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- **Wang, Ning**
China (Shanghai) Pilot Free Trade Zone (CN)
- **Wang, Hao**
China (Shanghai) Pilot Free Trade Zone (CN)
- **Zhao, Qijun**
China (Shanghai) Pilot Free Trade Zone (CN)
- **Gao, Bo**
China (Shanghai) Pilot Free Trade Zone (CN)
- **Li, Cui**
China (Shanghai) Pilot Free Trade Zone (CN)

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(71) Applicant: **Tyco Electronics (Shanghai) Co. Ltd.**
Shanghai 200131 (CN)

(74) Representative: **Grünecker Patent- und
Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)**

(72) Inventors:
• **Yu, Jianfei**
China (Shanghai) Pilot Free Trade Zone (CN)

(54) **CONTACT MODULE, CONNECTOR AND METHOD OF MANUFACTURING THE CONTACT MODULE**

(57) A contact module comprises an insulation body, a first row of contacts held in the insulating body and separated from each other by a first pitch, and a second row of contacts held in the insulating body and separated from each other by a second pitch. The first row of contacts are opposite to the second row of contacts in a first direction, each contact comprises an elastic contact end portion, a welding end portion and a connection portion between the elastic contact end portion and the welding end portion. The contacts of the first row of contacts correspond to the contacts of the second row of contacts, respectively, and the elastic contact end portions of each pair of corresponding contacts overlap with each other in the first direction. The connection portions of each pair of corresponding contacts are offset from each other in the first direction, and the insulation body is a single molding piece over-molded on the connection portions of the first and second rows of contacts, it decreases the cost of the connector.

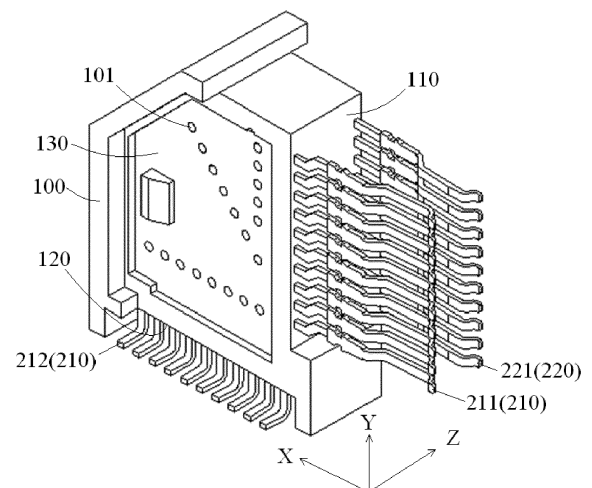


Fig. 1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Chinese Patent Application No. CN201510214878.X filed on April 30, 2015 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

[0002] The present invention relates to a contact module of a connector, a connector comprising the contact module, and a method of manufacturing the contact module.

Description of the Related Art

[0003] In the prior art, a connector applied to a small computer system interface (SCSI) mainly comprises: a vertical type connector, a right angle type connector, and a vertical flag type connector. The vertical type connector and the right angle type connector are commonly used, but the vertical flag type connector is rarely used.

[0004] In the prior art, the vertical flag type connector generally comprises two rows of contacts opposite to and separated from each other in a lateral direction of the connector. The two rows of contacts completely are aligned with each other in the lateral direction of the connector. With such arrangement of the two rows of contacts, it is impossible to mold a single insulation body, which may hold the two rows of contacts at the same time, on the two rows of contacts, because it is impossible to sandwich and hold the two rows of contacts by an injection mold. Thereby, in the prior art, it needs to individually mold an insulation body on each row of contacts. In this way, in the prior art, it needs to mold two separate insulation bodies on the two rows of contacts by two sets of separate injection molds. Thereby, it increases the investment cost of the injection molds. Furthermore, in the prior art, it needs to assemble the two separate insulation bodies together, increasing the cost of assembling the connector. As a result, in the prior art, the overall cost of the connector becomes very high, reducing the competitiveness of the connector product.

[0005] As described above, as for the vertical flag type connector in the prior art, it needs to assemble two separate contact modules together, increasing the cumulative error on dimensions, and decreasing the reliability of connector.

SUMMARY OF THE INVENTION

[0006] The present invention has been made to overcome or alleviate at least one aspect of the above men-

tioned disadvantages.

[0007] According to an object of the present invention, there is provided a contact module of a connector, in which the contact module comprises a single insulation body molded on two rows of contacts, thereby reducing the cost of the connector.

