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[Continued on next page]

(54) Title: FEMALE TERMINAL AND ELECTRICAL CONNECTOR

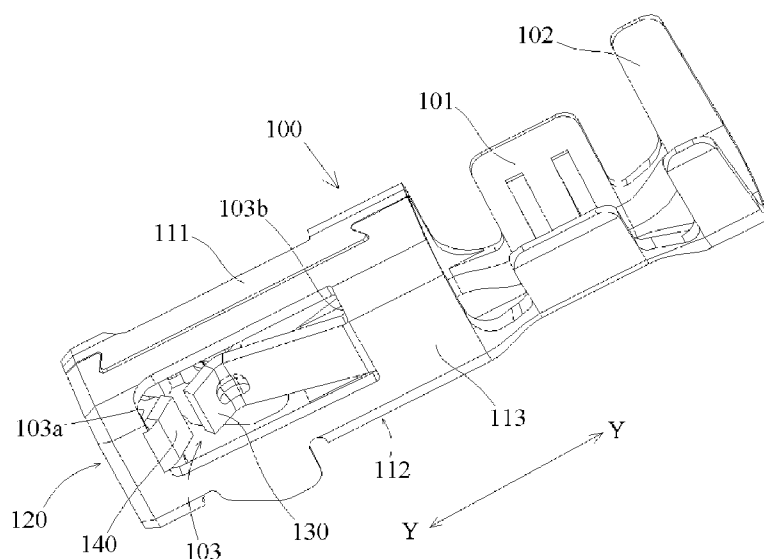


Fig.3

(57) Abstract: The present invention discloses a female terminal, comprising: an insertion slot, defined by a top wall, a bottom wall and a pair of sidewalls, extending in a longitudinal direction of the female terminal; and a pair of cantilever type electrical contact spring pieces, formed on the pair of sidewalls, respectively, each obliquely extending from a rear edge of an opening formed in the respective sidewall toward front and inside of the insertion slot, so as to electrically contact a male terminal inserted into the insertion slot, wherein the female terminal further comprises a pair of cantilever type guide spring pieces each obliquely extending from a front edge of the opening formed in the respective sidewall toward rear and inside of the insertion slot, to guide the male terminal to be inserted between the pair of electrical contact spring pieces. The male terminal maybe correctly and smoothly inserted into a gap between the pair of electrical contact spring pieces under the guidance of the pair of guide spring pieces, and the electrical contact spring pieces cannot be collapsed by the male terminal. Furthermore, the pair of guide

spring pieces is formed by parts of the pair of sidewalls, reducing the material for manufacturing the female terminal, saving the cost.



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FEMALE TERMINAL AND ELECTRICAL CONNECTOR

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No. CN201420371706.4 filed on July 7, 2014 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a female terminal and an electrical connector comprising the female terminal.

Description of the Related Art

Fig.1a is an illustrative perspective view of a female terminal in the prior art; and Fig.1b is a cross section view of the female terminal of Fig.1a.

As shown in Fig.1a and Fig.1b, the female terminal 10 comprises an insertion slot 12, defined by four walls, in the front thereof, and a pair of cantilever type electrical contact spring pieces 13 formed in a pair of sidewalls 11 of the insertion slot 12. The pair of cantilever type electrical contact spring pieces 13 is configured to electrically contact a male terminal inserted into the insertion slot 12 of the female terminal 10.

During inserting the male terminal into the insertion slot 12 of the female terminal of Fig.1a and Fig.1b, in order to ensure that the male terminal is smoothly inserted, the male terminal should be inserted in a posture parallel to a longitudinal direction of the female terminal 10.

However, as shown in Fig.1b, in the actual operation process, due to negligence, an operator often inserts the male terminal 20 in a posture oblique to the longitudinal direction of the female terminal 10. In this case, as shown in Fig.1b, the tip end of the male terminal 20 may directly push against the end of one of the electrical contact spring pieces 13, and cannot be inserted into a gap between the pair of electrical contact spring pieces 13, 13. As a result, the electrical contact spring piece 13 of the female terminal 10 may be collapsed and failed by the male terminal 20.

In order to solve the above technical problem of the female terminal 10 of Fig.1a and Fig.1b in the prior art, there is provided a female terminal with guide spring pieces, for

example, as shown in Fig.2a and Fig.2b.

Referring to Fig.2a and Fig.2b, a pair of guide spring pieces 14', 14' are formed on a pair of opposite side edges of a front port of the insertion slot 12' of the female terminal 10'. Each of the guide spring pieces 14', 14' is bent toward inside of the insertion slot 12' from the side edge of the front port of the insertion slot 12', and obliquely extending toward rear of the insertion slot 12'. A pair of cantilever type electrical contact spring pieces 13', 13' are formed on a pair of sidewalls 11', 11' and obliquely extend toward front and inside of the insertion slot 12'.

As shown in Fig.2b, during inserting a male terminal 20' into the insertion slot 12' of the female terminal 10', a tip end of the male terminal 20' is guided by the pair of guide spring pieces 14', 14' and smoothly inserted into a gap between the pair of cantilever type electrical contact spring pieces 13', 13', and electrically contacts electrical contact portions of the pair of cantilever type electrical contact spring pieces 13', 13'.

In the female terminal 10' shown in Fig.2a and Fig.2b, even if the male terminal 20' is inserted into the insertion slot 12' of the female terminal 10' in a posture oblique to the longitudinal direction of the female terminal 10', the pair of guide spring pieces 14', 14' may guide the oblique male terminal 20' to the correct posture parallel to the longitudinal direction of the female terminal 10', so that the male terminal 20' is smoothly inserted into the gap between the pair of cantilever type electrical contact spring pieces 13', 13', and it protects the female terminal 10' from being collapsed and failed by the male terminal 20'.

