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Meng et al.

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(54) **BOARD-TO-BOARD CONNECTOR ASSEMBLY WITH METAL MEMBERS ALLOWING LARGER CURRENT TRANSMISSION**

(71) Applicant: **Advanced Connectek Inc.**, New Taipei (TW)

(72) Inventors: **Ta-Teh Meng**, New Taipei (TW); **Mei Shi**, New Taipei (TW); **Ya-Ping Liang**, New Taipei (TW); **Ping Shi**, New Taipei (TW); **Meng Liu**, New Taipei (TW); **Man Ge**, New Taipei (TW); **Hao Xie**, New Taipei (TW)

(73) Assignee: **Advanced Connectek Inc.**, New Taipei (TW)

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(58) **Field of Classification Search**
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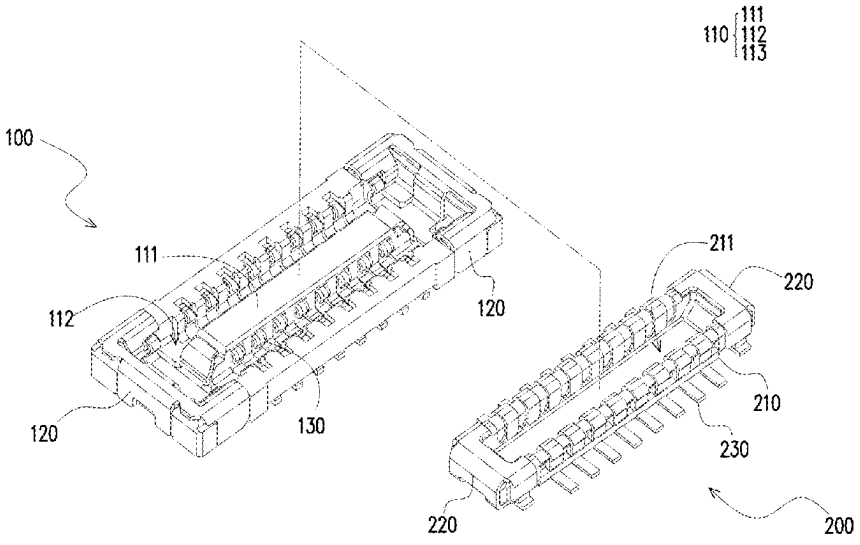
Primary Examiner — Justin M Kratt
(74) *Attorney, Agent, or Firm* — JCIPRNET

(57) **ABSTRACT**

A board-to-board connector assembly includes a receptacle connector and a plug connector mated with each other. The receptacle connector includes a first body, first terminals and a pair of first metal members. The first body includes an island structure and a first receiving slot surrounding the island structure. The first terminals are respectively disposed on a first side and a second side of the first receiving slot, the first and second sides being opposite to each other. The first metal members are respectively disposed on a third side and a fourth side of the first receiving slot, the third and fourth sides being opposite to each other. The first metal member includes a base extending to a bottom on the third side or a bottom on the fourth side, and a pair of first elastic arms extending from the base and facing away from each other.

18 Claims, 7 Drawing Sheets



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H01R 12/51	(2011.01)
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H01R 12/73	(2011.01)
H01R 13/53	(2006.01)
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(52) **U.S. Cl.**

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(58) **Field of Classification Search**

CPC H01R 12/7005; H01R 12/707; H01R 12/712; H01R 12/73; H01R 13/53; H01R 24/00

See application file for complete search history.