[0008] According to an aspect of the present invention, there is provided a contact module, comprising: an insulation body; a first row of contacts held in the insulating body and separated from each other by a first pitch; and a second row of contacts held in the insulating body and separated from each other by a second pitch, the first row of contacts being arranged to be opposite to the second row of contacts in a first direction, wherein each contact of the first and second rows of contacts comprises an elastic contact end portion, a welding end portion and a connection portion between the elastic contact end portion and the welding end portion; the contacts of the first row of contacts correspond to the contacts of the second row of contacts, respectively, and the elastic contact end portions of each pair of corresponding contacts are aligned with each other in the first direction; the connection portions of each pair of corresponding contacts are offset from each other in the first direction; and the insulation body is a single molding piece over-molded on the connection portions of the first and second rows of contacts.

[0009] According to an exemplary embodiment of the present invention, the first pitch is equal to the second pitch, the connection portions of each pair of corresponding contacts are offset from each other in the first direction by a pitch equal to half of the first pitch or the second pitch.

[0010] According to another exemplary embodiment of the present invention, the welding end portions of each pair of corresponding contacts are offset from each other in the first direction by a pitch equal to half of the first pitch or the second pitch.

[0011] According to another exemplary embodiment of the present invention, the elastic contact end portion of each contact of the first and second rows of contacts extends beyond an end surface of the insulation body, and the welding end portions of each contact of the first and second rows of contacts extends beyond a bottom surface of the insulation body, wherein the end surface of the insulation body is perpendicular to the bottom surface of the insulation body.

[0012] According to another exemplary embodiment of the present invention, the end surface of the insulation body is defined by the first direction and a second direction perpendicular to the first direction, the bottom surface of the insulation body is defined by the first direction and a third direction perpendicular to the first direction and the second direction.

[0013] According to another exemplary embodiment of the present invention, the connection portions of the first row of contacts are arranged in a first plane perpendicular to the first direction, the connection portions of the second row of contacts are arranged in a second

plane perpendicular to the first direction, the first plane is separated from the second plane by a predetermined distance in the first direction.

[0014] According to another aspect of the present invention, there is provided a connector, comprising: a housing; and the above contact module.

[0015] According to an exemplary embodiment of the present invention, the connector is configured to be a vertical flag type connector.

[0016] According to another aspect of the present invention, there is provided a method of manufacturing the contact module according to any one of claims -, comprising steps of:

providing an injection mold, wherein the injection mold comprises an upper die and a lower die matched with the upper die, a plurality of column protrusions are formed on each of the upper die and the lower die, the column protrusions of the upper die correspond to the column protrusions of the lower die, respectively, and each pair of corresponding column protrusions are aligned to each other in the first direction, so as to sandwich the respective contact from both sides;

placing the first row of contacts and the second row of contacts between the upper die and the lower die, and closing the injection mold, so that the connection portion of each contact of the first and second rows of contacts is sandwiched and held between the column protrusion of the upper die and the column protrusion of the lower die;

injecting a molten plastic material into the injection mold; and

opening the injection mold and taking the contact module out after the molten plastic material is cold and solidified.

[0017] According to an exemplary embodiment of the present invention, the connection portion of each contact of the first and second rows of contacts is sandwiched and held by one or more pairs of column protrusions.

[0018] In the above various exemplary embodiments of the present invention, since the connection portions of the first and second rows of contacts are offset from each other in the lateral direction of the connector, the first and second rows of contacts may be fixed in the injection mold by sandwiching the connection portions of the first and second rows of contacts from both sides of the connection portions. In this way, a single insulation body may be over molded on the first and second rows of contacts, decreasing the cost of the connector.

[0019] Furthermore, in the present invention, since the two rows of contacts are held in a single insulation body without a need to assemble two separate insulation bodies, it improves the assembly precision of the connector and increases the reliability of connector.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The above and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 is an illustrative perspective view of a contact module according to an exemplary embodiment of the present invention;

Fig.2 is an illustrative plan view of the contact module of Fig.1 in a first direction;

Fig.3 is an illustrative plan view of the contact module of Fig.1 in a second direction;

Fig.4 is an illustrative plan view of two rows of contacts of the contact module of Fig.1 in a first direction; Fig.5 is an illustrative plan view of a first row of contacts of Fig.4; and

Fig.6 is an illustrative plan view of a second row of contacts of Fig.4.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0021] Exemplary 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.

[0022] 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.

[0023] According to a general concept of the present invention, there is provided a contact module, comprising: an insulation body; a first row of contacts held in the insulating body and separated from each other by a first pitch; and a second row of contacts held in the insulating body and separated from each other by a second pitch, the first row of contacts are arranged to be opposite to the second row of contacts in a first direction. Each contact of the first and second rows of contacts comprises an elastic contact end portion, a welding end portion and a connection portion between the elastic contact end portion and the welding end portion. The contacts of the first row of contacts correspond to the contacts of the second row of contacts, respectively, and the elastic contact end portions of each pair of corresponding contacts are aligned with each other in the first direction. The connec-

tion portions of each pair of corresponding contacts are offset from each other in the first direction, and the insulation body is a single molding piece over-molded on the connection portions of the first and second rows of contacts.

