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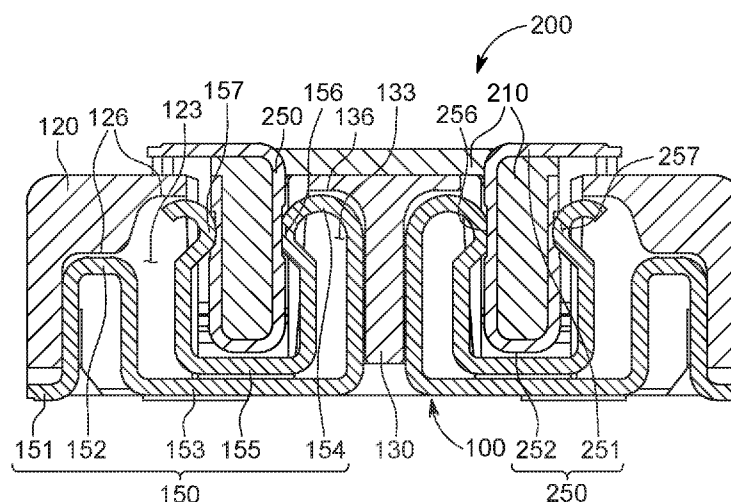


FIG. 6

(57) Abstract: The present disclosure relates to a connector which electrically connects boards, and maintains a stable connection in response to external vibration and shock. A receptacle connector includes: an external housing which is formed of a frame of an insulating material and has a space formed therein; an internal housing which is formed of a frame of an insulating material, and is separated from the external housing and is arranged in the inner space of the external housing; a receptacle contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into terminal insertion holes formed on the frames of the external housing and the internal housing, and is electrically in contact with the board of one side; and a receptacle fitting nail which is mounted on the board of one side while pressurizing both ends of the external housing, thereby fixing the external housing, and the plug connector includes: a plug housing which is formed of a frame of an insulating material, and is inserted into a plug receiving portion formed by the external housing and the internal housing; a plug contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into a terminal insertion hole formed on the frame of the plug housing and is electrically in contact with the board of the other side; and a plug fitting nail which is mounted on the board of the other side while pressurizing both ends



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BOARD TO BOARD CONNECTOR

RELATED APPLICATIONS

[0001] This application claims priority to Korean Application No. 10-2017-0041647, filed March 31, 2017, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a connector which is used to connect boards, and more particularly, to a connector which electrically connects boards, and maintains a stable connection even in response to external vibration and shock.

BACKGROUND ART

[0003] As a means for electrically connecting two or more components, the connectors normally used in electric and electronic industry fields are increasingly used with the development of electric and electronic industries.

[0004] In recent years, vehicles are provided with various electronic equipment systems for convenience of drivers or passengers, and, in such a system, a connector is used to electrically connect printed circuit boards (PCBs) embedded in the system to each other. In particular, as a connector used in vehicles, a floating type board-to-board connector (hereinafter, referred to as a “connector”) is usually used in order to respond to vibrations continuously generated. In addition, as recent vehicles are rapidly digitized like electric cars, self-driving cars, etc., there is a demand for slimmer and high-reliability connectors.

[0005] FIG. 1 is a cross-sectional view showing a related-art connector in an assembled state. As shown in the drawing, the connector is divided into a receptacle connector (hereinafter,

referred to as a “receptacle”), and a plug connector (hereinafter, referred to as a “plug”).

[0006] The receptacle 10 is mounted on a first board 10' of one side, and includes a first housing 11 which is divided into an external housing 12 and an internal housing 13, and a plurality of first contact terminals 14 which connect the external housing 12 and the internal housing 13, and are in contact with second contact terminals 24 of the plug 20, which will be described below. The first contact terminal 14 has one side assembled with the external housing 12 and also mounted on the first board 10', and the other side assembled with the internal housing 13. Accordingly, the external housing 12 and the internal housing 13 are spatially separated from each other, while being connected to each other by means of the first contact terminals 14.

[0007] The plug 20 is mounted on a second board 20' of the other side, and includes a second housing 21, and a plurality of second contact terminals 24 assembled with the second housing 21 to be in contact with the first contact terminals 14.

[0008] In the connector having the above-described configuration, when the receptacle 10 and the plug 20 are connected to each other, the second contact terminals 24 are inserted into the first contact terminals 14 and thus an electric contact is achieved therebetween. To achieve this, the first contact terminal 14 includes a contact point portion 14a which is in contact with a circuit electrode of a surface of the first board 10', a bending portion 14b which upwardly (z direction) protrudes from an end of the contact point portion 14a and bends, a U shape portion 14c which extends from an end of the bending portion 14b in the shape of U to receive the second contact terminal 24, and a contact portion 14d which inwardly protrudes from an end of the U shape portion 14c to be in contact with the second contact terminal 24.

[0009] The second contact terminal 24 is inserted into the U shape portion 14c of the first contact terminal 14 when the second housing 21 of the plug 20 is connected to the internal housing 13 of the receptacle 10. In this case, the internal housing 13 of the receptacle 10 enables

a flow with respect to the external housing 12 to some extent due to the U shape portion 14c, and as a result, the second housing 21 connected to the internal housing 13 enables a flow with respect to the external housing 12.

[0010] It is common that the connector provided in the vehicle is exposed to continuous vibrations. As described above, the connector has a structure in which the internal housing 13 enables a flow with respect to the external housing 12, such that the receptacle 10 and the plug 20 connected to each other via their respective housings can prevent a vibration of one side from being transmitted to the other side since the vibration is absorbed by the U shape portion 14c.

[0011] However, in the related-art connector, the U shape portion 14c of the first contact terminal 14 has a single structure, and thus may not completely prevent the vibration of the receptacle 10 or plug 20, and a portion of the vibration generated at one side may be transmitted to the other side. In addition, in the related-art connector, a force generated in the vertical direction when the second contact terminal 24 is inserted into the first contact terminal 14 or is drawn out from the first contact terminal 14 may be transmitted to the contact point portion 14a via the bending portion 14b. Accordingly, in the related-art connector, a loose contact may frequently occur due to the vibration of the vehicle or the force generated when the connector is mounted or dismounted, and there is also a problem that a contact point between the board and the contact terminal is damaged.

[0012] Patent Document 1: U.S. Patent No. 9,325,103 B2 (registered on April 26, 2016)

[0013] Patent Document 2: Korean Patent Registration No. 10-1294155 (registered on August 1, 2013).

SUMMARY

[0014] The electric and electronic systems applied to recent vehicles are becoming more compact, and accordingly, the connectors are becoming slimmer and also the guarantee of reliability is becoming a great issue.

[0015] An object of the present disclosure is to provide a board-to-board connector which can prevent a poor contact point between each board and a contact terminal by efficiently preventing a vibration of a vehicle or a vibration generated when the contact terminal is inserted and is drawn out, and thus can enhance reliability of the contact point.

[0016] In addition, another object of the present disclosure is to provide a board-to-board connector which can easily achieve sliminess, while guaranteeing reliability of contact of a contact terminal.

[0017] In addition, still another object of the present disclosure is to provide a board-to-board connector which can enhance reliability of a contact point by stably controlling flows in a horizontal direction (x and y directions) and a vertical direction (z direction).

[0018] To achieve the above-mentioned objects, the present disclosure provides a board-to-board connector in which a receptacle connector and a plug connector mounted on respective boards are connected to each other by being attached to or detached from each other.

[0019] The receptacle connector may include: an external housing which is formed of a frame of an insulating material and has a space formed therein; an internal housing which is formed of a frame of an insulating material, and is separated from the external housing and is arranged in the inner space of the external housing; a receptacle contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into terminal insertion holes formed on the frames of the external housing and the internal housing, and is electrically in contact with the board of one side; and a receptacle fitting nail which is mounted on the

board of one side while pressurizing both ends of the external housing, thereby fixing the external housing.

[0020] The plug connector may include: a plug housing which is formed of a frame of an insulating material, and is inserted into a plug receiving portion formed by the external housing and the internal housing; a plug contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into a terminal insertion hole formed on the frame of the plug housing and is electrically in contact with the board of the other side; and a plug fitting nail which is mounted on the board of the other side while pressurizing both ends of the plug housing, thereby fixing the plug housing.

[0021] The receptacle contact terminal may be configured to form a double U shape structure, and to prevent a vibration from being transmitted between the external housing and the internal housing.

[0022] In addition, the receptacle contact terminal may include: a first contact point portion which is in contact with the board; a first bending portion which extends from an end of the first contact point portion in the opposite direction of the first contact point portion, while bending to be convex upwardly; a first U shape portion which extends from an end of the first bending portion in the shape of “U”; a second bending portion which bends from an end of the first U shape portion to be convex upwardly, and extends to an inside of the first U shape portion; and a second U shape portion which extends from an end of the second bending portion in the shape of “U” in the space of the first U shape portion. The plug contact terminal may include: a second contact point portion which is in contact with the board; and a third bending portion which extends from an end of the second contact point portion while bending to be convex downwardly, and is inserted into the second U shape portion.

[0023] In addition, the receptacle contact terminal and the plug contact terminal may form a double contact structure with first and second contact portions which are formed on insides

of frames of both ends of the second U shape portion, and with third and fourth contact portions formed on outer surfaces of frames of the third bending portion.