10 { 100, 200 } 100 { 110, 120, 130 } 200 { 210, 220, 230 }

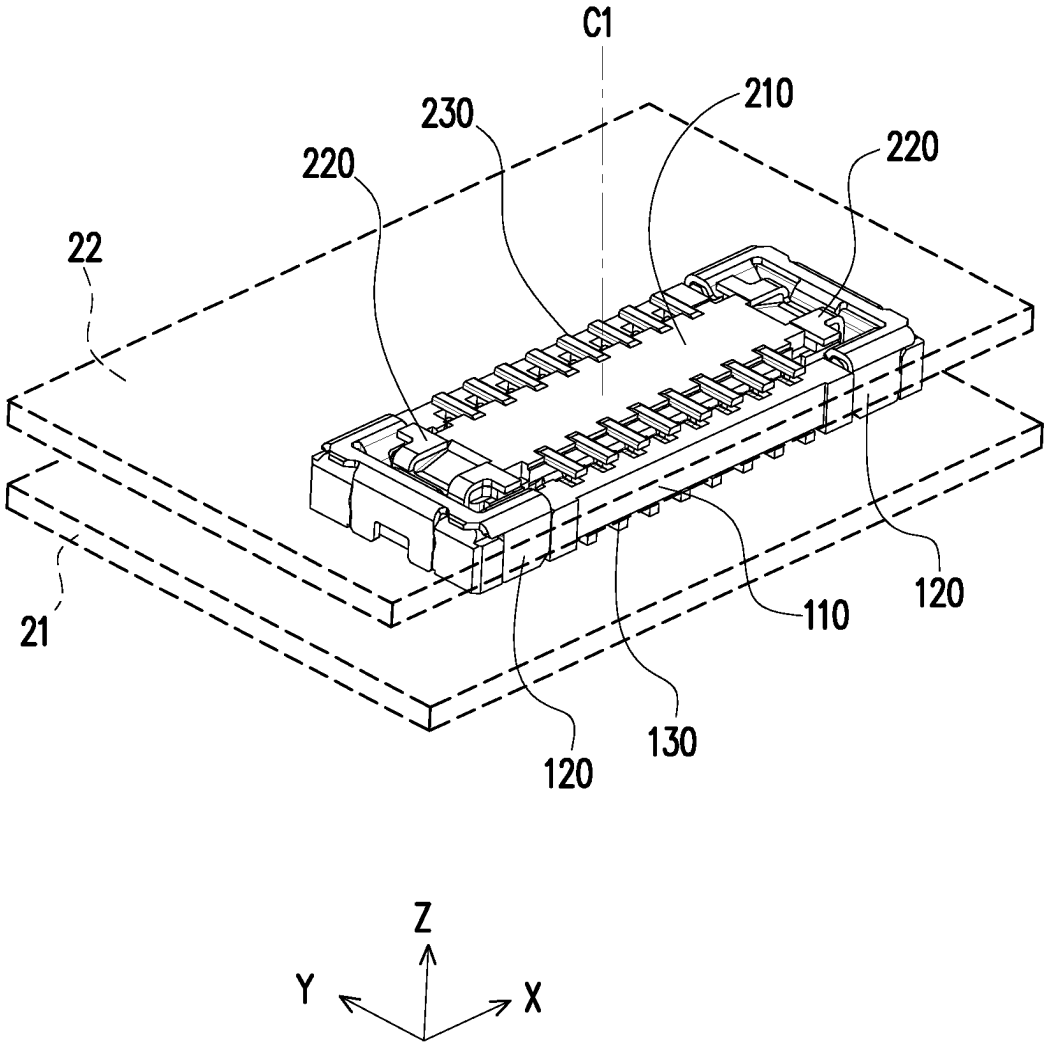

FIG. 1

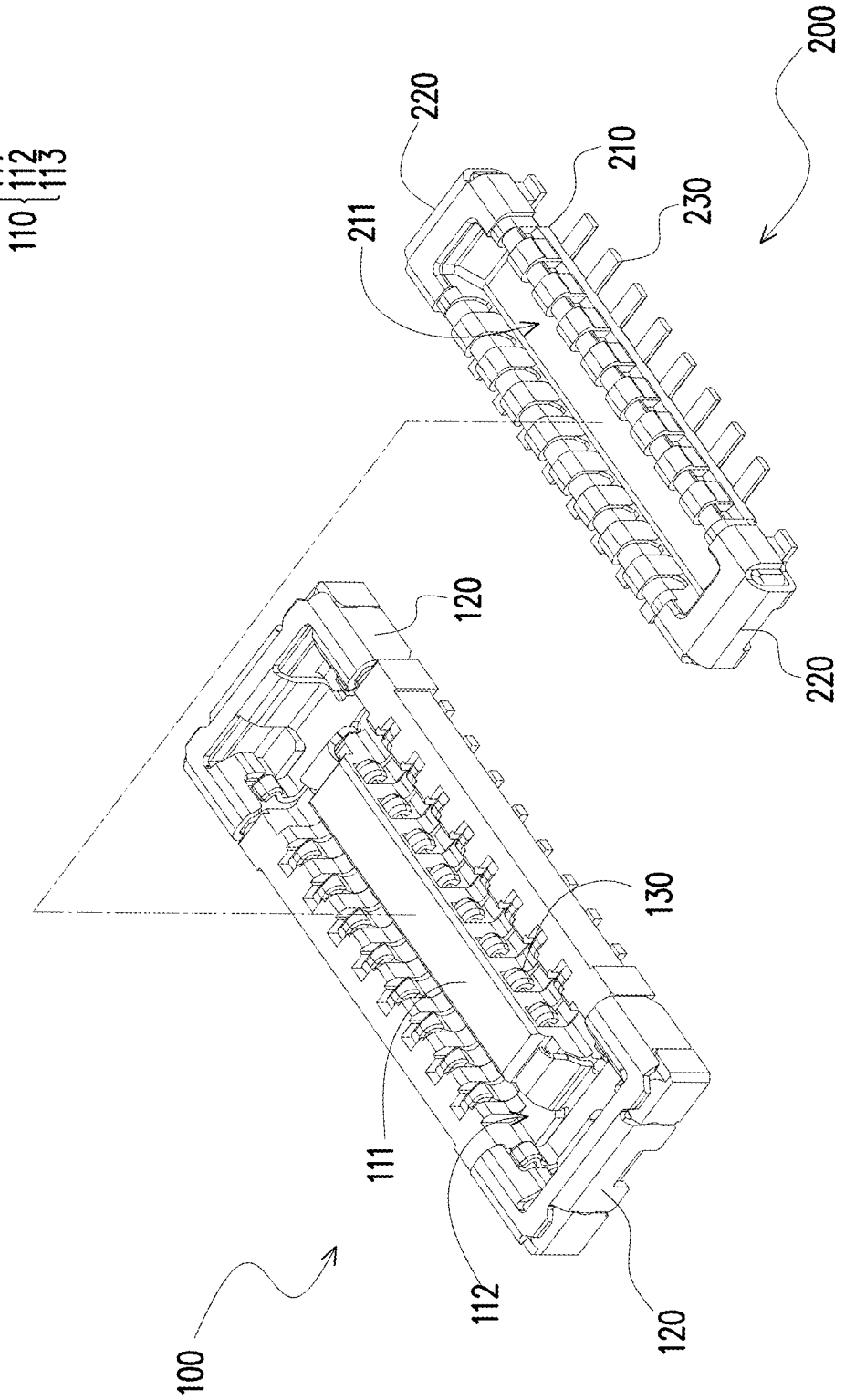

FIG. 2