[0024] Fig.1 is an illustrative perspective view of a contact module according to an exemplary embodiment of the present invention.

[0025] As shown in Fig.1, the contact module of the connector mainly comprises an insulation body 100, a first row of contacts 210 and a second row of contacts 220. The first row of contacts 210 and the second row of contacts 220 are held in the insulation body 100. The first row of contacts 210 are arranged to be opposite to and separated from the second row of contacts 220 in a first direction Z (or referred as a lateral direction of the connector).

[0026] Fig.4 is an illustrative plan view of two rows of contacts 210, 220 of the contact module of Fig.1 in a first direction; Fig.5 is an illustrative plan view of a first row of contacts 210 of Fig.4; and Fig.6 is an illustrative plan view of a second row of contacts 220 of Fig.4.

[0027] As shown in Figs. 1, 4-6, the first row of contacts 210 are arranged to separate from each other by a first pitch, the second row of contacts 220 are arranged to separate from each other by a second pitch. Each contact 210, 220 of the first and second rows of contacts comprises an elastic contact end portion 211, 221, a welding end portion 212, 222 and a connection portion 213, 223 between the elastic contact end portion 211, 221 and the welding end portion 212, 222.

[0028] Fig.2 is an illustrative plan view of the contact module of Fig.1 in the first direction Z; Fig.3 is an illustrative plan view of the contact module of Fig.1 in a second direction Y (or referred as a height direction of the connector) perpendicular to the first direction Z.

[0029] As shown in Figs.1-6, the contacts 210 of the first row of contacts correspond to the contacts 220 of the second row of contacts, respectively. As clearly shown in Figs.2 and 4, the elastic contact end portions 211, 221 of each pair of corresponding contacts 210, 220 are aligned with each other in the first direction Z.

[0030] As shown in Figs.2 and 4, the connection portions 213, 223 of each pair of corresponding contacts 210, 220 are offset from each other in the first direction Z.

[0031] In an embodiment, as shown in Figs.2 and 4, the first pitch may be equal to the second pitch, the connection portions 213, 223 of each pair of corresponding contacts 210, 220 may be offset from each other in the first direction Z by a pitch equal to half of the first pitch or the second pitch.

[0032] In an embodiment, as shown in Fig.1, the insulation body 100 is a single molding piece that is over-molded on the connection portions 213, 223 of the first and second rows of contacts 210, 220. In this way, the first row of contacts 210 and the second row of contacts 220 both are held and fixed by the single insulation body 100.

[0033] As shown in Figs.3 and 4, the welding end portions 212, 222 of each pair of corresponding contacts 210, 220 are offset from each other in the first direction Z.

[0034] In an embodiment, as shown in Figs.1 and 4, the welding end portions 212, 222 of each pair of corresponding contacts 210, 220 may be offset from each other in the first direction Z by a pitch equal to half of the first pitch or the second pitch.

[0035] As shown in Fig.1, the elastic contact end portion 211, 221 of each contact 210, 220 of the first and second rows of contacts extends beyond an end surface 110 of the insulation body 100. The welding end portions 212, 222 of each contact 210, 220 of the first and second rows of contacts extends beyond a bottom surface 120 of the insulation body 100. The end surface 110 of the insulation body 100 is perpendicular to the bottom surface 120 of the insulation body 100.

[0036] Referring to Fig.1 again, the end surface 110 of the insulation body 100 is defined by the first direction Z and a second direction Y perpendicular to the first direction Z. The bottom surface 120 of the insulation body 100 is defined by the first direction Z and a third direction (or referred as a longitudinal direction of the connector) X perpendicular to the first direction Z and the second direction Y.

[0037] As shown in Fig.1, a plurality of holes 101 are formed in both sides 130 of the insulation body 100. These holes 101 correspond to the respective contacts 210, 220. During molding the insulation body 100 on the contacts 210, 220 by means of an injection mold (not shown), the respective contacts 210, 220 are sandwiched and fixed between column protrusions of the injection mold (it will be described in more detail in a method of manufacturing the contact module), so that the contacts are located in the insulation body 100 by the column protrusions. Thereby, after the column protrusions are pulled out of the insulation body 100, there are left these holes 101 in the insulation body 100.

[0038] As shown in Fig.1, the connection portions 213 of the first row of contacts 210 are arranged in a first plane perpendicular to the first direction Z. The connection portions 223 of the second row of contacts 220 are arranged in a second plane perpendicular to the first direction Z. The first plane is separated from the second plane by a predetermined distance in the first direction Z.

[0039] In another exemplary embodiment of the present invention, a connector mainly comprises a housing and the above contact module mounted in the housing as set forth in the above embodiments. Because the contact module is a single molding piece, it may be easily assembled into the housing.