However, in the female terminal 10' shown in Fig.2a and Fig.2b, the guide spring pieces 14', 14' are formed by additional tongues extending from the side edges of the front port of the insertion slot 12' of the female terminal 10', increasing the amount of material to manufacture the female terminal 10'. Furthermore, in the female terminal 10' shown in Fig.2a and Fig.2b, the width of the guide spring pieces 14', 14' is far larger than the width of the electrical contact spring pieces 13', 13', further increasing the amount of material to manufacture the female terminal 10'.

SUMMARY OF THE INVENTION

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

It would be advantageous to provide a female terminal with a guide structure configured to correctly guide a male terminal into a gap between a pair of electrical contact spring pieces of the female terminal.

It would also be advantageous to provide a female terminal manufactured by less material.

According to an aspect of the present invention, there is provided a female terminal,

comprising: an insertion slot, defined by a top wall, a bottom wall and a pair of sidewalls, extending in a longitudinal direction of the female terminal; and a pair of cantilever type electrical contact spring pieces, formed on the pair of sidewalls, respectively, each obliquely extending from a rear edge of an opening formed in the respective sidewall toward front and inside of the insertion slot, so as to electrically contact a male terminal inserted into the insertion slot, wherein the female terminal further comprises a pair of cantilever type guide spring pieces each obliquely extending from a front edge of the opening formed in the respective sidewall toward rear and inside of the insertion slot, to guide the male terminal to be inserted between the pair of electrical contact spring pieces.

According to an exemplary embodiment of the present invention, a distance between tips of free ends of the pair of guide spring pieces inside the insertion slot is less than a distance between tips of free ends of the pair of electrical contact spring pieces inside the insertion slot.

According to another exemplary embodiment of the present invention, the distance between the tips of free ends of the pair of guide spring pieces is larger than a distance between electrical contact portions of the pair of electrical contact spring pieces.

According to another exemplary embodiment of the present invention, the electrical contact spring piece has a width substantially equal to a width of the guide spring piece.

According to another exemplary embodiment of the present invention, the female terminal is formed by a single sheet of thin plate.

According to another exemplary embodiment of the present invention, when the female terminal is expanded into a single sheet of thin plate, the electrical contact spring piece and the guide spring piece on the same one sidewall are aligned with each other in the longitudinal direction of the female terminal and located in the opening in the sidewall.

According to another exemplary embodiment of the present invention, when the female terminal is expanded into a single sheet of thin plate, a length of the guide spring piece in the longitudinal direction is equal to 10%-35% of a length of the electrical contact spring piece in the longitudinal direction.

According to another exemplary embodiment of the present invention, the female terminal further comprising: a pair of first side wings formed at rear of the insertion slot and configured to be crimped on a conductor of a cable, so as to electrically connect the conductor of the cable.

According to another exemplary embodiment of the present invention, the female terminal further comprising: a pair of second side wings formed at rear of the pair of first side wings and configured to be crimped on an outer sheath of the cable, so that a pulling force exerted on the cable is transferred to the female terminal through the outer sheath of the cable, instead of being transferred to the conductor of the cable, so as to prevent the conductor of the cable from being pulled off.

According to another aspect of the present invention, there is provided an electrical connector, comprising: an insulation housing; and the above female terminal received in the insulation housing.

In the above various exemplary embodiments of the present invention, since the male terminal comprises a pair of guide spring pieces, the male terminal may be correctly and smoothly inserted into a gap between the pair of electrical contact spring pieces under the guidance of the pair of guide spring pieces. Thereby, even if the male terminal is inserted in a posture oblique to the longitudinal direction of the female terminal, the pair of guide spring pieces may guide the oblique male terminal to the correct posture parallel to the longitudinal direction of the female terminal, and the electrical contact spring pieces of the female terminal cannot be collapsed by the male terminal.

Furthermore, the pair of guide spring pieces is formed by parts of the pair of sidewalls of the insertion slot, instead of a pair of additional tongues protruding from the most front end of the pair of sidewalls. Thereby, it reduces the material for manufacturing the female terminal, saving the cost.

BRIEF DESCRIPTION OF THE DRAWINGS

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. 1a is an illustrative perspective view of a female terminal in the prior art;

Fig. 1b is a cross section view of the female terminal of Fig. 1a;

Fig. 2a is an illustrative perspective view of another female terminal in the prior art;

Fig. 2b is a cross section view of the female terminal of Fig. 2a;

Fig. 3 is an illustrative perspective view of a female terminal according to an exemplary embodiment of the present invention;

Fig. 4 is a cross section view of the female terminal of Fig. 3;

Fig. 5 is an illustrative cross section view of the female terminal after a mating male terminal is inserted into an insertion slot of the female terminal of Fig. 3; and

Fig. 6 is an illustrative view of expanding the female terminal of Fig. 3 into a single sheet of thin plate.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

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

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.

According to a general concept of the present invention, there is provided a female terminal, comprising: an insertion slot, defined by a top wall, a bottom wall and a pair of sidewalls, extending in a longitudinal direction of the female terminal; and a pair of cantilever type electrical contact spring pieces, formed on the pair of sidewalls, respectively, each obliquely extending from a rear edge of an opening formed in the respective sidewall toward front and inside of the insertion slot, so as to electrically contact a male terminal inserted into the insertion slot, wherein the female terminal further comprises a pair of cantilever type guide spring pieces each obliquely extending from a front edge of the opening formed in the respective sidewall toward rear and inside of the insertion slot, so as to guide the male terminal to be inserted between the pair of electrical contact spring pieces.

Fig.3 is an illustrative perspective view of a female terminal 100 according to an exemplary embodiment of the present invention.