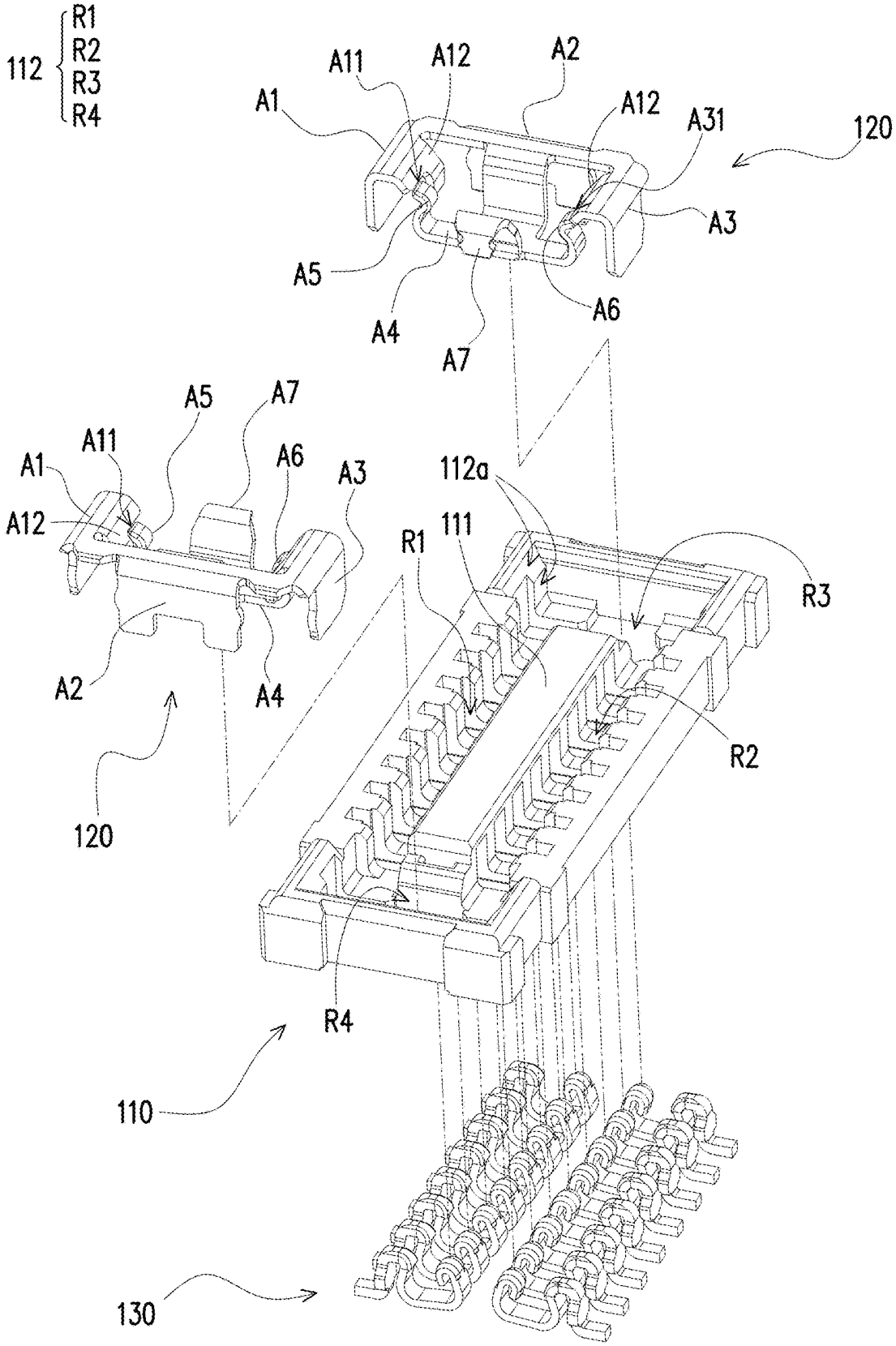
112
R1
R2
R3
R4
A11
A12
A2
A1
A12
A31
120
A3
A5
A6
A4
A7
A5
A7
A11
A1
A6
A3
112a
A12
111
R1
R3
A2
A4
R2
120
R4
110
130