[0024] In addition, the external housing and the internal housing may be provided with terminal locking projections by which the first bending portion and the second bending portion are locked so as to prevent the first contact terminal from being released.

[0025] In addition, the first fitting nail may include: a first side surface frame which surrounds an outer surface of an end of the external housing; a first support frame which extends from an upper end of the first side surface frame inwardly in a length direction (y direction) and is in close contact with an upper surface and an inner surface of the external housing; and second support frames which extend from an upper end of the first side surface frame inwardly in width directions (x direction) facing each other, and are in close contact with an upper surface and an inner surface of the external housing.

[0026] The second fitting nail may include: a first pressure frame which pressurizes a portion of a lower surface of the second housing; a third support frame which extends upward from an outer end of the length direction (y direction) of the first pressure frame, and is in close contact with a side surface of the second housing; fourth support frames which extend upward from both ends of the width direction (x direction) of the first pressure frame, and are in close contact with side surfaces of the second housing; and a fixing frame which extends upward from an inner end of the length direction (y direction) of the first pressure frame, and is assembled with the second housing.

[0027] In addition, the receptacle and the plug may be configured to have a flow in the width direction (x direction) within a range of a gap formed between the second support frame of the first fitting nail and the fourth support frame of the second fitting nail, may be configured to have a flow in the length direction (y direction) within a range of a gap formed between the first support frame of the first fitting nail and the third support frame of the second fitting nail,

and may be configured to a flow in a vertical direction (z direction) within a range of a gap formed between a lower end of the first support frame of the first fitting nail and a support plate of the internal housing.

[0028] The receptacle contact terminal of the connector of the present disclosure forms a double U shape structure, such that a board contact point portion of the receptacle contact terminal or plug contact terminal is completely independent from a vibration of the plug or receptacle, and thus a poor contact point which may be caused by a vibration of a vehicle or repeated mounting/dismounting of the connector does not appear.

[0029] In addition, the connector of the present disclosure stably controls a flow in vertical and horizontal directions in response to a vibration of a vehicle or repeated mounting/dismounting of the connector, such that contact reliability of the connector can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] FIG. 1 is a cross-sectional view showing a related-art connector in an assembled state;

[0031] FIG. 2 is a perspective view showing a connector according to an exemplary embodiment of the present disclosure;

[0032] FIG. 3 is an exploded perspective view showing a receptacle which is a main portion of FIG. 2;

[0033] FIG. 4 is a top view showing the receptacle of FIG. 3;

[0034] FIG. 5 is an exploded perspective view showing a plug which is a main portion of FIG. 2;

[0035] FIG. 6 is a cross-sectional view showing a connector structure in an assembled state according to an exemplary embodiment of the present disclosure;

[0036] FIG. 7 is a perspective view showing a contact terminal of the connector according to an exemplary embodiment of the present disclosure;

[0037] FIGS. 8A and 8B are views showing a distribution of stresses when a contact terminal of a single structure is inserted and is drawn out;

[0038] FIGS. 9A and 9B are views showing a distribution of stresses when a contact terminal of a double structure is inserted and is drawn out;

[0039] FIG. 10 is a cross-sectional view showing an x direction flow control structure of the connector in an assembled state according to an exemplary embodiment of the present disclosure; and

[0040] FIG. 11 is a cross-sectional view showing a y direction and z direction flow control structure of the connector in an assembled state according to an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0041] The present disclosure and the technical objects achieved by embodiments of the present disclosure will be more apparent by preferred embodiments of the present disclosure which will be described below. Embodiments presented below are merely examples for describing the present disclosure, and are not intended to limit the scope of the present disclosure. In the description of the present disclosure, expressions “first,” “second,” “upper,” “lower,” “front,” “rear,” “left,” “right,” or the like indicate orders, positions, directions, or the like which are relative to one another, and are not limited to their dictionary definitions.

[0042] FIG. 2 is a perspective view showing a connector according to an exemplary

embodiment, FIG. 3 is an exploded perspective view showing a receptacle which is a main portion of FIG. 2, FIG. 4 is a top view showing the receptacle of FIG. 3, and FIG. 5 is an exploded perspective view showing a plug which is a main portion of FIG. 2. As shown in these drawings, the connector of the present disclosure includes a receptacle 100 and a plug 200, and the receptacle 100 and the plug 200 are connected to each other while being mounted on boards (not shown) in the form of separated printed circuit boards (PCBs) or flexible PCBs (FPCBs).

[0043] Referring to FIGS. 2 to 4, the receptacle 100 includes a receptacle housing 110 including an external housing 120 and an internal housing 130, a plurality of receptacle contact terminals 150 assembled with the receptacle housing, and a receptacle fitting nail 170 for fixing the external housing 120 to a first board (not shown).

[0044] The external housing 120 is configured to form an exterior body of the receptacle 100, and may be formed of an injection molding body using resin which is an insulating material. The external housing 120 may be formed of an external frame 121 of a rectangular shape having a predetermined width and a predetermined length, and may have a space formed therein to place the internal housing 130. The external housing 120 may be fixed to the board (not shown) to bring the plurality of receptacle contact terminals 150 into contact with a circuit electrode of the board. To achieve this, the external housing 120 may have a plurality of external terminal insertion holes 123 formed on both sides of the external frame 121, facing each other in the length direction (y direction), so as to allow outsides of the receptacle contact terminals 150 to be assembled therewith.

[0045] The internal housing 130 is configured to be separated from the external housing 120 and to form an interior body of the receptacle 100, and may be formed of an injection molding body using resin which is an insulating material. The internal housing 130 may include an internal frame 131 of a rectangular pillar shape, and a support plate 132 supporting the

internal frame 131, and the internal frame 131 guarantees a predetermined space with the external frame 121 of the external housing 120 to provide a plug receiving portion 110a into which a plug housing 210 is inserted. In addition, the internal housing 130 may have a plurality of internal terminal insertion holes 133 formed on the internal frame 131 of the length direction, facing the external terminal insertion holes 123 of the external housing 120, so as to allow insides of the receptacle contact terminals 150 to be assembled therewith.

[0046] The receptacle contact terminals 150 may come into contact with plug contact terminals 250 while forming an electric contact point with the board, thereby electrically connecting the receptacle 100 and the plug 200. The plurality of receptacle contact terminals 150 may be inserted into the terminal insertion holes 123, 133 formed on the external housing 120 and the internal housing 130, respectively, thereby connecting the external housing 120 and the internal housing 130, and may be arranged in two rows with a predetermined distance from the plug receiving portion 110a in the length direction (y direction). The receptacle contact terminals 150 may be manufactured separately from the external housing 120 and the internal housing 130 and then may be assembled therewith, or may be integrally formed with the external housing 120 and the internal housing 130 by insert molding.

[0047] The receptacle contact terminals 150 may be formed of a metallic material having conductivity such as aluminum, and may be formed by stamping. In addition, the receptacle contact terminals 150 may be formed of a conductor having elasticity so as to allow the plug contact terminals 250 to be inserted thereinto, and in the present disclosure, may be formed in a double U shape structure having an upper portion opened.

[0048] The receptacle fitting nail 170 may be soldered to the board at both ends of the length direction of the external housing 120, thereby fixing the external housing 120 to the board. The receptacle fitting nail 170 includes a first side surface frame 171 which surrounds a side surface of the end of the length direction (y direction) of the external housing 120 and a

portion of both side surfaces of the end of the external housing 120 in the shape of “⊏,” a first support frame 172 which bends and extends inwardly from an upper end of the first side surface frame 171 in the length direction (y direction), and comes into close contact with an upper surface and an inner surface of the external housing 120, and a pair of second support frames 173 which bend and extend inwardly from the upper end of the first side surface frame 171 in width directions (x directions) facing each other, and come into close contact with an upper surface and an inner surface of the external housing 120. In addition, the receptacle fitting nail 170 may have a plurality of first soldering portions 175 formed on a lower end of the first side surface frame 171 to be coupled to the board.

[0049] The external housing 120 may have locking protrusions 124 and insertion recesses 125 formed on both ends thereof to allow the receptacle fitting nail 170 to be assembled therewith. In addition, the receptacle fitting nail 170 may be integrally formed with the external housing 120 by insert molding.

[0050] Referring to FIGS. 2 and 5, the plug 200 includes the plug housing 210, the plurality of plug contact terminals 250 assembled with the plug housing to come into electric contact with the receptacle contact terminals 150, and a plug fitting nail 270 for fixing the plug housing 210 to a second board (not shown).

[0051] The plug housing 210 may be configured to be connected to the receptacle housing 110 while forming a body of the plug 200, and may be formed of an injection molding body using resin which is an insulating material. The plug housing 210 includes a main plate 212 of a rectangular shape having a predetermined width and a predetermined length, and a connection frame 211 which protrudes from an edge of a lower surface of the main plate 212 in a rectangular shape to correspond to the plug receiving portion 110a of the receptacle housing 110. The plug housing 210 may be fixed to the board (not shown) to bring the plurality of plug contact terminals 250 into contact with the circuit electrode of the board, and to achieve this, a

plurality of plug terminal insertion holes 213 may be formed on both sides of the connection frame 211, facing each other, in the length direction (y direction), so as to allow the plug contact terminals 250 to be assembled therewith.

