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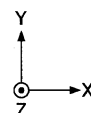
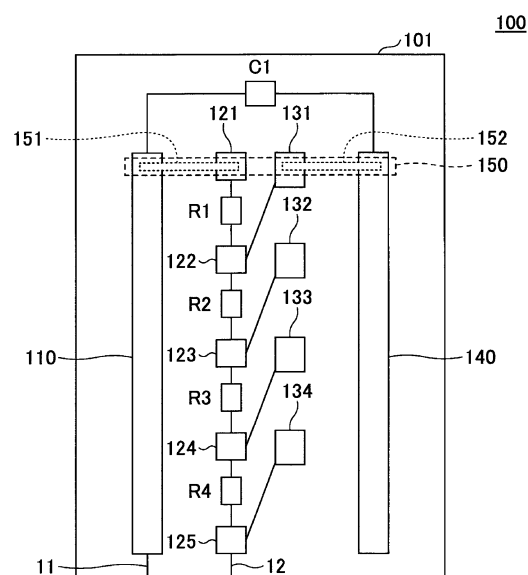
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(54) **MULTI-POINT SWITCHING DEVICE**

(57) A multi-point switching device in an embodiment has: a substrate; a first common electrode disposed on the substrate; a plurality of first switched electrodes arranged side by side along the first common electrode on the substrate; a sliding member that selects one of the plurality of first switched electrodes as an electric connection destination for the first common electrode by moving on a row composed of the plurality of first switched electrodes while in contact with the first common electrode; an electronic part, one end of which is connected to the first switched electrode selected by the sliding member; and a common protective part that is electrically connected in parallel to the electronic part through a conductive portion of the sliding member, the conductive portion being electrically connected to another end of the electronic part.

FIG. 1



Description

Technical Field

[0001] The present invention relates to a multi-point switching device.

Background Art

[0002] Conventionally, a multi-point switching device in which a plurality of switched electrodes are arranged is known as a switching device used to switch the operation of, for example, an electrical component (such as, for example, a wiper) in a vehicle in multiple stages. In PTL 1 below, for example, a technology is disclosed that is a multi-point switching device that performs switching in succession by moving a slider that slides on a common-side pattern and switching-side patterns in common. The multi-point switching device changes the resistance value of a current flowing in a first wire by moving the slider to switch a switching-side pattern, which is a connection destination for the common-side pattern, so as to change a connection position in a row of a plurality of resistors connected in series.

Citation List

Patent Literature

[0003] PTL 1: Japanese Unexamined Patent Application Publication No. 2015-216080

Summary of Invention

Technical Problem

[0004] Here, with the technology in PTL 1 above, there is the fear that when a connection destination is switched by moving the slider, static electricity enters the slider and a switching-side pattern section and resistors connected to a switching-side pattern suffer from electrostatic discharge damage. To prevent this, a method can be considered that prevents resistors from electrostatic discharge damage by, for example, a capacitor is connected in parallel to each of the plurality of resistors. However, adding a capacitor to each of the plurality of resistors leads to an increase in the number of parts. Thus, the manufacturing cost of the multi-point switching device is increased. In view of this, in a multi-point switching device that switches the electrode at a connection destination by moving the slider, it is demanded to prevent the electronic part connected to the electrode at a switching destination from electrostatic discharge damage while suppressing an increase in the manufacturing cost.

Solution to Problem

[0005] A multi-point switching device in an embodi-

ment has: a substrate; a first common electrode disposed on the substrate; a plurality of first switched electrodes arranged side by side along the first common electrode on the substrate; a sliding member that selects one of the plurality of first switched electrodes as an electric connection destination for the first common electrode by moving on a row composed of the plurality of first switched electrodes while in contact with the first common electrode; an electronic part, one end of which is connected to the first switched electrode selected by the sliding member; and a common protective part that is electrically connected in parallel to the electronic part through a conductive portion of the sliding member, the conductive portion being electrically connected to another end of the electronic part.

Advantageous Effects of Invention

[0006] According to an embodiment, in a multi-point switching device that switches the electrode at a connection destination by moving a slider, it is possible to prevent the electronic part connected to the electrode at a switching destination from electrostatic discharge damage while suppressing an increase in the manufacturing cost.

Brief Description of Drawings

[Fig. 1] Fig. 1 is a plan view indicating a multi-point switching device according to a first embodiment.

[Fig. 2A] Fig. 2A is a drawing indicating a state in which, in the multi-point switching device, a sliding member is positioned at a first switched position.

[Fig. 2B] Fig. 2B is a drawing indicating a state in which, in the multi-point switching device, the sliding member is positioned at a second switched position.

[Fig. 3] Fig. 3 is a partially enlarged view of the multi-point switching device according to the first embodiment.

[Fig. 4] Fig. 4 is a drawing indicating a first specific example of the shapes of each electrode and each slider in the multi-point switching device according to the first embodiment.

[Fig. 5] Fig. 5 is a drawing indicating a second specific example of the shapes of each electrode and each slider in the multi-point switching device according to the first embodiment.

[Fig. 6] Fig. 6 is a drawing indicating a third specific example of the shapes of each electrode and each slider in the multi-point switching device according to the first embodiment.

[Fig. 7] Fig. 7 is a drawing indicating a fourth specific example of the shapes of each electrode and each slider in the multi-point switching device according to the first embodiment.

[Fig. 8] Fig. 8 is a plan view indicating a multi-point switching device according to a second embodiment.

[Fig. 9A] Fig. 9A is a drawing indicating a state in which, in the multi-point switching device, a sliding

member is positioned at a first switched position.

[Fig. 9B] Fig. 9B is a drawing indicating a state in which, in the multi-point switching device, the sliding member is positioned at a second switched position.

[Fig. 10] Fig. 10 is a drawing indicating a first specific example of the shapes of each electrode and each slider in the multi-point switching device according to the second embodiment.

[Fig. 11] Fig. 11 is a drawing indicating a second specific example of the shapes of each electrode and each slider in the multi-point switching device according to the second embodiment.

[Fig. 12A] Fig. 12A is a plan view of the sliding member.

[Fig. 12B] Fig. 12B is a cross-sectional view of the sliding member indicated in Fig. 12A as taken along A-A.

[Fig. 12C] Fig. 12C is a cross-sectional view of the sliding member indicated in Fig. 12A as taken along B-B. Description of Embodiments

[First embodiment]

[0007] A first embodiment will be described below with reference to Figs. 1 to 3.

(Structure of a multi-point switching device 100)

[0008] Fig. 1 is a plan view indicating a multi-point switching device 100 according to the first embodiment. The multi-point switching device 100 indicated in Fig. 1 is a device intervening between a first wire 11 and a second wire 12 that are connected to an external device. This multi-point switching device 100 can switch the operation of the external device in multiple stages (five stages) by sliding and moving a sliding member 150 to select any one of switched electrodes 121 to 125 as an electrical connection destination for a first common electrode 110 so as to change a resistance value across the first wire 11 and second wire 12. Incidentally, in the description below, for the sake of convenience, the movement direction (Y-axis direction in the drawing) of the sliding member 150 will be taken as the front-back direction, and a direction (X-axis direction in the drawing) orthogonal to the movement direction of the sliding member 150 will be taken as the left-right direction.

[0009] As indicated in Fig. 1, the multi-point switching device 100 is structured by having a substrate 101, a first common electrode 110, switched electrodes (first switched electrodes) 121 to 125, resistors R1 to R4, switched electrodes (second switched electrodes) 131 to 134, a second common electrode 140, a capacitor C1, and the sliding member 150.

[0010] The substrate 101 is a thin-plate member, on the front surface of which a plurality of other constituting members are placed. For the substrate 101, a raw material such as, for example, a phenol resin or an epoxy is used. In the example indicated in Fig. 1, as a shape in

a plan view, the substrate 101 has a rectangular shape with the front-back direction (Y-axis direction in the drawing) taken as the longitudinal direction. However, the shape of the substrate 101 is not limited to this.

[0011] The first common electrode 110, which is a member that is shaped like a thin film and has conductivity, linearly extends in the front-back direction (Y-axis direction in the drawing) on the front surface of the substrate 101. For the first common electrode 110, a metal member such as, for example, copper is used. In the example indicated in Fig. 1, as a shape in a plan view, the first common electrode 110 has an elongated rectangular shape with the front-back direction (Y-axis direction in the drawing) taken as the longitudinal direction. However, the shape of the first common electrode 110 is not limited to this.

[0012] At the right side of the first common electrode 110 on the front surface of the substrate 101, the switched electrodes 121 to 125 are arranged linearly in a row at intervals of a fixed gap along the long sides of the first common electrode 110 (that is, in parallel to the first common electrode 110). Each of the switched electrodes 121 to 125 is a member that is shaped like a thin film and has conductivity. For each of the switched electrodes 121 to 125, a metal member such as, for example, copper is used. In the example indicated in Fig. 1, as a shape in a plan view, each of the switched electrodes 121 to 125 has a rectangular shape. However, the shape of each of the switched electrodes 121 to 125 is not limited to this.

[0013] The resistors R1 to R4 are each an example of "electronic part" described in the claims. One end of the resistor R1 is connected to the switched electrode 121, and the other end of the resistor R1 is connected to the switched electrode 122. One end of the resistor R2 is connected to the switched electrode 122, and the other end of the resistor R2 is connected to the switched electrode 123. One end of the resistor R3 is connected to the switched electrode 123, and the other end of the resistor R3 is connected to the switched electrode 124. One end of the resistor R4 is connected to the switched electrode 124, and the other end of the resistor R4 is connected to the switched electrode 125. Resistors having predetermined resistance values matching intended use of the multi-point switching device 100 are used as the resistors R1 to R4.

[0014] At the right side of a row composed of the switched electrodes 121 to 125 on the front surface of the substrate 101, the switched electrodes 131 to 134 are arranged linearly in a row at intervals of a fixed gap along the row composed of the switched electrodes 121 to 125 (that is, in parallel to the row composed of the switched electrodes 121 to 125). Specifically, the switched electrode 131 is placed on the right side of the switched electrode 121 and is connected to the switched electrode 122 with a wire. Also, the switched electrode 132 is placed on the right side of the switched electrode 122 and is connected to the switched electrode 123 with a wire. Also, the switched electrode 133 is placed on the

right side of the switched electrode 123 and is connected to the switched electrode 124 with a wire. Also, the switched electrode 134 is placed on the right side of the switched electrode 124 and is connected to the switched electrode 125 with a wire. Each of the switched electrodes 131 to 134 is a member that is shaped like a thin film and has conductivity. For each of the switched electrodes 131 to 134, a metal member such as, for example, copper is used. In the example indicated in Fig. 1, as a shape in a plan view, each of the switched electrodes 131 to 134 has a rectangular shape. However, the shape of each of the switched electrodes 131 to 134 is not limited to this.

[0015] At the right side of a row composed of the switched electrodes 131 to 134 on the front surface of the substrate 101, the second common electrode 140, which is a member that is shaped like a thin film and has conductivity, linearly extends in the front-back direction (Y-axis direction in the drawing) along the row composed of the switched electrodes 131 to 134 (that is, in parallel to the row composed of the switched electrodes 131 to 134). For the second common electrode 140, a metal member such as, for example, copper is used. In the example indicated in Fig. 1, as a shape in a plan view, the second common electrode 140 has an elongated rectangular shape with the front-back direction (Y-axis direction in the drawing) taken as the longitudinal direction. However, the shape of the second common electrode 140 is not limited to this.

[0016] The capacitor C1 is electrically connected in series between the first common electrode 110 and the second common electrode 140. The capacitor C1 is an example of "common protective part" described in the claims. The capacitor C1 is electrically connected in parallel to one of the resistors R1 to R4 according to the switched position of the sliding member 150. The capacitor C1 is provided to prevent electrostatic discharge damage to the resistors R1 to R4. Therefore, it is preferable to use, as the capacitor C1, a capacitor that has a capacitance and pressure resistance with which it is possible to accept static electricity that may flow in the resistors R1 to R4.

[0017] The sliding member 150 is a member provided so that it can slide and move in the front-back direction (Y-axis direction in the drawing) above (in the positive Z-axis direction in the drawing) the electrodes described above (first common electrode 110, switched electrodes 121 to 125, switched electrodes 131 to 134, and second common electrode 140). The sliding member 150 has a length extending from the first common electrode 110 to the second common electrode 140 in the left-right direction (X-axis direction in the drawing). A first slider 151 and a second slider 152 are provided on the bottom surface (surface facing the electrodes described above) of the sliding member 150 so as to be exposed. Incidentally, the first slider 151 and second slider 152 are not electrically connected to each other.

[0018] The first slider 151 has a length extending from

the first common electrode 110 to the row composed of the switched electrodes 121 to 125 in the left-right direction (X-axis direction in the drawing). Along with the slide movement of the sliding member 150 in the front-back direction, the first slider 151 slides and moves in the front-back direction on the first common electrode 110 and the row composed of the switched electrodes 121 to 125 while always in contact with the first common electrode 110. When the first slider 151 faces one of the switched electrodes 121 to 125, the first slider 151 further comes in contact with the opposing switched electrode. Due to this, the first common electrode 110 is electrically connected to the opposing switched electrode.

[0019] The second slider 152 is an example of "conductive portion" described in the claims. The second slider 152 has a length extending from the row composed of the switched electrodes 131 to 134 the second common electrode 140 in the left-right direction (X-axis direction in the drawing). Along with the slide movement of the sliding member 150 in the front-back direction, the second slider 152 slides and moves in the front-back direction on the second common electrode 140 and the row composed of the switched electrodes 131 to 134 while always in contact with the second common electrode 140. When the second slider 152 faces any one of the switched electrodes 131 to 134, the second slider 152 further comes in contact with the opposing switched electrode. Due to this, the second common electrode 140 is electrically connected to the opposing switched electrode.

