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(54) CONNECTOR FOR BEING MOUNTED ON THE EDGE OF A PCB, HAVING A REAR BACK METAL PORTION , WHICH CORRECTS THE CENTRE OF MASS

(57) Connector (100) according to the present invention can be mounted on an end portion of a substrate and stably held even when the connector has a bilaterally asymmetric shape. Front end side leg parts (171, 172) and rear end side leg parts (173, 174) are provided to protrude from bottom surface (105) on bottom surface (105) of connector main body (102). Front end side leg parts (171, 172) are provided on end surface (21) side of substrate (20) relative to rear end side leg parts (173). As viewed from mounting surface (21) side, leg parts (171, 172, 173) are provided on bottom surface (105) such that gravity center (G) of the connector itself is located within region (E1) defined by connecting the centers of leg parts (171, 172, 173).

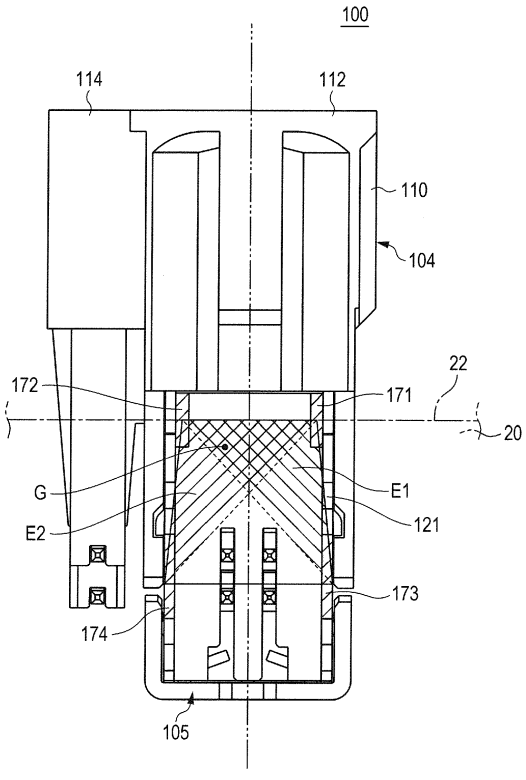

FIG. 10

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Description

Technical Field

[0001] The present invention relates to a connector that includes an interface part configured to be fitted and connected with a mating connector, and that connects, by the fitting and connecting with the mating connector at the interface part, a cable of another substrate or a cable of another electronic device with a substrate on which it is mounted. In particular, the present invention relates to a connector that is mounted on an end portion of the substrate.

Background Art

[0002] As a connector configured to be provided on a substrate of an electronic device, an electric connector is known in which an interface part to be fitted with a mating connector is projected from an end surface of a substrate and the connector is attached on the substrate with solder. Such an electric connector is disclosed in PTL 1 for example.

[0003] In addition, a connector of a pin-in-paste type is known in which a leg part for raising a connector main body relative to a substrate (specifically, a mounting surface) when a connector is mounted on the substrate. The leg part can provide a gap between the connector and the substrate, whereby flux creeping during reflow is prevented to improve cleanability at the connecting portion.

[0004] A connector configured to be mounted on an end portion of a substrate has an interface part that protrudes from the substrate side. As such, when the connector is mounted on an end portion of the substrate, in the state where reflow is not yet performed in soldering, the connector tends to be unstable depending on the position of the gravity center of the connector, and the connector may be dropped from the end portion of the substrate, or may be displaced from a give position, for example. Disadvantageously, this results in reduction in workability, connection failure and the like at the time of mounting the connector.

[0005] Under such circumstances, conventionally, when a connector is mounted at an end portion of a substrate, the gravity center of the connector is positioned on the substrate side as much as possible, and reflow is performed in a stabilized state to mount the connector by soldering.

Citation List

Patent Literature

PTL 1

[0006] Japanese Patent Application Laid-Open No. 2013-8670

Summary of Invention

Technical Problem

[0007] In recent years, from the standpoint of downsizing of the electronic part, in a connector that is mounted on an end portion of a substrate, it is desired to reduce a region of the substrate in which the connector is mounted so that the length of the protruding portion of the connector from the end surface of the substrate, that is, the length from the end surface of the substrate to the front end of the connector is greater than the length from the end surface of the substrate to the rear end portion of the connector. This in particular applies to a connector having on its front end side a lock function for holding connection with a mating connector.

[0008] There has been a desire to set the gravity center within the substrate region as much as possible to perform reflow of the connector in a stable state even with the above-mentioned unbalanced structure in which the length from the end surface of the substrate to the front end of the connector is great and the length from the end surface of the substrate to the rear end portion of the connector is limited.

[0009] In addition, there has been a desire to hold the connector such that the gravity center is located at a suitable position even in the case of a connector, which houses a terminal for electrical connection with a mating connector and is mounted on a substrate, is provided with another connecting part of another terminal on a side surface of the connector and has a bilaterally asymmetric shape in the width direction as viewed from the side opposite to the mounting surface.

[0010] An object of the present invention is to provide a connector that can be stably mounted on an end portion of a substrate even when the connector has a bilaterally asymmetric shape.

Solution to problem

[0011] To achieve the above-mentioned object, a connector according to an embodiment of the present invention includes: a connector main body including an attachment surface that faces a mounting surface of a substrate, the connector main body being configured to be mounted on the mounting surface; a connecting part provided to protrude from the connector main body, and project from an end surface of the mounting surface, the connecting part being configured to be connected to a mating connector; and first, second and third leg parts provided to protrude from the attachment surface, the first, second and third leg parts being configured to make contact with the mounting surface and define a gap between the attachment surface and the mounting surface, wherein the first leg part and the second leg part are provided on the attachment surface on the end surface side of the substrate relative to the third leg parts, and, as viewed from the mounting surface side, the first, sec-

ond and third leg parts are provided on the attachment surface such that a gravity center of the connector itself is located within regions defined by connecting centers of the leg parts.

Advantageous Effects of Invention

[0012] According to the present invention, a connector can be mounted and stably held on an end portion of a substrate even when the connector has a bilaterally asymmetric shape.

Brief Description of Drawings

[0013] The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawing wherein one example is illustrated by way of example, in which;

FIG. 1 is a perspective view illustrating a state where a connector of an embodiment of the present invention is mounted on a substrate;
FIG. 2 is a front view of the connector of the embodiment of the present invention;
FIG. 3 is a rear view of the connector of the embodiment of the present invention;
FIG. 4 is a bottom view of the connector of the embodiment of the present invention;
FIG. 5 is a right side view of the connector of the embodiment of the present invention;
FIG. 6 is a left side view of the connector of the embodiment of the present invention;
FIG. 7 is a sectional view taken along line II-II of FIG. 2;
FIG. 8 is a sectional view taken along line III-III of FIG. 2;
FIG. 9 illustrates a weight part of the connector of the embodiment of the present invention;
FIG. 10 is a bottom view illustrating a positional relationship on a substrate between leg parts and the gravity center of the connector of the embodiment of the present invention; and
FIG. 11 is a side view illustrating a positional relationship on a substrate between leg parts and the gravity center of the connector of the embodiment of the present invention.