[0052] The plug contact terminals 250 come into contact with the receptacle contact terminals 150 while forming an electric contact point with the board, thereby electrically connecting the plug 200 and the receptacle 100. The plurality of plug contact terminals 250 may be arranged on both sides of the plug housing 210 in the length direction in two rows with a predetermined distance therebetween, and may be assembled with the plug terminal insertion holes 213 formed on the plug housing 210. The plug contact terminals 250 may be manufactured separately from the plug housing 210 and then may be assembled therewith, or may be integrally formed with the plug housing 210 by insert molding.

[0053] Such plug contact terminals 250 may be formed of a metallic material having conductivity such as aluminum, and may be formed by stamping. In addition, the plug contact terminals 250 may be formed of a conductor having elasticity so as to be inserted into the receptacle contact terminals 150.

[0054] The plug fitting nail 270 may be soldered to the board at both ends of the length direction of the plug housing 210, thereby fixing the plug housing 210 to the board. The plug fitting nail 270 may include a first pressure frame 271 which pressurizes a portion of a lower surface of the plug housing 210, a third support frame 272 which bends upwardly from an outer end of the length direction (y direction) of the first pressure frame 271 to come into close contact with a side surface of the plug housing 210, a pair of fourth support frames 273 which bend upwardly from both ends of the width direction (x direction) of the first pressure frame 271 to come into close contact with side surfaces of the plug housing 210, and a fixing frame 274 which bends upwardly from an inner end of the length direction (y direction) of the first pressure frame 271 to be assembled with the plug housing 210. In addition, the plug fitting

nail 270 may form a second soldering portion 275 on an upper end of the third support frame 272 or the fourth support frame 273 to be connected to the board.

[0055] The plug housing 210 may have locking protrusions 214 and insertion recesses 215 formed on both ends thereof to be assembled with the plug fitting nail 270. In addition, the plug fitting nail 270 may be integrally formed with the plug housing 210 by insert molding.

[0056] FIG. 6 is a cross-sectional view (taken on line I-I of FIG. 2) showing the connector structure in an assembled state according to an exemplary embodiment, and FIG. 7 is a perspective view showing the contact terminal of the connector according to an exemplary embodiment.

[0057] Referring to these drawings, the connector of the present disclosure is assembled by inserting the upper plug 200 into the lower receptacle 100, such that the receptacle contact terminals 150 and the plug contact terminals 250 electrically come into contact with each other. The receptacle contact terminals 150 may have the internal housing 130 float over the external housing 120 fixed to the board, while connecting the external housing 120 and the internal housing 130, which are separated from each other, such that a vibration generated at the receptacle 100 or the plug 200 can be prevented from being transmitted to the other side.

[0058] The receptacle contact terminal 150 may include a first contact point portion 151 which is in contact with the board, a first bending portion 152 which extends from an end of the first contact point portion, while bending in the shape of “inverted U” to be convex upwardly, a first U shape portion 153 which extends from an end of the first bending portion in the shape of “U,” a second bending portion 154 which bends from an end of the first U shape portion in the shape of “inverted U” to be convex upwardly, and extends to the inner space of the first U shape portion 153, and a second U shape portion 155 which extends from an end of the second bending portion in the shape of “U.” That is, the receptacle contact terminal 150 may form a double U shape structure due to the presence of the first U shape portion 153 and

the second U shape portion 155.

[0059] The second U shape portion 155 may have one end fixed to the second bending portion 154 and the other end forming a free end. In addition, the second U shape portion 155 may be positioned inside the first U shape portion 153, and may have a first contact portion 156 and a second contact portion 157 convexly protruding from the fixing end of one side and the free end of the other side, respectively, to the inside.

[0060] The receptacle contact terminal 150 having the above-described configuration may be a metal frame having a predetermined length, and the first contact point portion 151 and the first bending portion 152 positioned on one side (outside) with reference to the center portion of the first and second U shape portions 153, 155 may be assembled with the external housing 120. To achieve this, the external housing 120 may form the external terminal insertion hole 123 into which the first bending portion 152 is inserted, and an external terminal locking projection 126 for preventing the first bending portion 152 from being released.

[0061] In addition, the receptacle contact terminal 150 may have the second bending portion 154 of the other side (inside) with reference to the center portion of the first and second U shape portions 153, 155 assembled with the internal housing 130. To achieve this, the internal housing 130 may form the internal terminal insertion hole 133 into which the second bending portion 154 is inserted, and an internal terminal locking projection 136 for preventing the second bending portion 154 from being released.

[0062] The external terminal locking projection 126 and the internal terminal locking projection 136 may prevent the receptacle contact terminal 150 from being dragged out with the plug contact terminal 250 when the plug contact terminal 250 is drawn out.

[0063] In addition, the receptacle contact terminal 150 may include a plurality of fixing protrusions 158 protruding from side portions of the metal frame in the shape of a wedge, and

the fixing protrusions 158 fix the receptacle contact terminal 150 to the external housing 120 and the internal housing 130.

[0064] The plug contact terminal 250 includes a second contact point portion 251 which is in contact with the board, and a third bending portion 252 which extends from an end of the second contact point portion 251, while bending in the shape of “U” to be convex downwardly. The third bending portion 252 is inserted into the second U shape portion 155 of the receptacle contact terminal 150. The third bending portion 252 may have a pair of a third contact portion 256 and a fourth contact portion 257 which are concave on an outer surface of the frame, and may be inserted into the second U shape portion 155 so as to allow the first contact portion 156 and the second contact portion 157 of the second U shape portion 155 to come into contact with the third contact portion 256 and the fourth contact portion 257.

[0065] The receptacle contact terminal 150 and the plug contact terminal 250 configured as described above form a double contact structure due to the presence of the pair of contact portions 156, 157, 256, 257, such that a stable contact can be achieved even in response to shaking caused by vibrations. In addition, the pair of contact portions 156, 157, 256, 257 may provide stable clicking feeling due to the contacts between protrusions and recesses corresponding to each other when the receptacle or plug is inserted or is drawn out. In this case, the first and second contact portions 156, 157 may be formed in the shape of a concave recess, and the third and fourth contact portions 256, 257 may be formed in the shape of a convex protrusion.

[0066] FIGS. 8A and 8B are views showing a distribution of stresses when a contact terminal of a single U shape structure is inserted and is drawn out, and FIGS. 9A and 9B are views showing a distribution of stresses when a contact terminal of a double U shape structure is inserted and is drawn out. According to exemplary embodiments, the receptacle contact terminal 150 and the plug contact terminal 250 can prevent a poor contact point caused by a

vibration, by efficiently preventing a vibration generated in a vehicle or a vibration generated when the receptacle 100 and the plug 200 are attached to or detached from each other from being transmitted to the other side.

[0067] First, referring to FIGS. 8A and 8B, the receptacle contact terminal of the single cup structure may generate stresses according to contacts with the plug contact terminal when the plug contact terminal is inserted (FIG. 8A) or is drawn out (FIG. 8B). The receptacle contact terminal and the plug contact terminal may initially generate stresses at respective contact portions, and, as shown in the drawing, the stresses may be distributed along the first U shape portion and the first bending portion in the receptacle contact terminal, and finally may be transmitted to the first contact point portion which is in contact with the board. The stress transmitted to the first contact point portion influences a contact point between the first contact point portion and the board. Therefore, the receptacle contact terminal of the single U shape structure may easily cause a poor contact point with the board due to a vibration of a vehicle or repeated insertion and drawing out of the plug contact terminal.

[0068] Referring to FIGS. 9A and 9B, the receptacle contact terminal of the double U shape structure may also generate stresses according to contacts with the plug contact terminal when the plug contact terminal is inserted (FIG. 9A) or is drawn out (FIG. 9B). The receptacle contact terminal and the plug contact terminal may generate stresses at respective contact portions, and, as shown in the drawing, most of the stresses may be distributed along the second U shape portion and the second bending portion, and the stresses may not be transmitted to the first U shape portion, the first bending portion, and the first contact point portion. This is because the receptacle contact terminal has the double U shape structure and thus the stresses generated at the respective contact portions are concentrated on the second bending portion and the second U shape portion formed inside the receptacle contact terminal. Accordingly, the receptacle contact terminal of the double U shape structure according to the present disclosure

can stably maintain contact points with the board even in response to the vibration of the vehicle or the vibration caused by repeated insertion and drawing out of the plug contact terminal, and thus can enhance reliability.

[0069] FIG. 10 is a cross-sectional view (taken on line II-II of FIG. 2) showing an x direction flow control structure of the connector in an assembled state according to an exemplary embodiment, and FIG. 11 is a cross-sectional view (taken on line III-III of FIG. 2) showing a y direction and z direction flow control structure of the connector in an assembled state according to an exemplary embodiment.

[0070] Referring to FIG. 10, the connector of the present disclosure has a predetermined gap f1 between the receptacle fitting nail 170 fixed to the board of one side and the plug fitting nail 270 fixed to the board of the other side with respect to the width direction (x direction). That is, the second support frame 173 of the receptacle fitting nail 170 for fixing the external housing 120, and the fourth support frame 273 of the plug fitting nail 270 for fixing the plug housing 210 are soldered to the respective boards to face each other while forming the predetermined gap f1 with respect to the width direction of the connector.

