US 20240186732A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0186732 A1**

Jiang (43) **Pub. Date: Jun. 6, 2024**

(54) **CONNECTORS AND CONNECTOR ASSEMBLIES**

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(21) Appl. No.: **18/531,193**

(22) Filed: **Dec. 6, 2023**

(30) **Foreign Application Priority Data**

Dec. 6, 2022 (JP) 2022-194863

Publication Classification

(51) **Int. Cl.**

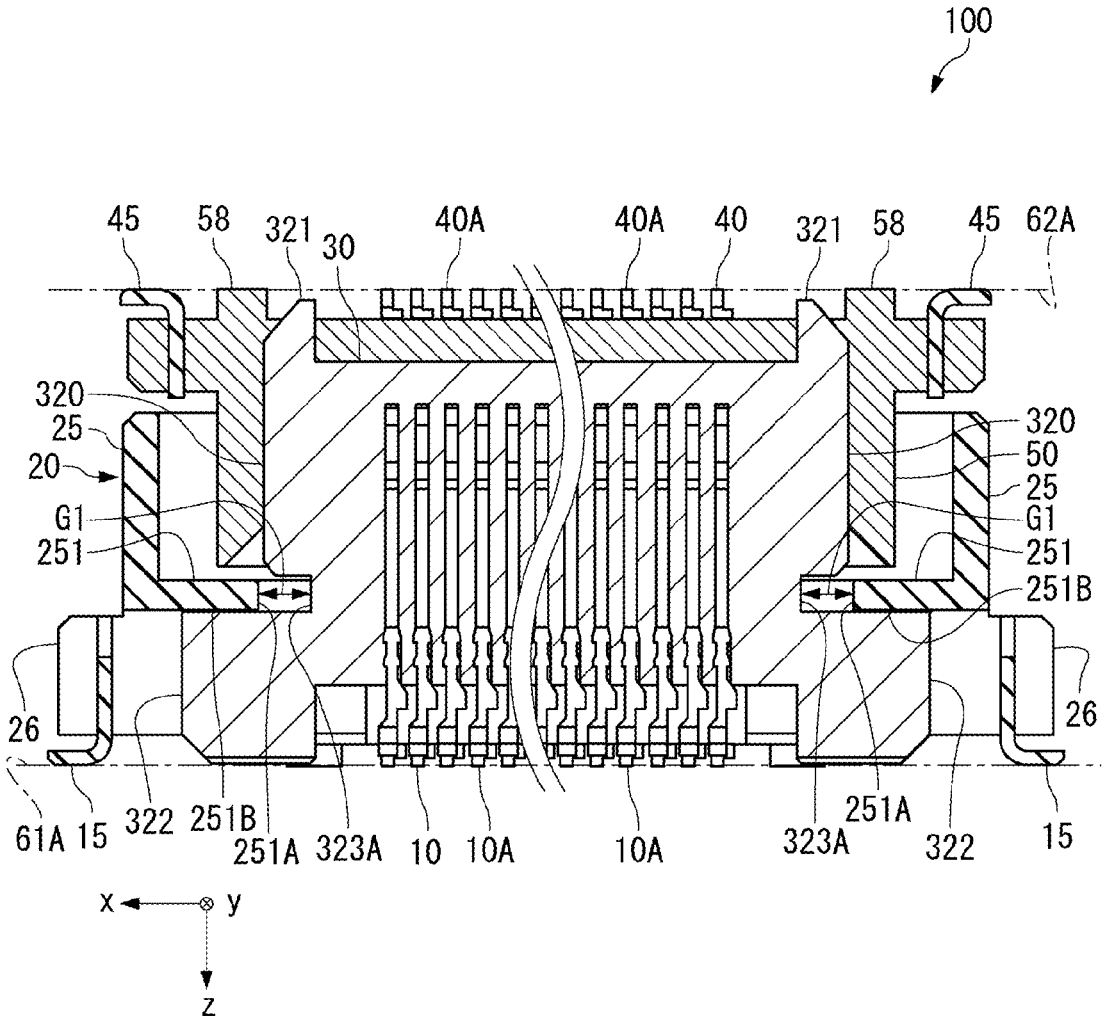
H01R 12/71	(2006.01)
H01R 13/506	(2006.01)
H01R 13/631	(2006.01)

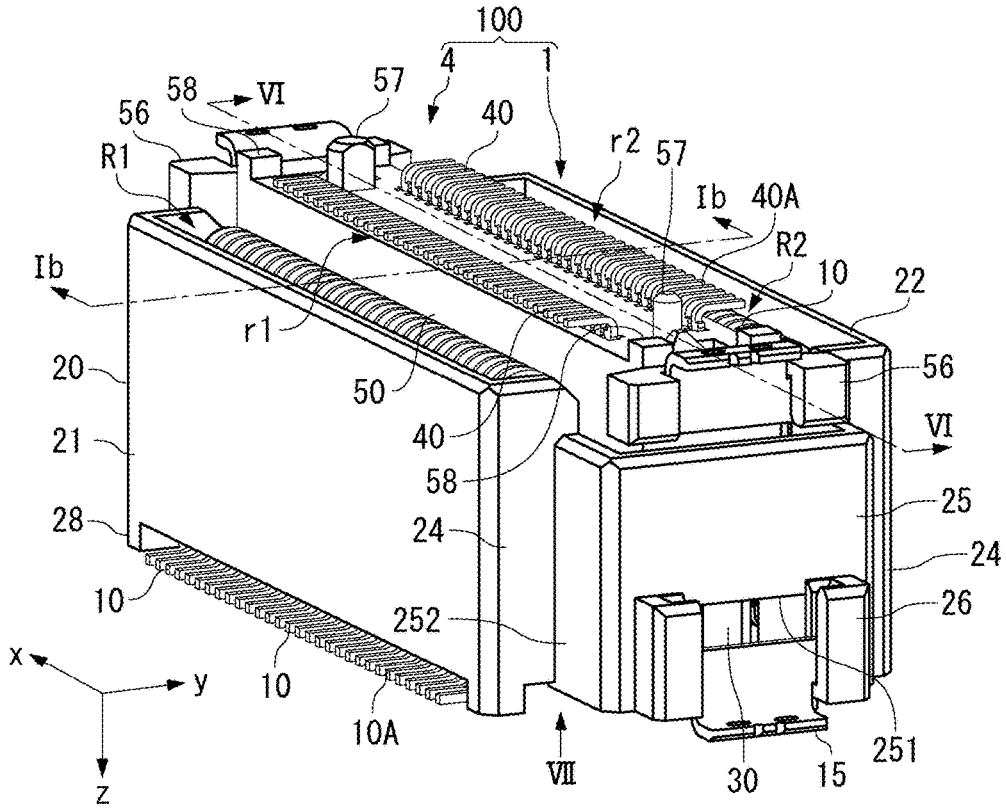
(52) **U.S. Cl.**

CPC ***H01R 12/716*** (2013.01); ***H01R 13/506*** (2013.01); ***H01R 13/631*** (2013.01)

(57) **ABSTRACT**

A connector comprises a plurality of contacts, a stationary housing, and a movable housing. The plurality of contacts are arranged along a predetermined first to form a first row and a second row in parallel, positioned on a reference surface encompassing the first direction and a second direction orthogonal to the first direction, and are bonded to an object to be bonded. The stationary housing surrounds the plurality of contacts and positioned on the reference surface. The movable housing sections an interior of the stationary housing into an area closer to the first row and an area closer to the second row, and is displaceable in the first direction and the second direction with respect to the stationary housing.

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4
1
58
VI
57
56
40
R1
r2
57
Ib
40A
R2
Ib
10
22
r1
20
50
56
40
VI
21
58
25
28
24
24
10
26
252
x
y
10
10A
VII
30
15
251
z

FIG. 1a

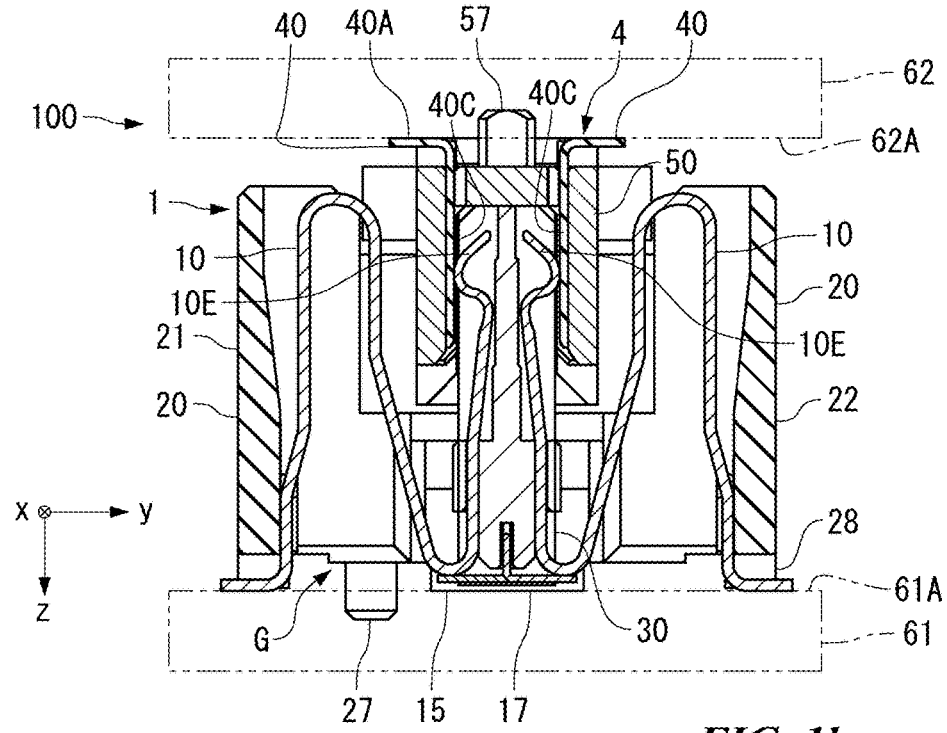
40
40A
57
4
40
62
100
40C
40C
62A
50
1
10
10
20
10E
10E
21
22
20
x
y
28
61A
z
G
30
61
27
15
17

FIG. 1b

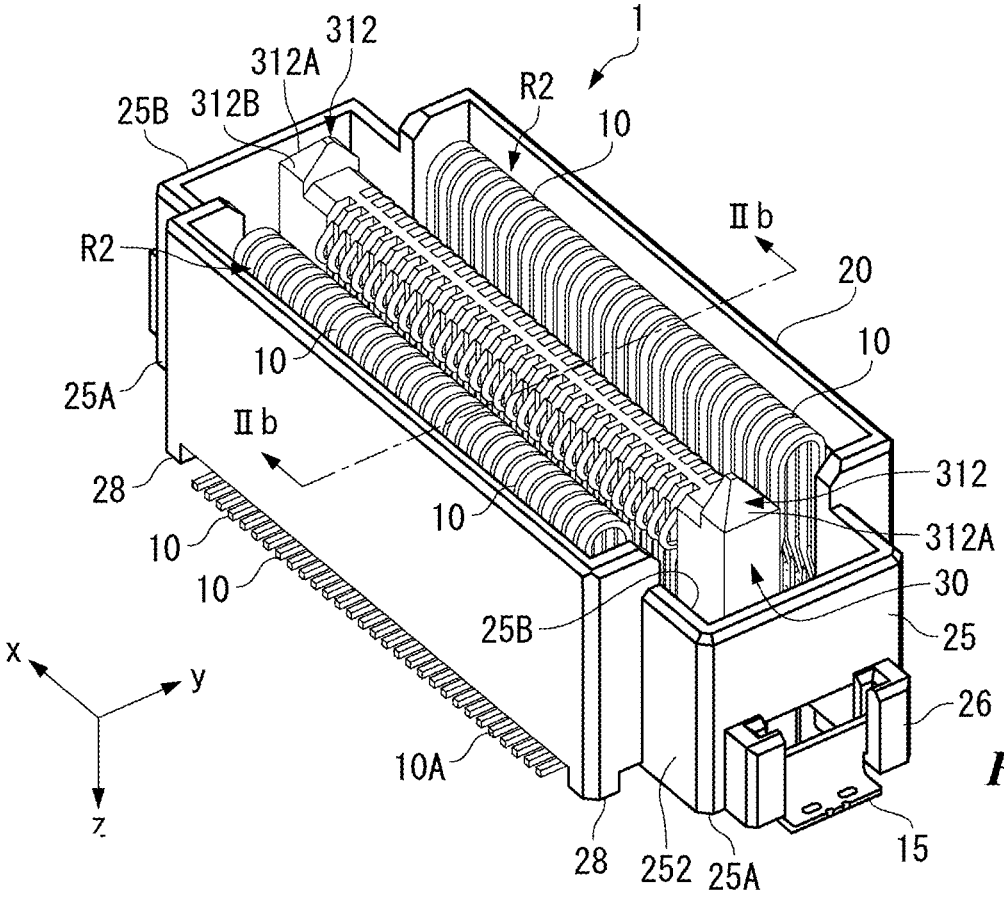
1
312
312A
312B
25B
R2
10
Ⅱb
20
25A
28
252
15
26
30
25
x
y
z

FIG. 2a

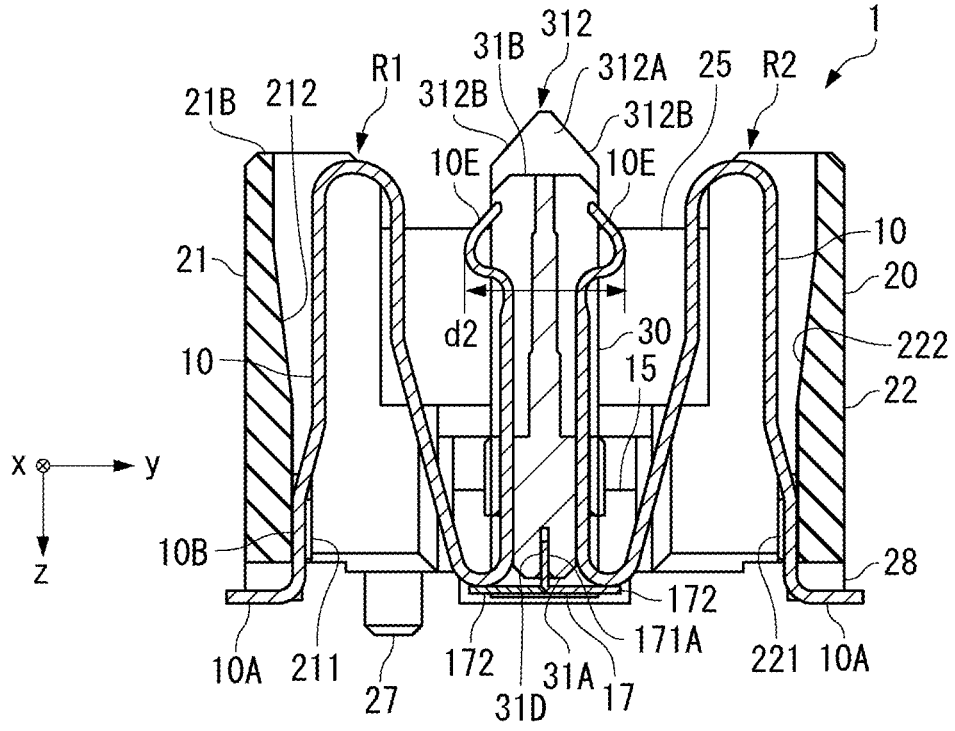
1
312
31B
312A
312B
25
R1
R2
21B
212
10E
d2
30
15
10
20
222
22
21
10B
28
172
171A
221
10A
211
27
31A
31D
17

