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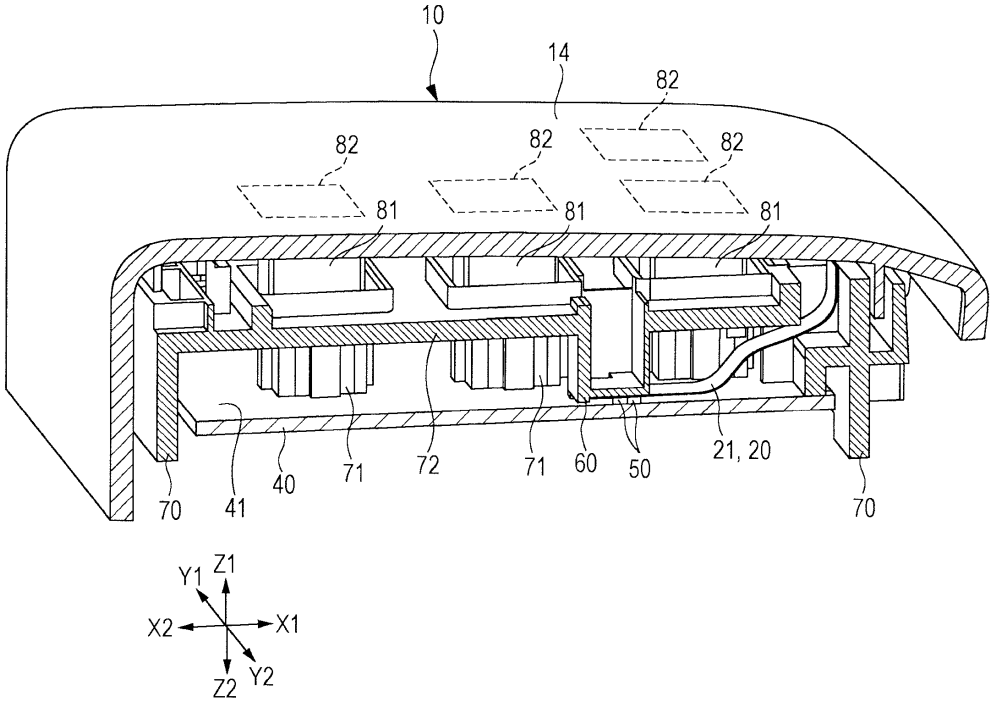
(54) WIRING CONNECTION STRUCTURAL BODY AND CAPACITIVE INPUT DEVICE

(57) A wiring connection structural body has: a wiring member (20) that includes an insulator (21), which is flexible and is formed like a sheet, and wires (22) formed on the insulator (21), at least part of each wire (22) being exposed from the insulator (21); a circuit board (40); conductive leaf springs (50) mounted on the component-side surface (41) of the circuit board (40); and a holding member (60) that holds at least part of each wiring member (20) to the circuit board (40) so that the contact electrode (23), exposed from the insulator (21), of each wire (22) is retained at a position at which the contact electrode (23) is pressed by the leaf spring (50). The leaf spring (50) and holding member (60) are independent of each other.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a wiring connection structural body used to connect a sheet-like wiring member and to a capacitive input device that uses the wiring connection structural body.

2. Description of the Related Art

[0002] To connect flexible printed circuits (FPC) to a wiring pattern on a circuit board, a connector for FPC use is mounted on the circuit board (for example, see Fig. 10 in Japanese Unexamined Patent Application Publication No. 2014-206814).

SUMMARY OF THE INVENTION

[0003] However, a connector used to connect a sheet-like wiring member such as an FPC has, for example, a mechanism in which the sheet-like wiring member is interposed and secured. Therefore, the structure of the connector is complex and large in size. This is disadvantageous in that when this type of connector is mounted on a circuit board as a part, a wide space on the circuit board is occupied by the connector. Another disadvantage is that since the mechanism of the connector has a complex structure, the connector is more expensive in relation to other parts.

[0004] The present invention addresses the above situation by providing a simple, inexpensive wiring connection structural body and a capacitive input device having the wiring connection structural body.

[0005] A wiring connection structural body according to a first aspect of the present invention includes has: a wiring member that includes an insulator, which is flexible and is formed like a sheet, and a wire formed on the insulator, at least part of the wire being exposed from the insulator; a circuit board; a conductive leaf spring mounted on the component-side surface of the circuit board; and a holding member that holds at least part of the wiring member to the circuit board so that the wire exposed from the insulator is retained at a position at which the wire is pressed by the leaf spring. The leaf spring and holding member are independent of each other.

[0006] In this structure, the leaf spring mounted on the component-side surface and the holding member that holds the wiring member to the circuit board are members that are independent of each other; the leaf spring and holding member are not formed integrally. Therefore, the structure is simplified when compared with an ordinary connector in which electrodes forming contact points and a mechanism that secures wires are integrated as a single member.

[0007] The wiring connection structural body according to the above first aspect preferably has a base that supports the circuit board. The holding member is preferably formed integrally with the base.

[0008] In this structure, the holding member is formed integrally with the base, so a part that secures the holding member to the circuit board does not need to be provided separately. Therefore, the structure is simplified.

[0009] The wiring connection structural body according to the above first aspect preferably has a reinforcing board secured to the insulator. The holding member preferably holds the reinforcing board to the circuit board.

[0010] In this structure, the reinforcing board secured to the insulator is held to the circuit board, so the insulator is stably held to the circuit board together with the reinforcing board.

[0011] The holding member preferably includes: a plane disposed so as to face the component-side surface, one surface of the reinforcing board abutting the plane; a fist restricting part extending uprightly around the reinforcing board on the plane, the fist restricting part restricting the displacement of the reinforcing board in a direction along the plane; and a second restricting part disposed between the reinforcing board and the component-side surface, the second restricting part restricting the displacement of the reinforcing board in a direction away from the plane. The reinforcing board preferably includes an elastically deformable part that can be elastically deformed in a direction away from the plane to a position at which the restriction by the fist restricting part is cancelled, outside a range within which the displacement of the reinforcing board is restricted by the second restricting part.

[0012] In this structure, the displacement of the reinforcing board is restricted by the first restricting part in a direction along the plane and is also restricted by the second restricting part in a direction away from the plane. Therefore, the reinforcing board is stably held at a position at which the reinforcing board faces the component-side surface. If the reinforcing board is attached at a position at which the reinforcing board is restricted by both the first restricting part and the second restricting part, when the elastically deformable part is elastically deformed in the middle of the attachment, the reinforcing board can be placed in a state in which the restriction by the first restricting part is cancelled. Therefore, a work operation to attach the reinforcing board is simplified.

[0013] The reinforcing board preferably includes a fixed part secured to the insulator and a linking part that links the fixed part and elastically deformable part together.

[0014] In this structure, the elastically deformable part is linked to the fixed part through the linking part; the elastically deformable part is not secured directly to the insulator. Therefore, even if the elastically deformable part is elastically deformed, the insulator is not deformed. Therefore, a work operation to attach the reinforcing board is simplified.

[0015] Part of the elastically deformable part is prefer-

ably interposed between the second restricting part and the plane. Preferably, the linking part elastically links the fixed part and part of the elastically deformable part interposed between the second restricting part and the plane together. In the plane, a hole is preferably formed in at least part of an area that faces the second restricting part with part of the elastically deformable part intervening between the plane and the second restricting part.

