(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 712 030 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.03.2014 Bulletin 2014/13

(51) Int Cl.:
H01R 12/73 *(2011.01)* ***H01R 13/6583*** *(2011.01)*

(21) Application number: **13185188.3**

(22) Date of filing: **19.09.2013**

(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

(30) Priority: **20.09.2012 JP 2012206831**

(71) Applicant: **Hirose Electric Co., Ltd.**
Shinagawa-ku
Tokyo 141 (JP)

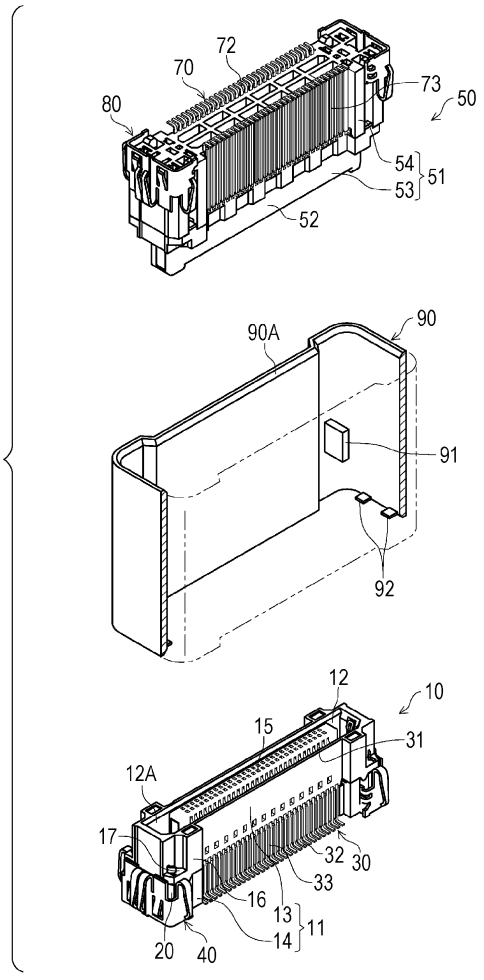
(72) Inventor: **Shibuya, Kazunari**
Tokyo 141-8587 (JP)

(74) Representative: **Eisenführ Speiser**
Patentanwälte Rechtsanwälte PartGmbB
Postfach 31 02 60
80102 München (DE)

(54) **Electric connector for circuit board and electric connector assembly including the same**

(57) An electric connector (10, 50, 210, 310, 350) for a circuit board, capable of being mounted on a surface of a circuit board, includes a housing (11, 51) that is capable of being covered by a tube-shaped or cover-shaped electrically conductive shield body (90, 190, 290, 390); terminals (30, 70) each having a solder connecting portion and positioned on a side of the housing (11, 51) that is to be attached to the circuit board, the solder connecting portion being capable of being soldered to the circuit board; and electrically conductive shield bases (40, 80) attached to an outer surface of the housing (11, 51). Each shield base (40, 80) includes an attached portion (41, 81), a solder ground portion (42, 82), and a holding portion (43, 83).

FIG. 1



EP 2 712 030 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an electric connector for a circuit board and an electric connector assembly including the same.

2. Description of the Related Art

[0002] Japanese Patent No. 3964252 discloses a tube-shaped shield cover that covers electric connectors attached to circuit boards around their entire peripheries. The shield cover according to Japanese Patent No. 3964252 includes a tube-shaped shield cover body, which surrounds a connector, and contact protrusions that protrude sideways from an opening edge of the shield cover body. When, for example, a pair of electric connectors attached to a circuit board are used, the shield cover body is disposed so as to surround the periphery of the connectors that fit together. The contact protrusions are in contact with connecting portions of terminals of the connectors as a result of being simply placed on the connecting portions without being soldered to the connecting portions. Japanese Patent No. 3964252 does not describe how the shield cover body is held. However, with consideration of the fact that the contact protrusions are required to be constantly in contact with the connecting portions of the terminals, it is assumed that the shield cover body is not held by housings of the connectors but is nipped between circuit boards by only the reaction force against contact pressure between the contact protrusions on the upper and lower opening edges and the connecting portions of the terminals while the connectors are in a state of having been fitted together to form an assembly.

[0003] However, since the shield cover is held only by its contact protrusions, when the shield cover receives an external force, the external force is directly transmitted to the contact protrusions and the connecting portions of the terminals with which the contact protrusions are in contact. Since the contact protrusions are required to have elasticity, the contact protrusions do not originally have high strength and the number of contact protrusions is not large. If an external force has a component in a direction parallel to surfaces of the circuit boards, the contact protrusions that are only in contact with the connecting portions of the terminals may be displaced with respect to the connecting portions and, when displaced, may apply a load, such as a high frictional force or a scratching force, to the connecting portions, thereby leading to a contact failure or breakage of the connecting portions. In addition, when the shield cover receives the above-described external force, the contact pressure between multiple contact protrusions and the connecting portions of the terminals may become uneven, which can also cause a contact failure. Furthermore, when the shield cover receives the above-described external force, not only are the contact protrusions of the shield cover displaced, but also the shield cover body itself is displaced from the original position with respect to the electric connectors. Thus, the shield cover is markedly unstable because it is displaced every time it receives an external force.

SUMMARY OF THE INVENTION

[0004] Accordingly, in view of the above circumstances, it is an object of the present invention to provide an electric connector for a circuit board and an electric connector assembly including the same, the electric connector having a simple configuration, being easily handleable, and including terminals having connecting portions with which a shield body is not in contact while being in use so that the connector is free from problems such as application of a load from the shield body to the connecting portions or displacement of the connection portions.

[0005] An electric connector for a circuit board according to an aspect of the invention is capable of being mounted on a surface of a circuit board. The electric connector includes a housing that is capable of being covered by a tube-shaped or cover-shaped electrically conductive shield body; terminals each having a solder connecting portion and positioned on a side of the housing that is attached to the circuit board, the solder connecting portion being capable of being soldered to the circuit board; and electrically conductive shield bases attached to an outer surface of the housing. Each of the shield bases includes an attached portion attached to a portion of the housing outside of a range within which the terminals are arranged in a direction in which the terminals are arranged; a solder ground portion that is capable of being grounded to the circuit board via solder; and a holding portion that is capable of holding the shield body by applying a contact pressure to the shield body.

[0006] In the electric connector having the above-described configuration of the present invention, shield bases are attached to the housing and each shield base has a holding portion. Thus, when it is required to attach a shield body to the electric connector for a circuit board, the shield body is selectively attachable so as to be held by the holding portions. The shield body attached to the electric connector is not in contact with connecting portions of the terminals and thus the terminals do not receive load. When the shield body is not used, the shield bases protect and reinforce the outer surfaces of the housing by being attached to the outer surfaces of the housing.

[0007] In an aspect of the present invention, the holding portion of each of the shield bases is an arm-shaped elastic piece.

[0008] By holding the shield body using elastic pieces on the inner or outer surface side in this manner, dimensional errors that have occurred during manufacture of

a shield body or positional errors that have occurred during attachment of a shield body can be compensated with elastic deformation of elastic pieces that hold the shield body, thereby making designing of a shield body more flexible. In the case where the shield body held by the shield bases receives an external force, the force can be absorbed to some degrees by elastic deformation of the elastic pieces.

[0009] In an aspect of the invention, the attached portions of the shield bases positioned at the portions of the housing outside of the range within which the terminals are arranged in the direction in which the terminals are arranged are coupled together with a coupling member, and the coupling member extends in a direction in which the solder connecting portions of the terminals are arranged at such portions that the coupling members are not in contact with the solder connecting portions but are in contact with or adjacent to a surface of the circuit board.

[0010] By coupling the attached portions on both ends of the housing via the coupling members to form a single shield base, handling of the shield base can be facilitated. In addition, since the coupling members are positioned adjacent to the connecting portions of the terminals without being in contact with the connecting portions, the connecting portions can be protected from the outside without being short-circuited. Furthermore, the coupling members can be formed so as to help the shield body and the connector fit to each other, thereby improving the reliability with which the shield body is held and electric contact between the coupling members and the shield body.

[0011] In an aspect of the invention, an electric connector assembly includes a pair of electric connectors mounted on circuit boards, the two electric connectors each being the electric connector according another aspect of the invention. A shield body is held so as to extend over the electric connectors.

[0012] In the above configuration of the electric connector assembly, the shield body is held by the holding portions of the shield bases of the connectors at two different positions along a direction in which the connectors are fitted to each other, and thus the shield body is stably held. Naturally, the shield body shields the connectors against the outside. In addition, the shield body is grounded via the shield bases without any ground terminals.

[0013] In an aspect of the invention, the shield body covers connecting portions of the electric connectors.

[0014] With this configuration, the shield body shields the entire region between the circuit boards and the connecting portions of the terminals are thus covered by the shield body without being exposed to the outside. Consequently, the connecting portions are prevented from receiving an undesired external force or coming into contact with impurities and thus are protected against such events.

[0015] In an aspect of the invention, a force with which the shield body is locked to one of the electric connectors in a direction in which the shield body is removed from the electric connector is larger than a force with which the shield body is locked to the other one of the electric connectors in the direction in which the shield body is removed from the other electric connector.

[0016] With this configuration, when one of the connectors attached to the circuit board is removed from the other connector while an electric connector assembly is being disassembled, the shield body remains being held on the other connector and thus components can be prevented being scattered.

