

(19)



(11)

EP 2 846 409 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.03.2015 Bulletin 2015/11

(51) Int Cl.:
H01R 12/91 (2011.01) **H01R 13/24** (2006.01)
H01R 13/631 (2006.01) **H01R 13/26** (2006.01)
H01R 13/502 (2006.01)

(21) Application number: **14183191.7**

(22) Date of filing: **02.09.2014**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
 PL PT RO RS SE SI SK SM TR**
 Designated Extension States:
BA ME

(72) Inventors:
 • **Funayama, Daisuke**
Yokohama, Kanagawa 222-0033 (JP)
 • **Mitsuzuka, Shigeru**
Yokohama, Kanagawa 222-0033 (JP)
 • **Yamaguchi, Tomisaburo**
Yokohama, Kanagawa 222-0033 (JP)

(30) Priority: **05.09.2013 JP 2013184389**

(71) Applicant: **Iriso Electronics Co., Ltd.**
Kanagawa 222-0033 (JP)

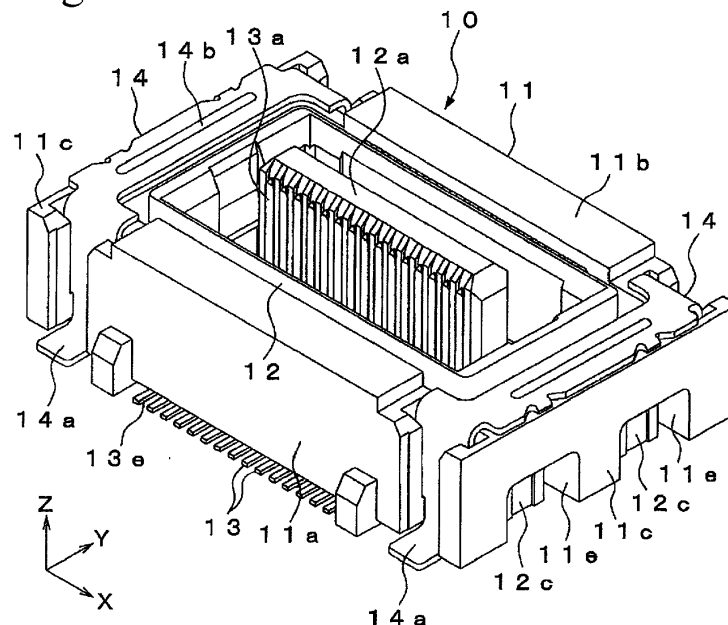
(74) Representative: **Lorenz, Markus**
Lorenz & Kollegen
Patentanwälte Partnerschaftsgesellschaft mbB
Alte Ulmer Straße 2
89522 Heidenheim (DE)

(54) **Connector**

(57) The movable portion of the first terminal of the first connector is formed to be larger in the width direction than in the thickness direction, so as to be elastically deformed in the front-back direction of the connector, and the movable portion of the second terminal of the second connector is formed to be larger in the thickness direction than in the width direction, so as to be elastically de-

formed in the width direction of the connector. Therefore, the movable portions can be formed with an increased cross-sectional area, thereby enabling the allowable current of the terminals to be increased, unlike a configuration in which the movable portion is elastically deformable to a sufficient extent both in the front-back direction and in the width direction of the connector.

Fig.1



EP 2 846 409 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a connector used for connecting, for example, a pair of printed substrates to each other.

2. Description of the Related Art

[0002] Connector units are thus far known that include a first connector attached to one of a pair of substrates disposed such that respective surfaces oppose each other, and a second connector attached to the other substrate, the first connector and the second connector being configured to be fitted together to connect the substrates, for example as disclosed in Japanese Unexamined Patent Application Publication No. 2007-18785.

[0003] One of the connectors includes a fixed housing to be fixed to the substrate, a movable housing disposed to move relative to the fixed housing in a front-back direction and a width direction of the connector, and a plurality of terminals each having an end portion retained by the movable housing and the other end portion retained by the fixed housing. The movable housing is displaced relative to the fixed housing by elastic deformation of a movable portion provided between the end portions of each of the terminals, so as to absorb a positional shift between the substrates arising from vibration or impact.

[0004] With the mentioned connector unit, the positional shift between the substrates takes place in the front-back direction and the width direction of the connector, however only the terminals of one of the connectors are elastically deformable so as to allow the movable housing to be displaced. Accordingly, the movable portion of the terminal has to be elastically deformed by a sufficient amount in both the front-back direction and the width direction of the connector. Therefore, the movable portion in the terminal of one of the connectors is formed in a shape having a generally square cross section and with a small cross-sectional area. Such a configuration impedes an increase in allowable current of the terminal, thus making it difficult to employ the connector for large-current devices.

[0005] The present invention has been accomplished in view of the foregoing drawback, and provides a connector that enables the allowable current of a terminal to be increased, despite the connector being configured to move in a front-back direction and a width direction relative to a mating connector.

SUMMARY OF THE INVENTION

[0006] In an aspect, the present invention provides a connector unit including a first connector attached to one substrate and a second connector attached to another

substrate, the first connector and the second connector being configured to be fitted together to connect the substrates. The first connector includes a first fixed housing to be fixed to the one substrate, a first movable housing disposed so as to move relative to the first fixed housing, and a first terminal having one end portion retained by the first movable housing and the other end portion retained by the first fixed housing. The first terminal includes a movable portion elastically deformable in a front-back direction of the connector, and the movable portion has a width taken in a width direction of the connector larger than a thickness taken in the front-back direction or an up-down direction of the connector. The second connector includes a second fixed housing to be fixed to the another substrate, a second movable housing disposed so as to move relative to the second fixed housing, and a second terminal having one end portion retained by the second movable housing and the other end portion retained by the second fixed housing. The second terminal includes a movable portion elastically deformable in the width direction of the connector, and the movable portion has a thickness taken in the front-back direction or up-down direction of the connector larger than a width taken in the width direction of the connector.

[0007] In the connector unit configured as above, the movable portion of the first terminal of the first connector can easily be elastically deformed in the front-back direction or up-down direction of the connector, since the movable portion is larger in the width direction than in the thickness direction. Likewise, the movable portion of the second terminal of the second connector can easily be elastically deformed in the width direction of the connector, since the movable portion is larger in the thickness direction than in the width direction. Therefore, when the positional shift between the substrates takes place in the front-back direction of the connector the movable portion of the first terminal is elastically deformed, and when the positional shift between the substrates takes place in the width direction of the connector the movable portion of the second terminal is elastically deformed.

[0008] Forming thus the movable portion of the first terminal of the first connector to be larger in the width direction than in the thickness direction, so as to be elastically deformed in the front-back direction of the connector, and the movable portion of the second terminal of the second connector to be larger in the thickness direction than in the width direction, so as to be elastically deformed in the width direction of the connector, allows the respective movable portions of the first and second terminals to be formed with an increased cross-sectional area, thereby enabling the allowable current of the terminal to be increased, unlike a configuration in which the movable portion is elastically deformable to a sufficient extent both in the front-back direction and in the width direction of the connector.

[0009] In another aspect, the present invention provides a connector attached to one substrate and config-

ured to be fitted to another connector attached to another substrate so as to connect the substrates. The connector includes a fixed housing to be fixed to the one substrate, a movable housing disposed so as to move relative to the fixed housing, and a terminal having one end portion retained by the movable housing and the other end portion retained by the fixed housing. The terminal includes a first and a second contact portion to be brought into contact with a terminal of the another connector, with a spacing between the first and the second contact portion in the direction in which the connectors are fitted together, and a movable portion elastically deformable in the width direction of the connector, and the movable portion has a thickness taken in the front-back direction or up-down direction of the connector larger than a width taken in the width direction of the connector.

[0010] The movable portion of the terminal configured as above has a thickness taken in the front-back direction or up-down direction of the connector larger than a width taken in the width direction of the connector, and is hence easy to elastically deform in the width direction of the connector. Accordingly, the cross-sectional area of the movable portion can be increased, so that the allowable current of the terminal can be increased. In addition, the terminal includes the first and second contact portions to be brought into contact with the terminal of the other connector, with a spacing defined between the first and the second contact portion in the direction in which the connectors are fitted together. With the mentioned configuration, when the connector is fitted to the other connector the second contact portion can make contact with the terminal of the other connector following up the sliding track of the first contact portion marked thereon, and therefore even though a foreign matter is stuck to the terminal of the other connector, the second contact portion can make contact therewith after the foreign matter is removed by the first contact portion, which leads to upgraded connection reliability of the connectors.

[0011] Further, the terminal contacts the mating terminal via the first and second contact portions, and hence exerts a larger contact force on the mating terminal to firmly hold the same, compared with the case of contacting via a single contact portion. Therefore, even though the connectors are subjected to vibration during the practical use, the first and second contact portions can be prevented from microsliding relative to the mating terminal and from thus scraping off the plating and increasing the contact resistance. In this aspect also, the connection reliability of the connectors can be upgraded.