Description of Embodiments

[0014] In the following, an embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0015] FIG. 1 is a perspective view illustrating a state where a connector of an embodiment of the present invention is mounted on a substrate. FIG. 2 is a front view of the connector. FIG. 3 is a rear view of the connector. FIG. 4 is a bottom view of the connector. FIG. 5 is a right side view of the connector. FIG. 6 is a left side view of the connector. It is to be noted that, in the present embodiment, the terms of the front end (front), rear, left, and right directions and the like which are used for describing the configurations and operations of components of the connector are relative directions, not absolute directions. The terms hold true when the orientation of the components of the connector is the same as that illustrated in the drawings, but when the orientation is changed, the terms should be interpreted in accordance with the changed orientation. In the following descriptions, the side of an end of the connector at which the connector is connected to a mating connector is referred to as front end (front) side, the other end opposite to the front end is referred to as rear end, and the surface facing the mounting surface is referred to as bottom surface, thus defining the other directions.

[0016] Connector 100 of the present embodiment is, but not limited to, a connector for data transfer which is used for high-speed data transfer between apparatuses. Connector 100 of the present embodiment is applicable to any connectors which are mounted on an end portion of a substrate.

[0017] Connector 100 of the present embodiment illustrated in FIG. 1 includes connector main body 102 that is mounted on mounting surface 21 of an end portion of substrate 20 (see FIGS. 4 and 5), and interface part (connecting part) 104 that projects from connector main body 102 and is fitted and connected with a mating connector (see FIGS. 4 and 5).

[0018] As illustrated in FIG. 3 to FIG. 6, connector 100 has a shape provided with cutout part 103 that is provided by cutting out the bottom surface side of connector main body 102. Connector main body 102 is attached on an end portion of a substrate positioned at cutout part 103. In this manner, connector 100 is mounted on substrate 20 in the state where interface part 104 protrudes from end surface 22 of substrate 20.

[0019] When interface part 104 is fitted with the interface part of a mating connector connected with another cable or another substrate, interface part 104 is electrically connected with the mating connector. Interface part 104 is disposed such that interface part 104 protrudes from end surface 22 of substrate 20.

[0020] As illustrated in FIG. 2, interface part 104 includes first fitting part 112 having first opening part 112a that opens to the front side (front end side), and second fitting part 114 having second opening part 114a. That is, connector 100 of the present embodiment is electrically connected at the two different parts, first and second fitting parts 112 and 114, with the corresponding parts of the interface part of the mating connector.

[0021] First fitting part 112 and second fitting part 114 are disposed side by side in the lateral direction of connector 100 (the direction that is parallel to mounting surface 21 and extends along end surface 22, or the width direction of connector 100). With this configuration, interface part 104 has an asymmetric shape in the width

direction of interface part 104, and connector 100 has a bilaterally asymmetric shape in its entirety.

[0022] In first fitting part 112 and second fitting part 114, first opening part 112a and second opening part 114a open to the outside and are adjacent to each other, with outer housing 110. On the inner periphery surface of first opening part 112a which extends along the direction in which the connector is connected with the mating connector, a key groove corresponding to the fitting shape of the mating connector to be connected is formed. Since first fitting part 112 has an inner periphery surface having a shape corresponding to the fitted part of the mating connector to be connected, only mating connectors that have a fitted part having a predetermined shape is allowed to be fitted with first fitting part 112.

[0023] First fitting part 112 includes outer housing 110, cylindrical part 122 covered by outer housing 110, and first terminal 130 disposed in cylindrical part 122 and configured to be connected with a mating connector terminal.

[0024] FIG. 7 is a sectional view taken along line II-II of FIG. 2.

[0025] As illustrated in FIG. 7, cylindrical part 122 is integrally connected with an end portion, which is covered by outer housing 110, of shell 120.

[0026] Together with first terminal 130 disposed inside, cylindrical part 122 is disposed in first opening part 112a of outer housing 110 such that it faces the front side (front end side).

[0027] Cylindrical part 122 and shell 120 integrally provided with cylindrical part 122 are composed of a plate member having conductivity, and in this case, cylindrical part 122 and shell 120 are configured by processing a sheet metal.

[0028] Shell 120 has a box-like shape that opens to the bottom surface side, and covers inner housing 140 on which first terminal 130 is fixed. Shell 120 is connected at a front side wall part with cylindrical part 122 such that the inner spaces thereof are continuously provided. It is to be noted that, together with weight part 180 and inner housing 140, shell 120 is provided as a principal part of connector main body 102. As illustrated in FIG. 4, at the lower end of shell 120, four leg parts 121 protruding downward are formed with predetermined spaces therebetween. Leg parts 121 are disposed to surround rear end portion 132 of first terminal 130 disposed in first opening part 112a (see FIG. 2). Leg parts 121 are inserted to respective through holes 224 (see FIG. 11) formed in substrate 20, and are fixed to be grounded through solder.

[0029] Inner housing 140 is formed of a material having an insulation property, and in this case, inner housing 140 is formed of a resin. As illustrated in FIGS. 4, 5 and 7, rear end portion (connecting end) 132 of first terminal 130 that is connected to substrate 20 protrudes downward from the bottom surface of inner housing 140. Rear end portion 132 of first terminal 130 that protrudes from the bottom surface of inner housing 140 is inserted to corresponding through hole 221 (see FIG. 11) formed in substrate 20 and is joined by soldering.

[0030] In addition, connector 100 includes second terminal 150 in addition to first terminal 130, and second terminal 150 is disposed in second opening part 114a.

[0031] FIG. 8 is a sectional view taken along line III-III of FIG. 2.

[0032] As illustrated in FIG. 2 and FIG. 8, second terminal 150 is disposed such that its front end portion serving as the contacting part extends along the fitting direction in second opening part 114a of second fitting part 114. The front end portion of second terminal 150 is disposed parallel to first terminal 130 (end portion) in first opening part 112a.

[0033] As illustrated in FIG. 4, FIG. 6 and FIG. 8, rear end portion 152 of second terminal 150 is disposed to protrude to the bottom surface side as with rear end portion 132 of first terminal 130. Rear end portion 152 is inserted to corresponding through hole 222 (see FIG. 11) formed in substrate 20 and is joined by soldering.

[0034] It is to be noted that the position of connector 100 relative to substrate 20 is set by inserting rear end portion 132 of first terminal 130 to through hole 221, rear end portion 152 of second terminal 150 to through hole 222, and leg parts 121 to through holes 224.

[0035] FIG. 9 illustrates weight part 180 of connector 100.

[0036] In this case, weight part 180 is formed by processing a sheet metal as with shell 120. Weight part 180 is formed by bending a sheet metal to cover the top surface and lateral surfaces of the rear end portion of shell 120 in an inverted U-shape with the top surface 181 and lateral surfaces 182 and 183 in back view. Weight part 180 includes hooks 184 on lateral surfaces 182 and 183 that engage the lateral surfaces of shell 120.

