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(54) **INSULATING PROTECTOR AND ELECTRICITY STORAGE MODULE**

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| ***H01R 4/70*** | (2006.01) |

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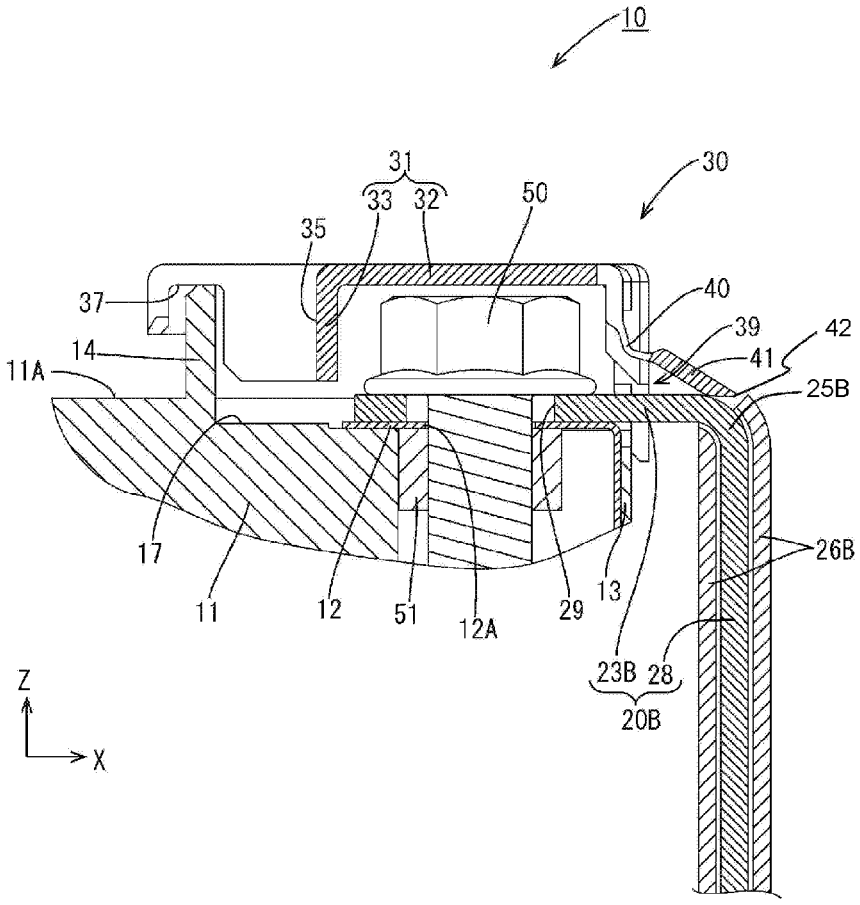
(57) **ABSTRACT**

An insulating protector that is to be attached to an electricity storage module that has positive and negative electrode terminals, the insulating protector including: a main cover portion that is configured to allow a first bus bar that is connected to an electrode terminal, to be led out, and to allow a second bus bar that is connected to an electrode terminal, to be led out via a path that is different from a path via which the first bus bar is led out; and a sub cover portion that is pivotable about a hinge portion relative to the main cover portion, and covers the bus bar.