FIG. 2b

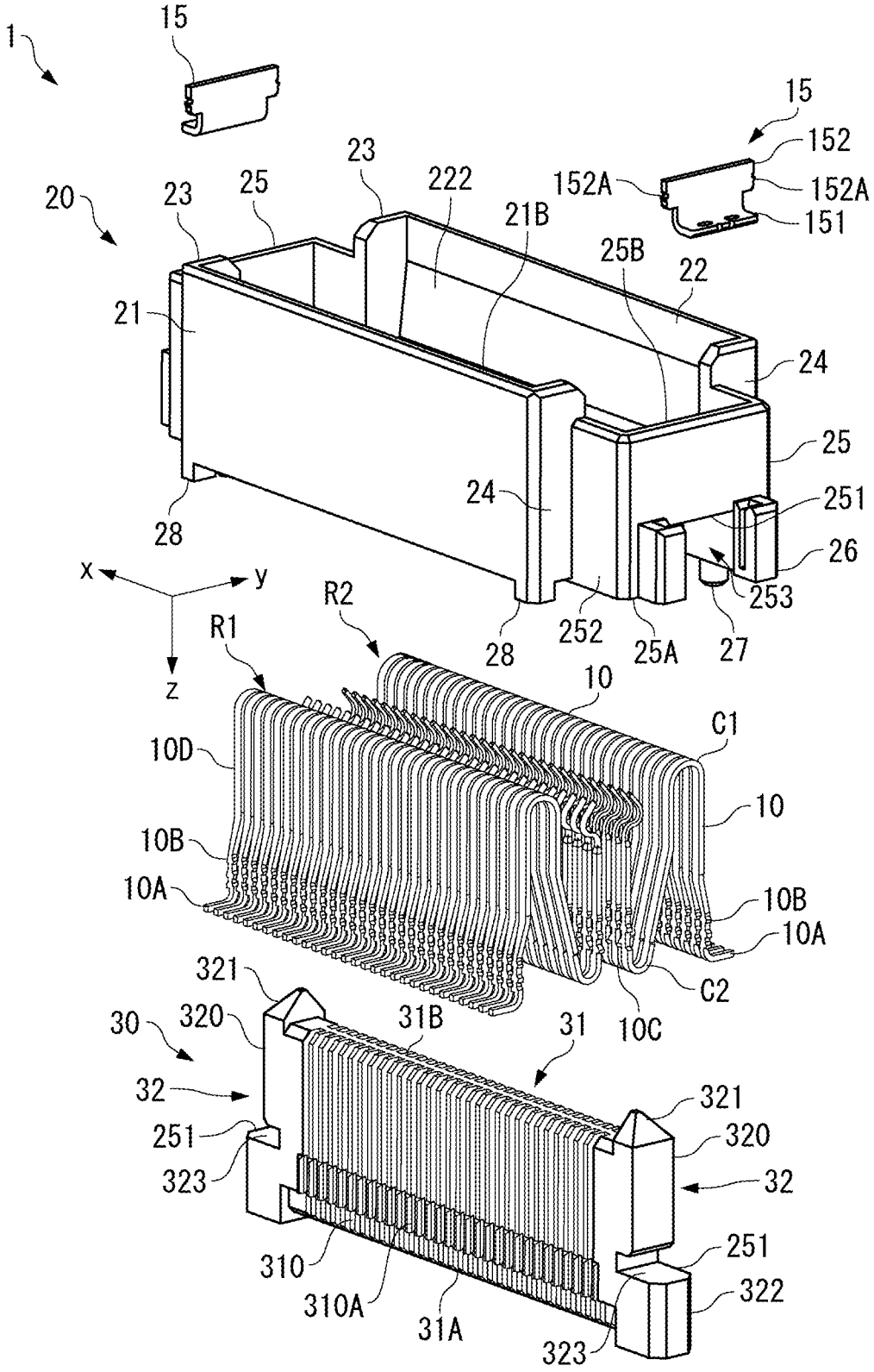
1
15
15
152
152A
152A
151
20
23
25
23
222
21B
25B
22
21
24
25
251
24
26
28
253
x
y
z
R1
R2
28
252
25A
27
10
C1
10D
10
10B
10A
10B
10A
C2
10C
321
320
30
31B
31
32
321
251
320
323
32
251
310
322
310A
31A
323

FIG. 3

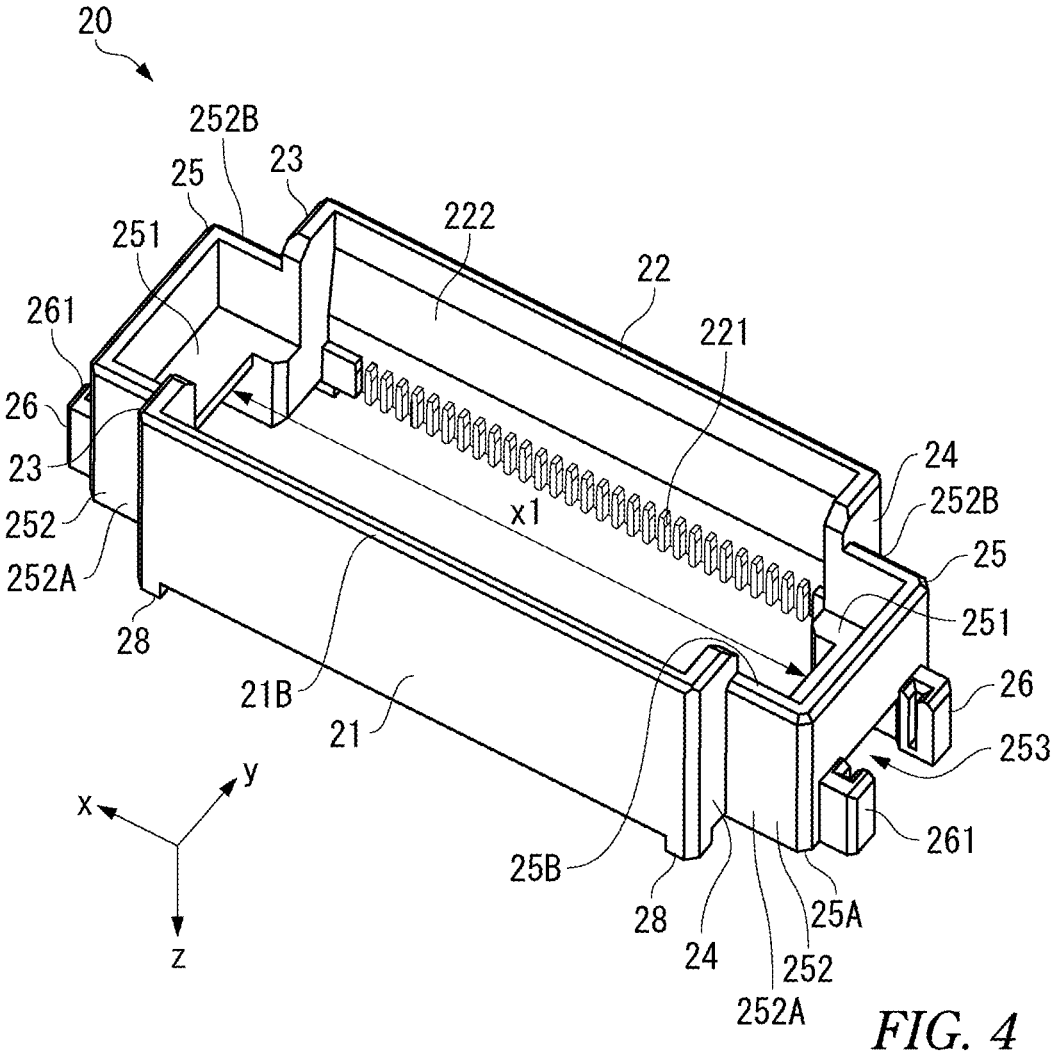
20
252B
25
23
251
222
22
261
221
26
23
252
252A
28
x1
24
252B
25
251
26
253
261
21B
21
25B
28
24
252
252A
25A
y
x
z

FIG. 4

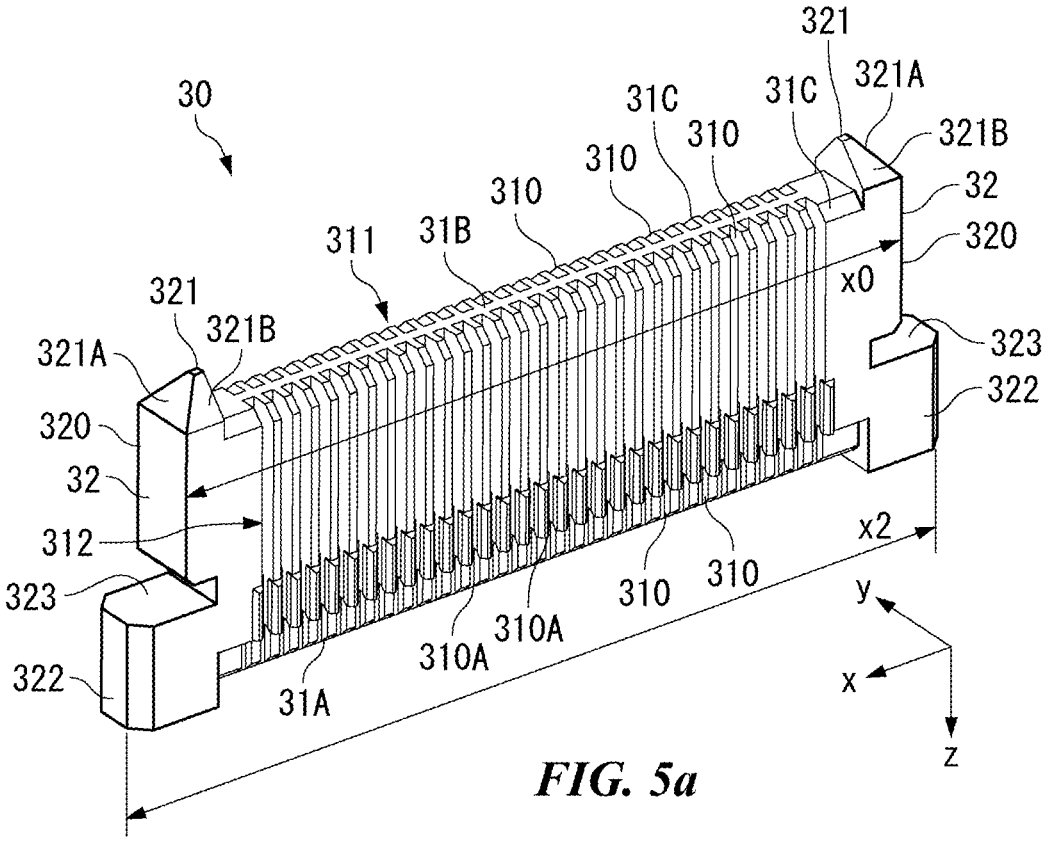

FIG. 5a

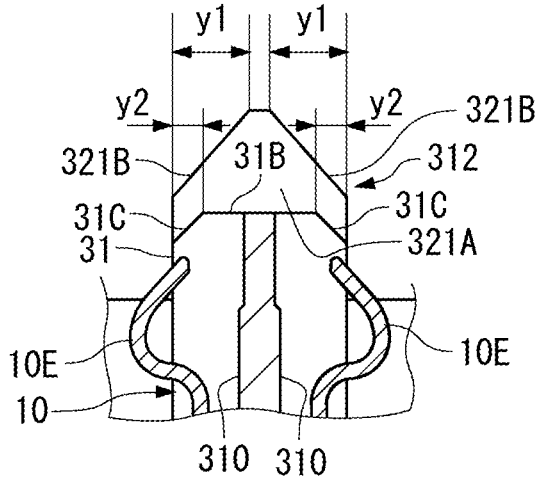

FIG. 5b

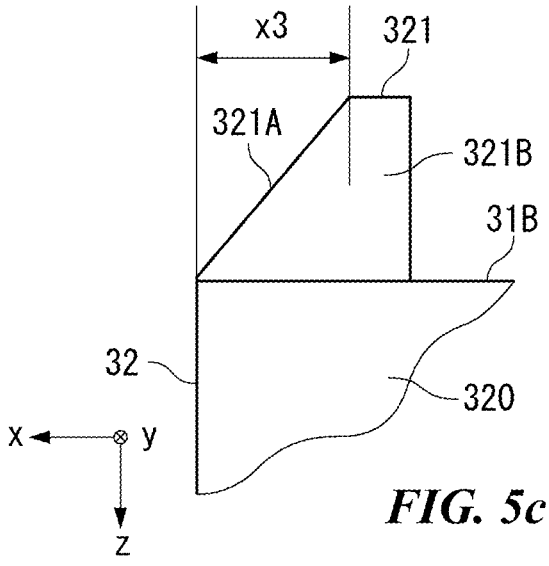

FIG. 5c

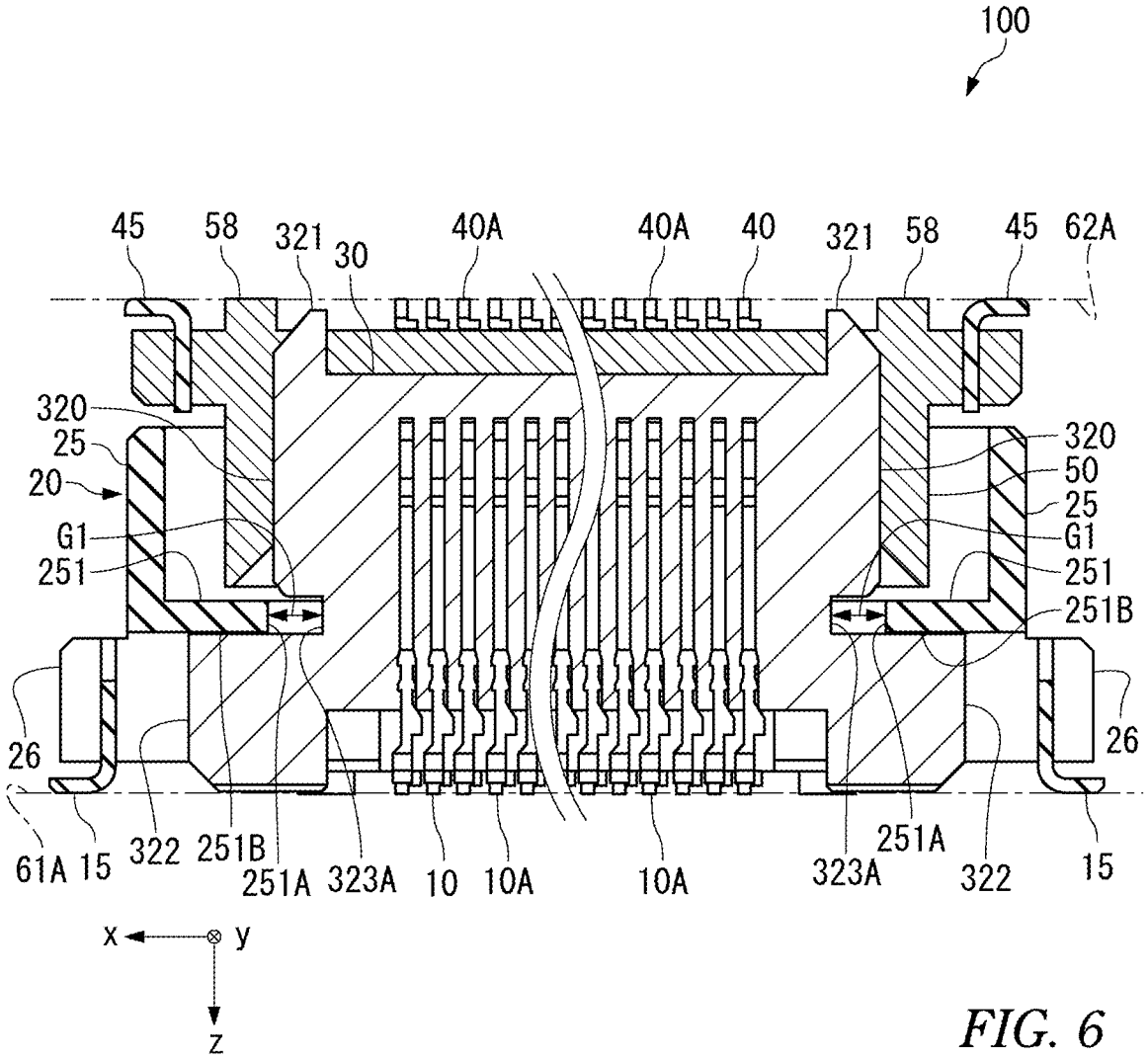
100
45
58
321
30
40A
40A
40
321
58
45
62A
320
25
20
G1
251
320
50
25
G1
251
251B
26
26
61A
15
322
251B
251A
323A
10
10A
10A
323A
251A
322
15
x
y
z

