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(54) CONNECTOR SHELL HAVING PIN FIXING STRUCTURE

(57) A connector housing having a pin fixing structure. The connector housing defines a terminal channel for receiving a pin terminal and comprises the pin fixing structure for the pin terminal, wherein the pin fixing structure comprises: several flexible positioning elements distributed along the circumference of the terminal channel, wherein the flexible positioning elements are to be used for elastically snapping into the pin terminal; and several rigid positioning elements distributed along the circumference of the terminal channel, wherein the rigid positioning elements are to abut against the pin terminal within a first predetermined length along an axial direction of the terminal channel, so as to limit the swinging of the pin terminal.

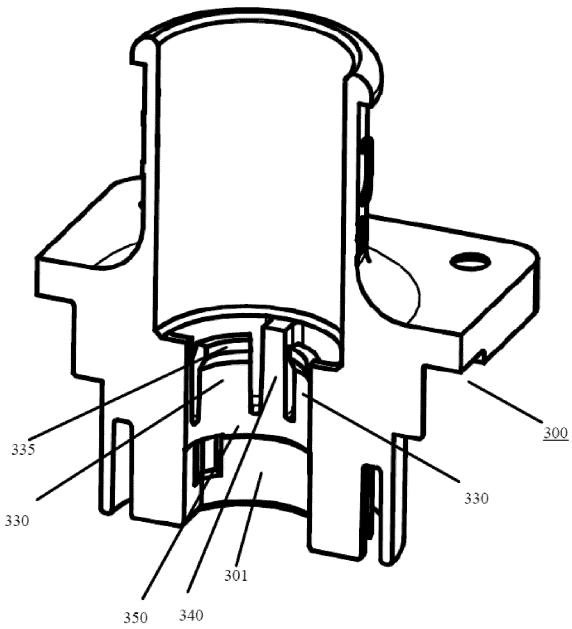

FIG. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to the field of electrical connection technology, and more specifically, to a connector housing with an improved pin fixing structure.

BACKGROUND

[0002] Electric connectors are widely used in various industrial fields, such as vehicle connectors in automotive electronic and electrical architecture, as well as energy storage connectors in photovoltaic power generation systems.

[0003] Electric connectors typically include a plastic outer housing and a terminal installed inside the housing. After the terminal is inserted into the housing, its front and rear ends are electrically connected to other conductors through appropriate wiring techniques (for example, the front end of the terminal is plugged into a mating terminal, and the rear end of the terminal is connected to a wire by means of crimping or bolting). Figure 1A shows a post-wiring state of a socket connector used to accommodate a pin terminal, where the pin terminal 110 is used to be inserted into a plastic housing of the socket connector 100 from the rear end of the connector, and then the front end of the socket connector 100 can be plugged together with a mating connector (not shown). Figure 1B shows the socket connector in Figure 1A from another perspective.

[0004] Figure 2 shows a type of pin terminal 110 that can be used in the application shown in Figure 1A. Referring to the external view of Figure 1A, the cross-sectional view of Figure 1D, and the pin terminal of Figure 2, the pin terminal 110 includes a front end 112 to be inserted into the socket connector 100, and a tail end 116 to be left outside the socket connector 100. The tail end 116 may be flat and provided with a threaded hole 118, which can be used to connect copper busbars or other conductors with threaded holes to the tail end of the pin terminal 110 through fastening elements such as bolts 120. The front end 112 of the pin terminal 110 can be divided into three sections, namely positioning boss 113, snap mounting section 114, and plug head section 115. The positioning boss 113 is used to mate with the housing structure of the socket connector 100 to provide a basic positioning. The snap mounting section 114 may be provided with an annular snap slot 1141 for mating with elastic latches described below in conjunction with Figure 1C. The cylindrical plug head section 115 is located at the end and is used to establish an electrical connection with a mating terminal in a mating connector.

[0005] Figure 1C shows a view of the front end (i.e. the end opposite to the insertion end of the pin terminal) of this socket connector 100. As shown in Figure 1C, in the cavity of socket connector 100 for accommodating the pin terminal 110, there are six elastic latches 130 evenly distributed along the circumference. Figure 1D shows a cross-sectional view of the socket connector along section A-A in Figure 1C, and Figure 1E shows an enlarged view of the area indicated by the box in Figure 1D. As shown in Figures 1D and 1E, the elastic latches 130 are a cantilever structure extending from an inner wall of the cavity of the socket connector 100. This cantilever generally extends axially, and its free end includes a snap protrusion 135 protruding radially inwardly. The snap protrusion 135 is used to snap into the snap slot structure 1141 on the pin terminal, thereby fixing the pin terminal 110.

[0006] As further shown in Figure 1E, the section where a physical connection occurs between the pin terminal 110 and the cavity of the socket connector 100 is divided into a rigid mating section 151 and an elastic mating section 152. The rigid mating section is defined by a depth of a terminal rear insertion hole at the tail end of socket connector 100, and the body of pin terminal 110 is in close contact with the inner wall of the terminal rear insertion hole throughout the entire thickness range. The elastic mating section 152 is the section where the body of the pin terminal 110 and the elastic latches 130 come into contact, and this section may be substantially defined by an axial extension length of the elastic latches 130. The length of the rigid mating section 151 plus the length of the elastic mating section 152 is the total mating length between the pin terminal and the connector housing. For example, if the length of the rigid mating section is 7.8 mm and the length of the elastic mating section is 6.3 mm, the total mating length is 14.1 mm.

[0007] In practical applications, a bolt 120 shown in Figure 1A is to be rotated by a torque tool to achieve wiring operations. However, during the use of the torque tool, the transmission of force applied by the tool may cause the pin terminal 110 to shake inside the housing, and the elastic latches 130 will deform with the shaking of the pin. After the deformation of the elastic latches 130, the interference between the latches and the pin will be reduced, thereby increasing the risk of pin detachment. In addition, the significant shaking of the pin terminal 110 during installation will affect the accuracy of the torque loaded, thereby affecting the reliability of the electrical connection.

[0008] Therefore, it is desirable to develop a connector housing with an improved pin fixing structure, thereby reducing the risk of failure caused by the shaking of the pin terminal inside the insertion hole.

Summary of the Invention

[0009] According to one aspect of the present invention, a connector housing is proposed, the connector housing defines a terminal channel for receiving a pin terminal and comprises a pin fixing structure for the pin terminal, wherein the pin fixing structure comprises: sev-

eral flexible positioning elements distributed along the circumference of the terminal channel, wherein the flexible positioning elements are to be used for elastically snapping into the pin terminal; and several rigid positioning elements distributed along the circumference of the terminal channel, wherein the rigid positioning elements are to abut against the pin terminal within a first predetermined length along an axial direction of the terminal channel, so as to limit the swinging of the pin terminal.