[0037] In weight part 180, top surface 181 and lateral surfaces 182 and 183 are fitted on shell 120, thus restricting the movement in the lateral direction (the width direction of the connector) with respect to shell 120, that is, the direction that is orthogonal to the direction in which the connector is connected with the mating connector, and is parallel to mounting surface 21 of substrate 20. The engagement of hooks 184 and shell 120 restricts the vertical movement of weight part 180 with respect to shell 120. It is to be noted that weight part 180 may be formed by using a sheet metal having the thickness same as that of the sheet metal used as shell 120. In this manner, unlike the configuration of conventional and commonly used connectors in which weight part 180 is formed integrally with shell 120 by aluminum die casting, the position of gravity center G of connector 100 can be set at a position on the rear end side of connector 100 by only processing a sheet metal by bending. That is, it is not necessary to separately manufacture an expensive metal mold to manufacture a die casting, and noise tolerance can be readily achieved by processing an inexpensive sheet metal. Moreover, increase in lifetime of the metal mold itself with use of a press member is achieved, and the connector 100 can be held at an end portion of sub-

strate 20 with gravity center G being stabilized, while achieving cost reduction.

[0038] As illustrated in FIG. 4 to FIG. 9, connector 100 having the above-mentioned configuration includes on its bottom surface (attachment surface) 105 leg part 170 (171 to 174) that protrudes downward. It is to be noted that, in FIG. 4, leg part 170 (171 to 174) is hatched for convenience.

[0039] Leg part 170 includes front end leg parts 171 and 172 (first leg parts 171 and second leg parts 172) and rear end side leg parts (third leg parts) 173 and 174 which are provided at respective positions on bottom surface 105 of connector main body 102 that faces mounting surface 21 when connector 100 is mounted on substrate 20.

[0040] In the present embodiment, four leg parts, front end side leg parts 171 and 172 and rear end side leg parts 173 and 174 are provided. Front end side leg parts 171 and 172 and rear end side leg parts 173 and 174 define a gap between bottom surface 105 and mounting surface 21. Front end side leg parts 171 and 172 are provided on bottom surface 105 at respective position nearer to end surface 22 of substrate 20 relative to rear end side leg parts 173 and 174. It is to be noted that one or both of the two parts, rear end side leg parts 173 and 174, is used as a third leg part.

[0041] FIG. 10 is a bottom view illustrating a positional relationship between the leg parts and the gravity center of the connector on the substrate, and FIG. 11 is a side view illustrating a positional relationship between the leg parts and the gravity center of the connector on the substrate.

[0042] Front end side leg parts 171 and 172 are provided with a space therebetween along the lateral direction of the connector, that is, the direction that is orthogonal to the connecting direction of interface part 104, and extends along mounting surface 21 of substrate 20. Front end side leg parts 171 and 172 are disposed with a space therebetween along end surface 22 at respective positions near end surface 22. It is to be noted that in bottom view, the center between front end side leg parts 171 and 172 is adjacent to the end surface 22, with a space therebetween. In this manner, the position of the gravity center of connector 100 itself can be further separated from end surface 22 of substrate 20.

[0043] In addition, rear end side leg parts 173 and 174 are located at respective positions on the inner side of substrate 20, that is, on the rear end portion side of connector 100 relative to front end side leg parts 171 and 172.

[0044] As illustrated in FIG. 10, in bottom view (as viewed from mounting surface 21 side), the positions of leg parts 171 to 174 are set such that gravity center G of connector 100 is located in triangular regions E1 and E2 defined by straight lines that connect front end side leg parts 171 and 172 and rear end side leg parts 173 or 174. To be more specific, leg parts 171 to 174 are provided on bottom surface 105 such that gravity center G is located in triangular regions E1 and E2 which are defined by connecting the centers of leg parts 171 to 174 in bottom view (centers on which load of connector 100 is exerted) by straight lines (or, the region obtained by connecting the centers of leg parts 171, 172 and 173, and the region obtained by connecting the centers of leg parts 171, 172 and 174).

[0045] In connector 100, gravity center G of connector 100 is located in one or both of triangular region E1 of front end side leg parts 171 and 172 and rear end side leg parts 173, and triangular region E2 of front end side leg parts 171 and 172 and rear end side leg parts 174.

[0046] In addition, as illustrated in FIG. 11, the protrusion length L1 of front end side leg parts 171 and 172 from the bottom surface (bottom surface 105 of connector main body 102) of connector 100 is preferably equal to or greater than protrusion length L2 of rear end side leg parts 173 and 174 from the bottom surface of connector 100. In the present embodiment, L1>L2 is satisfied. Lengths L1 and L2 of leg parts 171 to 174 may be increased on the front end side and reduced on the rear end side by a tolerance from a predetermined length (height of substrate 20) n, for example. Front end side leg parts 171 and 172 are each set to n+0.05 mm, and rear end side leg parts 173 and 174 are each set to n-0.05 mm or the like.

[0047] It is to be noted that connector main body 102 of connector 100 is integrally provided with weight part 180 that is fitted with shell 120.

[0048] According to connector 100 having the above-mentioned configuration, when connector 100 is mounted to substrate 20 by pin-in-paste, first, solder paste is thinly applied to a circuit pattern on mounting surface 21 of substrate 20 with use of masking, and then connector 100 is disposed at a corresponding position. At this time, connector 100 is placed perpendicular to substrate 20, and disposed at a corresponding position.

[0049] In the case of connector 100 disposed on mounting surface 21 of substrate 20, gravity center G of connector 100 is located between front end side leg parts 171 and 172, and rear end side leg parts 173 and 174 (or one of rear end side leg parts 173 and 174) (in region E1 or E2 illustrated in FIG. 11). With this structure, even in the case where connector 100 is of a type having a bilaterally asymmetric shape and is different from a bilaterally symmetric type (having only the first connecting part whose center gravity is located at the center of the connector), connector 100 can be stably held on mounting surface 21 in the state where interface part 104 projects from end surface 22 of substrate 20.

[0050] In addition, in connector 100, the height of front end side leg parts 171 and 172 is greater than that of rear end side leg parts 173 and 174 (one of which may not be provided) (L1>L2). With this configuration, when connector 100 is placed on mounting surface 21 of substrate 20 at a predetermined position, connector 100 itself is slanted rearward rather than frontward (front side). In this manner, gravity center G of connector 100 is located at a position on the inner side of substrate 20 relative to

end surface 22 of substrate 20, that is, at a position separated from end surface 22 of substrate 20 in the region of end surface 22 of substrate 20. As a result, connector 100 disposed at an end portion of substrate 20 is more stably held, and in this state, reflow is performed. In this manner, connector 100 is held at an end portion of substrate 20 such that connector 100 is not moved or shifted in front, rear, left and right directions with respect to substrate 20, and thus, connector 100 can be correctly and stably mounted by reflow with solder.

[0051] That is, without increasing the size of connector main body 102 on substrate 20 more than necessary, gravity center G of connector 100 can be positioned on the rear end portion side of the connector relative to front end side leg parts 171 and 172 in the region of substrate 20.