FIG. 6

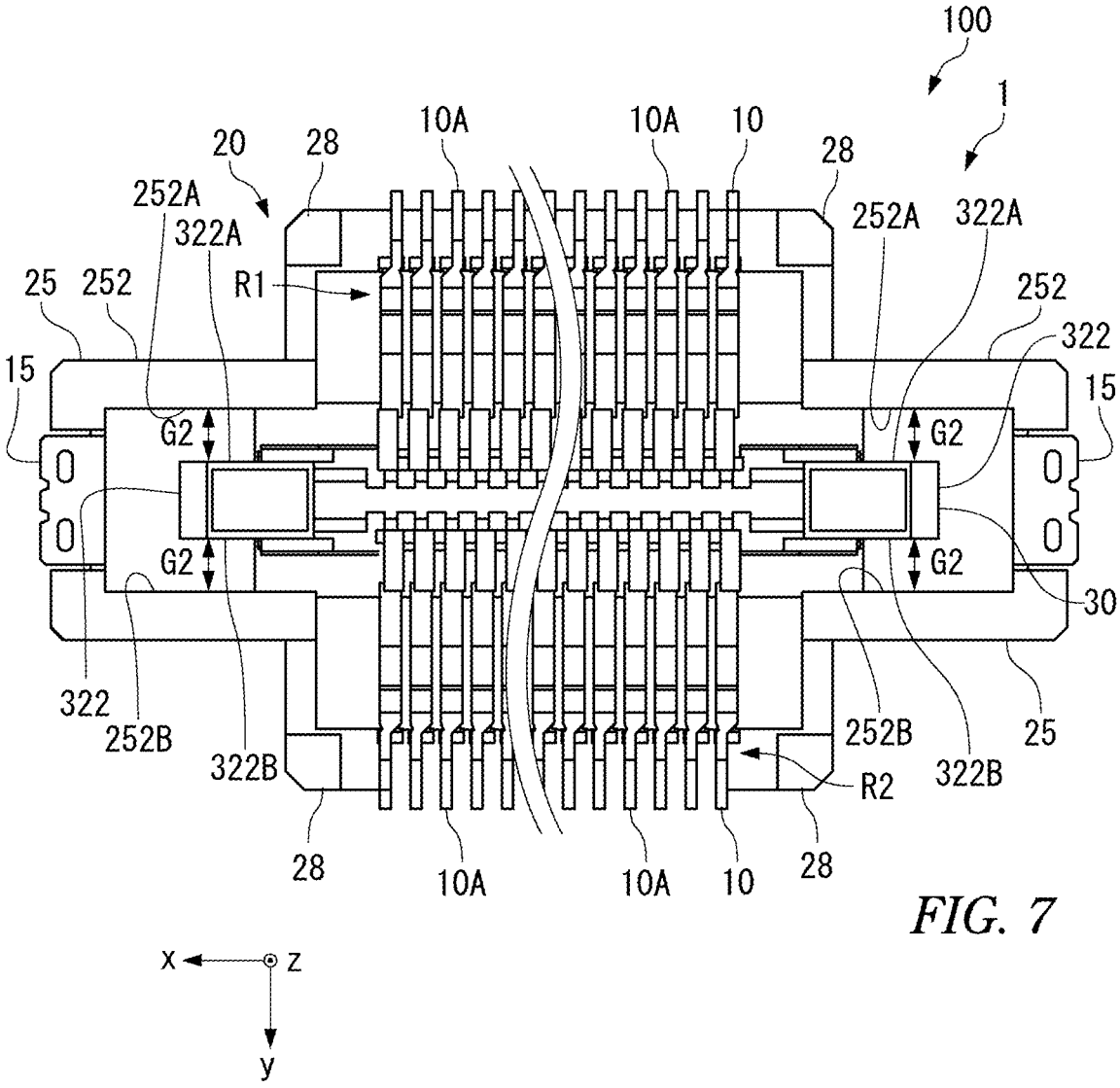
100
1
20
28
10A
10A
10
28
252A
322A
252A
322A
25
252
R1
252
322
15
15
G2
G2
G2
G2
30
322
252B
322B
252B
322B
25
R2
28
10A
10A
10
28
x
z
y