FIG. 3

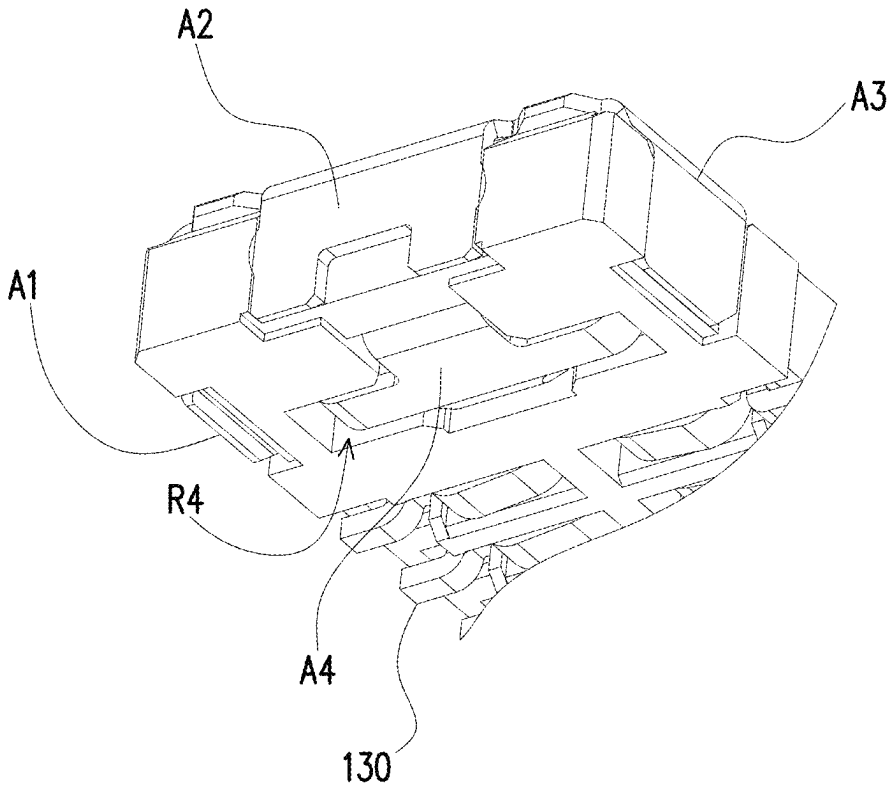

FIG. 4

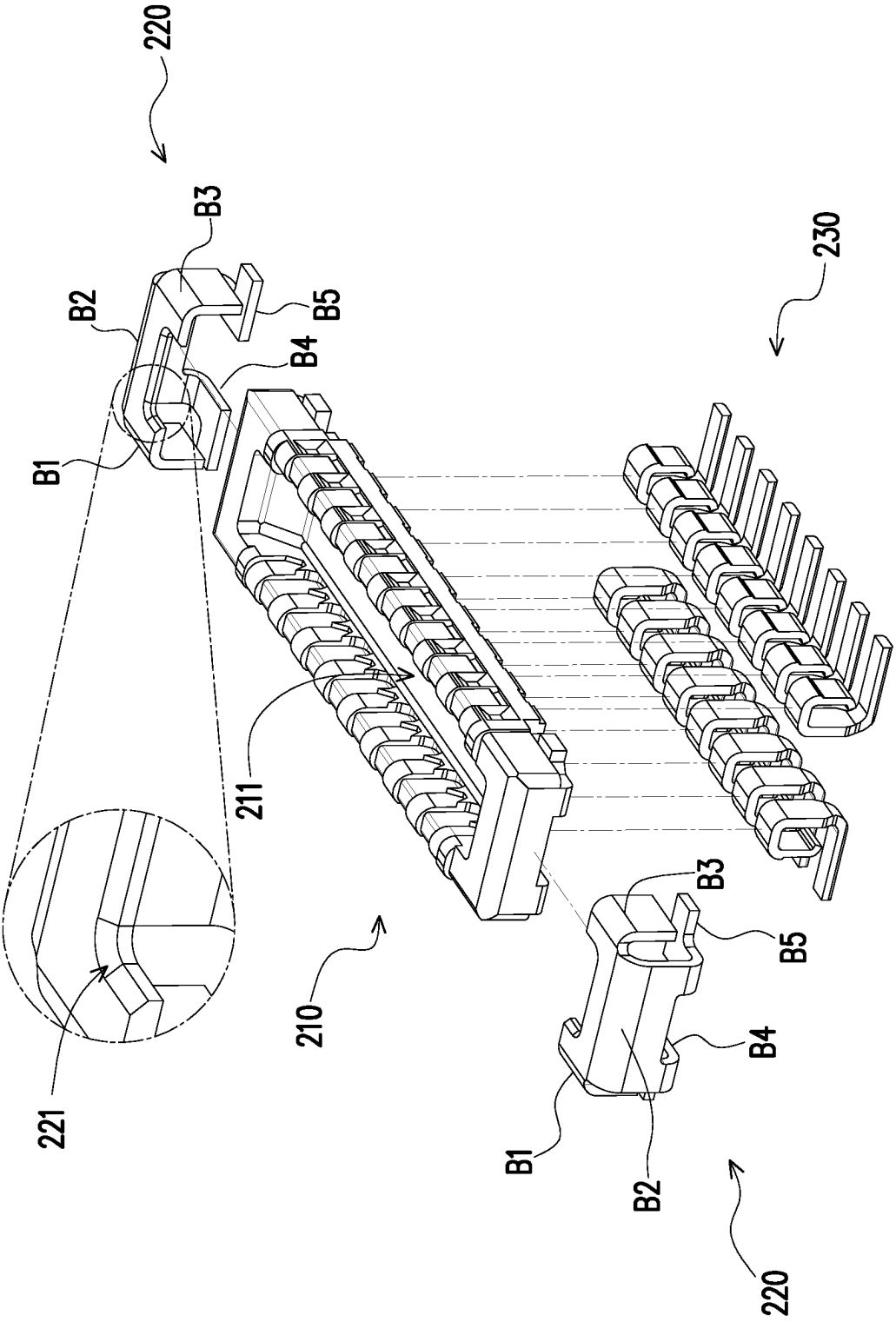

FIG. 5

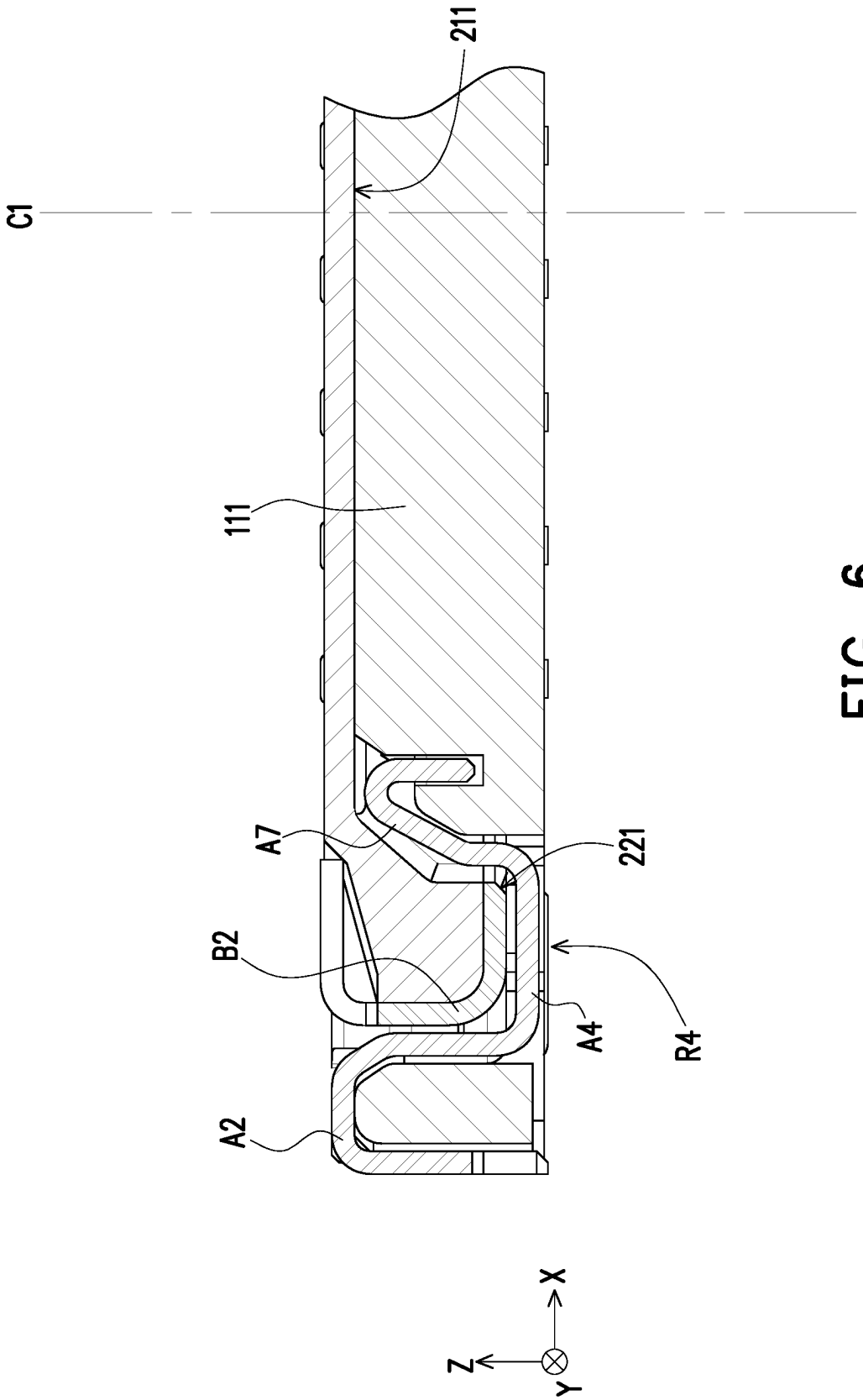

FIG. 6

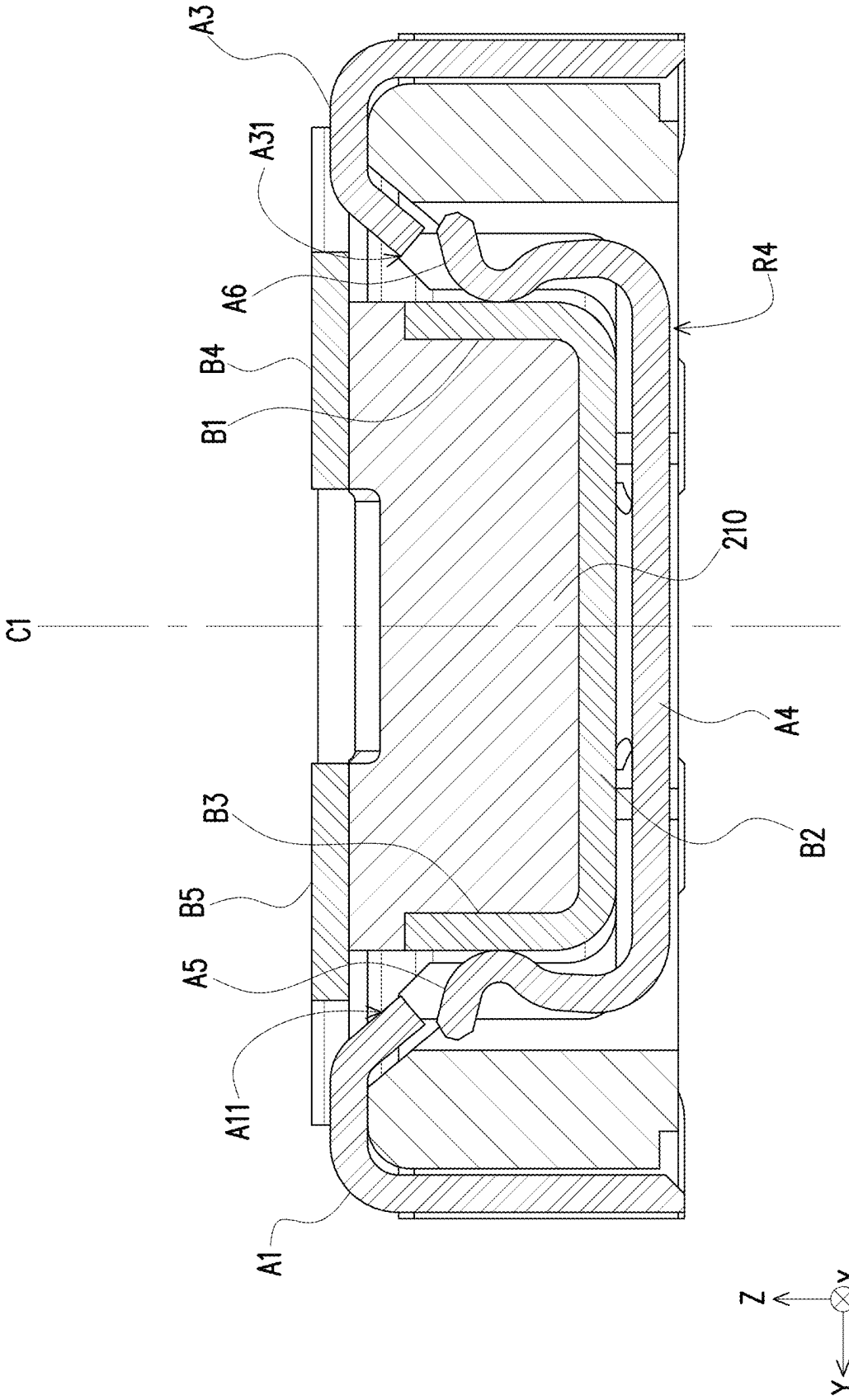

FIG. 7

BOARD-TO-BOARD CONNECTOR ASSEMBLY WITH METAL MEMBERS ALLOWING LARGER CURRENT TRANSMISSION

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of China application serial no. 202110728194.7, filed on Jun. 29, 2021. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND

Technical Field

The disclosure relates to a connector assembly, and more particularly, to a board-to-board connector assembly.

Description of Related Art

A board-to-board connector is used to connect different circuit boards, and has a receptacle connector and a plug connector to be respectively mounted on different circuit boards, thereby connecting the circuit boards to each other. In mobile devices such as smartphones, the board-to-board connector assembly is very small in size, which reduces the structural strength and lifespan of each connector.

Furthermore, the above-mentioned reduction in structural strength is also reflected in the plugging and unplugging operations of the male terminal (plug) and the female terminal (receptacle); that is, part of the structure is damaged due to structural interference during the process of pulling the male terminal and the female terminal away from each other due to the reduction in strength or terminal elasticity.

Accordingly, how to improve the structural strength of the board-to-board connector so as to maintain and withstand the plugging and unplugging actions of the male and female terminals is a problem that the people skilled in the art need to consider and solve.

SUMMARY

The disclosure provides a board-to-board connector assembly, including a receptacle connector and a plug connector mated with each other. The receptacle connector includes a first body, a plurality of first terminals and a pair of first metal members. The first body includes an island structure and a first receiving slot surrounding the island structure. The first terminals are respectively disposed on a first side and a second side of the first receiving slot, and the first side and the second side are opposite to each other. The first metal members are respectively disposed on a third side and a fourth side of the first receiving slot, and the third side and the fourth side are opposite to each other. The first metal member includes a base extending to a bottom on the third side or a bottom on the fourth side, and a pair of first elastic arms extending from the base and facing away from each other.