[0040] In an embodiment, the connector may be a vertical flag type connector.

[0041] Hereafter it will discuss a method of manufacturing the above contact module. In an embodiment, the method may comprise steps of:

providing an injection mold, wherein the injection

mold comprises an upper die and a lower die matching with the upper die, a plurality of column protrusions are formed on each of the upper die and the lower die, the column protrusions of the upper die correspond to the column protrusions of the lower die, respectively, each pair of corresponding column protrusions are aligned to each other in the first direction Z, so as to sandwich the respective contact 210, 220 from both sides;

placing the first row of contacts and the second row of contacts between the upper die and the lower die, and closing the injection mold, so that the connection portion 213, 223 of each contact 210, 220 of the first and second rows of contacts is sandwiched and held between the column protrusion of the upper die and the column protrusion of the lower die;

injecting a molten plastic material into the injection mold; and

opening the injection mold and taking the contact module out after the molten plastic material is cold and solidified.

[0042] As described above, after taking the contact module out of the injection mold, the holes 101, corresponding to the column protrusions of the injection mold, are formed in both sides of the insulation body 100.

[0043] In an embodiment, the column protrusions of the upper die correspond to the column protrusions of the lower die, respectively. Each pair of corresponding column protrusions are aligned to each other in the first direction Z, so as to reliably sandwich the respective contact 210, 220 from both sides of the respective contact 210, 220.

[0044] In an embodiment, during molding the insulation body 100 on the contacts 210, 220 by means of the injection mold, the connection portion 213, 223 of each contact 210, 220 of the first and second rows of contacts is sandwiched and held by one or more pairs of column protrusions. For example, in an embodiment, the connection portion 213, 223 of each contact 210, 220 is sandwiched and held by three pairs of column protrusions at three different locations in different lines. In this way, each contact 210, 220 may be reliably sandwiched and fixed in the injection mold.

[0045] 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.

[0046] 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 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.

[0047] 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.

Claims

1. A contact module, comprising:

an insulation body;

a first row of contacts held in the insulating body and separated from each other by a first pitch; and

a second row of contacts held in the insulating body and separated from each other by a second pitch, the first row of contacts being arranged to be opposite to the second row of contacts in a first direction,

wherein each contact of the first and second rows of contacts comprises an elastic contact end portion, a welding end portion and a connection portion between the elastic contact end portion and the welding end portion,

wherein the contacts of the first row of contacts correspond to the contacts of the second row of contacts, respectively, and the elastic contact end portions of each pair of corresponding contacts are aligned with each other in the first direction,

wherein the connection portions of each pair of corresponding contacts are offset from each other in the first direction, and

wherein the insulation body is a single molding piece over-molded on the connection portions of the first and second rows of contacts.

2. The contact module according to claim 1, wherein the first pitch is equal to the second pitch, the connection portions of each pair of corresponding contacts are offset from each other in the first direction by a pitch equal to half of the first pitch or the second pitch.

3. The contact module according to claim 2, wherein the welding end portions of each pair of corresponding contacts are offset from each other in the first direction by a pitch equal to half of the first pitch or the second pitch

4. The contact module according to claim 2,
wherein the elastic contact end portion of each contact of the first and second rows of contacts extends beyond an end surface of the insulation body,
wherein the welding end portions of each contact of the first and second rows of contacts extends beyond a bottom surface of the insulation body which is perpendicular to the end surface of the insulation body. 5
5. The contact module according to claim 4,
wherein the end surface of the insulation body is defined by the first direction and a second direction perpendicular to the first direction,
wherein the bottom surface of the insulation body is defined by the first direction and a third direction perpendicular to the first direction and the second direction. 10 15
6. The contact module according to claim 5,
wherein the connection portions of the first row of contacts are arranged in a first plane perpendicular to the first direction,
wherein the connection portions of the second row of contacts are arranged in a second plane perpendicular to the first direction, and
wherein the first plane is separated from the second plane by a predetermined distance in the first direction. 20 25
7. A connector, comprising: 30
 - a housing; and
 - the contact module, according to claim, mounted in the housing. 35
8. The connector according to claim 7, wherein the connector is configured to be a vertical flag type connector.
9. A method of manufacturing the contact module according to any one of claims 1-6, comprising steps of: 40
 - providing an injection mold, wherein the injection mold comprises an upper die and a lower die matched with the upper die, a plurality of column protrusions are formed on each of the upper die and the lower die, the column protrusions of the upper die correspond to the column protrusions of the lower die, respectively, and each pair of corresponding column protrusions are aligned to each other in the first direction, so as to sandwich the respective contact from both sides; 45 50
 - placing the first row of contacts and the second row of contacts between the upper die and the lower die, and closing the injection mold, so that the connection portion of each contact of the first and second rows of contacts is sandwiched and 55
10. A method according to claim 8,
wherein the connection portion of each contact of the first and second rows of contacts is sandwiched and held by one or more pairs of column protrusions.