[0016] In this structure, part of the elastically deformable part interposed between the plane and the second restricting part is elastically linked to the fixed part through the linking part. If another portion, of the elastically deformable part, that is not interposed between the plane and the second restricting part is elastically deformed in a direction away from the plane, the linking part is elastically deformed. In this case, part of the elastically deformable part interposed between the second restricting part and the component-side surface is inclined toward the hole. As a result, the elastically deformable part is further likely to be deformed in a direction away from the plane. Therefore, a work operation to attach the reinforcing board is further simplified.

[0017] The insulator is preferably a band-like member. The fixed part is preferably secured to an end of the band-like member in its longitudinal direction. The elastically deformable part preferably extends in a brachial shape along the longitudinal direction of the band-like member. The linking part preferably links an end of the elastically deformable part and an end of the fixed part in the longitudinal direction of the band-like member together. The reinforcing board preferably includes two elastically deformable parts arranged in a direction orthogonal to the longitudinal direction of the band-like member with the fixed part intervening between the two elastically deformable parts and also includes two linking parts, each of which links one of the two elastically deformable parts to the fixed part.

[0018] In this structure, the two elastically deformable parts extending in a brachial shape along the longitudinal direction of the band-like member are arranged in a direction orthogonal to the longitudinal direction of the band-like member with the fixed part intervening between the two elastically deformable parts, so the shape of the reinforcing board can be made compact. Since an end of the fixed part in the longitudinal direction of the band-like member and an end of the elastically deformable part are linked together by the linking part, it is possible to largely elastically deform the elastically deformable part extending in a brachial shape in a direction away from the plane.

[0019] The wire of the wiring member is preferably a carbon ink layer formed on the insulator.

[0020] In this structure, the wire is formed by printing a carbon ink on the insulator, so the wire can be inexpensively formed on the insulator in a simple process.

[0021] A capacitive input device in a second aspect of the present invention has the wiring connection structural body in the above first aspect, a sensor unit formed integrally with the wiring member, the sensor unit including a detection electrode the capacitance of which changes depending on the proximity of an object, and a capacitance detecting circuit that detects the capacitance of the detection electrode according to charges accumulated in the detection electrode. The detection electrode is connected to the leaf spring through the wire of the wiring member. The circuit board includes a wire that interconnects the leaf spring and capacitance detecting circuit.

[0022] In this structure, the sensor unit is formed integrally with the wiring member, so the structure is simplified.

[0023] In the present invention, a capacitive input device that can be easily assembled can be provided while precision with which an input operation is detected is maintained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 is a perspective cross-sectional view illustrating an example of a capacitive input device in an embodiment of the present invention;

Fig. 2 illustrates a sensor unit, a wiring member, a reinforcing board, and a circuit board in the perspective cross-sectional view illustrated in Fig. 1;

Fig. 3 is an enlarged perspective view illustrating a state in which the reinforcing board is held by a holding member;

Fig. 4 is a drawing in which the wiring member and reinforcing board illustrated are eliminated from the enlarged perspective view in Fig. 3;

Fig. 5 is an enlarged perspective view in which the tip of the wiring member with the reinforcing board secured is illustrated;

Figs. 6A and 6B illustrate an example of a leaf spring, Fig. 6A being a perspective view, Fig. 6B being a plan view; and

Fig. 7 illustrates an example of a structure, in a capacitive input device, that is involved in the detection of a capacitance.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] A capacitive input device in an embodiment of the present invention will be described below with reference to the drawing. The capacitive input device in this embodiment is used in operation panels of various devices such as, for example, an operation panel used for air conditioning in a vehicle. The capacitive input device detects an input operation (such as a touch operation) on the operation panel. Fig. 1 is a perspective cross-sectional view illustrating an example of the capacitive input device in an embodiment of the present invention.

[0026] In this description, three directions that mutually orthogonal will be denoted X, Y, and Z. Directions that are included in the X direction and are mutually opposite

will be denoted X1 and X2. Directions that are included in the Y direction and are mutually opposite will be denoted Y1 and Y2. Directions that are included in the Z direction and are mutually opposite will be denoted Z1 and Z2.

[0027] As illustrated in Fig. 1, the capacitive input device in this embodiment has an outer envelope 10, on which an operation surface 14 used by the user to perform a touch operation is formed, a circuit board 40, on which electronic parts are mounted, and a base 70, which supports the outer envelope 10 and circuit board 40. The outer envelope 10 and circuit board 40 are secured to the base 70 with screws, snap fasteners, or the like.

[0028] In the example in Fig. 1, the outer envelope 10 is positioned substantially on the Z1 side with respect to the base 70. The circuit board 40 is positioned on the Z2 side of the base 70. The operation surface 14 of the outer envelope 10 faces the Z1 side, and expands in the X direction and Y direction as a whole. The circuit board 40 has a component-side surface 41 parallel to an XY plane. The base 70, disposed opposite to the component-side surface 41, has a floor part 72 substantially parallel to the XY plane.

[0029] A plurality of light-emitting areas 82 are formed on the operation surface 14 of the outer envelope 10. Light emitted from light-emitting elements 80 mounted on the circuit board 40 passes through the light-emitting areas 82. The light-emitting element 80 will be described later. A light guiding member 81 having translucency is provided between each light-emitting element 80 on the circuit board 40 and its corresponding light-emitting area 82 on the outer envelope 10. Each light guiding member 81 is supported by a support member 71 provided on the base 70 and is secured to the outer envelope 10 and circuit board 40.

[0030] Fig. 2 illustrates internal main members (a sensor unit 24, a wiring member 20, a reinforcing board 30, and the circuit board 40, which will be described later) in the perspective cross-sectional view illustrated in Fig. 1. The capacitive input device in this embodiment has a sensor unit 24 in which capacitances changes depending on the proximity of a finger or another object and also has capacitance detecting circuits 90 that detect capacitances in the sensor unit 24. As illustrated in Figs. 1 and 2, the sensor unit 24 is disposed on the inner surface of the outer envelope 10, the inner surface facing the operation surface 14. The capacitive input device also has a holding member 60 and leaf springs 50. The wiring member 20, reinforcing board 30, holding member 60, leaf springs 50, and circuit board 40 constitute a wiring connection structural body, in this embodiment, that electrically interconnects the sensor unit 24 and capacitance detecting circuits 90.

[0031] The sensor unit 24 is a sheet-like member as illustrated in Fig. 2. The sensor unit 24 is disposed along the inner surface of the outer envelope 10, the inner surface facing the operation surface 14. The sensor unit 24 has an insulator 26, which is made of, for example, a flexible, thin resin, and also has a plurality of detection electrodes 25 formed like a thin film on a surface of the insulator 26 by using conductors made of a sliver paste, a carbon ink, or the like. When, on the operation surface 14, a finger or another object comes in contact with an area opposite to a detection electrode 25, the capacitance of the detection electrode 25 changes as the result of the contact of the object (the proximity of the object with the outer envelope 10 intervening between the object and the detection electrode 25). In the wiring connection structural body in this embodiment, a conductive path is formed so as to transfer charges accumulated in the detection electrode 25 to the capacitance detecting circuit 90, according to the capacitance of the detection electrode 25.

