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(54) **HIGH-VOLTAGE CONNECTOR AND ELECTRICAL CONNECTOR ASSEMBLY HAVING THE SAME**

(57) A high-voltage connector is disclosed. The high-voltage connector contains TPA and CPA mechanisms, and is designed to be a female electrical connector. After connecting a male electrical connector to the high-voltage connector, N numbers of first terminals in the male electrical connector contacts N numbers of second terminals in the female electrical connector (i.e., the high-voltage connector), respectively. In the meantime, the TPA mechanism actuates to fix the connection between each first terminal and each second terminal. Moreover, the CPA mechanism also actuates to fix the connection between a first insulative housing of the male electrical connector and a second insulative housing of female electrical connector. It is worth further stating that, high-voltage connector has many advantages, including being modularized and having simple structure.

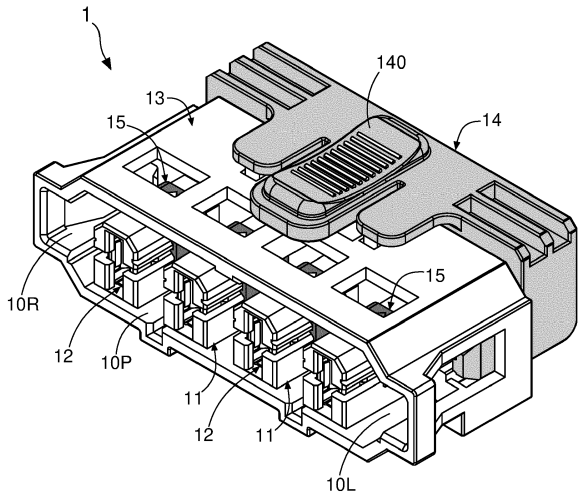

FIG. 1A

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to the technology field of new energy source, and more particularly to a high-voltage connector for application in an alternative fuel vehicle.

2. Description of the Prior Art

[0002] Alternative fuel vehicle is a motor vehicle that runs on alternative fuel rather than traditional petroleum fuels (petrol or petrodiesel), and there are various types of alternative fuel vehicle currently, including hybrid electric vehicle (HEV), battery electric vehicle (BEV), plug-in hybrid electric vehicle (PHEV), and fuel-cell electric vehicles (FCEV). Nowadays, many countries have regarded how to develop and promote the alternative fuel vehicle domestically.

[0003] It is worth noting that, high-voltage connector is one of necessary electronic components for an alternative fuel vehicle, and is found to include many drawbacks, such as not being modularized and not having simple structure. In general, a high-voltage connector is required to possess high reliability and good stability, and commonly comprises: an insulative housing, a plurality of terminals, a terminal position assurance (TPA) mechanism, and a connector position assurance (CPA). For example, China patent publication No. CN112088469A has disclosed one type of high-voltage connector which includes the TPA and CPA designs. On the other hand, Taiwan patent publication No. TW201818615A has disclosed another one type of high-voltage connector which also includes the TPA and CPA designs.

[0004] However, it is a pity that there are still rooms for improvement in the conventional designs on the TPA and/or CPA mechanisms. In view of that, inventors of the present application have made great efforts to make inventive research and eventually provided a high-voltage connector and electrical connector assembly having the same.

SUMMARY OF THE INVENTION

[0005] The primary objective of the present invention is to disclose a high-voltage connector containing TPA and CPA mechanisms. This novel high-voltage connector is designed to be a female electrical connector. After connecting a male electrical connector to the high-voltage connector, N numbers of first terminals in the male electrical connector contacts N numbers of second terminals in the female electrical connector (i.e., the high-voltage connector), respectively. In the meantime, the TPA mechanism actuates to fix the connection between each first terminal and each second terminal. Moreover, the CPA mechanism also actuates to fix the connection between a first insulative housing of the male electrical connector and a second insulative housing of female electrical connector.

[0006] For achieving the primary objective mentioned above, the present invention provides an embodiment of the high-voltage connector, comprising;

a first insulative housing containing N numbers of channels, wherein N is a positive integer;

N numbers of first accommodating members, wherein each said first accommodating member has a front opening and a rear opening, and being connected to the first insulative housing so as to make the rear opening communicate with the channel;

N numbers of terminal units, being disposed in said N numbers of first accommodating members, respectively; wherein each said terminal unit has a first conductive member, and the first conductive member has a wire connecting portion positioned in the channel and a first terminal contacting portion positioned in the first accommodating members;

a peripheral frame, comprising: a first top plate connected to a top surface of the first insulative housing, a first bottom plate connected to a bottom surface of the first insulative housing, a first left plate, and a first right plate; wherein the first top plate is provided with a position limiting structure comprising a first recess and a second recess thereon, a left channel being encircled by the first left plate, the first top plate, the first bottom plate, and a left-side surface of the first insulative housing, a right channel being encircled by the first right plate, the first top plate, the first bottom plate, and a right-side surface of the first insulative housing, a receiving opening being encircled by the first top plate, the first bottom plate, the first left plate, and the first right plate, and said N numbers of terminal units being positioned in the receiving opening; and

a first position limiting device, comprising:

a first main plate having at least one first position limiting block on a bottom surface thereof, wherein the first position limiting block falls into the first recess or the second recess in case the first main plate is moved to a first position or a second position;

a first right position limiting unit, comprising a first right connection plate that is connected with the first main plate and a right propping member positioned in the right channel; and

a first left position limiting unit, comprising a first left connection plate that is connected with the first main plate and a left propping member positioned in the left channel.

[0007] Moreover, the present invention also discloses an electrical connector assembly, comprising:

a female connector, comprising:

a first insulative housing containing N numbers of channels, wherein N is a positive integer;
N numbers of first accommodating members, wherein each said first accommodating member has a front opening and a rear opening, and being connected to the first insulative housing so as to make the rear opening communicate with the channel;
N numbers of terminal units, being disposed in said N numbers of first accommodating members, respectively; wherein each said terminal unit has a first conductive member, and the first conductive member has a wire connecting portion positioned in the channel and a first terminal contacting portion positioned in the first accommodating members;
a peripheral frame, comprising: a first top plate connected to a top surface of the first insulative housing, a first bottom plate connected to a bottom surface of the first insulative housing, a first left plate, and a first right plate; wherein the first top plate is provided with a position limiting structure comprising a first recess and a second recess thereon, a left channel being encircled by the first left plate, the first top plate, the first bottom plate, and a left-side surface of the first insulative housing, a right channel being encircled by the first right plate, the first top plate, the first bottom plate, and a right-side surface of the first insulative housing, a receiving opening being encircled by the first top plate, the first bottom plate, the first left plate, and the first right plate, and said N numbers of terminal units being positioned in the receiving opening; and

a first position limiting device, comprising:

a first main plate having at least one first position limiting block on a bottom surface thereof, wherein the first position limiting block falls into the first recess or the second recess in case the first main plate is moved to a first position or a second position;
a first right position limiting unit, comprising a first right connection plate that is connected with the first main plate and a right propping member positioned in the right channel; and
a first left position limiting unit, comprising a first left connection plate that is connected with the first main plate and a left propping member positioned in the left channel; and

a male connector, comprising:

a second insulative housing;
N numbers of second accommodating members connected to the second insulative housing, wherein each said second accommodating member has a front opening;
N numbers of second conductive members, being disposed in said N numbers of second accommodating members, respectively; wherein each said second conductive member has a second terminal contacting portion positioned in the second accommodating members and a plugging portion protruded out of a bottom surface of the second insulative housing;
a second left position limiting unit, comprising a left arm extended from a left-side surface of the second insulative housing and a left position limiting member connected to the left extension arm; and
a second right position limiting unit, comprising a right arm extended from a right-side surface of the second insulative housing and a right position limiting member connected to the right extension arm;
wherein after the male connector is connected to the female connector, said N numbers of second accommodating members being received in the receiving opening of the female connector, and said N numbers of first accommodating members of the female connector being inserted into said N numbers of second accommodating members of the male connector, respectively, such that each said first terminal contacting portion contacts with each said second terminal contacting portion contacts, thereby making each said first conductive member be electrically connected to each said second conductive member;
wherein after said N numbers of second accommodating members are received in the receiving opening of the female connector, the left position limiting member being stayed in the left channel so as to be propped by the left propping member, and the right position limiting member being stayed in the right channel so as to be propped by the right propping member.

[0008] In one embodiment, two sides of each said first accommodating member are both provided with a groove and a side opening thereon, and a top opening is formed on a top side of said first accommodating members.

[0009] In one embodiment, each said terminal unit further has a shielding frame consisting of a second top plate, a second bottom plate, a second left plate, and a second right plate; wherein the second top plate is provided with at least one position limiting opening thereon, the second left plate having a first elastic member, the second right plate having a second elastic member, a second receiving opening is encircled by the second top plate, the second bottom plate, the second left plate, and the second right plate, and there is a stopping member

disposed at an edge of the second receiving opening.

[0010] In one embodiment, the female connector further comprises:

N numbers of second position limiting devices, being connected to said N numbers of first accommodating members, respectively; wherein each said second position limiting device comprises:

a second main plate having at least one second position limiting block on a bottom surface thereof;
a second right connection plate, being connected with the second main plate, and being provided with an embedding block and a propping block on a surface thereof; and
a second left connection plate, being connected with the second main plate, and being also provided with one said embedding block) and one said propping block on a surface thereof;

wherein the embedding block of said second right connection plate and the embedding block of said second left connection plate are embedded in two said groove of said first accommodating member in an initial state;
wherein after the second main plate is pressed down, the embedding block of said second right connection plate and the embedding block of said second left connection plate are released from two said grooves, and then downward moving so as to get into two said side opening of said first accommodating member, such that the first elastic member of said second left plate is propped by the embedding block of said second left connection plate, the second elastic member of said second right plate being propped by the embedding block of said second right connection plate, and the second position limiting block of said second main plate falling into the position limiting opening of said second top plate.

[0011] In one embodiment, the left-side surface and the right-side surface of the first insulative housing are both further provided with a guide groove thereon, and the position limiting structure further comprises a protrusion block disposed between the first recess and the second recess.

[0012] In one embodiment, the first bottom plate is provided with a left recess and a right recess thereon, and the left recess and the right recess being positioned in the left channel and the right channel, respectively.

[0013] In one embodiment, the first left position limiting unit further comprises a left engaging member confining in the left recess, and the first right position limiting unit further comprises a right engaging member confining in the right recess.