[0071] The plug 200 is electrically connected to the receptacle 100 by connecting the plug housing 210 to the internal housing 130 of the receptacle 100, and the internal housing 130 is connected to the external housing 120 by means of the receptacle contact terminals 150, thereby having a flow. Accordingly, the plug housing 210 may have a flow with respect to the external housing 120 with the internal housing 130, and such a flow absorbs vibrations between the receptacle 100 and the plug 200 and prevents the vibrations from being transmitted.

[0072] In this case, the flow of the plug housing 210 in the width direction should be controlled to be achieved within the predetermined gap f1, and the flow gap f1 in the width direction may be controlled by the receptacle fitting nail 170 and the plug fitting nail 270. That is, the plug housing 210 may have a flow in the width direction only within the gap f1 between

the fourth support frame 273 of the plug fitting nail 270 and the second support frame 173 of the receptacle fitting nail 170 which contact each other.

[0073] When the flow of the receptacle 100 and the plug 200 is controlled by the housing made of resin, the housing may be easily damaged or wear down and thus a flow control may be destroyed. However, according to the present disclosure, the flow of the receptacle 100 and the plug 200 is controlled by the receptacle fitting nail 170 and the second fitting nail 270 which are made of a metallic material and are directly mounted on the respective boards, such that the flow control can be securely performed.

[0074] In addition, referring to FIG. 11, the connector of the present disclosure forms a predetermined gap f2 between the receptacle fitting nail 170 fixed to the board of one side and the plug fitting nail 270 fixed to the board of the other side with respect to the length direction (y direction). That is, the first support frame 172 of the receptacle fitting nail 170 for fixing the external housing 120, and the third support frame 272 of the plug fitting nail 270 for fixing the plug housing 210 are soldered to the respective boards to face each other, while forming the predetermined gap f2 with respect to the length direction of the connector. Accordingly, the flow of the plug housing 210 in the length direction may be controlled to be achieved only within the gap f2 between the first support frame 172 of the receptacle fitting nail 170 and the third support frame 272 of the plug fitting nail 270 which contact each other.

[0075] In addition, the connector of the present disclosure may be configured such that a flow in the vertical direction (z direction) is controlled within a gap f3 between the receptacle fitting nail 170 and the internal housing 130. As shown in the drawing, the first support frame 172 of the receptacle fitting nail 170 is assembled with the external housing 120 to have the predetermined gap f3 between a lower end of the first support frame 172 and the support plate 132 of the internal housing 130 with respect to the vertical direction. Accordingly, the flow of the plug housing 210 in the vertical direction may be controlled to be achieved only within the

gap between the first support frame 172 of the receptacle fitting nail 170 and the support plate 132 of the internal housing 130 which contact each other.

[0076] As described above, the connector of the present disclosure controls the receptacle and the plug to have a flow within a predetermined range with respect to the x, y, and z directions, such that a vibration generated in a vehicle can be efficiently prevented from being transmitted, and an electric contact point can be stably achieved in response to the vibration.

[0077] Although the present disclosure has been described with reference to the embodiments illustrated in the drawings, it will be understood by an ordinary person skilled in the related art that various changes can be made therefrom and other equivalent embodiments are possible.

CLAIMS

What is claimed is:

1. A board-to-board connector in which a receptacle connector and a plug connector mounted on respective boards are connected to each other by being attached to or detached from each other,

wherein the receptacle connector comprises:

an external housing which is formed of a frame of an insulating material and has a space formed therein;

an internal housing which is formed of a frame of an insulating material, and is separated from the external housing and is arranged in the inner space of the external housing;

a receptacle contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into terminal insertion holes formed on the frames of the external housing and the internal housing, and is electrically in contact with the board of one side; and

a receptacle fitting nail which is mounted on the board of one side while pressurizing both ends of the external housing, thereby fixing the external housing,

wherein the plug connector comprises:

a plug housing which is formed of a frame of an insulating material, and is inserted into a plug receiving portion formed by the external housing and the internal housing;

a plug contact terminal which is an elastic body formed of a frame of a metallic material, and is inserted into a terminal insertion hole formed on the frame of the plug housing and is electrically in contact with the board of the other side; and

a plug fitting nail which is mounted on the board of the other side while pressurizing both ends of the plug housing, thereby fixing the plug housing,

wherein the receptacle contact terminal is configured to form a double U shape structure, and to prevent a vibration from being transmitted between the external housing and the internal

housing.

2. The board-to-board connector of claim 1, wherein the receptacle contact terminal comprises:

a first contact point portion which is in contact with the board;

a first bending portion which extends from an end of the first contact point portion in the opposite direction of the first contact point portion, while bending to be convex upwardly;

a first U shape portion which extends from an end of the first bending portion in the shape of “U”;

a second bending portion which bends from an end of the first U shape portion to be convex upwardly, and extends to an inside of the first U shape portion; and

a second U shape portion which extends from an end of the second bending portion in the shape of “U” in the space of the first U shape portion.

3. The board-to-board connector of claim 2, wherein the plug contact terminal comprises:

a second contact point portion which is in contact with the board; and

a third bending portion which extends from an end of the second contact point portion while bending to be convex downwardly, and is inserted into the second U shape portion.’

4. The board-to-board connector of claim 3, wherein the receptacle contact terminal and the plug contact terminal form

a double contact structure with first and second contact portions which are formed on insides of frames of both ends of the second U shape portion, and with third and fourth contact portions formed on outer surfaces of frames of the third bending portion.

5. The board-to-board connector of claim 2, wherein the external housing and the internal housing are provided with terminal locking projections by which the first bending portion and the second bending portion are locked so as to prevent the receptacle contact terminal from being released.

6. The board-to-board connector of claim 1, wherein the receptacle fitting nail comprises:

a first side surface frame which surrounds an outer surface of an end of the external housing;

a first support frame which extends from an upper end of the first side surface frame inwardly in a length direction (y direction) and is in close contact with an upper surface and an inner surface of the external housing; and

second support frames which extend from an upper end of the first side surface frame inwardly in width directions (x direction) facing each other, and are in close contact with an upper surface and an inner surface of the external housing,

wherein the plug fitting nail comprises:

a first pressure frame which pressurizes a portion of a lower surface of the plug housing;

a third support frame which extends upward from an outer end of the length direction (y direction) of the first pressure frame, and is in close contact with a side surface of the plug housing;

fourth support frames which extend upward from both ends of the width direction (x direction) of the first pressure frame, and are in close contact with side surfaces of the plug housing; and

a fixing frame which extends upward from an inner end of the length direction (y direction) of the first pressure frame, and is assembled with the plug housing.

7. The board-to-board connector of claim 6, wherein the receptacle and the plug are configured to have a flow in the width direction (x direction) within a range of a gap formed between the second support frame of the receptacle fitting nail and the fourth support frame of the plug fitting nail.

8. The board-to-board connector of claim 6, wherein the receptacle and the plug are configured to have a flow in the length direction (y direction) within a range of a gap formed between the first support frame of the receptacle fitting nail and the third support frame of the plug fitting nail.

9. The board-to-board connector of claim 6, wherein the receptacle and the plug are configured to have a flow in a vertical direction (z direction) within a range of a gap formed between a lower end of the first support frame of the receptacle fitting nail and a support plate of the internal housing.

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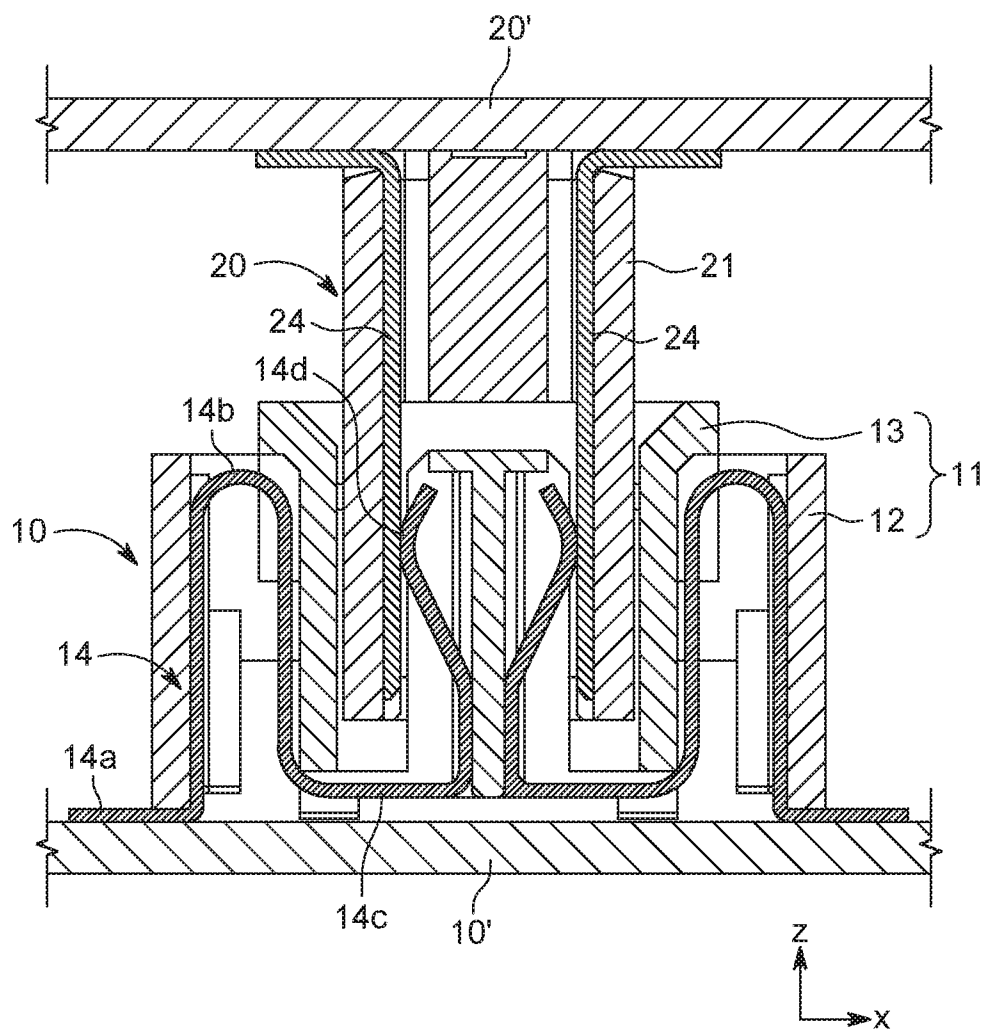