[0052] In addition, in connector 100 mounted on an end portion of substrate 20 illustrated in FIG. 11, even when connector 100 has a configuration in which length L3 from end surface 22 of substrate 20 to the front end of connector 100 is equal to or greater than that of length L4 from end surface 22 of substrate 20 to the rear end portion of connector 100, gravity center G of connector 100 is located on the rear end side of connector 100 relative to front end side leg parts 171 and 172. In addition, on mounting surface 21, gravity center G is located in regions E1 and E2.

[0053] Thus, when connector 100 is mounted on an end portion of substrate 20, connector 100 can be held such that connector 100 is not moved in front, rear, left and right directions, and substrate 20 itself provided with connector 100 can be downsized.

[0054] While front end side leg parts 171 and 172 of leg part 170 are formed on the bottom surface of inner housing 140 along the end sides separated in the width direction in the present embodiment, this is not limitative, and front end side leg parts 171 and 172 may be provided at an end portion on the end side on the bottom surface of shell 120.

[0055] In addition, while rear end side leg parts 173 and 174 are provided at an end portion on the rear end side on the bottom surface of shell 120, rear end side leg parts 173 and 174 may be formed along the end portion on the rear end side on the bottom surface of shell 120, and along the end sides separated in the width direction on the bottom surface of inner housing 140.

[0056] The embodiment disclosed herein is merely an exemplification and should not be considered as limitative. The scope of the present invention is specified by the following claims, not by the above-mentioned description. It should be understood that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors in so far as they are within the scope of the appended claims or the equivalents thereof.

[0057] Hereinabove, the embodiment of the present invention has been described. It is to be noted that the above-mentioned descriptions are merely examples of the present invention, and the scope of the present invention is not limited to the above-mentioned description. That is, the above-mentioned configuration of and apparatus and the shapes of the components are merely exemplifications, and various modifications, combinations, sub-combinations and alterations may occur in the scope of the present invention.

Industrial Applicability

[0058] The connector according to the embodiment of the present invention is suitable for a connector that is mounted on a substrate of an electronic component to be downsized.

Reference Signs List

[0059]

20	Substrate
21	Mounting surface
22	End surface of substrate
100	Connector
102	Connector main body
103	Cutout part
104	Interface part (connecting part)
105	Bottom surface (attachment surface)
110	Outer housing
112	First fitting part
112a	First opening part
114	Second fitting part
114a	Second opening part
120	Shell
122	Cylindrical part
130	First terminal
132, 152	Rear end portion
140	Inner housing
150	Second terminal
170	Leg part
171, 172	Front end side leg parts
173, 174	Rear end side leg parts
180	Weight part
181	Top surface
182, 183	Lateral surface
184	Hook
221, 222, 224	Through hole
E1, E2	Triangular region

Claims

1. A connector (100) comprising:

a connector main body (102) including an attachment surface (105) that faces a mounting surface (21) of a substrate (20), the connector main body (102) being configured to be mounted on the mounting surface;

a connecting part (104) provided to protrude from the connector main body, and project from an end surface (for example, an end surface 22 of the substrate) of the mounting surface, the connecting part (104) being configured to be connected to a mating connector; and
first, second and third leg parts (171, 172, 173, 174) provided to protrude from the attachment surface, the first, second and third leg parts (171, 172, 173, 174) being configured to make contact with the mounting surface and define a gap between the attachment surface and the mounting surface, wherein
the first leg part (171) and the second leg part (172) are provided on the attachment surface on the end surface side of the substrate relative to the third leg parts (173 and 174), and,
as viewed from the mounting surface side, the first, second and third leg parts are provided on the attachment surface such that a gravity center (G) of the connector itself is located within regions defined by connecting centers of the leg parts.

2. The connector according to claim 1, wherein a protrusion length of each of the first and second leg parts is greater than a protrusion length of each of the third leg parts.

3. The connector according to claim 1 or 2, wherein the connecting part has a shape that is asymmetric in a width direction.

4. The connector according to any of claims 1 to 3, wherein the connector main body includes a weight part (180) configured to adjust the gravity center.

5. The connector according to claim 4, wherein the weight part is formed of a sheet metal.

6. The connector according to any of claims 1 to 5, wherein a length from the end surface of the substrate to a front end portion that is an end portion of the connecting part in a protruding direction of the connecting part is equal to or greater than a length from the end surface of the substrate to a rear end portion of the connector main body.