[0014] In one embodiment, the right propping member has a left sliding block capable of sliding in the guide groove of the right-side surface of the first insulative housing, and the left propping member has a left sliding block capable of sliding in the guide groove of the left-side surface of the first insulative housing.

[0015] In one embodiment, the first left plate is provided with a long left opening thereon, and a left return stop portion is formed between a front side of the first left plate and the long left opening, such that a bottom of the left position limiting member is engaged by the left return stop portion, thereby preventing the left position limiting member from returning.

[0016] In one embodiment, the first right plate is provided with a long right opening thereon, and a right return stop portion is formed between a front side of the first right plate and the long right opening, such that a bottom of the right position limiting member is engaged by the right return stop portion, thereby preventing the right position limiting member from returning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention as well as a preferred mode of use and advantages thereof will be best understood by referring to the following detailed description of an illustrative embodiment in conjunction with the accompanying drawings, wherein:

FIG. 1A shows a first stereo diagram of a high-voltage connector according to the present invention;
FIG. 1B shows a second stereo diagram of the high-voltage connector;
FIG. 1C shows a third stereo diagram of the high-voltage connector;
FIG. 2A shows a first exploded view of the high-voltage connector;
FIG. 2B shows a second exploded view of the high-voltage connector;
FIG. 3A shows a first stereo diagram of an electrical connector assembly according to the present invention;
FIG. 3B shows a second stereo diagram of the electrical connector assembly;
FIG. 3C shows a third stereo diagram of the electrical connector assembly;
FIG. 4 shows a stereo diagram of N numbers of second conductive members and the high-voltage connector;
FIG. 5A and FIG. 5B show kinematic diagrams of a shielding frame and a second position limiting device in case of achieving terminal position assurance (TPA); and
FIG. 6A and FIG. 6B show kinematic diagrams of a peripheral frame, a first position limiting device, a second left position limiting unit, and a second right position limiting unit in case of achieving connector position assurance (CPA).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] To more clearly describe a high-voltage connector for application in an alternative fuel vehicle, embodiments of the present invention will be described in detail with reference to the attached drawings hereinafter.

High-voltage connector

[0019] With reference to FIG. 1A, FIG. 1B and FIG. 1C, there are shown a first stereo diagram, a second stereo diagram and a third stereo diagram a high-voltage connector according to the present invention. Moreover, FIG. 2A shows a first exploded view of the high-voltage connector, and FIG. 2B shows a second exploded view of the high-voltage connector. The present invention discloses a high-voltage connector, which is designed to be a female electrical connector, and comprises: a first insulative housing 10 containing N numbers of channels 101, N numbers of first accommodating members 11, N numbers of terminal units 12, a peripheral frame 13, a first position limiting device 14, and N numbers of second position limiting devices 15. According to the present invention, each said first accommodating member 11 has a front opening and a rear opening, and being connected to the first insulative housing 10 so as to make the rear opening communication with the channel 101. Moreover, said N numbers of terminal units 12 are disposed in said N numbers of first accommodating members 11, respectively, wherein each said terminal unit 12 has a first conductive member 121, and the first conductive member 121 has a wire connecting portion positioned in the channel 101 and a first terminal contacting portion positioned in the first accommodating members 11.

[0020] As described in more detail below, in case of connecting a male connector to the female connector 1 (i.e., the high-voltage connector), the peripheral frame 13 cooperates with the first position limiting device 14 so as to achieve connector position assurance (CPA). The peripheral frame 13 comprises a first top plate 13T connected to a top surface of the first insulative housing 10, a first bottom plate 13B connected to a bottom surface of the first insulative housing 10, a first left plate 13L, and a first right plate 13R. According to the present invention, the first top plate 13T is provided with a position limiting structure comprising a first recess 13T1 and a second recess 13T2 thereon, such that a left channel 10L is encircled by the first left plate 13L, the first top plate 13T, the first bottom plate 13B, and a left-side surface of the first insulative housing 10. Moreover, a right channel 10R is encircled by the first right plate 13R, the first top plate 13T, the first bottom plate 13B, and a right-side surface of the first insulative housing 10. On the other hand, a receiving opening 10P is encircled by the first top plate 13T, the first bottom plate 13B, the first left plate 13L, and the first right plate 13R, such that said N numbers of terminal units 12 are positioned in the receiving opening 10P.

[0021] On the other hand, the first position limiting device 14 comprises a first main plate 141, a first right position limiting unit and a first left position limiting unit, of which the first main plate 141 has at least one first position limiting block 141B on a bottom surface thereof, such that the first position limiting block 141B falls into the first recess 13T1 or the second recess 13T2 in case the first main plate 141 is moved to a first position or a second position. According to the present invention, the first right position limiting unit comprises a first right connection plate 14R1 that is connected with the first main plate 141 and a right propping member 14R2 positioned in the right channel 10R. Moreover, the first left position limiting unit comprises a first left connection plate 14L1 that is connected with the first main plate 141 and a left propping member 14L2 positioned in the left channel 10L.

[0022] It is worth noting that, the left-side surface and the right-side surface of the first insulative housing 10 are both further provided with a guide groove 102 thereon, and the right propping member 14R2 has a left sliding block 14R4 capable of sliding in the guide groove 102 of the right-side surface of the first insulative housing 10. In addition, the left propping member 14L2 also has a left sliding block 14L4 capable of sliding in the guide groove 102 of the left-side surface of the first insulative housing 10. As FIG. 2A, FIG. 2B and FIG. 1C show, the first bottom plate 13B is provided with a left recess 10LL and a right recess 10RR thereon, and the left recess 10LL and the right recess 10RR is positioned in the left channel 10L and the right channel 10R, respectively. Accordingly, the first left position limiting unit further comprises a left engaging member 14L3 confining in the left recess 10LL, and the first right position limiting unit further comprising a right engaging member 14R3 confining in the right recess 10RR.

[0023] As FIG. 2A and FIG. 2B show, the first left plate 13L is provided with a long left opening 13L1 thereon, and a left return stop portion is formed between a front side of the first left plate 13L and the long left opening 13L1. Similarly, the first right plate 13R is also provided with a long right opening 13R1 thereon, and a right return stop portion is formed between a front side of the first right plate 13R and the long right opening 1RL1. It needs to explained that, said long left opening 13L1 fails to be clear shown because it is shield by the first insulative housing 10.

[0024] On the other hand, each said terminal unit 12 further has a shielding frame, and each said shielding frame cooperates with one said second position limiting devices 15 so as to achieve terminal position assurance (TPA). According to the present invention, the shielding frame consists of a second top plate 12T, a second bottom plate 12B, a second left plate 12L, and a second right plate 12R, of which the second top plate 12T is provided with at least one position limiting opening 12T1 thereon, the second left plate 12L has a first elastic mem-

ber 12L1, and the second right plate 12R has a second elastic member 12R1. By such arrangements, a second receiving opening 12P is encircled by the second top plate 12T, the second bottom plate 12B, the second left plate 13L, and the second right plate 13R, and there is a stopping member 122S disposed at an edge of the second receiving opening 12P.

[0025] As FIG. 2A and FIG. 2B show, two sides of each said first accommodating member 11 are both provided with a groove 111 and a side opening 112 thereon, and a top opening 113 is formed on a top side of said first accommodating members 11. On the other hand, said N numbers of second position limiting devices 15 are connected to said N numbers of first accommodating members 11, respectively, and each said second position limiting device 15 comprises: a second main plate 151, a second a second left connection plate 15L and right connection plate 15R. As described in more detail below, the second main plate 151 has at least one second position limiting block 151B on a bottom surface thereof. Moreover, the second right connection plate 15R is connected with the second main plate 151, and is provided with an embedding block 153 and a propping block 154 on a surface thereof. On the other hand, the second left connection plate 15L is connected with the second main plate 151, and is also provided with one said embedding block 153 and one said propping block 154 on a surface thereof.

Electrical connector assembly

[0026] With reference to FIG. 3A, FIG. 3B and FIG. 3C, there are shown a first stereo diagram, a second stereo diagram and a third stereo diagram an electrical connector assembly according to the present invention. The present invention simultaneously discloses an electrical connector assembly EA, and the electrical connector assembly EA comprises: a male connector 2 and the foregoing female connector 1 (i.e., high-voltage connector). As FIG. 3A, FIG. 3B and FIG. 3C show, the male connector 2 comprises: a second insulative housing 20, a peripheral mounting flange 24, N numbers of second accommodating members 21, N numbers of second conductive members 221, a second left position limiting unit consisting of a left arm 2L1 and a left position limiting member 2L2, and a second right position limiting unit consisting of a left arm 2R1 and a left position limiting member 2R2.

[0027] As described in more detail below, said N numbers of second accommodating members 21 are connected to the second insulative housing 20, and each said second accommodating member 21 has a front opening. FIG. 4 shows a stereo diagram of N numbers of second conductive members 221 and the female connector 1. According to FIG. 3A , FIG. 3B, FIG. 3C, and FIG. 4, it is known that said N numbers of second conductive members 221 are disposed in said N numbers of second accommodating members 21, respectively, wherein each said second conductive member 221 has a second terminal contacting portion positioned in the second accommodating members 21 and a plugging portion protruded out of a bottom surface of the second insulative housing 20. On the other hand, the left arm 2L1 is extended from a left-side surface of the second insulative housing 20, and the left position limiting member 2L2 is connected to the left extension arm 2L1. Moreover, the right arm 2R1 is extended from a right-side surface of the second insulative housing 20, and the right position limiting member 2R2 is connected to the right extension arm 2R1.

[0028] Please simultaneously refer to FIG. 2A, FIG. 2B, FIG. 3A, FIG. 3B, and FIG. 3C. After the male connector 2 is connected to the female connector 1, said N numbers of second accommodating members 21 are received in the receiving opening 10P of the female connector 1, and said N numbers of first accommodating members 11 of the female connector 1 are inserted into said N numbers of second accommodating members 21 of the male connector 2, respectively. Therefore, each said first terminal contacting portion contacts with each said second terminal contacting portion contacts, such that each said first conductive member 121 is electrically connected to each said second conductive member 221. In such case, each said shielding frame cooperates with each said second position limiting devices 15 so as to apply a terminal position assurance TPA to each said terminal unit 12.

