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(71) Applicant: **Phoenix Contact Asia-Pacific (Nanjing) Co., Ltd.**
211100 Jiangsu (CN)

(72) Inventor: **ZHANG, Miao**
Nanjing, Jiangsu 211100 (CN)

(74) Representative: **Pfenning, Meinig & Partner mbB Patent- und Rechtsanwälte**
Theresienhöhe 11a
80339 München (DE)

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(54) **SELF-SHORTING CONNECTOR**

(57) Disclosed by the present application is a self-shorting connector, comprising: an insulated core body; a plurality of insertion terminals arranged inside said insulating core body, which are arranged in the respective terminal hole positions of said insulating core body, each of said insertion terminals being formed by bending and processing a metal sheet, comprising a wiring base and an inserting portion; said inserting portion being connected with said wiring base and extending outward from the wiring base. The insertion terminal also comprises a side leg structure, said side leg structure extending from the wiring base, and the extension direction of the side leg structure and the extension direction of the inserting portion being substantially parallel. The inserting portion of the insertion terminal is located in the terminal hole position of the insulating core body, and the side leg structure is located outside the terminal hole position of said insulating core body.

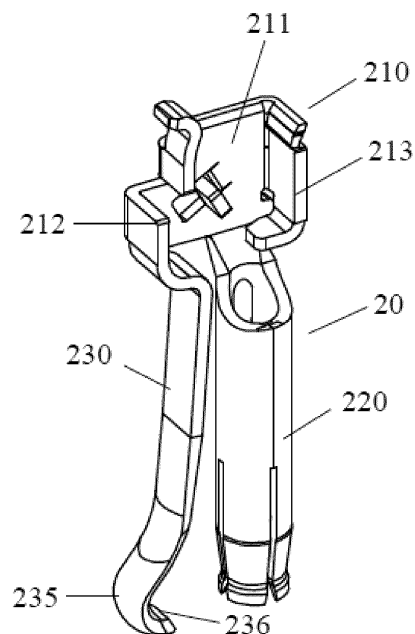


FIG.2

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Description

TECHNICAL FIELD

[0001] The present invention relates to an electrical connection device, especially a self-shortening connector with a novel configuration.

BACKGROUND

[0002] In some electrical connection occasions, the connector is required to have self-shortening function to enhance the safety of the system. Connector with self-shortening function is often referred to as "self-shortening connector". The self-shortening connector can automatically realize the functions of shorting and de-shortening according to the requirements of use. In other words, after the mated connectors are separated from each other, a shorting mechanism works to short-circuit the contacts in the connector with the housing, that is, in a self-shortening state; after the connectors are mated, the shorting state caused by the shorting mechanism is automatically released, and a normal connection state is restored.

[0003] The classification and characteristic of self-shortening connector can be divided into single-core self-shortening connector and multi-core self-shortening connectors according to the number of electrical contacts of the connector. The self-shortening configuration of multi-core self-shortening connector requires not only automatic short-circuit between the contact and the housing, but also automatic short-circuit among contacts.

[0004] In the prior art, a separate shorting configuration (for example, an elastic shorting piece) is often used to connect pins in two positions to realize two-way self-shortening. An extended shorting structure can realize multi-way self-shortening.

SUMMARY

[0005] The present invention proposes a self-shortening connector with a novel configuration, which can effectively reduce the contact resistance during self-shortening, and reduce the number of parts and the complexity of core body structure in two-way self-shortening applications.

[0006] According to one aspect of the present invention, a self-shortening connector is proposed, comprising: an insulated core body; a plurality of insertion terminals arranged inside said insulating core body, which are arranged in the respective terminal hole positions of said insulating core body, each of said insertion terminals being formed by bending and processing a metal sheet, comprising a wiring base and an inserting portion; said inserting portion being connected with said wiring base and extending outward from the wiring base, the insertion terminal also comprises a side leg structure, said side leg structure extending from the wiring base, and the extension direction of the side leg structure and the extension direction of the inserting portion being substantially

parallel, the inserting portion of the insertion terminal is located in the terminal hole position of the insulating core body, and the side leg structure is located outside the terminal hole position of said insulating core body.

[0007] In the aforementioned scheme of self-shortening connector, the plurality of insertion terminals comprise one or more insertion terminal pairs, each insertion terminal pair comprises two insertion terminals symmetrically placed in space, and the side leg structures of the two insertion terminals are opposite to each other and are capable of being in contact with each other to form an electrical connection.

[0008] In the aforementioned scheme of the self-shortening connector, the self-shortening connector further comprises a bridging short-circuit piece capable of being electrically connected to the side leg structure of the insertion terminal placed adjacent to each other.

[0009] In the aforementioned scheme of the self-shortening connector, the self-shortening connector further comprises a bridging short-circuit piece capable of bridging two or more insertion terminal pairs disposed adjacent to each other.