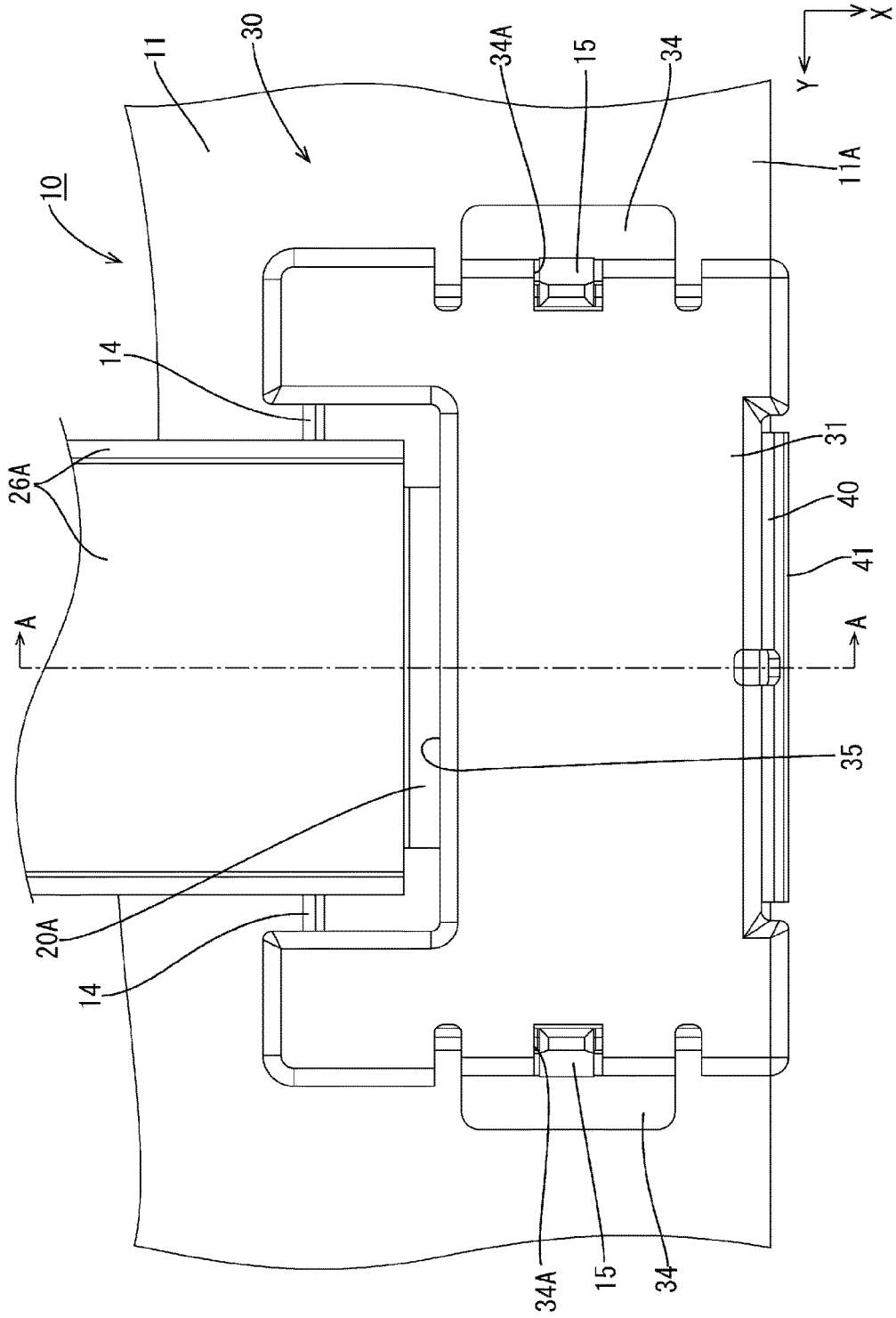



FIG. 1