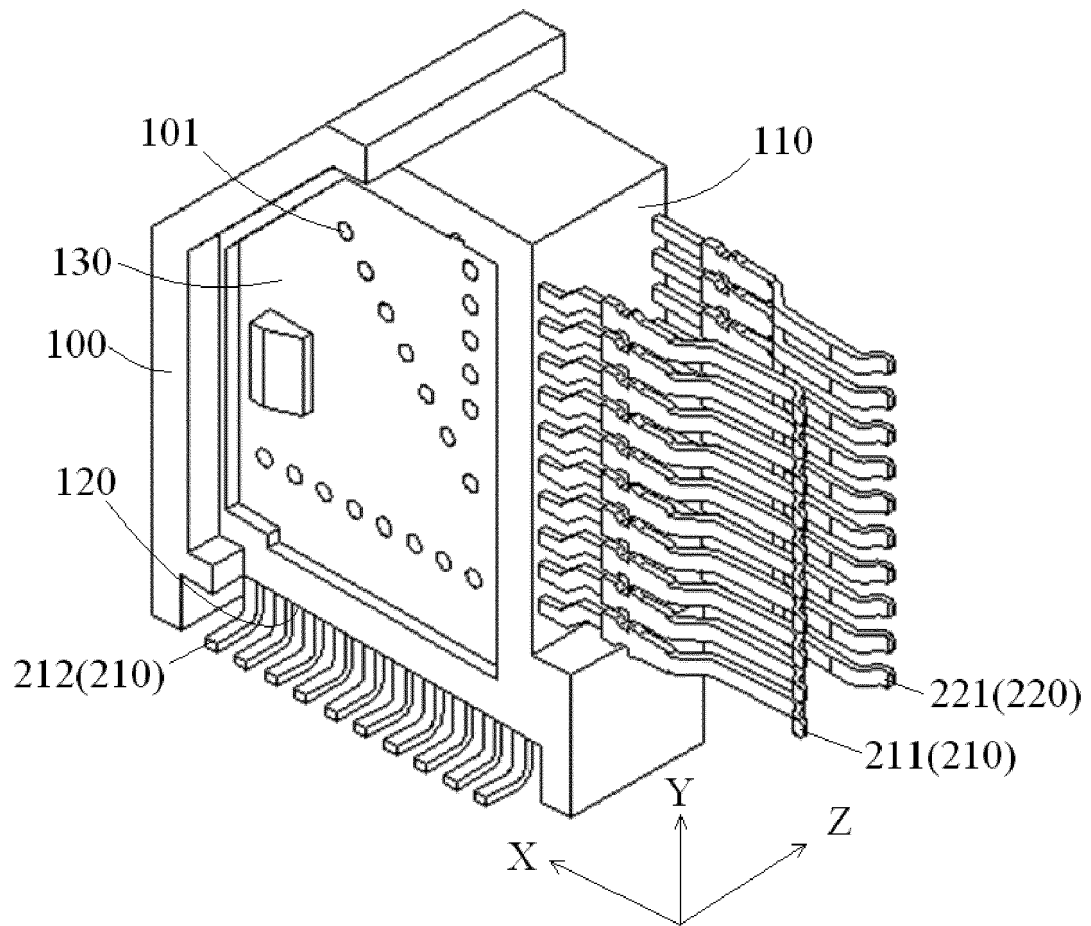


Fig. 1

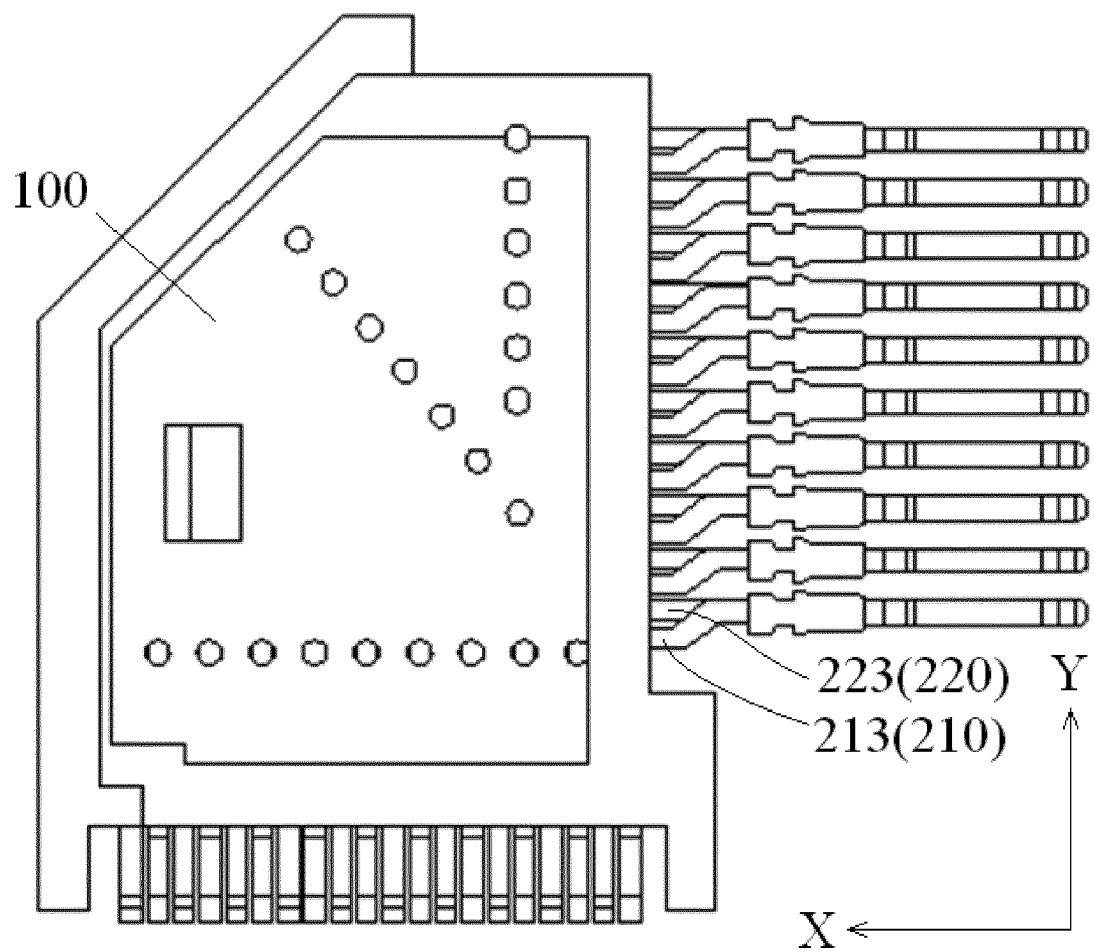


Fig. 2

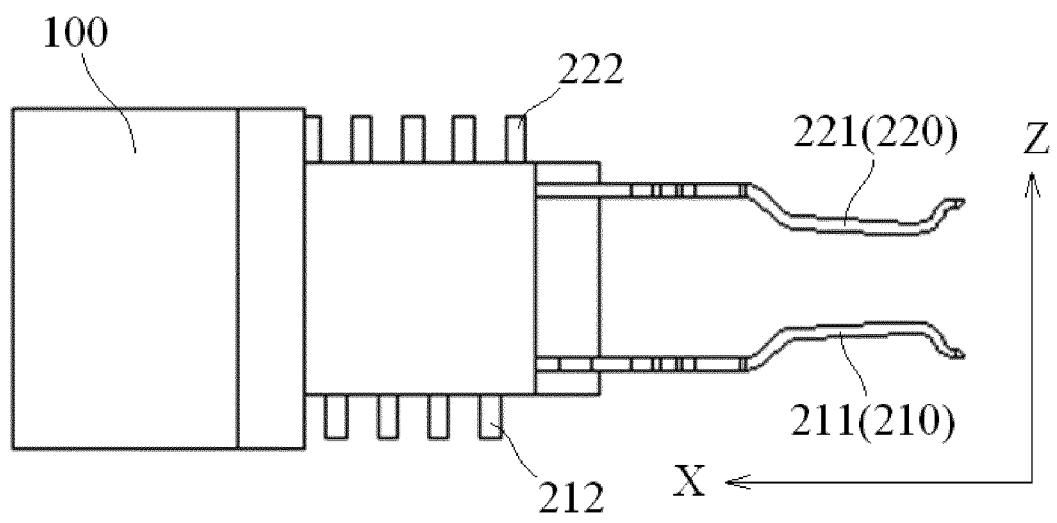


Fig. 3