As shown in Fig.3, in the illustrated embodiment, the female terminal 100 mainly comprises an insertion slot 120, a pair of cantilever type electrical contact spring pieces 130, 130, a pair of cantilever type guide spring pieces 140, 140, a pair of first side wings 101 and a pair of second side wings 102.

In an embodiment of the present invention, as shown in Fig.3, the insertion slot 120 is defined by a top wall 111, a bottom wall 112 and a pair of sidewalls 113, 113. The insertion slot 120 is formed to extend in a longitudinal direction Y of the female terminal 100.

As shown in Fig.3, the cantilever type electrical contact spring pieces 130, 130 is arranged to face with the cantilever type guide spring pieces 140, 140, respectively. An opening 103 is formed in each of the sidewalls 113. One of the cantilever type electrical contact spring pieces 130, 130 and one corresponding cantilever type guide spring pieces 140, 140 extend toward each other from a rear edge 103b and a front edge 103a of the opening 103, respectively.

Fig.4 is a cross section view of the female terminal 100 of Fig.3.

As shown in Figs.3 and 4, in the illustrated embodiment, a rear end (right end in Fig. 4) of each of the cantilever type electrical contact spring pieces 130 is connected to the rear edge 103b of the opening 103, and the cantilever type electrical contact spring piece 130 obliquely extends from a rear edge 103b of an opening 103 toward front (left side of Fig.4)

and inside of the insertion slot 120, so as to electrically contact a male terminal 200 (see Fig.5) inserted into the insertion slot 120.

Please referring to Figs.3 and 4 again, in the illustrated embodiment, a front end (left end in Fig. 4) of each of the cantilever type guide spring pieces 140, 140 is connected to the front edge 103a of the opening 103. Each of the cantilever type guide spring pieces 140, 140 obliquely extends from a front edge 103a of the opening 103 toward rear (right side of Fig.4) and inside of the insertion slot 120, so as to guide the male terminal 200 (see Fig.5) to be inserted into a gap between the pair of electrical contact spring pieces 130, 130.

In an embodiment of the present invention, as shown in Fig.3, the pair of first side wings 101 are formed at rear of the insertion slot 120 and configured to be crimped on a conductor of a cable (not shown), so as to electrically connect the conductor of the cable.

Referring to Fig.3 again, in an embodiment, the pair of second side wings 102 are formed at rear of the pair of first side wings 101 and configured to be crimped on an outer sheath of the cable (not shown), so that a pulling force exerted on the cable is transferred to the female terminal 100 through the outer sheath of the cable, instead of being transferred to the conductor of the cable, so as to prevent the conductor of the cable from being pulled off.

Fig.5 is an illustrative cross section view of the female terminal 100 after a mating male terminal 200 is inserted into the insertion slot 120 of the female terminal 100 of Fig.3.

As shown in Figs.4 and 5, in an embodiment of the present invention, a distance L1 between tips of free ends of the pair of guide spring pieces 140, 140 inside the insertion slot 120 is less than a distance L2 between tips of free ends of the pair of electrical contact spring pieces 130, 130 inside the insertion slot 120. In this way, as shown in Fig.5, it is possible to effectively prevent any one of the tips of the electrical contact spring pieces 130 of the female terminal 100 from being pressed against by a tip of the mating male terminal 200 during inserting the male terminal 200 into the female terminal 100. Thereby, the male terminal 200 may be correctly and smoothly inserted into the gap between the pair of electrical contact spring pieces 130, 130 under the guidance of the pair of guide spring pieces 140, 140 and sandwiched between electrical contact portions 130a, 130a of the pair of electrical contact spring pieces 130, 130, achieving a stable electrical connection between the male terminal 200 and the female terminal 100.

In the illustrated embodiment shown in Figs.3-5, even if the male terminal 200 is inserted in an unsuitable posture oblique to the longitudinal direction Y of the female terminal 100, the pair of guide spring pieces 140, 140 may guide the oblique male terminal 200 to the correct posture parallel to the longitudinal direction Y of the female terminal 100. Thereby, the electrical contact spring pieces 130, 130 of the female terminal 100 cannot be collapsed and failed by the male terminal 200.

Referring to Figs.3-5 again, in an embodiment of the present invention, the distance L1 between tips of the pair of guide spring pieces 140, 140 inside the insertion slot 120 is set

larger than a distance between the electrical contact portions 130a of the pair of electrical contact spring pieces 130, 130. In this way, it is possible to prevent the male terminal 200 from simultaneously contacting the pair of guide spring pieces 140, 140 and the pair of electrical contact portions 130a, 130a, reducing the insertion force, and facilitating the insertion of the male terminal 200.

Fig.6 is an illustrative view of expanding the female terminal 100 of Fig.3 into a single sheet of thin plate.

As shown in Figs.3-6, in an exemplary embodiment of the present invention, the female terminal 100 is folded by a single sheet of thin plate. As clearly shown in Fig.6, when the female terminal 100 is expanded into a single sheet of thin plate, the electrical contact spring piece 130 and the guide spring piece 140 on the same one sidewall 113 are aligned with each other in the longitudinal direction Y of the female terminal 100 and located in the opening 103 of the sidewall 113. That is, the electrical contact spring piece 130 and the guide spring piece 140 both are formed by a portion of the sidewall 113 within the opening 103, instead of being formed by a pair of additional tongues protruding from the most front end (a lower end in Fig. 6) of the pair of sidewalls. Thereby, it reduces the material for manufacturing the female terminal 100, saving the cost.

In an embodiment of the present invention, as shown in Fig.6, the electrical contact spring piece 130 has a width substantially equal to a width of the guide spring piece 140. A gap between the tips of the electrical contact spring piece 130 and the guide spring piece 140 on the same one sidewall 113 in the longitudinal direction Y of the female contact 100 is very small, or even equal to zero.