[0017] As described above, in the present invention, electrically conductive shield bases are attached to the outer surfaces of the housing of an electric connector for a circuit board and a tube-shaped or cover-shaped shield body can be selectively held by the shield bases. Thus, when the shield body is attached to the connector, the shield body is held by the shield bases without coming into contact with the connecting portions of the terminals. Consequently, even when an external force is applied to the shield body, the shield body is securely and firmly held without causing problems such as a contact failure between the connecting portions of the terminals and the circuit board, displacement of contact positions, or a load exerted on the terminals. When the shield body is not used, portions of a housing outside of a range in which the terminals are arranged in the direction in which the terminals are arranged, which are in most cases end portions of a housing in the direction in which the terminals are arranged and positioned on the outer surfaces of the housing and thus are most susceptible to an external force during handling, can be protected and reinforced by the shield bases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 illustrates an electric connector assembly according to a first embodiment of the present invention and is a perspective view in which two connectors and a shield body are separate from one another before being assembled together;

Fig. 2 is perspective view of one of the connectors illustrated in Fig. 1 while shield bases are separately illustrated;

Figs. 3A and 3B illustrate the state where the connector that is illustrated in Fig. 2 and to which the shield bases are attached is disposed on a circuit board and a shield body is fitted on the connector although illustration of the circuit board is omitted, where Fig. 3A illustrates the state in perspective and Fig. 3B illustrates the state in a bottom view;

Fig. 4 illustrates the state where another connector which is not fitted and connected to the connector illustrated in Fig. 3 is disposed above the connector and in which only the shield body is illustrated in a cross section;

Fig. 5 illustrates an electric connector assembly ac-

cording to a second embodiment and is a perspective view in which two connectors and a shield body are separate from one another before being assembled together;

Fig. 6 is a perspective view of one of the connectors illustrated in Fig. 5 while a shield base is separate from the connectors;

Fig. 7 illustrates the state, in a bottom view, where the connector that is illustrated in Fig. 6 and to which the shield base is attached is disposed on a circuit board and a shield body is fitted to the connector although illustration of the circuit board is omitted;

Figs. 8A and 8B are perspective views of an electric connector assembly according to a third embodiment, where Fig. 8A illustrates the state before the connectors are fitted and connected together and Fig. 8B illustrates the state after the connectors have been fitted and connected together.

Figs. 9A and 9B are perspective views of a shield body for a connector assembly illustrated in Figs. 8A and 8B, where Fig. 9A illustrates only the shield body such that part of the shield body is cutaway and Fig. 9B is a perspective view of the shield body fitted to the connector assembly;

Figs. 10A and 10B are perspective views of an electric connector assembly according to a fourth embodiment, where Fig. 10A illustrates the state before two connectors are fitted and connected together and Fig. 10B illustrates the state after the connectors have been fitted and connected together; and

Figs. 11A and 11B are perspective views of a shield body for the connector assembly illustrated in Figs. 10A and 10B, where Fig. 11A illustrates only the shield body such that part of the shield body is cutaway and Fig. 11B is a perspective view of the shield body fitted to the connector assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring to the drawings, embodiments of the present invention will be described below.

First Embodiment

[0020] Fig. 1 illustrates an electric connector assembly according to a first embodiment in which two electric connectors 10 and 50 fitted together hold a shield body 90 in a state where the connectors 10 and 50 and the shield body 90 are separate from one another.

[0021] In Fig. 1, the two connectors 10 and 50 positioned on the lower and upper sides face each other away from each other in directions in which the connectors 10 and 50 are fitted to each other (upward and downward) before being fitted together. The connector 10 is a receptacle connector in which a recessed portion 12 is formed in a housing 11 made of an electrically insulating material. The connector 50, on the other hand, is a plug connector in which a protruding portion 52 that is fitted into the recessed portion 12 is provided to a housing 51 made of an electrically insulating material. The housing 11 of the receptacle connector 10 holds terminals 30 and shield bases 40, which will be described below, are attached to the housing 11. The housing 51 of the plug connector 50 holds terminals 70. Shield bases 80, which have the same shape as the shield bases 40 and will be described below, are attached to the housing 51.

[0022] Fig. 2 illustrates the connector 10 in a state where the shield bases 40 are separated from the housing 11 before being attached to the housing 11. As illustrated in Fig. 1 and Fig. 2, in this embodiment, the housing 11 is divided into two sections, which are a counterpart-side housing 13 and a board-side housing 14. However, the housing 11 may be formed as an integrated unit.

[0023] As illustrated in Figs. 1 and 2, the counterpart-side housing 13 includes the recessed portion 12 in which a long and narrow opening 12A is formed on a counterpart-side (upper side in Figs. 1 and 2) so as to receive the connector 50. A contact portion mount 15 having a plate shape is positioned in the recessed portion 12 in an island-like manner. In other words, the recessed portion 12 is formed in the counterpart-side housing 13 such that a rectangular tube-shaped peripheral space surrounding the island-like contact portion mount 15 is open to the upper side. Contact portions 31 of terminals 30 are arranged on both surfaces of the contact portion mount 15 along a longitudinal direction of the opening 12A of the recessed portion 12.

[0024] The counterpart-side housing 13 has ridge portions 16 that extend vertically on outer surfaces of the counterpart-side housing 13 near both end portions of the opening 12A in the longitudinal direction. The counterpart-side housing 13 also has flange-shaped couplers 17 used for joining itself and the board-side housing 14 together. The flange-shaped couplers 17 are located between lower ends of the ridge portions 16 and the lower edges of the outer surfaces of the counterpart-side housing 13 in end portions of the counterpart-side housing 13 in the longitudinal direction so as to come into contact with the board-side housing 14.

[0025] As illustrated in Fig. 2, the board-side housing 14 has such an external shape that the outer peripheral shape of the counterpart-side housing 13 at the lower edge of the counterpart-side housing 13 including the couplers 17 is extended downward as it is. Thus, the board-side housing 14 includes a terminal mount 19 (see Fig. 3B) and end wall portions 20. The terminal mount 19 has outer surfaces on which leg portions 33 of terminals 30, which will be described below, are arranged. The end wall portions 20 are longer than the terminal mount 19 in a direction perpendicular to the longitudinal direction (or longer in a lateral direction). The outer surfaces of the end wall portions 20 are located at such positions that the outer peripheral surfaces of the ridge portions 16 and the couplers 17 of the counterpart-side housing 13 are extended downward.

[0026] Each terminal 30 is formed by bending a thin

metal strip and includes a contact portion 31, a connecting portion 32, and a leg portion 33. The contact portion 31 is located on one end side and comes into contact with a corresponding one of terminals of the counterpart connector 50. The connecting portion 32 is located on the other end side and is connected to a circuit board by soldering. The leg portion 33 connects the connecting portion 32 and the contact portion 31 together. The contact portions 31 formed on one end side of the terminals 30 are arrayed on the surfaces of the contact portion mount 15 disposed in the recessed portion 12 of the counterpart-side housing 13. On the other hand, the connecting portions 32 of the terminals 30 are bent so as to protrude in a direction away from the outer surfaces of the terminal mount 19 of the board-side housing 14 and are positioned so as to come into contact with a circuit board (not illustrated) on which the connector 10 is mounted. The leg portions 33 that connect the contact portions 31 and the connecting portions 32 together are bent in a crank form in the middle of the leg portions 33. The bent portions are positioned at a joint at which the counterpart-side housing 13 and the board-side housing 14 are fitted together. The contact portions 31 are formed above the bent portions and portions of the terminals 30 below the bent portions are positioned on the surfaces of the terminal mount 19, which are outer surfaces of the board-side housing 14. Since the terminals 30 themselves are not mainly related to the present invention, further description of the terminals 30 are not provided. In other words, the terminals 30 may be in other forms.

[0027] As illustrated in Fig. 1, shield bases 40 formed by processing metal plates are attached to the outer peripheral surfaces of the end wall portions 20 of the board-side housing 14 located on both end portions in the longitudinal direction. Each shield base 40 is substantially U-shaped when viewed in the vertical direction so as to match the outer peripheral surfaces (three surfaces) of the corresponding end wall portion 20. Each shield base 40 includes an attached portion 41, solder ground portions 42, and holding portions 43. The attached portion 41 is attached to the outer peripheral surfaces of the corresponding end wall portion 20 such that the surfaces of the attached portion 41 are in contact with the outer peripheral surfaces. The solder ground portions 42 are connected to a circuit board by soldering. The holding portions 43 hold the shield body 90, which will be described below. The attached portion 41 is made of a U-shaped board. As illustrated in Fig. 2, the attached portion 41 includes wedge-shaped attachment legs 41A in both end portions of the attached portion 41 such that the attachment legs 41A protrude so as to face each other. Each shield base 40 is attached to the outer surfaces of the board-side housing 14 by inserting the attachment legs 41A into corresponding slits 21A formed in the board-side housing 14.

[0028] As illustrated in Fig. 2, the holding portions 43 of the shield base 40 include holding pieces 44 and locking pieces 45, which are two types of arm-shaped elastic pieces extending from the attached portion 41 made of a U-shaped board. The holding pieces 44 are elastic pieces formed at multiple positions on the upper edges of three sides of the U-shaped board, forming the attached portion 41, so as to extend outward from the upper edges and then bend downward. On the other hand, the locking pieces 45 are tongue-shaped elastic pieces formed by slitting the middle side of the attached portion 41 so as to be shifted outward. The protruding end of each holding piece 44 applies a contact pressure to the inner surface of a tube-shaped shield body 90, which will be described below. The shield body 90 is held by this contact pressure. On the other hand, the locking pieces 45 function as holding pieces when locking protrusions 92 of the shield body 90, which will be described below, are locked to the locking pieces 45.

[0029] Each shield base 40 also includes solder ground portions 42, which are small protrusions, at multiple positions on the lower edge of the attached portion 41 illustrated in Fig. 2. When the connector 10 is placed on a circuit board, the lower edge of the attached portion 41 comes close to the circuit board. Thus, the surfaces of the solder ground portions 42 come into contact with corresponding solder portions of the circuit board and are fixed thereto by soldering to be grounded.

[0030] As illustrated in Fig. 1, in the connector 50, which serves as a plug connector, shield bases 80 are attached to the housing 51 that holds the terminals 70. The housing 51 is formed by joining a counterpart-side housing 53, which includes a protruding portion 52, and a board-side housing 54, which is to be attached to the circuit board, together.