[0012] The connectors configured as above enable the allowable current of the terminal to be increased, despite the connectors being configured to move relative to each other in the front-back direction and the width direction thereof, and are therefore applicable to large-current devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

- 5 Fig. 1 is a perspective view showing a first connector according to an embodiment of the present invention;
 Fig. 2 is a front view showing the first connector;
 Fig. 3 is a side view showing the first connector;
 10 Fig. 4 is a cross-sectional view taken along a line IV-IV in Fig. 2;
 Fig. 5 is a plan view showing the first connector;
 Fig. 6 is a bottom view showing the first connector;
 Fig. 7 is a perspective view showing a second connector;
 15 Fig. 8 is a front view showing the second connector;
 Fig. 9 is a side view showing the second connector;
 Fig. 10 is a cross-sectional view taken along a line X-X in Fig. 8;
 20 Fig. 11 is a plan view showing the second connector;
 Fig. 12 is a bottom view showing the second connector;
 Fig. 13 is a perspective view showing a first terminal;
 25 Fig. 14 is a perspective view showing a second terminal;
 Fig. 15 is a perspective view for explaining a connection process of a connector unit; and
 Fig. 16 is a side cross-sectional view for explaining the connection process of the connector unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Fig. 1 through Fig. 16 illustrate a connector unit according to an embodiment of the present invention, used for connecting, for example, a pair of printed substrates to each other. In the drawings, X-direction represents a width direction of the connector, Y-direction represents a front-back direction of the connector, and Z-direction represents an up-down direction of the connector.

[0015] The connector unit according to this embodiment includes a first connector 10 to be attached to a substrate 1 of the pair of substrates 1, 2 disposed such that respective surfaces oppose each other, and a second connector 20 to be attached to the other substrate 2.

[0016] Here, although the second connector 20 is turned upside down in Fig. 15 and Fig. 16 with respect to Fig. 7 to Fig. 12, the up-down direction referred to in the following description will be based on the up-down direction in Fig. 7 to Fig. 12.

Configuration of First Connector 10

[0017] The first connector 10 includes a first fixed housing 11 to be attached to the substrate 1, a first movable housing 12 disposed so as to move relative to the first fixed housing 11, a plurality of first terminals 13 retained by the first fixed housing 11 and the first movable housing

12, and a pair of first fixing members 14 for fixing the first fixed housing 11 to the substrate 1. The first terminals 13 are aligned at predetermined intervals in the width direction of the connector so as to form two rows, the two rows being aligned in the front-back direction of the connector.

[0018] The first fixed housing 11 is formed of a synthetic resin by molding, into a generally rectangular block shape smaller in height than in width and depth. The first fixed housing 11 includes a front face 11a, a rear face 11b, and a left and right lateral faces 11c, and the upper and the lower face are open upward and downward, respectively.

[0019] A plurality of fixing grooves 11d for fixing the respective first terminals 13 are provided on the inner side of the front face 11a and the rear face 11b, and the lateral faces 11c each include a pair of cutaway portions 11e of a generally rectangular shape that delimit the movement of the first movable housing 12 in the front-back direction, the cutaway portions 11e being aligned in the front-back direction.

[0020] The first movable housing 12 is formed of a synthetic resin by molding, into a generally rectangular block shape smaller in height than in width and depth. The first movable housing 12 is formed in a hollow shape having an opening oriented upward, and includes a projecting portion 12a erected upward from a central portion of the bottom face in the front-back direction.

[0021] The projecting portion 12a has a flat shape extending in the width direction of the first movable housing 12, and includes a plurality of holding grooves 12b formed on the front and rear faces, for holding the respective first terminals 13. When the first connector 10 and the second connector 20 are fitted together, the top portion of the projecting portion 12a is located close to a bottom portion of an insertion cavity 22c of a second movable housing 22 and a distal end portion of a second elastic portion 23d extending in a bent shape from a first fixing portion 23e.

[0022] The first movable housing 12 has an outer shape smaller than the inner shape of the first fixed housing 11, and disposed inside the first fixed housing 11 so as to move in the front-back direction and the width direction. In this embodiment, the top end of the first movable housing 12 is located at generally the same level as the uppermost end portion of the first fixed housing 11.

[0023] Further, the first movable housing 12 includes a pair of projections 12c projecting in the width direction from each of the lateral faces, the projections 12c being aligned in the front-back direction. The projections 12c are each disposed in the corresponding cutaway portion 11e of the first fixed housing 11 so as to move in the front-back direction, the width direction, and the up-down direction. Here, a gap is provided between the bottom face of the first movable housing 12 and the substrate 1 as shown in Fig. 16, and the gap serves as a moving margin that allows the first movable housing 12 to move downward (toward the substrate 1).

[0024] The first terminals 13 are formed by bending conductive metal plates, and made larger in the width direction (X-direction) than in the thickness direction (Y-direction or Z-direction), as shown in Fig. 13.

[0025] The first terminals 13 each include a contact portion 13a to be brought into contact with a terminal of the second connector 20, a first fixing portion 13b fixed to the first movable housing 12, a movable portion 13c elastically deformable in the front-back direction of the connector, a second fixing portion 13d fixed to the first fixed housing 11, and a substrate connection portion 13e to be connected to the substrate 1.

[0026] The contact portion 13a linearly extends in the up-down direction, and is retained by the holding groove 12c of the first movable housing 12.

[0027] The first fixing portion 13b extends in the front-back direction from the lower end portion of the contact portion 13a, and is fixed to the lower face of the first movable housing 12.

[0028] The movable portion 13c extends upward from the first fixing portion 13b along the outer face of the first movable housing 12, and is bent in an inverted U-shape in the vicinity of the upper end portion of the first movable housing 12 so as to extend downward. Accordingly, the movable portion 13c is elastically deformable in the front-back direction (Y-direction) of the connector, about the bent portion.

[0029] The second fixing portion 13d extends downward as further extension of the movable portion 13c, and is fixed to the fixing groove 11d of the first fixed housing 11.

[0030] The substrate connection portion 13e extends in the front-back direction from the lower end portion of the second fixing portion 13d, and sticks out of the first fixed housing 11 from the lower end portion of the front face 11a or rear face 11b of the first fixed housing 11.

[0031] Thus, the portion of the first terminal 13 on the side of the first fixing portion 13b and the portion thereof on the side of the second fixing portion 13d are located with a spacing therebetween in the front-back direction of the connector, and the movable portion 13c is provided between the first fixing portion 13b and the second fixing portion 13d.

[0032] The first fixing members 14 are formed by bending a metal plate, and located on the respective sides of the first fixed housing 11 in the width direction. The first fixing members 14 are each formed in a generally channel shape so as to extend along the upper face of the corresponding lateral face 11c of the first fixed housing 11 toward the front and rear faces, and the front and rear end portions of the first fixing member 14 are respectively fixed to the front face and the rear face of the lateral face 11c. The first fixing members 14 each include a pair of fixing portions 14a, via which the first fixing member 14 is soldered to the substrate 1, formed so as to respectively extend in the front-back direction from the front and rear end portions. The first fixing member 14 also includes a rib portion 14b formed on the upper face so as

to extend in the front-back direction.

Configuration of Second Connector 20

[0033] The second connector 20 includes a second fixed housing 21 to be attached to the substrate 2, the second movable housing 22 disposed so as to move relative to the second fixed housing 21, a plurality of second terminals 23 retained by the second fixed housing 21 and the second movable housing 22, and a pair of second fixing members 24 for fixing the second fixed housing 21 to the substrate 2, and the second terminals 23 are aligned at predetermined intervals in the width direction of the connector so as to form two rows, the two rows being aligned in the front-back direction of the connector.

[0034] The second fixed housing 21 is formed of a synthetic resin by molding, into a generally rectangular block shape smaller in height than in width and depth. The second fixed housing 21 includes a front face 21a, a rear face 21b, and a left and right lateral faces 21c, and the upper and the lower face are open upward and downward, respectively. A plurality of fixing holes 21d for fixing the respective second terminals 23 are provided on the lower end portion of the front face 21a and the rear face 21b, and the lateral faces 21c each include a cutaway portion 21e of a generally rectangular shape that delimits the movement of the second movable housing 22 in the front-back direction.

[0035] The second movable housing 22 is formed of a synthetic resin by molding, into a generally rectangular block shape larger in height than in width and depth.

[0036] The second movable housing 22 includes an insertion port 22a formed on the upper face, for the projecting portion 12a of the first movable housing 12 to be inserted therethrough, the insertion port 22a having a slender shape extending in the width direction of the first movable housing 12.

[0037] A plurality of terminal slots 22b in which the second terminals 23 are respectively accommodated are provided in the second movable housing 22. The terminal slots 22b are aligned at predetermined intervals in the width direction of the connector so as to form two rows, the two rows being aligned in the front-back direction of the connector. The upper portion of each of the terminal slots 22b is open toward a central portion of the inner space of the second movable housing 22 in the front-back direction, and the insertion cavity 22c, into which the projecting portion 12a of the first movable housing 12 is inserted through the insertion port 22a, is formed between the front row and the rear row of the terminal slots 22b. The second terminals 23 are each fixed to the lower portion of the corresponding terminal slot 22b, and the lower end portion of each of the terminal slots 22b is open downward.

[0038] The second movable housing 22 has an outer shape smaller than the inner shape of the second fixed housing 21, and disposed inside the second fixed housing 21 so as to move in the front-back direction and the

width direction. In this embodiment, the second movable housing 22 sticks out upward from the uppermost end portion of the second fixed housing 21, by approximately half of the height of the second movable housing 22. In addition, the second movable housing 22 includes a projection 22c projecting in the width direction from each of the lateral faces. The projection 12c is disposed in the cutaway portion 21e of the second fixed housing 21 so as to move in the front-back direction, the width direction, and the up-down direction.