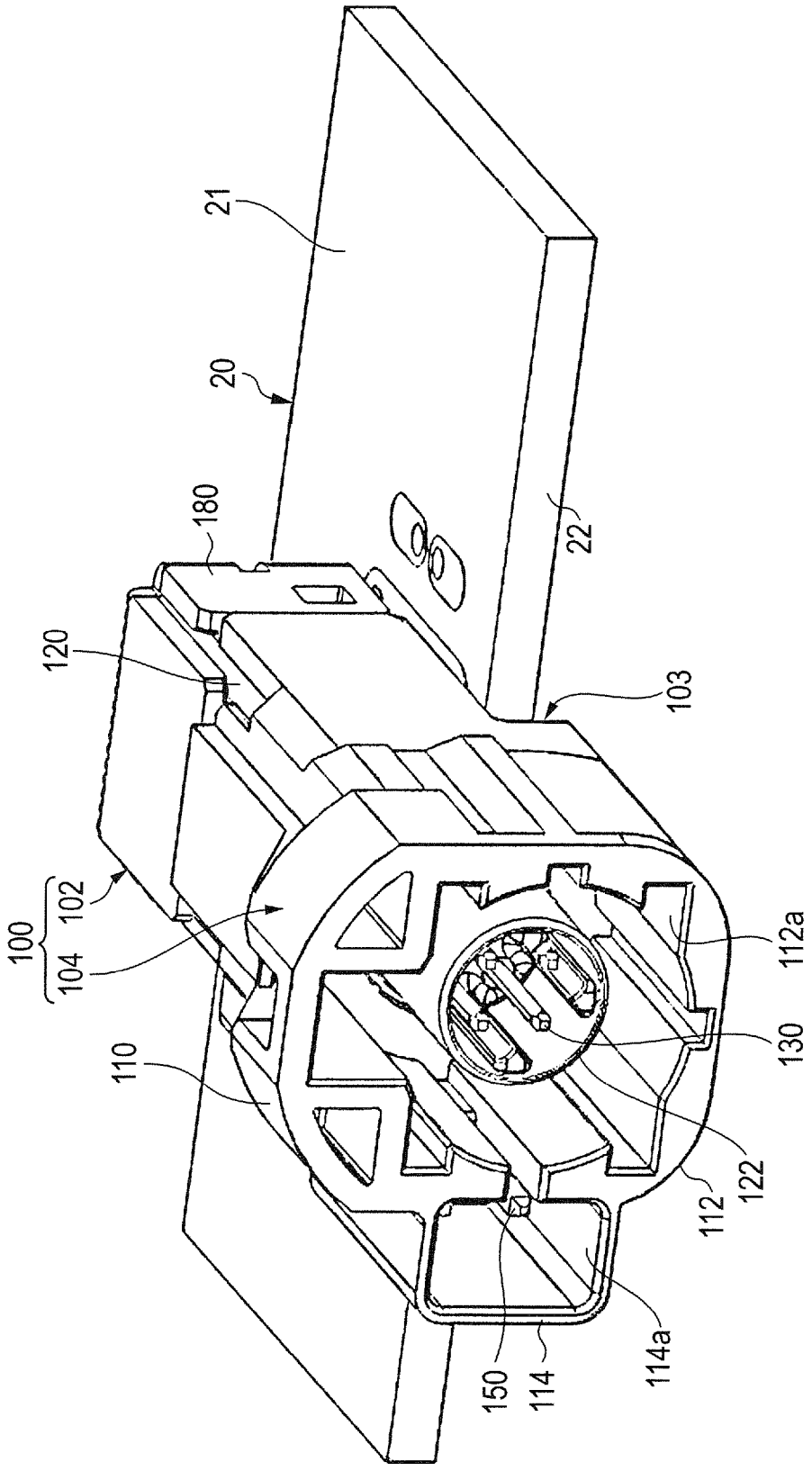
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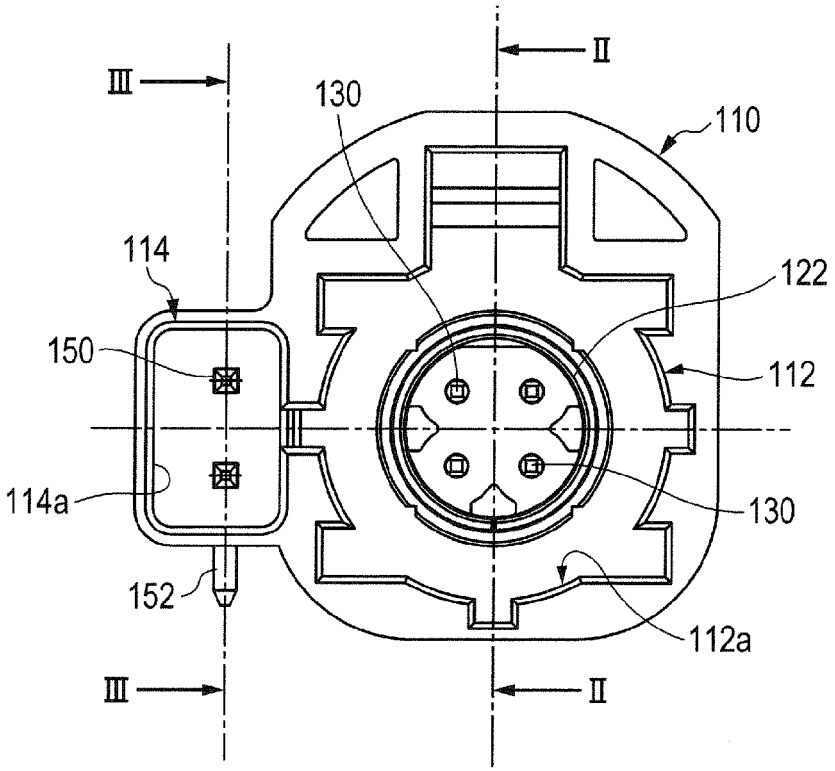
FIG. 1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III
II

FIG. 2

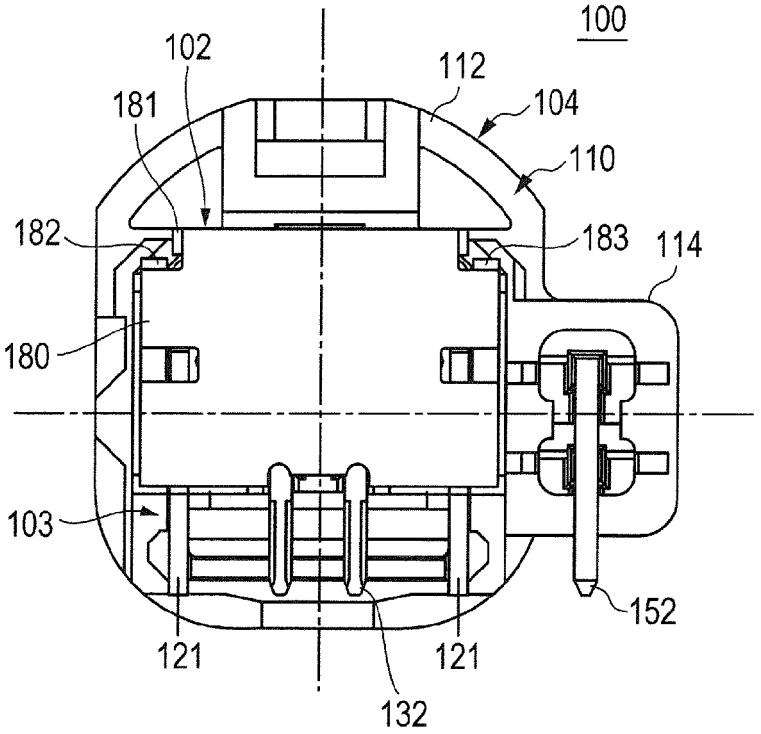
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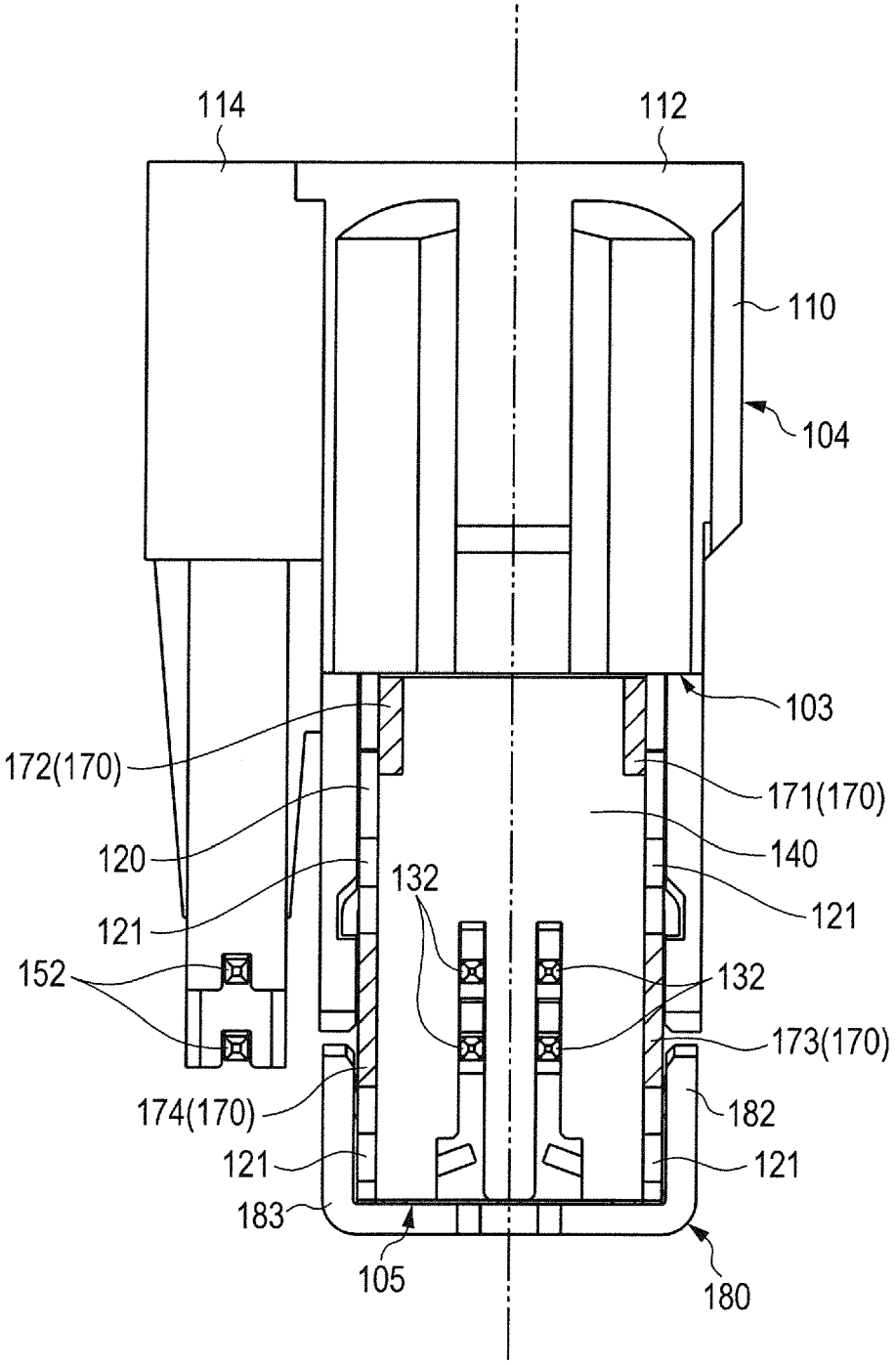
FIG. 3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172(170)
171(170)
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FIG. 4

