of the present invention will in no way be limited to the simply schematic
25 views, the number of constituting components, the materials thereof, the shapes thereof, the relative arrangement thereof, etc., and are disclosed simply as an example of an embodiment.

 The present invention provides an electric connector assembly, which is flexible and has a deflection capability. This electric connector assembly may be applied in flexible printed circuit board (PCB) to satisfy requirements of some latest electronic products, such as
30 deflectable electronic readings, LCD screens with flexible function, etc.. Hereafter, taken an electric connector assembly cooperated with a Flexible Printed Cable (FPC) as an example, the electric connector assembly of the present invention is illustrated and described in detail.

- 6 -

Refer to Fig. 1 and Fig. 2, the electric connector assembly of the present invention may be soldered onto a flexible PCB and is used for connecting with a FPC cable. The electric connector assembly mainly comprises a plurality of separate terminal units 10 and an outside housing 50 detachably disposed over these terminal units 10. These separate terminal units 10 are arranged in a row at a predetermined pitch. As shown in Fig. 3, each terminal unit 10 comprises a housing unit 11 and a metal terminal 12 accommodated in the housing unit 11 and adapted for electrically connecting a flexible PCB to a cable (not shown). According to the present invention, the electric connector assembly further comprises holders 30 respectively provided at both longitudinal ends of the row of terminal units 10. When the cable (not shown) is connected with the metal terminal 10, the holders 30 lock the cable to the row of terminal units 10. In the present invention, the outside housing 50 is detachably disposed over the row of terminal units 10 to integrate the row of terminal units 10 into an integral one so as to achieve a relatively rigid construction. Fig. 1 is a schematic view which shows that the row of terminal units 10 and the two holders 30 are integrated by the outside housing 50 to an integral one, while Fig. 2 is a schematic view which shows the outside housing 50 is detached from these terminal units 10 and the two holders 30. As a result, when the outside housing 50 is detached from these terminal units 10, a flexible deflection capability is achieved among these terminal units 10.

Specifically, in this electric connector assembly, the metal terminal 12 is adapted for electrically connecting the flexible PCB and the cable and transferring electronic signals. The metal terminal 12 is embedded in the housing unit 11 and has one end to be soldered to the flexible PCB and the other end to be connected with the FPC cable. The independent housing unit 11 is used for securing the metal terminal 12 to prevent short circuit among the metal terminals 12. A single terminal unit 10 is obtained by combining the metal terminal 12 together with the housing unit 11, and the specific structure and function of the terminal unit will be illustrated in detail below. The outside housing 50 is used for facilitating precise positioning these single terminal units 10 and precise determination of the pitches among these terminal units 10. The holders 30 are adapted for locking the cable when the row of terminal units 10 are connected with the FPC cable.

According to the present invention, each terminal unit 10 of the electric connector assembly is a sub-connector independent from the others. According to a preferred embodiment of the present invention, as shown in Fig. 3 and Fig. 4, the metal terminal 12 in each terminal unit 10 is adapted for electrically connecting the flexible PCB and the cable.

- 7 -

The metal terminal 12 comprises a cable receiving portion 121 at one end thereof and a connecting portion 122 for electrically connecting with the flexible PCB at the other end thereof. The connecting portion 122 extends out of a bottom side of the housing unit 11. Further, the cable receiving portion 121 is composed of a chamber 121a and a neck portion 121b. The groove 121a is adapted for receiving a cable therein while the neck portion 121b is formed adjacent to an opening of the chamber 121a to elastically retain the flexible cable so as to achieve an electric connection therebetween. At the same time, referring to Fig. 3, in order to receive the metal terminal, a groove 111 is provided in each housing unit 11. Specifically, the cable receiving portion 121 of the metal terminal 12 is embedded in the groove 111 of the housing unit 11, and the opening of the cable receiving portion 121 is oriented in the same direction as the longitudinal direction of the groove 111. The connecting portion 122 of the metal terminal 12 extends out of the groove 111 through an opening disposed in the bottom side of the housing unit 11. As shown in Fig. 3, a transversely through passage 112 for receiving the cable is formed in the housing unit 11. Hence, according to the concept of the present invention, when a plurality of housing units 11 are arranged in a row, the passages 112 of these housing units 11 together form a lengthwise socket into which the cable is inserted. In this preferred embodiment, the housing unit 11 is preferably made of plastic material.