[0031] Since the connector 50 is fitted into the counterpart connector 10 from above, the connector 50 illustrated in Fig. 1 is in a turned upside down position with respect to the connector 10. The board-side housing 54 is positioned on the upper side and the counterpart-side housing 53 is positioned on the lower side. The shield bases 80 are attached to the board-side housing 54.

[0032] The board-side housing 54 and the shield bases 80 of the connector 50 are formed similarly to the board-side housing 14 and the shield bases 40 of the connector 10. Thus, portions of the connector 50 are denoted by reference numerals obtained by adding 40 to the numbers of the corresponding portions of the connector 10, and the description of these portions is omitted.

[0033] As illustrated in Fig. 1, the counterpart-side housing 53 of the connector 50 includes the protruding portion 52 that protrudes toward the counterpart connector 10. The protruding portion 52 is rectangular tube-shaped so as to suitably fit into the recessed portion 12 formed in the connector 10 as a rectangular tube-shaped peripheral space. In the process of fitting the connectors to each other, the outer surfaces of the rectangular tube-shaped protruding portion 52 are guided by the inner surfaces of the recessed portion 12 and the inner surfaces of the protruding portion 52 are guided by the outer surfaces of the plate-shaped contact portion mount 15 lo-

cated in the recessed portion 12 in an island-like manner. Contact portions (not illustrated) of terminals 70, which will be described below, are arranged on the inner surfaces of the recessed portion 12 of the counterpart-side housing 53 of the connector 50. The contact portions of the terminals 70 come into contact with the contact portions 31 of the terminals 30 arranged on the contact portion mount 15.

[0034] The terminals 70 of the connector 50 are formed by bending thin metal strips in the same manner as in the case of the terminals 30 of the connector 10. As illustrated in Fig. 1, each terminal 70 includes the contact portion on one end side and a connecting portion 72 on the other end side. A crank-shaped bent portion and a leg portion 73, which are formed between the contact portion and the connecting portion 72, connect the contact portion and the connecting portion 72 together. Except for the contact portion, each terminal 70, in a range from the bent portion to the connecting portion 72, is formed in the same manner as the terminal 30 in the corresponding range. Thus, the connecting portions 72 of the terminals 70 protrude sideways from the leg portions 73 located on the terminal mount 59 (see Fig. 7), serving as outer surfaces of the board-side housing 54, at the bottom of the board-side housing 54 (at the top in Fig. 1). The shield bases 80, which are formed in the same manner as the shield bases 40 of the connector 10, are attached to the board-side housing 54.

[0035] A shield body 90 is made of metal and substantially rectangular tube-shaped. As illustrated in Fig. 1, the shield body 90 is hollow throughout in the vertical direction. In Fig. 1, in order to show the inner surfaces of the shield body 90, the shield body 90 is illustrated while being partially cut at middle positions of the upper and lower openings in the lateral direction, which is perpendicular to the longitudinal direction of the upper and lower openings.

[0036] The width of the openings, which is a dimension in the lateral direction, of the shield body 90 on both end portions in the longitudinal direction is larger than the width of the openings in the middle portion in the longitudinal direction. Taper edges 90A, which taper inward, are formed on inner peripheral portions of the upper and lower openings of the shield body 90 so that the shield body 90 is smoothly fitted on the connectors 10 and 50. The shield body 90 may have such uniform inner surfaces that the cross section of the shield body 90 remains the same wherever the shield body 90 is cut from the upper opening to the lower opening. Alternatively, the shield body 90 may have a locking member on the inner surface so as to support or hold the connectors. As illustrated in Fig. 1, examples suitable as such a locking member include protruding boards 91 and locking protrusions 92. The protruding boards 91 are disposed on the inner surfaces of side walls, which form openings having a large width, in both end portions in the longitudinal direction so as to protrude toward each other and face each other in the lateral direction. The protruding boards 91 come into contact with end portions of side surfaces of the counterpart-side housing 13 of the connector 10 in the longitudinal direction. The locking protrusions 92 are formed at the bottom of the end walls so as to be locked to the lower edges of the shield bases 40 of the connector 10. An end surface of the protruding board 91, which is at the end in the direction in which the protruding board 91 protrudes (in the lateral direction of the protruding board 91), is guided by a corresponding side surface of the counterpart-side housing 13 of the connector 10 to make the position of the shield body 90 stable. The locking protrusions 92 are locked to the lower edges of the locking pieces 45 of the shield bases 40 so as to keep the shield body 90 joined with the connector 10 against an upward force with which the shield body 90 is separated from the connector 10 after being attached to the connector 10. The protruding boards 91 only have to be guided by the connector 10 positioned on the lower side and the locking protrusions 92 do not have to be locked to the connector 50. Thus, the protruding boards 91 and the locking protrusions 92 only have to be provided so as to operate in relation to the connector 10.

[0037] The two connectors 10 and 50 according to the embodiment having the above-described configurations are attached to circuit boards in the following manner and coupled with each other using the shield body 90 to form an electric connector assembly.

[0038] Firstly, the shield bases 40 are attached to the connector 10 and the shield bases 80 are attached to the connector 50. For example, regarding the connector 10, the shield bases 40 are attached to both end wall portions 20 of the board-side housing 14 of the housing 11 illustrated in Fig. 2 to make the connector 10 as illustrated in Fig. 1. Although not illustrated, the shield bases 80 are attached to the connector 50 in the same manner.

[0039] In this manner, the connector 10 equipped with the shield bases 40 and the connector 50 equipped with the shield bases 80 are obtained as illustrated in Fig. 1. These connectors 10 and 50 are attached to corresponding circuit boards P1 and P5 (also see Fig. 4).

[0040] Then, as illustrated in Fig. 4, the connector 10 mounted on a circuit board P1 is placed such that the circuit board P1 is positioned on the lower side and the shield body 90 is fitted on the connector 10 from above (also see Fig. 3A). When the shield body 90 is fitted on the connector 10, the holding portions 43 of the shield bases 40 attached to the connector 10, that is, the holding pieces 44 formed as elastic pieces apply contact pressure to the shield body 90 using their elasticity and thus the shield body 90 is held by the holding pieces 44 (also see Fig. 3B illustrating the holding state from the bottom surface side of the connector 10). Here, the protruding boards 91 (see Fig. 4) attached to the inner surfaces of the shield body 90 come into contact with the side surfaces of the counterpart-side housing 13 of the connector 10 so as to make the position of the shield body 90 stable. The locking protrusions 92 are positioned under the lower edges of the shield bases 40 and locked to the lower

edges of the locking pieces 45 of the shield bases 40 against upward force with which the shield body 90 is removed from the connector 10 so that the shield body 90 is prevented from being removed from the connector 10.

[0041] As illustrated in Fig. 3B, the shield body 90 held by the holding portions 43 of the shield bases 40 surrounds the periphery of the connector 10 without coming into contact with the terminals 30 of the connector 10.

[0042] Then, as illustrated in Fig. 4, the connector 50 mounted on a circuit board P2 is brought down toward the connector 10 from above and fitted into the connector 10. Thus, the protruding portion 52 of the connector 50 is inserted into the recessed portion 12 of the connector 10 and the contact portions of the terminals 30 and 70 of the connectors 10 and 50 come into contact with one another and are connected to one another. Also in this case, the shield body 90 is held by the holding portions 83, which are the holding pieces 84 and the locking pieces 85, of the shield bases 80 attached to the connector 50. As in the case of the connector 10, the shield body 90 is held by the holding portions 83 but is not in contact with the terminals 70 of the connector 50.

[0043] Consequently, the shield body 90 surrounds the entire periphery of the connectors 10 and 50 fitted together. In terms of the height direction (vertical direction), the shield body 90 extends over the range between the positions close to the two circuit boards P1 and P2, thereby functioning as a substantially perfect shield. If shield layers were provided on the circuit boards P1 and P2 on which the connectors 10 and 50 are mounted, shielding would be securer. Since the shield body 90 is held by the holding portions 43 and 83 of the shield bases 40 and 80 of the connectors 10 and 50 and is not in contact with the terminals 30 and 70, the shield does not exert any adverse effect on the terminals 30 and 70 even when the shield body 90 receives an external force.

Second Embodiment

[0044] In the first embodiment illustrated in Fig. 1 to Fig. 4, separate shield bases 40 are attached to the electric connector 10 on both end sides of the connector 10 and separate shield bases 80 are attached to the electric connector 50 on both sides of the connector 50. In the second embodiment, on the other hand, shield bases 40 or 80 attached to both end sides of the connectors 10 and 50 in the first embodiment are coupled together by coupling members. Thus, one shield base is attached to one connector.

[0045] In the second embodiment illustrated in Fig. 5, connector bodies of the connectors 10 and 50 excluding shield bases 140 and 180, that is, the housings 11 and 51 and the terminals 30 and 70, are the same as those in the case of the first embodiment. Thus, the same components are denoted by the same reference numerals and are not described again.

[0046] The shield bases 140 and 180 have the same configuration. As in the case of the first embodiment, the shield bases 140 and 180 include attached portions 41 and 81, holding portions 43 and 83, and solder ground portions 42 and 82. In this embodiment, the attached portions 41 on both sides are coupled together with coupling members 46 so as to form a single shield base 140 and the attached portions 81 on both sides are coupled together with coupling members 86 so as to form a single shield base 180. As described above, since the shield bases 140 and 180 have the same configuration, only the shield base 140 is described below.

[0047] As illustrated in Fig. 6, each coupling member 46 of the shield base 140 includes bent portions 46A and a straight portion 46B that extends in a direction in which the terminals are arranged. The bent portions 46A and the straight portion 46B are formed so as to protrude in the lateral direction of the connector 10 beyond a straight line (imaginary line) connecting ends of the two attached portions 41 on both end sides of the shield base 140. These coupling members 46 are positioned substantially on the surface of the circuit board in the vertical direction and near the connecting portions 32 of the terminals 30 without being in contact with the connecting portions 32.