[0039] The second terminals 23 are each formed by punching a conductive metal plate, into a shape larger in the thickness direction (Y-direction or Z-direction) than in the width (X-direction), as shown in Fig. 14.

[0040] The second terminals 23 each include a first contact portion 23a and a second contact portion 23b to be brought into contact with the first terminal 13 of the first connector 10, a first elastic portion 23c and the second elastic portion 23d elastically deformable in the direction for contacting the first terminal 13, the first fixing portion 23e fixed to the second movable housing 22, a movable portion 23f elastically deformable in the width direction of the connector, a second fixing portion 23g fixed to the second fixed housing 21, and a substrate connection portion 23h to be connected to the substrate 2.

[0041] The first contact portion 23a and the second contact portion 23b have a generally triangular shape, and each project into the insertion cavity 22c from an upper portion of the terminal slot 22b. In this embodiment, the contact portions 23a, 23b are located with a spacing therebetween in the up-down direction, the first contact portion 23a being located on the upper side of the second contact portion 23b.

[0042] Because of the mentioned configuration, the second terminal 23 contacts the first terminal 13 via the first and second contact portions 23a, 23b, and hence exerts a larger contact force on the first terminal 13 to firmly hold the same, compared with the case of contacting via a single contact portion. Therefore, even though the first connector 10 and the second connector 20 fitted together are subjected to vibration during the practical use, the first and second contact portions 23a, 23b can be prevented from microsliding relative to the first terminal 13 and from thus scraping off the plating and increasing the contact resistance. Consequently, the connection reliability of the connectors can be upgraded.

[0043] The first elastic portion 23c extends upward from the upper end portion of the first fixing portion 23e, and the first contact portion 23a is formed on the distal end portion of the first elastic portion 23c.

[0044] The second elastic portion 23d extends upward from the upper end portion of the first fixing portion 23e, and the second contact portion 23b is formed on the distal end portion of the second elastic portion 23d. In this embodiment, the elastic portions 23c, 23d are located with a spacing therebetween in the front-back direction, the second elastic portion 23d being located closer to the

center of the insertion cavity 22c in the front-back direction.

[0045] The second elastic portion 23d includes a bent section formed close to the proximal end portion thereof connected to the first fixing portion 23e, so as to circumvent along the shape of the distal end portion and a part of the lateral portion of the projecting portion 12a of the first movable housing 12. The bent section is connected via the proximal end portion to the first fixing portion 23e at the position where the bent section contacts a central partition wall of the second movable housing 22 provided between the front row and the rear row of the second terminals 23, and is bent forward or backward away from the central partition wall and then curved toward the center of the insertion cavity 22c in the front-back direction.

[0046] In the case where the second elastic portion 23d is formed in a linear shape, the proximal end portion connected to the first fixing portion 23e has to be shifted forward or backward away from the central partition wall in order to avoid interference with the projecting portion 12a of the first movable housing 12, and hence the size of the second movable housing 22 in the front-back direction has to be increased. Therefore, not only the second connector 20 but also the first connector 10 have to be made larger in the front-back direction. In contrast, forming the second elastic portion 23d with the bent section configured as above allows the interference to be avoided thereby enabling reduction in size of the connectors. In addition, the bent section serves to increase the spring length of the second elastic portion 23d, thereby preventing degradation in insertion and removal performance and in spring elasticity, and decline in connection reliability of the connectors.

[0047] The first fixing portion 23e extends downward from the proximal end portion of the elastic portions 23c, 23d, and is fixed to the lower end portion of the terminal slot 22b.

[0048] The movable portion 23f extends upward from the lower end portion of the first fixing portion 23e along the outer face of the second movable housing 22, and then extends downward in an inverted U-shape from a generally central position of the second movable housing 22 in the up-down direction, so as to be elastically deformed in the width direction (X-direction) of the connector, about the top end of the inverted U-shape.

[0049] The second fixing portion 23g extends upward as further extension of the movable portion 23f, and is fixed in the fixing hole 21d of the second fixed housing 21.

[0050] The substrate connection portion 23h extends in the front-back direction from the lower end portion of the second fixing portion 23g, and sticks out of the second fixed housing 21 from the lower end portion of the front face 21a or rear face 21b of the second fixed housing 21.

[0051] Thus, the portion of the second terminal 23 on the side of the first fixing portion 23e and the portion thereof on the side of the second fixing portion 23g are located with a spacing therebetween in the front-back direction of the connector, and the movable portion 23f is provided

between the first fixing portion 23e and the second fixing portion 23g.

[0052] The second fixing members 24 are formed by bending a metal plate, and located on the respective sides of the second fixed housing 21 in the width direction. The second fixing members 24 are each formed in a generally channel shape so as to extend along the upper face of the corresponding lateral face 21c of the second fixed housing 21 toward the front and rear faces, and the front and rear end portions of the second fixing member 24 are respectively fixed to the front face and the rear face of the lateral face 21c. The second fixing members 24 each include a pair of fixing portions 24a, via which the second fixing member 24 is soldered to the substrate 2, formed so as to extend in the front-back direction. The second fixing member 24 also includes a rib portion 24b formed on the upper face so as to extend in the front-back direction.

20 Mounting on Substrate

[0053] With the connectors configured as above, the first fixed housing 11 of the first connector 10 is fixed to the substrate 1, by soldering the fixing portions 14a of the respective first fixing members 14 and the substrate connection portions 13e of the respective first terminals 13 of the first connector 10 to the substrate 1. Likewise, the second fixed housing 21 of the second connector 20 is fixed to the substrate 2, by soldering the fixing portions 24a of the respective second fixing members 24 and the substrate connection portions 23h of the respective second terminals 23 of the second connector 20 to the substrate 2. Connection and Working of Connectors

[0054] To connect the first connector 10 and the second connector 20 to each other, the second connector 20 and the substrate 2 are turned upside down as shown in Fig. 15 and Fig. 16, and the first movable housing 12 of the first connector 10 and the second movable housing 22 of the second connector 20 are fitted to each other.

[0055] Upon doing so, the second movable housing 22 is inserted in the first movable housing 12, and the projecting portion 12a of the first movable housing 12 is inserted in the insertion cavity 22c of the second movable housing 22 through the insertion port 22a thereof. Accordingly, the contact portions 13a of the respective first terminals 13 are press-inserted into between the front row and the rear row of the first and second contact portions 23a, 23b of the second terminal 23, and the contact portions 13a of the first terminal 13 and the first and second contact portions 23a, 23b of the second terminals 23 are respectively brought into contact with each other, so that the first terminals 13 and the second terminals 23 are respectively connected to each other.

[0056] In this process, the second contact portion 23b of the second terminal 23 makes contact with the contact portion 13a of the first terminal 13 following first contact portion 23a of the second terminal 23, and therefore even though a foreign matter such as dust or stain is stuck to

the contact portion 13a of the first terminal 13, the second contact portion 23b can make contact therewith after the foreign matter is removed by the first contact portion 23a.

[0057] In the case where the substrates 1 and 2 are positionally shifted relative to each other in the front-back direction (Y-direction) or the up-down direction (Z-direction) of the connector after the connection is completed, the first movable housing 12 of the first connector 10 is displaced in the front-back direction (Y-direction) or the up-down direction (Z-direction) of the connector relative to the first fixed housing 11, to thereby absorb the positional shift between the substrates 1 and 2 in the front-back direction or the up-down direction of the connector.

[0058] In the case where the substrates 1 and 2 are positionally shifted relative to each other in the width direction (X-direction) of the connector, the second movable housing 22 of the second connector 20 is displaced in the width direction (X-direction) of the connector relative to the second fixed housing 21, to thereby absorb the positional shift between the substrates 1 and 2 in the width direction of the connector.

[0059] The mentioned working is realized because the movable portion 13c of the first terminal 13 of the first connector 10 is larger in the width direction (X-direction) than in the thickness direction (Y-direction or Z-direction), and can hence be elastically deformed easily in the front-back direction (Y-direction) or the up-down direction (Z-direction) of the connector.

[0060] Likewise, the movable portion 23f of the second terminal 23 of the second connector 20 is larger in the thickness direction (Y-direction or Z-direction) than in the width direction (X-direction), and can hence be elastically deformed easily in the width direction (X-direction) of the connector.

[0061] Accordingly, when the positional shift between the substrates 1 and 2 takes place in the front-back direction (Y-direction) of the connector, the movable portion 13c of the first terminal 13 is elastically deformed by a larger amount than the movable portion 23f of the second terminal 23, and when the positional shift between the substrates 1 and 2 takes place in the width direction (X-direction) of the connector the movable portion 23f of the second terminal 23 is elastically deformed by a larger amount than the movable portion 13c of the first terminal 13.

[0062] In addition, since the movable portion 13c of the first terminal 13 is located between the portion of the first terminal 13 on the side of the first fixing portion 13b and the portion thereof on the side of the second fixing portion 13d, and the mentioned portions of the first terminal 13 are spaced from each other in the front-back direction of the connector, making the movable portion 13c of the first terminal 13 in a vertically elongate shape in the up-down direction does not lead to an increase in size of the first terminal 13 in the up-down direction.