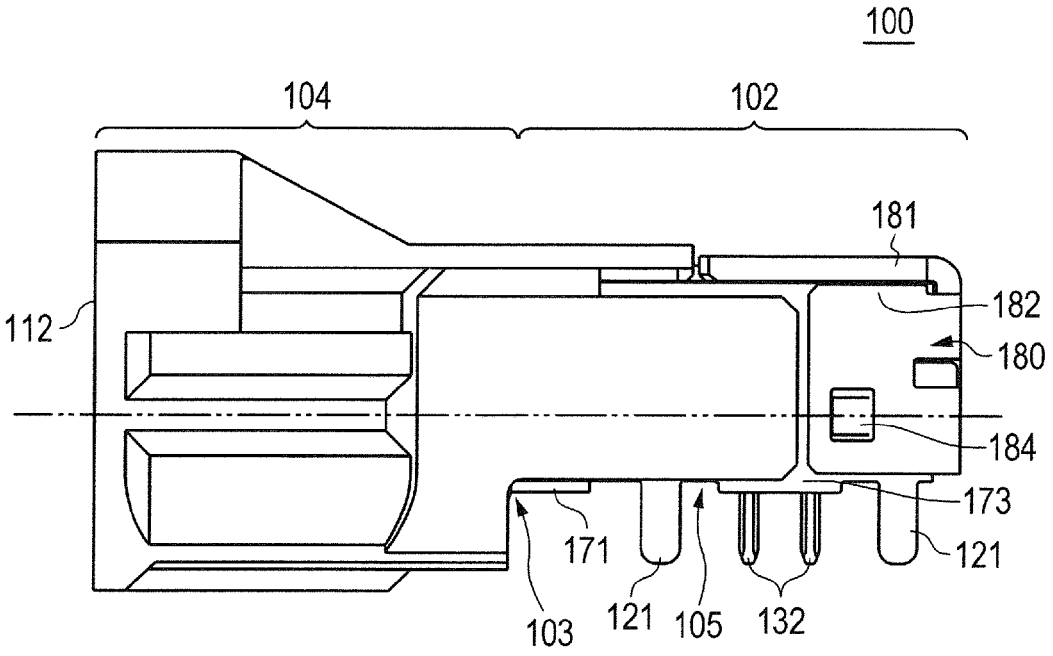
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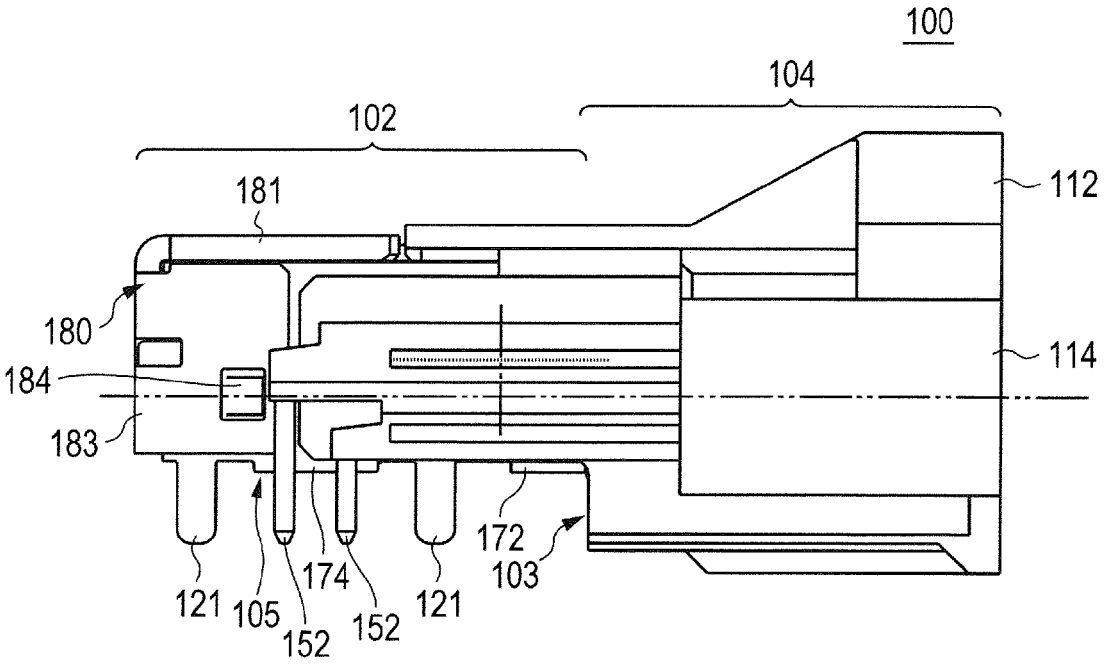
FIG. 5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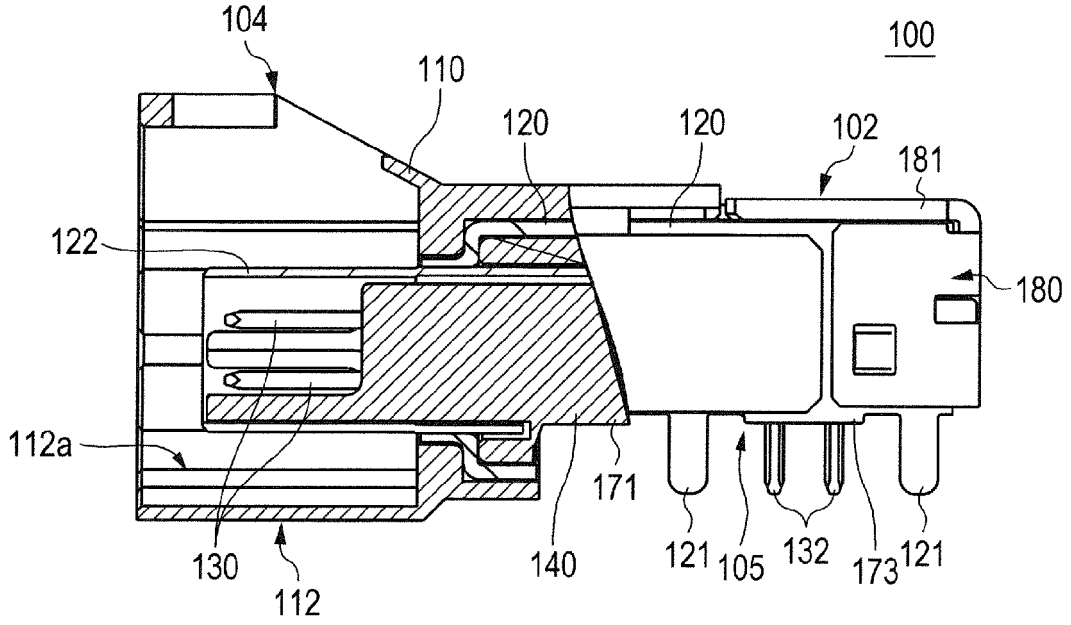
121