[0010] In the aforementioned scheme of the self-shortening connector, an end of the side leg structure comprises a shorting arc portion configured to gradually move away from the inserting portion along a segment of arc, and then return, to form a tail hook.

[0011] In the aforementioned scheme of the self-shortening connector, the wiring base is configured to be a frame body formed by a substrate and walls at two ends of the substrate, and the side leg structure is connected to a first wall at one end of the substrate and extends out from the wall.

[0012] In the aforementioned scheme of the self-shortening connector, the frame body of the wiring base is a wiring frame.

[0013] In the aforementioned scheme of the self-shortening connector, the side leg structure is configured as an elastic arm structure.

[0014] In the aforementioned scheme of the self-shortening connector, a maximum distance between an end of the side leg structure and an axis of the inserting portion is greater than a distance between the first wall and the axis of the inserting portion.

[0015] In the aforementioned scheme of the self-shortening connector, the insertion terminal is a pin terminal or a jack terminal.

[0016] According to one aspect of the present invention, a connector assembly is proposed, comprising: a self-shortening connector abovementioned, and a connector for mating with the self-shortening connector, wherein an insulating partition plate is provided in the insulating core body of the mating connector, and is configured to intervene between the side leg structures of the two insertion terminals of each insertion terminal pair when the self-shortening connector and the mating connector are mated in place.

[0017] In the aforementioned scheme of the connector

assembly, a groove is formed in the upper end of the insulating partition plate of the mating connector.

[0018] According to one aspect of the present invention, an insertion terminal being formed by bending and processing a metal sheet is proposed, the insertion terminal comprises a wiring base and an inserting portion, the inserting portion being connected with the wiring base and extending outward from the wiring base, the insertion terminal further comprises a side leg structure, the side leg structure extending from the wiring base, and the extension direction of the side leg structure and the extension direction of the inserting portion are substantially parallel.

[0019] In the aforementioned scheme of the insertion terminal, the wiring base is configured to be a frame body formed by a substrate and walls at two ends of the substrate, and the side leg structure is connected to a first wall at one end of the substrate and extends out from the wall.

[0020] In the aforementioned scheme of the insertion terminal, the frame body of the wiring base is a wiring frame.

[0021] In the aforementioned scheme of the insertion terminal, an end of the side leg structure is configured to gradually move away from the inserting portion along a segment of arc, and then return, to form a tail hook.

[0022] In the aforementioned scheme of the insertion terminal, the inserting portion of the insertion terminal is a pin or a jack.

DESCRIPTION OF DRAWINGS

[0023]

Fig. 1 is a schematic diagram of a self-shortening connector according to an embodiment of the present invention.

FIG. 2 is a schematic diagram of an insertion terminal in the self-shortening connector shown in FIG. 1.

FIG. 3 is a schematic diagram showing the positional and structural relationship between a plurality of insertion terminals and a bridging short-circuit piece.

FIG. 4 is a cross-sectional view of the structure shown in FIG. 3.

FIG. 5 is a top view of the structure shown in FIG. 3.

FIG. 6 is a schematic diagram of a mating pin terminal in the self-shortening connector shown in FIG. 1.

FIG. 7 is a cross-sectional view of a mated state of a self-shortening connector and a mating connector as shown in FIG. 1.

Fig. 8 shows a wiring manner of the insertion terminal shown in FIG. 2.

[0024] Some reference numbers:

- 10 cover
- 20, 20A, 20B, 20C, 20D insertion terminal
- 30 insulation core body

- 40 mating insulating core body
- 50 mating insulating core body
- 80 bridging short-circuit piece
- 100 self-shortening connector
- 200 mating connector
- 210 wiring base
- 211 substrate
- 212 first Wall
- 213 second wall
- 220 inserting portion
- 230, 230A, 230B side leg structure
- 235 shorting arc portion
- 240 wire-pressing spring
- 250 push block
- 510 insulating partition plate

DETAILED DESCRIPTION

[0025] In the following description, the present invention is described with reference to various embodiments. However, one skilled in the art will recognize that the various embodiments may be practiced without one or more of the specific details, or with other alternative and/or additional methods, materials, or components. In other circumstances, well-known structures, materials, or operations are not shown or described in detail so as not to obscure aspects of the various embodiments of the present invention. Similarly, for purposes of explanation, specific quantity, material and configuration are set forth in order to provide a thorough understanding of embodiments of the present invention. However, the present invention may be practiced without these specific details. Furthermore, it should be understood that the various embodiments shown in the drawings are illustrative representations and are not necessarily drawn to scale.

[0026] The present invention will be further described below in conjunction with the accompanying figures.

[0027] FIG. 1 is a schematic diagram of a self-shortening connector according to an embodiment of the present invention. Specifically, FIG. 1 shows a connector assembly, which includes a self-shortening connector 100 and a mating connector 200 that can be mated with each other. The self-shortening connector 100 may include a cover 10, a plurality of insertion terminals 20, an insulation core body 30 and a bridging short-circuit piece 80. The mating connector 200 includes a mating insulation core body 40 and a plurality of mating insertion terminals 50. Although not shown, it can be understood that the insertion terminals 20 can be placed in the corresponding terminal hole positions in the insulation core body 30, and the mating insertion terminals 50 can be placed in the corresponding terminal hole positions in the mating insulation core body 40.