[0063] Likewise, since the movable portion 23f of the second terminal 23 is located between the portion of the second terminal 23 on the side of the first fixing portion

23e and the portion thereof on the side of the second fixing portion 23g, and the mentioned portions of the second terminal 23 are spaced from each other in the front-back direction of the connector, making the movable portion 23f of the second terminal 23 in a vertically elongate shape does not lead to an increase in size of the second terminal 23 in the up-down direction.

Advantageous Effects of Embodiment

[0064] According to this embodiment, as described thus far, the movable portion 13c of the first terminal 13 of the first connector 10 is formed to be larger in the width direction than in the thickness direction, so as to be elastically deformed in the front-back direction (Y-direction) of the connector, and the movable portion 23f of the second terminal 23 of the second connector 20 is formed to be larger in the thickness direction than in the width direction, so as to be elastically deformed in the width direction (X-direction) of the connector. Therefore, the movable portions 13c, 23f can be formed with an increased cross-sectional area, thereby enabling the allowable current of the terminals 13, 23 to be increased, unlike a configuration in which the movable portion is elastically deformable to a sufficient extent both in the front-back direction and in the width direction of the connector.

[0065] Consequently, the connectors configured as above enable the allowable current of the terminal to be increased, despite the connectors being configured to move relative to each other in the front-back direction and the width direction thereof, and are therefore applicable to large-current devices. Naturally, the connectors may be applied to various purposes other than for the large-current devices.

[0066] In the foregoing connectors, since the portion of the first terminal 13 on the side of the first fixing portion 13b and the portion thereof on the side of the second fixing portion 13d are spaced from each other in the front-back direction of the connector, and the movable portion 13c of the first terminal 13 is located between those portions, the movable portion 13c can be formed in a vertically elongate shape without incurring an increase in size of the first terminal 13 in the up-down direction.

[0067] Likewise, since the portion of the second terminal 23 on the side of the first fixing portion 23e and the portion thereof on the side of the second fixing portion 23g are spaced from each other in the front-back direction of the connector, and the movable portion 23f of the second terminal 23 is located between those portions, the movable portion 23f can be formed in a vertically elongate shape without incurring an increase in size of the second terminal 23 in the up-down direction.

[0068] The mentioned configuration enables the displacement ranges of the first and second movable housings 12, 22 to be increased without incurring an increase in size of the first and second connectors 10, 20 in the up-down direction, thereby allowing the first and second

connectors 10, 20 to be advantageously applied to the substrates 1 and 2 disposed with a narrow clearance or disposed so as to make a large positional shift therebetween.

[0069] In addition, since the movable portion 13c of the first terminal 13 is bent in the up-down direction, the movable portion 13c can be flexurally deformed about the bent position in the thickness direction, in which the movable portion 13c is smaller than in the width direction, and therefore the first terminal 13 can be elastically deformed easily.

[0070] Likewise, the movable portion 23f of the second terminal 23 is bent in the up-down direction, the movable portion 23f can be flexurally deformed about the bent position in the width direction, in which the movable portion 23f is smaller than in the thickness direction, and therefore the second terminal 23 can be elastically deformed easily.

[0071] Further, the first terminal 13 includes the contact portion 13a to be brought into contact with the second terminal 23, and the second terminal 23 includes the elastically deformable first and second contact portions 23a, 23b to be brought into contact with the contact portion 13a of the first terminal 13, the first and second contact portions 23a, 23b being disposed with a spacing therebetween in the direction in which the first and second connectors 10, 20 are fitted together. Therefore, even though a foreign matter such as dust or stain is stuck to the contact portion 13a of the first terminal 13, the second contact portion 23b can make contact therewith after the foreign matter is removed by the first contact portion 23a, which assures the electrical conduction between the first terminal 13 and the second terminal 23.

[0072] Although the counterpart of the first connector 10 is exemplified by the multi-contact second connector 20 including the plurality of elastic portions and contact portions in the foregoing embodiment, the first connector 10 may also be connected to a single-contact connector including only one each of the elastic portion and the contact portion.

[0073] Although the counterpart of the first connector 10 is exemplified by the second connector 20 including the movable portion 23 in the foregoing embodiment, the first connector 10 may also be connected to a connector without a floating function in which the movable portion 23 is not included and the fixed housing 21 and the movable housing 22 are not distinctively provided. Likewise, although the counterpart of the second connector 20 is exemplified by the first connector 10 including the movable portion 13, the second connector 20 may also be connected to a connector without a floating function in which the movable portion 13 is not included and the fixed housing 11 and the movable housing 12 are not distinctively provided.

[0074] Further, although the connectors 10, 20 are configured on the premise that the substrates 1, 2 are opposed to each other in the up-down direction in the foregoing embodiment, in the case where the substrates

are opposed in directions other than the up-down direction, the specified direction in which the substrates are opposed corresponds to the up-down direction in the present invention.

Claims

1. A connector unit comprising:

a first connector attached to one substrate and a second connector attached to another substrate, the first connector and the second connector being configured to be fitted together to connect the substrates,

wherein the first connector includes: a first fixed housing to be fixed to the one substrate; a first movable housing disposed so as to move relative to the first fixed housing; and a first terminal having one end portion retained by the first movable housing and the other end portion retained by the first fixed housing,

the first terminal includes a movable portion elastically deformable in a front-back direction of the connector, the movable portion having a width taken in a width direction of the connector larger than a thickness taken in the front-back direction or an up-down direction of the connector,

the second connector includes: a second fixed housing to be fixed to the another substrate; a second movable housing disposed so as to move relative to the second fixed housing; and a second terminal having one end portion retained by the second movable housing and the other end portion retained by the second fixed housing,

the second terminal includes a movable portion elastically deformable in the width direction of the connector, and

the movable portion has a thickness taken in the front-back direction or up-down direction of the connector larger than a width taken in the width direction of the connector.

2. The connector unit according to claim 1,

wherein the movable portion is bent in the up-down direction of the connector.

3. The connector unit according to either claim 1 or claim 2,

wherein the first terminal includes a contact portion to be brought into contact with the second terminal, and the second terminal includes a first and a second contact portion to be brought into contact with the contact portion of the first terminal, the first and the second contact portion being elastically deformable, and

the first and the second contact portion of the second terminal are located with a spacing therebetween in a direction in which the first connector and the second connector are fitted together.

5

4. A connector attached to one substrate and configured to be fitted to another connector attached to another substrate so as to connect the substrates, the connector comprising:

10

a fixed housing to be fixed to the one substrate;
a movable housing disposed so as to move relative to the fixed housing; and a terminal having one end portion retained by the movable housing and the other end portion retained by the fixed housing,

15

wherein the terminal includes: a first and a second contact portion to be brought into contact with a terminal of the another connector, with a spacing between the first and the second contact portion in the direction in which the connectors are fitted together; and a movable portion elastically deformable in the width direction of the connector, and

20

the movable portion has a thickness taken in the front-back direction or up-down direction of the connector larger than a width taken in the width direction of the connector.

25

5. The connector according to claim 4, wherein the movable portion is bent in a direction in which the connector is inserted in and removed from the another connector.

30

6. The connector according to either claim 4 or claim 5, wherein the terminal includes:

35

a fixing portion fixed to the movable housing;
a first elastic portion having one end portion connected to the fixing portion and the other end portion connected to the first contact portion;
and

40

a second elastic portion having one end portion connected to the fixing portion and the other end portion connected to the second contact portion.

45

7. The connector according to claim 6, wherein a movable housing of the another connector includes a projecting portion retaining the terminal and inserted in the movable housing, and the one end portion of the second elastic portion includes a bent section extending so as to circumvent along a shape of a distal end portion and a part of a lateral portion of the projecting portion.