[0029] FIG. 5A and FIG. 5B show kinematic diagrams of a shielding frame and a second position limiting device in case of achieving terminal position assurance (TPA). As FIG. 2A, FIG. 2B, FIG. 5A, and FIG. 5B show, when said N numbers of second accommodating members 21 are received in the receiving opening 10P of the female connector 1, each said second main plate 151 is pressed down by the inner wall of one said second accommodating members 21, such that each said second position limiting devices 15 moves downward. Then, the embedding block 153 of said second right connection plate 15R and the embedding block 153 of said second left connection plate 15L are released from two said grooves 111, and then downward move so as to get into two said side opening 112 of said first accommodating member 11. As a result, the first elastic member 12L1 of said second left plate 12L is propped by the embedding block 153 of said second left connection plate 15L, the second elastic member 12R1 of said second right plate 12R is propped by the embedding block 153 of said second right connection plate 15L, and the second position limiting block 151B of said second main plate 151 falls into the position limiting opening 12T1 of said second top plate 12T.

[0030] According to the present invention, there is a stopping member 122S disposed at an edge of the second receiving opening 12P, the second top plate 12T is provided with at least one position limiting opening 12T1 thereon, and the second main plate 151 has at least one

second position limiting block 151B on a bottom surface thereof. By such arrangements, after pressing down the second position limiting device 15 so as to make the second main plate 151 move into the top opening 113 of the first accommodating members 11, the second position limiting block 151B of the second main plate 151 therefore falls into the position limiting opening 12T1 of the second top plate 12T, thereby achieving a first type of terminal position assurance TPA. Moreover, the stopping member 122S props against the first conductive member 121 so as to achieve a second type of terminal position assurance (TPA).

[0031] As FIG. 2A, FIG. 2B, FIG. 3A, FIG. 3B, and FIG. 3C show, after the male connector 1 is connected to the female connector 1, the peripheral frame 13, the first position limiting device 14, the second left position limiting unit consisting of a left arm 2L1 and a left position limiting member 2L2, and the second right position limiting unit consisting of a left arm 2R1 and a left position limiting member 2R2 cooperate with each other so as to apply a connector position assurance to the first insulative housing 10 and the second insulative housing 20.

[0032] FIG. 6A and FIG. 6B show kinematic diagrams of the peripheral frame, the first position limiting device, the second left position limiting unit, and the second right position limiting unit in case of achieving connector position assurance (CPA). As FIG. 2A, FIG. 2B, FIG. 4, FIG. 6A, and FIG. 6B show, after the male connector 2 is connected to the female connector 1, the left position limiting member 2L2 is stayed in the left channel 10L so as to be propped by the left propping member 14L2. As described in moredetail below, the left propping member 14L2 has a skived slant portion. Therefore, when the left propping member 14L2 moves in the left channel 10L, the skived slant portion would eventually be embedded into the gap between the left-side surface of the first insulative housing 10 and the left position limiting member 2L2. Consequently, with the left position limiting member 2L2 contiguously moving along the left channel 10L, the left position limiting member 2L2 is propped by the left propping member 14L2. In such case, a bottom of the left position limiting member 2L2 is engaged by a left return stop portion that is formed between a front side of the first left plate 13L and the long left opening 13L1, thereby the left position limiting member 2L2 is prevented from returning.

[0033] As FIG. 2A, FIG. 2B, FIG. 4, FIG. 6A, and FIG. 6B show, after the male connector 2 is connected to the female connector 1, the right position limiting member 2R2 is stayed in the right channel 10R so as to be propped by the right propping member 14R2. As described in more detail below, the right propping member 14R2 has a skived slant portion. Therefore, when the right propping member 14R2 moves in the right channel 10R, the skived slant portion would eventually be embedded into the gap between the right-side surface of the first insulative housing 10 and the right position limiting member 2R2. Consequently, with the right position limiting member 2R2 contiguously moving along the right channel 10R, the right position limiting member 2R2 is propped by the right propping member 14R2. In such case, a bottom of the right position limiting member 2R2 is engaged by a right return stop portion that is formed between a front side of the first right plate 13R and the long right opening 13R1, thereby the right position limiting member 2R2 is prevented from returning.

[0034] It is worth further explaining that, it is able to release the male connector 2 from the female connector 1. As FIG. 2A, FIG. 2B, FIG. 6A, and FIG. 6B show, after firstly applying a force to a pressing block 140 so as to make the first position limiting device 14 move backward, the first position limiting block 141B of the first main plate 141 falls into the first recess 13T1. In such case, the left position limiting member 2L2 is released from the propping of the left propping member 14L2, and the right position limiting member 2R2 is simultaneously released from the propping of the right propping member 14R2. Subsequently, in case the right position limiting member 2R2 and the left position limiting member 2L2 are clamped, it is allowed to move the male connector 2 backward so as to make the right position limiting member 2R2 and the left position limiting member 2L2 leave the right channel 10R and the left channel 10L, respectively. As a result, the male connector 2 is released from the connection of the female connector 1.

[0035] Therefore, through the above descriptions, all embodiments of the high-voltage connector according to the present invention have been introduced completely and clearly. Moreover, the above description is made on embodiments of the present invention. However, the embodiments are not intended to limit the scope of the present invention, and all equivalent implementations or alterations within the spirit of the present invention still fall within the scope of the present invention.

Claims

1. A high-voltage connector, being a female electrical connector, and comprising:

a first insulative housing (10) containing N numbers of channels (101), wherein N is a positive integer;

N numbers of first accommodating members (11), wherein each said first accommodating member (11) has a front opening and a rear opening, and being connected to the first insulative housing (10) so as to make the rear opening communication with the channel (101);

N numbers of terminal units (12), being disposed in said N numbers of first accommodating members (11), respectively; wherein each said terminal unit (12) has a first conductive member (121), and the first conductive member (121) has a wire connecting portion positioned in the channel (101) and a first terminal contacting portion

positioned in the first accommodating members (11);

a peripheral frame (13), comprising: a first top plate (13T) connected to a top surface of the first insulative housing (10), a first bottom plate (13B) connected to a bottom surface of the first insulative housing (10), a first left plate (13L), and a first right plate (13R); wherein the first top plate (13T) is provided with a position limiting structure comprising a first recess (13T1) and a second recess (13T2) thereon, a left channel (10L) being encircled by the first left plate (13L), the first top plate (13T), the first bottom plate (13B), and a left-side surface of the first insulative housing (10), a right channel (10R) being encircled by the first right plate (13R), the first top plate (13T), the first bottom plate (13B), and a right-side surface of the first insulative housing (10), a receiving opening (10P) being encircled by the first top plate (13T), the first bottom plate (13B), the first left plate (13L), and the first right plate (13R), and said N numbers of terminal units (12) being positioned in the receiving opening (10P); and

a first position limiting device (14), comprising:

a first main plate (141) having at least one first position limiting block (141B) on a bottom surface thereof, wherein the first position limiting block (141B) falls into the first recess (13T1) or the second recess (13T2) in case the first main plate (141) is moved to a first position or a second position;

a first right position limiting unit, comprising a first right connection plate (14R1) that is connected with the first main plate (141) and a right propping member (14R2) positioned in the right channel (10R); and

a first left position limiting unit, comprising a first left connection plate (14L1) that is connected with the first main plate (141) and a left propping member (14L2) positioned in the left channel (10L).

2. The high-voltage connector of claim 1, wherein two sides of each said first accommodating member (11) are both provided with a groove (111) and a side opening (112) thereon, and a top opening (113) being formed on a top side of said first accommodating members (11).

3. The high-voltage connector of claim 2, wherein each said terminal unit (12) further has a shielding frame consisting of a second top plate (12T), a second bottom plate (12B), a second left plate (12L), and a second right plate (12R); wherein the second top plate (12T) is provided with at least one position limiting opening (12T1) thereon, the second left plate (12L) having a first elastic member (12L1), the second right plate (12R) having a second elastic member (12R1), a second receiving opening (12P) being encircled by the second top plate (12T), the second bottom plate (12B), the second left plate (13L), and the second right plate (13R), and there being a stopping member (122S) disposed at an edge of the second receiving opening (12P).

4. The high-voltage connector of claim 3, further comprising:

N numbers of second position limiting devices (15), being connected to said N numbers of first accommodating members (11), respectively; wherein each said second position limiting device (15) comprises:

a second main plate (151) having at least one second position limiting block (151B) on a bottom surface thereof;

a second right connection plate (15R), being connected with the second main plate (151), and being provided with an embedding block (153) and a propping block (154) on a surface thereof; and

a second left connection plate (15L), being connected with the second main plate (151), and being also provided with one said embedding block (153) and one said propping block (154) on a surface thereof;

wherein the embedding block (153) of said second right connection plate (15R) and the embedding block (153) of said second left connection plate (15L) are embedded in two said groove (111) of said first accommodating member (11) in an initial state;

wherein after the second main plate (151) is pressed down, the embedding block (153) of said second right connection plate (15R) and the embedding block (153) of said second left connection plate (15L) are released from two said grooves (111), and then downward moving so as to get into two said side opening (112) of said first accommodating member (11), such that the first elastic member (12L1) of said second left plate (12L) is propped by the embedding block (153) of said second left connection plate (15L), the second elastic member (12R1) of said second right plate (12R) being propped by the embedding block (153) of said second right connection plate (15L), and the second position limiting block (151B) of said second main plate (151) falling into the position limiting opening (12T1) of said second top plate (12T).

5. The high-voltage connector of claim 1, wherein the

left-side surface and the right-side surface of the first insulative housing (10) are both further provided with a guide groove (102) thereon, and the position limiting structure further comprising a protrusion block (13T0) disposed between the first recess (13T1) and the second recess (13T2).

6. The high-voltage connector of claim 5, wherein the first bottom plate (13B) is provided with a left recess (10LL) and a right recess (10RR) thereon, and the left recess (10LL) and the right recess (10RR) being positioned in the left channel (10L) and the right channel (10R), respectively.

7. The high-voltage connector of claim 6, wherein the first left position limiting unit further comprises a left engaging member (14L3) confining in the left recess (10LL), and the first right position limiting unit further comprising a right engaging member (14R3) confining in the right recess (10RR).

8. The high-voltage connector of claim 5, wherein the right propping member (14R2) has a left sliding block (14R4) capable of sliding in the guide groove (102) of the right-side surface of the first insulative housing (10), and the left propping member (14L2) having a left sliding block (14L4) capable of sliding in the guide groove (102) of the left-side surface of the first insulative housing (10).

9. The high-voltage connector of claim 7, wherein the first left plate (13L) is provided with a long left opening (13L1) thereon, and a left return stop portion being formed between a front side of the first left plate (13L) and the long left opening (13L1).