[0028] In the embodiment of FIG. 1, the insertion terminal 20 is shown as jack terminal and the mating insertion terminal 50 is shown as pin terminal. When the insulating core body 30 and the mating insulating core body 40 are mated in place, the jack terminal and the pin ter-

minal are mated together to form an electrical connection.

[0029] In the embodiment of FIG. 1, the self-shorting function of the self-shorting connector 100 is at least partially realized by the specific configuration of the insertion terminal 20. FIG. 2 is a schematic diagram of the insertion terminal 20 in the self-shorting connector 100 shown in FIG. 1, exemplarily showing the details of the specific configuration. Specifically, the insertion terminal 20 shown in FIG. 2 may be a structure of single-piece metal sheet that has been bent and processed multiple times, and includes a wiring base 210 and an inserting portion 220. The wiring base 210 and the inserting portion 220 are connected structure. In FIG. 2, the inserting portion 220 is configured to extend along the insertion direction (wire-entrance direction) of the insertion terminal.

[0030] The wiring base 210 is configured as a frame body formed of a substrate 211 and a first wall 212 and a second wall 213 at both ends thereof. A side leg structure 230 is connected to the first wall 212 at one end of the substrate 211 and extends out from the first wall 212. The extension direction of the side leg structure 230 is substantially parallel to the extension direction of the inserting portion 220, that is, extends along the insertion direction of the insertion terminal.

[0031] As shown in FIG. 2, the side leg structure 230 is preferably configured as an elastic arm structure. The elasticity of such elastic arm is to facilitate forming a reliable electrical contact.

[0032] The side leg structure 230 can be roughly a long and narrow metal sheet, and the surface of the metal sheet is substantially perpendicular to the surface of the substrate 211. A shorting arc portion 235 is formed at the end of the side leg structure 230, and the shorting arc portion 235 is structurally configured to gradually move away from the inserting portion 220 along a segment of arc, and then return, to form a tail hook 236. That is, the distance between the shorting arc portion 235 and the axis of the inserting portion 220 first gradually increases, and then gradually decreases, along the extension direction of the side leg structure 230 (the insertion direction of the insertion terminal).

[0033] In order for the side leg structure 230 to fully realize the self-shorting function, a maximum distance between the end of the side leg structure 230 and the axis of the inserting portion 220 is greater than a distance between the first wall 212 and the axis of the inserting portion 220. This makes the end of the side leg structure 230 spatially farther away from the axis of the inserting portion 220 than the frame body of the wiring base 210, which is beneficial to the electrical connecting of the end of side leg structure 230 of one insertion terminal 20 with side leg structure 230 of another spatially symmetrically placed insertion terminal 20.

[0034] Although not shown in the figure, it can be understood that the inserting portion 220 of the insertion terminal 20 is used to be inserted into a respective terminal hole position of the insulating core body 30, and the side leg structure 230 is located outside the terminal

hole position of the insulating core body 30.

[0035] The cover 10 in FIG. 1 can be used to secure the wiring base 210 of the insertion terminal 20 and isolate the electrical connection with adjacent positions.

[0036] FIG. 3 is a schematic diagram showing the positional and structural relationship of a plurality of insertion terminals and a bridging short-circuit piece. As shown in FIG. 3, when four insertion terminals 20 are installed in place, two insertion terminals 20A and 20B placed symmetrically in space form an insertion terminal pair, and insertion terminals 20C and 20D placed symmetrically in space form another insertion terminal pair. In the present application, unless otherwise specified, the spatial positional relationship between the insertion terminals 20A and 20B shown in FIG. 3 is referred to as "in opposite position", and the spatial positional relationship between the insertion terminals 20A and 20C shown in FIG. 3 is referred to as "in adjacent position".

[0037] For two insertion terminals that constitute an insertion terminal pair, for example, the insertion terminals 20A and 20B that are inserted into the opposite positions of terminal hole positions of the insulating core body 30, when the self-shorting connector 100 is not mated in place with the mating connector 200, the side leg structure 230A of the insertion terminal 20A contacts with the side leg structure 230B of the insertion terminal 20B, thereby realizing a two-way self-shorting. It can be understood that there is only one contact point to be present between the opposite insertion terminals 20A and 20B, that is, the contact point of the side leg structures 230A and 230B, to realize electrical contact required by the self-shorting. This greatly reduces contact resistance of two-way self-shorting.