[0020] The sliding member 150 can move to five switched positions (a first switched position to a fifth switched position). The first switched position is a position at which the first switched electrode selected by the sliding member 150 becomes the switched electrode 121, and at which the first slider 151 comes in contact with the switched electrode 121 and the first common electrode 110 and switched electrode 121 are electrically connected to each other. Incidentally, the first switched position is also a position at which the second switched electrode selected by the sliding member 150 becomes the switched electrode 131, and at which the second slider 152 comes into contact with the switched electrode 131 and the second common electrode 140 and switched electrode 131 are electrically connected to each other.

[0021] The second switched position is a position at which the first switched electrode selected by the sliding member 150 becomes the switched electrode 122, and at which the first slider 151 comes in contact with the switched electrode 122 and the first common electrode 110 and switched electrode 122 are electrically connected to each other. Incidentally, the second switched position is also a position at which the second switched electrode selected by the sliding member 150 becomes the switched electrode 132, and at which the second slider 152 comes into contact with the switched electrode 132 and the second common electrode 140 and switched electrode 132 are electrically connected to each other.

[0022] The third switched position is a position at which the first switched electrode selected by the sliding member 150 becomes the switched electrode 123, and at which the first slider 151 comes in contact with the switched electrode 123 and the first common electrode 110 and switched electrode 123 are electrically connected to each other. Incidentally, the third switched position is also a position at which the second switched electrode selected by the sliding member 150 becomes the switched electrode 133, and at which the second slider 152 comes into contact with the switched electrode 133 and the second common electrode 140 and switched electrode 133 are electrically connected to each other.

[0023] The fourth switched position is a position at which the first switched electrode selected by the sliding member 150 becomes the switched electrode 124, and at which the first slider 151 comes in contact with the switched electrode 124 and the first common electrode 110 and switched electrode 124 are electrically connected to each other. Incidentally, the fourth switched position is also a position at which the second switched electrode selected by the sliding member 150 becomes the switched electrode 134, and at which the second slider 152 comes into contact with the switched electrode 134 and the second common electrode 140 and switched electrode 134 are electrically connected to each other.

[0024] The fifth switched position is a position at which the first switched electrode selected by the sliding member 150 becomes the switched electrode 125, and at which the first slider 151 comes in contact with the switched electrode 125 and the first common electrode 110 and switched electrode 125 are electrically connected to each other.

(Example of the switching operation of the multi-point switching device 100)

[0025] Fig. 2 is a drawing indicating an example of the switching operation of the multi-point switching device 100 according to the first embodiment. Here, an example will be described in which the first switched electrode selected by the sliding member 150 by moving the sliding member 150 from the first switched position to the second switched position is switched from the switched electrode 121 to the switched electrode 122.

[0026] Fig. 2A indicates a state in which, in the multi-point switching device 100, the sliding member 150 is positioned at the first switched position. In this state, the first slider 151 of the sliding member 150 is in contact with both the first common electrode 110 and the switched electrode 121. Due to this, the first common electrode 110 and switched electrode 121 are electrically connected to each other. At this time, a resistance value across the first wire 11 connected to the first common electrode 110 and the second wire 12 connected to the switched electrode 125 is the sum ($R1 + R2 + R3 + R4$) of the resistance values of all resistors disposed behind the switched electrode 121. Due to this, the operation of

the external device connected to the first wire 11 and second wire 12 can be switched to an operation matching this sum ($R1 + R2 + R3 + R4$).

[0027] Also, when the sliding member 150 is positioned at the first switched position, the second slider 152 of the sliding member 150 is in contact with both the second common electrode 140 and the switched electrode 131. Due to this, the switched electrode 122 is connected to the capacitor C1 through the switched electrode 131, second slider 152, and second common electrode 140. That is, the resistor R1 and capacitor C1 are electrically connected in parallel to each other between the switched electrode 121 and the switched electrode 122. Therefore, static electricity generated on an electric path to the switched electrode 121 flows into the capacitor C1 without flowing into the resistor R1, one end of which is connected to the switched electrode 121, and electrostatic discharge damage to the resistor R1 is thereby avoided.

[0028] Fig. 2B indicates a state in which, in the multi-point switching device 100, the sliding member 150 is positioned at the second switched position. In this state, the first slider 151 of the sliding member 150 is in contact with both the first common electrode 110 and the switched electrode 122. Due to this, the first common electrode 110 and switched electrode 122 are electrically connected to each other. At this time, a resistance value across the first wire 11 connected to the first common electrode 110 and the second wire 12 connected to the switched electrode 125 is the sum ($R2 + R3 + R4$) of the resistance values of all resistors disposed behind the switched electrode 122. Due to this, the operation of the external device connected to the first wire 11 and second wire 12 can be switched to an operation matching this sum ($R2 + R3 + R4$).

[0029] Also, when the sliding member 150 is positioned at the second switched position, the second slider 152 of the sliding member 150 is in contact with both the second common electrode 140 and the switched electrode 132. Due to this, the switched electrode 123 is connected to the capacitor C1 through the switched electrode 132, second slider 152, and second common electrode 140. That is, the resistor R2 and capacitor C1 are electrically connected in parallel to each other between the switched electrode 122 and the switched electrode 123. Therefore, static electricity generated on an electric path to the switched electrode 122 flows into the capacitor C1 without flowing into the resistor R2, one end of which is connected to the switched electrode 122, and electrostatic discharge damage to the resistor R2 is thereby avoided.

[0030] Incidentally, when the sliding member 150 is positioned at the third switched position, the resistor R3, one end of which is connected to the switched electrode 123, and the capacitor C1 are electrically connected similarly in parallel to each other. Therefore, static electricity generated on an electric path to the switched electrode 123 flows into the capacitor C1 without flowing into the resistor R3, and electrostatic discharge damage to the resistor R3 is thereby avoided.

[0031] Furthermore, when the sliding member 150 is positioned at the fourth switched position, the resistor R4, one end of which is connected to the switched electrode 124, and the capacitor C1 are electrically connected similarly in parallel to each other. Therefore, static electricity generated on an electric path to the switched electrode 124 flows into the capacitor C1 without flowing into the resistor R4, and electrostatic discharge damage to the resistor R4 is thereby avoided.

(Difference in the shapes of the first switched electrode and second switched electrode)

[0032] Fig. 3 is a partially enlarged view of the multi-point switching device 100 according to the first embodiment. In the multi-point switching device 100 according to the first embodiment, not only can static electricity be bypassed to the capacitor C1, but the shapes of the mutually adjacent first switched electrode and second switched electrode (that is, the first switched electrode selected by the sliding member 150 and the second switched electrode selected by the sliding member 150) are made different from each other so that the static electricity is more reliably bypassed to the capacitor C1 without flowing into the resistors R1 to R4. Specifically, in the multi-point switching device 100 according to the first embodiment, in a relationship between the first switched electrode and second switched electrode that are mutually adjacent in the left-right direction (X-axis direction in the drawing), there is a difference in shapes as indicated below.

- The second switched electrode is longer than the first switched electrode in the front-back direction (Y-axis direction in the drawing).
- The front end of the second switched electrode is positioned ahead of the front end of the first switched electrode.
- The rear end of the second switched electrode is positioned behind the rear end of the first switched electrode.

[0033] In the example in Fig. 3, for example, the switched electrode 132, which is one second switched electrode, is longer than the switched electrode 122, which is one first switched electrode, in the front-back direction (Y-axis direction in the drawing). Also, the front end of the switched electrode 132 is positioned ahead of the front end of the switched electrode 122. Also, the rear end of the switched electrode 132 is positioned behind the rear end of the switched electrode 122.

[0034] Thus, when the sliding member 150 has moved to the second switched position from the front, the second slider 152 of the sliding member 150 comes into contact with the switched electrode 132 before the first slider 151 of the sliding member 150 comes into contact with the switched electrode 122, as indicated in Fig. 3. That is, when the first slider 151 comes into contact with the

switched electrode 122, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the switched electrode 132, so static electricity generated on the electric path to the switched electrode 122 can be more reliably bypassed to the capacitor C1.

[0035] Also, when the sliding member 150 has moved to the second switched position from the back, the second slider 152 of the sliding member 150 similarly comes into contact with the switched electrode 132 before the first slider 151 of the sliding member 150 comes into contact with the switched electrode 122. That is, when the first slider 151 comes into contact with the switched electrode 122, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the switched electrode 132, so static electricity generated on the electric path to the switched electrode 122 can be more reliably bypassed to the capacitor C1.

(First specific example of the shapes of each electrode and each slider)

[0036] Fig. 4 is a drawing indicating a first specific example of the shapes of each electrode and each slider in the multi-point switching device 100 according to the first embodiment. In this first specific example, the shapes of each electrode and each slider will be exemplified, the shapes being capable of being applied when a structure in which the sliding member 150 linearly moves in the front-back direction (Y-axis direction in the drawing) is used in the multi-point switching device 100 according to the first embodiment.

(Shape of the first slider 151)

[0037] In this first specific example indicated in Fig. 4, the first slider 151 of the sliding member 150 has a first sliding portion 151a, a second sliding portion 151b, a third sliding portion 151c, and a fourth sliding portion 151d, which are arranged in parallel to one another in the left-right direction (X-axis direction in the drawing). The first sliding portion 151a, second sliding portion 151b, third sliding portion 151c, and fourth sliding portion 151d are each a thin-plate-like member that has an elongated shape extending in the front-back direction (Y-axis direction in the drawing) and also have a spring property. The first sliding portion 151a and second sliding portion 151b are each a portion that moves on the first common electrode 110 along with the movement of the sliding member 150 while the end of the portion is in contact with the first common electrode 110. The third sliding portion 151c and fourth sliding portion 151d are each a portion the end of which comes into with one of the switched electrodes 121 to 125 while the portion is moving on the row composed of the switched electrodes 121 to 125 along with the movement of the sliding member 150. With the first slider 151, the bottom end of the first sliding portion 151a and second sliding portion 151b and the bottom end of the third sliding portion 151c and fourth

sliding portion 151d are physically and electrically connected to each other.

(Shape of the second slider 152)

[0038] Also, in this first specific example indicated in Fig. 4, the second slider 152 of the sliding member 150 has a first sliding portion 152a, a second sliding portion 152b, a third sliding portion 152c, and a fourth sliding portion 152d, which are arranged in parallel to one another in the left-right direction (X-axis direction in the drawing). The first sliding portion 152a, second sliding portion 152b, third sliding portion 152c, and fourth sliding portion 152d are each a thin-plate-like member that has an elongated shape extending in the front-back direction (Y-axis direction in the drawing) and also have a spring property. The first sliding portion 152a and second sliding portion 152b are each a portion the end of which comes into contact with one of the switched electrodes 131 to 134 while the portion is moving on the row composed of the switched electrodes 131 to 134 along with the movement of the sliding member 150. The third sliding portion 152c and fourth sliding portion 152d are each a portion that moves on the second common electrode 140 along with the movement of the sliding member 150 while the end of the portion is in contact with the second common electrode 140. With the second slider 152, the bottom end of the first sliding portion 152a and second sliding portion 152b and the bottom end of the third sliding portion 152c and fourth sliding portion 152d are physically and electrically connected to each other.

(Shape of each electrode)

[0039] Also, in the first specific example indicated in Fig. 4, each electrode has a linear shape along the movement direction of the sliding member 150 and is linearly arranged. Specifically, the first common electrode 110 and second common electrode 140 each have an elongated rectangular shape that linearly extends in the front-back direction (Y-axis direction in the drawing), which is the movement direction of the sliding member 150. The switched electrodes 121 to 125 and switched electrodes 131 to 134 are linearly arranged side by side in the front-back direction (Y-axis direction in the drawing), which is the movement direction of the sliding member 150. The switched electrodes 121 to 125 and switched electrodes 131 to 134 each have a rectangular shape.

[0040] Due to the structure in the first specific example indicated in Fig. 4, by linearly moving the sliding member 150 in the front-back direction (Y-axis direction in the drawing), the sliding member 150 can be moved to each of the first switched position to fifth switched position. At each of the first switched position to fifth switched position, the first common electrode 110 can be electrically connected to the first switched electrode by the first slider 151. In addition to this, at each of the first switched position to fourth switched position, the second common

electrode 140 can be electrically connected to the second switched electrode by the second slider 152. That is, at each of the first switched position to fourth switched position, the capacitor C1 can be electrically connected in parallel to the resistor, one end of which is connected to the first switched electrode. Therefore, static electricity generated on the electric path to the first switched electrode can be bypassed to the capacitor C1, and electrostatic discharge damage to the resistor with its one end connected to the first switched electrode can be avoided.

[0041] In this first specific example indicated in Fig. 4, noting mutually adjacent first switched electrode and second switched electrode, the second switched electrode is longer than the first switched electrode in the front-back direction (Y-axis direction in the drawing). The front end of the second switched electrode is positioned ahead of the front end of the first switched electrode, and the rear end of the second switched electrode is positioned behind the rear end of the first switched electrode. Due to this, when the sliding member 150 has moved from the front, the second slider 152 of the sliding member 150 comes into contact with the front end of the second switched electrode (the front end is the end on the side toward which the sliding member 150 approaches) before the first slider 151 of the sliding member 150 comes into contact with the front end of the first switched electrode (the front end is the end on the side toward which the sliding member 150 approaches). Also, when the sliding member 150 has moved from the back, the second slider 152 of the sliding member 150 comes into contact with the rear end of the second switched electrode (the rear end is the end on the side toward which the sliding member 150 approaches) before the first slider 151 of the sliding member 150 comes into contact with the rear end of the first switched electrode (the rear end is the end on the side toward which the sliding member 150 approaches). That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the second switched electrode, so static electricity generated on the electric path to the first switched electrode can be more reliably bypassed to the capacitor C1.