FIG. 6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181
122
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112a
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130
112
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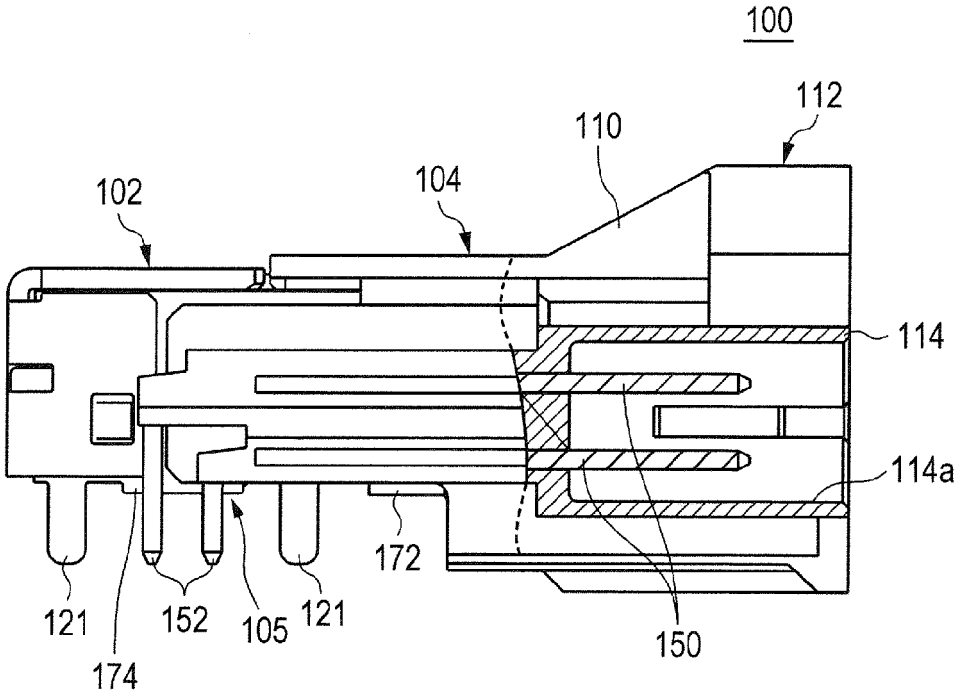
105
132
173
121

FIG. 7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114a
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152
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150
174

FIG. 8

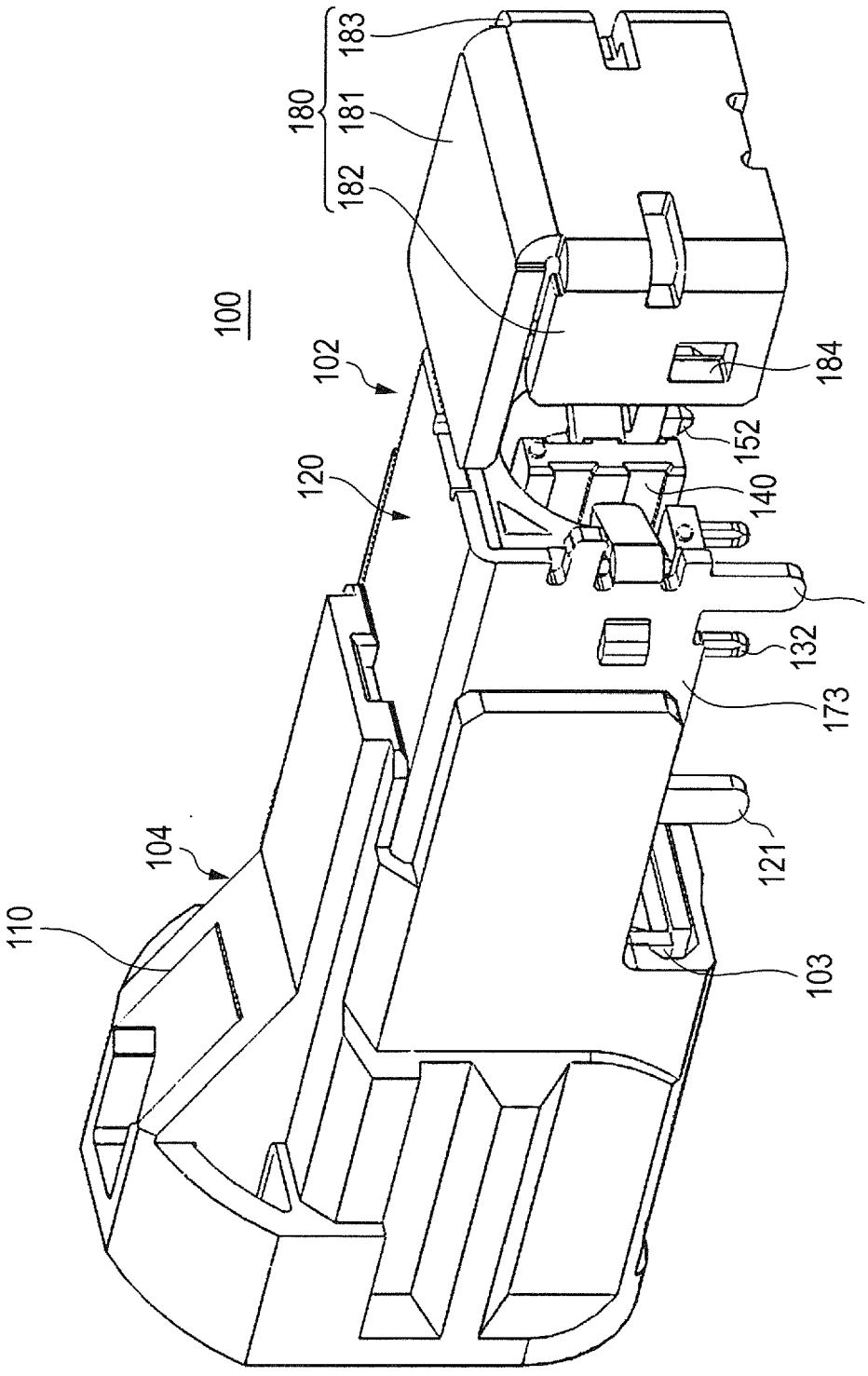
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FIG. 9