[0048] A substantially rectangular tube-shaped shield body 190 according to the second embodiment and the shield body 90 illustrated in Fig. 1 are slightly different only in that the shield body 190 has cutout portions and protrusions, which are described below.

[0049] As illustrated in Fig. 5, the shield body 190 has cutout portions 93 on upper and lower opening edges at such positions as to accept the bent portions 46A of the shield base 140 and bent portions (not illustrated) of the shield base 180. The presence of the cutout portions 93 allows the bent portions 46A of the shield base 140 to cross the shield body 190 when the shield body 190 is fitted on and held by the connector 10 equipped with the shield base 140 (see Fig. 7). In other words, when viewed from above, the attached portions 41 and the holding portions 43 of the shield base 140 are located inside the shield body 190 but the straight portions 46B of the coupling members 46 are located outside the shield body 190. The straight portions 46B of the coupling members 46 are positioned so as to be substantially in contact with the outer surfaces of the shield body 190. The protrusions 94 are formed at multiple positions along the opening edges of the outer surfaces of the shield body 190 along which the straight portions 46B of the coupling members 46 extend. Since the straight portions 46B of the coupling members 46 are in contact with the protrusions 94, the straight portions 46 can be grounded at a large number of positions. Multiple soldering protrusions 46C are provided on the lower edges of the straight portions 46B of the coupling members 46. The soldering protrusions 46C are connected, by soldering, to contact portions (not illustrated) of a circuit board on which the connector 10 is mounted.

[0050] By coupling the two attached portions via the coupling members to form a single shield base, handling

of the shield base can be facilitated and portions grounded to the circuit board can be increased. Furthermore, by holding the shield body also from the outer surface side, the reliability of holding the shield body is improved and the shield body can be securely held by the connectors.

Third Embodiment

[0051] In the electric connector assembly according to each of the first and second embodiments, the circuit boards P1 and P2 on which the two connectors 10 and 50 are mounted are positioned parallel to each other on the upper and lower sides. The present invention, however, is also applicable to a configuration in which the circuit boards are positioned orthogonal to each other, that is, a right-angle connector assembly.

[0052] In a third embodiment of the present invention illustrated in Fig. 8A, a connector 210 disposed on the circuit board P1 is a right-angle connector. The back surface of the connector 210 is attached to the circuit board P1 and the counterpart connector 50 is fitted into a recessed portion (not illustrated) that is hollow in the horizontal direction (that is open to the right side in Fig. 8A). The connector 50 itself is the same as that according to the first embodiment, but in Figs. 8A and 8B, the circuit board P2 to which the connector 50 is attached is vertically placed and thus is orthogonal to the circuit board P1 to which the connector 210 is attached. In this embodiment, the connector 50 on the circuit board P2 is fitted into the connector 210 on the circuit board P1 from the right side (see Fig. 8B).

[0053] A shield body 290 according to the third embodiment has a shape suitable for covering the connectors 210 and 50 between the circuit boards P1 and P2. Specifically, the shield body 290 has an L-shaped cross section as illustrated in Fig. 9A and covers both end portions of the connectors 210 and 50 in the longitudinal direction. The shield body 290 is attached to the connectors 210 and 50 illustrated in Fig. 8B. The shield body 290 is held such that the inner surfaces of the shield body 290 are held by the holding portions 43 and 83 of the shield bases 40 and 80 of the connectors 210 and 50. Thus, as illustrated in Fig. 9B, the connectors 210 and 50 are shielded by being completely covered by the shield body 290 between the circuit boards P1 and P2.

Fourth Embodiment

[0054] In the electric connector assembly according to each of the first and second embodiments, the circuit boards P1 and P2 on which the connectors 10 and 50 are respectively mounted are positioned parallel to each other on the upper and lower sides. In a fourth embodiment illustrated in Fig. 10A, on the other hand, two connectors 310 and 350 are fitted to and connected to each other while the circuit boards P1 and P2 are arranged on the same level.

[0055] In the fourth embodiment illustrated in Fig. 10A, the connector 310 mounted on the circuit board P1 and the connector 350 mounted on the circuit board P2 are both right-angle connectors. The back surfaces of the connectors 310 and 350 are attached to the circuit boards P1 and P2. The connectors 310 and 350 are fitted to and connected to each other in the vertical direction (see Fig. 10B) while the circuit boards P1 and P2 are arranged on the same level such that their counterpart-side edges abut against or are adjacent to each other.

[0056] A shield body 390 according to the fourth embodiment has a shape suitable for covering the connectors 310 and 350 from above the circuit boards P1 and P2. Specifically, the shield body 390 has an inverted U-shaped cross section as illustrated in Fig. 11A and covers both end portions of the connectors 310 and 350 in the longitudinal direction. The shield body 390 is attached to the connectors 310 and 350 illustrated in Fig. 10B. The shield body 390 is held such that the inner surfaces of the shield body 390 are held by the holding portions 43 and 83 of the shield bases 40 and 80 of the connectors 310 and 350. In this manner, as in the case of Fig. 11B, the connectors 310 and 350 are shielded by being completely covered by the shield body 390 between the circuit boards P1 and P2.

[0057] Although the shield body and the shield bases made of metal are described in the embodiments of the invention, the materials of the shield body and the shield bases are not limited to metal. Other materials having predetermined strength may be used instead provided that at least contact portions in which the shield body and the shield bases are in contact with each other and surfaces of soldered portions are electrically conductive. Partial use of metal is also possible by plating.

Claims

1. An electric connector (10, 50, 210, 310, 350) for a circuit board, the electric connector (10, 50, 210, 310, 350) being capable of being mounted on a surface of a circuit board, the electric connector (10, 50, 210, 310, 350) comprising:

a housing (11, 51) that is capable of being covered by a tube-shaped or cover-shaped electrically conductive shield body (90, 190, 290, 390);
terminals (30, 70) each having a solder connecting portion and positioned on a side of the housing (11, 51) that is to be attached to the circuit board, the solder connecting portion being capable of being soldered to the circuit board; and
electrically conductive shield bases (40, 80) attached to an outer surface of the housing (11, 51),
wherein each of the shield bases (40, 80) includes
an attached portion (41, 81) attached to a portion

of the housing (11, 51) outside of a range within which the terminals are arranged in a direction in which the terminals are arranged,
a solder ground portion (42, 82) that is capable of being grounded to the circuit board via solder, and
a holding portion (43, 83) that is capable of holding the shield body (90, 190, 290, 390) by applying a contact pressure to the shield body (90, 190, 290, 390).

2. The electric connector (10, 50, 210, 310, 350) according to Claim 1, wherein the holding portion (43, 83) of each of the shield bases (40, 80) is an arm-shaped elastic piece.

3. The electric connector (10, 50, 210, 310, 350) according to Claim 1 or 2,
wherein the attached portions (41, 81) of the shield bases (40, 80) positioned at the portions of the housing (11, 51) outside of the range within which the terminals (30, 70) are arranged in the direction in which the terminals (30, 70) are arranged are coupled together with a coupling member (46, 86), and
wherein the coupling member (46, 86) extends in a direction in which the solder connecting portions of the terminals are arranged at such portions that the coupling members (46, 86) are not in contact with the solder connecting portions but are in contact with or adjacent to a surface of the circuit board.

4. An electric connector assembly comprising:

a pair of electric connectors mounted on circuit boards, the electric connectors each being the electric connector (10, 50, 210, 310, 350) according to any one of Claims 1 to 3,
wherein a shield body (90, 190, 290, 390) is held so as to extend over the electric connectors.

5. The electric connector assembly according to Claim 4, wherein the shield body (90, 190, 290, 390) covers connecting portions of the electric connectors (10, 50, 210, 310, 350).

6. The electric connector assembly according to Claim 5, wherein a force with which the shield body (90, 190, 290, 390) is locked to one of the electric connectors (10, 50, 210, 310, 350) in a direction in which the shield body (90, 190, 290, 390) is removed from the electric connector (10, 50, 210, 310, 350) is larger than a force with which the shield body (90, 190, 290, 390) is locked to the other one of the electric connectors (10, 50, 210, 310, 350) in the direction in which the shield body (90, 190, 290, 390) is removed from the other electric connector (10, 50, 210, 310, 350).