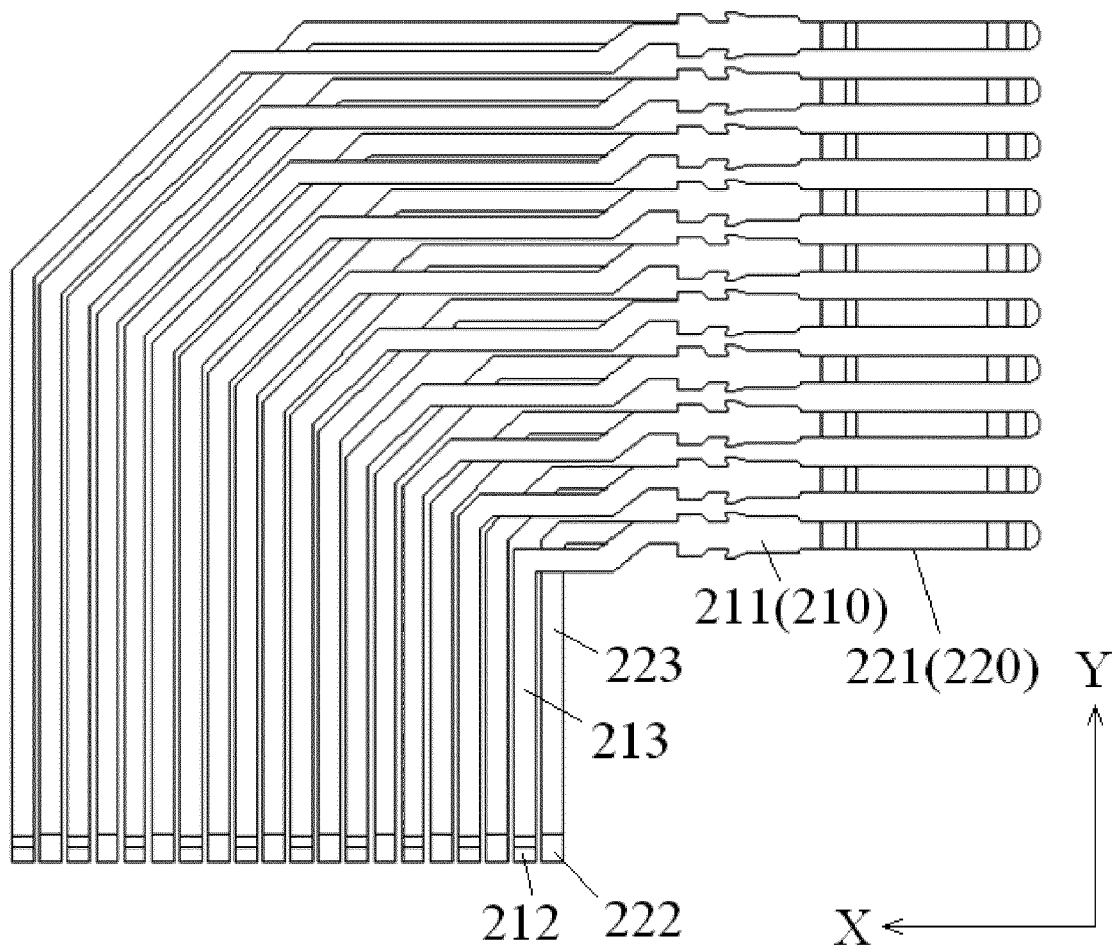


Fig. 4

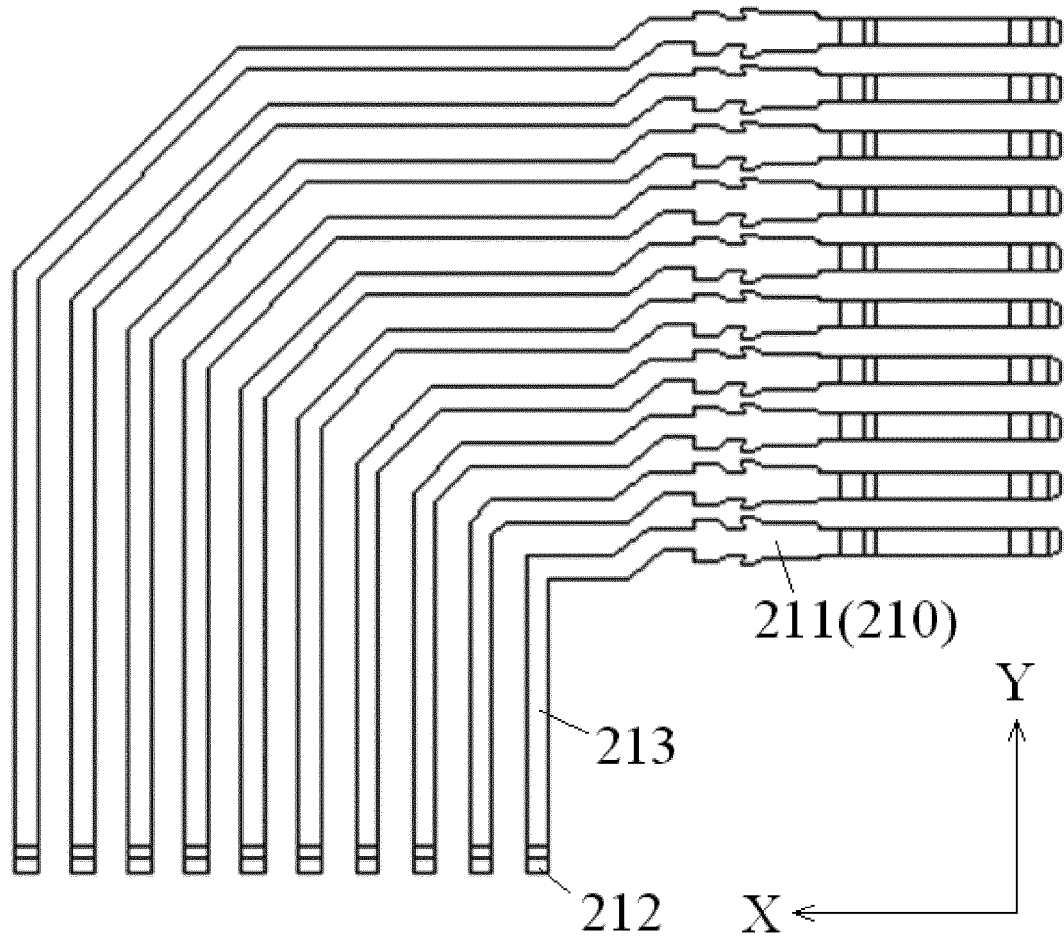


Fig. 5

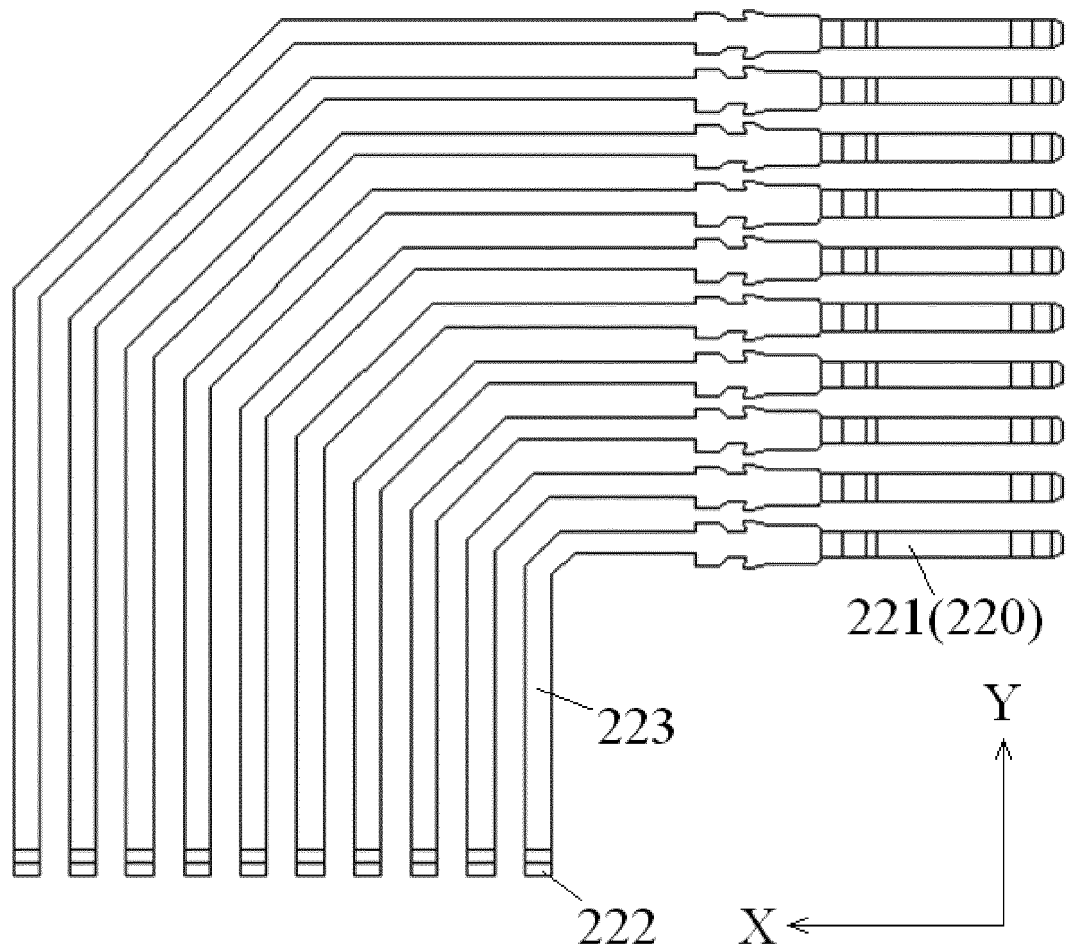


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 16 16 7767

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 August 2016	Examiner Kandyla, Maria
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 16 7767

5 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
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