FIG. 7

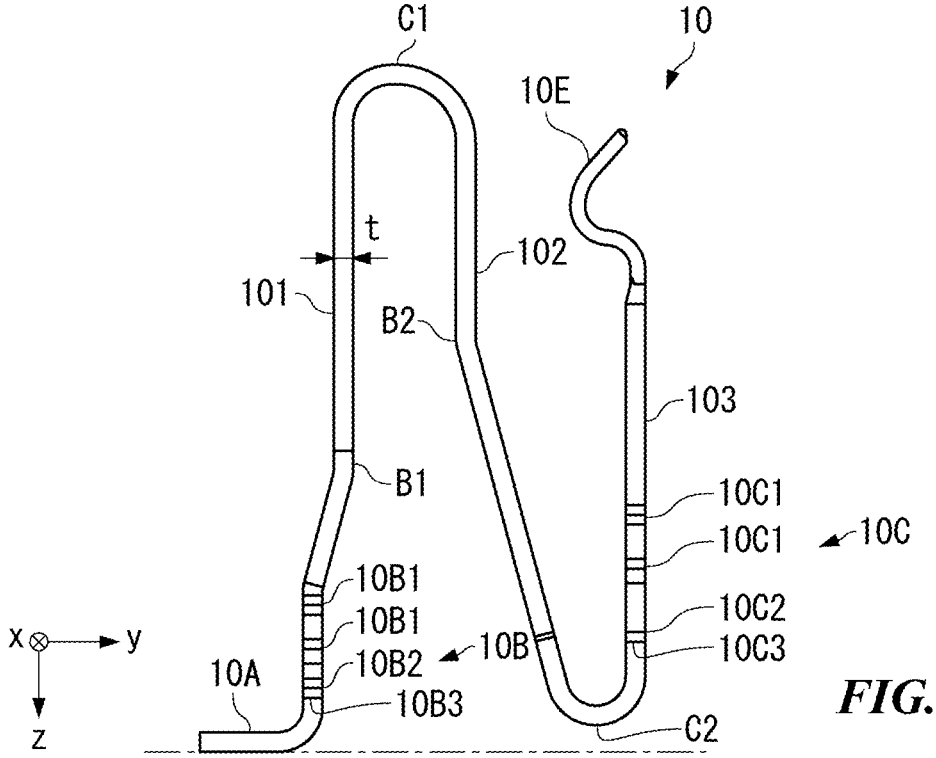

FIG. 8a

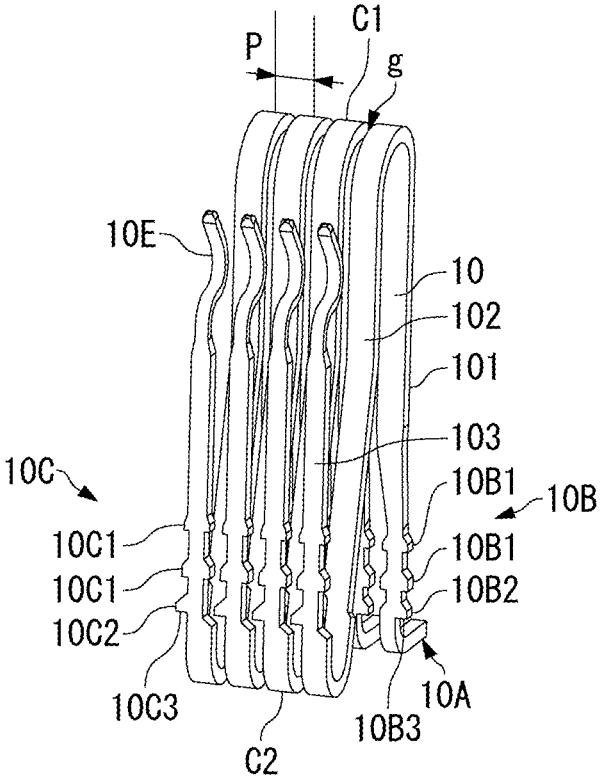

FIG. 8b

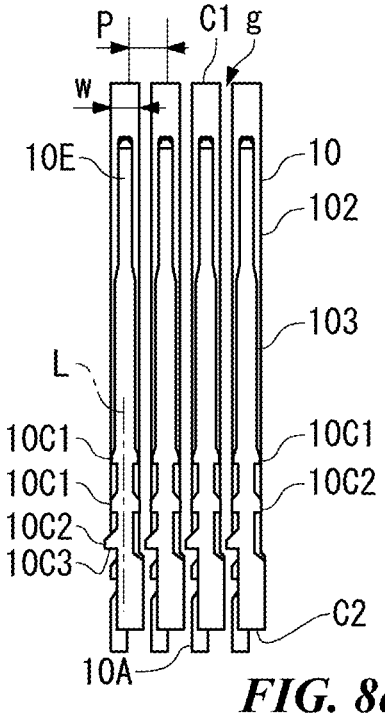

FIG. 8c

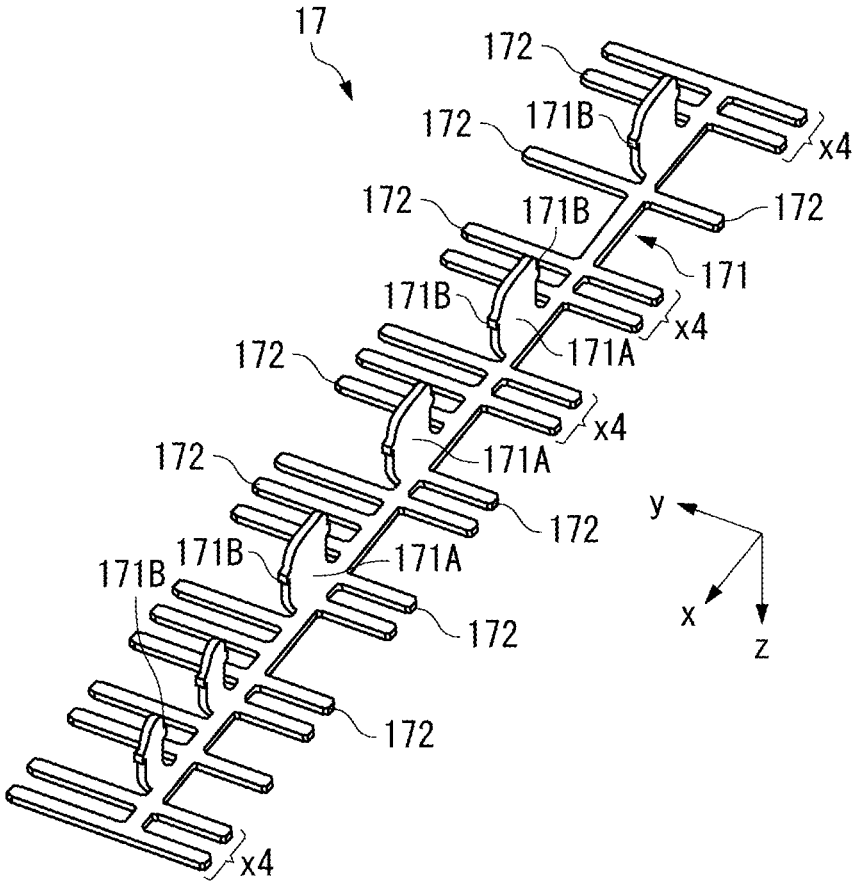

FIG. 9

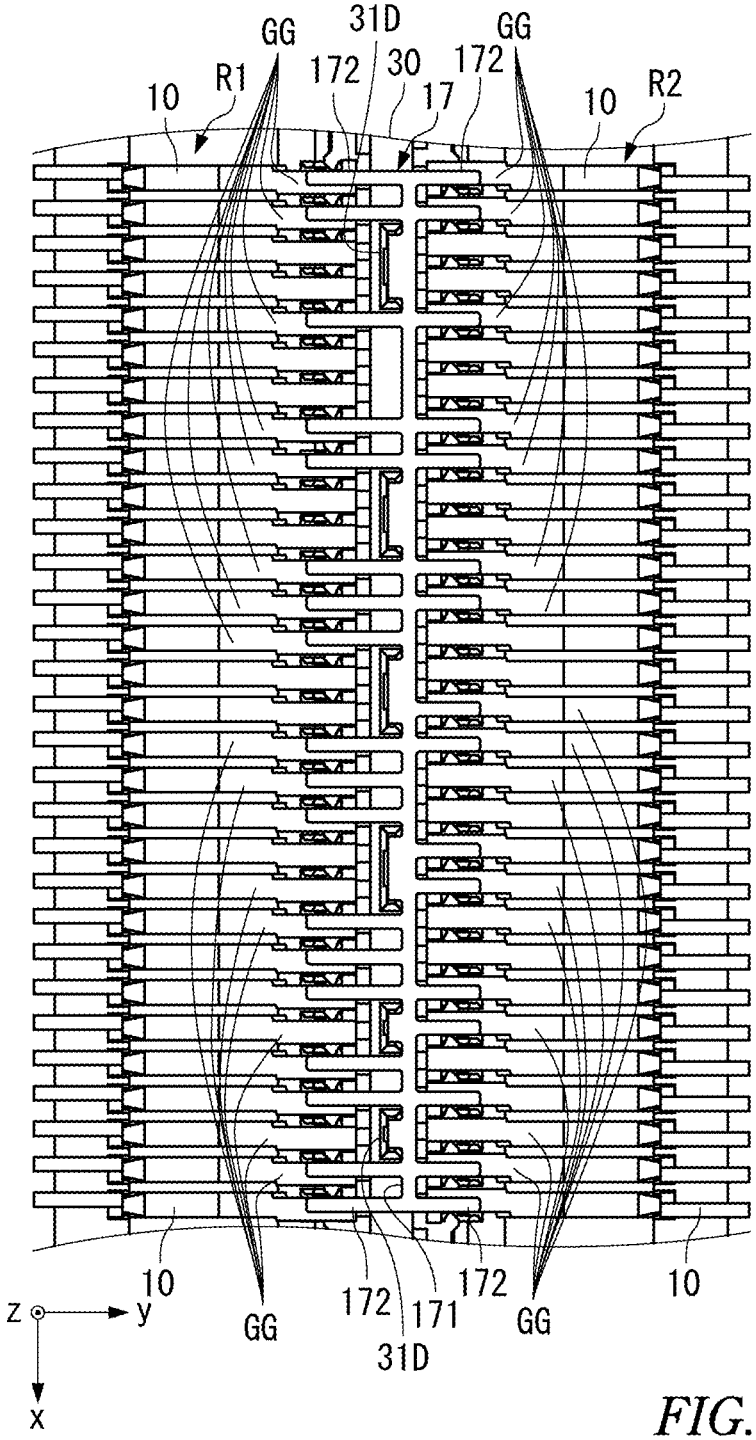

FIG. 10

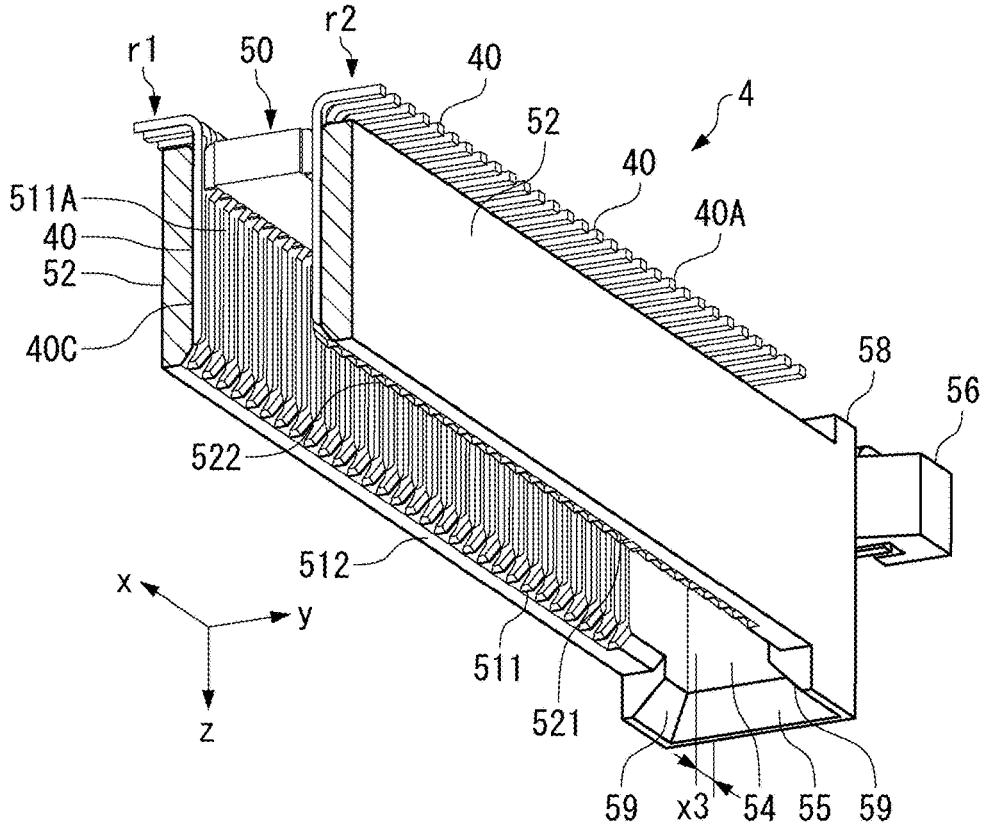

FIG. 11a

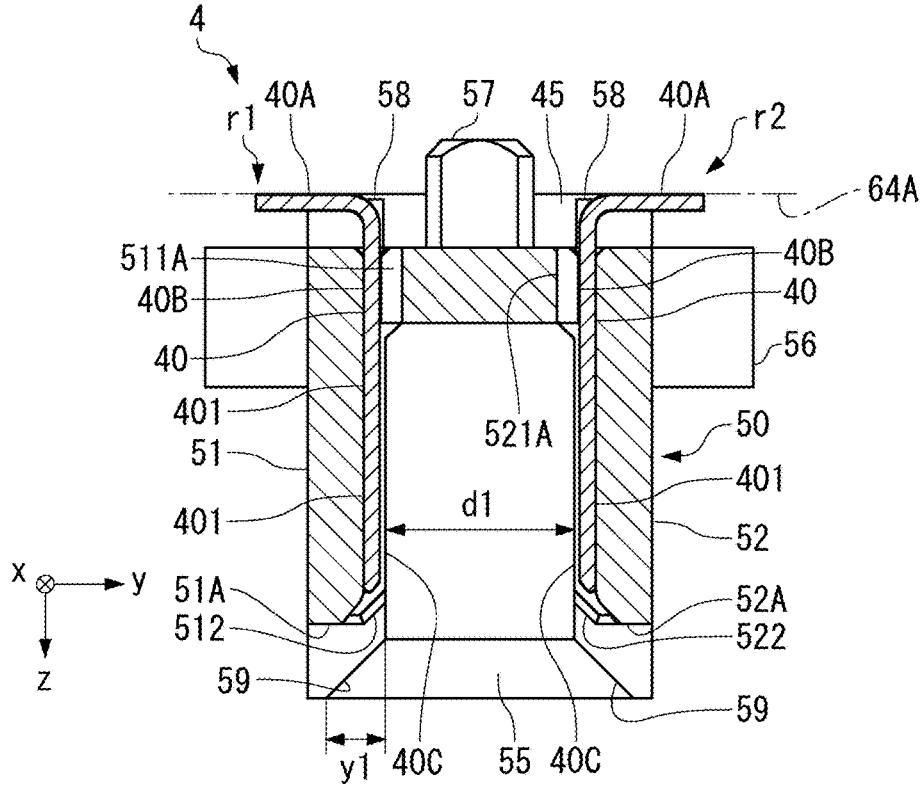

FIG. 11b

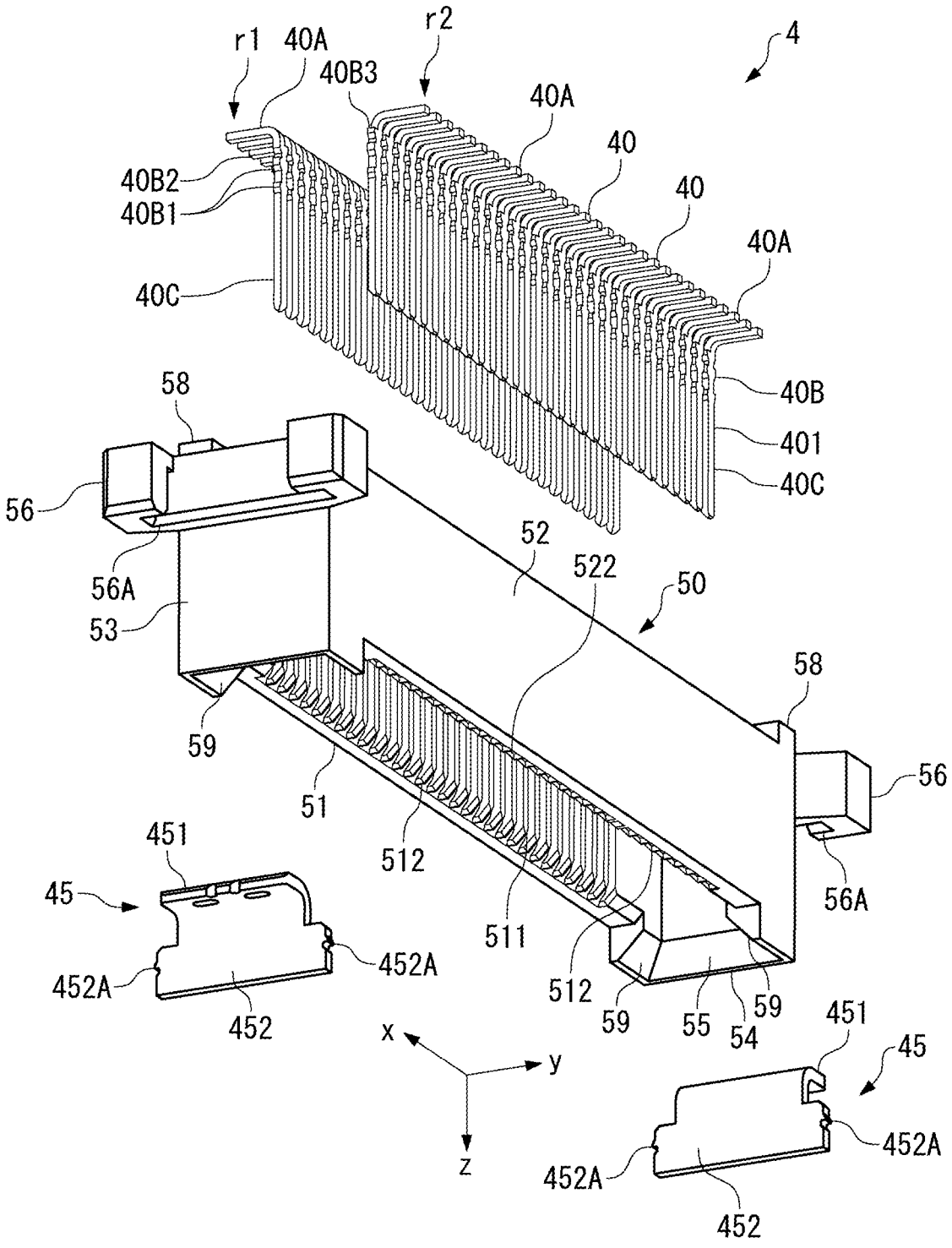
r1
40A
r2
40B3
4
40A
40
40
40A
40B2
40B1
40C
40B
401
40C
58
56
56A
53
52
522
50
58
59
51
512
56
56A
451
45
452A
452A
452
511
512
59
55
54
59
451
45
452A
452A
452
x
y
z

FIG. 12

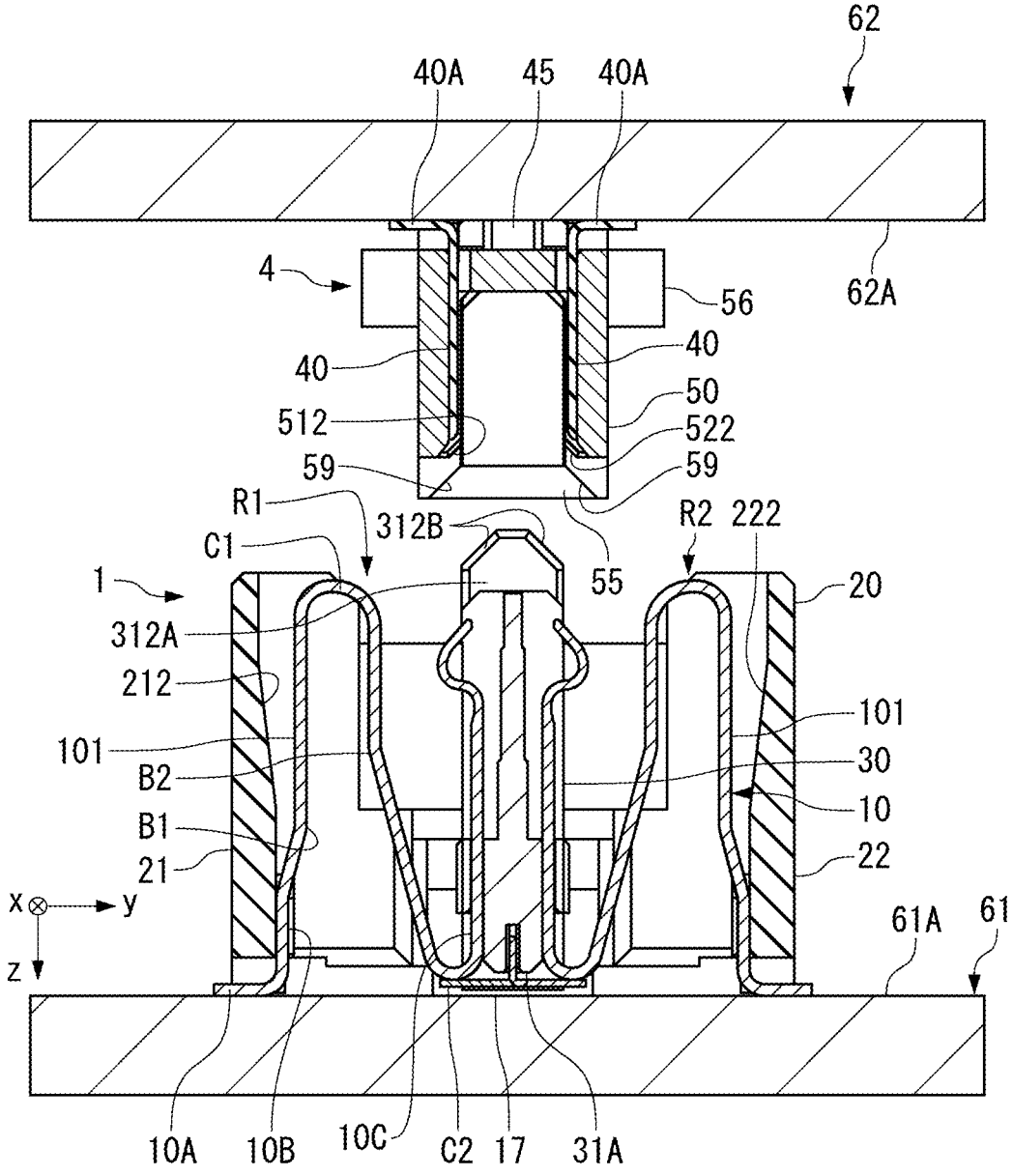
62
40A
45
40A
62A
4
56
40
40
50
512
522
59
59
R1
312B
R2
222
C1
55
1
20
312A
212
101
101
30
B2
10
B1
22
21
x
y
z
61A
61
10A
10B
10C
C2
17
31A

FIG. 13

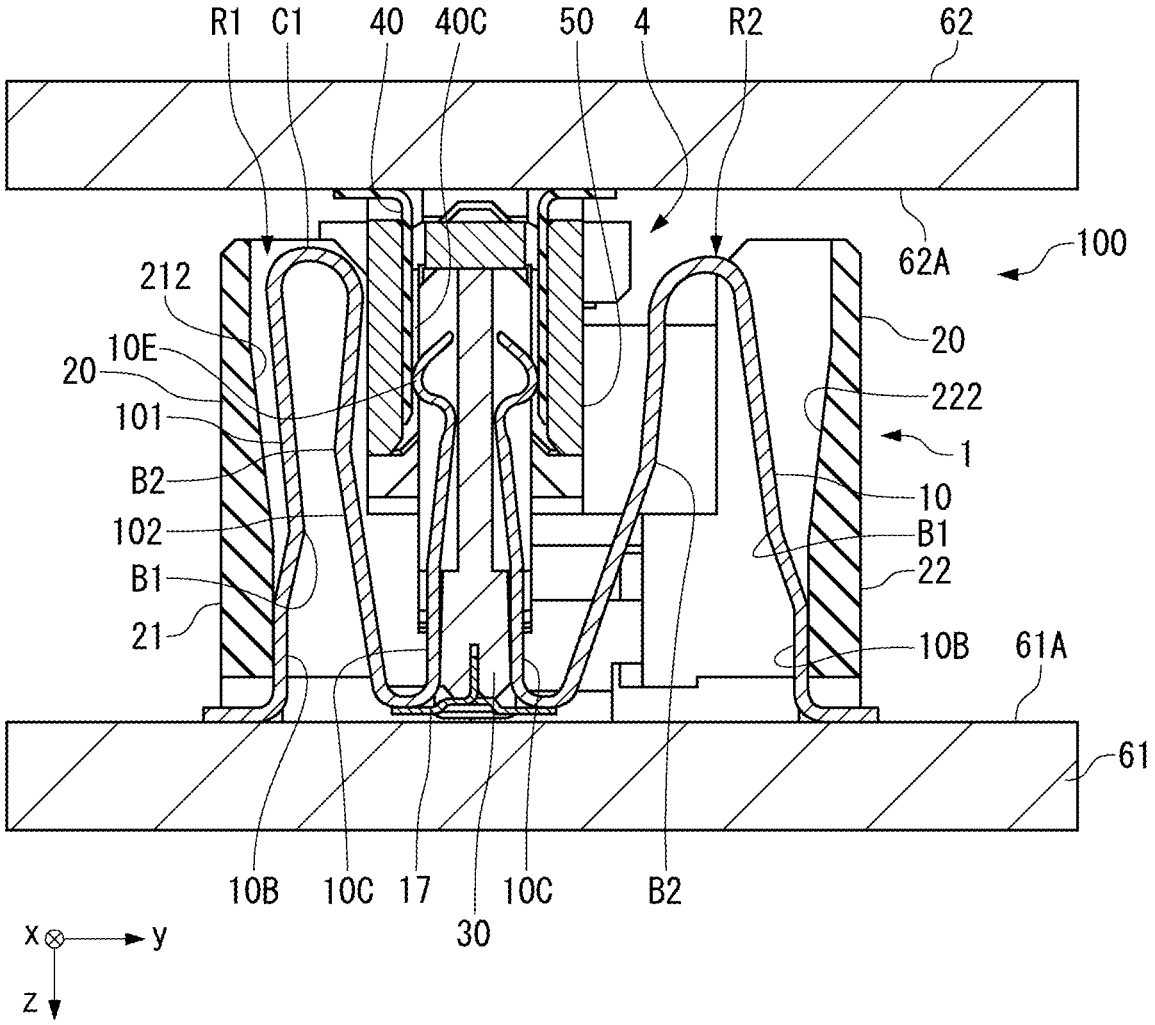
R1
C1
40
40C
50
4
R2
62
62A
100
212
20
10E
20
222
101
1
B2
10
102
B1
B1
22
21
10B
61A
61
10B
10C
17
30
10C
B2
x
y
z