10. The high-voltage connector of claim 9, wherein the first right plate (13R) is provided with a long right opening (13R1) thereon, and a right return stop portion being formed between a front side of the first right plate (13R) and the long right opening (1RL1).

11. An electrical connector assembly, comprising:

a female connector (1), comprising:

a first insulative housing (10) containing N numbers of channels (101), wherein N is a positive integer;
N numbers of first accommodating members (11), wherein each said first accommodating member (11) has a front opening and a rear opening, and being connected to the first insulative housing (10) so as to make the rear opening communicate with the channel (101);
N numbers of terminal units (12), being disposed in said N numbers of first accommodating members (11), respectively; wherein each said terminal unit (12) has a first conductive member (121), and the first conductive member (121) has a wire connecting portion positioned in the channel (101) and a first terminal contacting portion positioned in the first accommodating members (11);
a peripheral frame (13), comprising: a first top plate (13T) connected to a top surface of the first insulative housing (10), a first bottom plate (13B) connected to a bottom surface of the first insulative housing (10), a first left plate (13L), a first right plate (13R); wherein the first top plate (13T) is provided with a position limiting structure comprising a first recess (13T1) and a second recess (13T2) thereon, a left channel (10L) being encircled by the first left plate (13L), the first top plate (13T), the first bottom plate (13B), and a left-side surface of the first insulative housing (10), a right channel (10R) being encircled by the first right plate (13R), the first top plate (13T), the first bottom plate (13B), and a right-side surface of the first insulative housing (10), a receiving opening (10P) being encircled by the first top plate (13T), the first bottom plate (13B), the first left plate (13L), and the first right plate (13R), and said N numbers of terminal units (12) being positioned in the receiving opening (10P); and

a first position limiting device (14), comprising:

a first main plate (141) having at least one first position limiting block (141B) on a bottom surface thereof, wherein the first position limiting block (141B) falls into the first recess (13T1) or the second recess (13T2) in case the first main plate (141) is moved to a first position or a second position;
a first right position limiting unit, comprising a first right connection plate (14R1) that is connected with the first main plate (141) and a right propping member (14R2) positioned in the right channel (10R); and
a first left position limiting unit, comprising a first left connection plate (14L1) that is connected with the first main plate (141) and a left propping member (14L2) positioned in the left channel (10L); and

a male connector (2), comprising:

a second insulative housing (20);
N numbers of second accommodating members (21) connected to the second insulative housing (20), wherein each said

second accommodating member (21) has a front opening;

N numbers of second conductive members (221), being disposed in said N numbers of second accommodating members (21), respectively; wherein each said second conductive member (221) has a second terminal contacting portion positioned in the second accommodating members (21) and a plugging portion protruded out of a bottom surface of the second insulative housing (20);

a second left position limiting unit, comprising a left arm (2L1) extended from a left-side surface of the second insulative housing (20) and a left position limiting member (2L2) connected to the left extension arm (2L1); and

a second right position limiting unit, comprising a right arm (2R1) extended from a right-side surface of the second insulative housing (20) and a right position limiting member (2R2) connected to the right extension arm (2R1);

wherein after the male connector (2) is connected to the female connector (1), said N numbers of second accommodating members (21) being received in the receiving opening (10P) of the female connector (1), and said N numbers of first accommodating members (11) of the female connector (1) being inserted into said N numbers of second accommodating members (21) of the male connector (2), respectively, such that each said first terminal contacting portion contacts with each said second terminal contacting portion contacts, thereby making each said first conductive member (121) be electrically connected to each said second conductive member (221);

wherein after said N numbers of second accommodating members (21) are received in the receiving opening (10P) of the female connector (1), the left position limiting member (2L2) being stayed in the left channel (10L) so as to be propped by the left propping member (14L2), and the right position limiting member (2R2) being stayed in the right channel (10R) so as to be propped by the right propping member (14R2).

12. The electrical connector assembly of claim 11, wherein two sides of each said first accommodating member (11) are both provided with a groove (111) and a side opening (112) thereon, and a top opening (113) being formed on a top side of said first accommodating members (11).

13. The electrical connector assembly of claim 12, wherein each said terminal unit (12) further has a shielding frame consisting of a second top plate (12T), a second bottom plate (12B), a second left plate (12L), and a second right plate (12R); wherein the second top plate (12T) is provided with at least one position limiting opening (12T1) thereon, the second left plate (12L) having a first elastic member (12L1), the second right plate (12R) having a second elastic member (12R1), a second receiving opening (12P) being encircled by the second top plate (12T), the second bottom plate (12B), the second left plate (13L), and the second right plate (13R), and there being a stopping member (122S) disposed at an edge of the second receiving opening (12P).

14. The electrical connector assembly of claim 13, wherein the female connector (1) further comprises:

N numbers of second position limiting devices (15), being connected to said N numbers of first accommodating members (11), respectively; wherein each said second position limiting device (15) comprises:

a second main plate (151) having at least one second position limiting block (151B) on a bottom surface thereof;

a second right connection plate (15R), being connected with the second main plate (151), and being provided with an embedding block (153) and a propping block (154) on a surface thereof; and

a second left connection plate (15L), being connected with the second main plate (151), and being also provided with one said embedding block (153) and one said propping block (154) on a surface thereof;

wherein the embedding block (153) of said second right connection plate (15R) and the embedding block (153) of said second left connection plate (15L) are embedded in two said groove (111) of said first accommodating member (11) in an initial state;

wherein after the second main plate (151) is pressed down, the embedding block (153) of said second right connection plate (15R) and the embedding block (153) of said second left connection plate (15L) are released from two said grooves (111), and then downward moving so as to get into two said side opening (112) of said first accommodating member (11), such that the first elastic member (12L1) of said second left plate (12L) is propped by the embedding block (153) of said second left connection plate (15L), the second elastic member (12R1) of said second right plate (12R) being propped by the

embedding block (153) of said second right connection plate (15L), and the second position limiting block (151B) of said second main plate (151) falling into the position limiting opening (12T1) of said second top plate (12T).

15. The electrical connector assembly of claim 11, wherein the left-side surface and the right-side surface of the first insulative housing (10) are both further provided with a guide groove (102) thereon, and the position limiting structure further comprising a protrusion block (13T0) disposed between the first recess (13T1) and the second recess (13T2).

16. The electrical connector assembly of claim 15, wherein the first bottom plate (13B) is provided with a left recess (10LL) and a right recess (10RR) thereon, and the left recess (10LL) and the right recess (10RR) being positioned in the left channel (10L) and the right channel (10R), respectively.

17. The electrical connector assembly of claim 16, wherein the first left position limiting unit further comprises a left engaging member (14L3) confining in the left recess (10LL), and the first right position limiting unit further comprising a right engaging member (14R3) confining in the right recess (10RR).

18. The electrical connector assembly of claim 15, wherein the right propping member (14R2) has a left sliding block (14R4) capable of sliding in the guide groove (102) of the right-side surface of the first insulative housing (10), and the left propping member (14L2) having a left sliding block (14L4) capable of sliding in the guide groove (102) of the left-side surface of the first insulative housing (10).

19. The electrical connector assembly of claim 17, wherein the first left plate (13L) is provided with a long left opening (13L1) thereon, and a left return stop portion being formed between a front side of the first left plate (13L) and the long left opening (13L1), such that a bottom of the left position limiting member (2L2) is engaged by the left return stop portion, thereby preventing the left position limiting member (2L2) from returning.

20. The electrical connector assemblY of claim 19, wherein the first right plate (13R) is provided with a long right opening (13R1) thereon, and a right return stop portion being formed between a front side of the first right plate (13R) and the long right opening (1RL1), such that a bottom of the right position limiting member (2R2) is engaged by the right return stop portion, thereby preventing the right position limiting member (2R2) from returning.