[0038] In some occasions, it may need to realize multi-way self-shorting, so it is necessary to use bridging short-circuit structure across multiple positions. Because the present invention adopts the side leg structure for the insertion terminal, the bridging short-circuit across multiple positions is greatly simplified. For example, FIG. 3 shows a multi-way self-shorting based on a bridging short-circuit piece 80. The bridging short-circuit piece 80 is configured as a piece with a hook for easy installation into the insulating core body 30. The four-way bridging short-circuit piece 80 shown in FIG. 3 is installed in the insulating core body 30 and forms electrical connection with all the insertion terminals 20A, 20B, 20C, 20D of the two insertion terminal pairs. According to the specific needs of multi-way self-shorting, the bridging short-circuit piece 80 can be configured to bridge six positions, eight positions, etc.

[0039] FIG. 4 is a cross-sectional view of the structure shown in FIG. 3, and FIG. 5 is a bottom view of the structure shown in FIG. 3. FIG. 4 and FIG. 5 illustrate the contact between the bridging short-circuit piece 80 and the side leg structures 230A and 230B.

[0040] In conjunction with FIGs. 2-5, it can be understood that, by using the insertion terminal of the present invention, the functions of wire entrance, inserting and

two-way self-shortening are completed by one metal piece, which simplifies the composition and structure of the metal piece. Meanwhile, due to the reduction of amount of metal pieces, the structure of the insulating core body is correspondingly simplified.

[0041] FIG. 6 is a view of mating pin terminal 50 in FIG. 1. It can be understood that, in a modified example, an integral side leg structure as shown in FIG. 2 can be formed on the pin terminal shown in FIG. 6, and this type of pin terminal with side leg structure can be used for self-shortening connector.

[0042] FIG. 7 is a cross-sectional view of a mated state of a self-shortening connector and a mating connector as shown in FIG. 1. In the mating insulating core body 40 of the mating connector 200, an insulating partition plate 510 is provided. When the self-shortening connector 100 and the mating connector 200 are mated in place, the insulating partition plate 510 intervenes between the side leg structures of the two insertion terminals with opposite positions, thereby disconnecting the electrical connection between the side leg structures. The upper end of the insulating partition plate 510 is also provided with a groove. When the self-shortening connector 100 and the mating connector 200 are mated in place, the bridging short-circuit piece 80 is partially inserted into the groove, such that bridging short-circuit piece 80 and the side leg structures of the insertion terminals achieve electrical isolation.

[0043] Fig. 8 shows a wiring manner of the insertion terminal shown in FIG. 2. A wire-clamping spring 240 is mounted on the wiring frame of the wiring base 210 to form a straight plug-in wiring structure. A push block 250 can be used to push down the clamping arm of the wire-clamping spring 240 to realize wire retraction (it is also used for wire entrance in some applications).

[0044] Although the present invention is described by taking the connector shown in FIG. 1 as an example, it can be understood that the configuration of the insertion terminal proposed by the present invention can be applied to various connectors including two-way self-shortening and multi-way self-shortening applications.

[0045] The basic concept has been described above. Apparently, for those skilled in the art, the above disclosure is only an example, rather than constituting a limitation to the present application. Although not expressly stated here, various modifications, improvements and amendments to this application may be made by those skilled in the art. Such modifications, improvements and amendments are suggested in the present application, thus, such modifications, improvements and amendments still belong to the spirit and scope of the embodiments of the present application.

Claims

1. A self-shortening connector, comprising:

an insulated core body;

a plurality of insertion terminals arranged inside said insulating core body, which are arranged in the respective terminal hole positions of said insulating core body, each of said insertion terminals being formed by bending and processing a metal sheet, and comprising a wiring base and an inserting portion, said inserting portion being connected with said wiring base and extending outward from the wiring base, the insertion terminal also comprises a side leg structure, said side leg structure extending from the wiring base, and the extension direction of the side leg structure and the extension direction of the inserting portion being substantially parallel, the inserting portion of the insertion terminal is located in the terminal hole position of the insulating core body, and the side leg structure is located outside the terminal hole position of said insulating core body.

2. The self-shortening connector according to claim 1, wherein the plurality of insertion terminals comprise one or more insertion terminal pairs, each insertion terminal pair comprises two insertion terminals symmetrically placed in space, and the side leg structures of the two insertion terminals are opposite to each other and are capable of being in contact with each other to form an electrical connection.
3. The self-shortening connector according to claim 1, further comprising a bridging short-circuit piece capable of being electrically connected to the side leg structure of the insertion terminal placed adjacent to each other.
4. The self-shortening connector according to claim 2, further comprising a bridging short-circuit piece capable of bridging two or more insertion terminal pairs disposed adjacent to each other.
5. The self-shortening connector according to claim 1, wherein an end of the side leg structure comprises a shorting arc portion configured to gradually move away from the inserting portion along a segment of arc, and then return, to form a tail hook.
6. The self-shortening connector according to claim 1, wherein the wiring base is configured to be a frame body formed by a substrate and walls at two ends of the substrate, and the side leg structure is connected to a first wall at one end of the substrate and extends out from the wall.
7. The self-shortening connector according to claim 6, wherein the frame body of the wiring base is a wiring frame.