[0010] In further embodiments of the connector housing described above, in the axial direction of the terminal channel, the length of the flexible positioning element at least partially overlaps with the first predetermined length.

[0011] In further embodiments of the connector housing described above, the several flexible positioning elements are several elastic latches extending along the axial direction of the terminal channel, which are to be used for snapping into a snap slot structure that is located on the pin terminal for snap-mounting purpose.

[0012] In further embodiments of the connector housing described above, the several rigid positioning elements are several rigid ribs extending along the axial direction of the terminal channel.

[0013] In further embodiments of the connector housing described above, inner walls of the elastic latches and inner walls of the rigid ribs are co-circumferential.

[0014] In further embodiments of the connector housing described above, the terminal channel is provided with an annular step therein, wherein the annular step is to physically interfere with a positioning boss of the pin terminal to define an end of an insertion stroke of the pin terminal.

[0015] In further embodiments of the connector housing described above, the elastic latch is a cantilever structure that extends from the annular step and is provided with a radially inward protruding snap protrusion at its free end, wherein the snap protrusion is to snap into a snap slot structure on a plug terminal.

[0016] In further embodiments of the connector housing described above, the rigid ribs extend from the annular step and are to provide physical contact to the plug terminal at angular positions different from the elastic latches.

[0017] In further embodiments of the connector housing described above, the height of the rigid rib is greater than the height of the elastic latch.

[0018] In further embodiments of the connector housing described above, a curve length of the rigid rib around the axis of the terminal channel is smaller than a curve length of the elastic latch.

[0019] In further embodiments of the connector housing described above, a curve length of the rigid rib around the axis of the terminal channel is greater than a curve length of the elastic latch.

[0020] In further embodiments of the connector housing described above, the number of the rigid ribs and the number of the elastic latches are greater than or equal to three, respectively.

[0021] In further embodiments of the connector housing described above, the several elastic latches are evenly distributed along a circumferential direction, and the several rigid ribs are respectively disposed between adjacent elastic latches.

[0022] In further embodiments of the connector housing described above, the rigid ribs and the elastic latches are staggered one by one.

[0023] In further embodiments of the connector housing described above, at an insertion depth of the pin terminal, a position reached by an axial extension of the rigid rib exceeds a position where the elastic latch is snapping into the pin terminal.

[0024] In further embodiments of the connector housing described above, the connector housing is a socket connector housing.

[0025] According to one aspect of the present invention, a connector assembly is proposed, which comprises the connector housing described above and a pin terminal, wherein the pin terminal comprises a tail end for wiring and a front end for inserting into the connector housing, wherein the front end comprises a positioning boss, a snap mounting section, and a plug head section, wherein the snap mounting section has an annular snap slot for mating with elastic latches inside the connector housing, wherein when the pin terminal is inserted into the connector housing, the elastic latches inside the connector housing are snapped into the snap slot on the snap mounting section of the front end of the pin terminal to achieve positioning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In order to further clarify various embodiments of the present invention, reference will be made to the accompanying drawings to present a more specific description of various embodiments of the present invention. It should be understood that these drawings only depict typical embodiments of the present invention and will therefore not be considered a limitation on the protection scope of the present invention.

[0027] In addition, it should be understood that shown in the accompanying drawings are main connection relationships, rather than all connection relationships, of each component, and the components and connections in the drawings may not be drawn to actual scales.

Figure 1A shows the post-wiring state of a type of socket connector for accommodating a pin terminal as the background technology of the present invention.

Figure 1B shows another perspective view of the connector of Figure 1A.

Figure 1C shows a view of a front end of the socket connector in Figure 1A.

Figure 1D shows a longitudinal sectional view of the socket connector in Figure 1A.

Figure 1E shows a partial enlarged view of the longitudinal section of Figure 1D.

Figure 2 shows a pin terminal that can be used in the application of Figure 1A.

Figure 3 shows a longitudinal sectional view of a connector housing with a pin fixing structure according to embodiments of the present invention.

Figure 4 shows the front view of the connector housing shown in Figure 3, with specific markings for an elastic latch.

Figure 5 shows a longitudinal sectional view of the connector housing according to embodiments of the present invention after inserting the pin terminal.

DETAILED DESCRIPTION

[0028] The detailed description below is based on the accompanying drawings. The accompanying drawings illustrate, by way of example, specific embodiments of the claimed subject matter that can be practiced. It should be understood that the following specific embodiments are intended for illustrative purposes to provide specific descriptions of typical examples, but should not be construed as limitations of the present invention. Those skilled in the art may make appropriate modifications and adjustments to the disclosed embodiments without departing from the spirit and scope of the claimed subject matter of the present invention, provided that they fully understand the spirit and object of the present invention.

[0029] In the following detailed description, numerous specific details are elaborated to provide a thorough understanding of each described embodiment. However, it will be apparent to those skilled in the art that the various embodiments described can be practiced without these specific details. Unless otherwise defined, the technical and scientific terms used herein shall have the same meanings as those commonly understood by those skilled in the art to which this disclosure relates.

[0030] The terms "first", "second", etc. in the specification and claims of this application do not imply any order, quantity, or importance, but are only used to distinguish different components or features. An embodiment is an exemplary implementation or example. The references to "embodiments", "one embodiment", "some embodiments", "various embodiments", or "other embodiments" in the specification imply that specific features, constructions, or characteristics described in conjunction with the embodiments are included in at least some embodiments, but not necessarily all embodiments, of the present technology. The various appearances of "embodiments", "one embodiment", "some embodiments" do not necessarily refer to the same embodiment. Elements or aspects from one embodiment may be combined with elements or aspects from another embodiment.

[0031] The present invention will be further explained in conjunction with the accompanying drawings.

[0032] Firstly, referring to Figures 3-5, the first embodiment of the present invention will be described. As shown in Figure 3, a socket connector housing 300 includes a cavity which is open at two ends for accommodating a pin terminal, such as the pin terminal 110 shown in Figure 2. The pin terminal 110 can be inserted from a tail end of the socket connector housing 300, and its plug head section 115 can pass through a terminal channel 301. The terminal channel 301 is provided with an annular step 350 therein, which is used to physically interfere with the positioning boss 113 of the pin terminal to define an end of an insertion stroke of the pin terminal 110. Four elastic latches 330 are distributed along the circumference of the terminal channel 301 and extend inwardly in an axial direction from the annular step 350, for mating with the snap mounting section 114 on the pin terminal 110. In addition to the elastic latches 330, there are also rigid ribs 340 disposed between adjacent elastic latches. The rigid ribs 340 also extend inwardly in the axial direction from the annular step 350, for providing physical contact and positioning with a plug terminal. Along the axial direction of terminal channel 301, the height of the rigid rib 340 is greater than the height of the elastic latch 330.