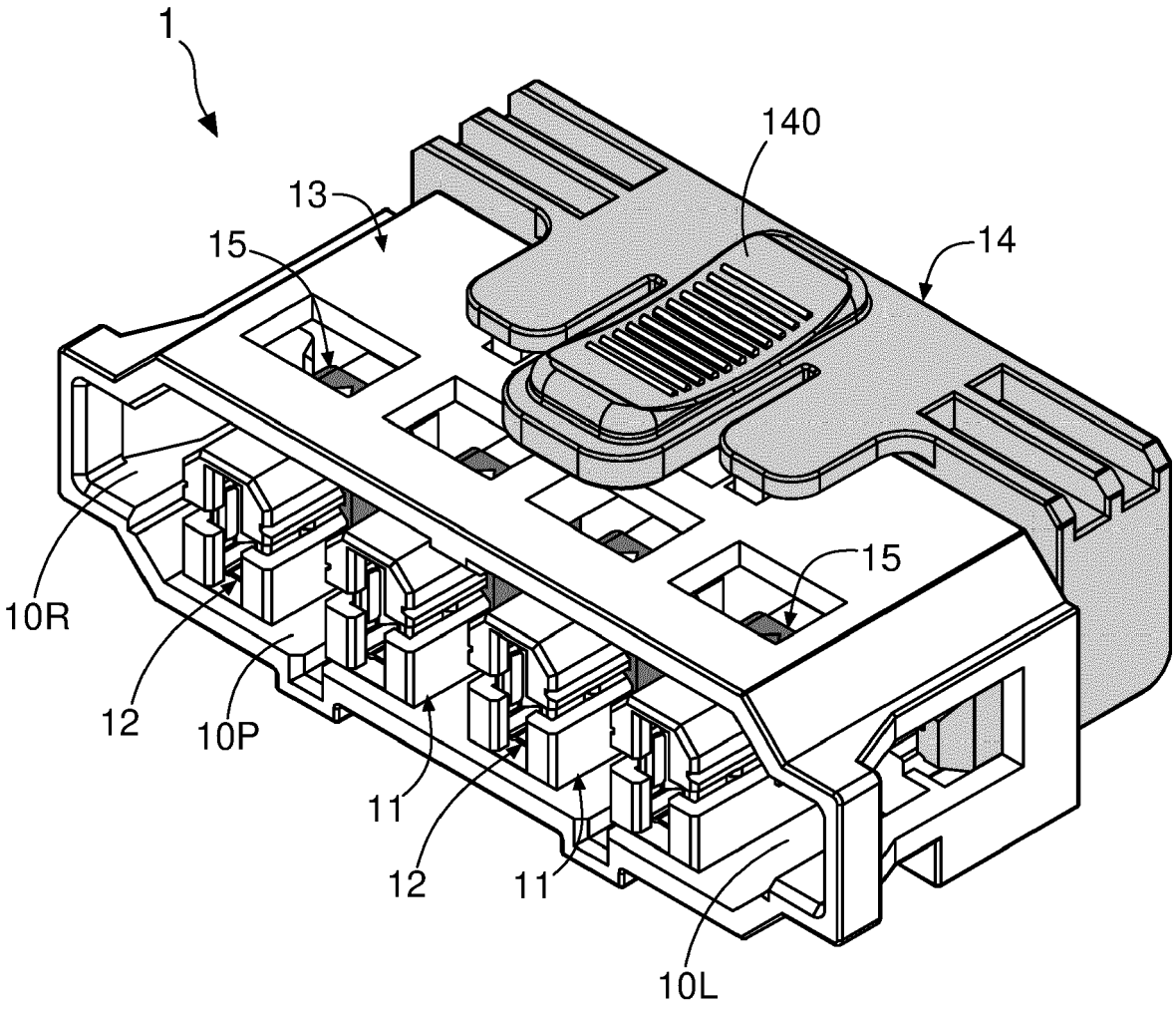


FIG. 1A

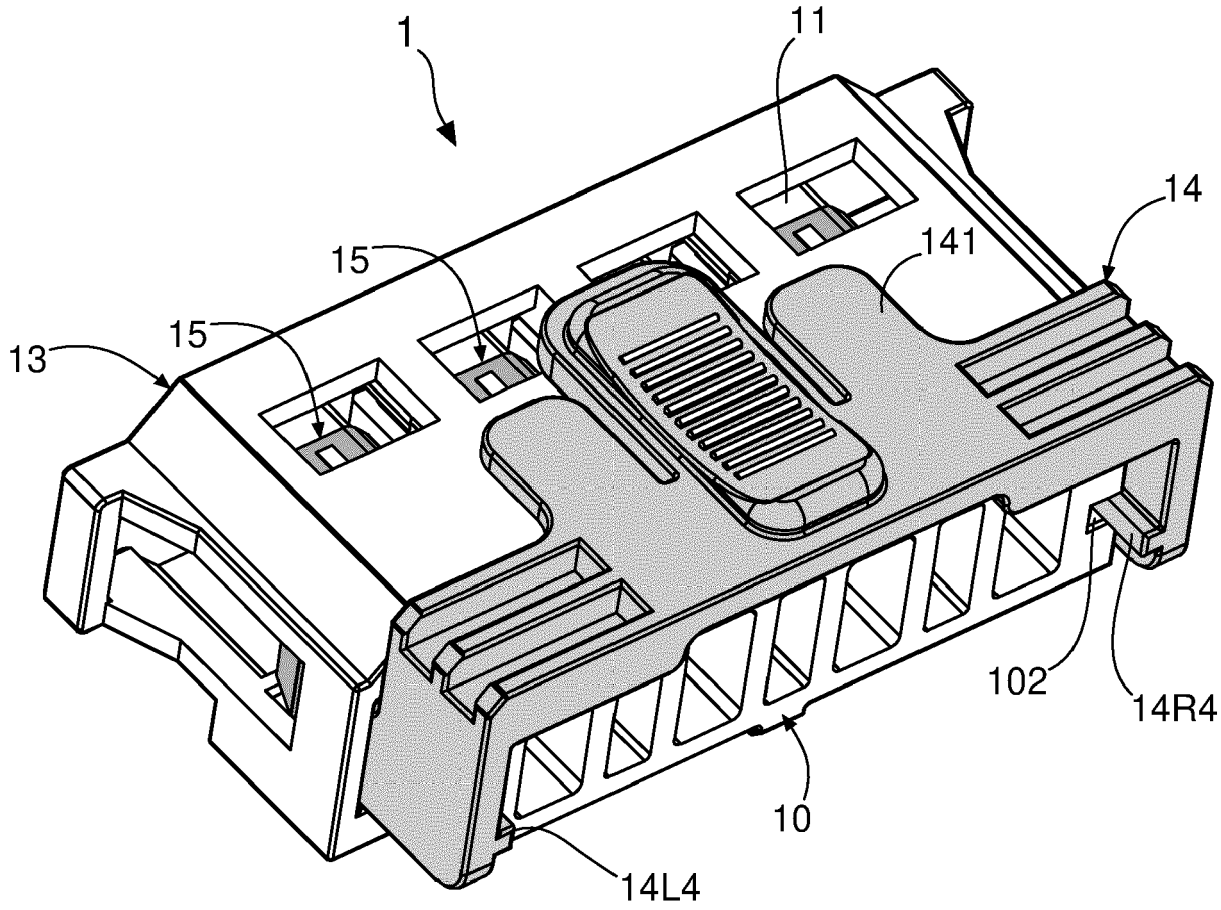


FIG. 1B

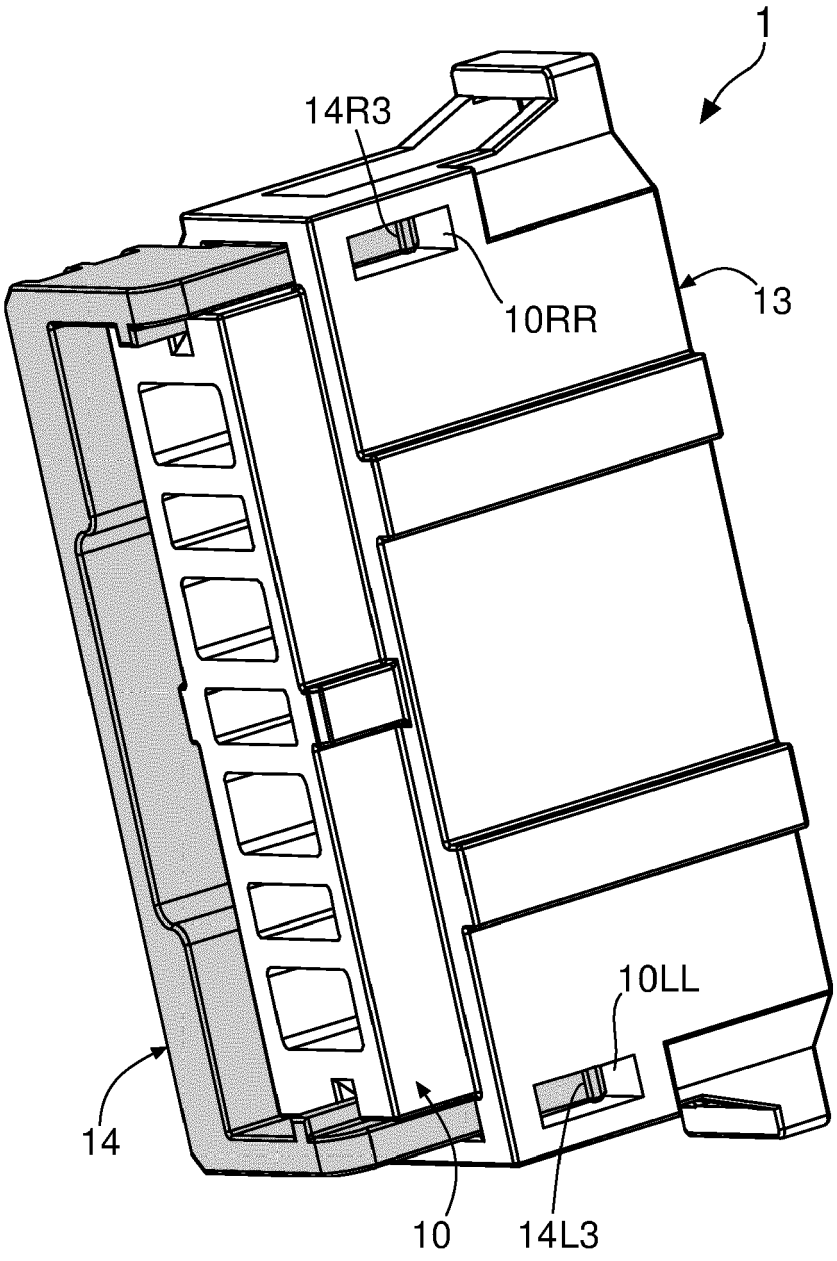
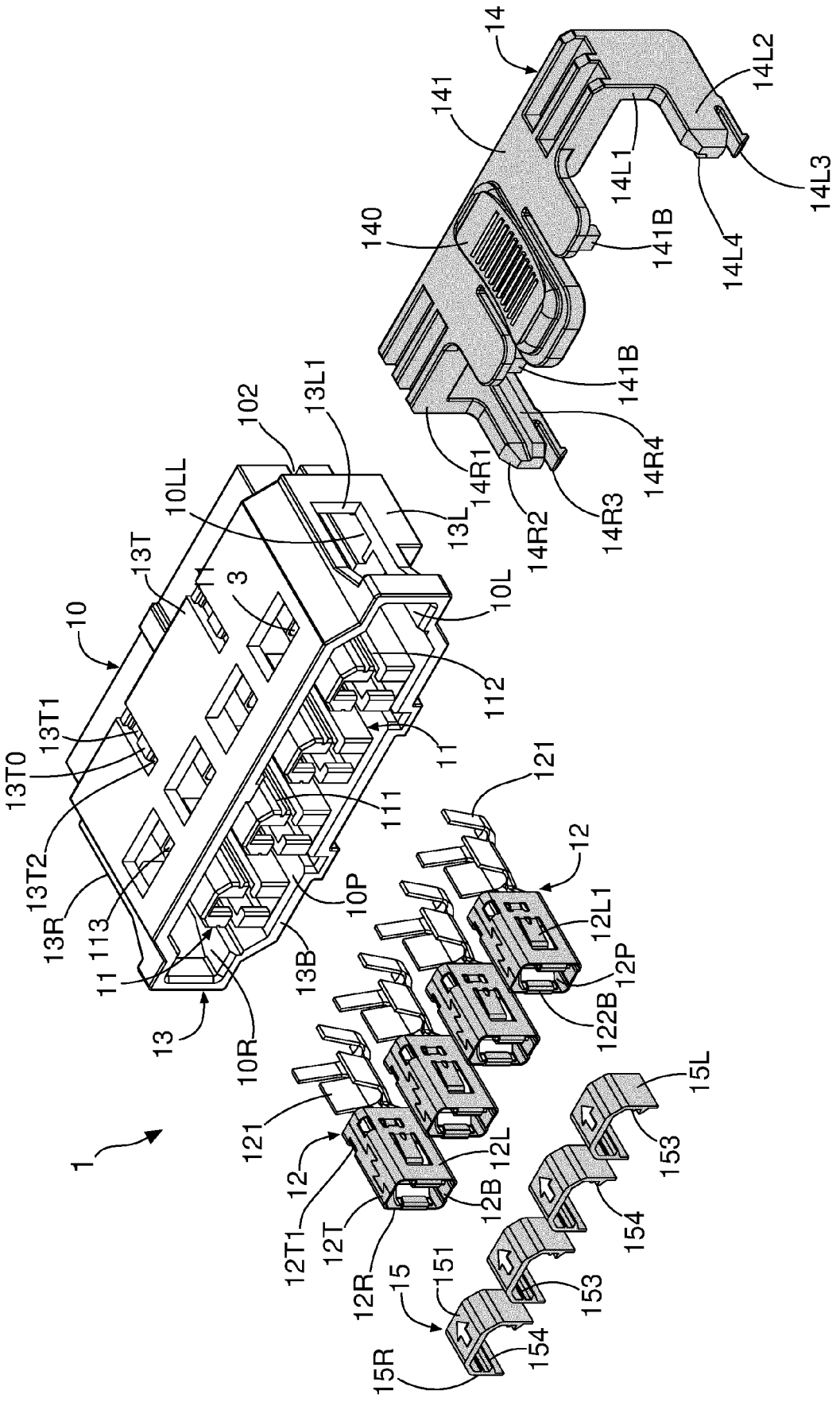