According to a preferred embodiment of the present invention, refer to Fig. 2, a plurality of positioning slots 51 are arranged in a row at a predetermined pitch in the outside housing 50, and the terminal unit 10 and the holders 30 are ready to be located in these positioning slots 51, respectively. Specifically, as shown in Figs. 5 and 6, the two holders 30 are respectively located in the positioning slots 51 at both ends of the outside housing 50. Each holder 30 has a locking groove 31 formed therein, and the locking groove 31 has a projecting portion 31a which engages with a recessed portion (not shown) of the cable so as to lock the cable.

According to a preferred embodiment of the present invention, a manufacturing and mounting method for the electrical connector assembly is provided. The method at least comprises the steps of: molding a plurality of housing units 11; press forming a plurality of metal terminals 12, and accommodating the metal terminals 12 into the housing units 11 respectively so as to form a plurality of terminal units 10 separate from each other; providing an outside housing 50 in accordance with the specific design requirements such as the predetermined pitch among these terminal units 10, then, locating these terminal units 10

- 8 -

respectively into these positioning slots 51 of the outside housing 50 arranged in a direction at the predetermined pitch; and, providing the two holders 30 into the positioning slots 51 which are located at both ends of the outside housing 50 respectively to produce an integrated electrical connector assembly.

5 Next, the usage of the above electrical connector assembly is illustrated. Firstly, placing the outside housing 50 integrated with these terminal units 10 and the holders 30 onto the flexible PCB, and locating the connecting portion 122 of each metal terminal 12 of these terminal units 10 at a corresponding solder point formed in the flexible PCB. Then, soldering the connecting portion 122 of each metal terminal 12 onto the flexible PCB so as to fix these
10 terminal units 10 onto the flexible PCB. Finally, removing the outside housing 50 away from these terminal units 10 so that these terminal units 10 can deflect along with the deflection of the flexible PCB. Furthermore, inserting the flexible cable into the lengthwise socket formed by the terminal units 10 and the holders 30, in which the recessed portion of the flexible cable are engaged with the projecting portions 31a of the holders 30 so as to lock the flexible cable
15 onto the electric connector assembly.

 Accordingly, the present invention further provides an electrical connector mounting assembly. As shown in Fig. 1, the mounting assembly comprises: a plurality of separate terminal units 10 arranged in a row at a predetermined pitch; holders 30 adapted for locking the cable to these terminal units 10; and an outside housing 50 adapted for temporarily
20 integrating the terminal units 10 and the holders 30 together, wherein the terminal units 10 can deflect along with the deflection of the flexible PCB when the outside housing 50 is detached from the terminal units 10 and the holders 30. Specifically, as shown in Fig. 3, each terminal unit 10 comprises a housing unit 11 and a metal terminal 12 accommodated in the housing unit 11. The metal terminal 12 is adapted for electrically connecting the flexible PCB with the cable. Specifically, as shown in Fig. 4, the metal terminal 12 comprises a cable
25 receiving portion 121 at one end thereof for electrically connecting with the cable and a connecting portion 122 at the other end thereof for electrically connecting with the flexible PCB. The connecting portion 122 extends out from a bottom side of the housing unit 11. According to a preferred embodiment of the present invention, as shown in Fig. 2, a plurality
30 of positioning slots 51 are arranged in a direction at the predetermined pitch in the outside housing 50, and the terminal unit 10 and the holders 30 are ready to be detachably located in these positioning slots 51, respectively. With this electric connector mounting assembly, the

- 9 -

electric connector assembly of the present invention may be mounted on a flexible PCB in a simple way.

Although several exemplary embodiments have been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made
5 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.

- 10 -

What is claimed is:

1. A terminal unit, comprising:
a housing unit; and
a metal terminal accommodated in said housing unit and adapted for electrically
5 connecting a flexible PCB and a cable,
wherein said metal terminal comprises a cable receiving portion at one end thereof for
electrically connecting the cable and a connecting portion at the other end thereof for
electrically connecting with the flexible PCB, wherein said connecting portion extends out
of a bottom side of said housing unit.
10
2. The terminal unit as claimed in claim 1, wherein said cable receiving portion comprises: a
chamber for accommodating the cable therein, and a neck part formed adjacent to an
opening of said chamber to elastically retain the cable for achieving electric connection.
- 15 3. The terminal unit as claimed in claim 1, wherein said housing unit has a groove formed
therein into which said cable receiving portion of said metal terminal is embedded, and the
opening of said cable receiving portion is oriented in the same direction as the
longitudinal direction of said groove,
wherein said connecting portion of said metal terminal extends out of said groove
20 through an opening formed in said bottom side of said housing unit.
4. The terminal unit as claimed in claim 1, wherein a transversely through passage for
receiving said cable is formed in said housing unit.
- 25 5. The terminal unit as claimed in claim 1, wherein said housing unit is made of plastic.
6. An electrical connector assembly consisted of a plurality of terminal units as claimed in
any one of claims 1-5, said electrical connector assembly comprising:
a plurality of terminal units that are arranged separately in a row at a predetermined pitch;
30 and
two holders provided at both ends of said row of terminal units respectively in said
direction and adapted to lock the cable to terminal units.