Preferably, the first elastic arms and a part of the first terminals are aligned collinearly.

Preferably, the first elastic arms are power terminals of the receptacle connector.

Preferably, the first metal member includes three saddles disposed on a periphery of the first body. The three saddles are adjacent to each other and disposed in a U shape. The saddle located in the middle extends out of the base. Each of the saddles contacts three different surfaces of the first body.

Preferably, the first metal member includes three saddles disposed on a periphery of the first body. The three saddles are adjacent to each other and disposed in a U shape. The first elastic arms respectively face an inward inclination of each of the saddles located at the first and last positions.

Preferably, the first metal member further includes a second elastic arm extending from the base to the island structure, and the second elastic arm is located between the first elastic arms.

Preferably, the first receiving slot is a through hole on the third side and the fourth side, and the base is exposed from a bottom surface of the first body through the through hole.

Preferably, the plug connector includes a second body, a plurality of second terminals, and a pair of second metal members. The second body includes a second receiving slot. The second terminals are respectively disposed on two opposite sides of the second body. The second metal members are disposed on another two opposite sides of the second body. When the plug connector is mated with the receptacle connector, the second body is inserted into the first receiving slot, and the island structure is inserted into the second receiving slot, and the first metal members abut the second metal members through the first elastic arms.

Preferably, the second metal members cover five different surfaces of the second body.

Preferably, the second metal member further includes a slope, so that when the plug connector is mated with the receptacle connector, the slope abuts and guides a second elastic arm of the first metal member.

Based on the above, the board-to-board connector assembly includes a plug connector and a receptacle connector that are mated with each other. In addition to being combined to opposite sides of the first body, the pair of first metal members of the receptacle connector further include the base extending to the bottom of the receiving slot of the first body and the first elastic arms extending from the base and facing away from each other. Accordingly, the first elastic arm can further serve as a structure for electrical connection with the plug connector, so as to improve the electrical contact area between components of the board-to-board connector assembly, which is adapted to carry out a larger current transmission operation with better structural stability.

To make the aforementioned more comprehensible, several embodiments accompanied with drawings are described in detail as follows.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawings are included to provide a further understanding of the disclosure, and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the disclosure and, together with the description, serve to explain the principles of the disclosure.

FIG. **1** is a schematic view of a board-to-board connector assembly according to an embodiment of the disclosure.

FIG. **2** is an exploded view of the board-to-board connector assembly of FIG. **1**.

FIG. **3** is an exploded view of the receptacle connector of FIG. **2**.

FIG. **4** is a partial schematic view of the receptacle connector of FIG. **2** from another perspective.

FIG. **5** is an exploded view of the plug connector of FIG. **2**.

FIG. **6** and FIG. **7** are cross-sectional views of the board-to-board connector assembly of FIG. **1** from different perspectives, respectively.

DESCRIPTION OF THE EMBODIMENTS

FIG. **1** is a schematic view of a board-to-board connector assembly according to an embodiment of the disclosure. FIG. **2** is an exploded view of the board-to-board connector assembly of FIG. **1**. Please refer to FIG. **1** and FIG. **2** at the same time. In this embodiment, the board-to-board connector assembly **10** includes a receptacle connector **100** and a plug connector **200** that may be mated with each other. The receptacle connector **100** is disposed on a circuit board **21**, for example, and the plug connector **200** is disposed on a circuit board **22**, for example, so that when the receptacle connector **100** is mated with the plug connector **200**, the circuit boards **21** and **22** may be electrically connected to each other.

FIG. **3** is an exploded view of the receptacle connector of FIG. **2**. Please refer to FIG. **2** and FIG. **3** at the same time. The receptacle connector **100** of this embodiment includes a first body **110**, a plurality of first terminals **130** and a pair of first metal members **120**. The first body **110** has an island structure **111** and a first receiving slot **112** surrounding the island structure **111**. The first terminals **130** are respectively disposed on a first side R**1** and a second side R**2** of the first receiving slot **112**, which are opposite to each other. The first metal members **120** are respectively disposed on a third side R**3** and a fourth side R**4** of the first receiving slot **112**, which are opposite to each other. Furthermore, the first metal member **120** has a base A**4** extending to the bottom of the third side R**3** or the bottom of the fourth side R**4**, and a pair of first elastic arms A**5** and A**6** extending from the base A**4** and facing away from each other.

In more detail, as shown in FIG. **3**, the first metal member **120** includes three saddles A**1**, A**2** and A**3** disposed on the periphery of the first body **110**, and the saddles A**1** to A**3** are adjacent to each other and disposed in a U shape and straddle the first receiving slot **112**, so that the saddles A**1** to A**3** contact three different surfaces of the first body **110**. Taking the saddle A**3** shown in FIG. **3** as an example, the saddle A**3** contacts the right side surface and the top surface of the first body **110**, and the inner surface of the first receiving slot **112**. Each of the first metal members **120** has a pair of protruding pieces A**12** respectively located between a corner of the U shape and one of the first elastic arms A**5**, A**6**, extending from the saddles at a first position (i.e. the saddle A**1**) and at a last position (i.e. the saddle A**3**) toward the first receiving slot **112**, and abutting against an inner wall **112***a* of the first receiving slot **112**.

FIG. **4** is a partial schematic view of the receptacle connector of FIG. **2** from another perspective. Please refer to FIG. **3** and FIG. **4** at the same time. In addition, the saddle A**2** in the middle further extends out of the base A**4**, and the first receiving slot **112** is a through hole on the third side R**3** and the fourth side R**4**, so that the base A**4** of the first metal member **120** is exposed from the bottom surface of the first body **110** through the through hole (the fourth side R**4** is taken as an example in FIG. **4**).

It should be noted that the first terminals **130** in this embodiment are disposed on the first body **110** in two rows, and the first elastic arms A**5** and A**6** of the first metal members **120** are respectively aligned collinearly with a part of the first terminals **130**. Therefore, the four first elastic arms A**5** and A**6** of the two first metal members **120** are also disposed in the same two rows as the above. Accordingly, the first elastic arms A**5** and A**6** of the embodiment are used as power terminals of the receptacle connector **100**, and since the first metal member **120** has a larger volume and surface area than the first terminal **130**, it is more adapted to transmit a large current.