FIG. 1

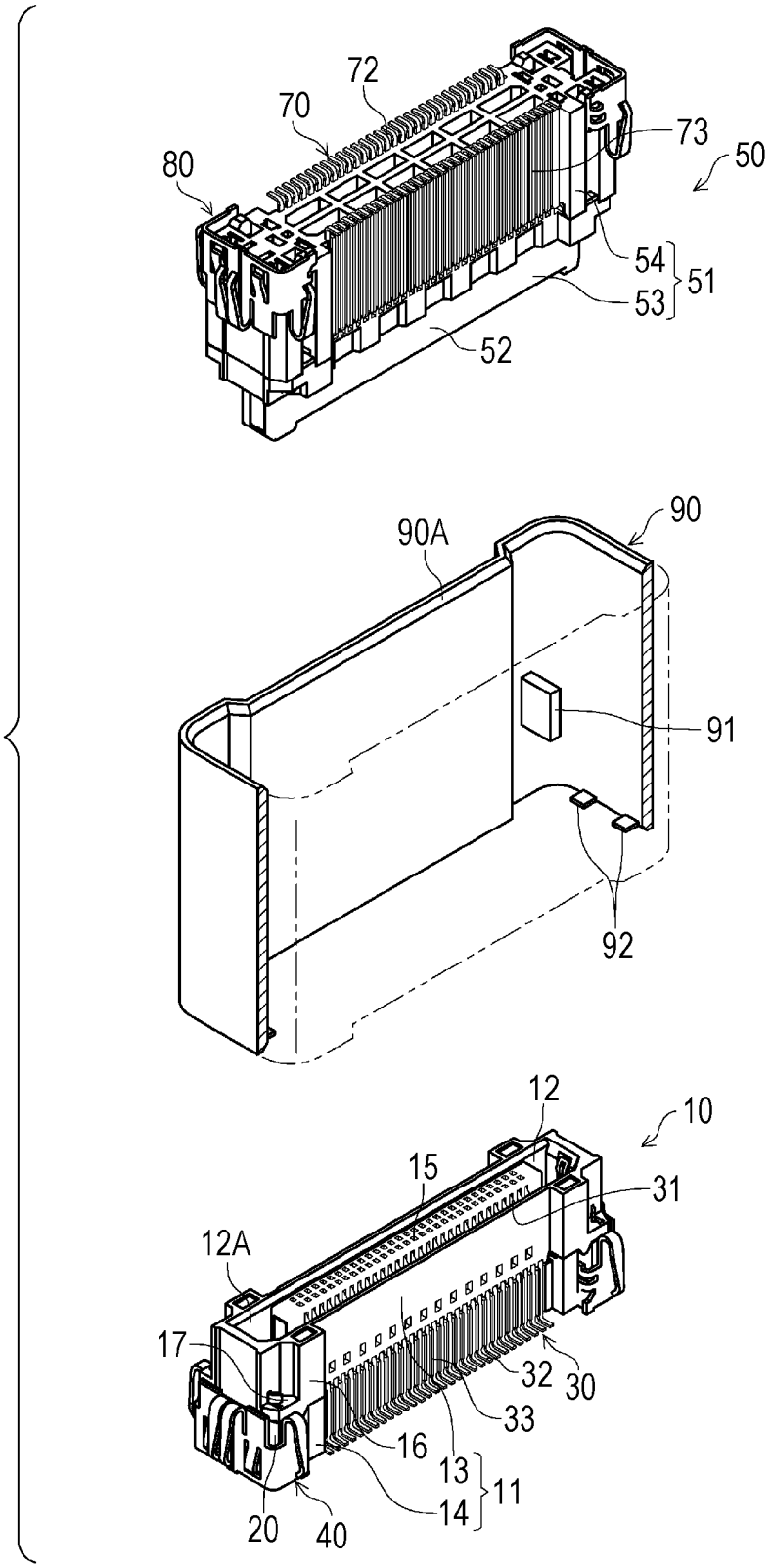

72
70
73
50
80
54
51
53
52
90
90A
91
92
12
10
15
31
12A
17
32
30
33
16
13
11
14
20
40

FIG. 2

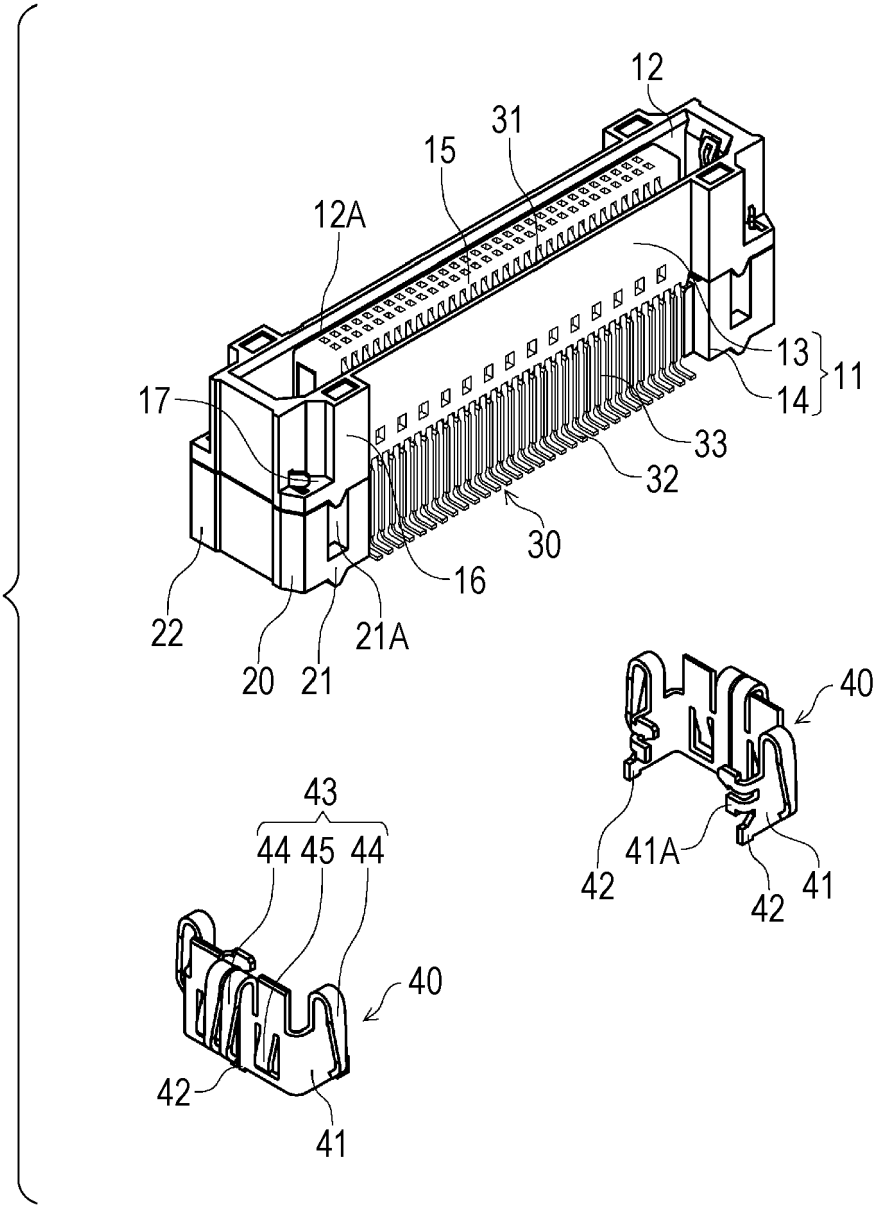

12
31
15
12A
13
14
11
17
33
32
30
16
22
20
21
21A
40
41A
42
41
43
44
45
44
40
42
41

FIG. 3A

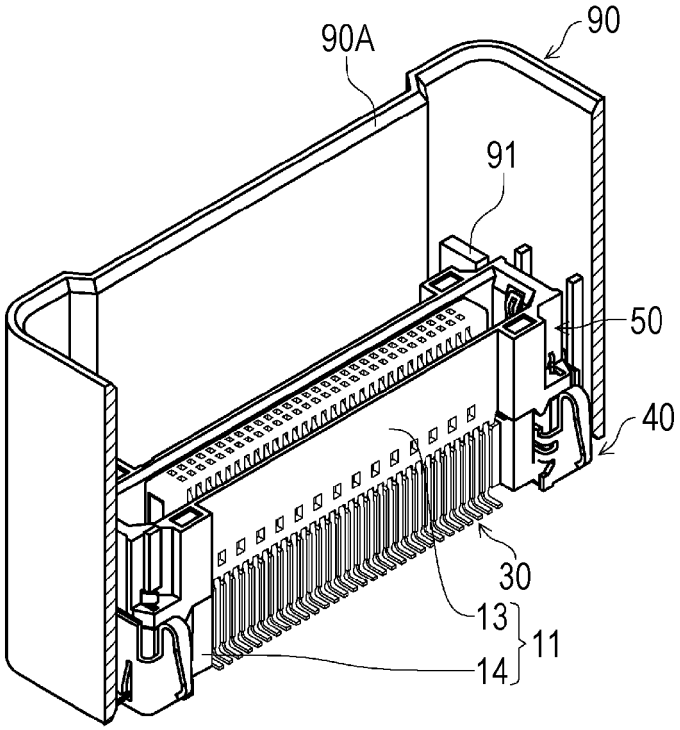


FIG. 3B

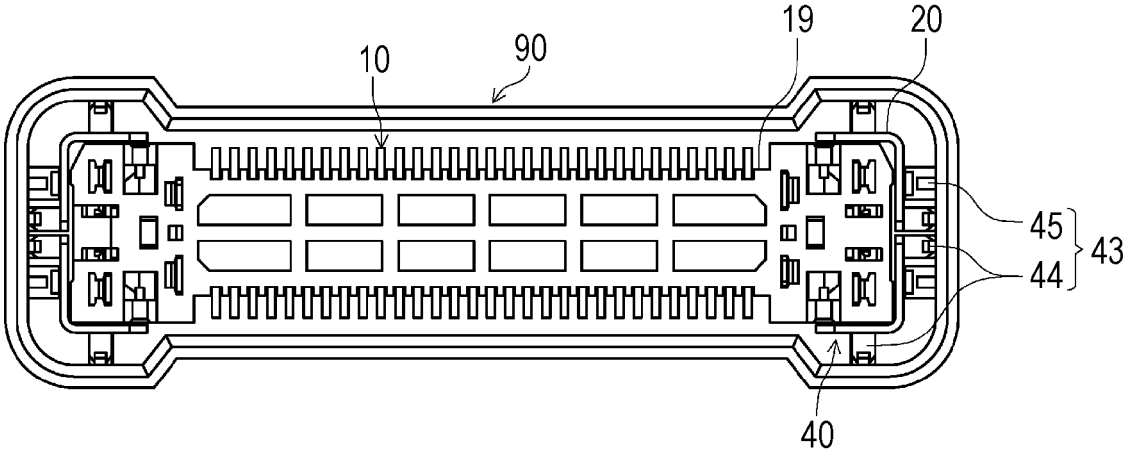


FIG. 4

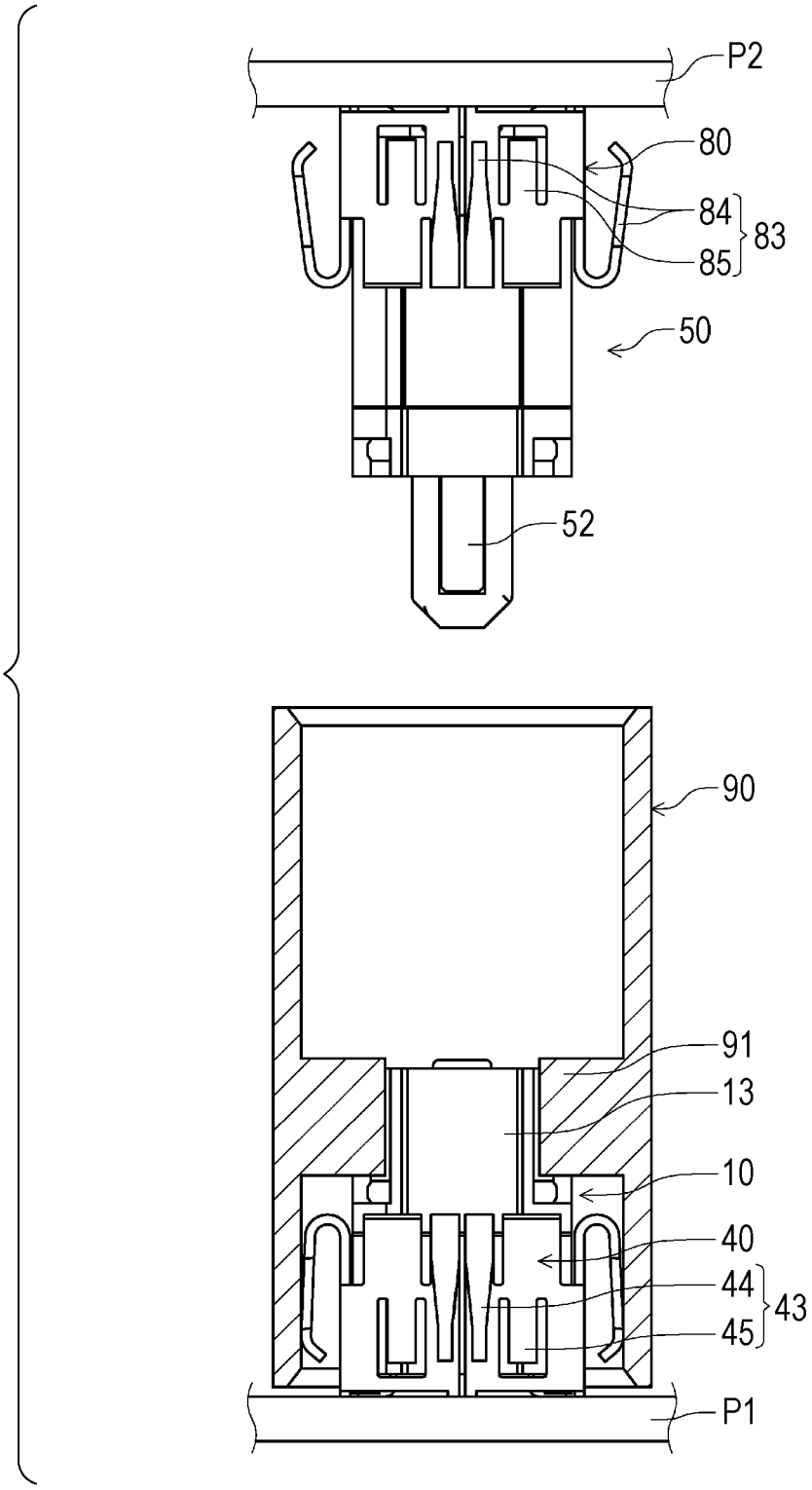


FIG. 5

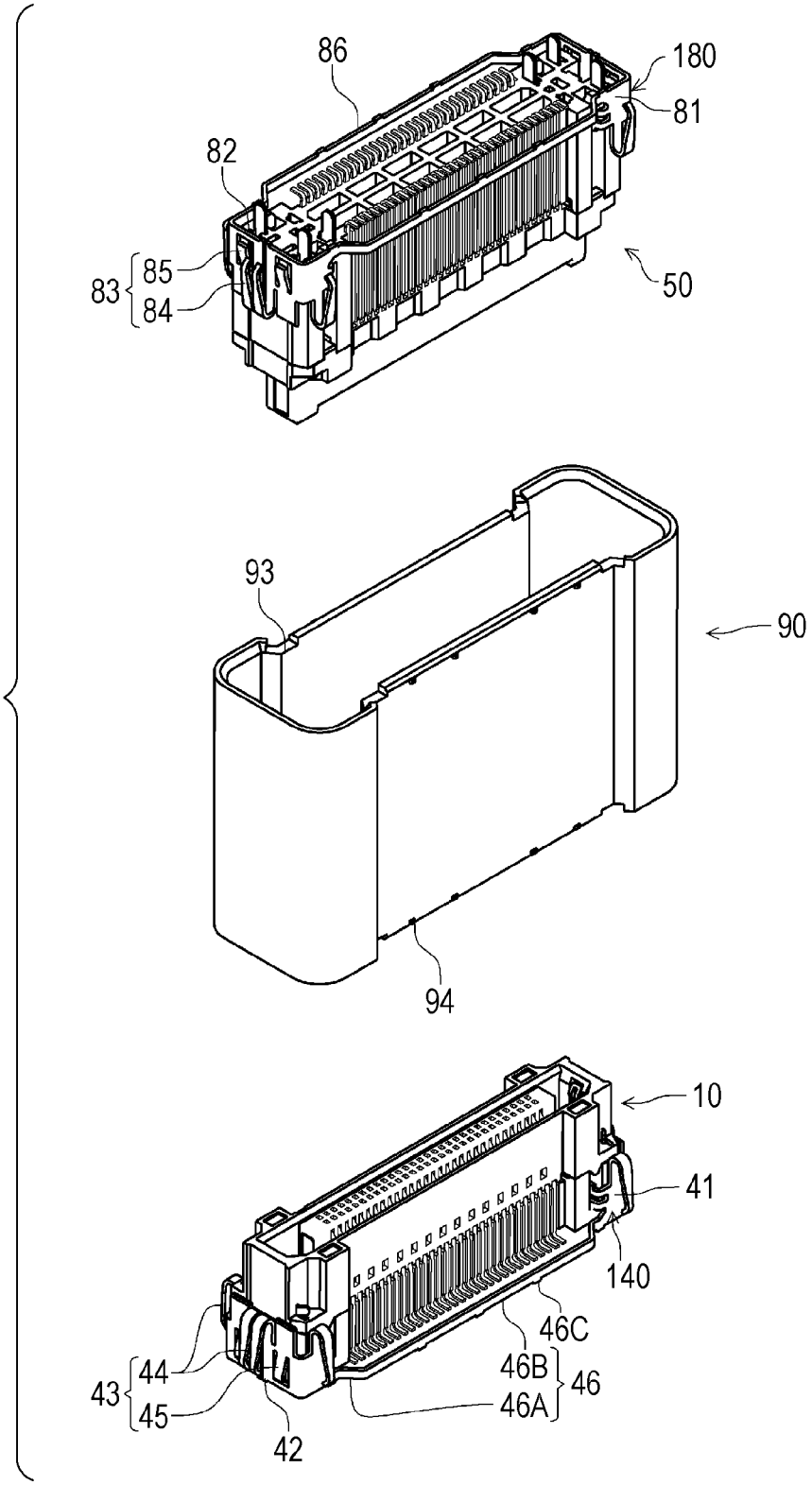


FIG. 6

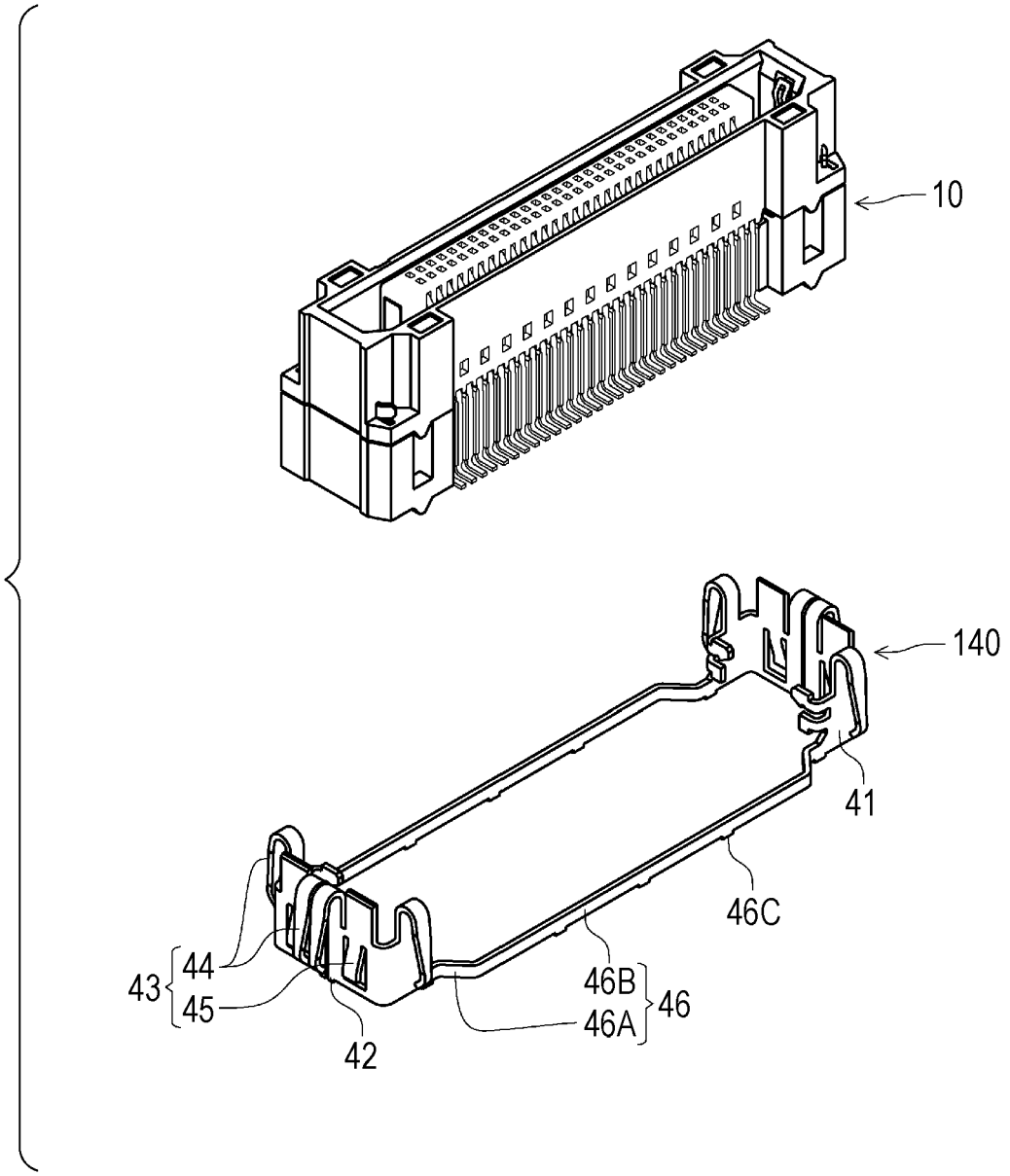