FIG. 14

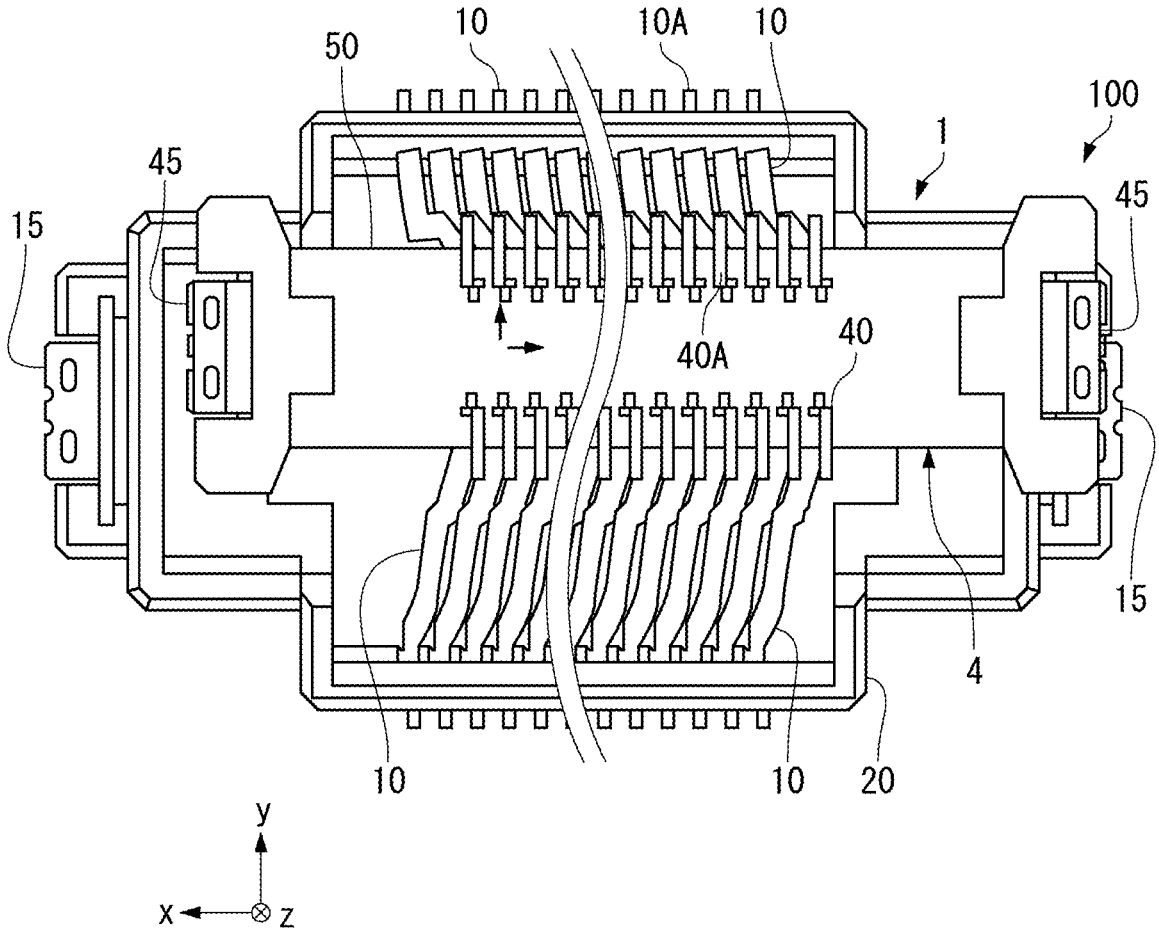

FIG. 15

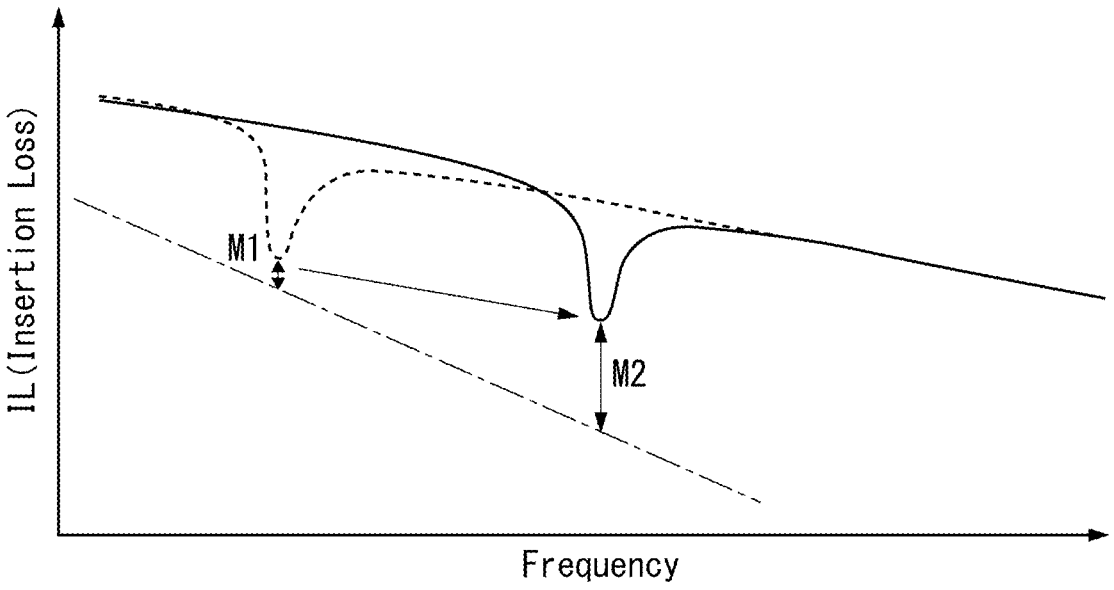

FIG. 16

CONNECTORS AND CONNECTOR ASSEMBLIES

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Japanese Patent Application No. 2022-194863 filed on Dec. 6, 2022, the whole disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a contact, a connector including the contact, and a connector assembly including the connector.

BACKGROUND

[0003] So-called floating-type connector assemblies can be used for mechanical and electrical connections between components included in various electronic instruments. Such a connector assembly includes, for example, a first connector including a contact that is bonded to a first circuit board and a second connector including a contact that is bonded to a second circuit board.

[0004] In order to prevent a hindrance to assembly of the first circuit board and the second circuit board due to the tolerance of a dimension and a shape, working, or assembly, and to achieve stable connection in the case of vibrations, the first connector and the second connector are configured so that elastic deformation of the contacts enables the first connector and the second connector to mate with each other even if the positions of the first connector and the second connector relatively deviate from each other in a predetermined floating range.

[0005] A socket connector of the prior art includes a bottom shell, a top shell that is introduced from above the bottom shell into the interior of the bottom shell, and a plurality of socket contacts that are retained by the bottom shell and the top shell, and mates with a plug connector. Each of the socket contacts is molded to have a shape including a plurality of bends, and is retained by the bottom shell and the top shell. The top shell is assembled with the bottom shell by engaging with fittings. When the top shell comes into contact with the housing of the plug connector and is guided along a slope, the socket contacts are elastically deformed according to the position of the contact of the plug connector.

[0006] Increases in floating ranges in connectors are demanded against the backdrops of the difficulty of management of tolerance, resulting from the complexity of the structures of electronic instruments, and the allowing of contact pitches to be fine.

[0007] However, the top and bottom shells of the prior art connector are pressed down against the circuit boards by the fittings that fit the top and bottom shells. Therefore, even if slight relative displacement is possible, the floating range which is the tolerance zone of the relative displacement is insufficient for the demand. Moreover, the fittings that fit the top shell and the bottom shell to each other are needed.

SUMMARY

[0008] According to an embodiment of the present disclosure, a connector comprises a plurality of contacts, a stationary housing, and a movable housing. The plurality of contacts are arranged along a predetermined first to form a first row and a second row in parallel, positioned on a reference surface encompassing the first direction and a second direction orthogonal to the first direction, and are bonded to an object to be bonded. The stationary housing surrounds the plurality of contacts and positioned on the reference surface. The movable housing sections an interior of the stationary housing into an area closer to the first row and an area closer to the second row, and is displaceable in the first direction and the second direction with respect to the stationary housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will now be described by way of example with reference to the accompanying Figures, of which:

[0010] FIG. **1**(*a*) is an isometric view illustrating a connector assembly according to an embodiment of the invention. The connector assembly includes a first connector and a second connector.

[0011] FIG. **1**(*b*) is a cross sectional view taken along the line Ib-Ib of section (a).

[0012] FIG. **2**(*a*) is an isometric view illustrating the first connector.

[0013] FIG. **2**(*b*) is a cross sectional view taken along the line IIb-IIb of FIG. **2**(*a*).

[0014] FIG. **3** is an exploded isometric view of the first connector (excluding ground contact connection elements).

[0015] FIG. **4** is an isometric view illustrating the stationary housing of the first connector.

[0016] FIG. **5**(*a*) is an isometric view illustrating the movable housing of the first connector.

[0017] FIG. **5**(*b*) is a partially enlarged front view of a guide projection.

[0018] FIG. **5**(*c*) is a partially enlarged side view of the guide projection.

[0019] FIG. **6** is a cross sectional view that is taken along the line VI-VI of FIG. **1**(*a*), and illustrates a first gap existing between the stationary housing and the movable housing in a first direction.

[0020] FIG. **7** is a bottom view that is viewed from the direction of the arrow VII of FIG. **1**(*a*), and illustrates a second gap between the stationary housing and the movable housing in a second direction.

[0021] FIG. **8**(*a*) is a side view of a first contact.

[0022] FIG. **8**(*b*) is an isometric view of the first contact, and FIG. **8**(*c*) is a front view of the first contact.

[0023] FIG. **9** is an isometric view of a ground contact connection element.

[0024] FIG. **10** is a bottom view of the ground contact connection elements and the first contacts.

[0025] FIG. **11**(*a*) is a partially cut away perspective view of the second connector.

[0026] FIG. **11**(*b*) is a transverse cross sectional view of FIG. **11**(*a*).

[0027] FIG. **12** is an exploded isometric view of the second connector.

[0028] FIG. **13** is a cross sectional view illustrating the first connector and the second connector prior to mating.

[0029] FIG. **14** is a cross sectional view illustrating a state in which connectors are elastically deformed in the first direction when the first connector and the second connector are mated with each other.

[0030] FIG. **15** is a top view illustrating a state in which contacts are elastically deformed in the first direction and the second direction when the first connector and the second connector are mated with each other.

[0031] FIG. **16** is a graph for explaining an advantage offered by the ground contact connection elements.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] Exemplary embodiments of the present disclosure will be described hereinafter in detail with reference to the attached drawings, wherein the like reference numerals refer to the like elements. The present disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiment set forth herein; rather, these embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the concept of the disclosure to those skilled in the art.

[0033] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[Overall Configuration]

[0034] A connector assembly **100** illustrated in FIGS. **1**(*a*) and **1**(*b*) includes a first connector **1** and a second connector **4** that are mated with each other, and is used for mechanical and electric connections between circuit boards included in various electronic instruments. First, the schematic configurations of the first connector **1** and the second connector **4** are described. The first connector **1** includes: a plurality of first contacts **10**; and a stationary housing **20** and a movable housing **30** that retain the plurality of first contacts **10**. The plurality of first contacts **10** are bonded to a first circuit board **61** as an object to be bonded. The first contacts **10** are positioned along a predetermined first direction x to form a first row R**1** and a second row R**2** in parallel, and positioned on a first mounting surface **61**A of the first circuit board **61**.

[0035] The second connector **4** incudes: a plurality of second contacts **40**; and a housing **50** that retains the plurality of second contacts **40**. The plurality of second contacts **40** are bonded to a second circuit board **62**. Like the first contacts **10**, the second contacts **40** are positioned to form a first row r**1** and a second row r**2** in parallel, and positioned on a second mounting surface **62**A of the second circuit board **62**. When the first connector **1** and the second connector **4** are mated with each other, the first contacts **10** in the first row R**1** are electrically connected to the second contacts **40** in the first row r**1**, respectively, and the first contacts **10** in the second row R**2** are electrically connected to the second contacts **40** in the second row r**2**, respectively.

[0036] The first connector **1** and the second connector **4** are mated with each other in a mating direction z orthogonal to the first mounting surface **61**A and the second mounting surface **62**A in a state in which the first circuit board **61** and the second circuit board **62** are positioned in parallel. The first mounting surface **61**A includes the first direction x and a second direction y orthogonal to the first direction x and the mating direction z. The same applies to the second mounting surface **62**A.

[0037] In the present specification, an area closer to the first circuit board **61** in the mating direction z is referred to as a lower area, and an area farther from the first circuit board **61** in the mating direction z is referred to as an upper area. The first connector **1** of the present embodiment permits relative displacement between the first circuit board **61** and the second circuit board **62** over a floating range depending on the dimensions of gaps set in the first direction x and the second direction y, respectively, between the stationary housing **20** and the movable housing **30**, as described later.

[Configuration of First Connector]

[0038] As illustrated in FIGS. **2**(*a*), **2**(*b*), and **3**, the first connector **1** includes the plurality of first contacts **10**, the stationary housing **20**, and the movable housing **30** that is positioned so as to be able to be relatively displaced with respect to the stationary housing **20**. The first connector **1** preferably includes: housing bonding elements **15** that allow the stationary housing **20** to be bonded to the first circuit board **61**; and a ground contact connection element **17** (FIG. **9**) that comes into contact with some of the contacts **10**. In some drawings, illustration of the ground contact connection element **17** is omitted.

[0039] The first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2** are each positioned at an equal pitch in the first direction x, and positioned adjacently to each other in the second direction y. In the present embodiment, the positions, in the first direction x, of the first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2** are arranged to correspond to each other. Without limitation thereto, the first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2** may be arranged to be shifted in the first direction x by the dimension half the pitch. The stationary housing **20** is integrally formed by injection molding using an insulating resin material. The same applies to the movable housing **30**.