FIG. 1C


1
10
102
10LL
13T
13T0
13T1
13T2
13R
13
13L1
13L
13B
10P
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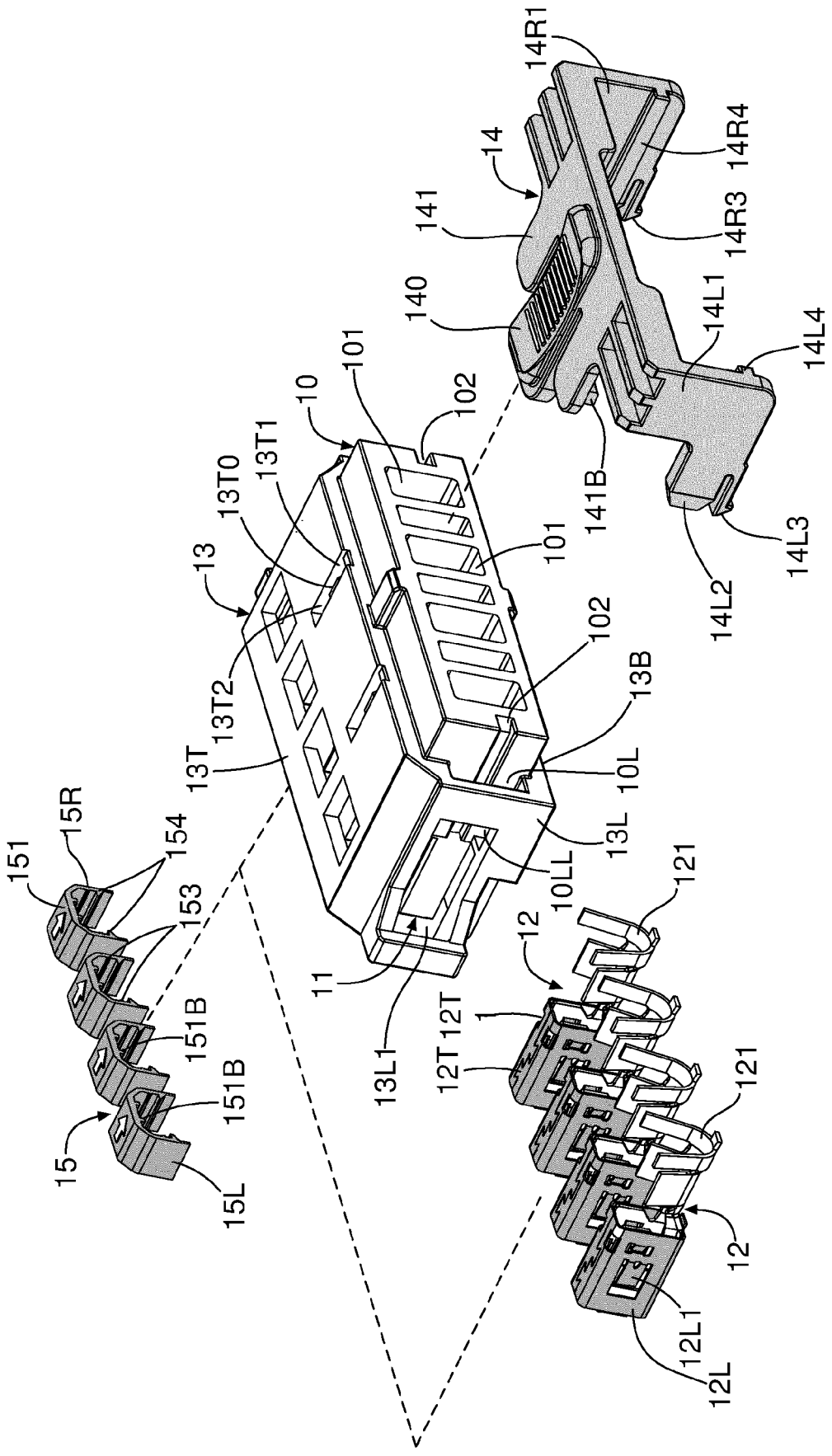
10L
11
111
112
113
3
14
140
141
141B
14L1
14L2
14L3
14L4
14R1
14R2
14R3
14R4
12
121
12L
12L1
12P
122B
12B
12T
12T1
12R
15
15L
15R
151
153
154

FIG. 2A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14R4
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14R3
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14L1
14L4
101
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141B
14L3
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102
13T2
13B
13T
10L
13L
10LL
121
151
15R
154
153
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151B
15
12
15L
12L1
12L