Referring to Fig.6 again, in an embodiment of the present invention, when the female terminal 100 is expanded into a single sheet of thin plate, a length of the guide spring piece 140 in the longitudinal direction Y is equal to 10%-35% of a length of the electrical contact spring piece 130 in the longitudinal direction Y. In this way, it is possible to ensure the electrical contact spring piece 130 has enough length, and ensure the electrical contact spring piece 130 has enough flexibility. Thereby, the male terminal 200 is allowed to be easily inserted into the female terminal 100 with small insertion force.

As shown in Fig.6, when the female terminal 100 is expanded into a single sheet of thin plate, the top wall 111 of the female terminal 100 comprises a first top wall portion 111a and a second top wall portion 111b formed at both sides of the single sheet of thin plate, respectively. As shown in Fig.3, when the single sheet of thin plate of Fig.6 is folded into the female terminal 100 of Fig.3, the first top wall portion 111a and the second top wall portion 111b are mated together to form the top wall 111 of the female terminal 100.

Although it is not shown, in another exemplary embodiment of the present invention, there is also provided an electrical connector comprising an insulation housing and the above female terminal 100 received in the insulation housing.

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

Although several 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.

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

What is claimed is,

1. A female terminal, comprising:

an insertion slot (120), defined by a top wall (111), a bottom wall (112) and a pair of sidewalls (113, 113), extending in a longitudinal direction (Y) of the female terminal (100); and

a pair of cantilever type electrical contact spring pieces (130, 130), formed on the pair of sidewalls (113, 113), respectively, each obliquely extending from a rear edge (103b) of an opening (103) formed in the respective sidewall (113) toward front and inside of the insertion slot (120), so as to electrically contact a male terminal (200) inserted into the insertion slot (120),

wherein the female terminal (100) further comprises a pair of cantilever type guide spring pieces (140, 140) each obliquely extending from a front edge (103a) of the opening (103) formed in the respective sidewall (113) toward rear and inside of the insertion slot (120), to guide the male terminal (200) to be inserted between the pair of electrical contact spring pieces (130, 130).

2. The female terminal according to claim 1,

wherein a distance (L1) between tips of free ends of the pair of guide spring pieces (140, 140) inside the insertion slot (120) is less than a distance (L2) between tips of free ends of the pair of electrical contact spring pieces (130, 130) inside the insertion slot (120).

3. The female terminal according to claim 2,

wherein the distance (L1) between the tips of free ends of the pair of guide spring pieces (140, 140) is larger than a distance between electrical contact portions (130a) of the pair of electrical contact spring pieces (130, 130).

4. The female terminal according to claim 1,

wherein the electrical contact spring piece (130) has a width substantially equal to a width of the guide spring piece (140).

5. The female terminal according to claim 1,

wherein the female terminal (100) is formed by a single sheet of thin plate.

6. The female terminal according to claim 5, wherein:

when the female terminal (100) is expanded into a single sheet of thin plate, the electrical contact spring piece (130) and the guide spring piece (140) on the same one

sidewall (113) are aligned with each other in the longitudinal direction (Y) of the female terminal (100) and located in the opening (103) in the sidewall (113).

7. The female terminal according to claim 6, wherein:

when the female terminal (100) is expanded into a single sheet of thin plate, a length of the guide spring piece (140) in the longitudinal direction (Y) is equal to 10%-35% of a length of the electrical contact spring piece (130) in the longitudinal direction (Y).

8. The female terminal according to claim 1, further comprising:

a pair of first side wings (101) formed at rear of the insertion slot (120) and configured to be crimped on a conductor of a cable, to electrically connect the conductor of the cable.

9. The female terminal according to claim 8, further comprising:

a pair of second side wings (102) formed at rear of the pair of first side wings (101) and configured to be crimped on an outer sheath of the cable, so that a pulling force exerted on the cable is transferred to the female terminal (100) through the outer sheath of the cable, instead of being transferred to the conductor of the cable.

10. An electrical connector, comprising:

an insulation housing; and

the female terminal (100), according to claim 1, received in the insulation housing.