(Stationary Housing)

[0040] As illustrated in FIG. **4**, the stationary housing **20** includes: side walls **21** and **22** and partial walls **23** and **24** that surround the plurality of first contacts **10**, and are positioned on the first mounting surface **61**A; expansion walls **25** that protrude outside the partial walls **23** and **24** in the first direction x, and are formed on both sides of the stationary housing **20** in the first direction x; bonding element retention portions **26** that retain the housing bonding elements **15**; bosses **27** for location that are introduced into holes that are opened in the first circuit board **61** and are not illustrated; and legs **28** that are positioned on the first mounting surface **61**A. Illustration of the bosses **27** is omitted in some drawings.

[0041] The side walls **21** and **22** extend in the first direction x in which the first contacts **10** are arranged. The side walls **21** and **22** face each other in the second direction y. The partial walls **23** and **24** orthogonal to the side walls **21** and **22** are positioned on both sides in the second direction y between the side walls **21** and **22**, and are contiguous to the expansion walls **25**. A space in which the first contacts **10** are positioned and which is rectangular in planar view is formed

in an inner area surrounded by the walls **21** to **24**. The legs **28** are formed on the lower end of four corners formed by the walls **21** to **24**.

[0042] The side walls **21** and **22** and the partial walls **23** and **24** stand up on the mounting surface **61**A from the lower end of each thereof (for example, **21**A) to an upper end that is slightly higher than the first contacts **10** (for example, **21**B). Gaps G (FIG. **1**(*b*)) are formed between the first mounting surface **61**A and the lower ends of the walls **21** to **24**.

[0043] Retention grooves **211** into which the first contacts **10** in the first row R**1** are press-fitted are formed at the same pitch as that of the first contacts **10** in the vicinity of the lower end of the inner side of the side wall **21**. Likewise, retention grooves **221** into which the first contacts **10** in the second row R**2** are press-fitted are formed at the same pitch as that of the first contacts **10** in the vicinity of the lower end of the inner side of the side wall **22**.

[0044] A chamfer **212** is formed in an area above the retention grooves **211** in the inner side of the side wall **21** in order to avoid interference between the first contacts **10** and the stationary housing **20**. The chamfer **212** is formed from a position above the retention grooves **211** to a position in the vicinity of the upper end **21**B of the side wall **21**. The chamfer **212** inclines with respect to the mating direction z, in the direction of being apart from the first sections **101** of the first contacts **10** in the second direction y with approaching from fixation retention portions **10**B toward first bends C**1**. A chamfer **222** similar to the chamfer **212** is formed inside the side wall **22**.

[0045] The expansion walls **25** are formed to be rectangular in planar view by walls standing from lower ends **25**A to upper ends **25**B in the mating direction z. The upper ends **25**B are lower than the upper end **21**B of the side wall **21** and the upper ends **31**B of the movable housing **30**. The expansion walls **25** contribute to fitting between the stationary housing **20** and the movable housing **30** while inwardly receiving parts of each of the movable housing **30** and the second connector **4** in both the sides of the stationary housing **20** in the first direction x. In addition, the expansion walls **25** set gaps between the stationary housing **20** and the movable housing **30** to set a floating range. It is preferable that the expansion walls **25** are formed symmetrically in the first direction x across the walls **21** to **24**.

[0046] As illustrated in FIGS. **6** and **7**, facing portions **251** that are positioned to face the first mounting surface **61**A in the interior of the stationary housing **20** are formed on the expansion walls **25**. The facing portions **251** set first gaps G**1** in the first direction x between the stationary housing **20** and the movable housing **30**. The facing portions **251** are formed to extend in the first direction x and the second direction y and to have a plate shape, and are supported by the walls of the expansion walls **25**. As understood from FIG. **4**, the facing portions **251** of the present embodiment are formed to have a generally C-shape in planar view. A predetermined dimension x**1** is given between the facing portions **251** in one end side and the other end side in the first direction x.

[0047] The housing **50** of the second connector **4** is positioned above the facing portions **251** in the inner sides of the expansion walls **25**. Areas below the facing portions **251** of the expansion walls **25** correspond to lower regions **252** (FIG. **4**) that set second gaps G**2** in the second direction y between the stationary housing **20** and the movable housing **30**. The lower regions **252** include side walls **252**A and **252**B that are below the facing portions **251** and extend in the first direction x and the mating direction z.

[0048] The bonding element retention portions **26** are disposed on the expansion walls **25** in both the sides of the stationary housing **20** in the first direction x, and retain the housing bonding elements **15** illustrated in FIG. **3**. Each housing bonding element **15** includes: a bond portion **151** that is bonded to the first circuit board **61** by solder that is not illustrated; and a press-fit portion **152** including projections **152**A in both sides thereof. A pair of grooves **261** that retain each housing bonding element **15** that is press-fitted from above the bonding element retention portions **26** is formed in the bonding element retention portions **26** along the mating direction z. An opening **253** is formed below the facing portion **251** on each expansion wall **25**, and between the pair of grooves **261**. The opening **253** need not be formed in each expansion wall **25**.

[0049] The stationary housing **20** includes the two pin-shaped bosses **27**, as illustrated in FIGS. **2**(*b*) and **3**. The two bosses **27** protrude in the mating direction z from the lower ends of the side walls **21** and **22** or the partial walls **23** and **24**, and are separated from each other in both the first direction x and the second direction y. The diameters of the bosses **27** differ from each other. Therefore, the first connector **1** can be attached to the first circuit board **61** in a correct direction in which the two bosses **27** can be introduced into the holes of the first circuit board **61**.

(Movable Housing)

[0050] The movable housing **30** sections the interior of the stationary housing **20** into an area closer to the first row R**1** and an area closer to the second row R**2**, as illustrated in FIGS. **2**(*a*), **2**(*b*), and **5** (*a*), and retains, together with the stationary housing **20**, the first contacts **10** in the first row R**1** and the contacts **10** in the second row R**2**. The movable housing **30** extends in the first direction x to have a length corresponding to the lengths of the rows R**1** and R**2**, and includes: a retainer region **31** in which the first contacts **10** are retained; and expanded regions **32** that are contiguous to both sides of the retainer region **31** in the first direction x, and take part in location with respect to the second connector **4**, fitting with the stationary housing **20**, and setting of a floating range.

[0051] The retainer region **31** is allowed to have a width (dimension in second direction y) and a height (dimension in mating direction z) that are necessary for retaining the first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2**. A plurality of grooves **310** in which the first contacts **10** are positioned are formed along the mating direction z in each of a side **311**, closer to the first row R**1**, and a side **312**, closer to the second row R**2**, of the retainer region **31**. Guiding slopes **31**C are formed on a side, closer to the first row R**1**, and a side, closer to the second row R**2**, in the upper ends **31**B of the retainer region **31** in order to locate the movable housing **30** with respect to the second contacts **40** of the second connector **4** in the second direction y.

[0052] The grooves **310** include retention grooves **310**A in which the first contacts **10** are press-fitted, and all the grooves **310** are successive over the entire height of each of the sides **311** and **312**. The grooves **310** are arranged at a constant pitch in the first direction x. The depth (dimension in second direction y) of each groove **310** varies in the

mating direction z, as illustrated in FIG. **2**(*b*). The retention grooves **310**A are formed in the vicinity of a lower end **31**A of the retainer region **31**.

[0053] Ground retention grooves **31**D (FIG. **2**(*b*)) into which the ground contact connection element **17** is press-fitted are formed in the lower end **31**A of the retainer region **31**. In the retainer region **31**, the plurality of ground retention grooves **31**D formed by making dents from the lower end **31**A toward above are scattered in the first direction x.

[0054] The expanded regions **32** include: upper portions **320** on which guide projections **321** positioned above the upper ends **31**B of the sides **311** and **312** are formed; and lower portions **322** positioned below the facing portions **251** of the stationary housing **20**. The expanded regions **32** are preferably formed symmetrically about the retainer region **31** in the first direction X.

[0055] Recesses **323** formed by making dents in the first direction x at positions corresponding to the facing portions **251** are formed in the expanded regions **32**. The upper portions **320** and the lower portions **322** are partitioned by the recesses **323**. The dimensions of the inner sides of the recesses **323** in the mating direction z are equivalent to or greater than the plate thicknesses of the facing portions **251**. Depending on the relative positions of the movable housing **30** and the stationary housing **20**, the facing portions **251** are introduced into the insides of the recesses **323**. The recesses **323** can receive the facing portions **251** up to hitting of the end surfaces **251**A of the facing portions **251** on the inmost faces **323**A of the recesses **323**.

[0056] The guide projections **321** come into contact with the housing **50** before the guiding slopes **31**C come into contact with the housing **50** or second contacts **40** of the second connector **4**. Then, the guide projections **321** guide the movable housing **30** in the first direction x and the second direction y while following the position of the housing **50**. Therefore, a slope **321**A inclined toward the yz plane and slopes **321**B inclined toward the xz plane are formed on each guide projection **321**.

[0057] As illustrated in FIG. **5**(*b*), guiding ranges y**1** that enable the movable housing **30** to be displaced in the second direction y by guiding by the slopes **321**B are set on the slopes **321**B of each guide projection **321**. Each guiding range y**1** is wider than each guiding range y**2** that enables the movable housing **30** to be displaced in the second direction y by guiding by each guiding slope **31**C. As illustrated in FIG. **5**(*c*), a guiding range x**3** that enables the movable housing **30** to be displaced in the first direction x by guiding by the slope **321**A is set on the slope **321**A of each guide projection **321**.

[0058] The dimension x**0** (FIG. **5**(*a*)) of each upper portion **320** in the first direction x is less than the dimension x**1** (FIG. **4**) between the facing portions **251** in both the sides. In contrast, the dimension x**2** (FIG. **5**(*a*)) of each lower portion **322** in the first direction x is more than the dimension x**1** (FIG. **4**) between the facing portions **251** on both the sides. Therefore, the movable housing **30** can be introduced from a lower area into the interior of the stationary housing **20** up to hitting of the lower portions **322** on lower surfaces **251**B of the facing portions **251**, as illustrated in FIG. **6**. In such a case, the upper portions **320** are accommodated up to positions above the facing portions **251** by the stationary housing **20**. The upper portions **320** are mated with the housing **50** of the second connector **4**. The housing **50** is positioned to surround the upper portions **320** in the stationary housing **20**.

[0059] When the first contacts **10** and the housing bonding elements **15** are bonded to the first circuit board **61** to fix the stationary housing **20** to the first circuit board **61**, the lower portions **322** are positioned between the facing portions **251** and the first mounting surface **61**A of the first circuit board **61**. The movable housing **30** is fitted to the stationary housing **20** and the first circuit board **61** in the state of being prevented from being removed upward and downward because the lower portions **322** are sandwiched between the facing portions **251** and the first circuit board **61** in the mating direction z. Therefore, the first connector **1** need not include fixation fittings or the like for fitting the movable housing **30**, the stationary housing **20**, and the first circuit board **61**, and the movable housing **30** and the stationary housing **20** are not restrained by such fixation fittings or and the like.

[0060] As illustrated in FIG. **6**, each first gap G**1** having a predetermined dimension is set between the end surface **251**A of the facing portion **251** and the inmost face **323**A of the recess **323** in each of both the sides of the first connector **1** in the first direction x. FIG. **6** illustrates a state in which the centers of the stationary housing **20** and the movable housing **30** in the first direction x coincide with each other. The relative displacement of the movable housing **30** in the first direction x from the state toward the right or left sides of FIG. **6** with respect to the stationary housing **20** is permitted up to the dimension of each first gap G**1**. For example, in a case in which each first gap G**1** is 1 mm, the first connector **1** is allowed to have a floating range of ±1 mm in the first direction x.

[0061] As illustrated in FIG. **7**, the second gaps G**2** are set between a side wall **322**A of each lower portion **322** and the inner surface of the side wall **252**A of each lower region **252**, and between a side wall **322**B of each lower portion **322** and the inner surface of the side wall **252**B of each lower region **252**, respectively. FIG. **7** illustrates a state in which the centers of the stationary housing **20** and the movable housing **30** in the second direction y coincide with each other. The relative displacement of the movable housing **30** in the second direction y from the state toward the upper or lower sides of FIG. **7** with respect to the stationary housing **20** is permitted up to the dimension of each second gap G**2**. For example, in a case in which each second gap G**2** is 1 mm, the first connector **1** is allowed to have a floating range of +1 mm in the second direction y. Since the movable housing **30** and the stationary housing **20** can be relatively displaced in the first direction x and the second direction y, the movable housing **30** also has the degree of positional freedom in a rotation direction in the xy plane with respect to the stationary housing **20**. The first connector **1** is allowed to have a floating range at a predetermined angle to the rotation direction in the xy plane. A floating range corresponding to the sufficiently large gaps G**1** and G**2** can be achieved up to the maximum elastic deformation volume of each first contact **10** because the movable housing **30** and the stationary housing **20** are not restrained.

(First Contact)

[0062] Configurations such as the shapes of the first contacts **10** illustrated in FIGS. **8**(*a*) to **8**(*c*), and the function of each site are described. FIGS. **8**(*a*) to **8**(*c*) illustrate the first

contacts **10** in a state in which no load is applied to the first contacts **10**. Each first contact **10** includes: a bond portion **10**A that is bonded to the first mounting surface **61**A by solder; a fixation retention portion **10**B that is retained by the stationary housing **20** by press-fitting; a movable retention portion **10**C that is retained by the movable housing **30** by press-fitting; and a terminating end **10**E that comes into contact with each second contact **40**. Each first contact **10** has a shape curved so that the first contact **10** can be elastically deformed in the first direction x and the second direction y.

[0063] The bond portion **10**A and the fixation retention portion **10**B that are positioned in parallel to the first mounting surface **61**A have an L-shape in side view. A first bend C**1** and a second bend C**2** are formed between the fixation retention portion **10**B and the movable retention portion **10**C. The first bend C**1** as the top of each first contact **10** has an inverted U-shape in side view. The second bend C**2** has a generally V-shape in side view. The lower end of the second bend C**2** is located above the bond portion **10**A. The terminating end **10**E has a generally C-shape in side view. The upper end of the terminating end **10**E is located below the upper end of the first bend C**1**. Each first contact **10** is bent in a generally N-shape as an overall general shape.

[0064] The first contacts **10** are molded by stamping a plate material, formed of a metal material such as a copper alloy, to have a linear, long, and narrow shape, and further subjecting the plate material to bending working. The floating range is set within the elastic region of each first contact **10** for each of the first direction x, the second direction y, and the rotation direction in the xy plane. Therefore, a material having a favorable spring property among the copper alloys is preferably used as the material of each first contact **10** from the viewpoint of increasing such a floating range.

[0065] Each first contact **10** is allowed to have a certain plate thickness over a very large portion of the first contact **10** in the lengthwise direction thereof. The plate thickness t of the first contact **10** is set to be, for example, in a range of 0.1 to 0.5 mm. The plate thickness of the terminating end **10**E is smaller than the plate thicknesses of the other portions.

[0066] The width w of each first contact **10** is set to be a value that is equal to or greater than at least the plate thickness t, for example, in a range of 0.1 to 0.5 mm in order to stably mold the first contacts **10**. The width w of each first contact **10** varies in the lengthwise direction of each first contact **10**. For example, the widths of the bond portion **10**A and the terminating end **10**E are allowed to be the smallest in the overall length from the bond portion **10**A of each first contact **10** to the terminating end **10**E in order to facilitate bending to enhance followability to the first mounting surface **61**A and the second contacts **40**. A region above the movable retention portion **10**C of each first contacts **10** has a width that is smaller than the width of the movable retention portion **10**C. The region is smoothly introduced from below into each retention groove **310**A of the movable housing **30**.