FIG. 2B

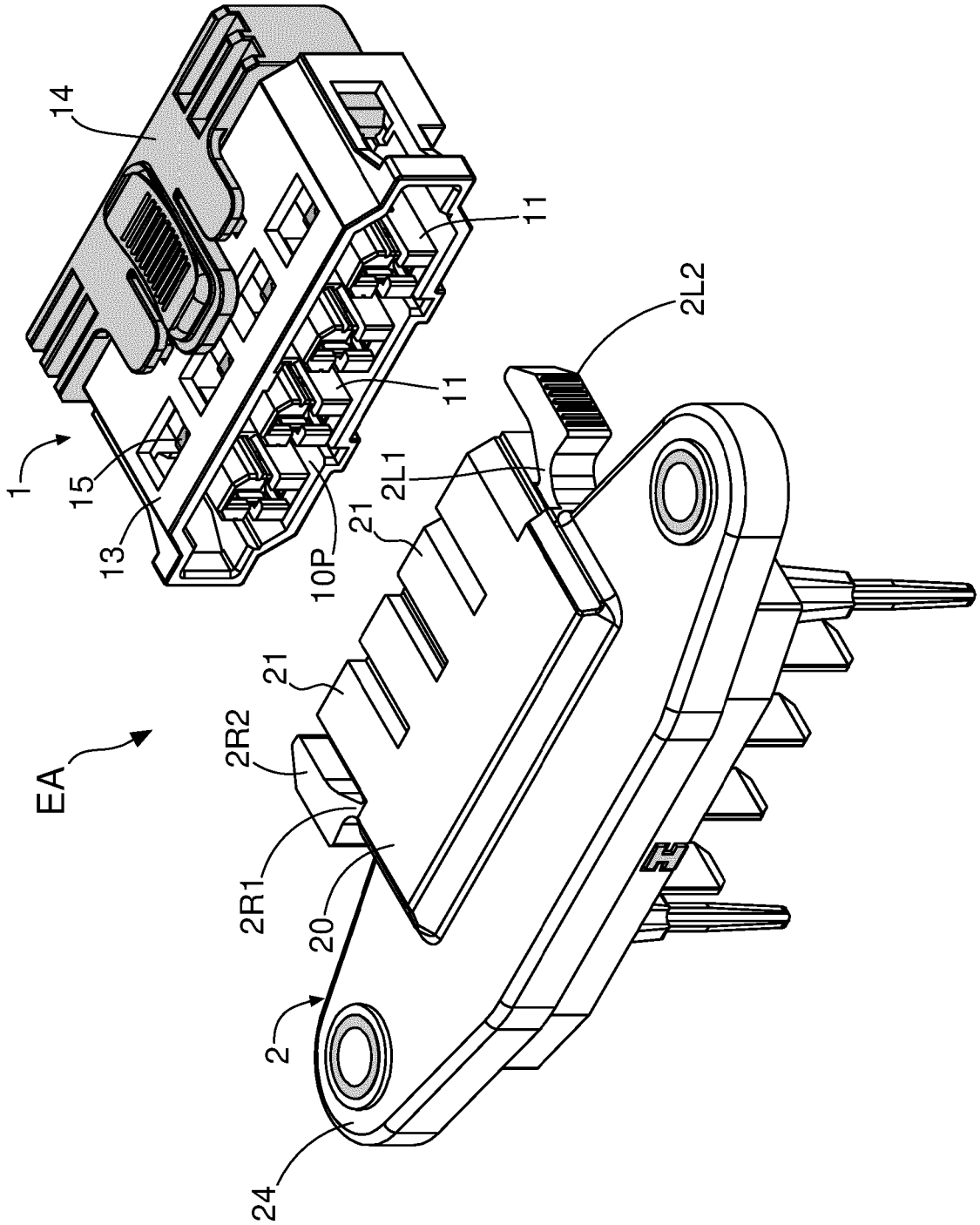

FIG. 3A

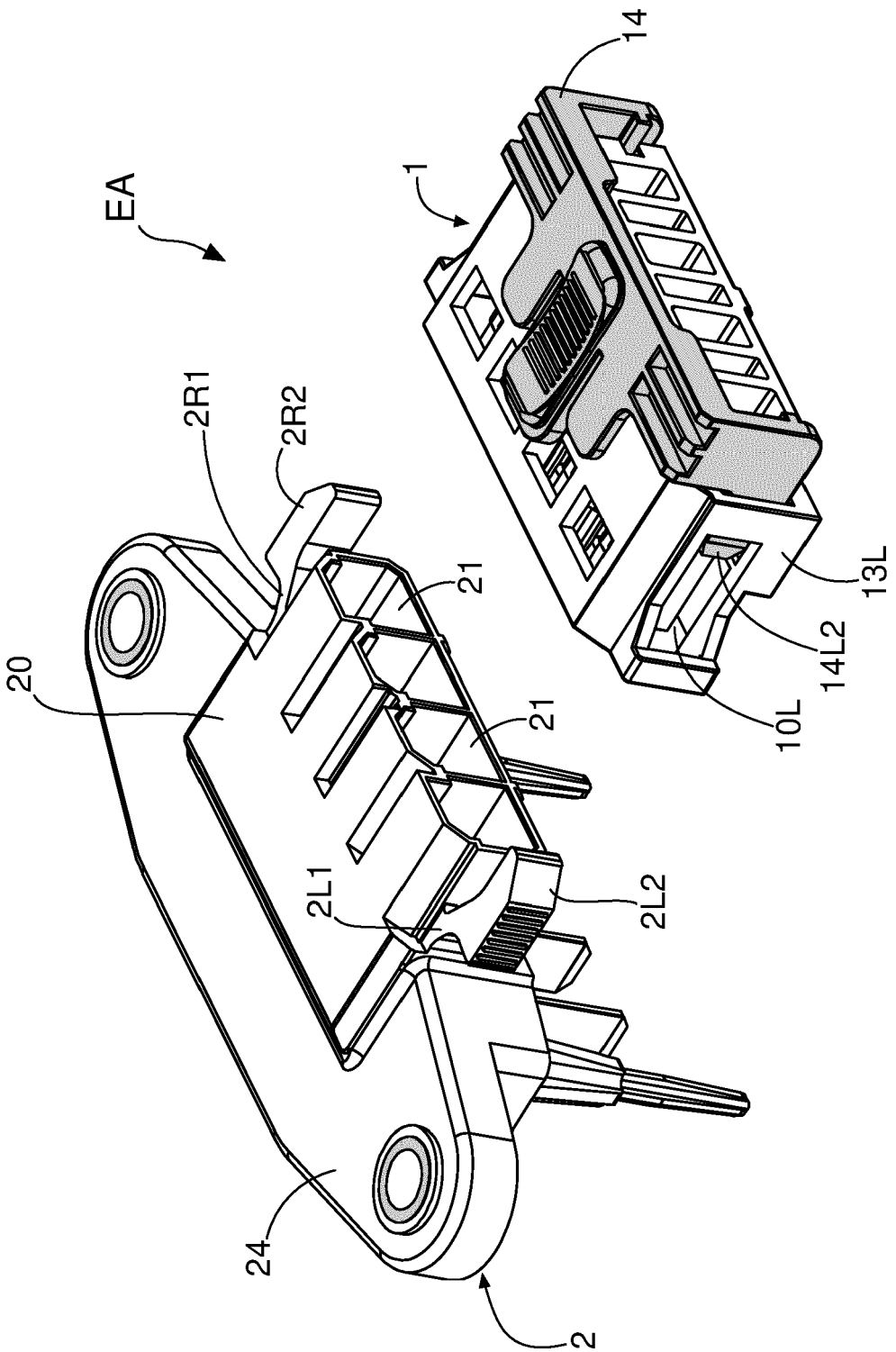

FIG. 3B

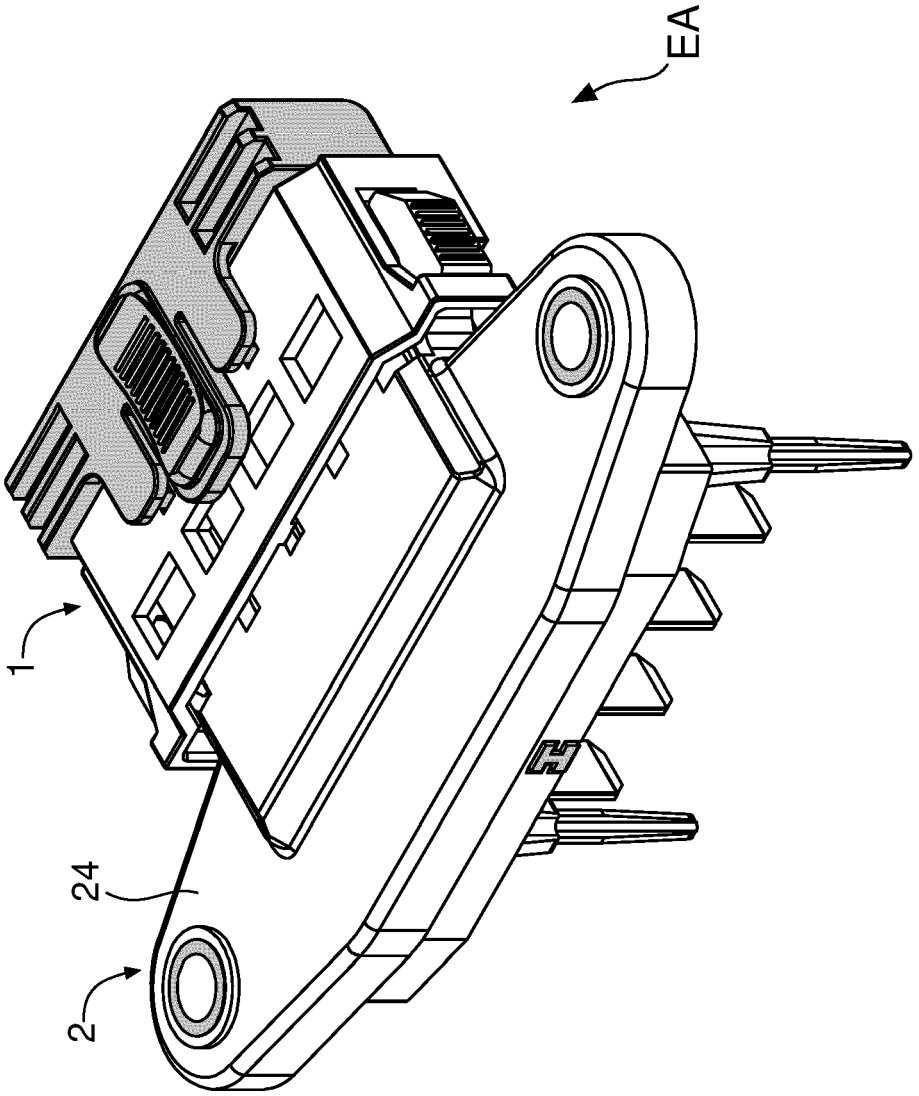

FIG. 3C

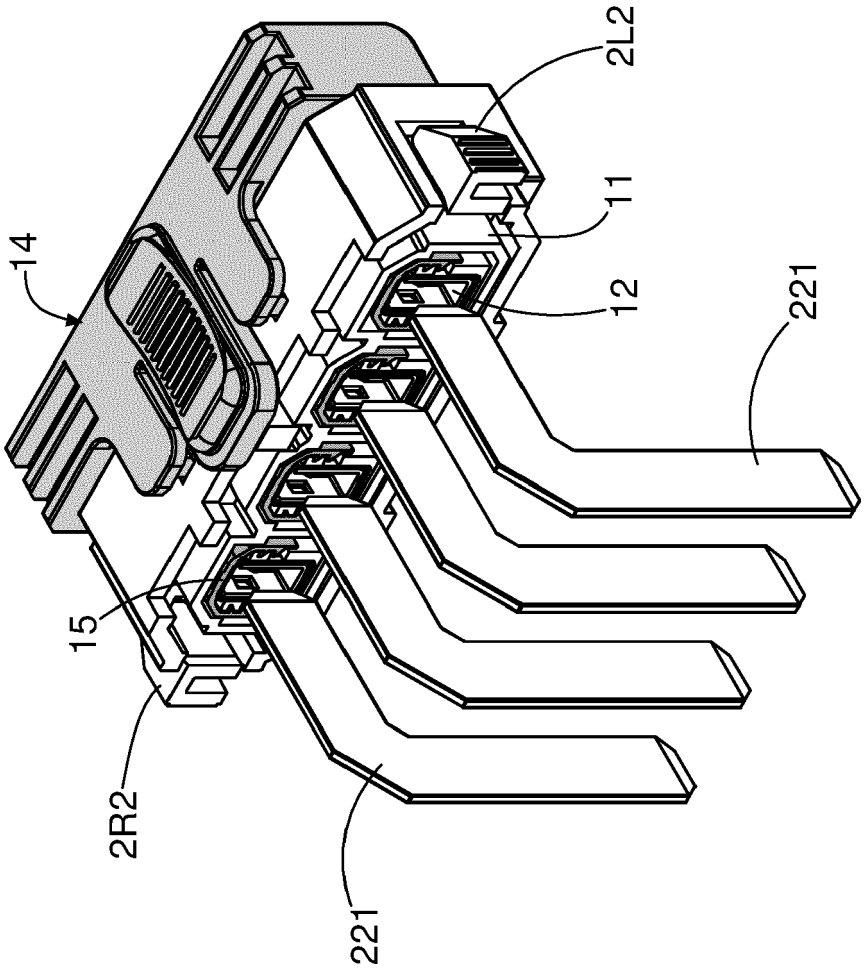

FIG. 4

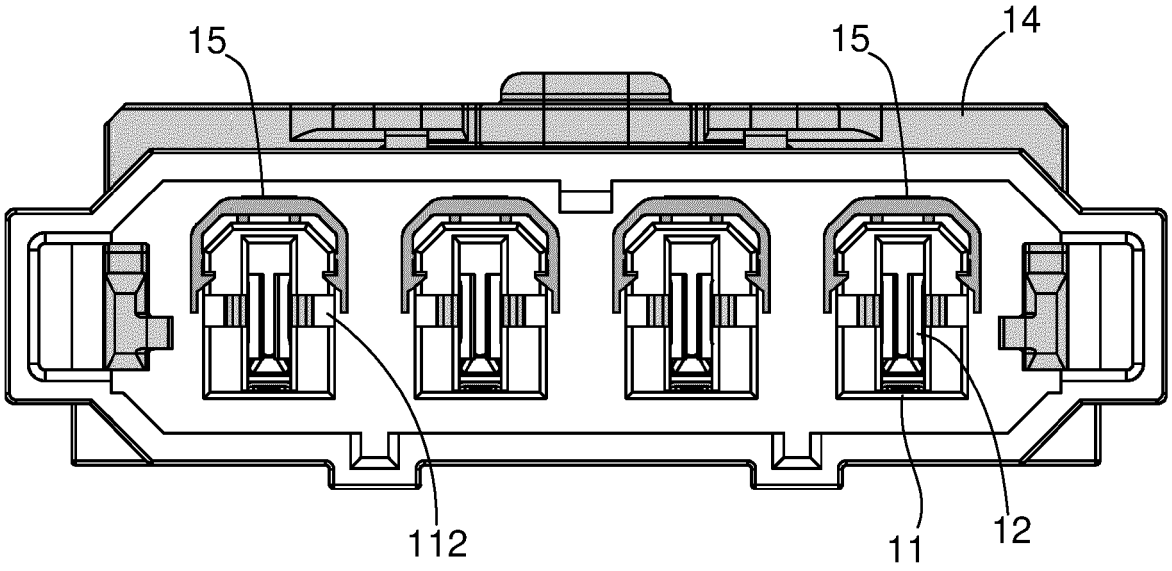

FIG. 5A

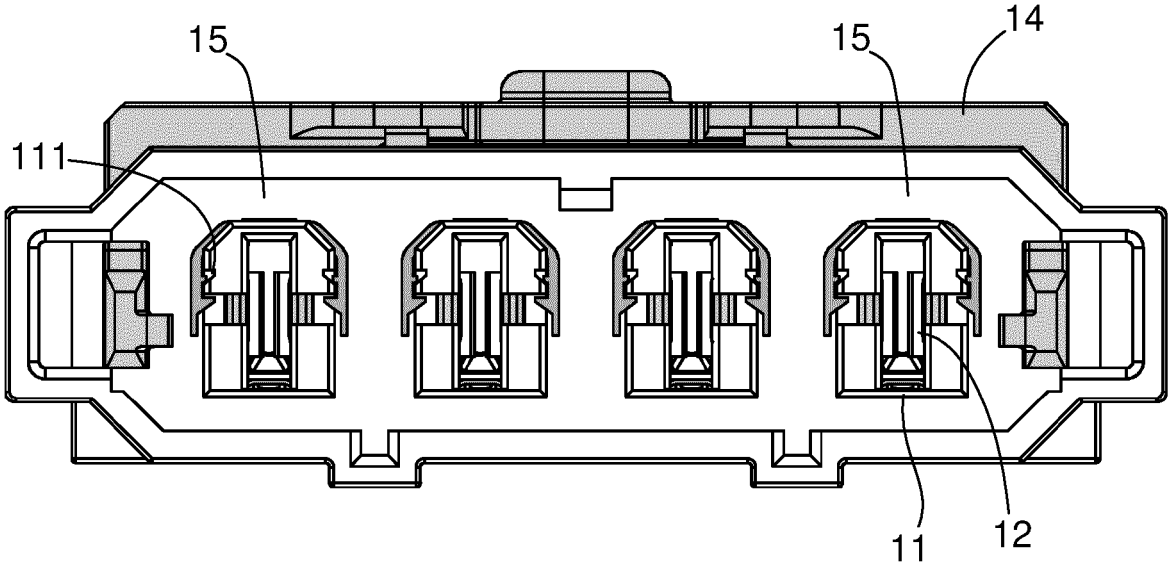

FIG. 5B

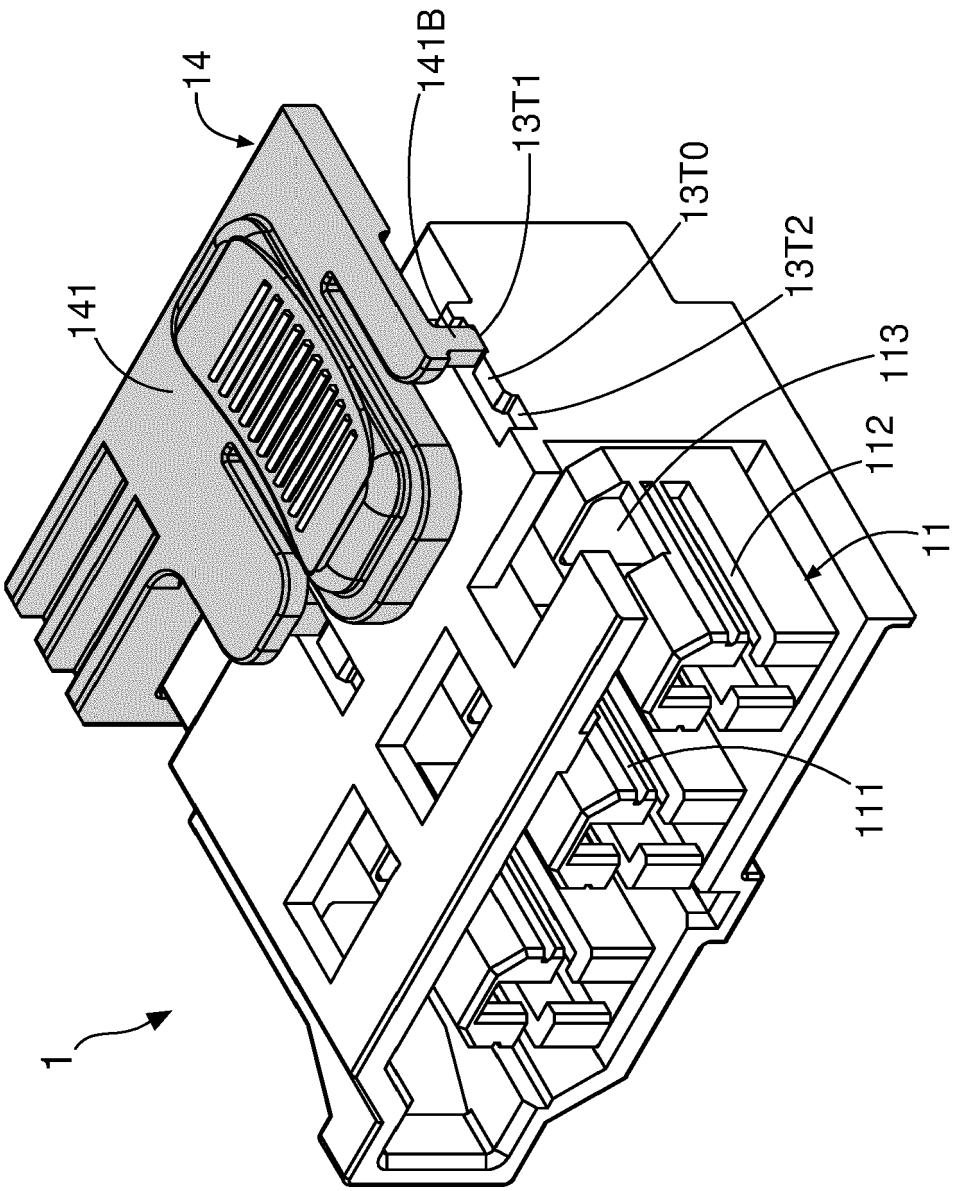

FIG. 6A

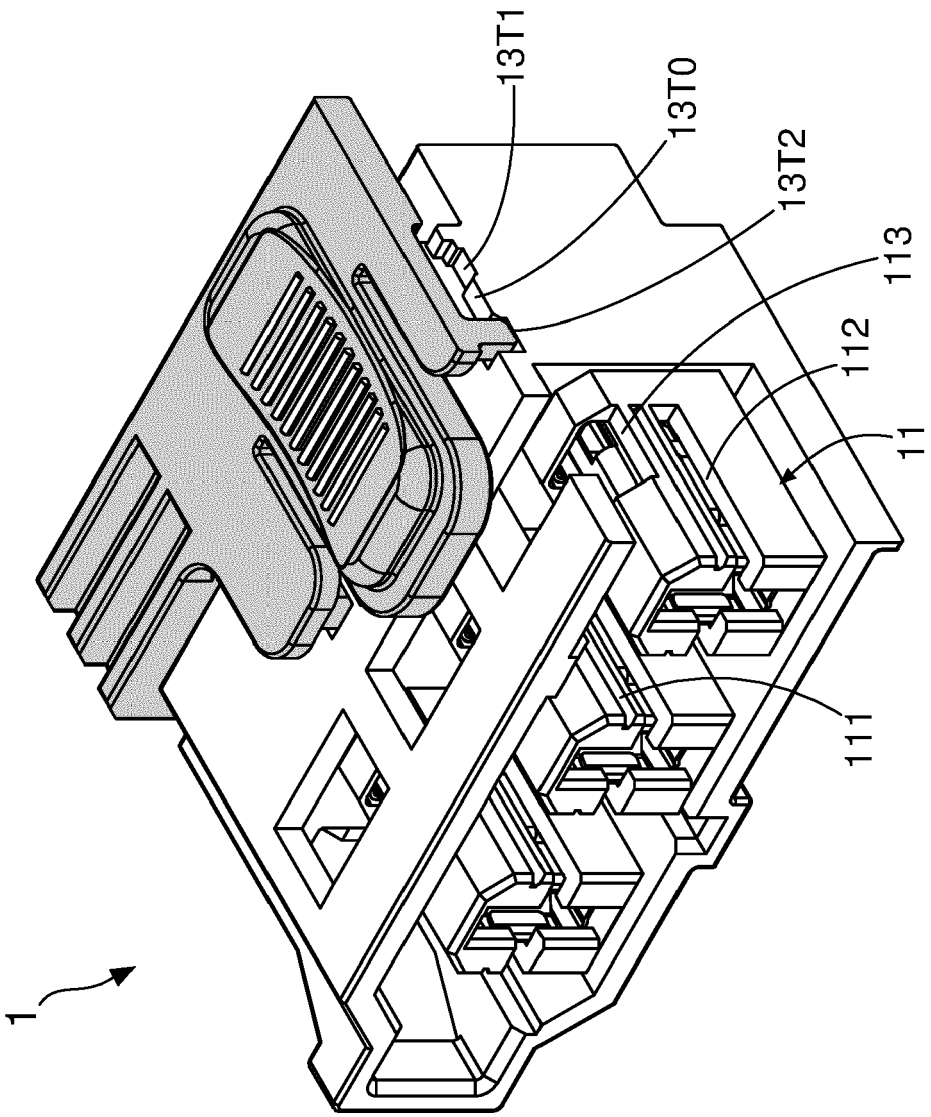

FIG. 6B

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 2744

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 3 766 140 A1 (FCI USA LLC [US]) 20 January 2021 (2021-01-20) * the whole document *	1,11	INV. H01R13/627 H01R13/639
A,D	TW 201 818 615 A (MOLEX LLC [US]) 16 May 2018 (2018-05-16) * the whole document *	1,11	
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TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 October 2022	Corrales, Daniel

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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27-10-2022

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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