[0033] Figure 4 shows a view of the front end (i.e., the side opposite to the tail end of the inserted pin) of the socket connector housing 300 shown in Figure 3. Through this view, the distribution of the elastic latches 330 and the rigid ribs 340 along the circumferential direction of the terminal channel 301 can be seen. Each elastic latch 330 is spaced 90 degrees apart from an adjacent elastic latch, and each rigid rib 340 is spaced 90 degrees apart from adjacent rigid rib. As shown in Figure 3, the elastic latch 330 has a cantilever structure that extends generally in an axial direction, and a radially inward protruding snap protrusion 335 is provided at a free end of the elastic latch. The snap protrusion 335 is used to snap into the snap slot structure on the pin terminal 110, thereby fixing the pin terminal. Based on Figure 3, an inner wall of the elastic latch 330 (excluding the snap protrusion part at its end) and an inner wall of the rigid rib 340 are co-circumferential, that is, their radial distances to the axis of the terminal channel 301 are equal.

[0034] Further combining with Figure 5, by providing a pin fixing structure as shown in Figures 3 and 4 inside the socket connector housing 300, when inserting the pin terminal 110 as shown in Figure 2 into the socket connector housing 300, the snap protrusions 335 of the four elastic latches 330 snap into the snap slot structure 1141 of the snap mounting section 114 on the pin terminal 110, and at the same time, the inner walls of the rigid ribs 340 are also physically abutting with the pin terminal 110, thereby increasing a rigid fitting length between the pin terminal 110 and the socket connector housing 300.

[0035] Compared to the situation shown in Figure 1D, the rigid fitting length is, based on a depth of a terminal rear insertion hole, further extended to the end of the rigid rib 340. For example, compared to the 7.8 mm rigid fitting length for existing product shown in Figure 1E (D1 in

Figure 5), the design in Figures 3 and 4 increases the rigid fitting length of the pin terminal to 14.9 mm (D2 in Figure 5) without changing the design of other fitting parts and the outer contour dimensions of the socket. Due to the fact that the length of the elastic latch 330 partially overlaps with the rigid fitting length D2 in the axial direction of the terminal channel 301, the rigid fitting and flexible fitting are combined and applied to the front end of the pin terminal 110. With this method, the shaking of the pin terminal can be suppressed, which can be reflected as a reduced maximum deflection angle between the pin terminal 110 and the socket connector housing 300 while there is no change to a fitting clearance between the pin terminal and the housing.

[0036] In an optional embodiment, the rigid rib 340 may exceed the elastic latch 330 in height, thus further preventing or suppressing deformation of the elastic latch during installation on the client side, thereby reducing the risk of pin detachment caused by deformation of the elastic latch.

[0037] In the above embodiments, the details regarding the plug terminal and rigid ribs are only provided as examples. As a feasible variation, in the insertion depth of the pin terminal, it is acceptable as long as the position reached by the axial extension of the rigid rib exceeds the position where the elastic latch is snapping into the pin terminal.

[0038] In the above embodiments, "rigid rib" or "rib" is to be understood that a rib structure is different from a cantilever structure of the elastic latch, such that it does not have physical properties that are prone to elastic deformation like the elastic latch. Therefore, the "rigidity" of the rib should be widely understood as various structural rigidity stronger than the cantilever structure, rather than absolute rigidity.

[0039] In the above embodiment, the pin terminal 110 as shown in Figure 2 is used, and the socket connector housing 300 with four elastic latches 330 and four rigid ribs 340 as shown in Figure 4 is used. It can be understood that the pin terminal is not limited to the structure shown in Figure 2, but can adopt any terminal with a snap mounting section that matches with the elastic latches. It can also be understood that the pin fixing structure of the socket connector housing is not limited to four elastic latches and four rigid ribs, but can be any complex number of elastic latches and rigid ribs, such as two elastic latches and two rigid ribs. In some variations, the number of the elastic latches and rigid ribs may not be the same, for example, four elastic latches and two rigid ribs. Furthermore, the connector housing is not limited to socket connector housing, but can be any suitable type of connector housing used to accommodate a pin terminal (thus requiring a terminal stability structure).

[0040] In the above embodiments, the use of elastic latches is only a specific example of the present invention. It can be understood that several elastic latches can be reasonably generalized to be several flexible positioning elements distributed along the circumference of the terminal channel, which are used for elastically snapping into the pin terminal. Similarly, the use of rigid ribs is only a specific example of the present invention. It can be understood that several rigid ribs can be reasonably generalized to be several rigid positioning elements distributed along the circumference of the terminal channel, which are used to abut against the pin terminal within a first predetermined length in the axial direction of the terminal channel. In the axial direction of the terminal channel, the length of the flexible positioning element at least partially overlaps with the first predetermined length, such that the rigid fitting and flexible fitting are combined and applied to the front end of the pin terminal. Through this approach, it is possible to better suppress the shaking of the pin terminal and reduce the maximum deflection angle between the pin terminal and the housing. Furthermore, by setting the position where the pin terminal and the flexible positioning element are engaged to be within the first predetermined length, the rigid positioning element further effectively limits the swinging of the pin terminal.

[0041] The basic concept of the present invention has been described above. Obviously, for those skilled in the art, the above disclosure is only an example and does not constitute a limitation on the present application. Although not expressly stated herein, those skilled in the art may make various modifications, improvements, and amendments to this application. Such modifications, improvements, and amendments are suggested in this application, so such modifications, improvements, and amendments remain within the spirit and scope of the embodiments of this application.

Claims

1. A connector housing, said connector housing defines a terminal channel for receiving a pin terminal and comprises a pin fixing structure for the pin terminal, **characterized in that**, the pin fixing structure comprises:

   several flexible positioning elements distributed along the circumference of the terminal channel, wherein the flexible positioning elements are to be used for elastically snapping into the pin terminal; and

   several rigid positioning elements distributed along the circumference of the terminal channel, wherein the rigid positioning elements are to abut against the pin terminal within a first predetermined length along an axial direction of the terminal channel, so as to limit the swinging of the pin terminal.

2. The connector housing of claim 1, wherein, in the axial direction of the terminal channel, the length of the flexible positioning element at least partially over-

laps with the first predetermined length.

3. The connector housing of claim 2, wherein the several flexible positioning elements are several elastic latches extending along the axial direction of the terminal channel, which are to be used for snapping into a snap slot structure that is located on the pin terminal for snap-mounting purpose.