[0067] The first contacts **10** are positioned in a state in which a gap g is opened between first contacts **10** adjacent to each other at a certain pitch P that is greater than the maximum width w set in the first bend C**1** and the second bend C**2**. The pitch P is, for example, 0.3 to 0.5 mm, and the first contacts **10** are positioned in a fine manner. The gap g is preferably 0.15 mm or more. All the first contacts **10** are positioned in parallel to the xz plane. The first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2** are positioned in line symmetry with reference to an axis parallel to the mating direction z.

[0068] Each first contacts **10** includes a first section **101**, a second section **102**, and a third section **103**. The first section **101** extends from the fixation retention portion **10**B to the first bend C**1** toward a side (upper side) opposite to the first mounting surface **61**A. The second section **102** extends from the first bend C**1** that is bent in an upward convex manner toward the first mounting surface **61**A, and is contiguous to the movable retention portion **10**C via the second bend C**2**. The third section **103** extends from the movable retention portion **10**C to the terminating end **10**E that is connected to each second contact **40** toward the side opposite to the first mounting surface **61**A.

[0069] A first bent portion B**1** formed to have a shape convex toward the second section **102** is formed in the first section **101**. In the second section **102**, a second bent portion B**2** formed to have a shape convex toward the first section **101** is formed at a position farther from the first mounting surface **61**A than the position of the first bent portion B**1** in the mating direction z.

[0070] As shown in FIGS. **8**(*b*) and **8**(*c*), the fixation retention portion **10**B includes two press-fit projections **10**B**1** formed in two stages in an upward-downward direction on both sides of the fixation retention portion **10**B in a width direction (corresponding to the first direction x), and a projection **10**B**2** formed on one side in the width direction. On the rear (lower part) of the projection **10**B**2** in a press-fitting direction, a press portion **10**B**3** that is pressed by a jig, which is not illustrated, when the fixation retention portion **10**B is press-fitted is formed perpendicularly to a central line L.

[0071] The movable retention portion **10**C includes press-fit projections **10**C**1**, a locating projection **10**C**2**, and a press portion **10**C**3** similar to the press-fit projections **10**B**1**, the projection **10**B**2**, and the press portion **10**B**3** of the fixation retention portion **10**B. A dimension by which the locating projection **10**C**2** protrudes in the first direction x from the central line L of each first contact **10** in the width direction is greater than a dimension by which each press-fit projection **10**C**1** protrudes from the central line L in the first direction x.

(Ground Contact Connection Element)

[0072] Some of the first contacts **10** included in the first row R**1** correspond to a signal potential in an electronic circuit including the first circuit board **61** and the second circuit board **62**, and the remainder correspond to the ground potential in the electronic circuit. Likewise, some of the first contacts **10** included in the second row R**2** correspond to the signal potential in the electronic circuit, and the remainder correspond to the ground potential in the electronic circuit. An assignment for a signal/ground to the first contacts **10** is appropriately designed. Examples of the assignment for a signal/ground include various patterns depending on a product.

[0073] As illustrated in FIGS. **9** and **10**, the ground contact connection element **17** comes into contact only with ground contact groups GG including the plurality of first contacts **10** assigned for a ground, among all the first contacts **10**. All of the first contacts **10** with which the ground contact connection element **17** comes into contact have an equal potential.

On account of illustration, reference characters GG are separately indicated in four places in FIG. **10**. The ground contact groups GG correspond to groups of the first contacts **10** corresponding to the ground potential as the entire ground contact connection element **17**. The ground contact groups GG correspond to some first contacts **10** in the first row R**1** and some first contacts **10** in the second row R**2**.

[0074] The ground contact connection element **17** includes: a support **171** that is disposed on the lower end **31**A of the movable housing **30** and extends in the first direction x; and a plurality of contact beams **172** that come into contact with the second bend C**2** of each of the first contacts **10** included in the ground contact groups GG. The contact beams **172** are positioned between the lower end **31**A and the first mounting surface **61**A, and come into contact with the second bends C**2** of the first contacts **10** adjacent to the lower end **31**A from an area closer to the first mounting surface **61**A.

[0075] The second bend C**2** of each first contact **10** is located in the vicinity of the movable retention portion **10**C retained by the movable housing **30**, and is therefore displaced while following the movable housing **30**. Therefore, a distance between the second bend C**2** and the movable housing **30** do not substantially vary even in a case in which the movable housing **30** is displaced with respect to the stationary housing **20** and the housing **50** of the second connector **4** while elastically deforming the first bend C**1** of each first contact **10** when the first connector **1** and the second connector **4** are mated with each other. Thus, the behavior of displacement of the movable housing **30** in a floating range with respect to the stationary housing **20** is not influenced even in a case in which the contact beams **172** come into contact with the second bend C**2**.

[0076] A plurality of retention portions **171**A that are press-fitted into the ground retention grooves **31**D of the movable housing **30**, respectively, are disposed on the support **171**. Press-fit projections **171**B are formed on both sides of each retention portion **171**A in the first direction x.

[0077] Each contact beam **172** protrudes in the second direction y, perpendicularly from the support **171** toward the contacts **10** for a ground in the first row R**1** or the contacts **10** for a ground in the second row R**2**. In the present embodiment, the length of each contact beam **172** that extends from the support **171** toward the first row R**1** and the length of each contact beam **172** that extends from the support **171** toward the second row R**2** are different from each other. However, the lengths may be equal to each other.

[0078] The widths (dimensions in the first direction x) of the contact beams **172** are less than the widths (dimensions in the first direction x) of places that come into contact with the contact beams **172** of the first contacts **10**. The width of each contact beam **172** may be equivalent to that of the bond portion **10**A or terminating end **10**E of each first contact **10**.

[0079] The ground contact connection element **17** can be molded by subjecting a metal plate material such as a copper alloy to stamping and bending working. Each retention portion **171**A is bent perpendicularly on one side of the support **171** in the width direction (second direction y). The retention portions **171**A can be formed in optional places in the first direction x, excluding places (for example, x**4** in FIG. **9**) in which the contact beams **172** are formed on both the sides of the support **171** in the width direction.

[0080] The ground contact connection element **17** can be allowed to be ready for various products by customizing the positions of the contact beams **172** and the retention portions **171**A depending on the pattern of assignment for a signal/ground. It is preferable to be able to produce the movable housing **30**, of which the positions of the ground retention grooves **31**D are different, by nesting portions corresponding to the ground retention grooves **31**D in a mold for molding the movable housing **30** in order to enable change of the positions of the retention portions **171**A by the customization,

[0081] Use of the ground contact connection element **17** enables SI (signal intensity) performance to be improved, for example, as showing the analysis results of the frequency characteristics of an insertion loss (IL) in FIG. **16**. The dashed line in FIG. **16** shows the frequency characteristics of an insertion loss in a case in which the first connector **1** does not include the ground contact connection element **17**, and the continuous line shows the frequency characteristics of an insertion loss in the case of including the ground contact connection element **17**. The alternate long and short dash line schematically shows required specifications. FIG. **16** reveals that the peak of a resonance frequency is shifted to a higher frequency by using ground contact connection element **17**. Thus, a design margin for requirement specifications is increased from M**1** to M**2**, and consequently, the SI performance is improved.

[Second Connector]

[0082] The more specific configuration of the second connector **4** is described with reference to FIGS. **11**(*a*), **11**(*b*), and **12**. The second connector **4** includes the plurality of second contacts **40**, the housing **50** that retains the second contacts **40**, and bonding elements **45**, and is mated with the movable housing **30**. Like the first contacts **10**, the second contacts **40** in the first row r**1** and the second contacts **40** in the second row r**2** are positioned at the constant pitch P in the first direction x, and are adjacent to each other in the second direction y.

[0083] The second contacts **40** are molded by stamping a plate material, formed of a metal material such as a copper alloy, to have a linear, long, and narrow shape, and further subjecting the plate material to bending working. Each second contact **40** includes: a bond portion **40**A that is bonded to the second circuit board **62**; a retention portion **40**B that is retained by the housing **50**; and a terminating end **40**C that is electrically connected to each first contact **10**.

[0084] Each second contact **40** of the present embodiment includes a section **401** that extends perpendicularly to the bond portion **40**A, and is formed to have an L-shape as a whole. The section **401** includes the retention portion **40**B and the terminating end **40**C. Like the fixation retention portion **10**B, the retention portion **40**B includes press-fit projections **40**B**1**, a projection **40**B**2**, and a press portion **40**B**3**, and is formed in the vicinity of the bond portion **40**A in the section **401**. A region below the retention portion **40**B in the section **401** corresponds to the terminating end **40**C. As illustrated in FIG. **1**(*b*), the terminating end **10**E of each first contact **10** in the first row R**1** and the terminating end **10**E of each first contact **10** in the second row R**2** are introduced between the terminating end **40**C in the first row r**1** and the terminating end **40**C in the second row r**2**.

[0085] The housing **50** includes: walls **51** to **54** that surround the second contacts **40** in the first row r**1** and the second row r**2** from all quarters and are positioned on the second mounting surface **62**A; bonding element retention

portions **56** that retain the bonding elements **45**; two bosses **57** (FIG. **1**(*a*)) for location that are introduced into holes, which are not illustrated, in the second circuit board **62**; and a leg **58** that is positioned on the second mounting surface **62**A.

[0086] The side wall **51** and the side wall **52** of which the lengths correspond to the lengths of the rows r**1** and r**2** extend in the first direction x, and face in the second direction y. On the inside of the side wall **51**, grooves **511** in which the second contacts **40** in the first row r**1** are positioned, respectively, are formed along the mating direction z. The grooves **511** include retention grooves **511**A into which the second contacts **40** are press-fitted. On the inside of the side wall **52**, each of the second contacts **40** in the second row r**2** is also positioned, and grooves **521** including retention grooves **521**A are also formed along the mating direction z.

[0087] A guiding slope **512** is formed on an inside in the lower end of the side wall **51** in order to relatively locate the movable housing **30** of the first connector **1** and the housing **50** in the second direction y. A similar guiding slope **522** is also formed on an inside in the lower end of the side wall **52**. The guiding slopes **512** and **522** are formed symmetrically in the second direction y.

[0088] When the second contacts **40** are introduced from an area closer to the terminating ends **40**C into the corresponding grooves **511** and **521** of the housing **50**, and press-fitted into the retention grooves **511**A and **521**A, the front ends of the terminating ends **40**C are positioned adjacently on the guiding slopes **512** and **522**, as illustrated in FIG. **11**(*b*). The bond portions **40**A are positioned outside the grooves **511** and **521**. The bond portions **40**A are located slightly above the position of the leg **58**.

[0089] A distance d**1**, in the second direction y, between the terminating end **40**C of each second contact **40** in the first row r**1** and the terminating end **40**C of each second contact **40** in the second row r**2** is less than a distance d**2** (FIG. **2**(*b*)), in the second direction y, between the vertex of the terminating end **10**E of each first contact **10** in the first row R**1** and the vertex of the terminating end **10**E of each first contact **10** in the second row R**2**. When the first connector **1** and the second connector **4** are mated with each other as illustrated in FIG. **1**(*b*), the terminating ends **10**E of the first contacts **10** in the first row R**1** come into contact with the terminating ends **40**C of the second contacts **40** at the vertices thereof while being pressed between the second contacts **40** in the first row r**1** and the movable housing **30**. The same applies to the terminating ends **10**E of the first contacts **10** in the second row R**2**. Since the terminating ends **40**C of the second contacts **40** are formed linearly in the mating direction z, the terminating ends **40**C and the terminating ends **10**E can be stably brought into contact with each other even in a case in which the positions of the first contacts **10** and the second contacts **40** in the mating direction z deviate.

[0090] The walls **53** and **54** are disposed on both sides of the side walls **51** and **52** in the first direction x, and face each other in the first direction x. The height of the wall **53** or **54** from the second mounting surface **62**A is greater than the height of the side wall **51** or **52** from the second mounting surface **62**A.

[0091] First guiding slopes **55** that incline toward the yz plane are formed on both ends of the walls **51** to **54** in the first direction x. Second guiding slopes **59** that incline toward the xz plane are formed at the four corners of the walls **51** to **54**. The guiding slopes **55** and **59** are positioned below the lower ends **51**A and **52**A of the side walls **51** and **52**. The first guiding slopes **55** are formed symmetrically in the first direction x. The second guiding slopes **59** are formed symmetrically in the second direction y.

[0092] The first guiding slopes **55** come into contact with the slopes **321**A of the guide projections **321** of the movable housing **30** before the guiding slopes **512** and **522** of the side walls **51** and **52** come into contact with the guiding slopes **31**C of the movable housing **30**. Then, the first guiding slopes **55** guide the movable housing **30** in the first direction x while following the position of the housing **50**. At the same time, the second guiding slopes **59** come into contact with the slopes **321**B of the guide projections **321** of the movable housing **30** before the guiding slopes **512** and **522** of the side walls **51** and **52** come into contact with the guiding slopes **31**C of the movable housing **30**. Then, the second guiding slopes **59** guide the movable housing **30** in the second direction y while following the position of the housing **50**. The first guiding slopes **55** incline toward the yz plane. The second guiding slopes **59** incline toward the xz plane.

[0093] A guiding range x**3** (FIG. **11**(*a*)) equivalent to that of the slope **321**A of each guide projection **321** of the movable housing **30** is set on each first guiding slope **55**. The guiding range x**3** is preferably greater than the dimension of each first gap G**1**. A guiding range y**1** (FIG. **11**(*b*)) equivalent to that of the slope **321**B of each guide projection **321** of the movable housing **30** is set on each second guiding slope **59**. The guiding range y**1** is preferably greater than the dimension of each second gap G**2**.

[0094] Each bonding element **45** includes: a bond portion **451** that is bonded to the second circuit board **62**; and a press-fit portion **452** of which both sides include projections **452**A. The bonding element retention portions **56** are disposed outside the walls **53** and **54**. A retention groove **56**A into which each bonding element **45** is press-fitted from a lower area is formed in each bonding element retention portion **56**.

[Assembly of Connector Assembly, and Effects of Present Embodiment]

[0095] Hereinafter, a procedure of assembling the connector assembly **100** is described, and principal effects obtained by the present embodiment are also described. First, an example of a procedure of assembling a first connector **1** is described. The housing bonding elements **15** are press-fitted from above into the pair of grooves **261** disposed on the expansion walls **25**, respectively, on both the sides of the stationary housing **20** (FIG. **2**(*a*)). Moreover, the movable housing **30** is positioned from below into the interior of the stationary housing **20** (FIGS. **2**(*b*) and **6**).

[0096] Then, the plurality of first contacts **10** can be attached from below to the stationary housing **20** and the movable housing **30** using jigs that are not illustrated. For example, the stationary housing **20** and the movable housing **30** are supported at predetermined positions by a first jig, and the first contacts **10** in the first row R**1** and the second row R**2** are pressed upward by a third jig that is brought into contact with the press portions **10**B**3** and the third jig that is brought into contact with the press portions **10**C**3** while the first contacts **10** are arranged in alignment to the first row R**1** and the second row R**2** by a second jig.

[0097] Then, the first contacts **10** in each of the rows R**1** and R**2** are introduced from an area closer to the first bends C**1** and the terminating ends **10**E into between the stationary housing **20** and the movable housing **30**. As illustrated in FIG. **2**(*b*), the fixation retention portions **10**B of the first contacts **10** in the first row R**1** are press-fitted into the retention grooves **211** of the stationary housing **20**, and the movable retention portions **10**C of the first contacts **10** in the first row R**1** are press-fitted into the retention grooves **310**A, closer to the first row R**1**, of the movable housing **30**. Simultaneously, the fixation retention portions **10**B of the first contacts **10** in the second row R**2** are press-fitted into the retention grooves **221** of the stationary housing **20**, and the movable retention portions **10**C of the first contacts **10** in the second row R**2** are press-fitted into the retention grooves **310**A, closer to the second row R**2**, of the movable housing **30**.