8. The self-shortening connector of claim 6, wherein the side leg structure is configured as an elastic arm structure.
9. The self-shortening connector according to claim 6, wherein a maximum distance between an end of the side leg structure and an axis of the inserting portion is greater than a distance between the first wall and the axis of the inserting portion.
10. The self-shortening connector according to any one of claims 1 to 9, wherein the insertion terminal is a pin terminal or a jack terminal.
11. A connector assembly, comprising:
 a self-shortening connector according to any one of claims 1-10, and
 a connector for mating with the self-shortening connector,
 wherein an insulating partition plate is provided in the insulating core body of the mating connector, and is configured to intervene between the side leg structures of the two insertion terminals of each insertion terminal pair when the self-shortening connector and the mating connector are mated in place.
12. The connector assembly according to claim 11, wherein a groove is formed in the upper end of the insulating partition plate of the mating connector.
13. An insertion terminal, being formed by bending and processing a metal sheet, the insertion terminal comprises a wiring base and an inserting portion, the inserting portion being connected with the wiring base and extending outward from the wiring base, the insertion terminal further comprises a side leg structure, the side leg structure extending from the wiring base, and the extension direction of the side leg structure and the extension direction of the inserting portion are substantially parallel.
14. The insertion terminal according to claim 13, wherein the wiring base is configured to be a frame body formed by a substrate and walls at two ends of the substrate, and the side leg structure is connected to a first wall at one end of the substrate and extends out from the wall.
15. The insertion terminal of claim 14, wherein the frame body of the wiring base is a wiring frame.
16. The insertion terminal of claim 14, wherein an end of the side leg structure is configured to gradually move away from the inserting portion along a segment of arc, and then return, to form a tail hook.
17. The insertion terminal of claim 13, wherein the inserting portion of the insertion terminal is a pin or a jack.