4. The connector housing of claim 3, wherein the several rigid positioning elements are several rigid ribs extending along the axial direction of the terminal channel.

5. The connector housing of claim 4, wherein inner walls of the elastic latches and inner walls of the rigid ribs are co-circumferential.

6. The connector housing of claim 4, wherein the terminal channel is provided with an annular step therein, wherein the annular step is to physically interfere with a positioning boss of the pin terminal to define an end of an insertion stroke of the pin terminal.

7. The connector housing of claim 6, wherein the elastic latch is a cantilever structure that extends from the annular step and is provided with a radially inward protruding snap protrusion at its free end, wherein the snap protrusion is to snap into a snap slot structure on a plug terminal.

8. The connector housing of claim 7, wherein the rigid ribs extend from the annular step and are to provide physical contact to the plug terminal at angular positions different from the elastic latches.

9. The connector housing of claim 8, wherein the height of the rigid rib is greater than the height of the elastic latch.

10. The connector housing of claim 9, wherein a curve length of the rigid rib around the axis of the terminal channel is smaller than a curve length of the elastic latch.

11. The connector housing of claim 9, wherein a curve length of the rigid rib around the axis of the terminal channel is greater than a curve length of the elastic latch.

12. The connector housing of claim 1, wherein the number of the rigid ribs and the number of the elastic latches are greater than or equal to three, respectively.

13. The connector housing of claim 4, wherein the several elastic latches are evenly distributed along a circumferential direction, and the several rigid ribs are respectively disposed between adjacent elastic latches.

14. The connector housing of claim 4, wherein the rigid ribs and the elastic latches are staggered one by one.

15. The connector housing of claim 4, wherein at an insertion depth of the pin terminal, a position reached by an axial extension of the rigid rib exceeds a position where the elastic latch is snapping into the pin terminal.

16. The connector housing of claim 1, wherein the connector housing is a socket connector housing.

17. A connector assembly comprising:

the connector housing of any one of claims 1-16; and

a pin terminal comprising a tail end for wiring and a front end for inserting into the connector housing, wherein the front end comprises a positioning boss, a snap mounting section, and a plug head section, wherein the snap mounting section has an annular snap slot for mating with elastic latches inside the connector housing,

wherein when the pin terminal is inserted into the connector housing, the elastic latches inside the connector housing are snapped into the snap slot on the snap mounting section of the front end of the pin terminal to achieve positioning.