[0032] As illustrated in Fig. 2, the sensor unit 24 has openings 27, through which light from the light guiding members 81 passes, at positions at which the openings 27 face the relevant light-emitting areas 82 on the operation surface 14. One detection electrode 25 is formed around each opening 27.

[0033] On the component-side surface 41 of the circuit board 40, a plurality of light-emitting elements 80 are mounted in correspondence to a plurality of light-emitting areas 82 on the operation surface 14, as illustrated in Fig. 2. Each light-emitting element 80 is driven by a light emitting element driving circuit (not illustrated) so as to be turned on to emit light or turned off according to a result of the detection of the capacitance of the detection electrode 25 disposed close to its corresponding light-emitting area 82.

[0034] The wiring member 20, formed integrally with sensor unit 24, includes an insulator 21, which is made of, for example, a flexible resin in a sheet shape, and also includes wires 22 formed on the insulator 21. The insulator 21 of the wiring member 20 and the insulator 26 of the sensor unit 24 are integrated together, forming a single sheet-like insulator. The wires 22 on the wiring member 20 and the detection electrodes 25 of the sensor unit 24 are formed on this common sheet-like insulator as conductive thin films formed with a silver paste, a carbon ink, or the like.

[0035] As illustrated in Figs. 1 and 2, the insulator 21 of the wiring member 20 is formed like a band. One end of the wiring member 20 is linked to the end of the sensor unit 24 on the X1 side. The holding member 60 holds the other end of the wiring member 20 toward the component-side surface 41. As illustrated in Fig. 1, the holding member 60 is formed integrally with the base 70. The holding member 60 extends uprightly from the Z2-side surface of the floor part 72 of the base 70 toward the component-side surface 41. The tip of the holding member 60 holds the other end of the wiring member 20 formed like a band.

[0036] Fig. 3 is an enlarged perspective view illustrating a state in which the reinforcing board 30 is held by the holding member 60. Fig. 4 is a drawing in which the wiring member 20 and reinforcing board 30 illustrated in

the enlarged perspective view in Fig. 3 are eliminated. Fig. 5 is an enlarged perspective view in which the tip of the wiring member 20 with the reinforcing board 30 secured is illustrated. In Figs. 3 to 5, the Z1 side is viewed from the Z2 side (the upper side of the perspective views in Figs. 1 and 2 is viewed from the lower side).

[0037] As illustrated in Fig. 5, the wiring member 20 has a plurality of wires 22 extending along the longitudinal direction of the wiring member 20. At an end of the wiring member 20 in its longitudinal direction, each wire 22 has a contact electrode 23 exposed from the insulator 21. The contact electrode 23 is brought into contact with one leaf spring 50 mounted on the component-side surface 41 of the circuit board 40, electrically interconnecting the sensor unit 24 and capacitance detecting circuit 90. The holding member 60 holds an end of the wiring member 20 to the circuit board 40 so that the contact electrode 23, exposed from the insulator 21, of each wire 22 is retained at a position at which the contact electrode 23 is pressed by the leaf spring 50.

[0038] As illustrated in Fig. 5, the reinforcing board 30 is secured to an end of the insulator 21, the contact electrodes 23 being exposed at the end. The reinforcing board 30 is a plate-like member formed by an insulative material such a resin. The reinforcing board 30 is thicker than the insulator 21. The holding member 60 holds the reinforcing board 30 to the circuit board 40.

[0039] As illustrated in Figs. 3 and 4, the holding member 60 has a plane 61, a first restricting part 62, and second restricting parts 64 and 65. The plane 61 is disposed so as to face the component-side surface 41 of the circuit board 40 and is parallel to the XY plane. One surface of the reinforcing board 30 abuts the plane 61.

[0040] The first restricting part 62 extends uprightly around an area, on the plane 61, that the reinforcing board 30 abuts. The first restricting part 62 restricts the displacement of the reinforcing board 30 in directions along the plane 61. In the example in Figs. 3 and 4, the first restricting part 62 is substantially C-shaped. The first restricting part 62 encloses the circumference of the edges of the reinforcing board 30, except the edges of part of the reinforcing board 30 on the X1 side, the insulator 21 in a band shape extending through the part.

[0041] The second restricting parts 64 and 65 are disposed between the reinforcing board 30 and the component-side surface 41. They restrict the displacement of the reinforcing board 30 in a direction away from the plane 61. In the example in Figs. 3 and 4, the second restricting parts 64 and 65 are disposed at the tip of the first restricting part 62 on the same side as the component-side surface 41 (on the Z2 side). The second restricting parts 64 and 65 protrude from the tip of the first restricting part 62 so as to overlap the reinforcing board 30 in a plan view toward the plane 61.

[0042] As illustrated in Fig. 5, the reinforcing board 30 has a fixed part 31, which is secured to the insulator 21, elastically deformable parts 32A and 32B, which can be elastically deformed in the Z direction, a linking part 33A that links the fixed part 31 and elastically deformable part 32A together, and a linking part 33B that links the fixed part 31 and elastically deformable part 32B together. In the example in Fig. 5, the fixed part 31 has a substantially rectangular shape and is secured to an end of the insulator 21 (band-like member) in its longitudinal direction, the contact electrodes 23 being exposed at the end. The elastically deformable parts 32A and 32B extend in a brachial shape along the longitudinal direction of the insulator 21 (band-like member), and are arranged in the Y direction with the fixed part 31 intervening between the elastically deformable parts 32A and 32B. The linking part 33A links an end 35A of the elastically deformable part 32A and an end 34 of the fixed part 31 in the longitudinal direction of the insulator 21 (band-like member) together.

[0043] The linking part 33B links an end 35B of the elastically deformable part 32B and the end 34 of the fixed part 31 in the longitudinal direction of the insulator 21 (band-like member) together.

[0044] As illustrated in Figs. 3 and 5, an end 321A of the elastically deformable part 32A is interposed between the second restricting part 64 and the plane 61. The linking part 33A elastically links the end 321A and fixed part 31 together. An end 321B of the elastically deformable part 32B is interposed between the second restricting part 65 and the plane 61. The linking part 33B elastically links the end 321B and fixed part 31 together.

[0045] As illustrated in Fig. 4, in the plane 61, a hole 66 is formed in an area opposite to the second restricting part 64 with the end 321A of the elastically deformable part 32A intervening between the plane 61 and the second restricting part 64 and a hole 67 is formed in an area opposite to the second restricting part 65 with the end 321B of the elastically deformable part 32B intervening between the plane 61 and second restricting part 65.

[0046] As illustrated in Fig. 5, the reinforcing board 30 has a concave part 36 substantially at the center of the end 34 of the fixed part 31 in the direction in which the elastically deformable parts 32A and 32B are arranged (in the Y direction). The concave part 36 engages a convex part 63 formed as part of the first restricting part 62.