50

55

Fig.1

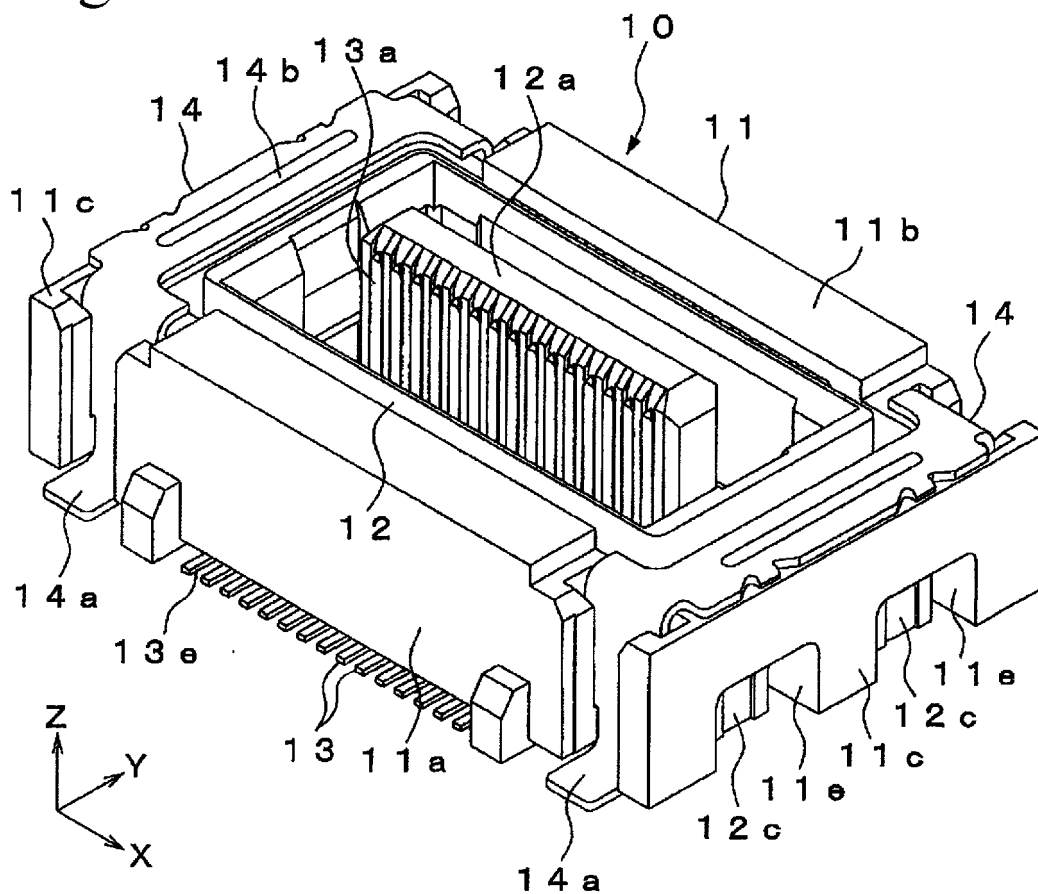


Fig.2

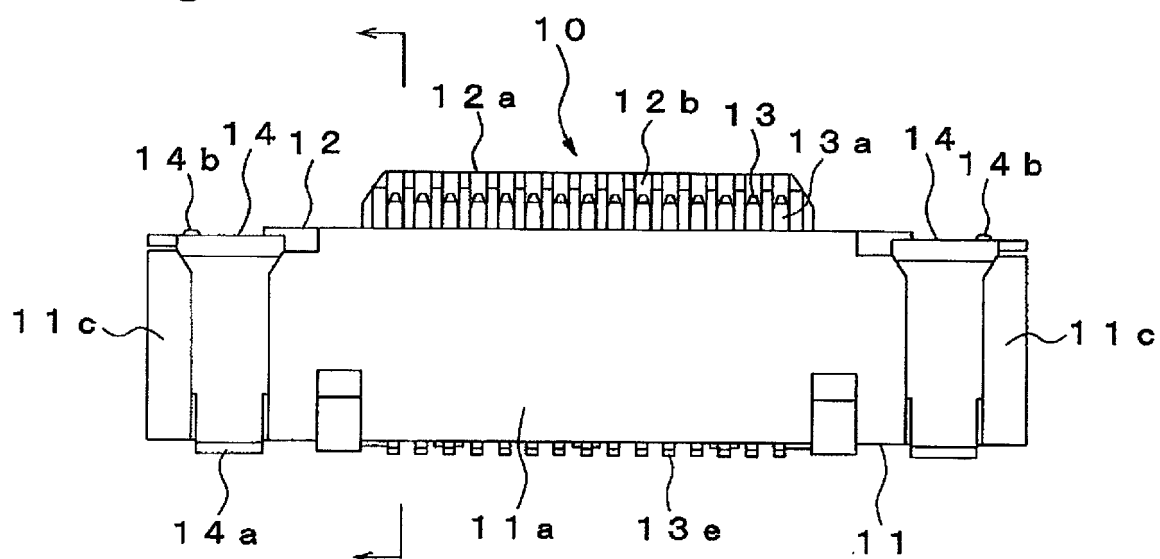


Fig.3

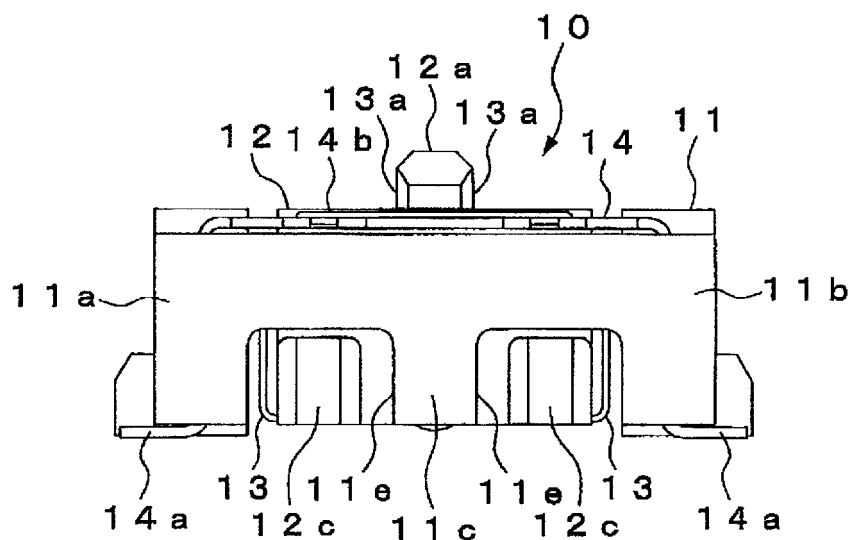


Fig.4

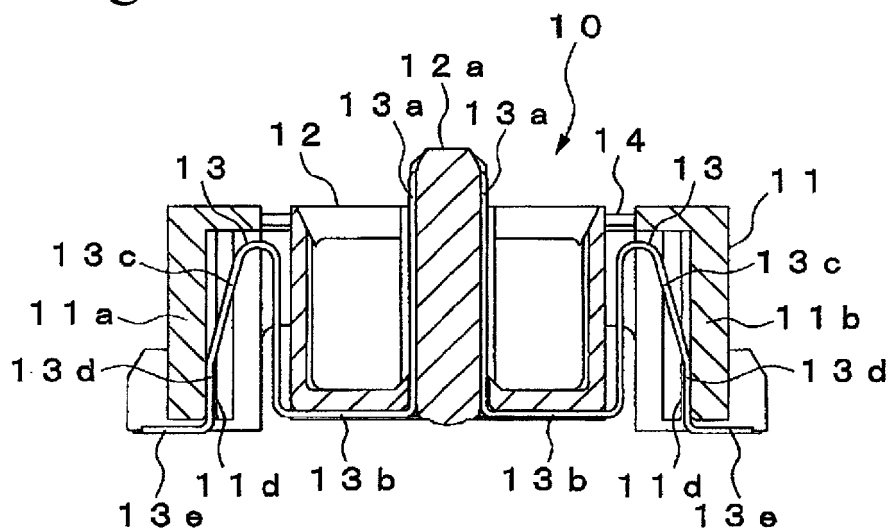


Fig.5