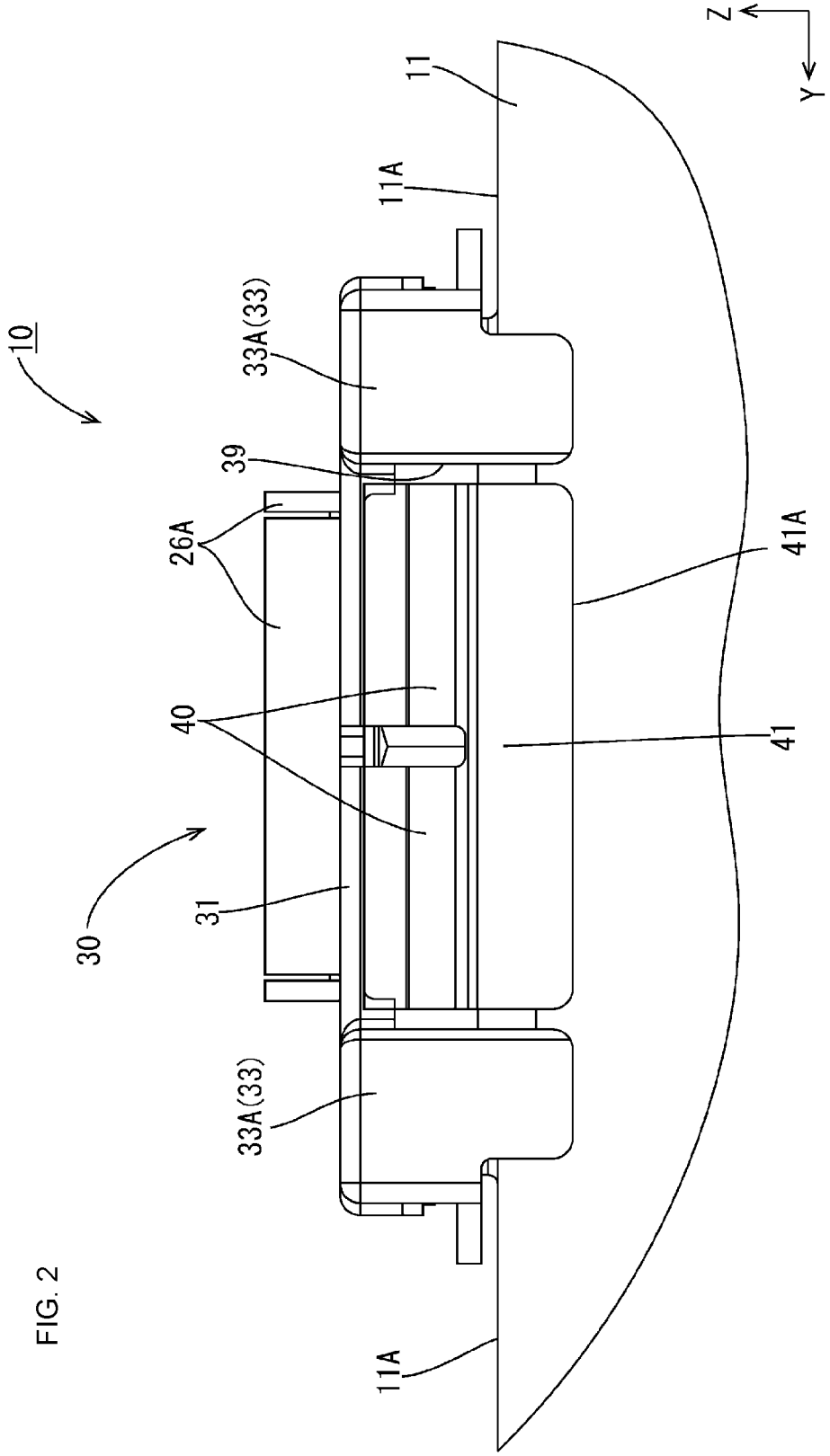



FIG. 2

FIG. 3