[0047] When the reinforcing board 30 is to be attached to the holding member 60, the reinforcing board 30 is first inserted from the X1 side toward the X2 direction so that the end 321A of the elastically deformable part 32A is interposed between the second restricting part 64 and the plane 61 and the end 321B of the elastically deformable part 32B is interposed between the second restricting part 65 and the plane 61. At that time, the reinforcing board 30 is slightly inclined in the Z1 direction so that part of the end 321A drops into the hole 66 in the plane 61 and part of the end 321B drops into the hole 67 in the plane 61. The elastically deformable parts 32A and 32B move onto the tip of the first restricting part 62 on the Z2 side and is elastically deformed in the Z2 direction. When the reinforcing board 30 is further inserted in the X direction, the concave part 36 of the reinforcing board 30 en-

gages the convex part 63 of the first restricting part 62, determining the position of the reinforcing board 30 in the Y direction. The elastically deformable parts 32A and 32B come off the tip of the first restricting part 62 on the Z2 side and their elastic deformation is restored to the original shape, making the elastically deformable parts 32A and 32B flat as a whole. Accordingly, the reinforcing board 30 is placed in a state in which its displacement is restricted by the first restricting part 62 in directions parallel to the plane 61 and is also restricted by the second restricting parts 64 and 65 in a direction away from the plane 61.

[0048] Figs. 6A and 6B illustrate an example of the leaf spring 50; Fig. 6A is a perspective view and Fig. 6B is a plan view.

[0049] The leaf spring 50 is an elastic member formed by bending a plate-like metallic body. The leaf spring 50 has band-like members 52 and 53 and a rectangular plate member 51, to which one end of the band-like member 52 and one end of the band-like member 53 are connected. The band-like members 52 and 53 are bent spirally around a center line L perpendicular to the XY plane in the same direction. The rectangular plate member 51 is substantially square in a plan view in the Z direction. A point at which the band-like member 52 and rectangular plate member 51 are mutually connected and a point at which the band-like member 53 and rectangular plate member 51 are mutually connected are symmetric with respect to the center of the square (center line L). The band-like members 52 and 53 extend from diagonally opposite corners of the square along opposite edges of the square. As illustrated in Fig. 6A, the band-like members 52 and band-like member 53 are gradually displaced away from the rectangular plate member 51 in the Z1 direction and the diameter of the turn of the spiral is gradually reduced, starting from their one ends at which they are connected to the rectangular plate member 51 until their other ends are reached. At the other end of the band-like member 52, which is not connected to the rectangular plate member 51, a contact part 55 is provided that is brought into contact with one contact electrode 23 of the wiring member 20. On the contact part 55, a protrusion 56 extending in the Z1 direction is formed at a position corresponding to the center of the turn of the spiral. The other end of the band-like member 53 is positioned on the Z2 side of the contact part 55. The leaf spring 50 produces an elastic force with which the contact electrode 23 in contact with the contact part 55 is pressed in the Z1 direction.

[0050] Fig. 7 illustrates an example of a structure, in the capacitive input device in this embodiment, that is involved in the detection of a capacitance. The capacitance detecting circuit 90 provided in the capacitive input device in this embodiment detects a capacitance depending on the proximity of an object 100 (such a finger) to the operation surface 14, according to charges accumulated in the relevant detection electrode 25 of the sensor unit 24. For example, the capacitance detecting circuit 90 periodically applies a pulse voltage with a certain amplitude to the detection electrode 25 and detects charges accumulated across the detection electrode 25 and a reference potential (ground) on the basis of the pulse voltage. The charges detected by the capacitance detecting circuit 90 are substantially proportional to the capacitance across the detection electrode 25 and the object 100 close to the operation surface 14. The capacitance detecting circuit 90, which includes, for example, an analog-to-digital convertor, outputs detected data Dout with a predetermined bit length, the detected data Dout indicating the amount of charges detected. The capacitance detecting circuit 90 is formed by one or a plurality of electronic parts and is mounted on the circuit board 40 or another board.

[0051] As described above, in the wiring connection structural body in this embodiment, the holding member 60 that holds the wiring member 20 to the circuit board 40 is provided so that the contact electrodes 23 of the wires 22, the contact electrodes 23 being exposed from the insulator 21, which is flexible and is formed like a sheet, are retained at positions at which the contact electrodes 23 are pressed by the relevant leaf springs 50 mounted on the circuit board 40. The holding member 60 is independent of the leaf springs 50; the holding member 60 and leaf springs 50 are not formed integrally. In an ordinary connector, electrodes forming contact points and a mechanism that secures wires are integrated as a single member. In the wiring connection structural body in this embodiment, however, a structure in which the leaf springs 50 and holding member 60 are integrated together is eliminated. Therefore, the structure of the wiring connection structural body is simplified and its size can be reduced when compared with a case in which an ordinary connector is used. In addition, the simplified structure enables the wiring connection structural body to be manufactured at a cost lower than the cost of an ordinary connector.

[0052] In the wiring connection structural body in this embodiment, the holding member 60 and the base 70 supporting the circuit board 40 are formed integrally, so a part that secures the holding member 60 to the circuit board 40 does not need to be provided separately. This further simplifies the structure of the wiring connection structural body.

[0053] In the wiring connection structural body in this embodiment, the reinforcing board 30 is secured to the insulator 21 and is held to the circuit board 40 by the holding member 60. Therefore, the insulator 21 having flexibility can be stably held to the circuit board 40 together with the reinforcing board 30.

[0054] In the wiring connection structural body in this embodiment, the displacement of the reinforcing board 30 is restricted by the first restricting part 62 in directions along the plane 61 and is also restricted by the second restricting parts 64 and 65 in a direction away from the plane 61. Therefore, the reinforcing board 30 can be stably held at a position at which the reinforcing board 30

faces the component-side surface 41.

[0055] In the wiring connection structural body in this embodiment, if the reinforcing board 30 is attached at a position at which the reinforcing board 30 is restricted by both the first restricting part 62 and the second restricting parts 64 and 65, when the elastically deformable parts 32A and 32B are elastically deformed in the middle of the attachment, the reinforcing board 30 can be placed in a state in which the restriction by the first restricting part 62 is cancelled. This simplifies a work operation to attach the reinforcing board 30 to the holding member 60.

[0056] In the wiring connection structural body in this embodiment, the elastically deformable part 32A is linked to the fixed part 31 through the linking part 33A and the elastically deformable part 32B is linked to the fixed part 31 through the linking part 33B; the elastically deformable parts 32A and 32B are not secured directly to the insulator 21. Therefore, even if the elastically deformable parts 32A and 32B are elastically deformed, the insulator 21 is not deformed. This simplifies the work operation to attach the reinforcing board 30 to the holding member 60.

[0057] In the wiring connection structural body in this embodiment, the end 321A, interposed between the second restricting part 64 and the plane 61, of the elastically deformable part 32A is elastically linked to the fixed part 31 through the linking part 33A, and the end 321B, interposed between the second restricting part 65 and the plane 61, of the elastically deformable part 32B is elastically linked to the fixed part 31 through the linking part 33B. Therefore, if another portion, of the elastically deformable part 32A, that is not interposed between the second restricting part 64 and the plane 61 is elastically deformed in a direction away from the plane 61, the linking part 33A is elastically deformed. This also true for another portion, of the elastically deformable part 32B, that is not interposed between the second restricting part 65 and the plane 61. In this case, the end 321A of the elastically deformable part 32A is inclined toward the hole 66 in the plane 61 and the end 321B of the elastically deformable part 32B is inclined toward the hole 67 in the plane 61. Therefore, the elastically deformable parts 32A and 32B are further likely to be deformed in the direction away from the plane 61, including the deformations of the linking part 33A and 33B, respectively. This further simplifies the work operation to attach the reinforcing board 30 to the holding member 60.