In addition, the first body **110** is electrically insulating, and the first terminals **130** and the first metal members **120** can be formed integrally with the first body **110** by insert molding. For the first body **110** and the first metal members **120**, in addition to improving the bonding strength by the saddles A**1** to A**3** contacting the three different surfaces of the first body **110**, the first metal members **120** also has the base A**4** extending to the bottom of the first receiving slot **112** and the first elastic arms A**5** and A**6** extending from the base A**4**. Therefore, a larger contact area can be provided when the first elastic arms A**5** and A**6** are used as the power terminals of the connector, thereby making the receptacle connector **100** suitable for transmitting a larger current.

FIG. **5** is an exploded view of the plug connector of FIG. **2**. FIG. **6** and FIG. **7** are cross-sectional views of the board-to-board connector assembly of FIG. **1** from different perspectives. Rectangular coordinates XYZ and a central axis C**1** are provided to facilitate identification of the cross-sectional orientations of FIG. **6** and FIG. **7**. Please refer to FIG. **2** and FIG. **5** first. In this embodiment, the plug connector **200** includes a second body **210**, a plurality of second terminals **230** and a pair of second metal members **220**, the material and combination of which are the same as the aforementioned first body **110**, the first terminals **130** and the first metal members **120**. The second body **210** has a second receiving slot **211**. The second terminals **230** are respectively disposed on two opposite sides of the second body **210**. The second metal members **220** are disposed on another two opposite sides of the second body **210**. As shown in FIG. **2** and FIG. **7**, when the plug connector **200** is mated with the receptacle connector **100**, the second body **210** is inserted into the first receiving slot **112**; the island structure **111** is inserted into the second receiving slot **211**; and the first metal members **120** abut against the second metal members **220** through the first elastic arms A**5** and A**6**.

In more detail, as shown in FIG. **5**, the second metal members **220** includes L-shaped parts B**1**, B**2** and B**3** being adjacent to each other to form a U-shaped outline, and the L-shaped parts B**1** to B**3** respectively contact a top surface and a side face of the second body **210**, so that the three L-shaped parts B**1** to B**3** partially surround the second body **210**, and there is a gap between the two adjacent L-shaped parts B**1** and B**2** (or B**2** and B**3**), so that corners of the second body **210** may be exposed, thereby providing the effect of structural limitation. Meanwhile, the middle L-shaped part B**2** further forms two L-shaped parts B**4** and B**5** extending to the bottom surface of the second body **210**, so that the second metal member **220** covers five different surfaces of the second body **210**. Also like the aforementioned receptacle connector **100**, the second metal members **220** and the second terminals **230** are formed integrally with the second body **220** by insert molding, and the bonding strength of the second metal members **220** and the second body **210** is improved by the aforementioned covering structures.

Please refer to FIG. **3**, FIG. **5** and FIG. **6** again. In this embodiment, the first metal member **120** further includes a second elastic arm A**7** extending from the base A**4** to the island structure **111**, and the second elastic arm A**7** is located between the first elastic arms A**5** and A**6** facing away from each other. Furthermore, as shown in FIG. **5** and FIG. **6**, the second metal member **220** further includes a slope **221**,

which is disposed along the three adjacent L-shaped parts B1 to B3, and there is an included angle relative to the plugging and unplugging direction of the connector, and the included angle is less than or equal to 45 degrees, so that when the plug connector **200** is mated with the receptacle connector **100**, the slope **221** abuts and guides the second elastic arm A7 of the first metal member **120**, so as to avoid damage to the terminals due to impact during the mating process.

Please refer to FIG. **3** and FIG. **7** again. The saddles A1 and A3 of the first metal member **120** of the embodiment (i.e., the first and last ones of the three saddles A1 to A3 adjacent to each other) have inward inclinations A11 and A31, and the pair of first elastic arms A5 and A6 face the inward inclinations A11 and A31, respectively. In this way, in addition to allowing the inward inclinations A11 and A31 to provide guidance for the plug connector **200** when the connectors are mated, the inward inclinations A11 and A31 may also be used to block the first elastic arms A5 and A6 along the plugging and unplugging axis (Z axis) of the plug connector **200** and the receptacle connector **100**. It should be noted that the blocking does not necessarily occur, but when the plug connector **200** is pulled away from the receptacle connector **100** (along the positive Z-axis direction), if the first elastic arms A5 and A6 are deformed due to the excessive clamping force on the plug connector **200** and are pulled out together along the positive Z-axis direction, due to the existence of the inward inclinations A11 and A31, the aforementioned situation can be prevented.

To sum up, in the above-mentioned embodiments of the disclosure, the board-to-board connector assembly includes a plug connector and a receptacle connector that may mate with each other. The pair of first metal members of the receptacle connector, in addition to being combined to opposite sides of the first body, further include the base extending to the bottom of the receiving slot of the first body and the first elastic arms extending from the base and facing away from each other.

Accordingly, the first elastic arms and the first terminals may be disposed in two rows alike to serve as the power terminals of the receptacle connector, so that the first metal members with a larger area can be used to improve the bonding strength with the first body, and it can also be used as a basis for larger current transmission operations. Furthermore, in the corresponding plug connector, the second metal member has a slope corresponding to the first elastic arms, so as to serve as a guide when the connectors are mated. In addition, the receptacle connector further includes inward inclinations facing the first elastic arms. In addition to the same guiding effect as the aforementioned slope, when the plug connector is pulled away from the receptacle connector and the first elastic arms are unfortunately deformed and may be pulled out, the inward inclinations have the effect of blocking the first elastic arms.

In this way, the board-to-board connector assembly can carry out a larger current transmission operation with better structural stability and plugging and unplugging tolerance according to the above-mentioned simple structure.