- 11 -

7. The electrical connector assembly as claimed in claim 6, wherein each of said holders has a locking groove therein, and said locking groove has a projecting portion which engages with a recessed portion of the cable so as to lock the cable.
- 5 8. A mounting method for said electrical connector assembly as claimed in claim 6, said method comprising the steps of:
molding a plurality of housing units;
press forming a plurality of metal terminals, and accommodating said metal terminals into said housing units respectively so as to form a plurality of separate terminal units;
10 providing an outside housing for positioning said terminal units, wherein said outside housing includes a plurality of positioning slots arranged in a row at said predetermined pitch, and placing each of said terminal units into each of said positioning slots of said outside housing respectively;
placing said two holders into said positioning slots which are located at two ends of said
15 outside housing respectively to form an integrated electrical connector assembly;
soldering said connecting portion of each of said metal terminals in said electrical connector assembly to the flexible PCB so as to mount said terminal units onto the flexible PCB; and
removing said outside housing from said row of terminal units, so as to enable said
20 terminal units to deflect along with the deflection of the flexible PCB.
9. An electrical connector mounting assembly, comprising:
a plurality of separate terminal units arranged in a row at a predetermined pitch, wherein each of said terminal units comprises a housing unit and a metal terminal accommodated in said housing unit and adapted for electrically connecting a flexible PCB and a cable;
25 wherein said metal terminal comprises a cable receiving portion at one end thereof for electrically connecting the cable, and a connecting portion at the other end thereof for electrically connecting with the flexible PCB; wherein said connecting portion extends out of a bottom side of said housing unit;
two holders provided respectively at both ends of said row of terminal units in said
30 direction and adapted to lock the cable to said row of terminal units; and
an outside housing for temporarily integrating said terminal units and said holders together, wherein said terminal units are able to deflect along with the deflection of the

- 12 -

flexible PCB when said outside housing is removed from said terminal units and said holders.

10. The electrical connector mounting assembly as claimed in claim 9, wherein said outside housing includes a plurality of positioning slots arranged in a row at said predetermined pitch, and said terminal units and said holders are detachably positioned in said
5 positioning slots of said outside housing respectively.

* * * * *

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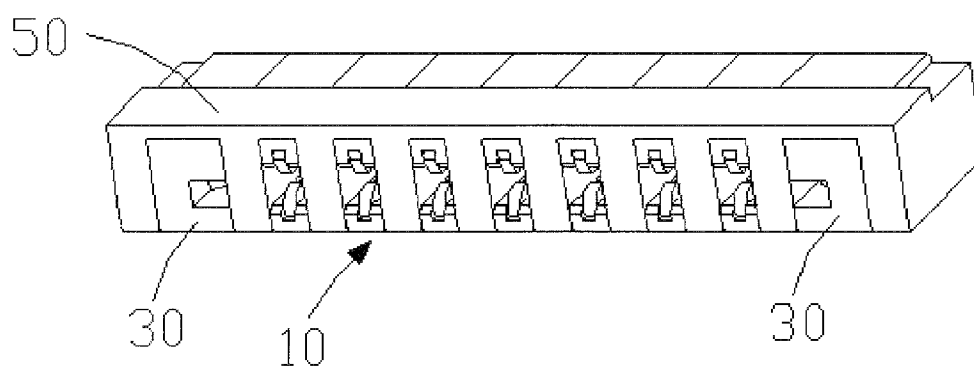