FIG. 7

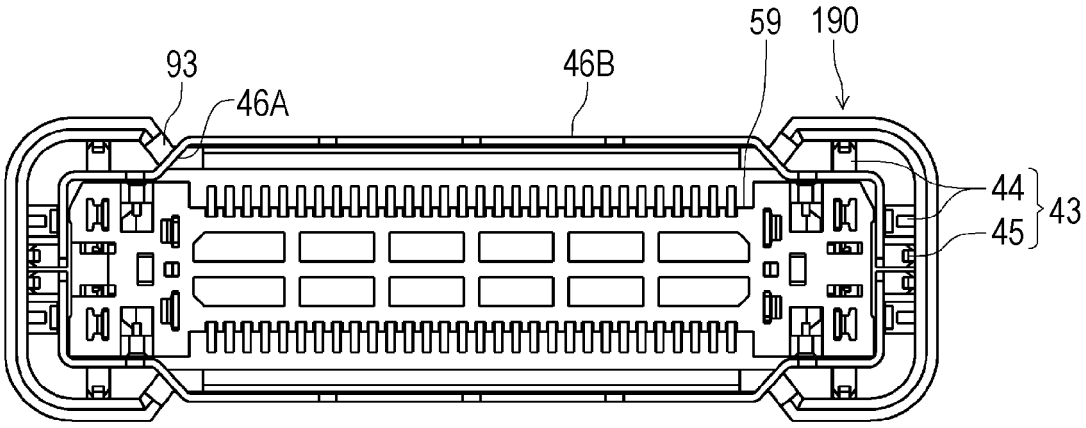


FIG. 8A

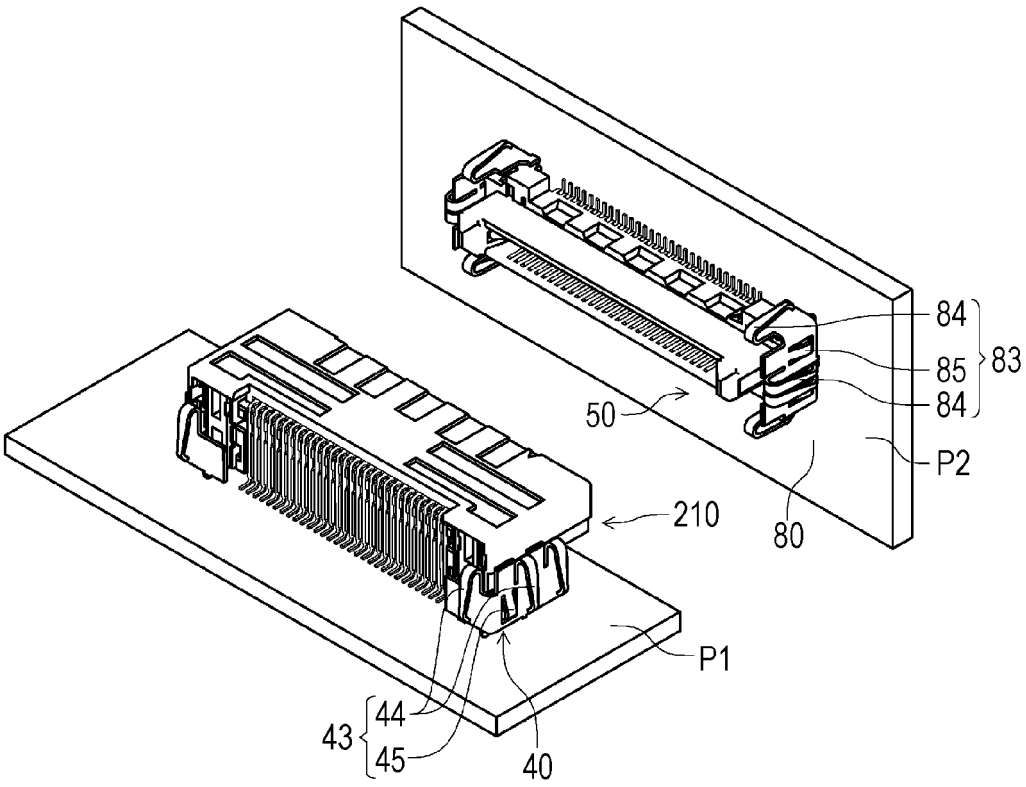


FIG. 8B

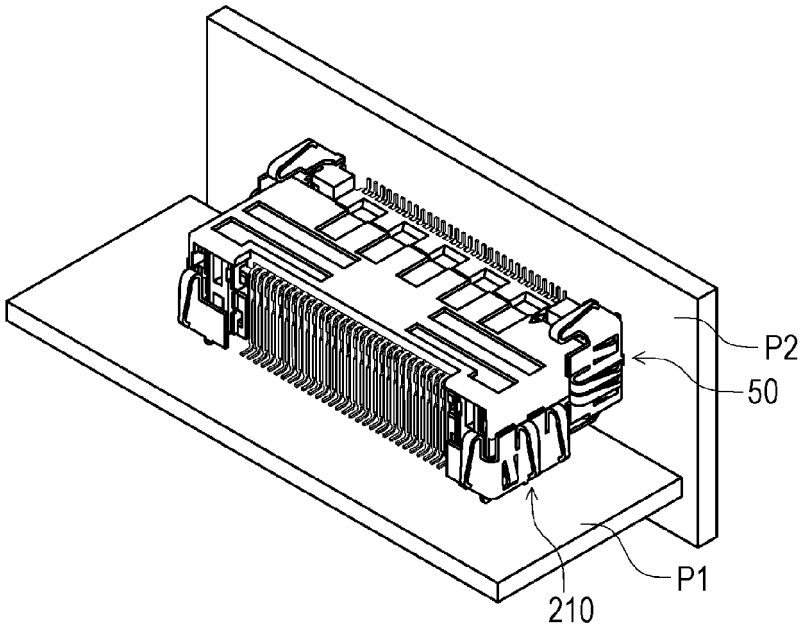


FIG. 9A

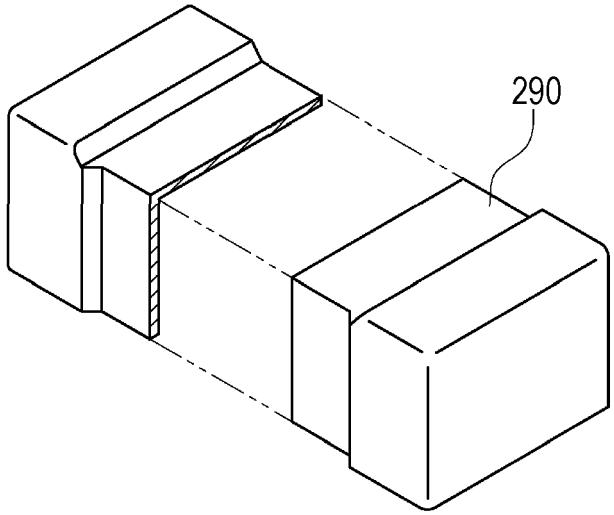


FIG. 9B

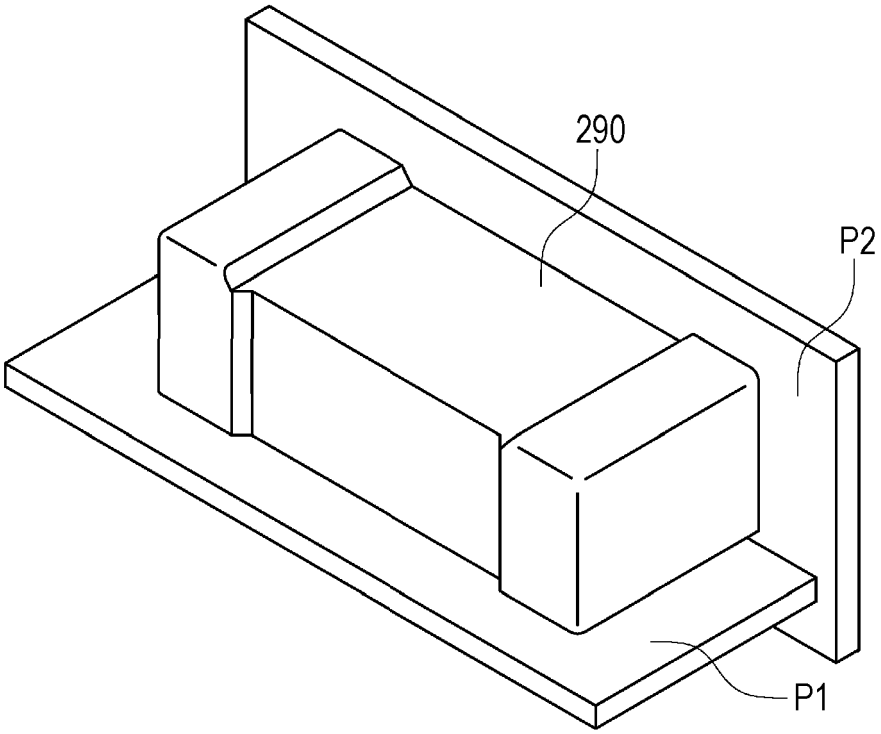


FIG. 10A

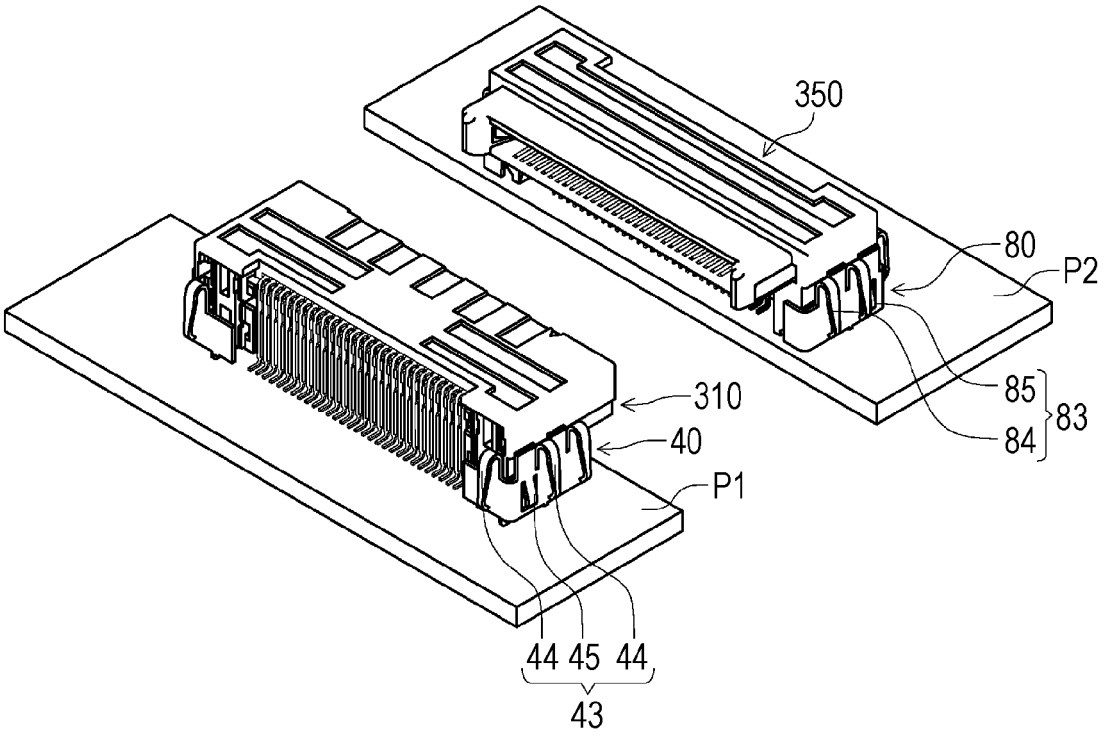


FIG. 10B

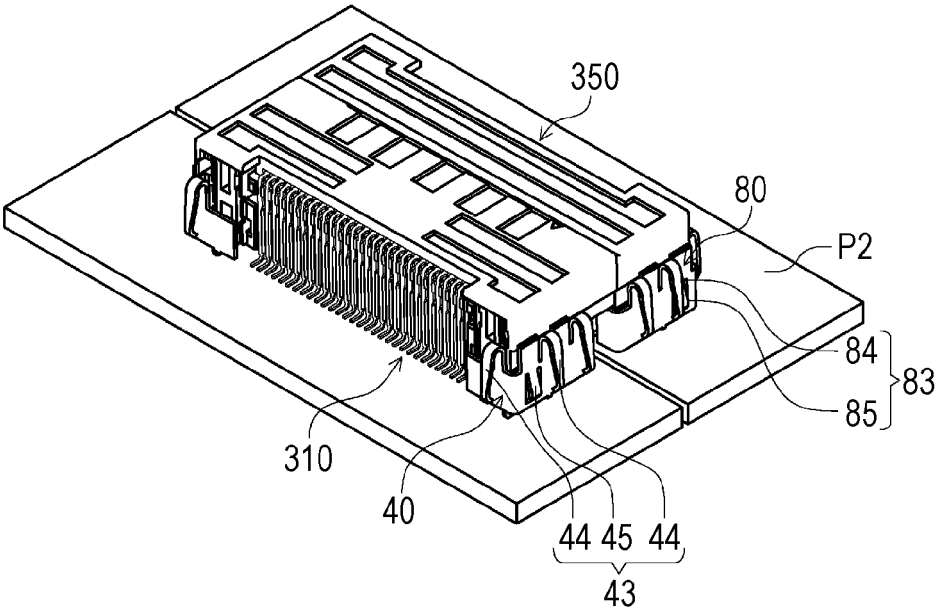


FIG. 11A

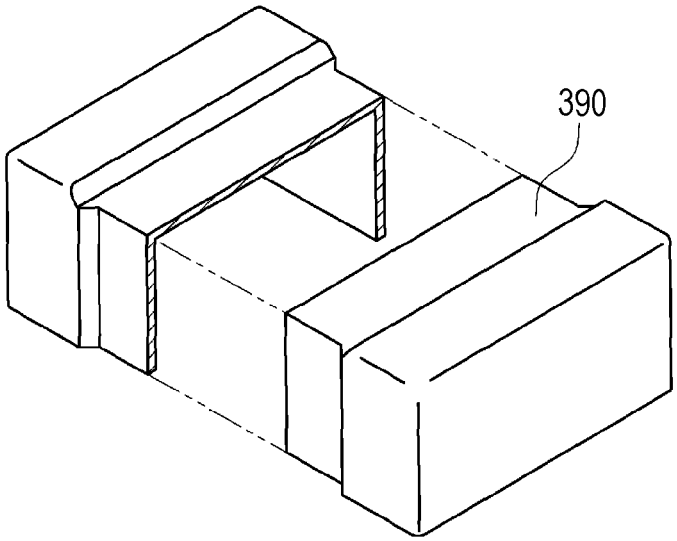
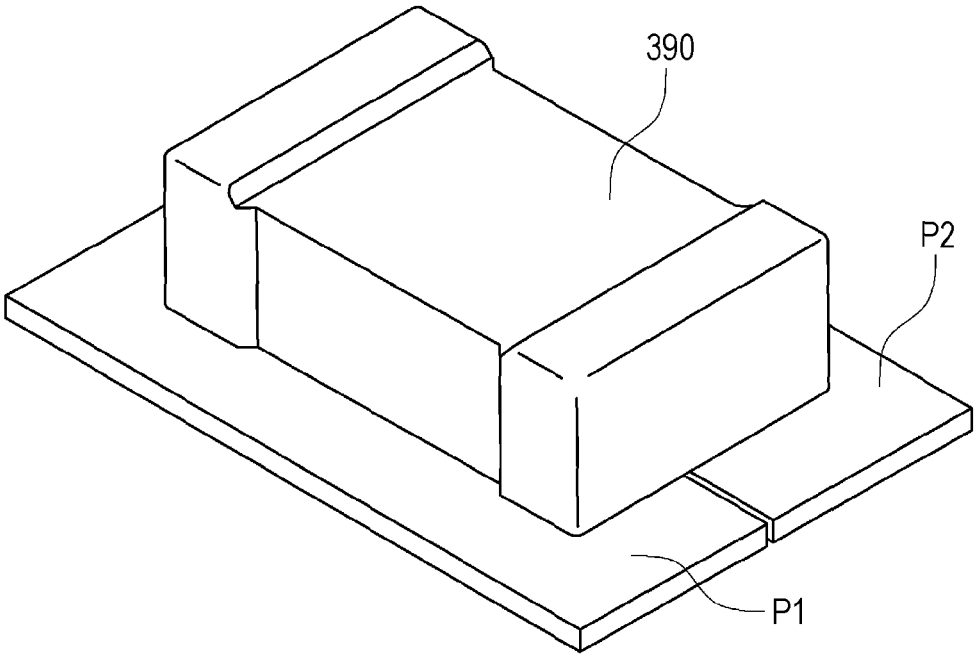


FIG. 11B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 18 5188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 114 981 B1 (HUANG MAO-JUNG [TW] ET AL) 3 October 2006 (2006-10-03) * page 1, paragraph 5 - paragraph 6; figure 7 * -----	1-6	INV. H01R12/73 H01R13/6583
A	US 2003/100211 A1 (WU MIN-FANG [TW]) 29 May 2003 (2003-05-29) * page 1, paragraph 17; figures 5,6 * -----	1	
A,D	JP 2003 308931 A (MITSUBISHI ELECTRIC CORP) 31 October 2003 (2003-10-31) * page 3, paragraph 15 - page 4, paragraph 20; figure 1 * -----	1,4-6	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 November 2013	Gomes Sirenkov E M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 18 5188

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-11-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7114981 B1	03-10-2006	NONE	
US 2003100211 A1	29-05-2003	NONE	
JP 2003308931 A	31-10-2003	JP 3964252 B2	22-08-2007
		JP 2003308931 A	31-10-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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 3964252 B **[0002]**