[0058] In the wiring connection structural body in this embodiment, the two elastically deformable parts 32A and 32B extending in a brachial shape along the longitudinal direction of the insulator 21 (band-like member) are arranged in a direction orthogonal to the longitudinal direction of the insulator 21 (band-like member) with the fixed part 31 intervening between the elastically deformable parts 32A and 32B. Therefore, the shape of the reinforcing board 30 can be made compact.

[0059] In the wiring connection structural body in this embodiment, the end 34 of the fixed part 31 and the end 35A of the elastically deformable part 32A are linked together by the linking part 33A, and the end 34 of the fixed part 31 and the end 35B of the elastically deformable part 32B are linked together by the linking part 33B. Therefore, the elastically deformable parts 32A and 32B extending in a brachial shape can be largely elastically deformed in a direction away from the plane 61.

[0060] In the wiring connection structural body in this embodiment, the wires 22 are formed by printing a carbon ink on the insulator 21, so the wires 22 can be inexpensively formed on the insulator 21 in a simple process.

[0061] In the capacitive input device in this embodiment, the sensor unit 24 is formed integrally with the wiring member 20 in the wiring connection structural body described above, so a connector or the like is not needed to interconnect the sensor unit 24 and wiring member 20. Therefore, the structure of the wiring connection structural body is simplified.

[0062] The present invention is not limited to the embodiment described above. That is, a person having ordinary skill in the art may make various modifications, combinations, subcombinations, and replacements for the constituent elements in the above embodiment, without departing from the technical range of the present invention or an equivalent range of the technical range.

[0063] For example, in the embodiment described above, two elastically deformable parts denoted 32A and 32B are provided on the reinforcing board 30. In the present invention, however, only one elastically deformable part or three or more elastically deformable parts may be provided. In the present invention, one elastically deformable part may be pressed by a plurality of second restricting parts, or a plurality of elastically deformable parts may be pressed by a single second restricting part. The second restricting part may press not only the elastically deformable part but also the fixed part.

Claims

1. A wiring connection structural body comprising:

a wiring member (20) that includes an insulator (21), which is flexible and is formed like a sheet, and a wire (22) formed on the insulator (21), at least part of the wire (22) being exposed from the insulator (21);
a circuit board (40);
a conductive leaf spring (50) mounted on a component-side surface (41) of the circuit board (40); and
a holding member (60) that holds at least part of the wiring member (20) to the circuit board (40) so that the wire (22) exposed from the insulator (21) is retained at a position at which the wire (22) is pressed by the leaf spring (50); wherein
the leaf spring (50) and the holding member (60) are independent of each other.

2. The wiring connection structural body according to Claim 1, further comprising a base (70) that supports the circuit board (40), wherein
the holding member (60) is formed integrally with the base (70).

3. The wiring connection structural body according to Claim 1 or 2, further comprising a reinforcing board (30) secured to the insulator (21), wherein
the holding member (60) holds the reinforcing board (30) to the circuit board (40).

4. The wiring connection structural body according to Claim 3, wherein:

the holding member (60) includes
a plane (61) disposed so as to face the component-side surface (41), one surface of the reinforcing board (30) abutting the plane (61),
a first restricting part (62) extending uprightly around the reinforcing board (30) on the plane (61), the first restricting part (62) restricting a displacement of the reinforcing board (30) in a direction along the plane (61), and
a second restricting part (64, 65) disposed between the reinforcing board (30) and the component-side surface (41), the second restricting part (64, 65) restricting a displacement of the reinforcing board (30) in a direction away from the plane (61); and
the reinforcing board (30) includes an elastically deformable part (32A, 32B) that is elastically deformable in a direction away from the plane (61) to a position at which a restriction by the first restricting part (62) is cancelled, outside a range within which the displacement of the reinforcing board (30) is restricted by the second restricting part (64, 65).

5. The wiring connection structural body according to Claim 4, wherein the reinforcing board (30) includes
a fixed part (31) secured to the insulator (21), and
a linking part (33A, 33B) that links the fixed part (31) and the elastically deformable part (32A, 32B) together.

6. The wiring connection structural body according to Claim 5, wherein:

part of the elastically deformable part (32A, 32B) is interposed between the second restricting part (64, 65) and the plane (61);
the linking part (33A, 33B) elastically links the fixed part (31) and part of the elastically deformable part (32A, 32B) interposed between the second restricting part (64, 65) and the plane (61) together; and
in the plane (61), a hole (66, 67) is formed in at least part of an area that faces the second restricting part (64, 65) with part of the elastically deformable part (32A, 32B) intervening between the plane (61) and the second restricting part (64, 65).

7. The wiring connection structural body according to Claim 5 or 6, wherein:

the insulator (21) is a band-like member;
the fixed part (31) is secured to an end of the band-like member in a longitudinal direction of the band-like member;
the elastically deformable part (32A, 32B) extends in a brachial shape along the longitudinal direction of the band-like member:

the linking part (33A, 33B) links an end of the elastically deformable part (32A, 32B) and an end of the fixed part (31) in the longitudinal direction of the band-like member together; and
the reinforcing board (30) includes
two elastically deformable parts (32A, 32B) arranged in a direction orthogonal to the longitudinal direction of the band-like member with the fixed part (31) intervening between the two elastically deformable parts (32A, 32B), and
two linking parts (33A, 33B), each of which links one of the two elastically deformable parts (32A, 32B) to the fixed part (31).

8. The wiring connection structural body according to any one of Claims 1 to 7, wherein the wire (22) of the wiring member (20) is a carbon ink layer formed on the insulator (21).

9. A capacitive input device comprising:

the wiring connection structural body according to any one of Claims 1 to 8,
a sensor unit (24) formed integrally with the wiring member (20), the sensor unit (24) including a detection electrode (25) the capacitance of which changes depending on a proximity of an object (100); and
a capacitance detecting circuit (90) that detects the capacitance of the detection electrode (25) according to a charge accumulated in the detection electrode (25); wherein
the detection electrode (25) is connected to the leaf spring (50) through the wire (22) of the wiring member (20), and
the circuit board (40) includes a wire that interconnects the leaf spring (50) and the capacitance detecting circuit (90).