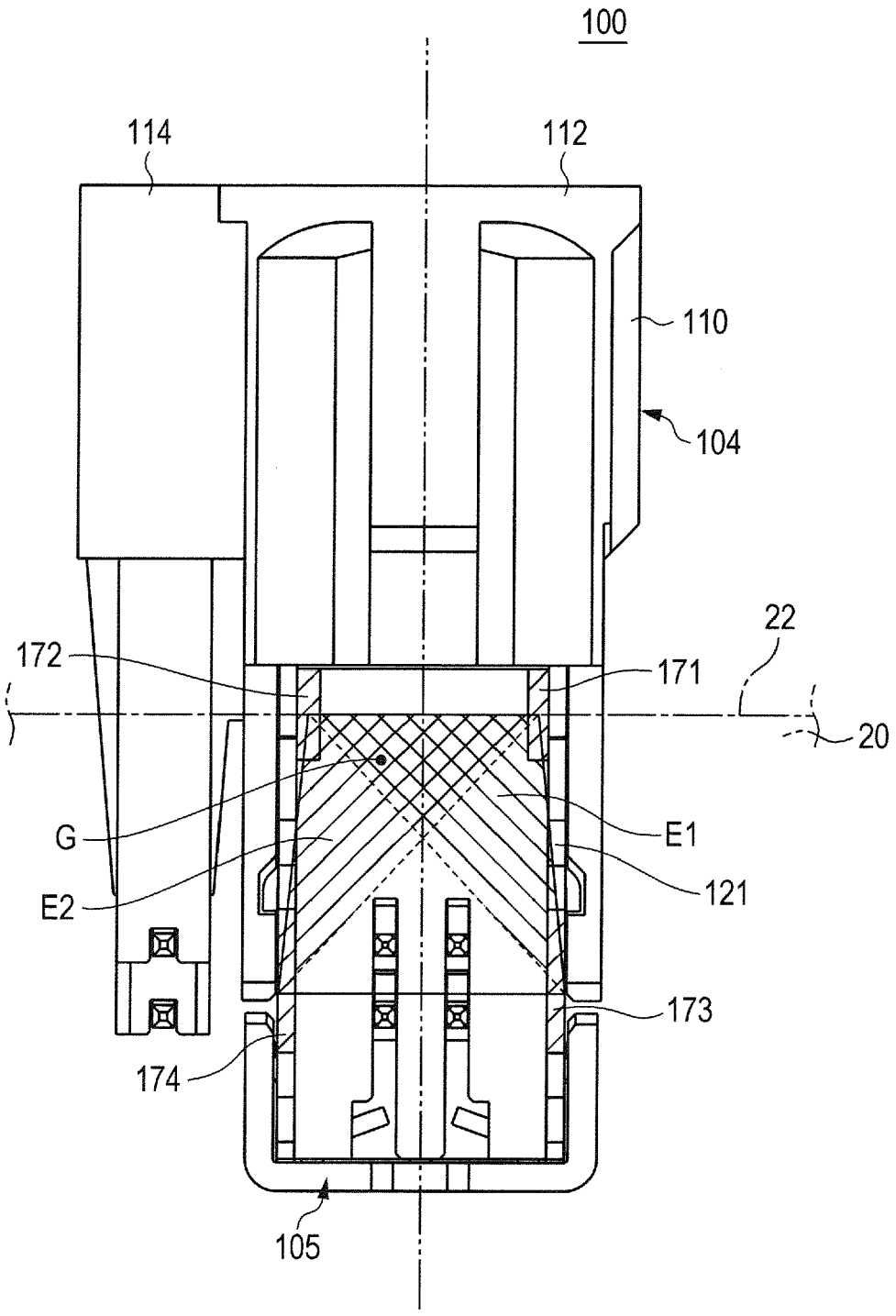

FIG. 10

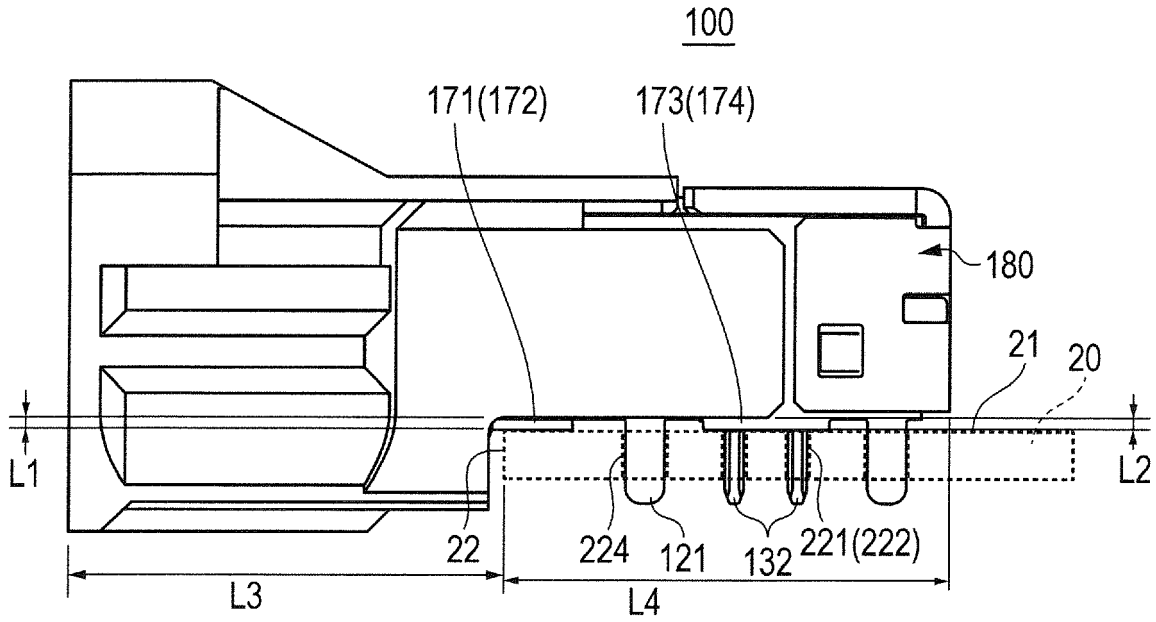

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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