(Second specific example of the shapes of each electrode and each slider)

[0042] Fig. 5 is a drawing indicating a second specific example of the shapes of each electrode and each slider in the multi-point switching device 100 according to the first embodiment. The second specific example indicated in Fig. 5 is a variation of the first specific example indicated in Fig. 4. In this second specific example, noting mutually adjacent first switched electrode and second switched electrode, the second switched electrode has the same length in the front-back direction (Y-axis direction in the drawing) as the first switched electrode. The front end of the first sliding portion 152a of the second

slider 152 is positioned ahead of the front ends of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 (that is, when the movement direction of the sliding member 150 is taken as the positive Y-axis direction (forward), the front end of the first sliding portion 152a is positioned at a position protruding in the movement direction). Also, the front end of the second sliding portion 152b of the second slider 152 is positioned behind the front ends of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 (that is, when the movement direction of the sliding member 150 is taken as the negative Y-axis direction (backward), the front end of the first sliding portion 152a is positioned at a position protruding in the movement direction). Due to this, when the sliding member 150 has moved from the front, the front end (contact) of the second sliding portion 152b of the second slider 152 comes into contact with the second switched electrode before the front ends (contacts) of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode. Also, when the sliding member 150 has moved from the back, the front end (contact) of the first sliding portion 152a of the second slider 152 comes into contact with the second switched electrode before the front ends (contacts) of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode. That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the second switched electrode, so static electricity generated on the electric path to the first switched electrode can be more reliably bypassed to the capacitor C1.

(Third specific example of the shapes of each electrode and each slider)

[0043] Fig. 6 is a drawing indicating a third specific example of the shapes of each electrode and each slider in the multi-point switching device 100 according to the first embodiment. In this third specific example, the shapes of each electrode and each slider will be exemplified, the shapes being capable of being applied when a structure in which the sliding member 150 rotationally moves is used in the multi-point switching device 100 according to the first embodiment. Incidentally, in the third specific example indicated in Fig. 6, the shapes of the first slider 151 and second slider 152 are similar to those in the first embodiment indicated in Fig. 4.

(Shape of each electrode)

[0044] In the third specific example indicated in Fig. 6, the first common electrode 110, switched electrodes 121 to 125, switched electrodes 131 to 134, and second common electrode 140 each have a shape along the circumferential direction of concentric circles. By rotationally

moving in the circumferential direction around an axis, which is the center of the concentric circles, the sliding member 150 can switch the electrodes (first switched electrode and second switched electrode) to be selected by the sliding member 150. Specifically, the first common electrode 110 and second common electrode 140 each have an elongated sector shape extending in the circumferential direction, which is the movement direction of the sliding member 150. The switched electrodes 121 to 125 and switched electrodes 131 to 134 are arranged side by side in the circumferential direction, which is the movement direction of the sliding member 150. The switched electrodes 121 to 125 and switched electrodes 131 to 134 each have a sector shape along the circumferential direction.

[0045] Due the structure in the third specific example indicated in Fig. 6, by rotationally moving the sliding member 150 in the circumferential direction, the sliding member 150 can be moved to each of the first switched position to fifth switched position. At each of the first switched position to fifth switched position, the first common electrode 110 can be electrically connected to the first switched electrode by the first slider 151. In addition to this, at each of the first switched position to fourth switched position, the second common electrode 140 can be electrically connected to the second switched electrode by the second slider 152. That is, at each of the first switched position to fourth switched position, the capacitor C1 can be electrically connected in parallel to the resistor, one end of which is connected to the first switched electrode. Therefore, static electricity generated on the electric path to the first switched electrode can be bypassed to the capacitor C1, and electrostatic discharge damage to the resistor with its one end connected to the first switched electrode can be avoided.

[0046] In the structure in the third specific example indicated in Fig. 6, noting mutually adjacent first switched electrode and second switched electrode, when the length of the first switched electrode in the circumferential direction is assumed to be equivalent to the rotational angle θ of the sliding member 150, the length of the second switched electrode is a length equivalent to the rotational angle $\theta + \alpha$ of the sliding member 150. The front end of the second switched electrode is positioned ahead of the front end of the first switched electrode in the circumferential direction. The rear end of the second switched electrode is positioned behind the rear end of the first switched electrode in the circumferential direction. Due to this, when the sliding member 150 has rotationally moved from the front, the second slider 152 of the sliding member 150 comes into contact with the front end of the second switched electrode (the front end is the end on the side toward which the sliding member 150 approaches) before the first slider 151 of the sliding member 150 comes into contact with the front end of the first switched electrode (the front end is the end on the side toward which the sliding member 150 approaches). Also, when the sliding member 150 has rotationally moved

from the back, the second slider 152 of the sliding member 150 comes into contact with the rear end of the second switched electrode (the rear end is the end on the side toward which the sliding member 150 approaches) before the first slider 151 of the sliding member 150 comes into contact with the rear end of the first switched electrode (the rear end is the end on the side toward which the sliding member 150 approaches). That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the second switched electrode, so static electricity generated on the electric path to the first switched electrode can be more reliably bypassed to the capacitor C1.

(Fourth specific example of the shapes of each electrode and each slider)

[0047] Fig. 7 is a drawing indicating a fourth specific example of the shapes of each electrode and each slider in the multi-point switching device 100 according to the first embodiment. The fourth specific example indicated in Fig. 7 is a variation of the third specific example indicated in Fig. 6. In this fourth specific example, noting mutually adjacent first switched electrode and second switched electrode, when the length of the first switched electrode in the circumferential direction is assumed to be equivalent to the rotational angle θ of the sliding member 150, the length of the second switched electrode is also a length equivalent to the rotational angle θ of the sliding member 150. The front end of the first sliding portion 152a of the second slider 152 is positioned at a position protruding forward in the circumferential direction with respect to the front ends of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151. Also, the front end of the second sliding portion 152b of the second slider 152 is positioned at a position protruding backward in the circumferential direction with respect to the front ends of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151. Due to this, when the sliding member 150 has rotationally moved from the front, the front end (contact) of the second sliding portion 152b of the second slider 152 comes into contact with the second switched electrode before the front ends (contacts) of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode. Also, when the sliding member 150 has rotationally moved from the back, the front end (contact) of the first sliding portion 152a of the second slider 152 comes into contact with the second switched electrode before the front ends (contacts) of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode. That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C1 is already in a state in which the capacitor C1 has been electrically connected to the second switched electrode, so static electricity generated on the

electric path to the first switched electrode can be more reliably bypassed to the capacitor C1.

[0048] As described so far, the multi-point switching device 100 according to the first embodiment has: the substrate 101; the first common electrode 110 disposed on the substrate 101; the switched electrodes 121 to 125 (a plurality of first switched electrodes) arranged side by side along the first common electrode 110 on the substrate 101; the sliding member 150 that selects one of the switched electrodes 121 to 125 as an electric connection destination for the first common electrode 110 by moving on a row composed of the switched electrodes 121 to 125 while in contact with the first common electrode 110; an electronic part (one of the resistors R1 to R4), one end of which is connected to the switched electrode (one of the switched electrodes 121 to 124) selected by the sliding member 150; and the capacitor C1 (common protective part) that is electrically connected in parallel to the electronic part through the second slider 152 (conductive portion) of the sliding member 150, the second slider 152 being electrically connected to another end of the electronic part. Due to this, according to the multi-point switching device 100 according to the first embodiment, when a switchover is made to a switched electrode to be selected by the sliding member 150 by sliding and moving the sliding member 150, it is possible to bypass, to the capacitor C1, static electricity generated to an electric path to the switched electrode newly selected by the sliding member 150. Therefore, it is possible to avoid electrostatic discharge damage to the electronic part (one of the resistors R1 to R4), one end of which is connected to the switched electrode (one of the switched electrodes 121 to 124) to be newly selected by the sliding member 150. In particular, the multi-point switching device 100 according to the first embodiment uses a structure in which a parallel connection is formed by sharing one capacitor C1. Therefore, according to the multi-point switching device 100 according to the first embodiment, it is possible to suppress an increase in the manufacturing cost and prevent the electronic part, one end of which is connected to the switched electrode to be newly selected by the sliding member 150, from electrostatic discharge damage.

[Second embodiment]

[0049] Next, a second embodiment will be described with reference to Fig. 8 to Fig. 12.

(Structure of a multi-point switching device 100A)

[0050] Fig. 8 is a plan view indicating a multi-point switching device 100A according to a second embodiment. In the multi-point switching device 100A in the second embodiment, constituting elements similar to those in the multi-point switching device 100 in the first embodiment will be assigned the same reference characters as those in the multi-point switching device 100 in the first

embodiment, and detailed descriptions will be omitted.

[0051] The multi-point switching device 100A indicated in Fig. 8 differs from the multi-point switching device 100 in the first embodiment in that a sliding member 150A is provided instead of the sliding member 150, a capacitor C2 is provided in the sliding member 150A instead of the capacitor C1, and the second common electrode 140 is not provided.

[0052] As indicated in Fig. 8, in the second embodiment, the capacitor C2, which is provided in the sliding member 150A, is electrically connected between the first slider 151 and the second slider 152 in the sliding member 150A. That is, in this second embodiment, the capacitor C2 is electrically connected in parallel to an electronic part (one of the resistors R1 to R4), one end of which is connected to the first switched electrode (one of the switched electrodes 121 to 124) selected by the sliding member 150A by sliding together with the sliding member 150A. Due to this, the capacitor C2 can prevent electrostatic discharge damage to the resistors R1 to R4 as in the first embodiment. Incidentally, since the structure in which the second common electrode 140 is omitted is used, the length of the second slider 152 of the sliding member 150A is shorter than in the first embodiment in the left-right direction (X-axis direction in the drawing).

(Example of the switching operation of the multi-point switching device 100A)

[0053] Fig. 9 is a drawing indicating an example of the switching operation of the multi-point switching device 100A according to the second embodiment. Here, an example will be described in which the first switched electrode selected by the sliding member 150A is switched from the switched electrode 121 to the switched electrode 122.

[0054] Fig. 9A indicates a state in which, in the multi-point switching device 100A, the sliding member 150A is positioned at the first switched position. With the sliding member 150A positioned at the first switched position like this, the second slider 152 of the sliding member 150A is in contact with the switched electrode 131. Due to this, the switched electrode 122 is connected to the capacitor C2 through the switched electrode 131 and second slider 152. That is, the resistor R1 and capacitor C2 are electrically connected in parallel to each other between the switched electrode 121 and the switched electrode 122. Therefore, static electricity generated on an electric path to the switched electrode 121 flows into the capacitor C2 without flowing into the resistor R1, one end of which is connected to the switched electrode 121, and electrostatic discharge damage to the resistor R1 is thereby avoided.

[0055] Fig. 9B indicates a state in which, in the multi-point switching device 100A, the sliding member 150A is positioned at the second switched position. With the sliding member 150A positioned at the second switched

position like this, the second slider 152 of the sliding member 150A is in contact with the switched electrode 132. Due to this, the switched electrode 123 is connected to the capacitor C2 through the switched electrode 132 and second slider 152. That is, the resistor R2 and capacitor C2 are electrically connected in parallel to each other between the switched electrode 122 and the switched electrode 123. Therefore, static electricity generated on an electric path to the switched electrode 122 flows into the capacitor C2 without flowing into the resistor R2, one end of which is connected to the switched electrode 122, and electrostatic discharge damage to the resistor R2 is thereby avoided.

[0056] Incidentally, when the sliding member 150A is positioned at the third switched position, the resistor R3 and the capacitor C2 are electrically connected similarly in parallel to each other. Therefore, static electricity generated on an electric path to the switched electrode 123 flows into the capacitor C2 without flowing into the resistor R3, one end of which is connected to the switched electrode 123, and electrostatic discharge damage to the resistor R3 is thereby avoided.

[0057] Furthermore, when the sliding member 150A is positioned at the fourth switched position, the resistor R4 and the capacitor C2 are electrically connected similarly in parallel to each other. Therefore, static electricity generated on an electric path to the switched electrode 124 flows into the capacitor C2 without flowing into the resistor R4, one end of which is connected to the switched electrode 124, and electrostatic discharge damage to the resistor R4 is thereby avoided.

(First specific example of the shapes of each electrode and each slider)

[0058] Fig. 10 is a drawing indicating a first specific example of the shapes of each electrode and each slider in the multi-point switching device 100A according to the second embodiment. In this first specific example, the shapes of each electrode and each slider will be exemplified, the shapes being capable of being applied when a structure in which the sliding member 150A linearly moves in the front-back direction (Y-axis direction in the drawing) is used in the multi-point switching device 100A according to the second embodiment.

(Shape of the first slider 151)

[0059] In this first specific example indicated in Fig. 10, the first slider 151 of the sliding member 150A has a first sliding portion 151a, a second sliding portion 151b, a third sliding portion 151c, and a fourth sliding portion 151d, which are arranged in parallel to one another in the left-right direction (X-axis direction in the drawing). The first sliding portion 151a, second sliding portion 151b, third sliding portion 151c, and fourth sliding portion 151d are each a thin-plate-like member that has an elongated shape extending in the front-back direction (Y-axis

direction in the drawing) and also have a spring property. The first sliding portion 151a and second sliding portion 151b are each a portion that moves on the first common electrode 110 along with the movement of the sliding member 150A while the end of the portion is in contact with the first common electrode 110. The third sliding portion 151c and fourth sliding portion 151d are each a portion the end of which comes into contact with one of the switched electrodes 121 to 125 while the portion is moving on the row composed of the switched electrodes 121 to 125 along with the movement of the sliding member 150A. With the first slider 151, the bottom end of the first sliding portion 151a and second sliding portion 151b and the bottom end of the third sliding portion 151c and fourth sliding portion 151d are physically and electrically connected to each other.

(Shape of the second slider 152)

[0060] Also, in this first specific example indicated in Fig. 10, the second slider 152 of the sliding member 150A has a first sliding portion 152a and a second sliding portion 152b, which are arranged in parallel to each other in the left-right direction (X-axis direction in the drawing). The first sliding portion 152a and second sliding portion 152b are each a thin-plate-like member that has an elongated shape extending in the front-back direction (Y-axis direction in the drawing) and also have a spring property. The first sliding portion 152a and second sliding portion 152b are each a portion the end of which comes into contact with one of the switched electrodes 131 to 134 while the portion is moving on the row composed of the switched electrodes 131 to 134 along with the movement of the sliding member 150A.