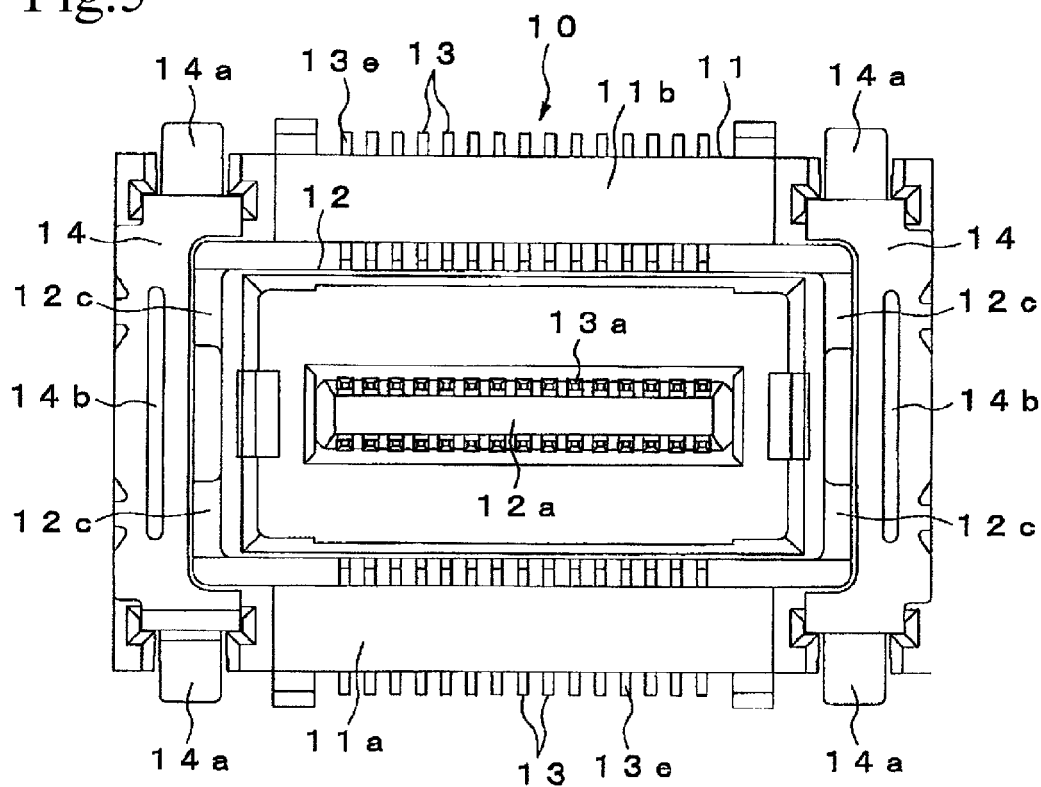


Fig.6

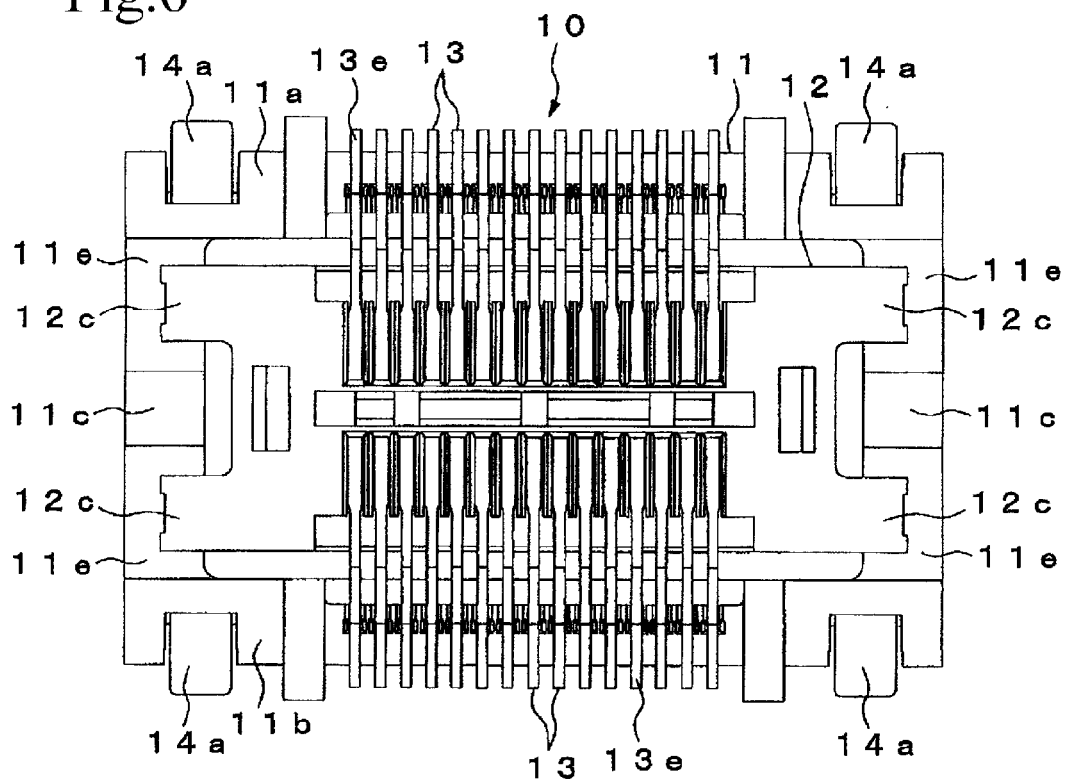


Fig.7

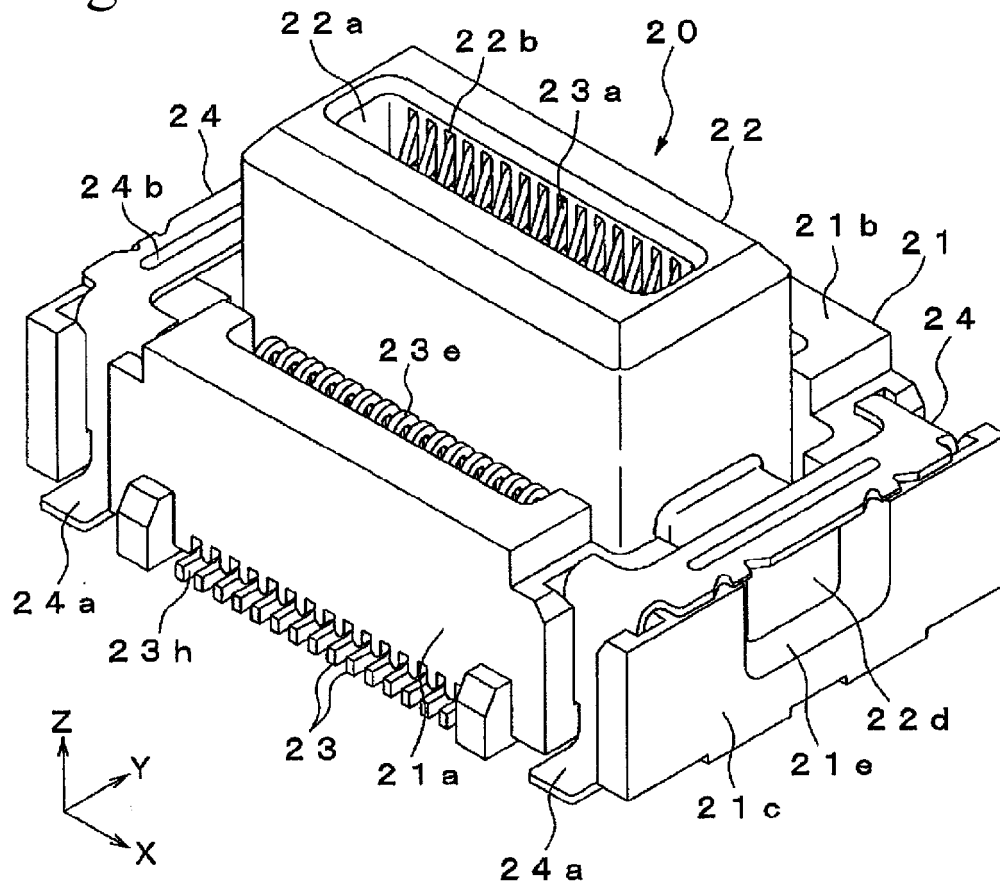


Fig.8

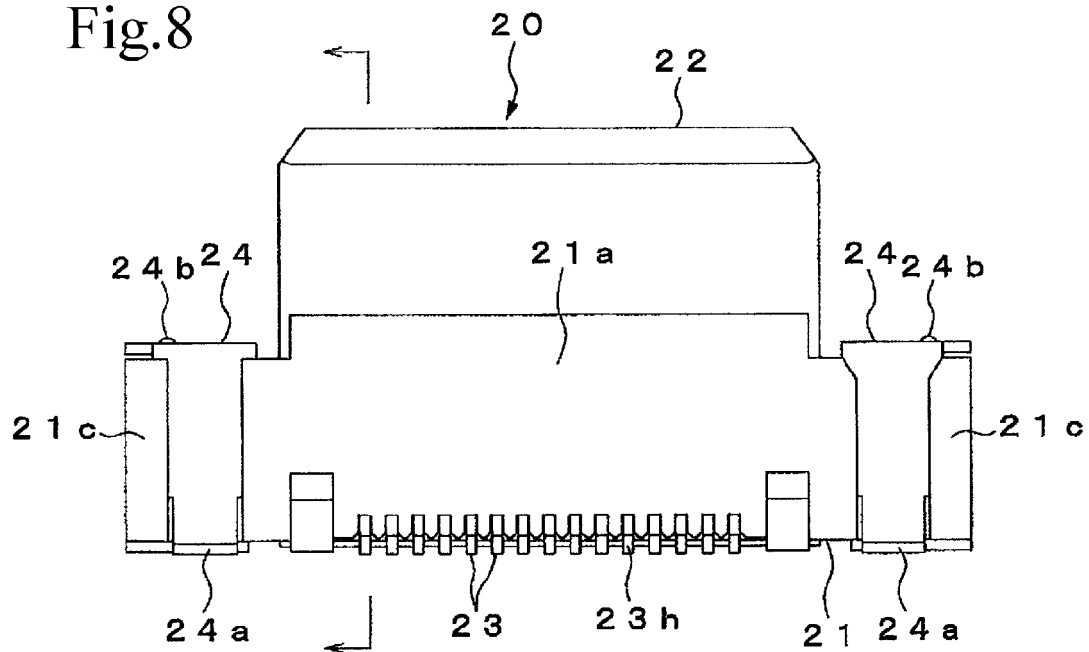


Fig.9

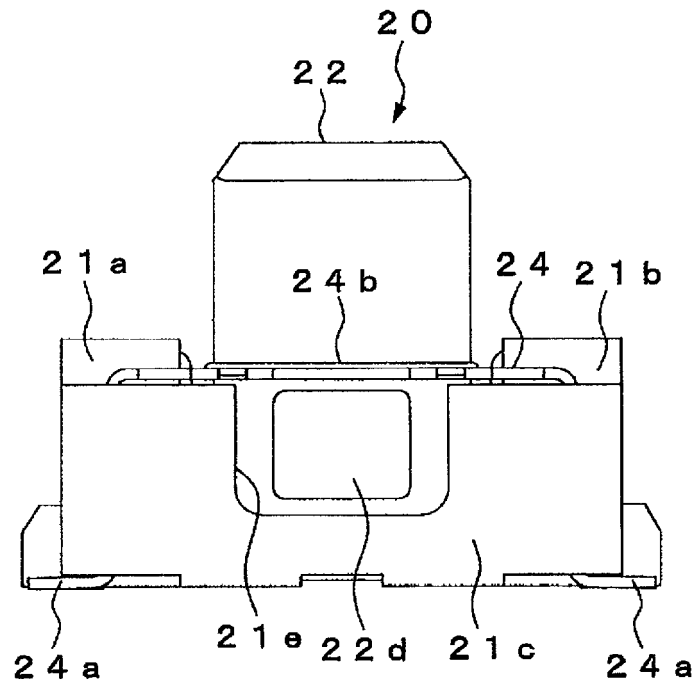