It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed embodiments without departing from the scope or spirit of the disclosure. In view of the foregoing, it is intended that the disclosure covers modifications and variations provided that they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A board-to-board connector assembly, comprising:

a receptacle connector, comprising:

a first body, comprising an island structure and a first receiving slot surrounding the island structure;

a plurality of first terminals, respectively disposed on a first side and a second side of the first receiving slot, wherein the first side and the second side are opposite to each other; and

a pair of first metal members, respectively disposed on a third side and a fourth side of the first receiving slot, wherein the third side and the fourth side are opposite to each other, wherein the first metal member comprises a base extending to a bottom on the third side or a bottom on the fourth side, and a pair of first elastic arms extending from the base and facing away from each other; and

a plug connector, configured to be mated with the receptacle connector,

wherein the plug connector has a pair of second metal members oppositely, each of the second metal members has three L-shaped parts adjacent to each other to form a U-shaped outline, and the three L-shaped parts form a structurally continuous slope along an inner edge of the U-shaped outline.

2. The board-to-board connector assembly according to claim **1**, wherein the first elastic arms and a part of each of the first terminals are aligned collinearly.

3. The board-to-board connector assembly according to claim **1**, wherein each of the first elastic arms is a power terminal of the receptacle connector.

4. The board-to-board connector assembly according to claim **1**, wherein the first metal member comprises three saddles disposed on a periphery of the first body, the three saddles are adjacent to each other and disposed in a U shape, the saddle located in the middle extends out of the base, and each of the saddles contacts three different surfaces of the first body.

5. The board-to-board connector assembly according to claim **1**, wherein the first metal member further comprises a second elastic arm extending from the base to the island structure, and the second elastic arm is located between the pair of first elastic arms.

6. The board-to-board connector assembly according to claim **1**, wherein the first receiving slot is a through hole on the third side and the fourth side, and the base is exposed from a bottom surface of the first body through the through hole.

7. The board-to-board connector assembly according to claim **1**, wherein the plug connector comprises:

a second body, comprising a second receiving slot;

a plurality of second terminals, respectively disposed on two opposite sides of the second body; and

the pair of second metal members, disposed on another two opposite sides of the second body, wherein when the plug connector is mated with the receptacle connector, the second body is inserted into the first receiving slot, the island structure is inserted into the second receiving slot, and the pair of first metal members abuts the pair of second metal members through each of the first elastic arms.

8. The board-to-board connector assembly according to claim **7**, wherein the second metal members cover five different exterior surfaces of the second body, including upper and lower surfaces of the second body.

9. The board-to-board connector assembly according to claim **7**, wherein when the plug connector is mated with the receptacle connector, the structurally continuous slope abuts and guides a second elastic arm of the first metal member.

10. The board-to-board connector assembly according to claim 1, wherein the first metal member comprises three saddles disposed on a periphery of the first body, the three saddles are adjacent to each other and disposed in a U shape, and the pair of first elastic arms respectively face an inward inclination of each of the saddles located at the first and last positions, wherein an orthogonal projection of the inward inclination on a plane where the base of the first metal member is located on partially overlaps an orthogonal projection of the first elastic arm on the plane.

11. A receptacle connector, comprising:

a first body, comprising an island structure and a first receiving slot surrounding the island structure;

a plurality of first terminals, respectively disposed on a first side and a second side of the first receiving slot, wherein the first side and the second side are opposite to each other; and

a pair of first metal members, respectively disposed on a third side and a fourth side of the first receiving slot, wherein the third side and the fourth side are opposite to each other,

wherein the first metal member comprises a base extending to a bottom on the third side or a bottom on the fourth side, and a pair of first elastic arms extending from the base and facing away from each other,

wherein the first metal member comprises three saddles disposed on a periphery of the first body, the three saddles are adjacent to each other and disposed in a U shape, each of the first metal members has a pair of protruding pieces respectively located between a corner of the U shape and one of the first elastic arms, extending from the saddles at a first position and at a last position toward the first receiving slot, and abutting against an inner wall of the first receiving slot.

12. The receptacle connector according to claim 11, wherein the first elastic arms and a part of each of the first terminals are aligned collinearly.

13. The receptacle connector according to claim 11, wherein each of the first elastic arms is a power terminal of the receptacle connector.

14. The receptacle connector according to claim 11, wherein the first metal member comprises three saddles disposed on a periphery of the first body, the three saddles are adjacent to each other and disposed in a U shape, the saddle located in the middle extends out of the base, and each of the saddles contacts three different surfaces of the first body.

15. The receptacle connector according to claim 11, wherein the first metal member further comprises a second elastic arm extending from the base to the island structure, and the second elastic arm is located between the pair of first elastic arms.

16. The receptacle connector according to claim 11, wherein the first receiving slot is a through hole on the third side and the fourth side, and the base is exposed from a bottom surface of the first body through the through hole.

17. The board-to-board connector assembly according to claim 11, wherein the pair of first elastic arms respectively face an inward inclination of each of the saddles located at the first and last positions, wherein an orthogonal projection of the inward inclination on a plane where the base of the first metal member is located on partially overlaps an orthogonal projection of the first elastic arm on the plane.

18. A board-to-board connector assembly, comprising:

a receptacle connector, comprising:

a first body, comprising an island structure and a first receiving slot surrounding the island structure;

a plurality of first terminals, respectively disposed on a first side and a second side of the first receiving slot, wherein the first side and the second side are opposite to each other; and

a pair of first metal members, respectively disposed on a third side and a fourth side of the first receiving slot, wherein the third side and the fourth side are opposite to each other, wherein the first metal member comprises a base extending to a bottom on the third side or a bottom on the fourth side, and a pair of first elastic arms extending from the base and facing away from each other; and

a plug connector, configured to be mated with the receptacle connector,

wherein the plug connector comprises:

a second body, comprising a second receiving slot;

a plurality of second terminals, respectively disposed on two opposite sides of the second body; and

a pair of second metal members, disposed on another two opposite sides of the second body, wherein when the plug connector is mated with the receptacle connector, the second body is inserted into the first receiving slot, the island structure is inserted into the second receiving slot, and the pair of first metal members abuts the pair of second metal members through each of the first elastic arms,

wherein the second metal member has three L-shaped parts adjacent to each other to form a U-shaped outline covering side surfaces and a top surface of the second body,

wherein the second metal member has another two L-shaped parts extending from a middle one of the three L-shaped parts, and the another two L-shaped parts extend to and cover a bottom surface of the second body, wherein adjacent two of the three L-shaped parts are structurally integrated at a top surface of the second body and separated at a side of the second body to expose a corner of the second body to structurally constrain the second metal member and the second body together.

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