(Shape of each electrode)

[0061] Also, in the first specific example indicated in Fig. 10, each electrode has a linear shape along the movement direction of the sliding member 150A and is linearly arranged. Specifically, the first common electrode 110 has an elongated rectangular shape that linearly extends in the front-back direction (Y-axis direction in the drawing), which is the movement direction of the sliding member 150A. The switched electrodes 121 to 125 and switched electrodes 131 to 134 are linearly arranged side by side in the front-back direction (Y-axis direction in the drawing), which is the movement direction of the sliding member 150A. The switched electrodes 121 to 125 and switched electrodes 131 to 134 each have a rectangular shape.

(Capacitor C2)

[0062] Also, in the first specific example indicated in Fig. 10, the capacitor C2 is provided in the sliding member 150A. Specifically, the capacitor C2 is disposed so as to span the first slider 151 and second slider 152. One end

of the capacitor C2 is electrically connected to the first slider 151. The other end of the capacitor C2 is electrically connected to the second slider 152.

[0063] Due to the structure in the first specific example indicated in Fig. 10, by linearly moving the sliding member 150A in the front-back direction (Y-axis direction in the drawing), the sliding member 150A can be moved to each of the first switched position to fifth switched position. At each of the first switched position to fifth switched position, the first common electrode 110 can be electrically connected to the first switched electrode by the first slider 151. In addition to this, since the capacitor C2 is provided in the sliding member 150A, at each of the first switched position to fourth switched position, the capacitor C2 can be electrically connected between the first switched electrode and the second switched electrode. That is, at each of the first switched position to fourth switched position, the capacitor C2 can be electrically connected in parallel to the resistor, one end of which is connected to the first switched electrode. Therefore, static electricity generated on the electric path to the first switched electrode can be bypassed to the capacitor C2, and electrostatic discharge damage to the resistor with its one end connected to the first switched electrode can be avoided.

[0064] In this first specific example indicated in Fig. 10, noting mutually adjacent first switched electrode and second switched electrode, the second switched electrode is longer than the first switched electrode in the front-back direction (Y-axis direction in the drawing). The front end of the second switched electrode is positioned ahead of the front end of the first switched electrode, and the rear end of the second switched electrode is positioned behind the rear end of the first switched electrode. Due to this, when the sliding member 150A has moved from the front, the second slider 152 of the sliding member 150A comes into contact with the front end of the second switched electrode (the front end is the end on the side toward which the sliding member 150A approaches) before the first slider 151 of the sliding member 150A comes into contact with the front end of the first switched electrode (the front end is the end on the side toward which the sliding member 150A approaches). Also, when the sliding member 150A has moved from the back, the second slider 152 of the sliding member 150A comes into contact with the rear end of the second switched electrode (the rear end is the end on the side toward which the sliding member 150A approaches) before the first slider 151 of the sliding member 150A comes into contact with the rear end of the first switched electrode (the rear end is the end on the side toward which the sliding member 150A approaches). That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C2 is already in a state in which the capacitor C2 has been electrically connected to the second switched electrode, so static electricity generated on the electric path to the first switched electrode can be more reliably bypassed to the capacitor C2.

[0065] Incidentally, as a variation of the first specific

example indicated in Fig. 10, a structure may be used in which by making the lengths of the first sliding portion 152a and second sliding portion 152b of the second slider 152 different from the lengths of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 as in the first embodiment (Fig. 5), the first sliding portion 152a and second sliding portion 152b of the second slider 152 come into contact with the second switched electrode before the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode.

(Second specific example of the shapes of each electrode and each slider)

[0066] Fig. 11 is a drawing indicating a second specific example of the shapes of each electrode and each slider in the multi-point switching device 100A according to the second embodiment. In this second specific example, the shapes of each electrode and each slider will be exemplified, the shapes being capable of being applied when a structure in which the sliding member 150A rotationally moves is used in the multi-point switching device 100A according to the second embodiment. Incidentally, in the second specific example indicated in Fig. 11, the shapes of the first slider 151 and second slider 152 are similar to those in the first embodiment indicated in Fig. 10.

(Shape of each electrode)

[0067] In the second specific example indicated in Fig. 11, the first common electrode 110, switched electrodes 121 to 125, and switched electrodes 131 to 134 each have a shape along the circumferential direction of concentric circles. By rotationally moving in the circumferential direction around an axis, which is the center of the concentric circles, the sliding member 150A can switch the electrodes (first switched electrode and second switched electrode) to be selected by the sliding member 150A. Specifically, the first common electrode 110 has an elongated sector shape extending in the circumferential direction, which is the movement direction of the sliding member 150A. The switched electrodes 121 to 125 and switched electrodes 131 to 134 are arranged side by side in the circumferential direction, which is the movement direction of the sliding member 150A. Each of the switched electrodes 121 to 125 and switched electrodes 131 to 134 has a sector shape along the circumferential direction.

[0068] Due the structure in the second specific example indicated in Fig. 11, by rotationally moving the sliding member 150A in the circumferential direction, the sliding member 150A can be moved to each of the first switched position to fifth switched position. At each of the first switched position to fifth switched position, the first common electrode 110 can be electrically connected to the first switched electrode by the first slider 151. In addition

to this, since the capacitor C2 is provided in the sliding member 150A, at each of the first switched position to fourth switched position, the capacitor C2 can be electrically connected between the first switched electrode and the second switched electrode. That is, at each of the first switched position to fourth switched position, the capacitor C2 can be electrically connected in parallel to the resistor, one end of which is connected to the first switched electrode. Therefore, static electricity generated on the electric path to the first switched electrode can be bypassed to the capacitor C2, and electrostatic discharge damage to the resistor with its one end connected to the first switched electrode can be avoided.

[0069] In the structure in the second specific example indicated in Fig. 11, noting mutually adjacent first switched electrode and second switched electrode, when the length of the first switched electrode in the circumferential direction is assumed to be equivalent to the rotational angle θ of the sliding member 150A, the length of the second switched electrode is a length equivalent to the rotational angle $\theta + \alpha$ of the sliding member 150A. The front end of the second switched electrode is positioned ahead of the front end of the first switched electrode in the circumferential direction. The rear end of the second switched electrode is positioned behind the rear end of the first switched electrode in the circumferential direction. Due to this, when the sliding member 150A has rotationally moved from the front, the second slider 152 of the sliding member 150A comes into contact with the front end of the second switched electrode (the front end is the end on the side toward which the sliding member 150A approaches) before the first slider 151 of the sliding member 150A comes into contact with the front end of the first switched electrode (the front end is the end on the side toward which the sliding member 150A approaches). Also, when the sliding member 150A has rotationally moved from the back, the second slider 152 of the sliding member 150A comes into contact with the rear end of the second switched electrode (the rear end is the end on the side toward which the sliding member 150A approaches) before the first slider 151 of the sliding member 150A comes into contact with the rear end of the first switched electrode (the rear end is the end on the side toward which the sliding member 150A approaches). That is, when the first slider 151 comes into contact with the first switched electrode, the capacitor C2 is already in a state in which the capacitor C2 has been electrically connected to the second switched electrode, so static electricity generated on the electric path to the first switched electrode can be more reliably bypassed to the capacitor C2.

[0070] Incidentally, as a variation of the second specific example indicated in Fig. 11, a structure may be used in which by making the lengths of the first sliding portion 152a and second sliding portion 152b of the second slider 152 different from the lengths of the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 as in the first embodiment (Fig. 7), the first sliding portion

152a and second sliding portion 152b of the second slider 152 come into contact with the second switched electrode before the third sliding portion 151c and fourth sliding portion 151d of the first slider 151 come into contact with the first switched electrode.

(Example of the structure of the sliding member 150A)

[0071] Fig. 12 is a drawing indicating an example of the structure of the sliding member 150A in the multi-point switching device 100A according to the second embodiment. Fig. 12A is a plan view of the sliding member 150A. Fig. 12B is a cross-sectional view of the sliding member 150A indicated in Fig. 12A as taken along A-A. Fig. 12C is a cross-sectional view of the sliding member 150A indicated in Fig. 12A as taken along B-B.

[0072] As indicated in Fig. 12, the sliding member 150A has the first slider 151, the second slider 152, a case 153, and the capacitor C2. The case 153 is a vessel-like member that accommodates the first slider 151, second slider 152, and capacitor C2. In the bottom surface of the case 153, an opening 153A is formed in which the first slider 151, second slider 152, and capacitor C2 are accommodated.

[0073] During the assembling of the sliding member 150A, the capacitor C2 is first placed in the opening 153A in the case 153. Then, the bottom end of the first slider 151 and the bottom end of the second slider 152 are fitted to predetermined positions in the opening 153A in the case 153 while these bottoms are pressed against the capacitor C2. At this time, one terminal of the capacitor C2 comes into contact with the bottom end of the first slider 151, and the other end of the capacitor C2 comes into contact with the bottom end of the second slider 152.

[0074] In the opening 153A, a locking portion (not illustrated) is provided that locks the bottom end of the first slider 151 and the bottom end of the second slider 152, these bottoms having been fitted to the predetermined positions. Due to this, the first slider 151 and second slider 152 are stably fixed in the opening 153A in a state in which they are in contact with the capacitor C2, so the first slider 151 and second slider 152 do not rattle in the opening 153A, nor do they easily come off the opening 153A.

[0075] Since the sliding member 150A has the structure described above, a troublesome work operation such as soldering the capacitor C2 to the first slider 151 and second slider 152 is not required, so assembling can be easily performed. Therefore, the sliding member 150A can contribute to a reduction in the manufacturing cost of the multi-point switching device 100A.

[0076] As described above, in the multi-point switching device 100A according to the second embodiment, the capacitor C2 (common protective member) is accommodated in the case 153. Therefore, the capacitor C2 is electrically connected in parallel to an electronic part (one of the resistors R1 to R4), one end of which is connected to the first switched electrode (one of the switched elec-

trodes 121 to 124) selected by the sliding member 150A by sliding together with the sliding member 150A. Due to this, according to the multi-point switching device 100A according to the second embodiment, neither a space in which the capacitor C1 is placed in the substrate 101 nor a space in which the second common electrode 140 is placed on the substrate 101 is required when compared with the multi-point switching device 100 according to the first embodiment. According to the multi-point switching device 100A according to the second embodiment, therefore, the substrate 101 can be downsized, that is, the entire size of the multi-point switching device 100A can be downsized.

[0077] So far, embodiments of the present invention has been described in detail. However, the present invention is not limited to these embodiments, and various variations and modifications are possible without departing from the intended scope of the present invention described in the claims.

[0078] For example, although, in the above embodiments, examples have been described in which the present invention is applied to a multi-point switching device that can make a switchover in five stages, this is not a limitation. The present invention can be applied to, for example, a multi-point switching device that can make a switchover in four stages. The present invention can also be applied to, for example, a multi-point switching device that can make a switchover in six stages.

[0079] Also, although, in the above embodiments, a capacitor is used as an example of "common protective part" described in the claims, this is not a limitation. "Common protective part" described in the claims may be, for example, a zener diode (TVS diode), an ESD suppressor, a laminated chip capacitor, or the like.

[0080] Also, although, in the above embodiments, a resistor is used as an example of "electronic part" described in the claims, this is not a limitation. "Electronic part" described in the claims may be, for example, any electronic part such as an LED. Also, "electronic part" described in the claims may be, for example, a combination of a plurality of electronic parts.

[0081] This international application claims priority based on Japanese Patent Application No. 2017-134100 filed on July 7, 2017, and the entire contents of the application are incorporated in this international application by reference.

Reference Signs List

[0082]

100 multi-point switching device

101 substrate

110 first common electrode

121 to 125 switched electrode (first switched electrode)

131 to 134 switched electrode (second switched electrode)

140 second common electrode
 150 sliding member
 C1 capacitor (common protective part)
 R1 to R4 resistor (electronic part)

Claims

1. A multi-point switching device comprising:

a substrate;
 a first common electrode disposed on the substrate;
 a plurality of first switched electrodes arranged side by side along the first common electrode on the substrate;
 a sliding member that selects one of the plurality of first switched electrodes as an electric connection destination for the first common electrode by moving on a row composed of the plurality of first switched electrodes while in contact with the first common electrode;
 an electronic part, one end of which is connected to the first switched electrode selected by the sliding member; and
 a common protective part that is electrically connected in parallel to the electronic part through a conductive portion of the sliding member, the conductive portion being electrically connected to another end of the electronic part.

2. The multi-point switching device according to Claim 1, further comprising:

a plurality of second switched electrodes arranged side by side along the row composed of the plurality of first switched electrodes; and
 a second common electrode extending along a row composed of the plurality of second switched electrodes;

wherein

the common protective part is electrically connected to the second common electrode, and
 at each switched position, the sliding member electrically interconnects the first common electrode and the first switched electrode selected by the sliding member, electrically interconnects the second switched electrode and the second common electrode through the conductive portion, and electrically connects the common protective part in parallel to the electronic part, one end of which is connected to the first switched electrode selected by the sliding member.

3. The multi-point switching device according to Claim 1, further comprising a plurality of second switched

electrodes arranged side by side along the row composed of the plurality of first switched electrodes, wherein
 the common protective part is provided in the sliding member, and
 at each switched position, the sliding member electrically interconnects the first common electrode and the first switched electrode selected by the sliding member, electrically interconnects the second switched electrode and the common protective part through the conductive portion, and electrically connects the common protective part in parallel to the electronic part, one end of which is connected to the first switched electrode selected by the sliding member.

4. The multi-point switching device according to Claim 2 or 3, wherein when the sliding member selects each switched position, the sliding member electrically interconnects the second switched electrode selected by the sliding member and the second common electrode or the common protective part before the sliding member electrically interconnects the first common electrode and the first switched electrode selected by the sliding member.

5. The multi-point switching device according to Claim 4, wherein when the sliding member moves, an end of the second switched electrode selected by the sliding member, the end being on a side toward which the sliding member approaches, is positioned at a position closer to the sliding member than is an end of the first switched electrode selected by the sliding member, the end being on a side toward which the sliding member approaches.