FIG. 1

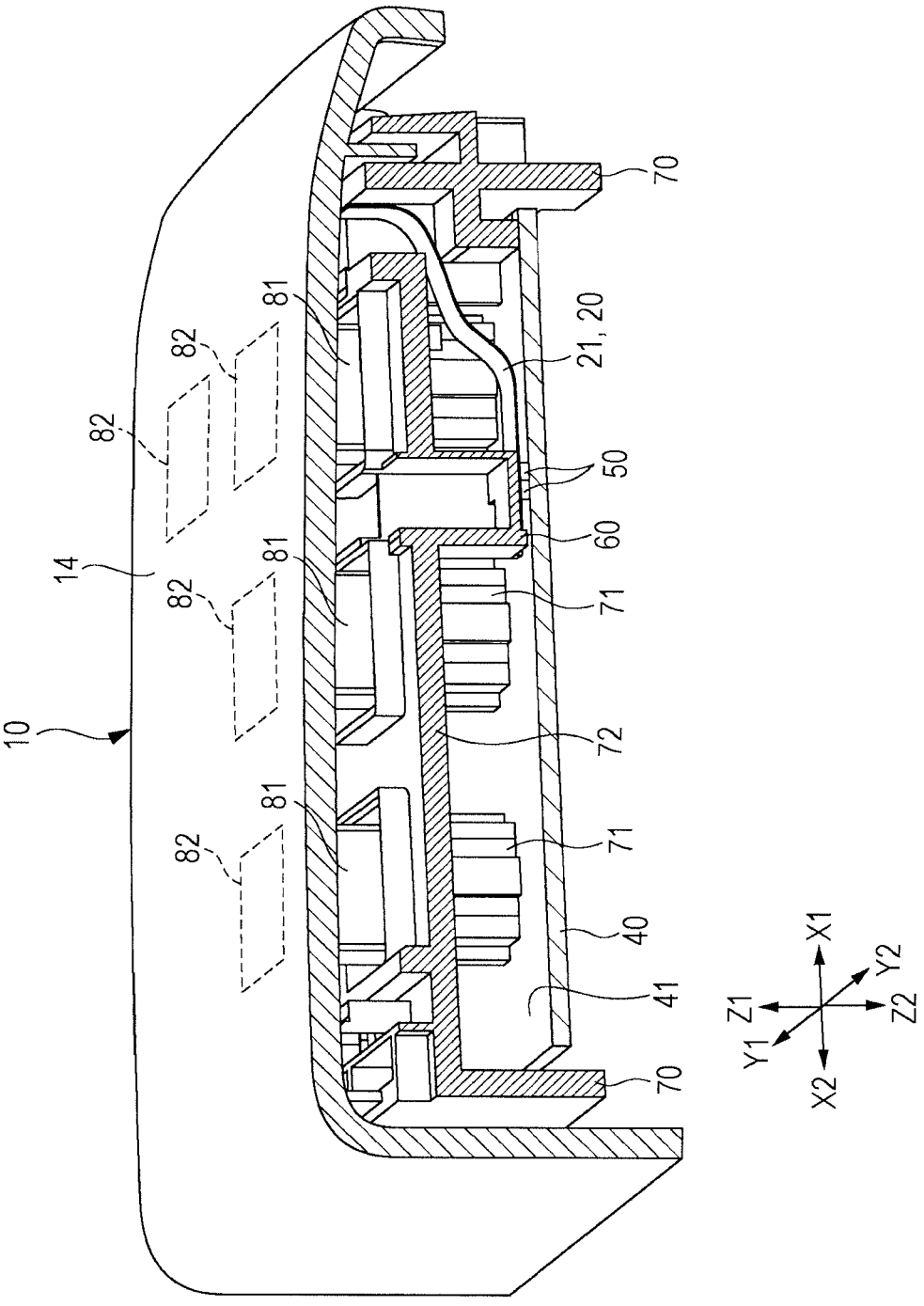

10
14
81
82
82
81
82
81
82
70
21, 20
50
60
71
72
71
40
41
70
X1
Y2
Z2
Z1
Y1
X2

FIG. 2

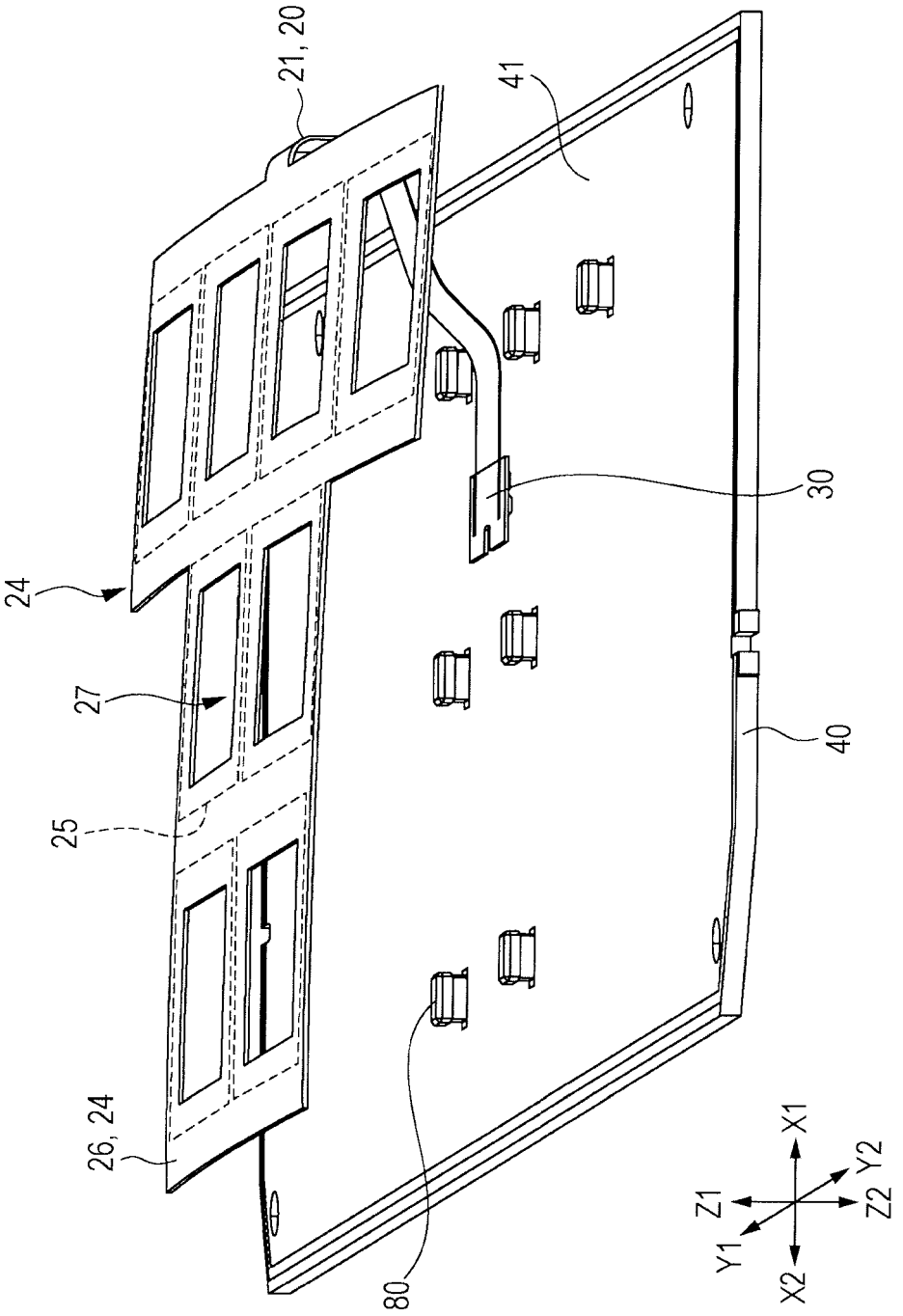


FIG. 3

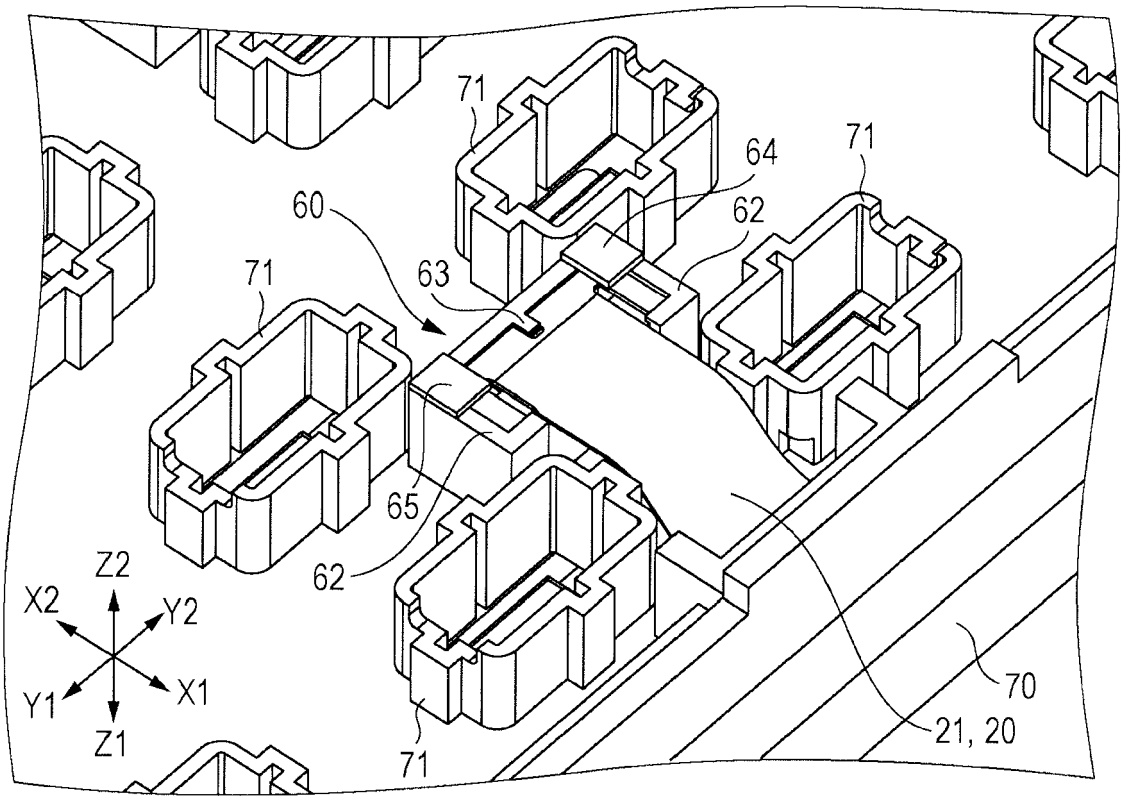