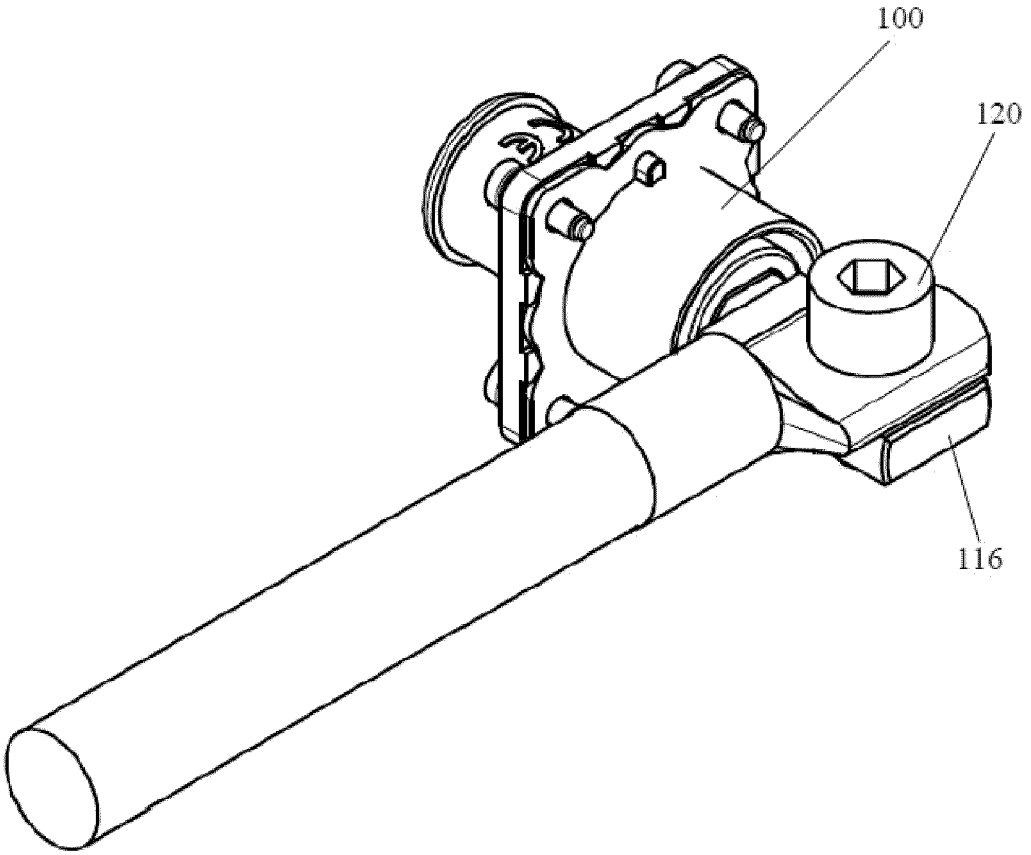

FIG. 1A

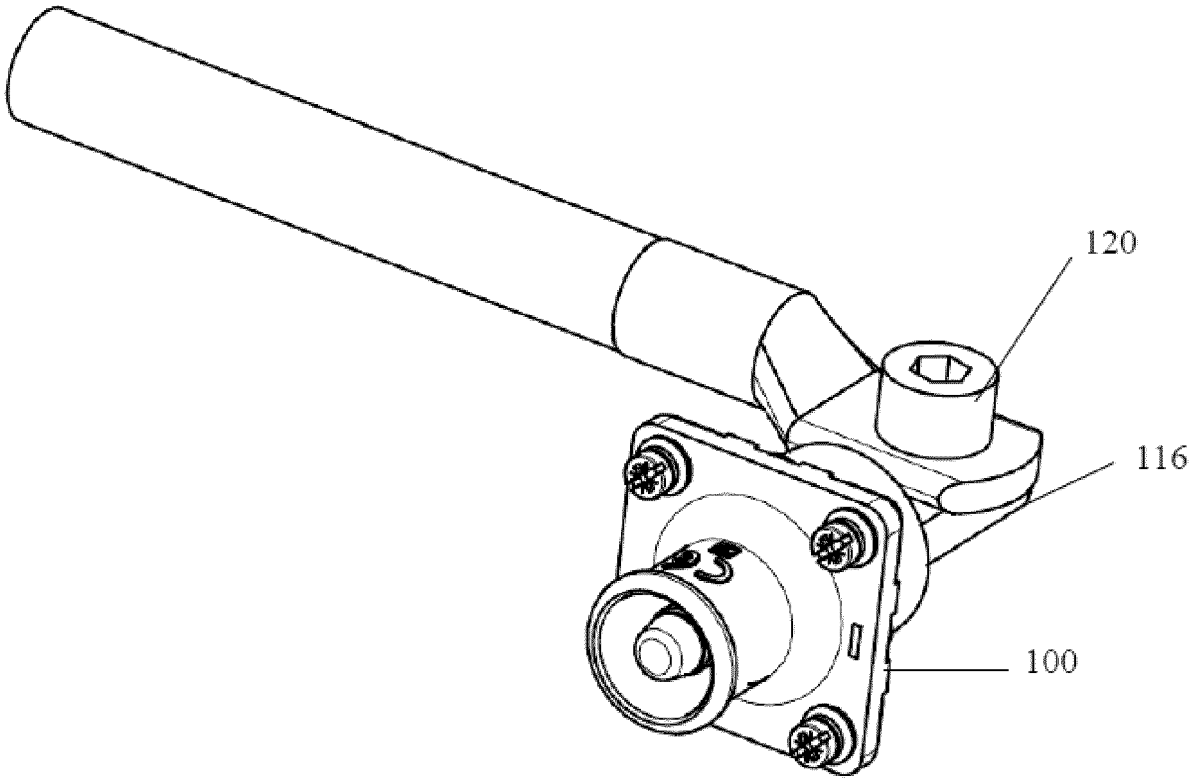

FIG. 1B

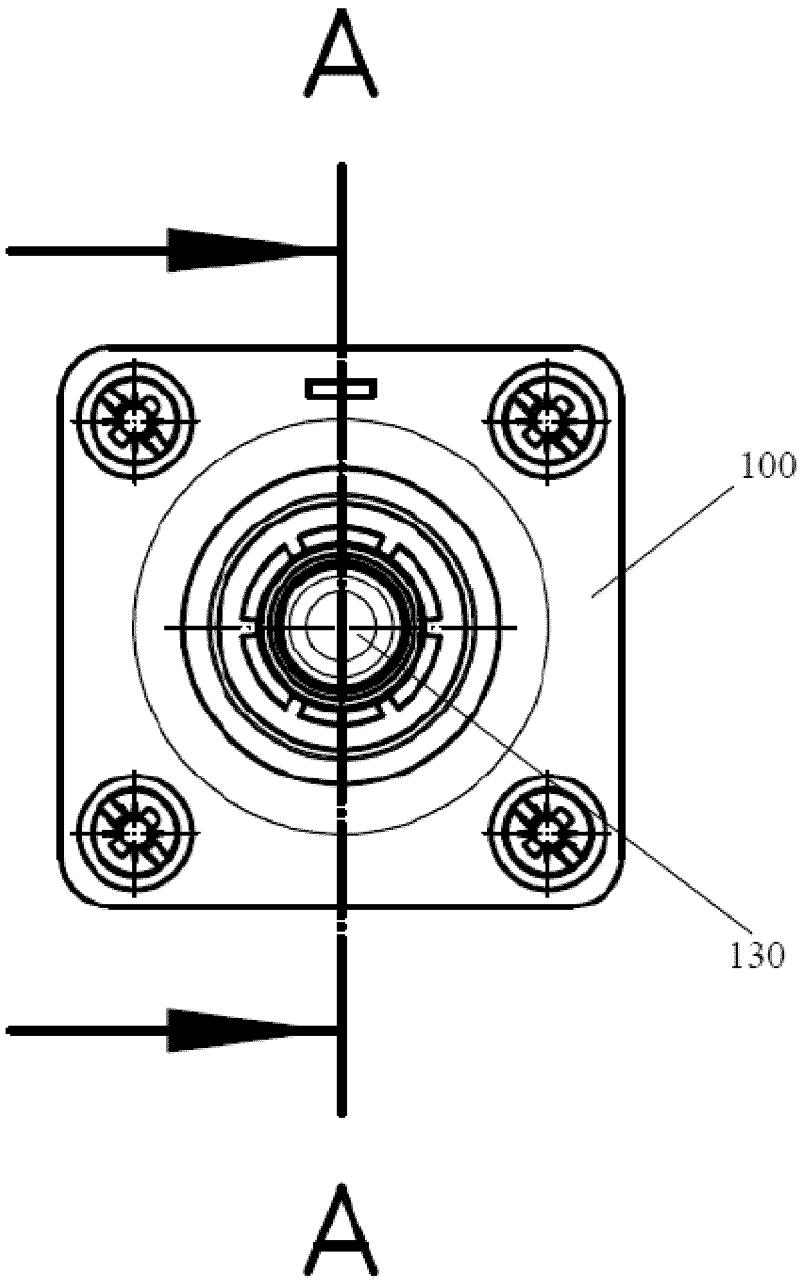

FIG. 1C

A–A

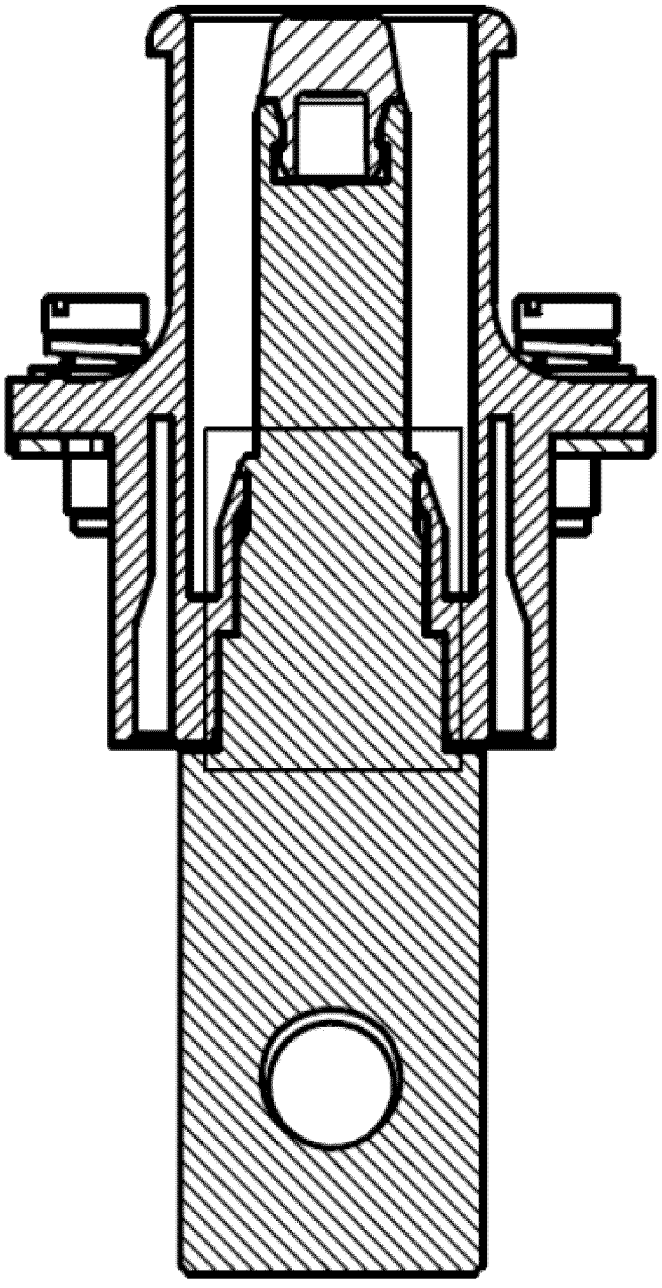

FIG. 1D

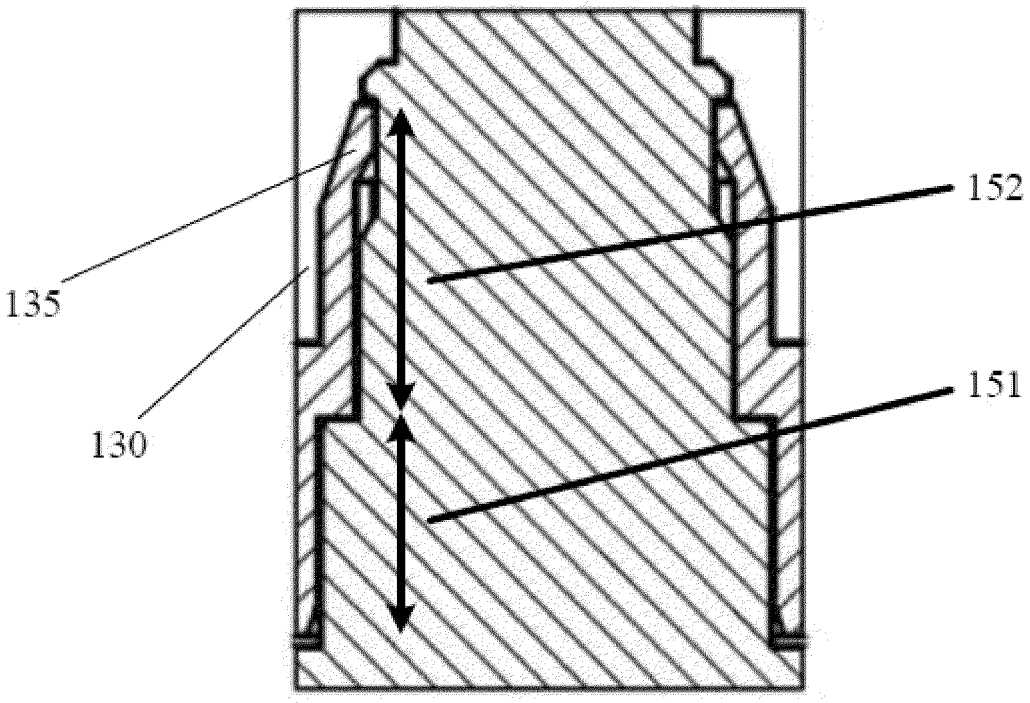

FIG. 1E

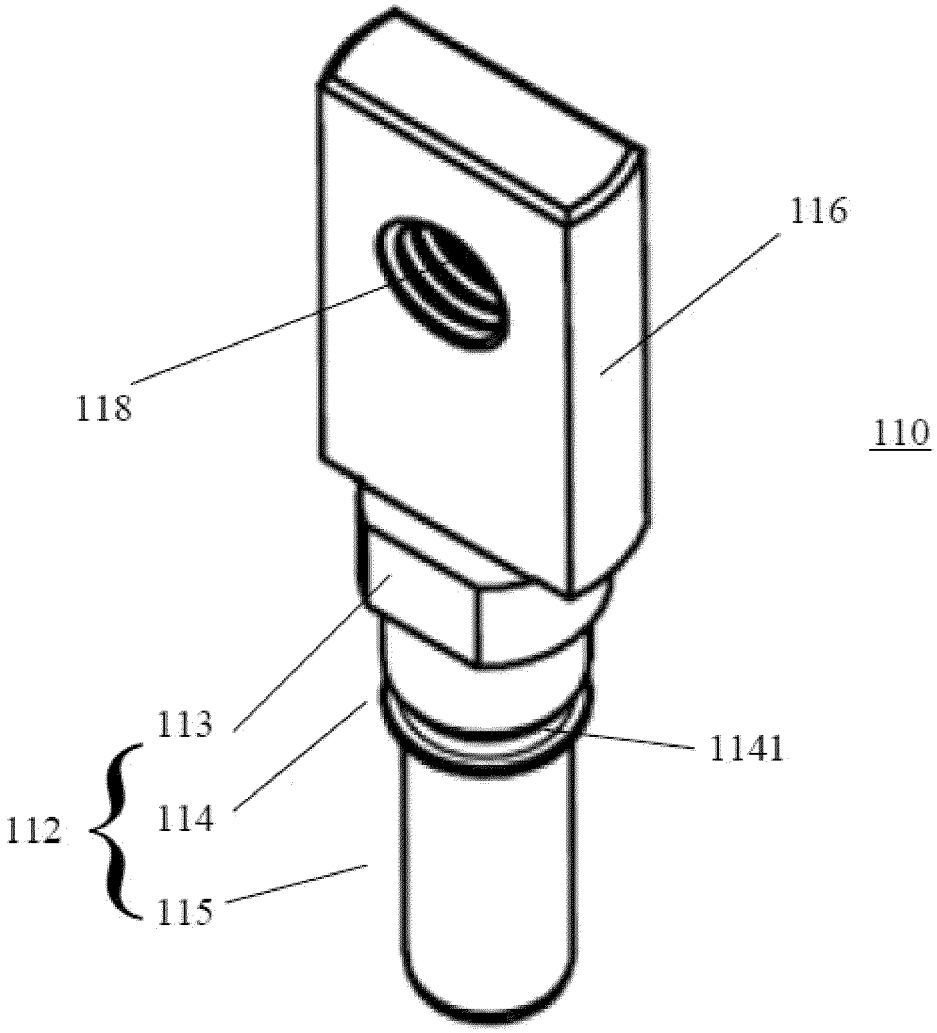

FIG. 2

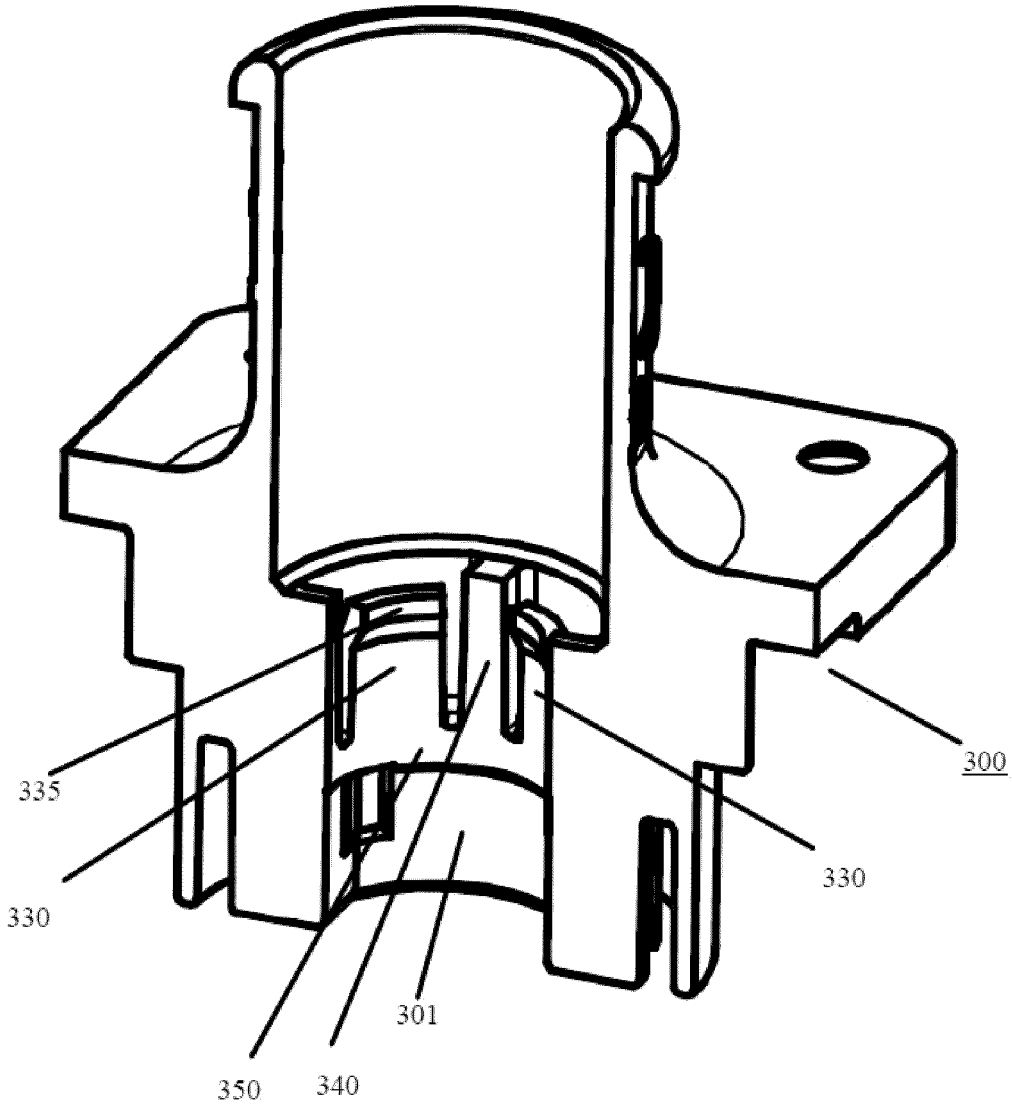

FIG. 3

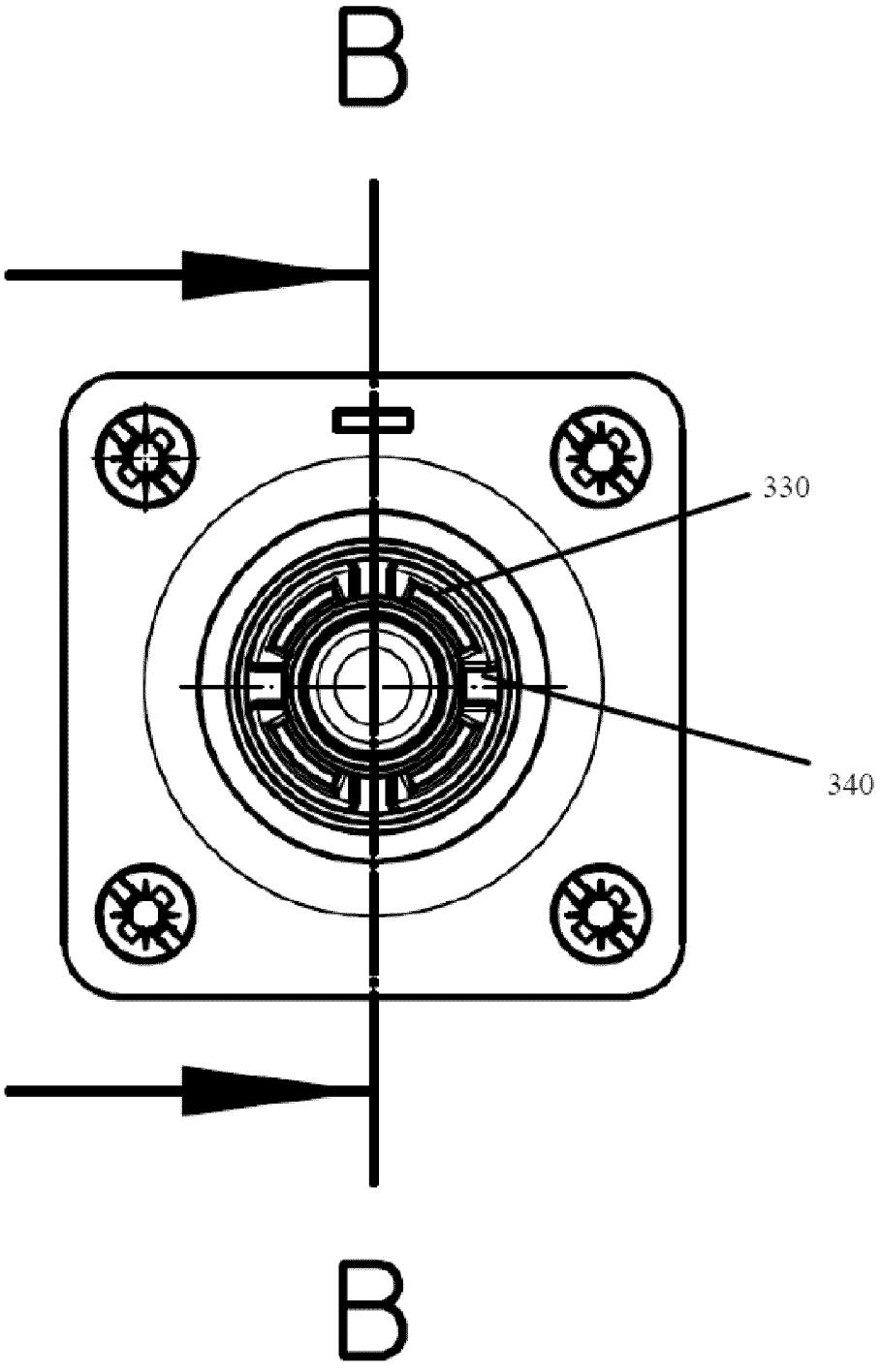

FIG. 4

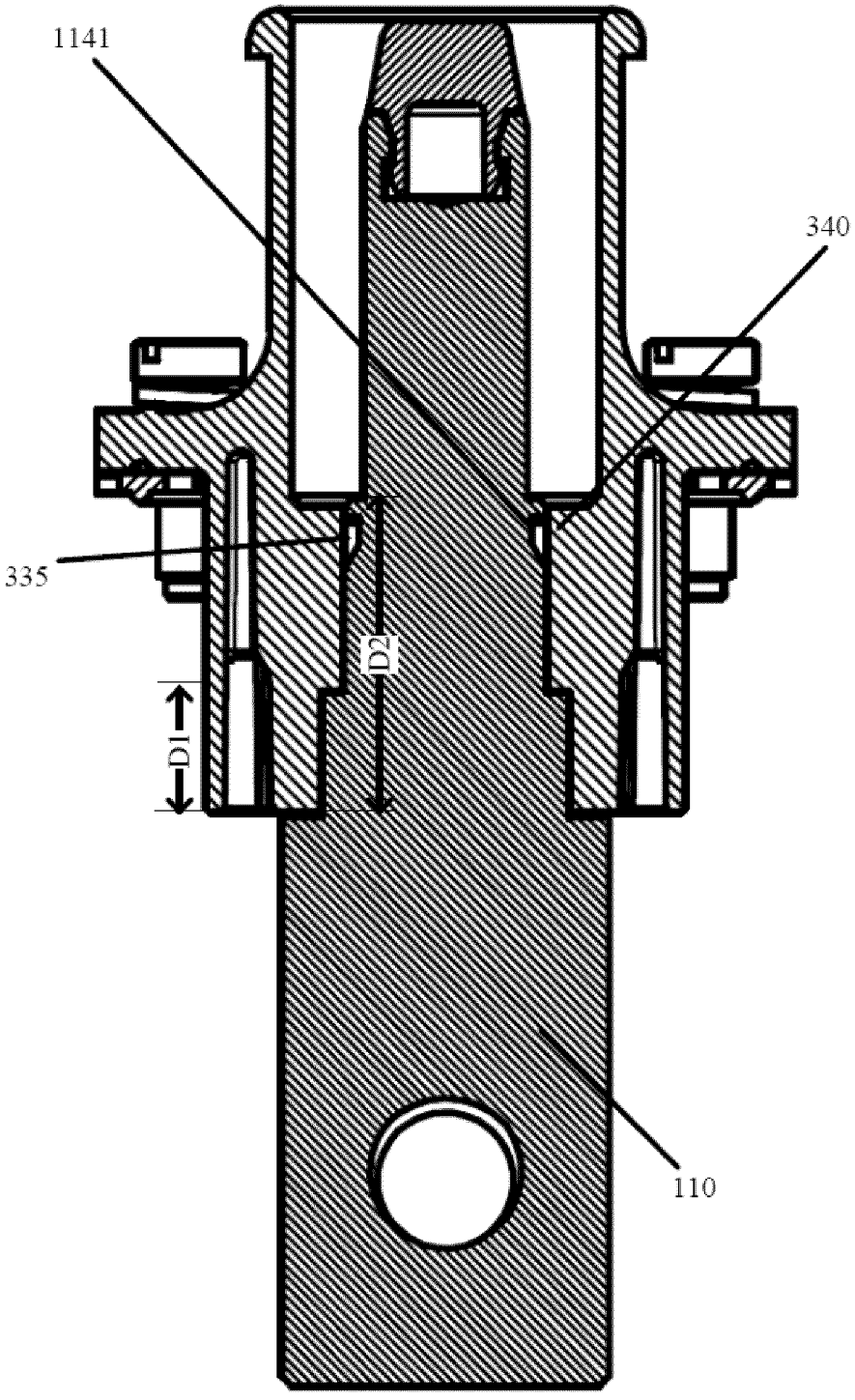

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/081565