Fig.10

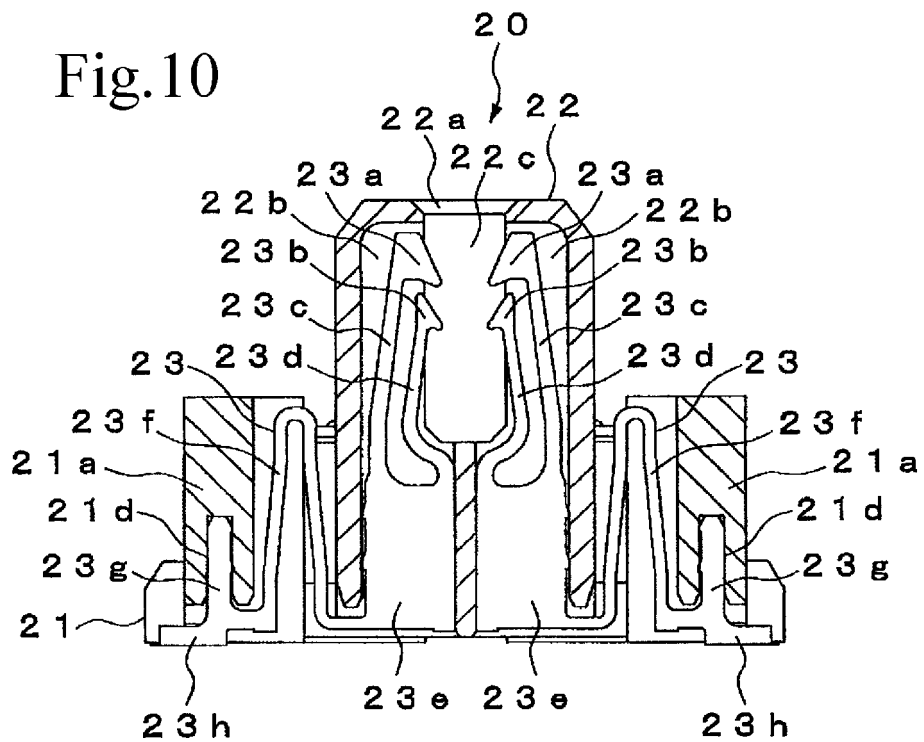


Fig.11

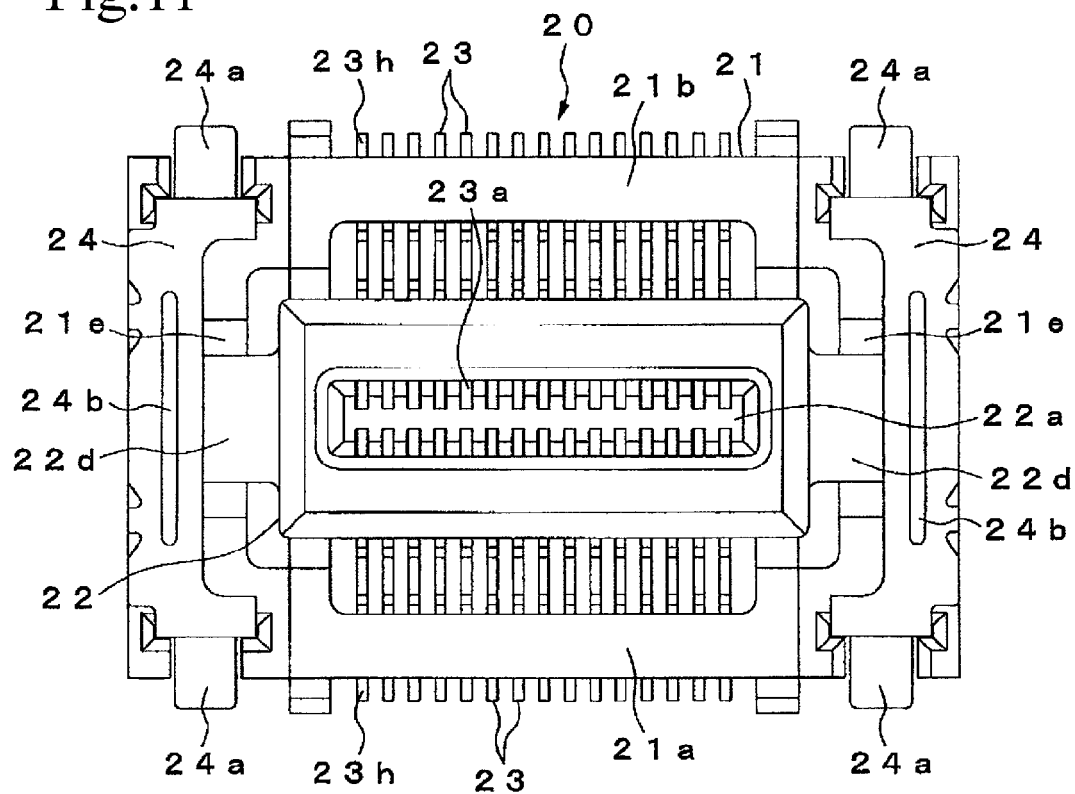


Fig.12

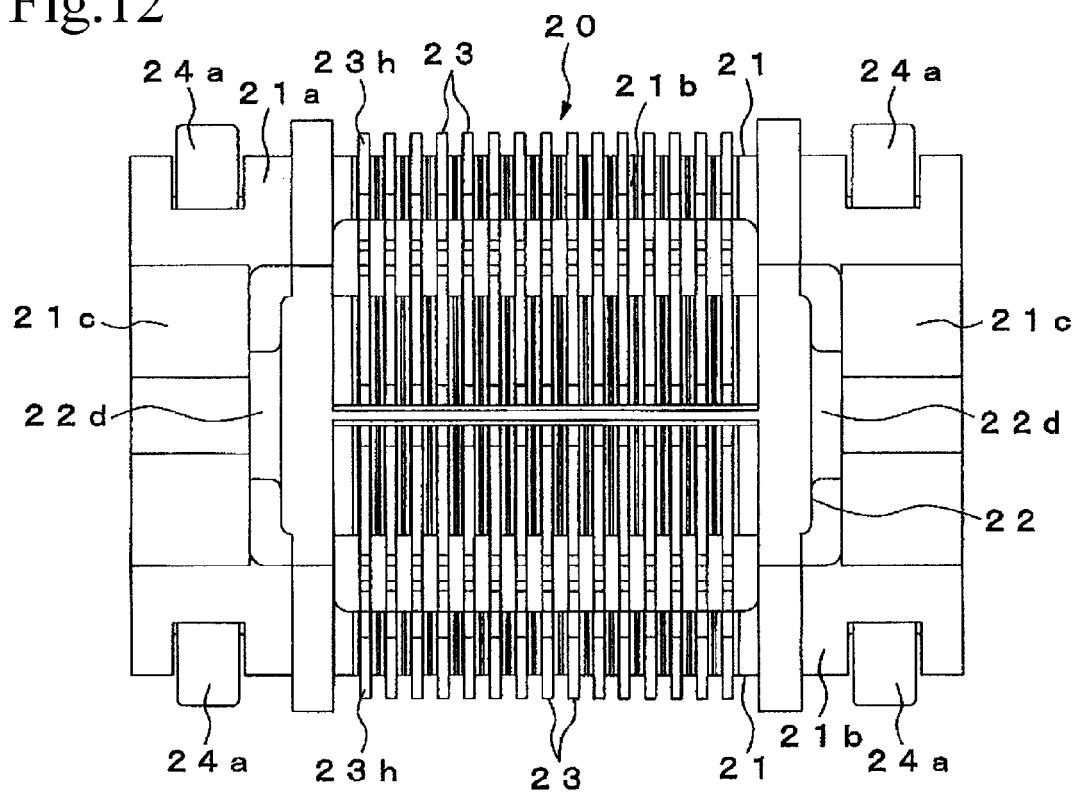


Fig.13

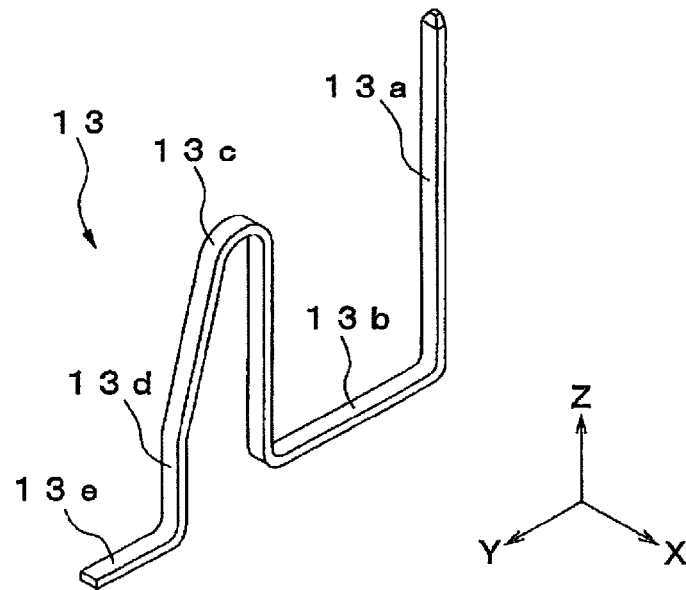