6. The multi-point switching device according to Claim 4, wherein when the sliding member moves toward the first switched electrode to be selected by the sliding member, a contact at which the sliding member will come into contact with the second switched electrode to be selected by the sliding member is positioned at a position protruding in a direction in which the sliding member moves, with respect to a contact at which the sliding member will come into contact with the first switched electrode to be selected by the sliding member.

7. The multi-point switching device according to any one of Claims 1 to 6, wherein the electronic part is electrically connected in series between each pair of adjustment first switched electrodes.

FIG. 1

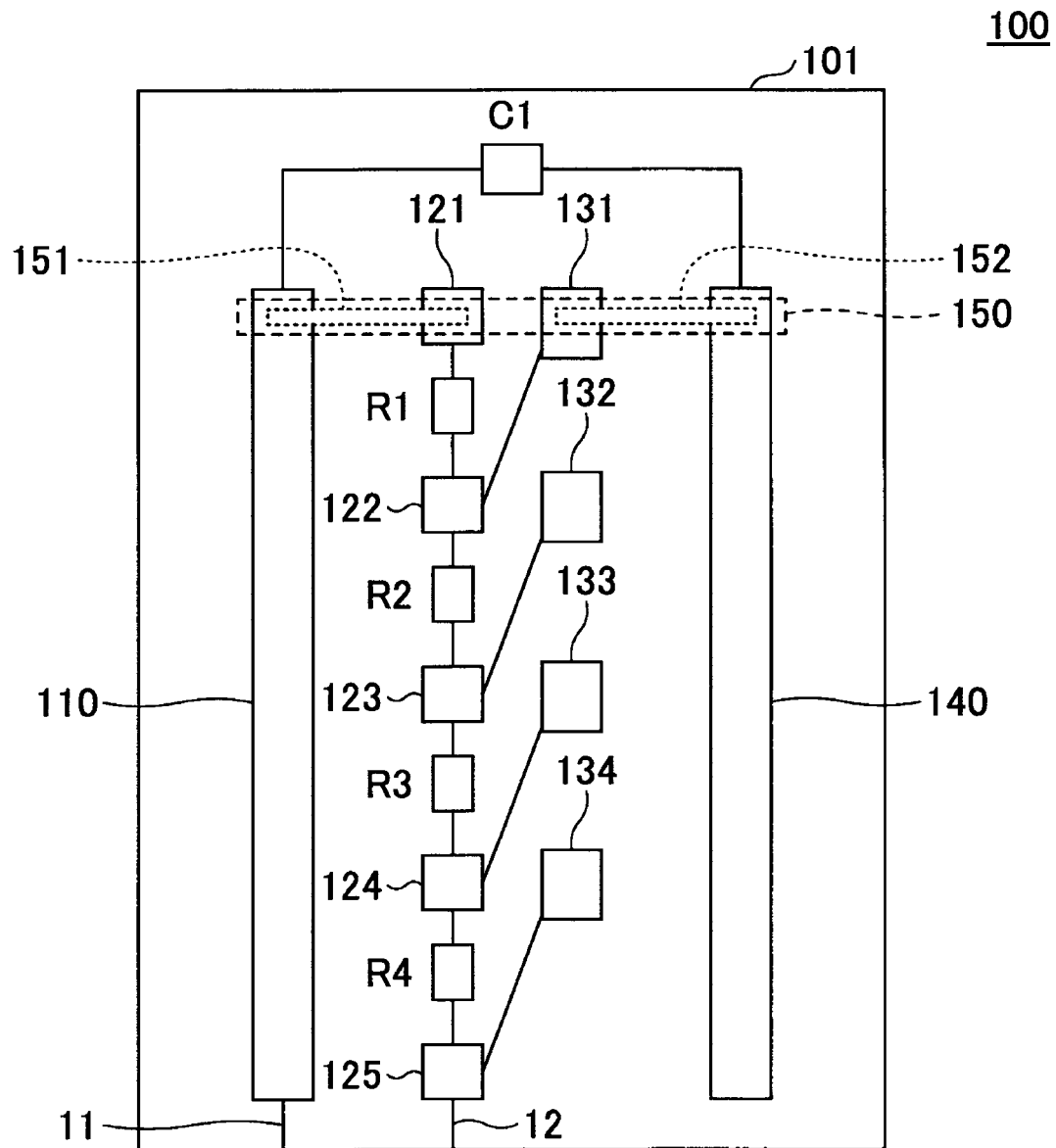


FIG. 2A

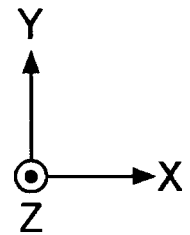
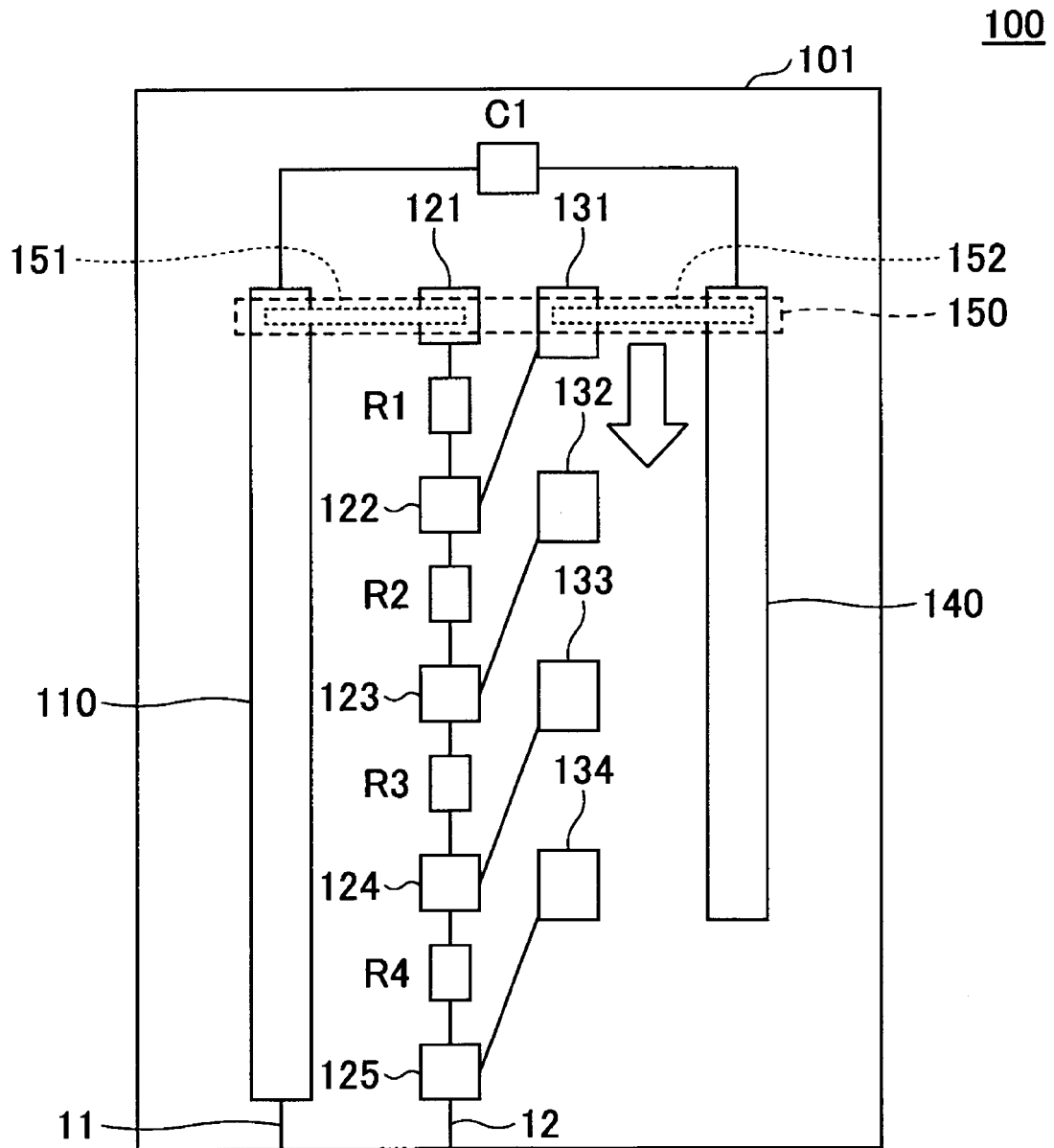