FIG. 1

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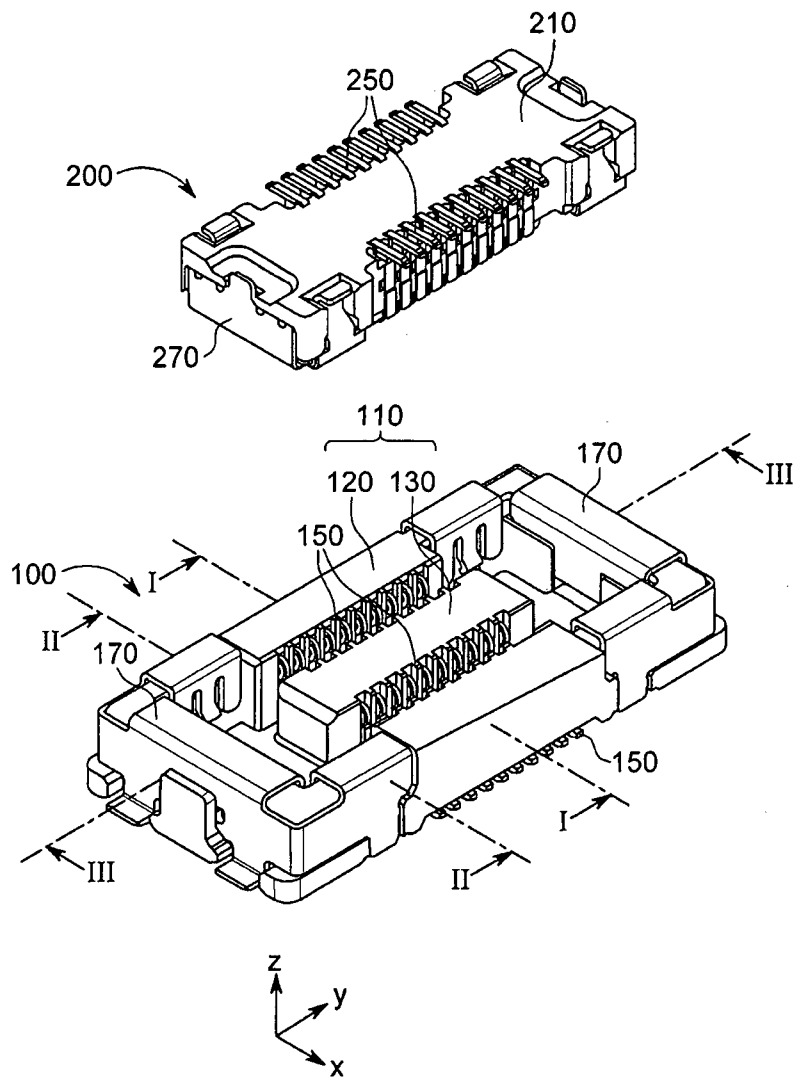


FIG. 2

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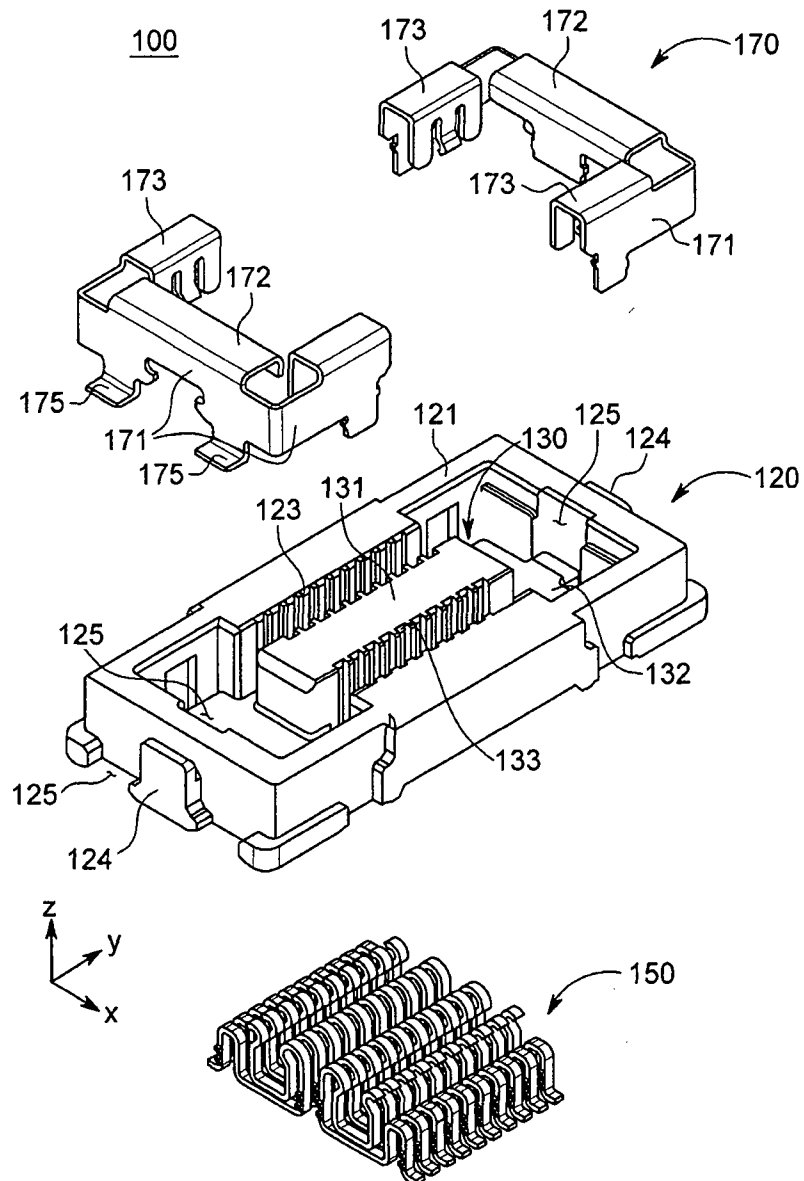


FIG. 3

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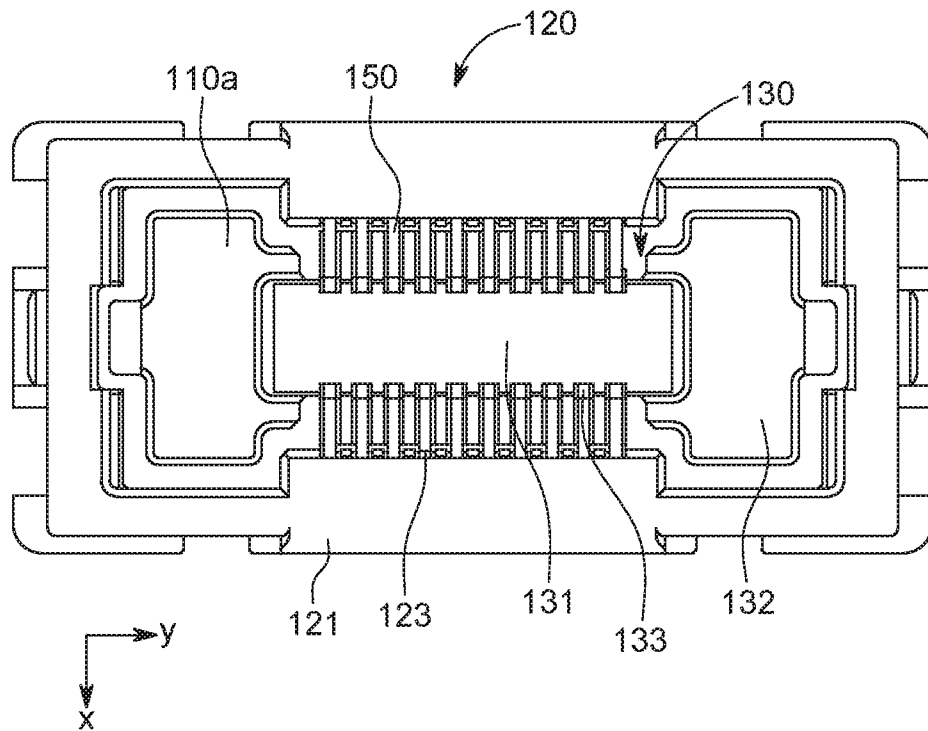