FIG. 4

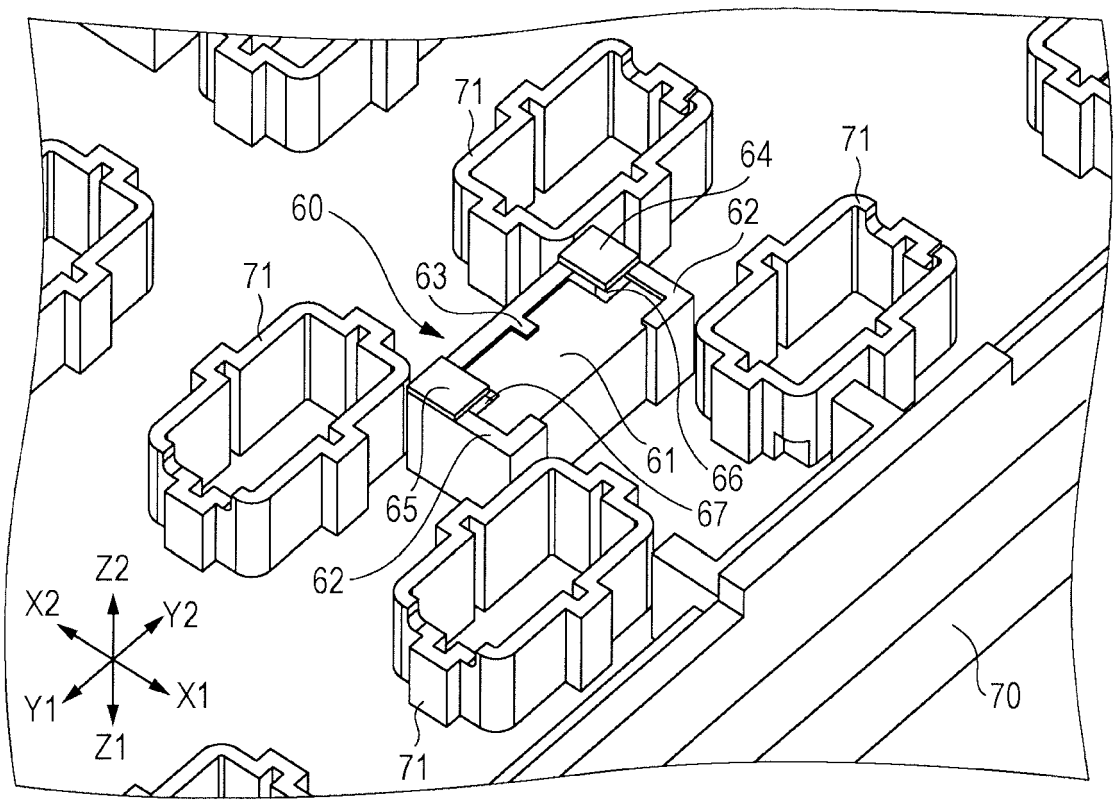


FIG. 5

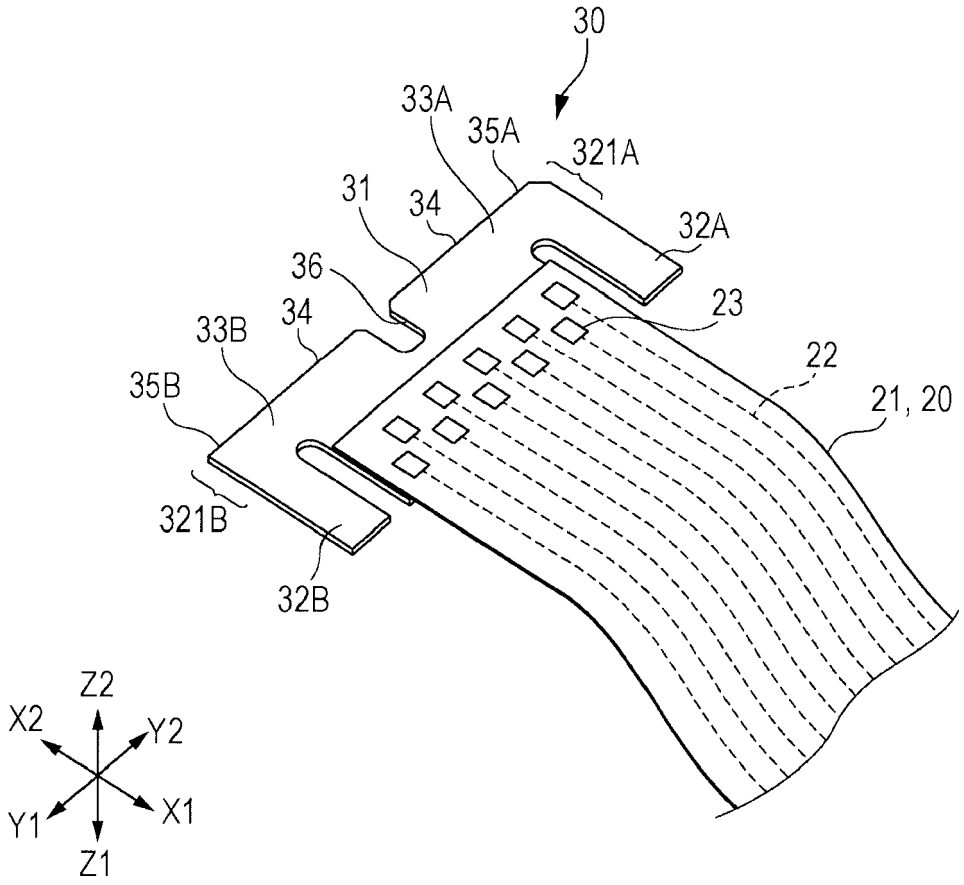

30
33A
35A
321A
31
34
32A
36
23
34
33B
22
35B
21, 20
321B
32B
Z2
X2
Y2
Y1
X1
Z1

FIG. 6A

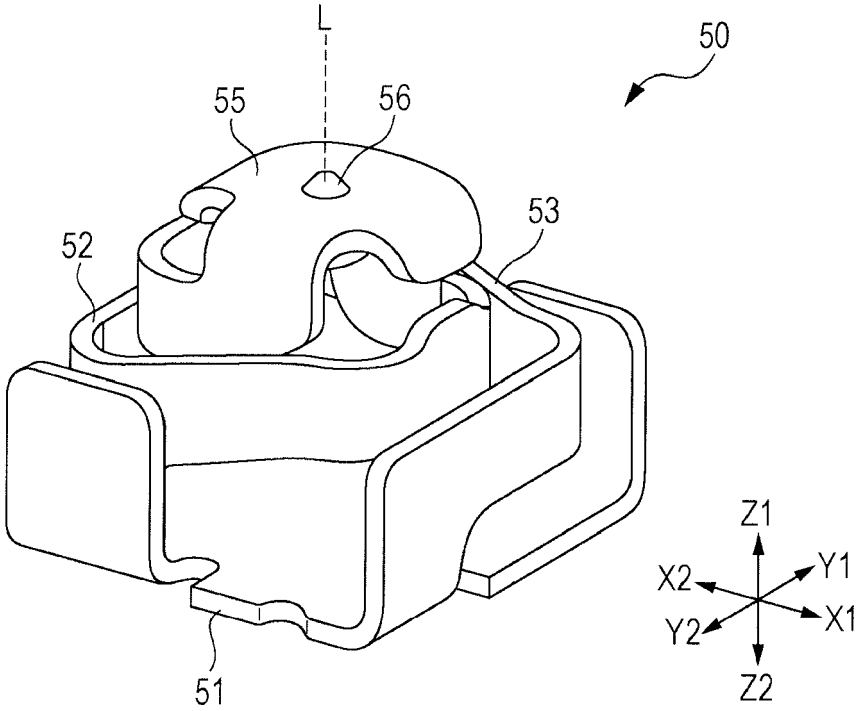