[0098] When the fixation retention portions **10**B and the movable retention portions **10**C are press-fitted, the movable housing **30** is supported by the second bends C**2** of the first contacts **10** in the first row R**1** and the second bends C**2** of the first contacts **10** in the second row R**2**. In such a case, the lower end **31**A of the movable housing **30** is located above the legs **28** of the stationary housing **20**. The second bends C**2** are located below the lower end **31**A of the movable housing **30**, and located above the legs **28**. The bond portions **10**A of the contacts **10** are located slightly below the legs **28** of the stationary housing **20**.

[0099] After the attachment of first contact **10**, the retention portions **171**A are press-fitted into the ground retention grooves **31**D to attach the ground contact connection element **17** to the movable housing **30**. When the retention portions **171**A are press-fitted into the ground retention grooves **31**D at a predetermined depth, each contact beam **172** is bent in a plate thickness direction, and pressed in the mating direction z against the second bend C**2** of each first contact **10** for a ground. Therefore, the contact beams **172** can be stably brought into contact with the contact groups GG even in a case in which the positions of the second bends C**2** of the first contacts **10** vary in the mating direction z. SI performance can be stabilized by allowing the contacts **10** for a ground to have the same potential by the element **17** including the contact beams **172** that are stably brought into contact with the first contacts **10** in such a manner.

[0100] As a result, the assembly of the first connector **1** is completed (FIGS. **2**(*a*) and **2**(*b*)). The movable housing **30** is supported in the state of having the degree of positional freedom over the floating ranges in the first direction x, the second direction y, and the rotation direction in the xy plane by elastic deformation of the first contacts **10** in the first row R**1** and the first contacts **10** in the second row R**2**.

[0101] The two bosses **27** of the stationary housing **20** are introduced into the holes, which are not illustrated, of the first circuit board **61**, respectively, to bring the legs **28** into contact with the first mounting surface **61**A in a case in which the first connector **1** is positioned and mounted on the first circuit board **61** as illustrated in FIG. **1**(*b*). In such a state, the bond portion **10**A of each first contact **10** is bonded, by solder, to a terminal portion that is formed on the first mounting surface **61**A and is not illustrated, and the bond portions **151** of the housing bonding elements **15** are bonded to the first mounting surface **61**A by solder. The bonding strength between the first circuit board **61** and the first connector **1** are increased by using the housing bonding elements **15**.

[0102] When the stationary housing **20** is fixed to the first circuit board **61** by the bonding of the first contacts **10** and the housing bonding elements **15**, the lower portions **322** of the movable housing **30** is positioned between the first circuit board **61** and the facing portions **251** of the stationary housing **20** as illustrated in FIG. **6**, and therefore, the movable housing **30**, the stationary housing **20**, and the first circuit board **61** are fitted to each other.

[0103] In a case in which the second connector **4** is assembled (FIGS. **11** and **12**), the second contacts **40** are introduced from above into the grooves **511** and **521** of the housing **50** while arranging the second contacts **40** in each of the first row r**1** and the second row r**2**, for example, using jigs, which are not illustrated, and the press portions **40**B**3** are pressed to press-fit the second contacts **40** into the retention grooves **511**A and **521**A. Moreover, the bonding elements **45** are press-fitted into the bonding element retention portions **56**. As a result, the assembly of the second connector **4** is completed.

[0104] The bosses **57** of the housing **50** are introduced into holes, which are not illustrated, of the second circuit board **62** to bring the leg **58** into contact with the contact second mounting surface **62**A in a case in which the second connector **4** is positioned and mounted on the second circuit board **62**. In such a state, the bond portion **40**A of each second contact **40** is bonded to the second mounting surface **62**A by solder, and the bond portions **451** of the bonding elements **45** are bonded to the second mounting surface **62**A by solder.

[0105] In a case in which a structure including the first circuit board **61** and the first connector **1**, and a structure including the second circuit board **62** and the second connector **4** are assembled, coincidence of the positions of the first connector **1** and the second connector **4** in the second direction y as illustrated in FIG. **13** is not necessarily ensured due to the accumulated tolerance of the tolerances of the dimensions and shapes of the elements, working, and assembly, and the like. However, it is possible to mate the first connector **1** and the second connector **4** with each other to obtain the connector assembly **100**, and to assemble the first circuit board **61** and the second circuit board **62**, on the basis of the configuration of the first connector **1**, even in a case in which the position of each of the first connector **1** and the second connector **4** deviates toward at least one of the first direction x and the second direction y.

[0106] The movable housing **30** is supported by the stationary housing **20** via the first contacts **10** in a state in which the movable housing **30**, the stationary housing **20**, and the first circuit board **61** are assembled. In other words, the movable housing **30** is supported to elastically deform the first contacts **10** in the first direction x and the second direction y to be able to displace the first contacts **10**. In such a case, with regard to a direct relationship between the movable housing **30** and the stationary housing **20**, the lower portions **322** of the movable housing **30** and the facing portions **251** of the stationary housing **20** face each other in the mating direction z, and the relative displacement between the movable housing **30** including the lower portions **322** and the stationary housing **20** including the facing portions **251** in the first direction x and the second direction y is possible within the floating ranges corresponding to the

gaps G1 and G2 existing between the movable housing **30** and the stationary housing **20**. Since the lower portions **322** are positioned between the facing portions **251** and the first circuit board **61** to fit the movable housing **30** and the stationary housing **20** to each other, the movable housing **30** and the stationary housing **20** are not restrained by fittings for fitting, or the like. A floating range can be sufficiently secured over all the gaps G1 and G2 because a hindrance to relative displacement between the movable housing **30** and the stationary housing **20** is not constituted by such fittings. Therefore, in accordance with the present embodiment, the first connector **1** and the connector assembly **100**, in which a floating range can be increased to, for example, a degree of ±1 mm or more, can be provided.

[0107] For example, in a case in which the first connector **1** and the second connector **4** in which positional deviation in the second direction y occurs are mated with each other, the movable housing **30** is displaced in the second direction y with respect to the stationary housing **20** while following the position of the housing **50** to allow the first contacts **10** to be elastically deformed in the second direction y, as illustrated in FIG. **14**. In such a case, the first contacts **10** in one of the first row R1 and the second row R2 (the first row R1 in the example of FIG. **14**) are deformed in a direction in which the fixation retention portions **10**B and the movable retention portions **10**C approach each other, and the first contacts **10** in the other (the second row R2 in the example of FIG. **14**) are deformed in a direction in which the fixation retention portions **10**B and the movable retention portions **10**C move away from each other.

[0108] Contact between the sites of the first contacts **10** and contact between the first contacts **10** and the stationary housing **20** are avoided even in a case in which the elastic deformation volumes of the first contacts **10** are increased with an increase in floating range. The first bent portions B1 of the first sections **101** and the second bent portions B2 of the second sections **102** approach each other in the second direction y when the first contacts **10** are deformed in a direction in which the fixation retention portions **10**B and the movable retention portions **10**C approach each other, for example, as in the case of the first contacts **10** in the first row R1 illustrated in FIG. **14**. However, the first bent portions B1 and the second bent portions B2 do not come into contact with each other because the positions of the first bent portions B1 and the second bent portions B2 in the mating direction z are different. Therefore, generation of excessive stress on the first contacts **10** due to a collision between the sites of the first contacts **10** can be avoided, and the deterioration of signal transmission characteristics due to the contact and conduction between the sites of the first contacts **10** can be avoided.

[0109] When the fixation retention portions **10**B and the movable retention portions **10**C approach each other at not less than a certain distance in the second direction y, the first sections **101** incline in the mating direction z, whereby parts, closer to the first bends C1, of the first sections **101** get closer to the side wall **21** of the stationary housing **20** than parts, closer to the fixation retention portions **10**B, of the first sections **101**. However, since the chamfer **212** having a shape following the direction of the slope of each first section **101** in such a case is formed on the inside of the side wall **21** of the stationary housing **20**, the first sections **101** do not come into contact with the stationary housing **20**. Thus, a state in which the first contacts **10**, except predetermined sites such as the fixation retention portions **10**B and the movable retention portions **10**C, are apart from the housings **20** and **30** can be maintained. Accordingly, generation of excessive stress on the first contacts **10** due to a collision with the stationary housing **20** can be avoided, and the impedance match of a transmission path can be favorably maintained.

[0110] Positional deviation amounts corresponding to predetermined floating ranges in the first direction x, the second direction y, and the xy rotation direction, based on the first gaps G1 and the second gaps G2, are permitted in the first connector **1** and the second connector **4**. When the first connector **1** and the second connector **4** are mated with each other, the movable housing **30** is guided in the second direction y by the action between the slopes **321**B of the guide projections **321** and the second guiding slopes **59** of the housing **50**, whereby the general position of the movable housing **30** in the second direction y is determined, and then, the movable housing **30** is located in the second direction y with respect to the housing **50** by the action between the guiding slopes **31**C and the guiding slopes **512** and **522**. Therefore, the movable housing **30** and the housing **50** can be smoothly mated with each other.

[0111] FIG. **15** illustrates a state in which positional deviation between the first connector **1** and the second connector **4** occurs in both the first direction x and the second direction y. Even in such a case, the movable housing **30** is displaced with respect to the stationary housing **20** and the housing **50** by the action between the guiding slopes **31**C and the guiding slopes **512** and **522** following the action between the guiding slopes **55** and **59**, and the slopes **321**A and **321**B of the guide projections **321**, within a floating range. Thus, each first contact **10** is elastically deformed in the first direction x and the second direction y.

[0112] In addition to the above, the configurations described in the embodiment described above can be chosen, or can be changed to other configurations as appropriate, without departing from the gist of the invention. An object to be bonded, to which the first contacts **10** are bonded, is not necessarily limited to a circuit board. Likewise, an object to which the second contacts **40** are bonded is not necessarily limited to a circuit board. The facing portions **251** that are formed on the stationary housing **20**, and a part of the movable housing **30** that is positioned between the facing portions **251** and a reference surface (first mounting surface **61**A) of an object to be bonded are not limited to the embodiment described above, and can be configured as appropriate. Not only the first gaps G1 are set between the facing portions **251** and the recesses **323** as in the case of the embodiment described, but also the first gaps G1 may be set between the movable housing **30** and the stationary housing **20** at positions apart from the facing portions **251** and the recesses **323**. Likewise, not only the second gaps G2 are set between the side walls **322**A and **322**B of the expanded regions **32**, and the side walls **252**A and **252**B of the expansion walls **25** as in the case of the embodiment described above, but also the second gaps G2 may be set between the movable housing **30** and the stationary housing **20** at positions apart from the expanded regions **32** and the expansion walls **25**.

[0113] In addition, those areas in which it is believed that those of ordinary skill in the art are familiar, have not been described herein in order not to unnecessarily obscure the invention described. Accordingly, it has to be understood

that the invention is not to be limited by the specific illustrative embodiments, but only by the scope of the appended claims.

[0114] It should be appreciated for those skilled in this art that the above embodiments are intended to be illustrated, and not restrictive. For example, many modifications may be made to the above embodiments by those skilled in this art, and various features described in different embodiments may be freely combined with each other without conflicting in configuration or principle.

[0115] Although several exemplary embodiments have been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

[0116] As used herein, an element recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of the elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements having a particular property may include additional such elements not having that property.

What is claimed is:

1. A connector, comprising:

a plurality of contacts arranged along a predetermined first to form a first row and a second row in parallel, positioned on a reference surface encompassing the first direction and a second direction orthogonal to the first direction, and bonded to an object to be bonded;

a stationary housing surrounding the plurality of contacts and positioned on the reference surface; and

a movable housing that sections an interior of the stationary housing into an area closer to the first row and an area closer to the second row, and is displaceable in the first direction and the second direction with respect to the stationary housing.

2. The connector according to claim **1**, wherein the contacts are retained by the stationary housing and the movable housing.

3. The connector according to claim **2**, wherein the stationary housing includes facing portions positioned to face the reference surface in the interior of the stationary housing.

4. The connector according to claim **3**, wherein portions of the movable housing are positioned between the facing portions and the reference surface.

5. The connector according to claim **4**, wherein the facing portions are formed each of two sides of the stationary housing in the first direction.

6. The connector according to claim **5**, wherein first gaps exist between the movable housing and the facing portions in the first direction.

7. The connector according to claim **6**, wherein regions that are positioned on both sides of the stationary housing in the second direction, and include second gaps between the movable housing and the stationary housing in the second direction, are formed in the stationary housing.

8. The connector according to claim **7**, wherein the facing portions extend in the first direction and the second direction have a plate shape.

9. The connector according to claim **8**, wherein recesses that are dented at positions of the facing portions in the first direction and can receive the facing portions are formed in the movable housing.

10. The connector according to claim **9**, wherein the regions extend in the first direction and a mating direction in which the movable housing is mated with a mating connector, in an area closer to the reference surface than the facing portions, and on both the sides of the stationary housing in the first direction.

11. The connector according to claim **1**, wherein each of the contacts includes a fixation retention portion retained by the stationary housing, and a movable retention portion retained by the movable housing.

12. The connector according to claim **11**, wherein a first bend and a second bend are formed between the fixation retention portion and the movable retention portion.

13. The connector according to claim **12**, wherein each of the contacts comprises:

a first section extending from the fixation retention portion to the first bend toward a side opposite to the reference surface;

a second section extending from the first bend toward the reference surface, and is contiguous to the movable retention portion via the second bend; and

a third section extending from the movable retention portion to a terminating end that is connected to a contact of a mating connector with which the movable housing is mated, toward the side opposite to the reference surface.

14. The connector according to claim **13**, wherein:

a first bent portion formed to have a shape convex toward the second section is formed on the first section; and

in the second section, a second bent portion formed to have a shape convex toward the first section is formed at a position farther from the reference surface than a position of the first bent portion in a mating direction in which the movable housing and the mating connector are mated with each other.

15. The connector according to claim **1**, wherein:

each of the contacts comprises a fixation retention portion that is retained by the stationary housing, and a movable retention portion that is retained by the movable housing;

a first bend and a second bend are formed between the fixation retention portion and the movable retention portion; and

each of the contacts comprises:

a first section that extends from the fixation retention portion to the first bend toward a side opposite to the reference surface;

a second section that extends from the first bend toward the reference surface, and is contiguous to the movable retention portion via the second bend; and

a third section that extends from the movable retention portion to a terminating end that is connected to a contact of a mating connector with which the movable housing is mated, toward the side opposite to the reference surface.

16. The connector according to claim **15**, wherein a chamfer separated in the second direction with respect to the

first section with approaching from the fixation retention portion toward the first bend is formed on an inner wall of the stationary housing.

17. The connector according to claim **1**, wherein:

each of the contacts comprises the fixation retention portion that is retained by the stationary housing, and the movable retention portion that is retained by the movable housing; and

a first bend and a second bend are formed between the fixation retention portion and the movable retention portion.

18. The connector according to claim **17**, wherein the connector comprises a ground contact connection element that comes into contact with ground contact groups corresponding to some of the contacts in the first row and some of the contacts in the second row.

19. The connector according to claim **18**, wherein the ground contact connection element is disposed on a portion, facing the reference surface, of the movable housing along the first direction, and comprises a plurality of contact portions that come into contact with the second bends of the contacts included in the ground contact groups.

20. A connector assembly, comprising:

a first connector, including:

a plurality of contacts arranged along a predetermined first to form a first row and a second row in parallel, positioned on a reference surface encompassing the first direction and a second direction orthogonal to the first direction, and bonded to an object to be bonded;

a stationary housing surrounding the plurality of contacts and positioned on the reference surface; and

a movable housing that sections an interior of the stationary housing into an area closer to the first row and an area closer to the second row, and is displaceable in the first direction and the second direction with respect to the stationary housing; and

a second connector mated with the movable housing of the first connector.

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