DRAWINGS

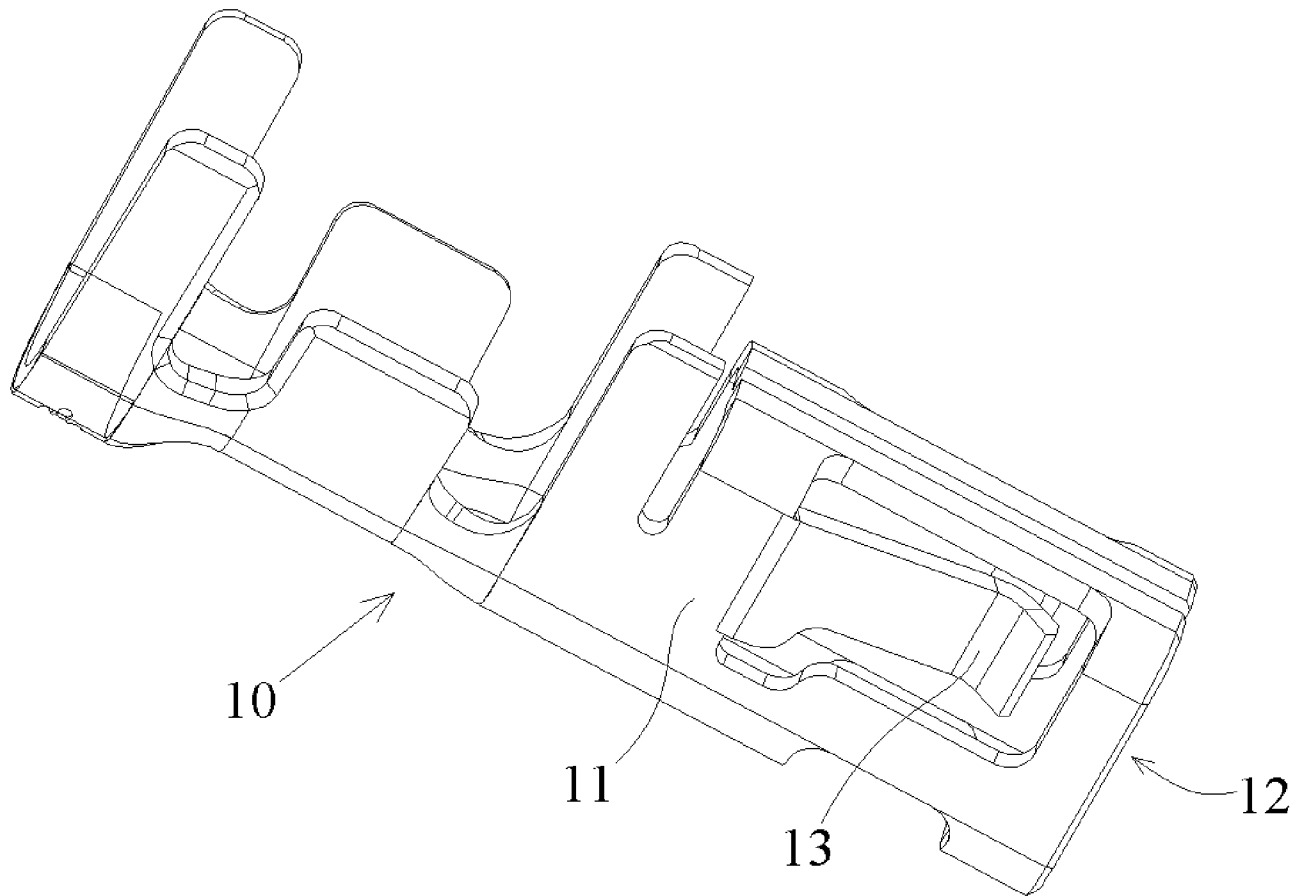


Fig. 1a

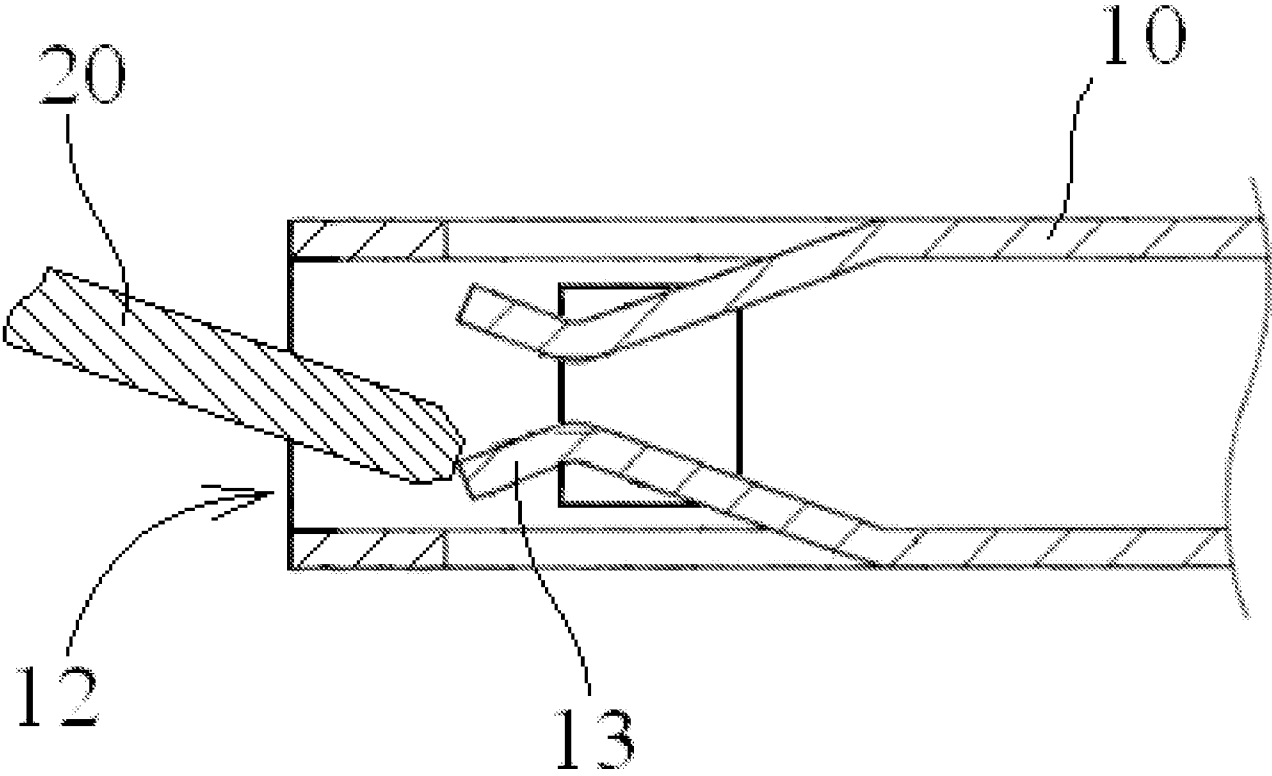


Fig. 1b

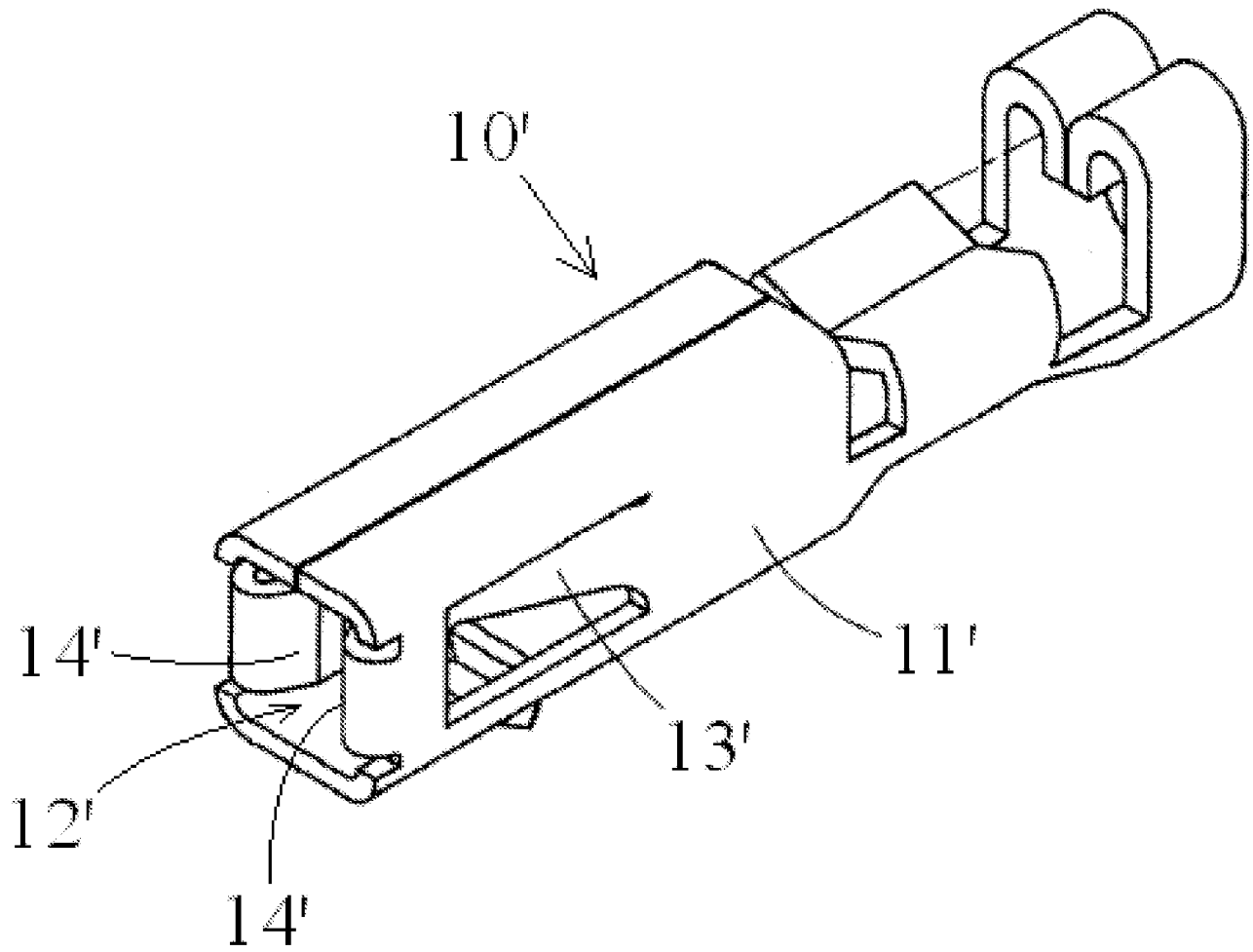


Fig.2a

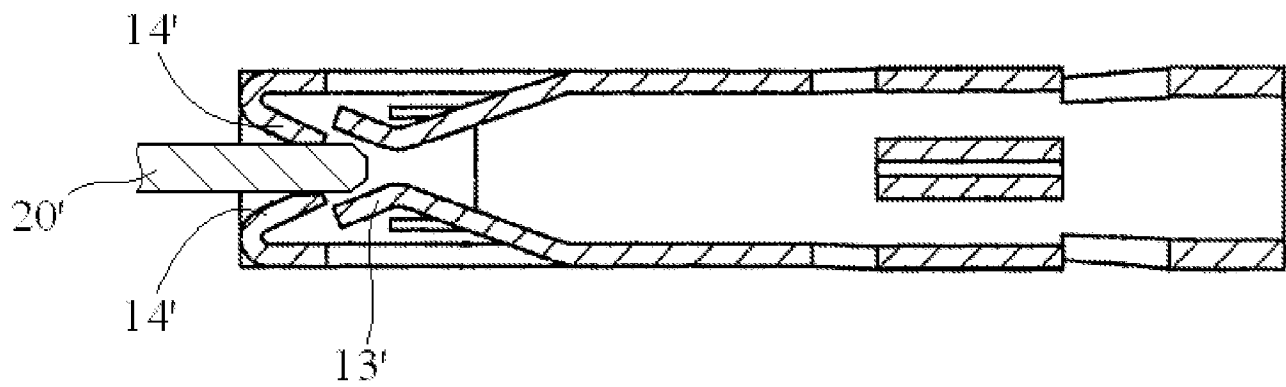


Fig.2b

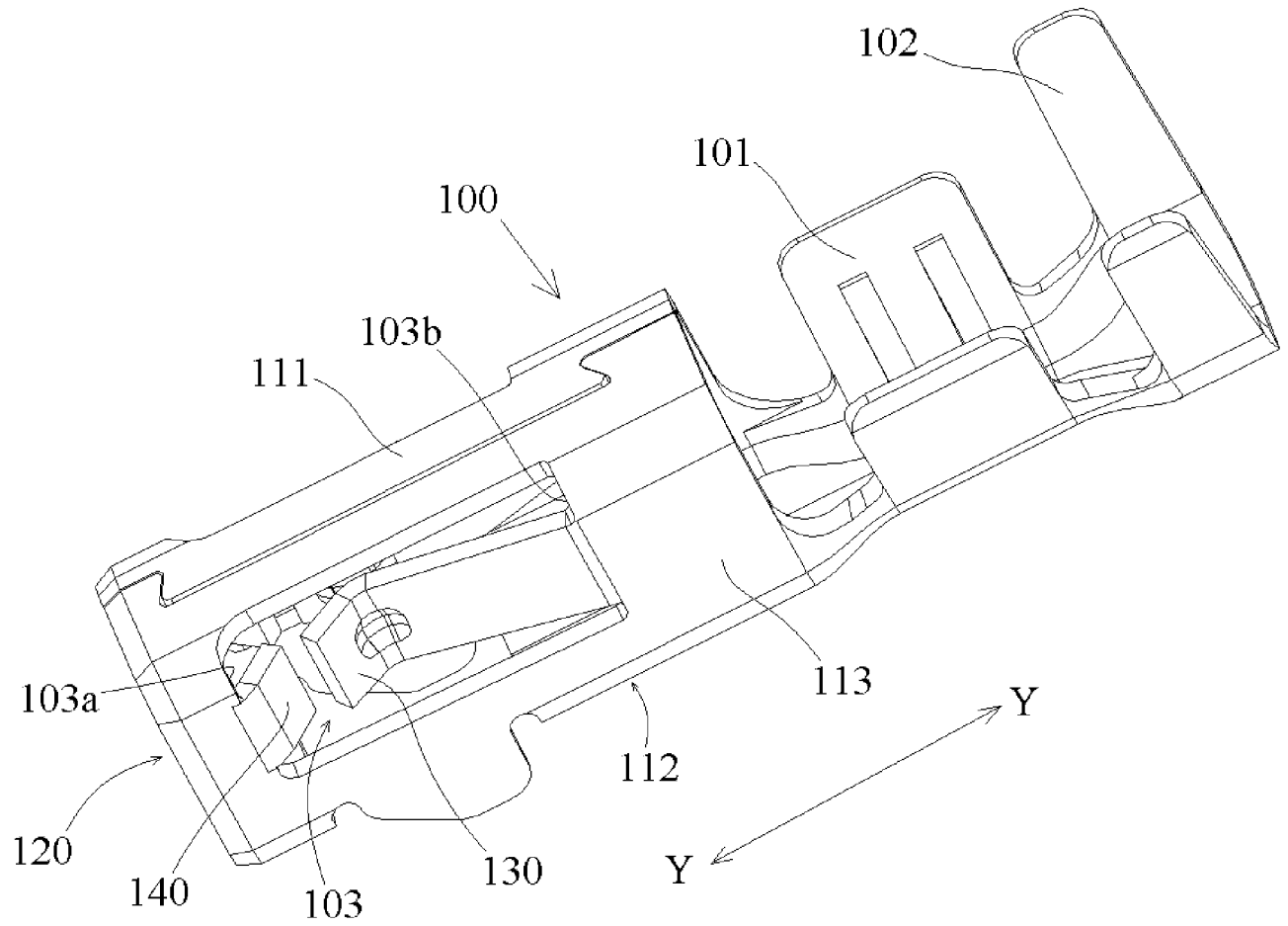


Fig.3

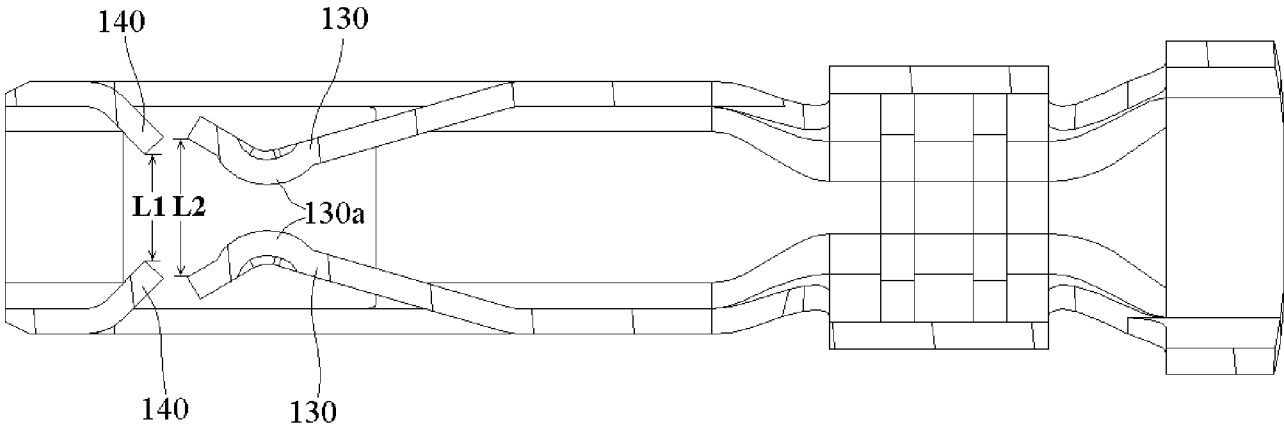


Fig.4

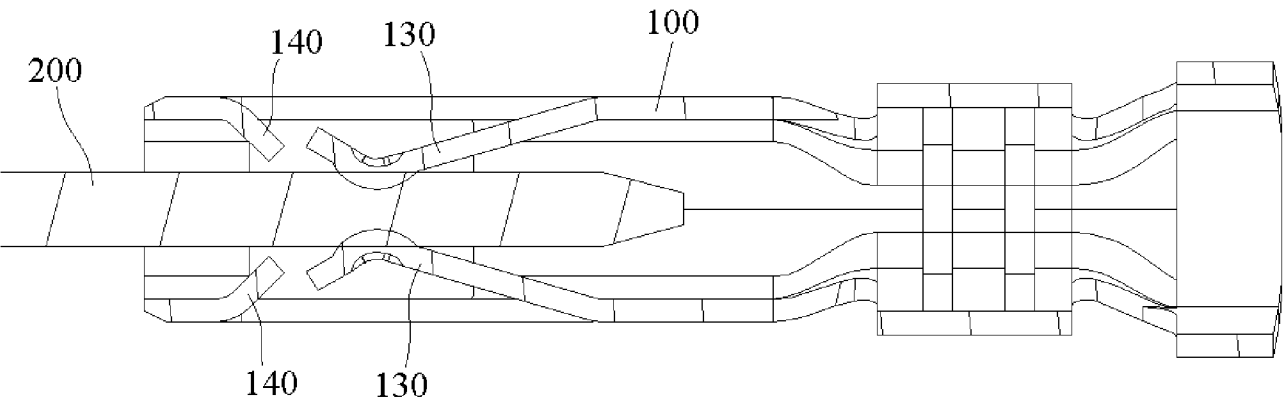


Fig.5

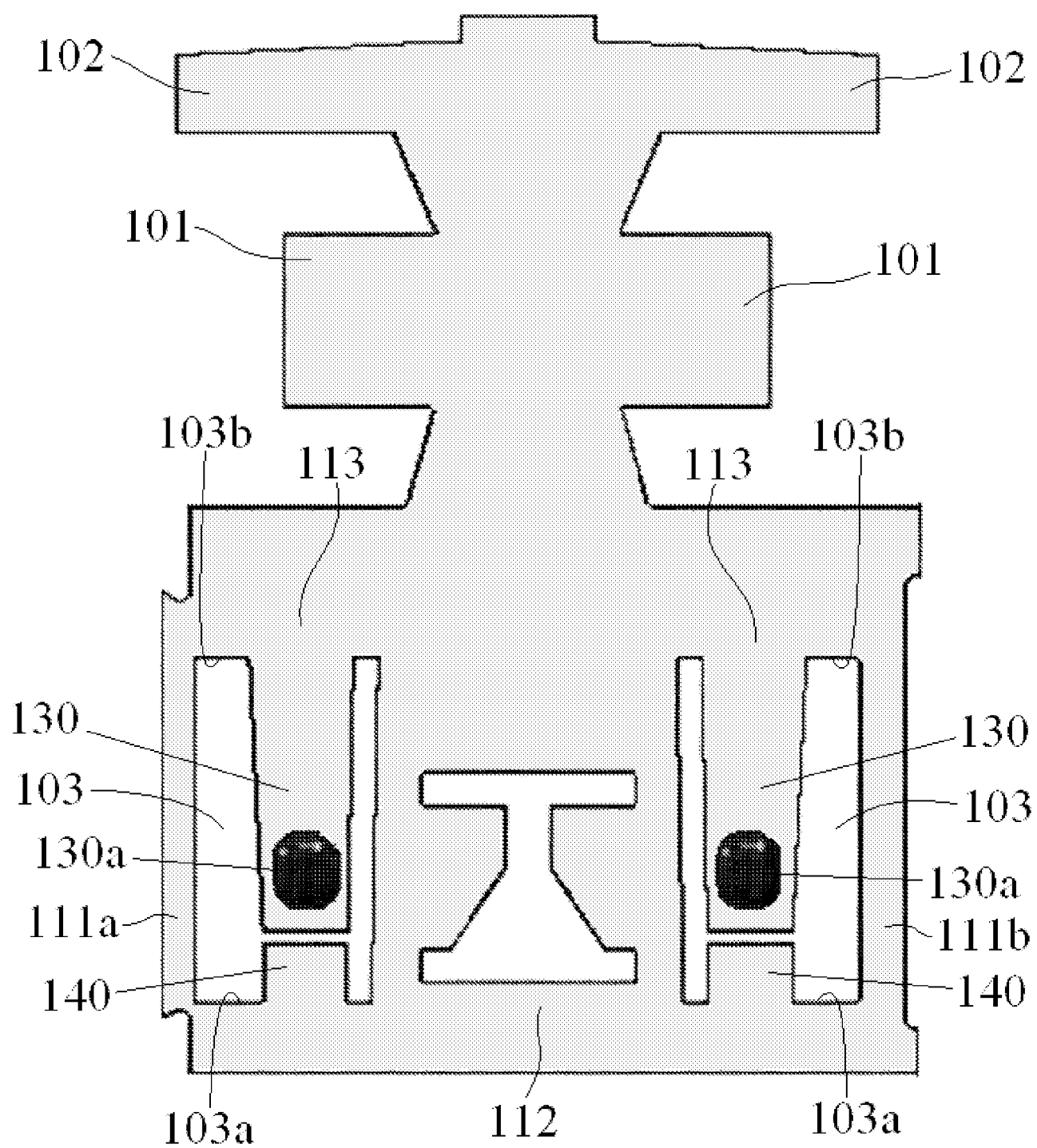


Fig.6

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2015/055081

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/11
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 152 042 A (OSTAPOVITCH HAROLD J [CA]) 1 May 1979 (1979-05-01) column 2, lines 42-68, column 3, lines 1-6; figures 4, 12, 13-22 -----	1-10
X	DE 19 09 416 A1 (SIEMENS AG) 12 November 1970 (1970-11-12) the whole document -----	1-10
X	US 3 663 931 A (BROWN ELVIN E) 16 May 1972 (1972-05-16) column 2, lines 31-75; figures 1, 2 -----	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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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

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Date of the actual completion of the international search

24 September 2015

Date of mailing of the international search report

02/10/2015

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López García, Raquel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2015/055081

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4152042	A	01-05-1979	US 4076369 A US 4152042 A	28-02-1978 01-05-1979
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