FIG. 4

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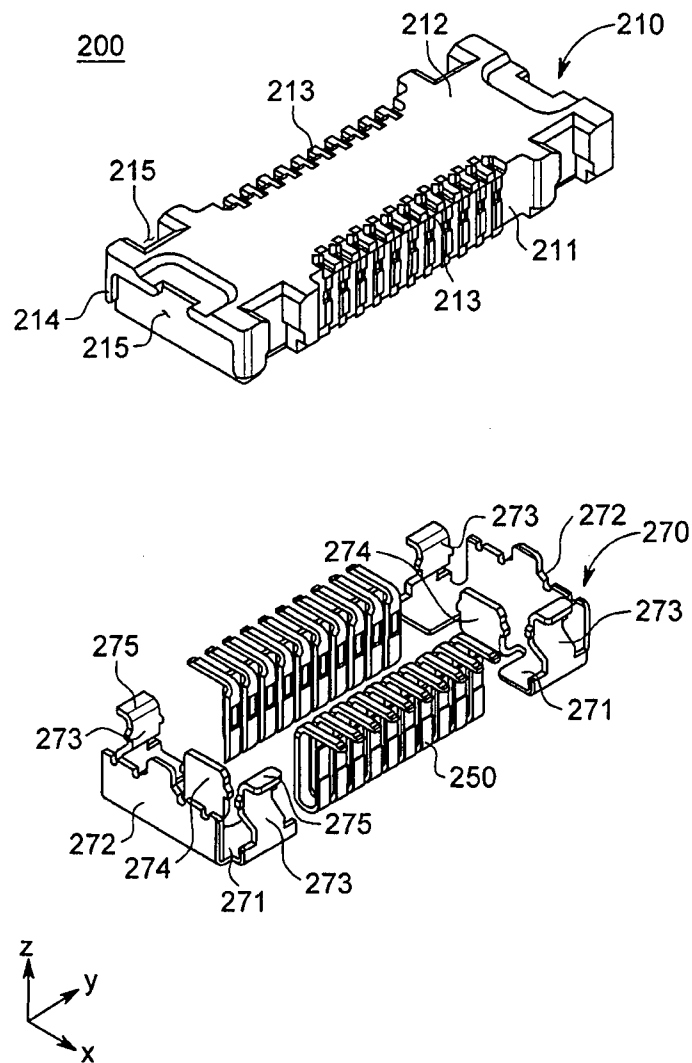


FIG. 5

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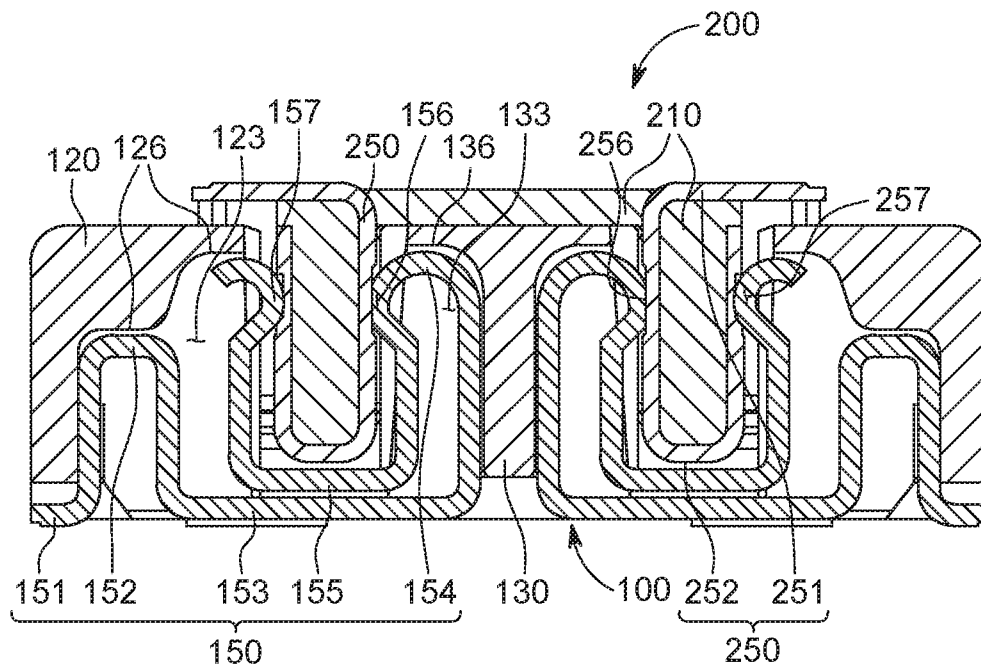


FIG. 6

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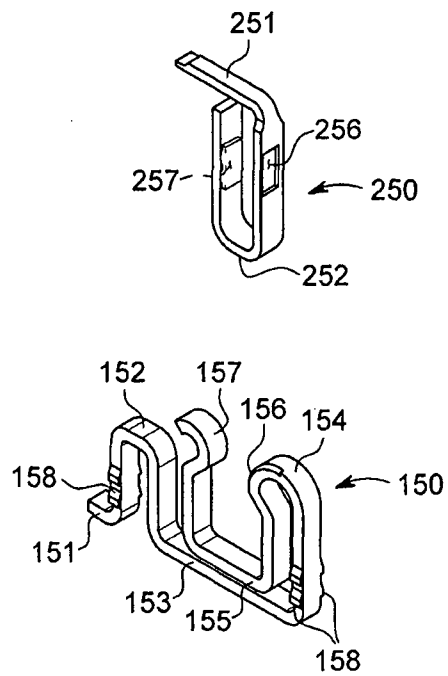
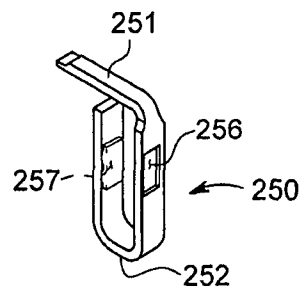


FIG. 7



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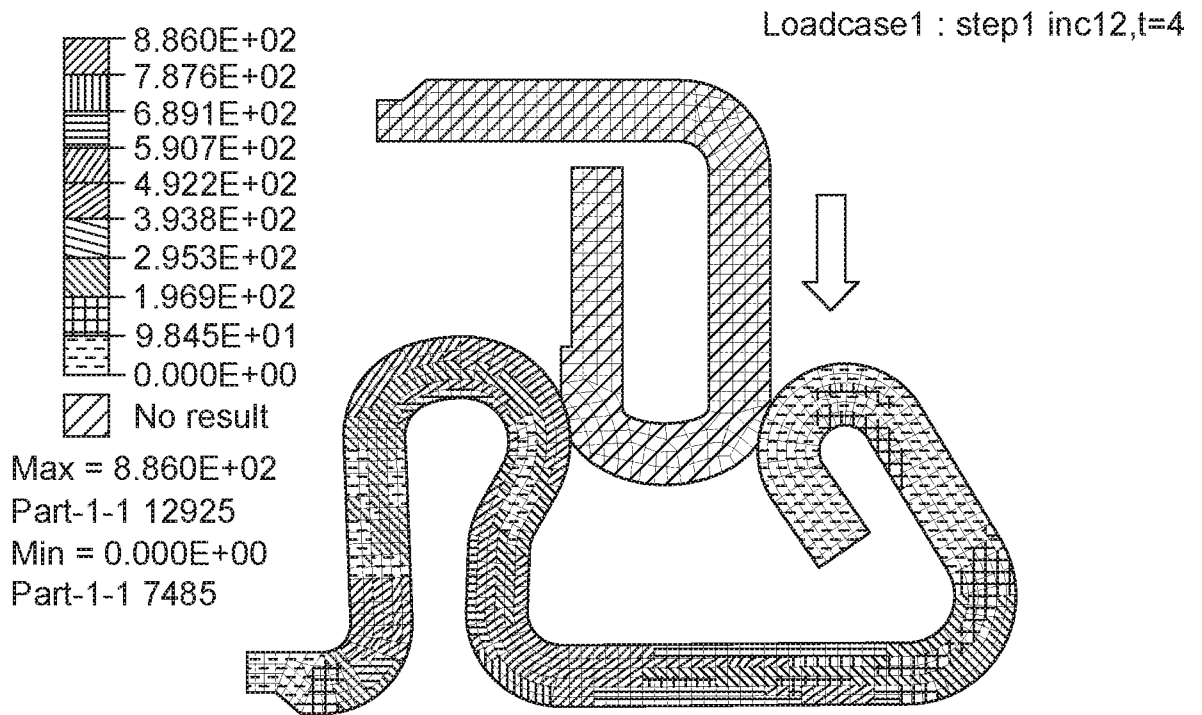