Fig.14

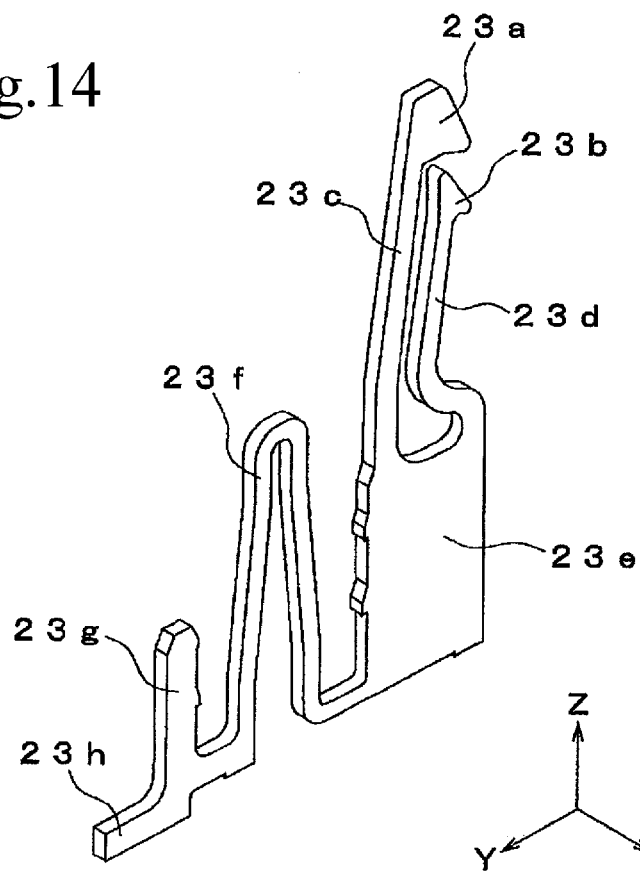


Fig.15

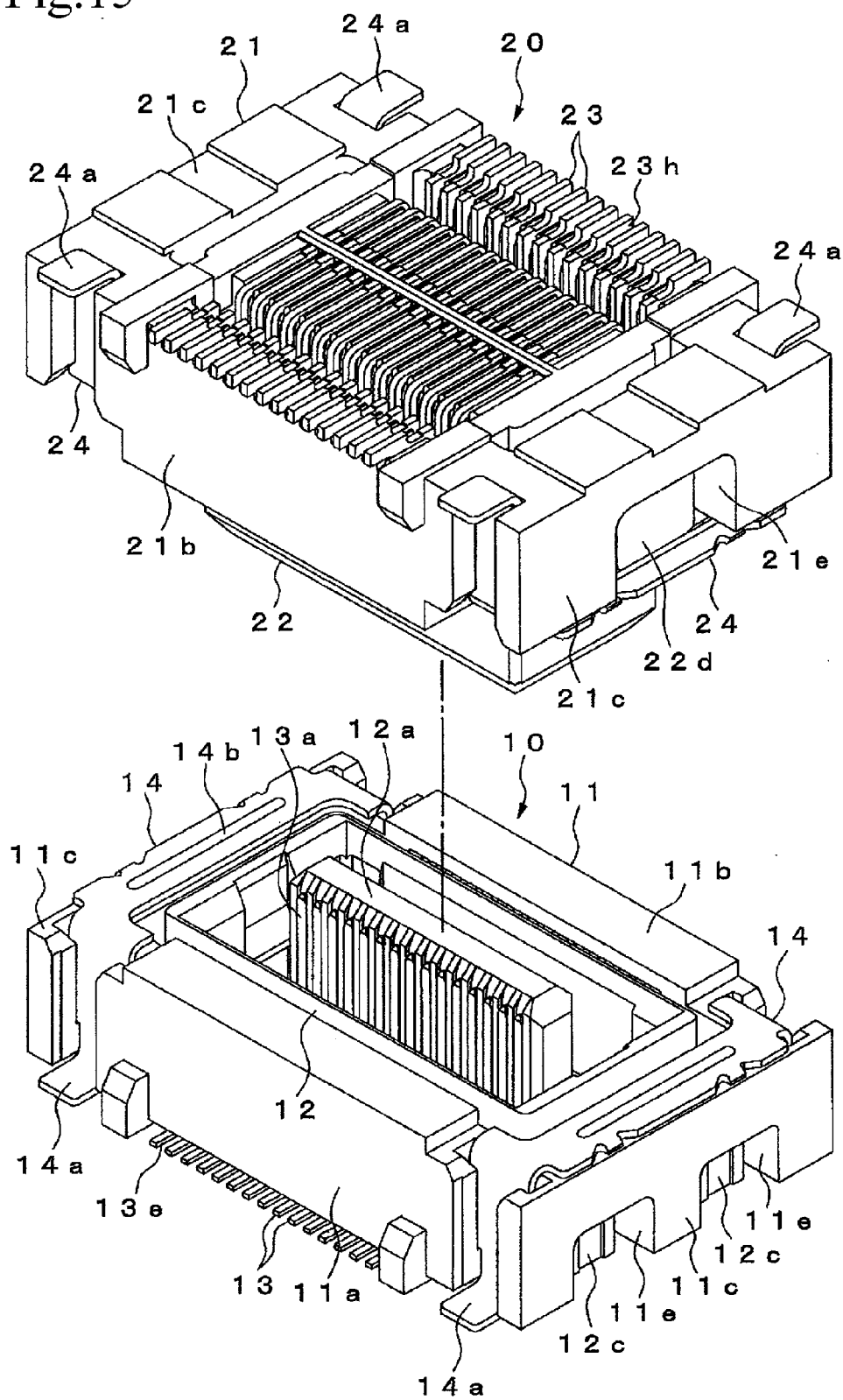
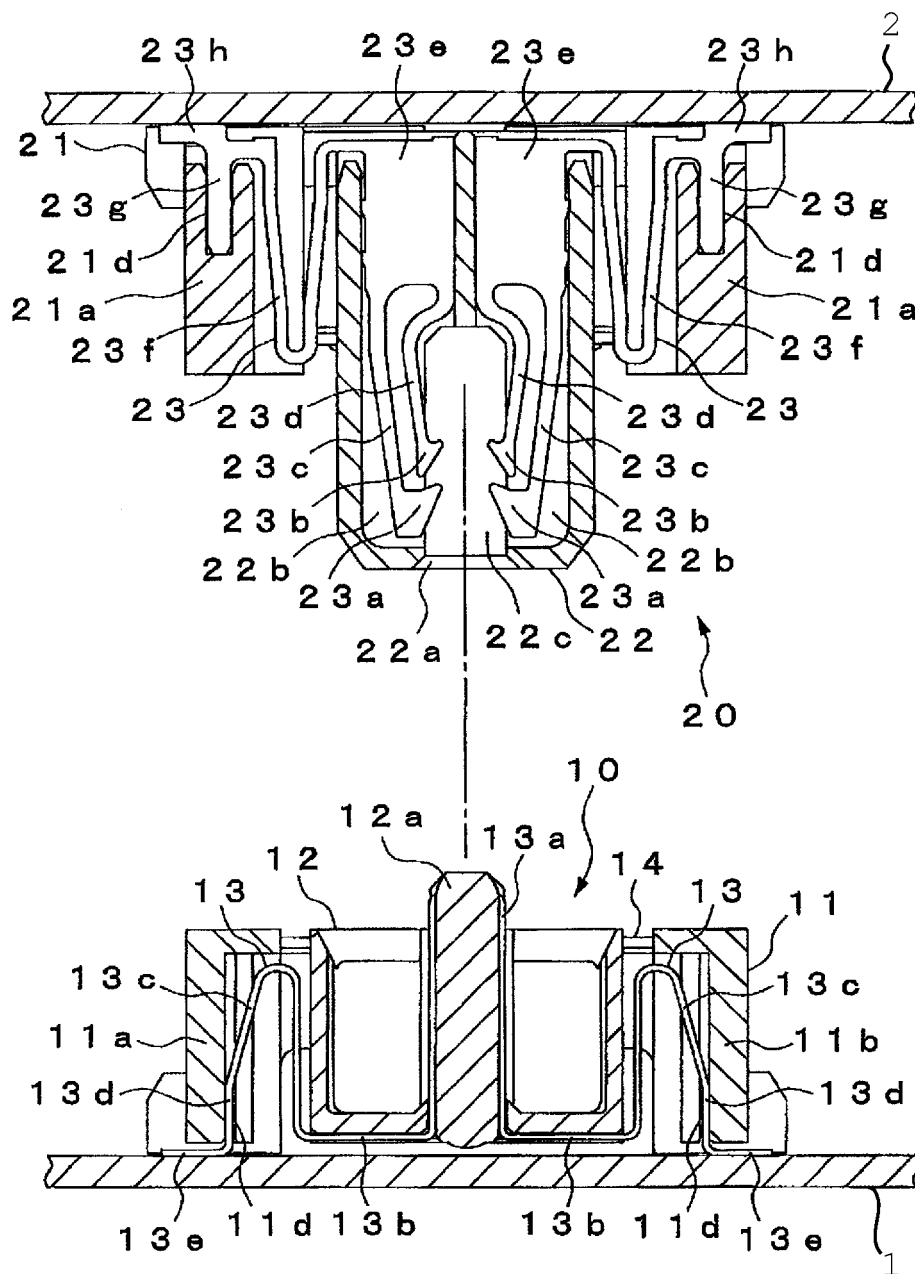


Fig.16



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2007018785 A [0002]