Fig. 1

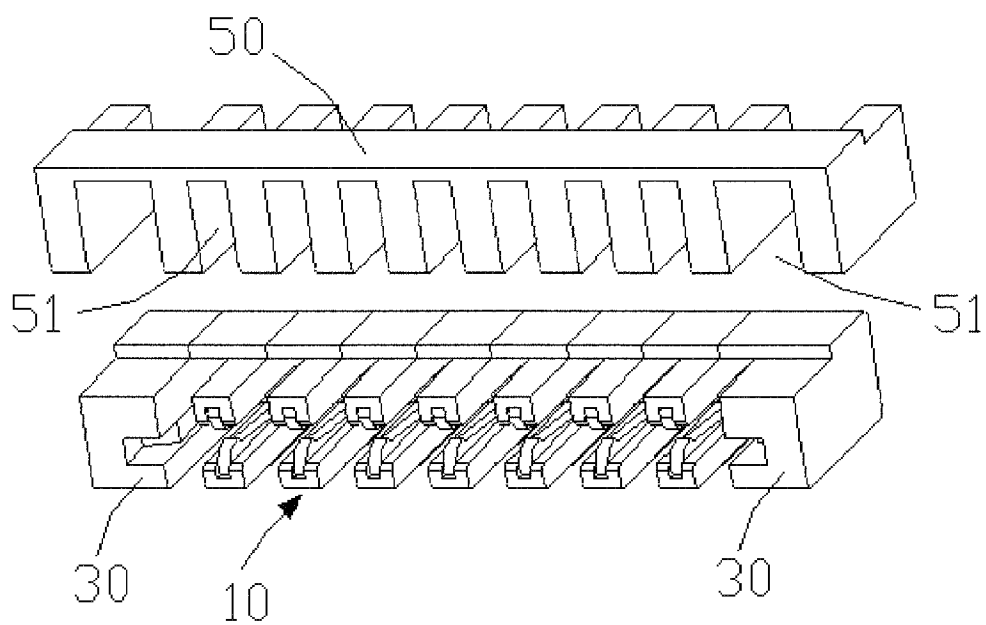


Fig. 2

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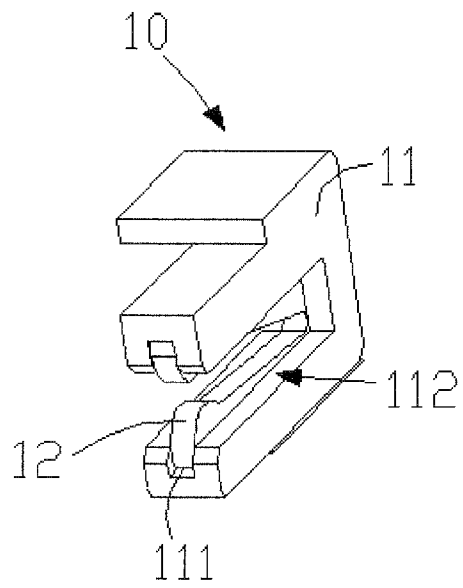


Fig. 3

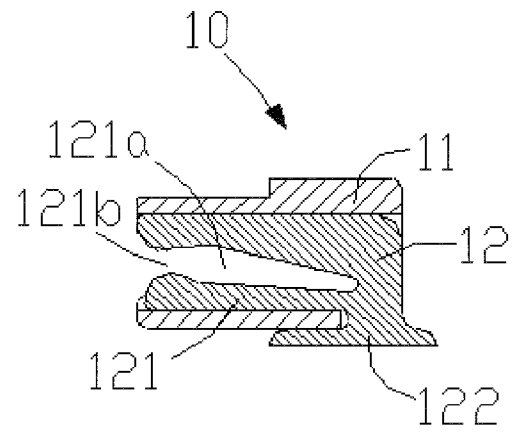


Fig. 4

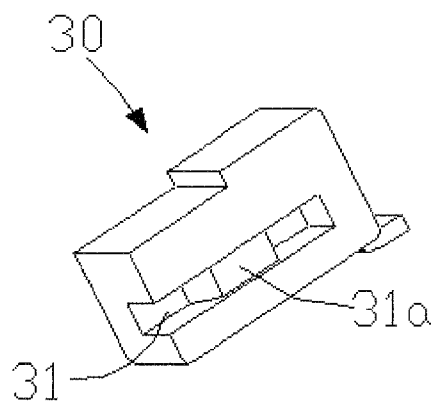


Fig. 5

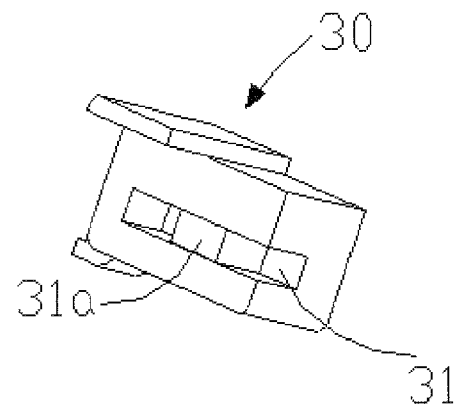


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/051255

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R12/24

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	* abstract	2-8
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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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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

14 June 2010

Date of mailing of the international search report

23/06/2010

Name and mailing address of the ISA/

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Bertin, Michel

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2010/051255

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Information on patent family members

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