FIG. 2B

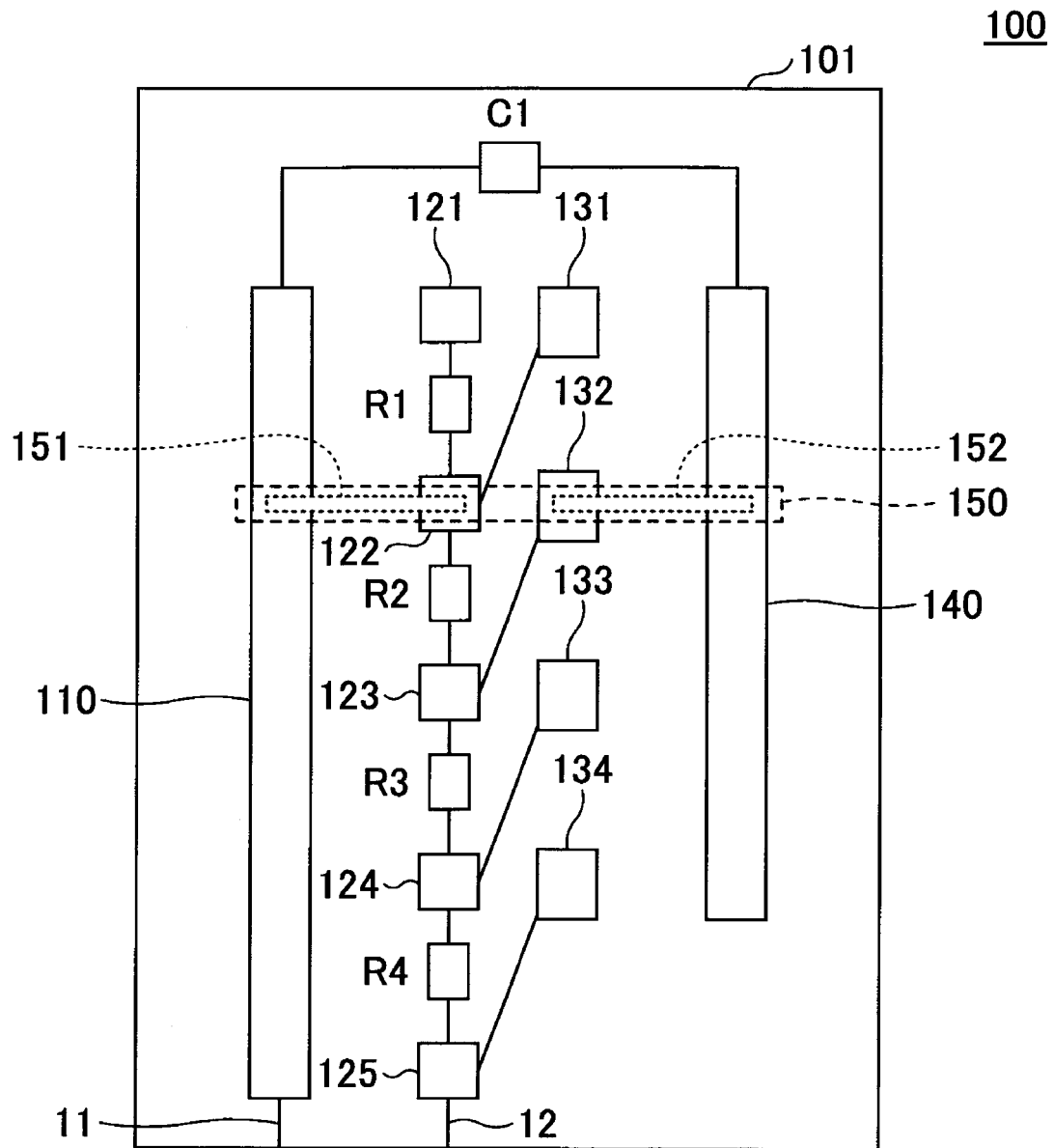


FIG. 3

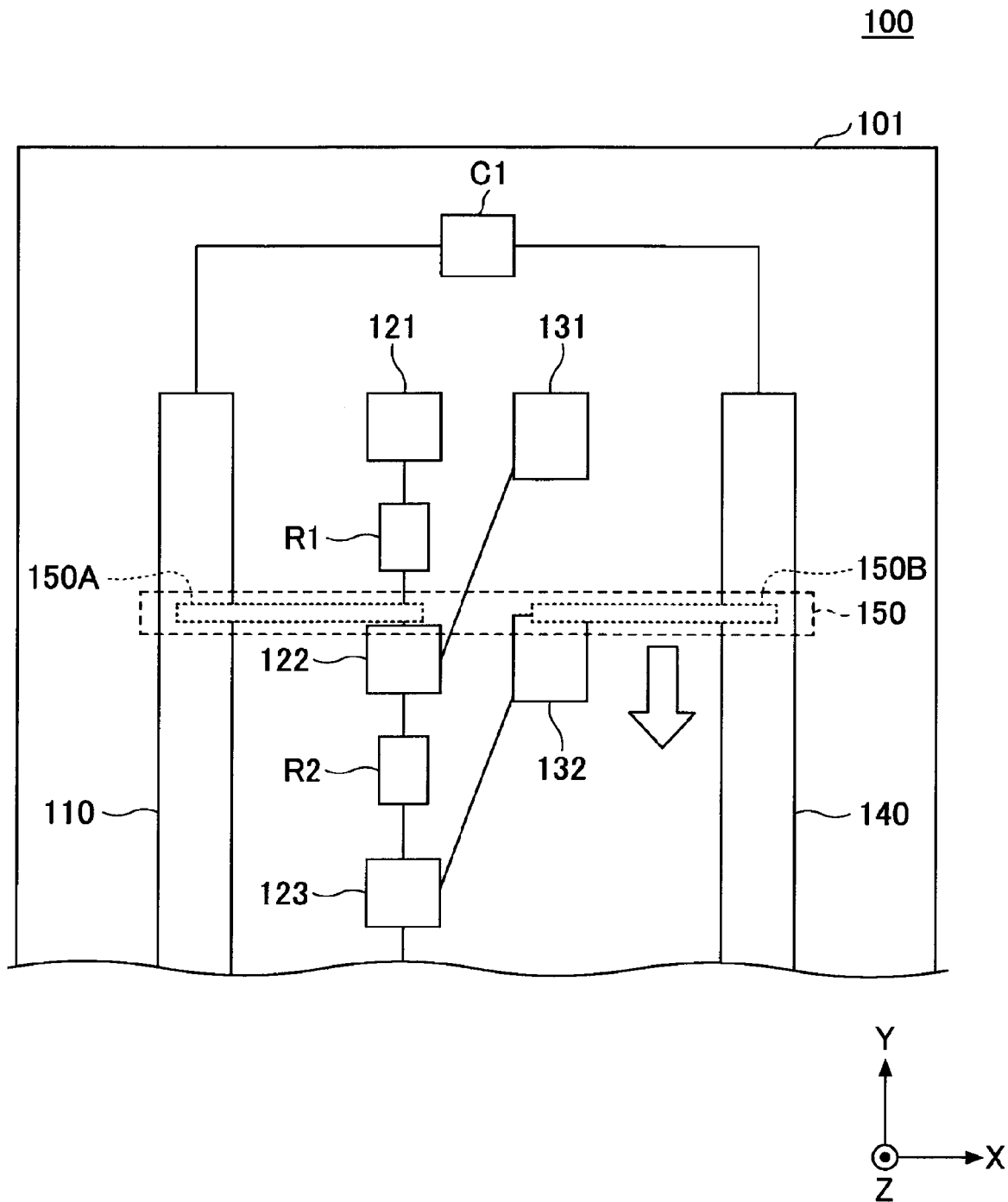


FIG. 4

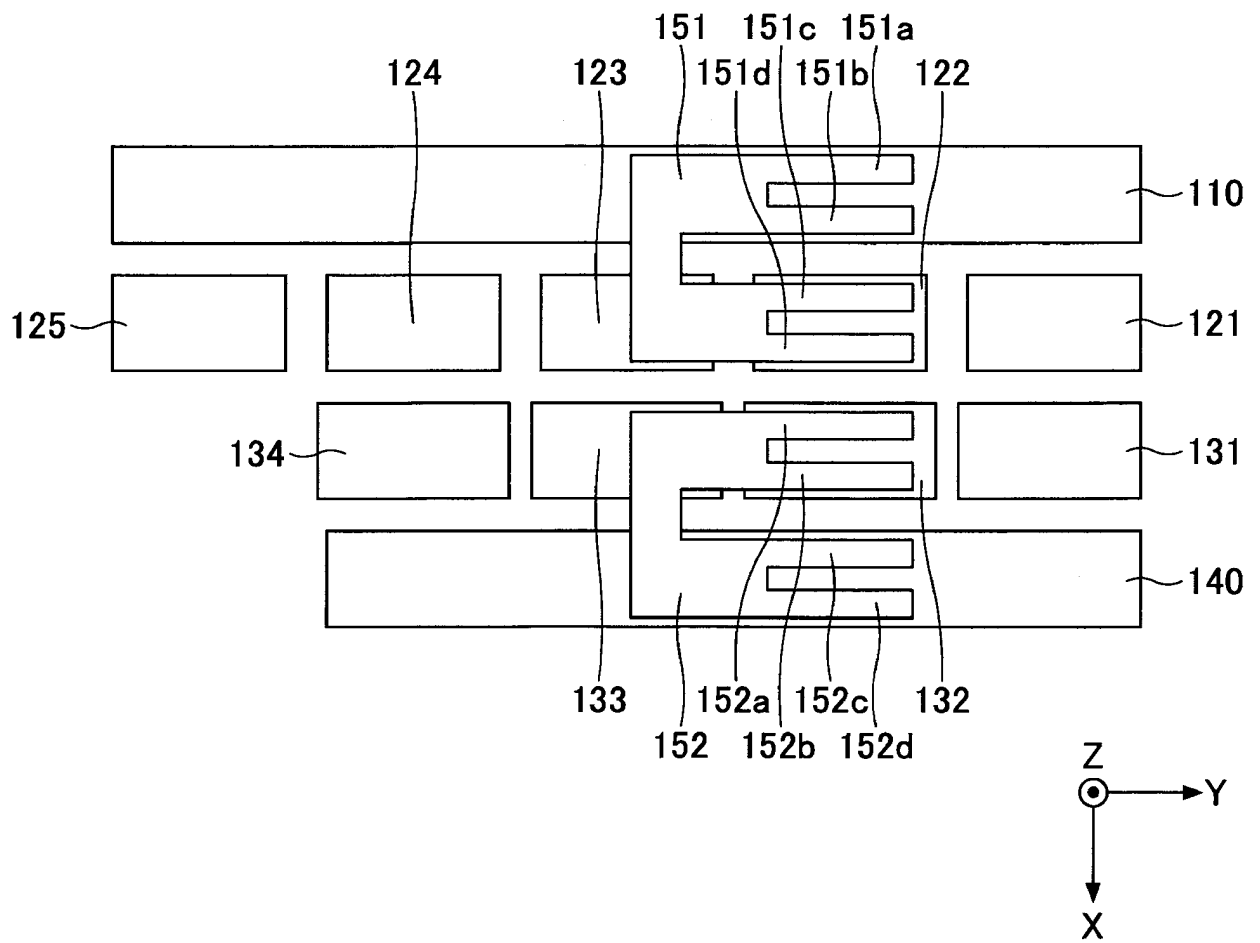


FIG. 5

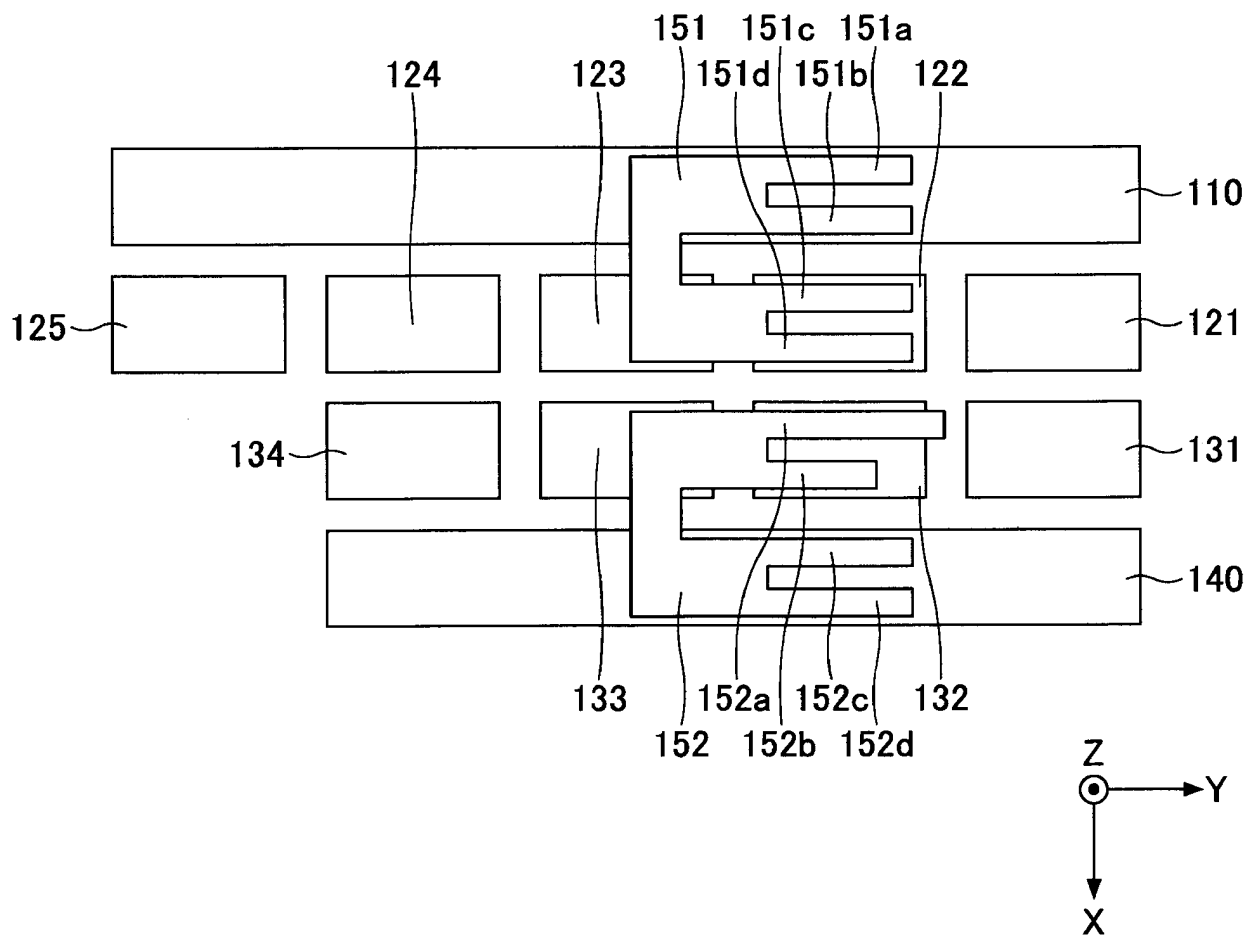


FIG. 6