FIG. 8A

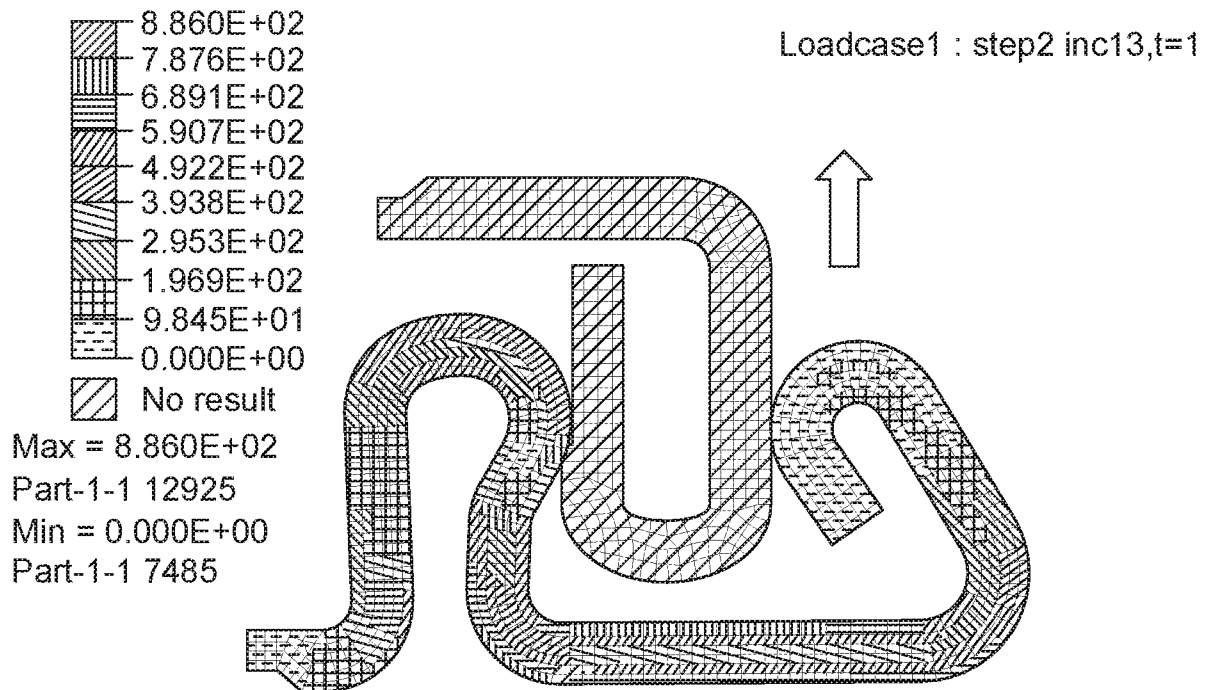


FIG. 8B

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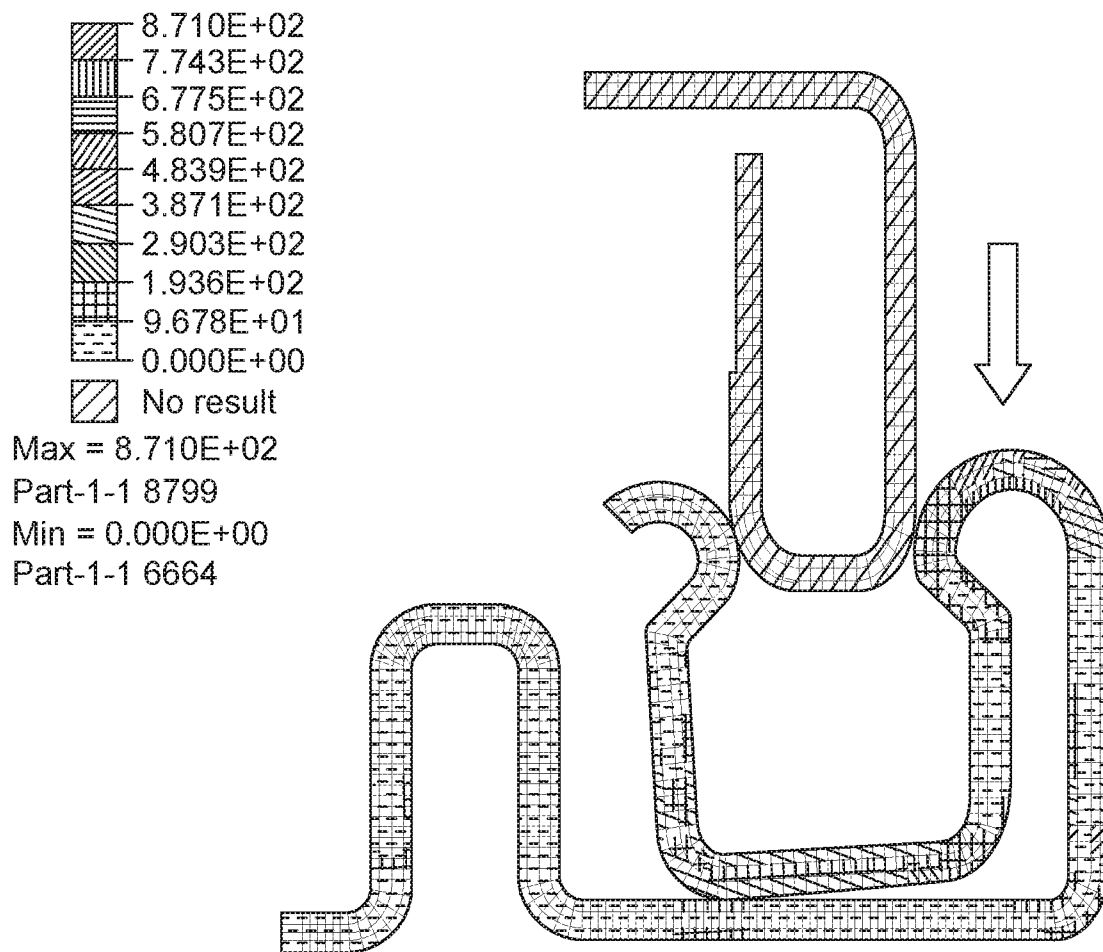


FIG. 9A

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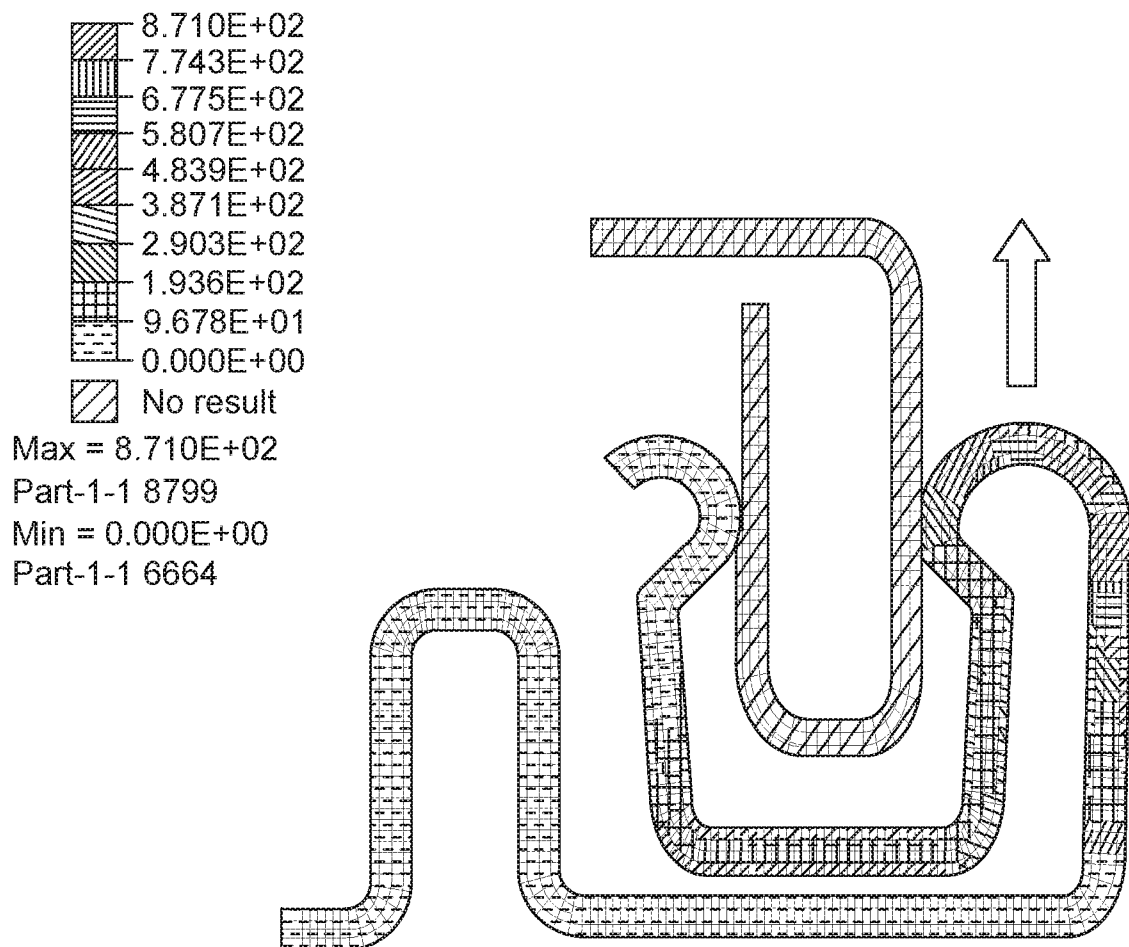