FIG. 6B

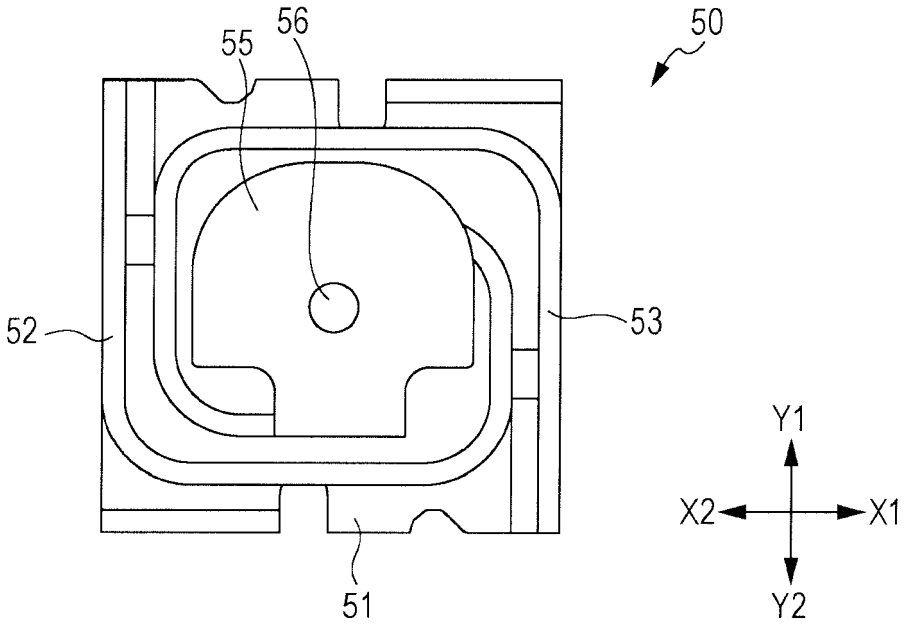
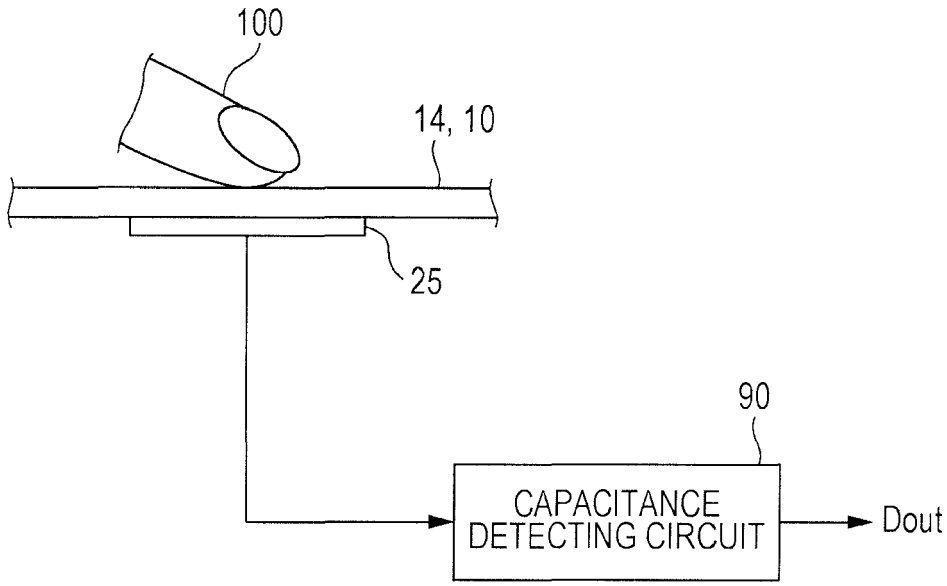


FIG. 7



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

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