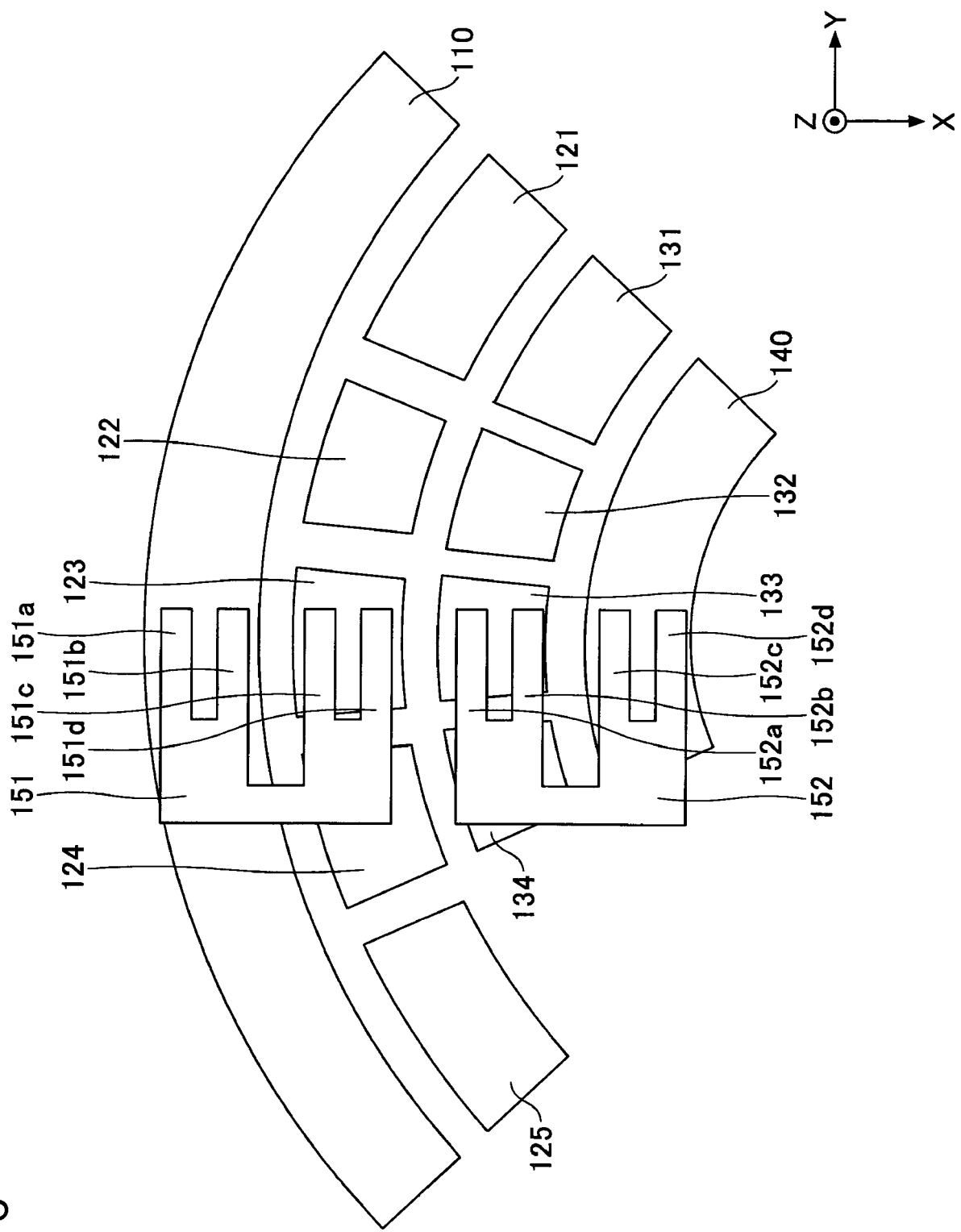


FIG. 7

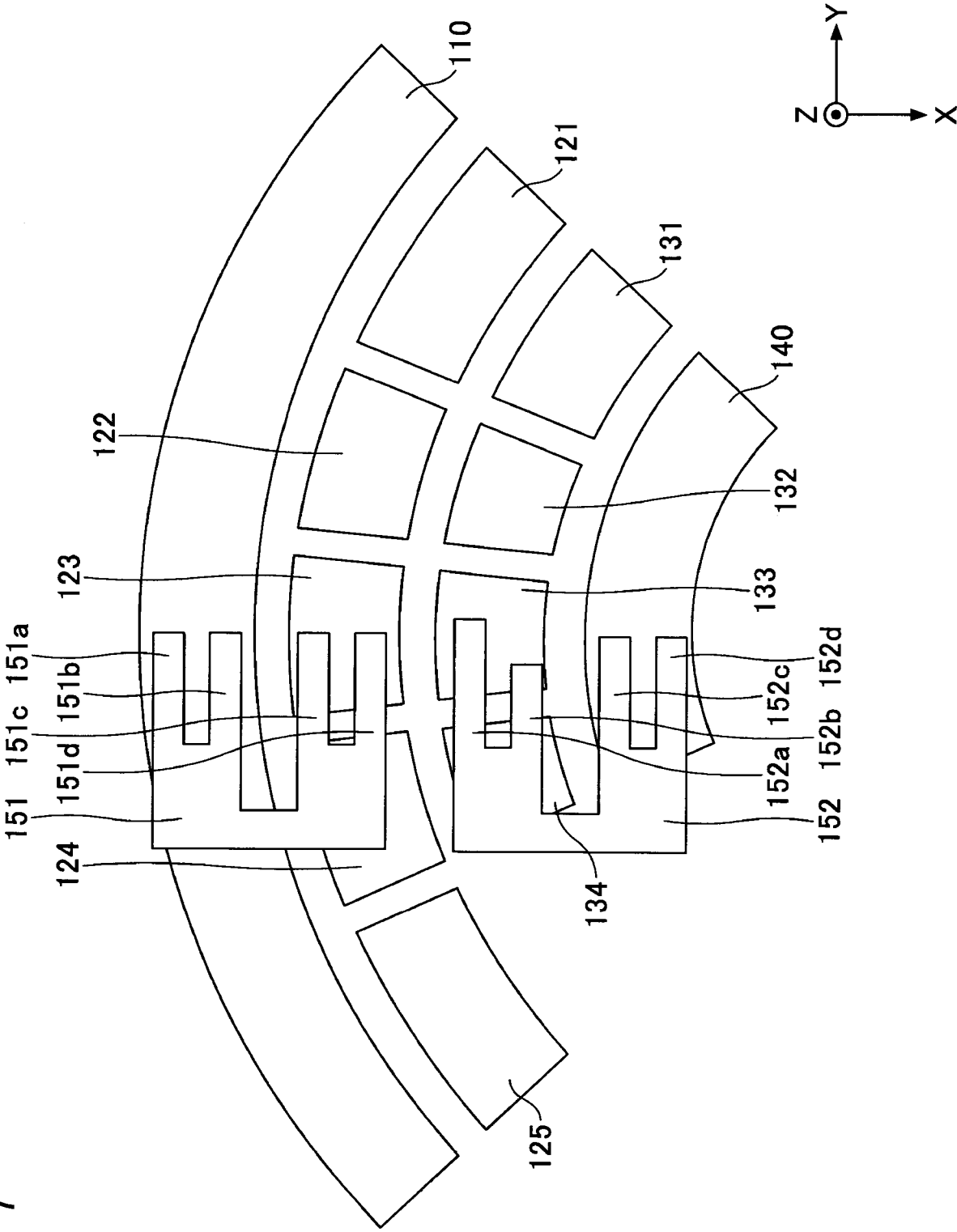


FIG. 8

100A

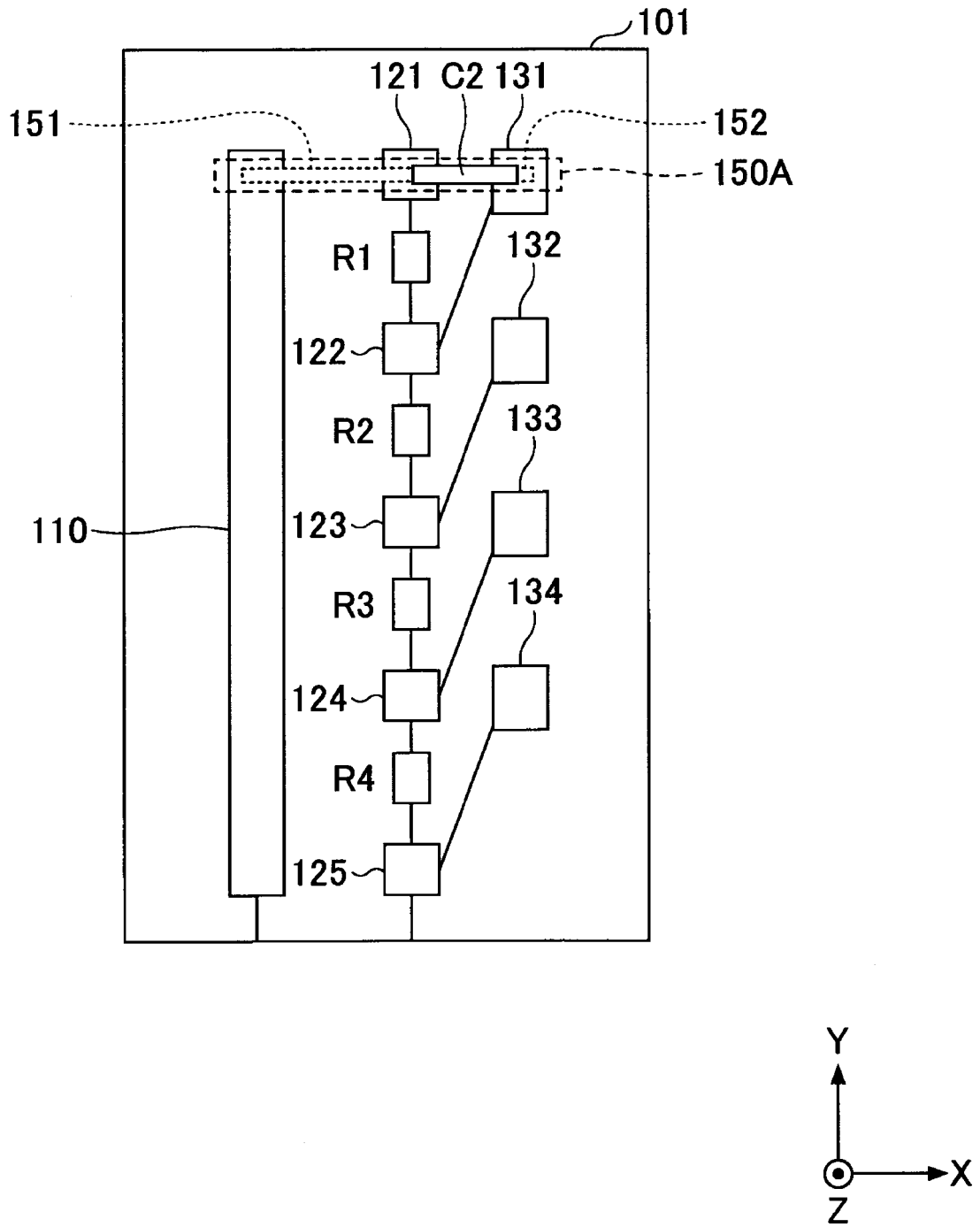


FIG. 9A

100A

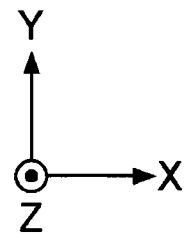
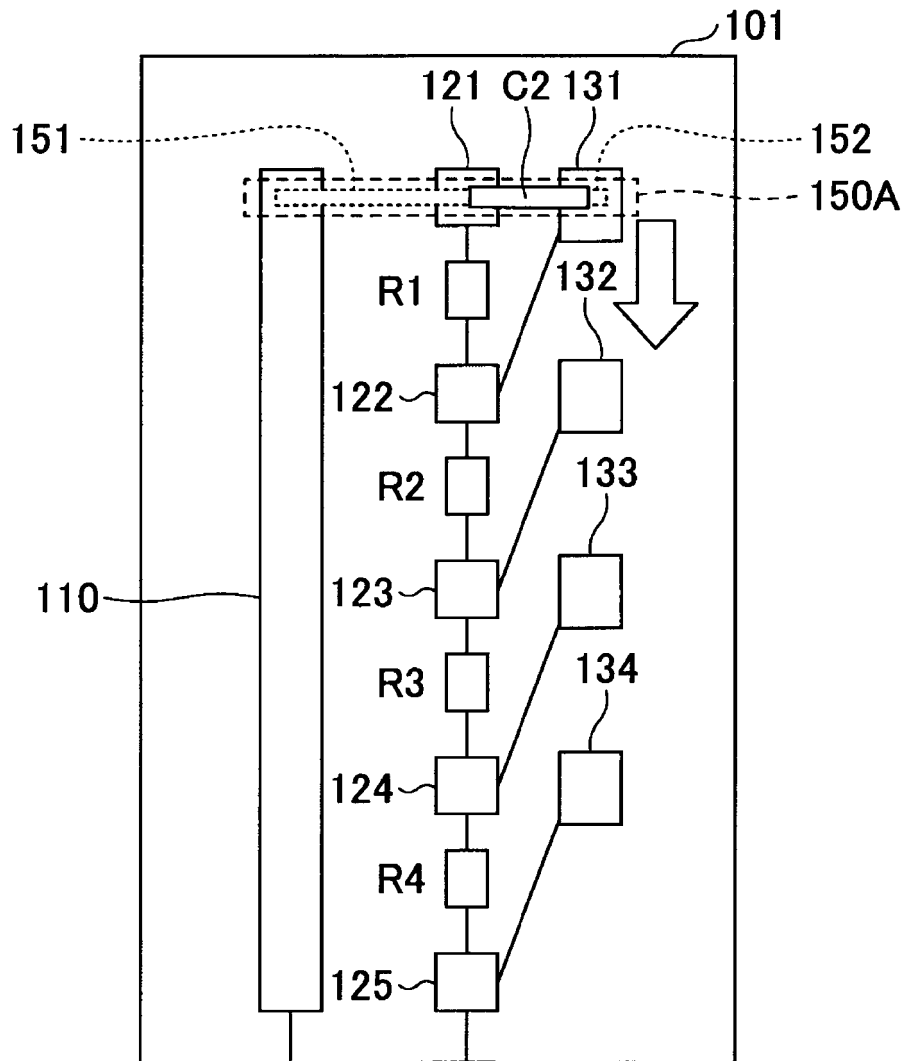