FIG. 9B

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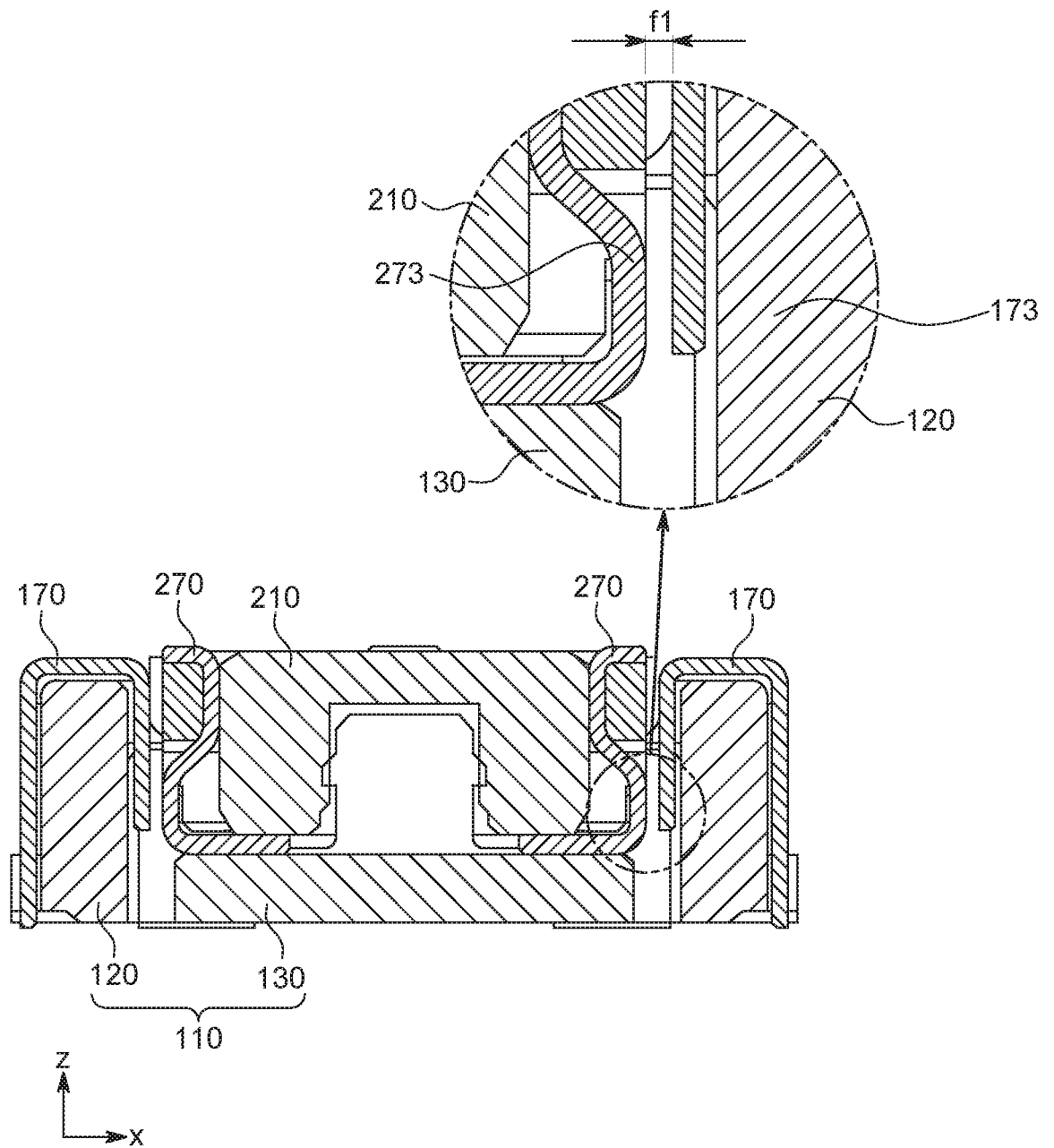


FIG. 10

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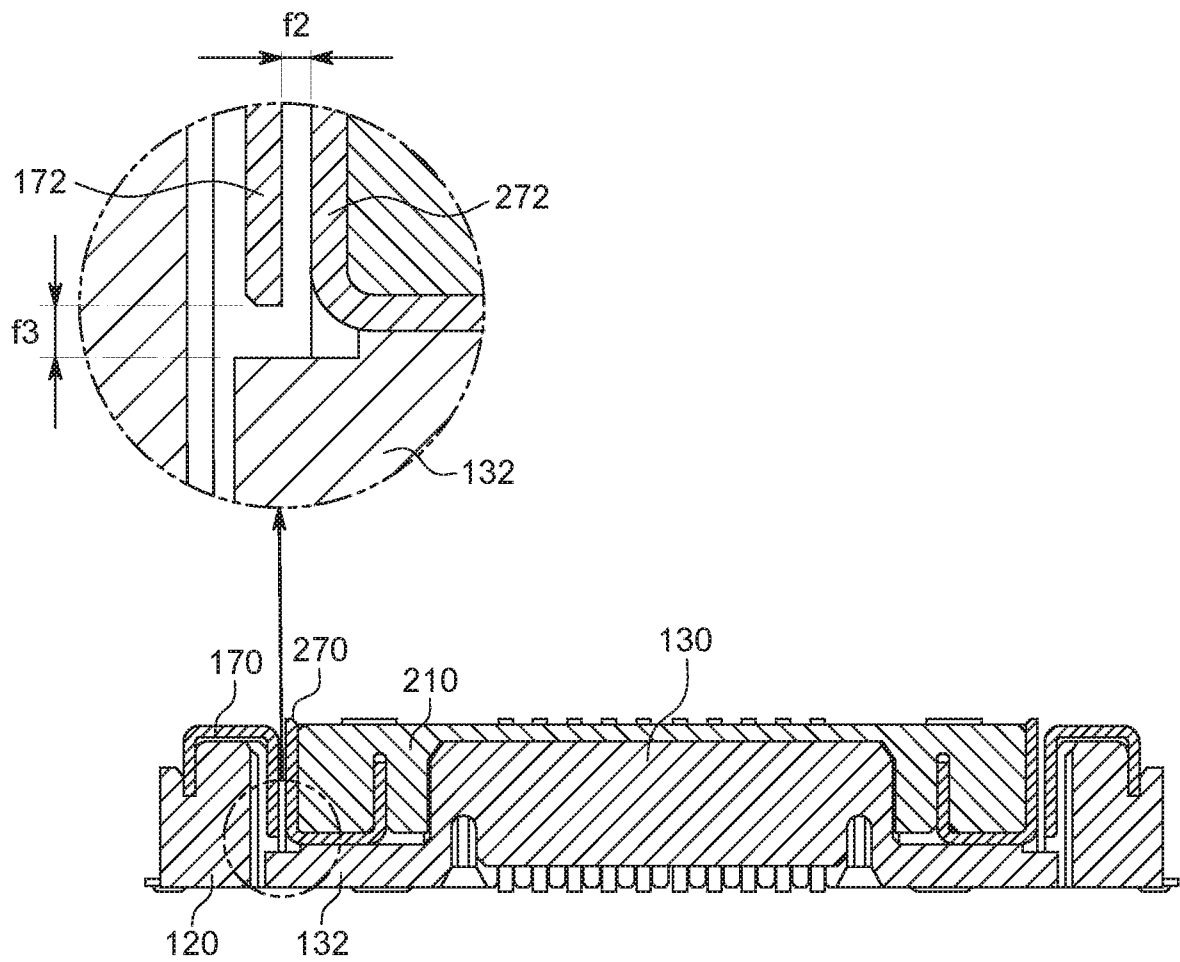


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/024528**A. CLASSIFICATION OF SUBJECT MATTER****H01R 13/533(2006.01)i, H01R 13/639(2006.01)i, H01R 13/22(2006.01)i, H01R 12/57(2011.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R 13/533; H01R 13/428; H01R 12/73; H01R 13/639; H01R 13/631; H01R 12/71; H01R 12/00; H01R 13/22; H01R 12/57

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: board-to-board connector, receptacle, plug, fitting nail, double U shape structure

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7766666 B1 (CHUNG-YU CHEN et al.) 03 August 2010 See column 1, line 11 - column 5, line 22, claim 1 and figures 1-7.	1,6-9
A		2-5
Y	KR 10-1610748 B1 (UJU ELECTRONICS CO., LTD.) 08 April 2016 See paragraphs [0034]-[0057], claim 1 and figures 2-5.	1,6-9
A	US 2015-0311610 A1 (HON HAI PRECISION INDUSTRY CO., LTD.) 29 October 2015 See paragraphs [0017]-[0031], claims 1-3 and figures 1-5.	1-9
A	JP 2015-185541 A (JAPAN AVIATION ELECTRONICS INDUSTRY LTD. et al.) 22 October 2015 See paragraphs [0026]-[0045], claim 1 and figures 1-5.	1-9
A	JP 2013-232386 A (HIROSE ELECTRIC CO., LTD.) 14 November 2013 See paragraphs [0020]-[0039] and figures 1-3.	1-9

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

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

18 July 2018 (18.07.2018)

Date of mailing of the international search report

18 July 2018 (18.07.2018)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

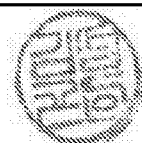


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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/024528

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