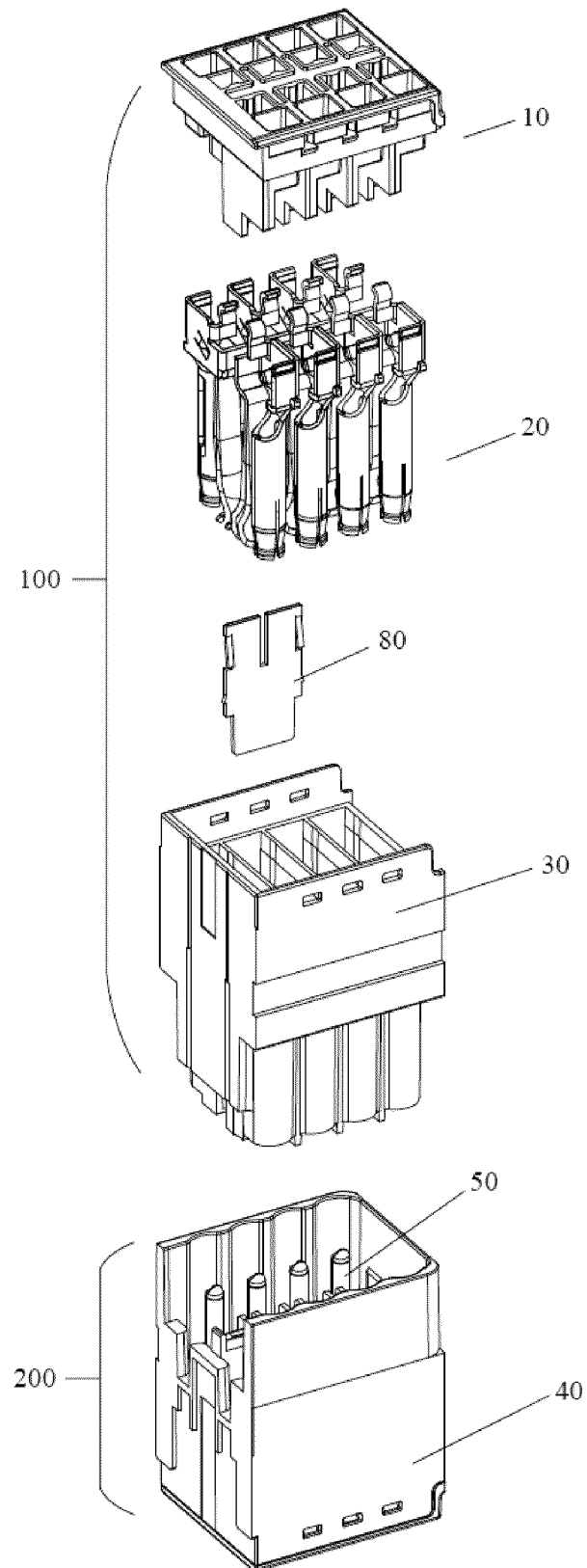


FIG.1

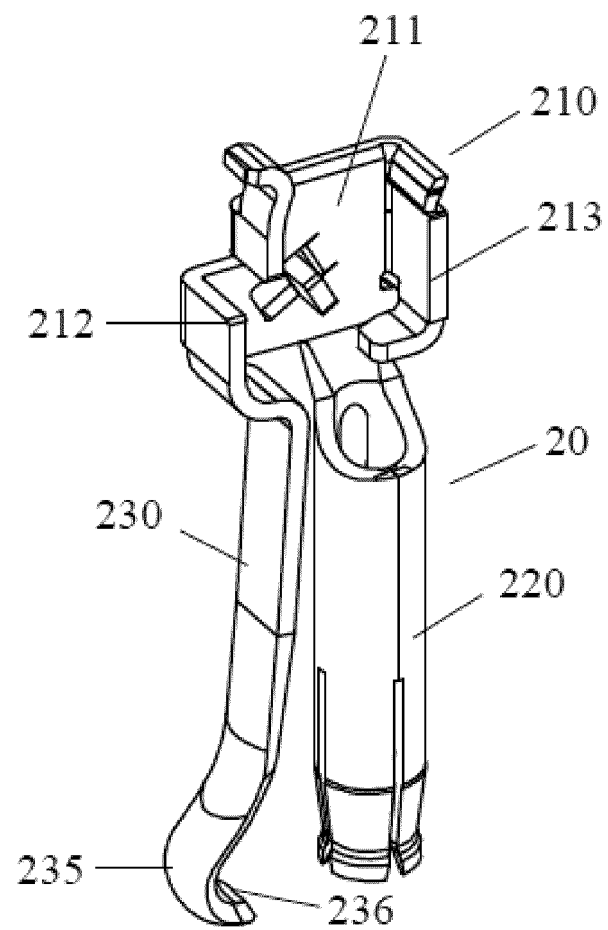


FIG.2

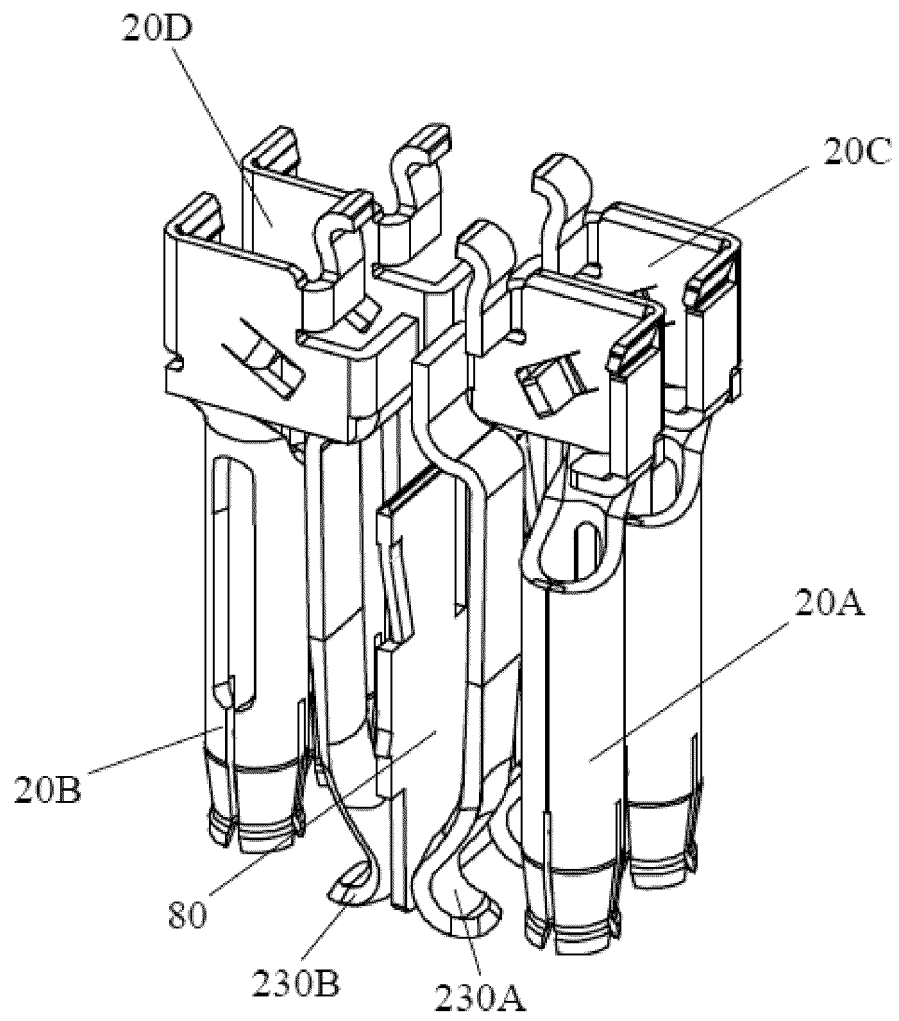


FIG.3

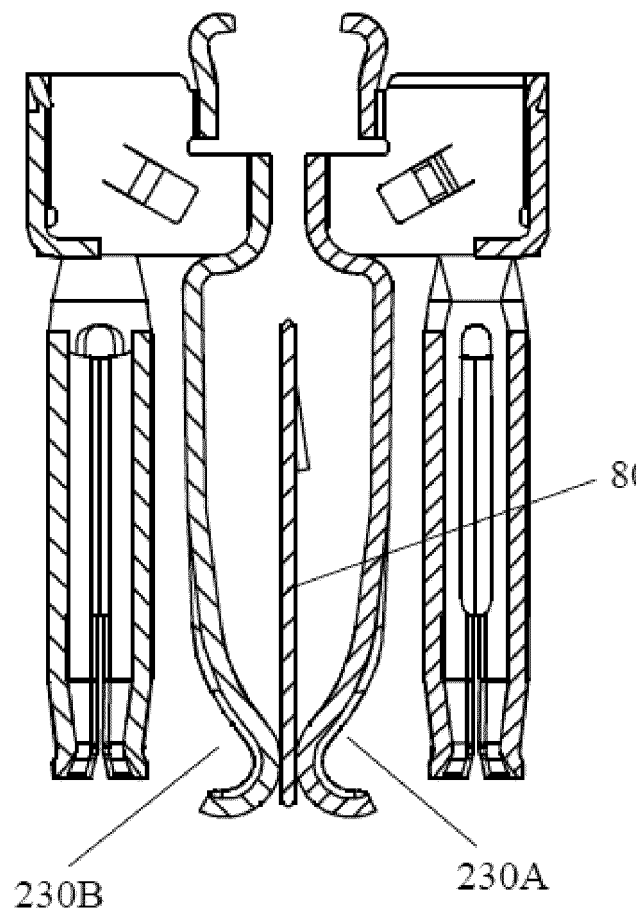


FIG.4

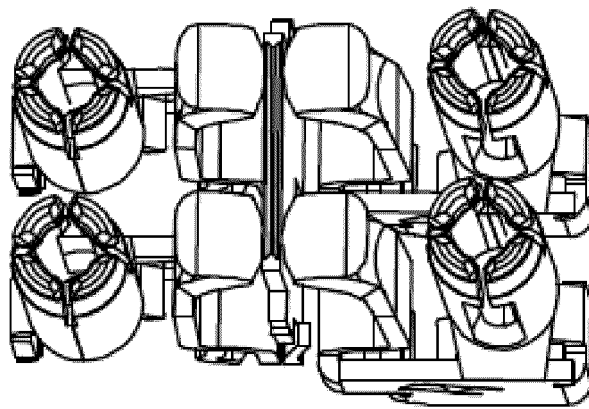


FIG.5

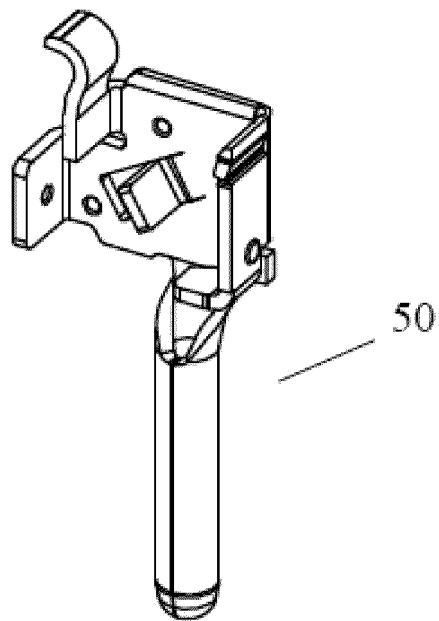


FIG.6

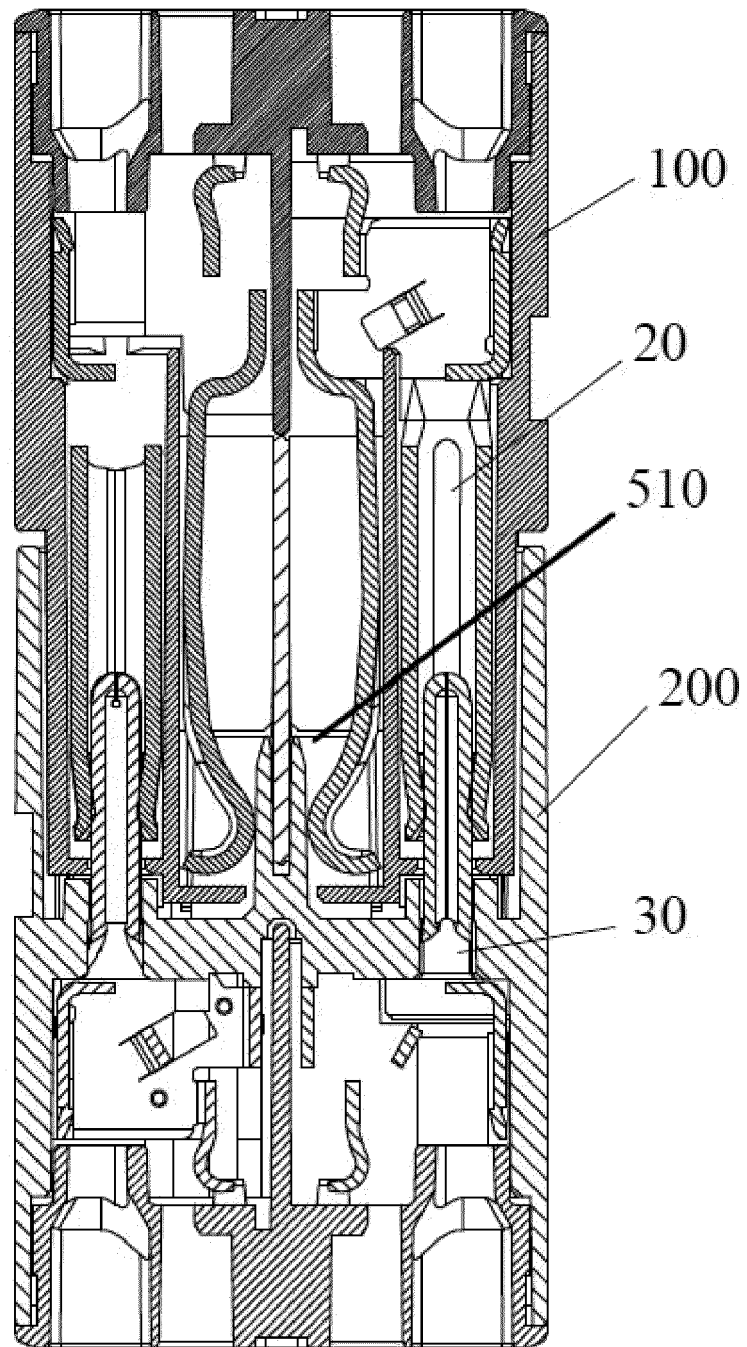


FIG.7

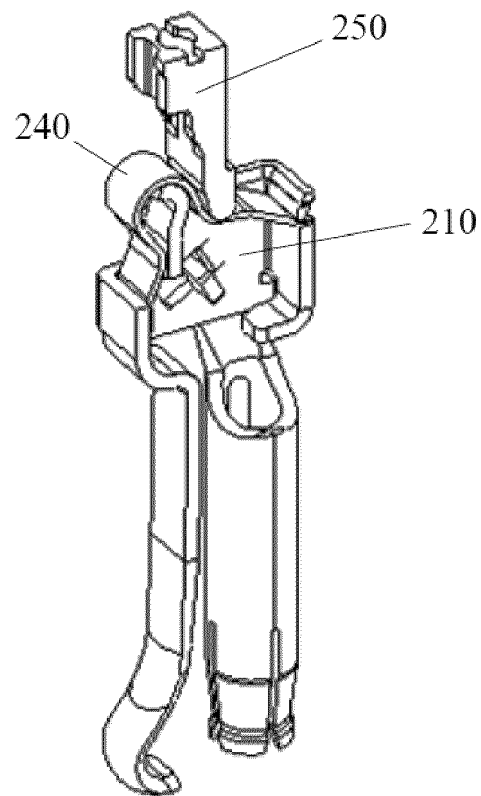


FIG.8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/114026

A. CLASSIFICATION OF SUBJECT MATTER

H01R 13/11(2006.01)i; H01R 13/40(2006.01)i

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)

CNABS; CNTXT; CNKI; SIPOABS; DWPI: 自短路, 连接器, 绝缘, 壳体, 端子, 插接, 连接臂, 弹性臂, 弹片, 边腿; self-shorti
ng, connector, insulate, casing, housing, terminal, pin, insert, connecting arm, elastic arm, leaf spring, side leg**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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E	CN 214068948 U (PHOENIX ASIAN-PACIFIC ELECTRIC (NANJING) CO., LTD.) 27 August 2021 (2021-08-27) claims 1-14, description paragraphs 49-66, figures 1-6	1-10, 13-17
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Y	CN 111200223 A (AVIC JONHON OPTRONIC TECHNOLOGY CO., LTD.) 26 May 2020 (2020-05-26) description, paragraphs 25-38, figures 1-4	3, 4
Y	CN 11129894 A (AVIC JONHON OPTRONIC TECHNOLOGY CO., LTD.) 08 May 2020 (2020-05-08) description, paragraphs 31-46, figures 1-5	3, 4
A	CN 2418594 Y (MOLEX INCORPORATED) 07 February 2001 (2001-02-07) entire document	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

16 November 2021

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Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing
100088, China

Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/114026

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5538434 A (WHITAKER CORP.) 23 July 1996 (1996-07-23) entire document	1-17

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/CN2021/114026

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