FIG. 9B

100A

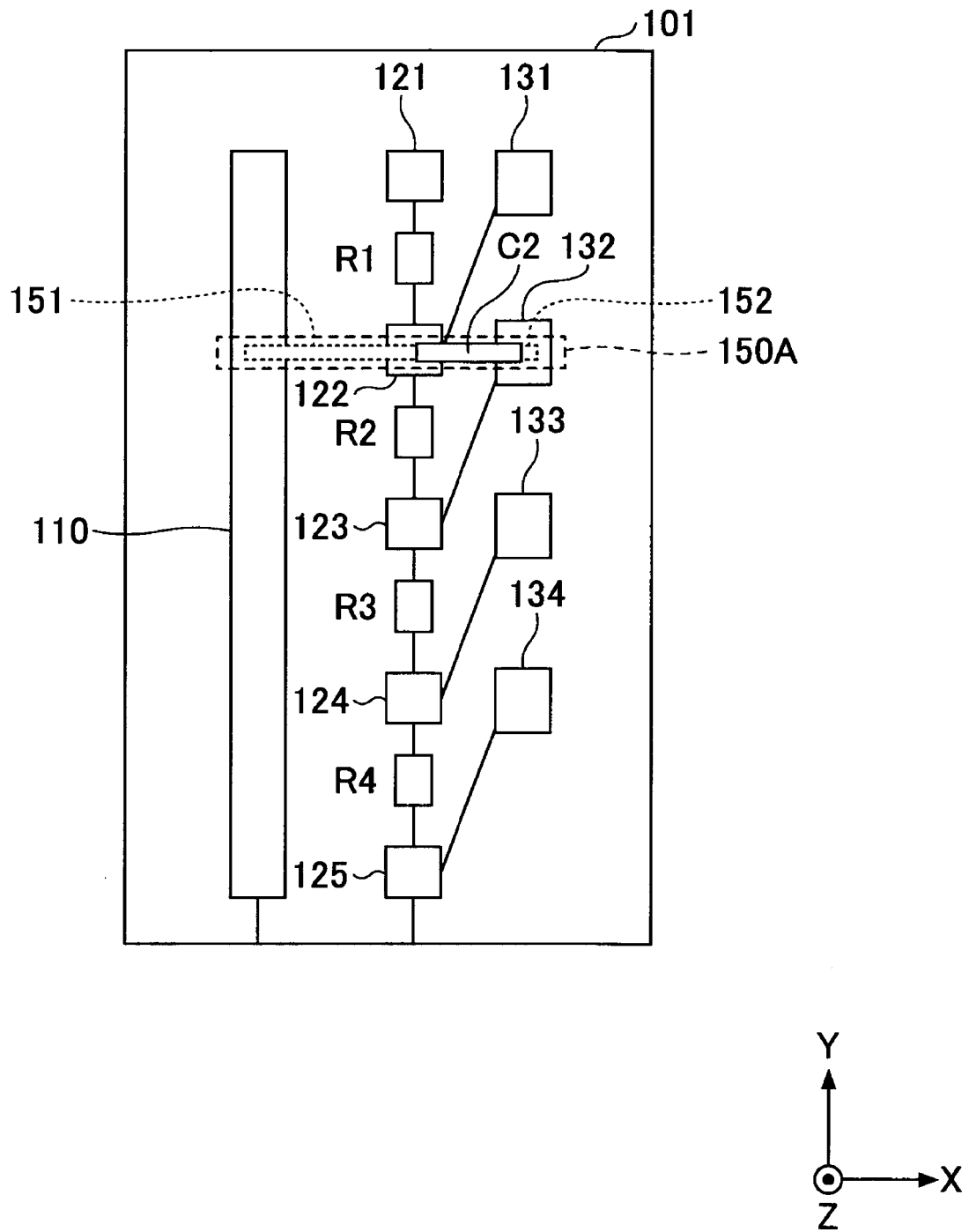


FIG. 10

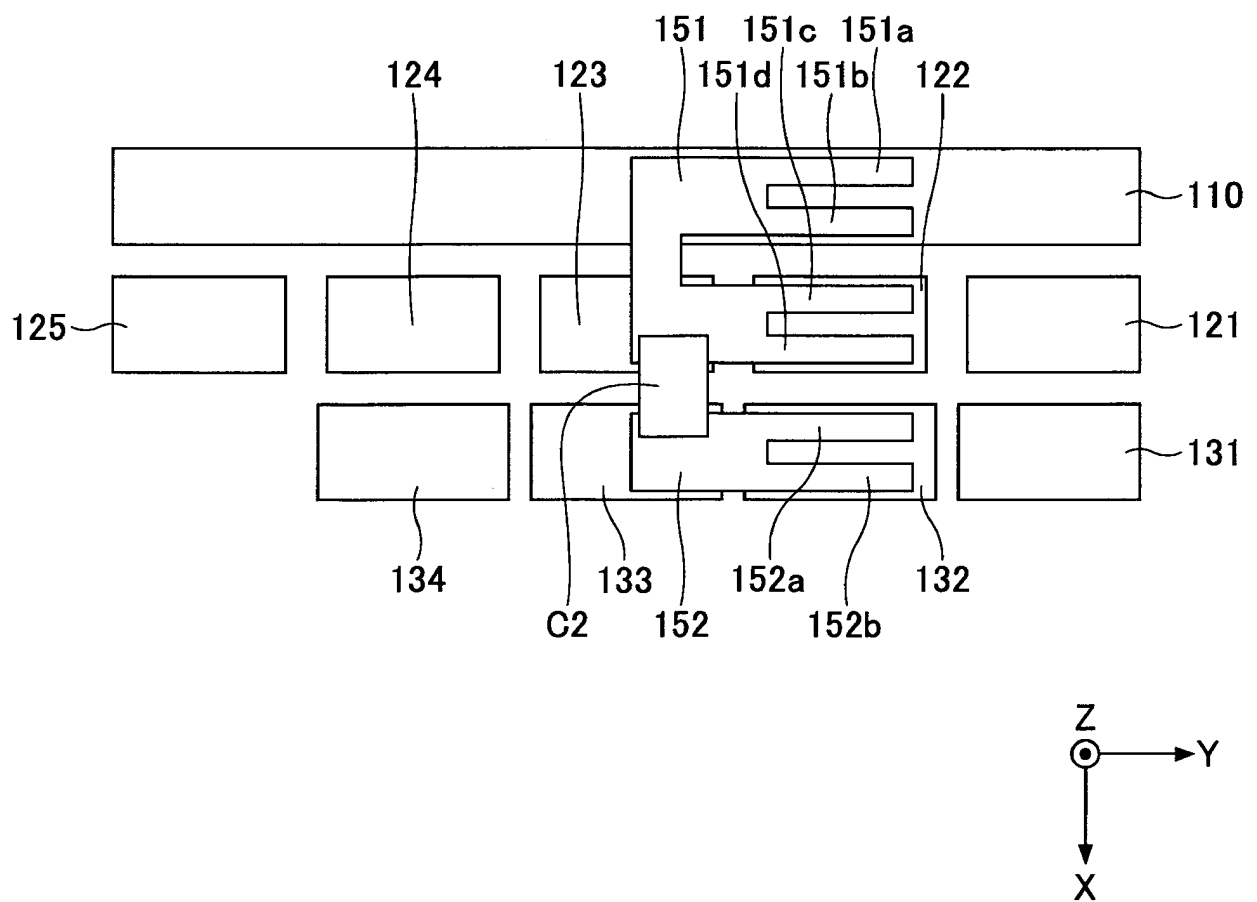


FIG. 11

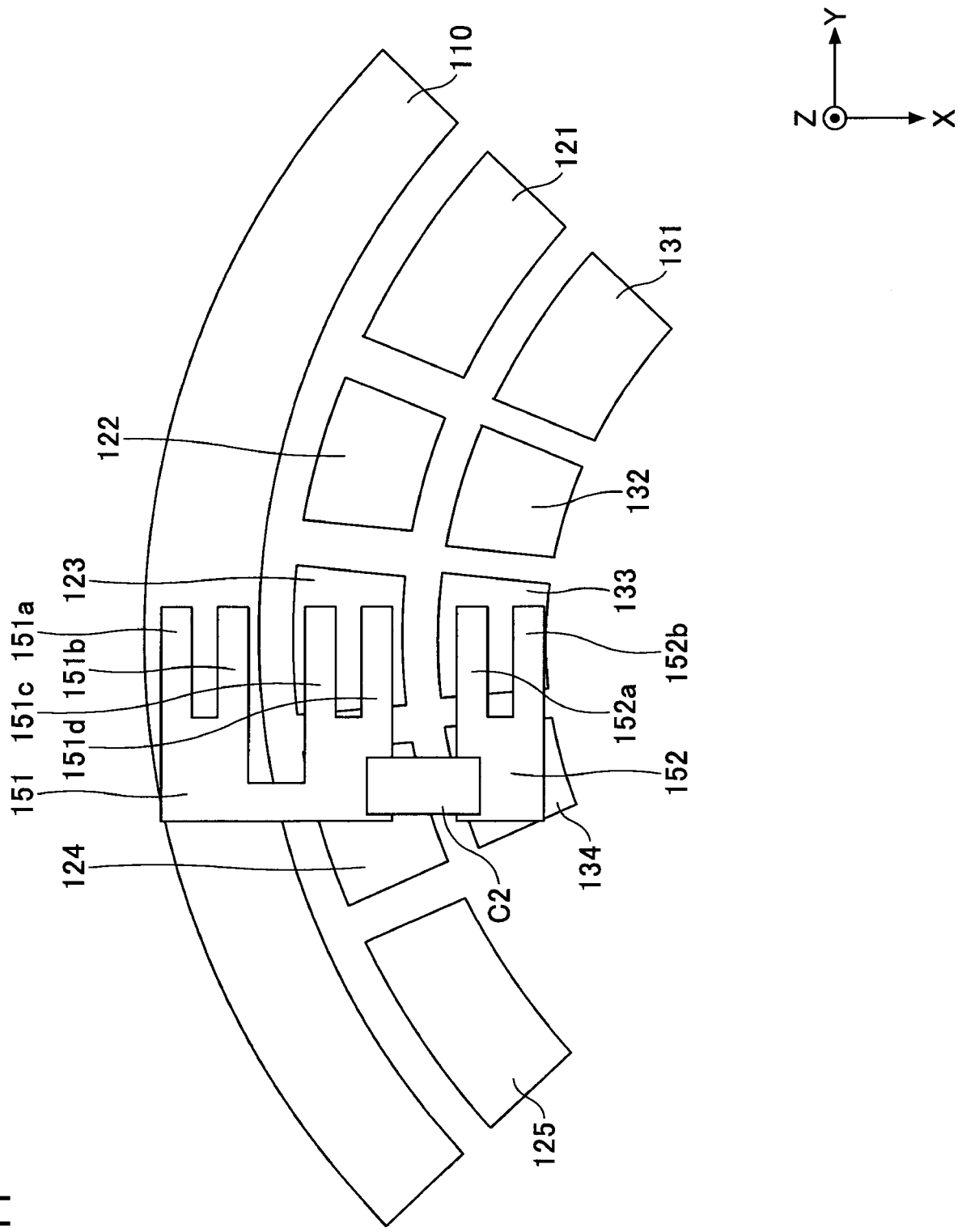


FIG. 12A

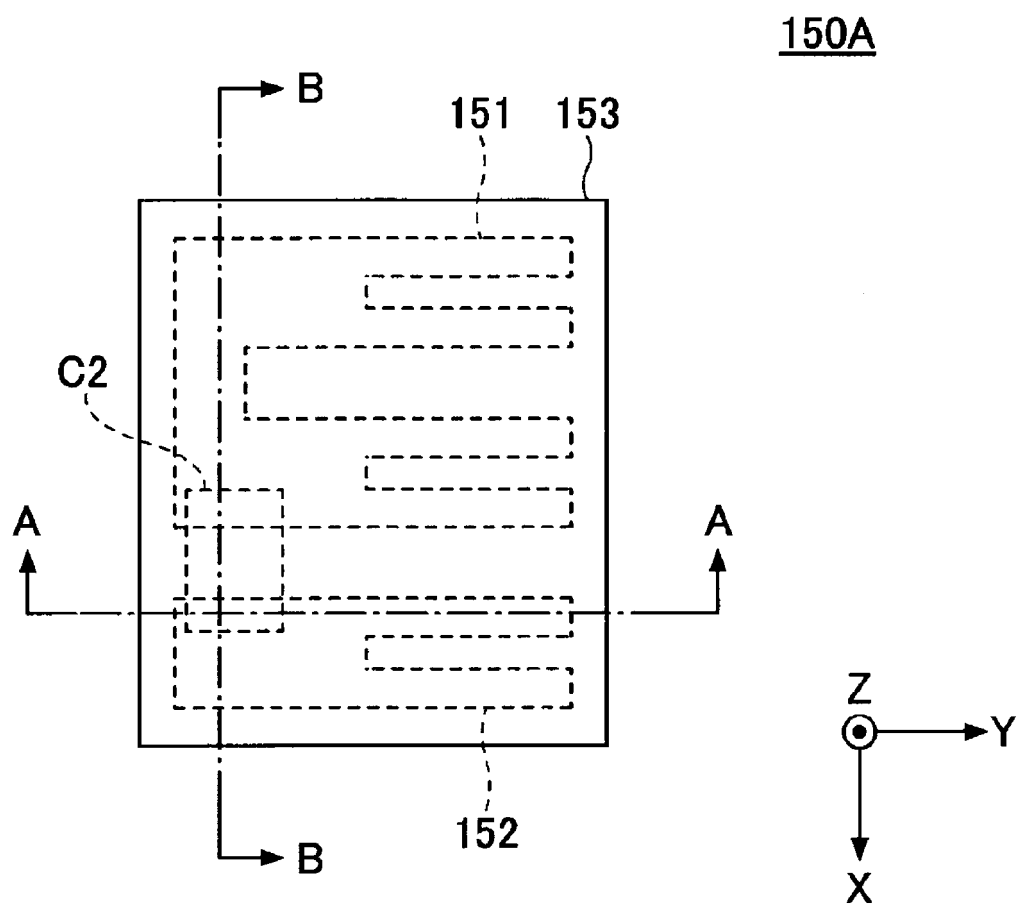


FIG. 12B

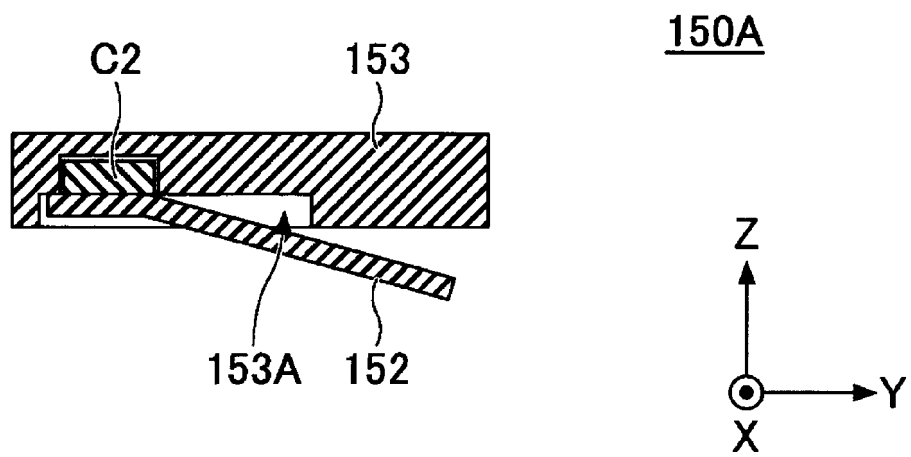
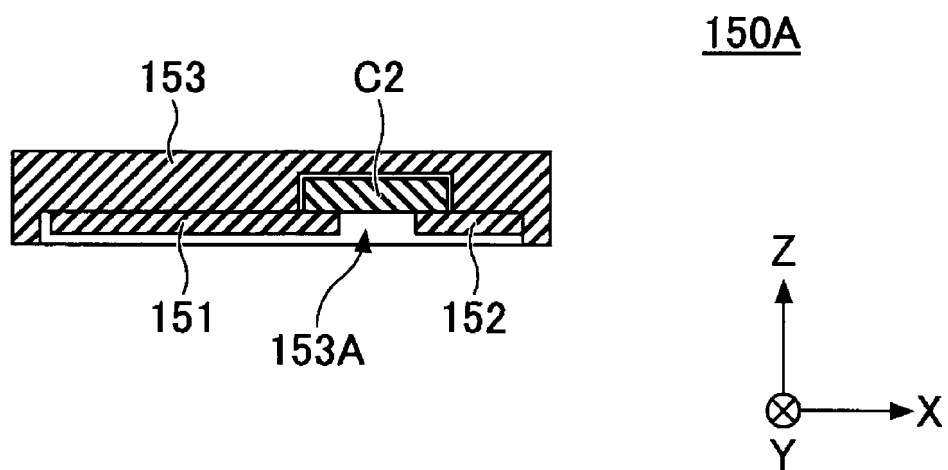


FIG. 12C



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/010765

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. H01H1/40 (2006.01) i, H01H1/20 (2006.01) i, H01H15/04 (2006.01) n

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. H01H1/40, H01H1/20, H01H15/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 49-27859 A (CANON INC.) 12 March 1974, page 1, lower left column, line 15 to lower right column, line 10, page 2, upper right column, line 2 to page 3, lower right column, line 5, fig. 1-3 (Family: none)	1, 7 2-6
Y A	JP 2015-216080 A (ALPS ELECTRIC CO., LTD.) 03 December 2015, paragraph [0004], fig. 9 & US 2015/0332876 A1, paragraph [0007], fig. 9 & CN 105097346 A	1, 7 2-6



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search
17.05.2018Date of mailing of the international search report
29.05.2018Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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Patent documents cited in the description

- JP 2015216080 A [0003]
- JP 2017134100 A [0081]