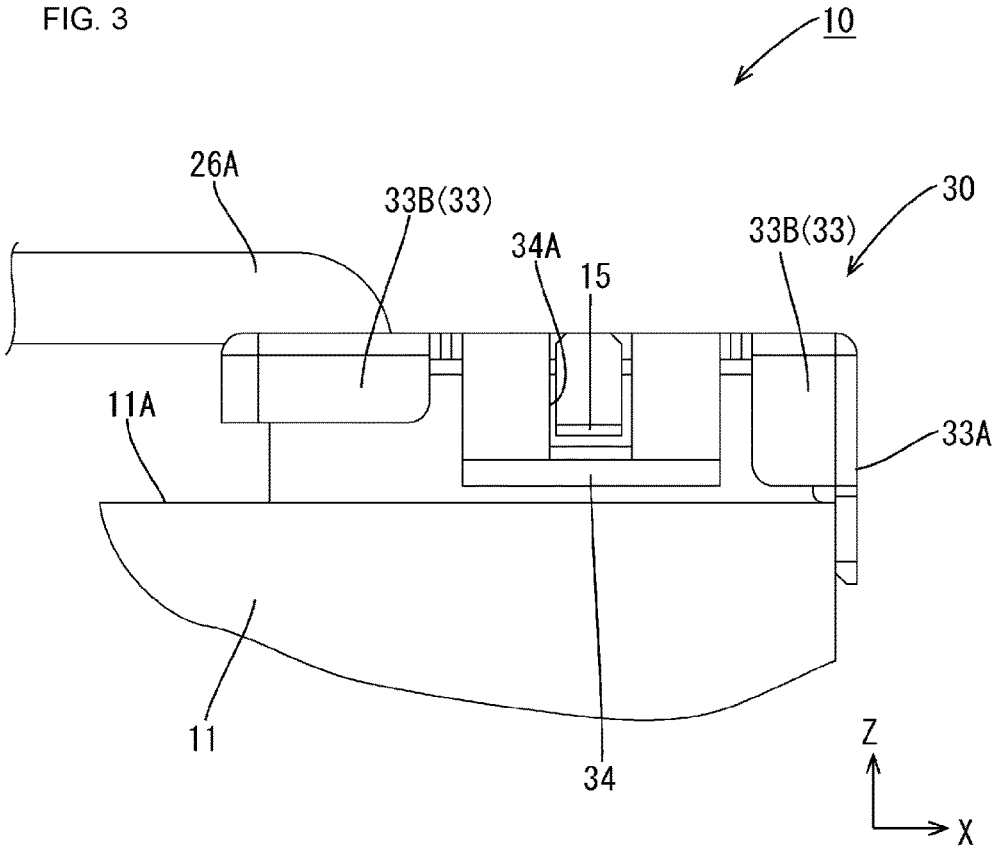
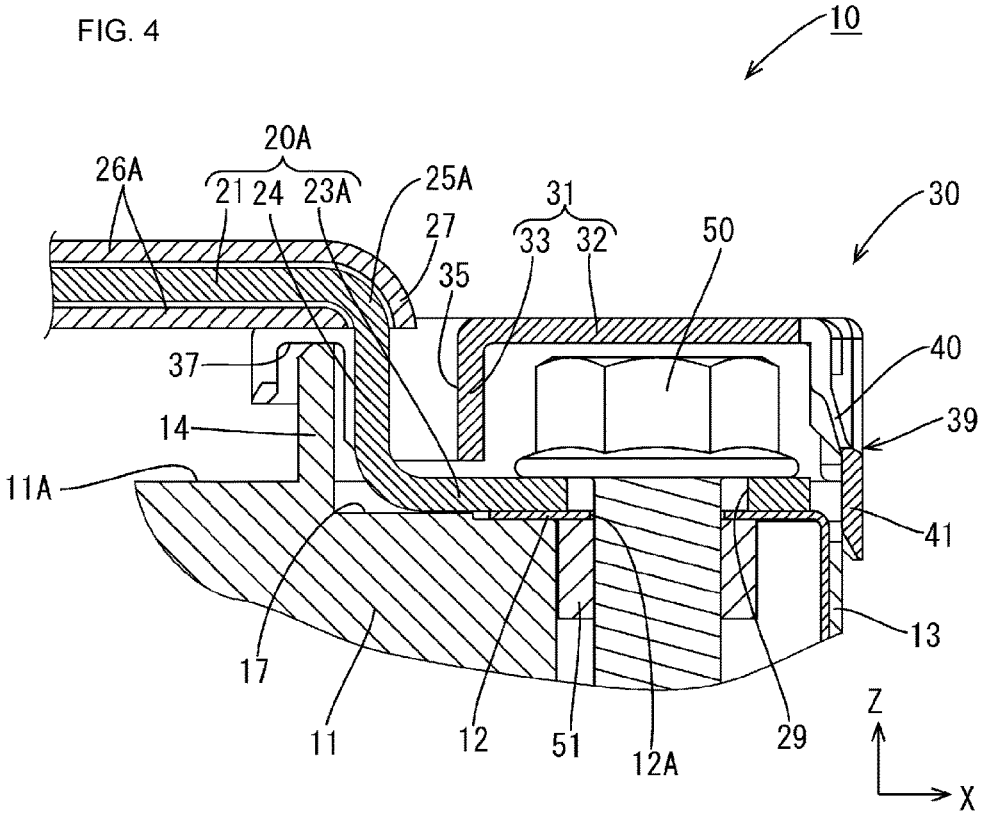