A. CLASSIFICATION OF SUBJECT MATTER

H01R13/40(2006.01)i; H01R13/02(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)

IPC: 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)

CNTXT, CNABS, VEN, ENTXTC, CNKI, IEEE: 菲尼克斯亚太电气 (南京) 有限公司, 王睿, 车敏, 连接器, 插座, 壳, 弹, 卡扣, 弹指, 弹片, 棘爪, 筋, 凸起, 突起, 凸条, 突条, 突筋, 凸筋, 端子, connector, socket, elastic+, detent, bar, rib, bead, protrusion, housing, shell, casing, terminal+, spring 1W finger, elastic+ S plate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114628936 A (PHOENIX ASIAN-PACIFIC ELECTRIC (NANJING) CO., LTD.) 14 June 2022 (2022-06-14) claims 1-17, description, paragraphs 41-49, and figures 1A-5	1-17
X	CN 212908192 U (JIANGXI BASIBA NEW ENERGY TECHNOLOGY CO., LTD.) 06 April 2021 (2021-04-06) description, paragraphs 65-92, and figures 1-20	1-17
A	CN 109742582 A (SHENZHEN BUSBAR SCI-TECH DEVELOPMENT CO., LTD.) 10 May 2019 (2019-05-10) entire document	1-17
A	CN 206340736 U (CHANGZHOU NUODE ELECTRONICS CO., LTD.) 18 July 2017 (2017-07-18) entire document	1-17
A	CN 209029569 U (SHENZHEN BUSBAR SCI-TECH DEVELOPMENT CO., LTD.) 25 June 2019 (2019-06-25) entire document	1-17

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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	Date of mailing of the international search report
08 June 2023	**16 June 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/081565

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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