FIG. 4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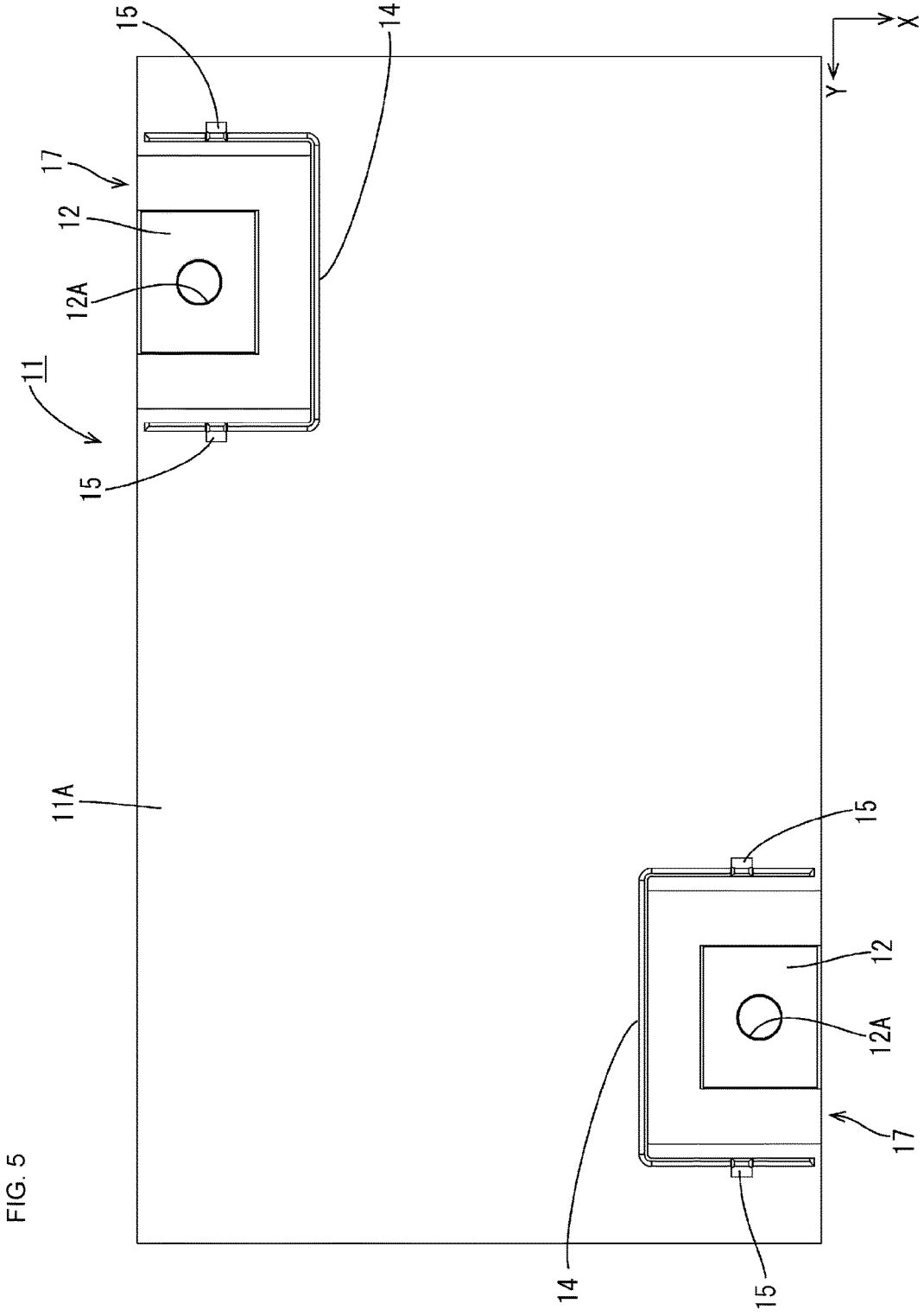



FIG. 5

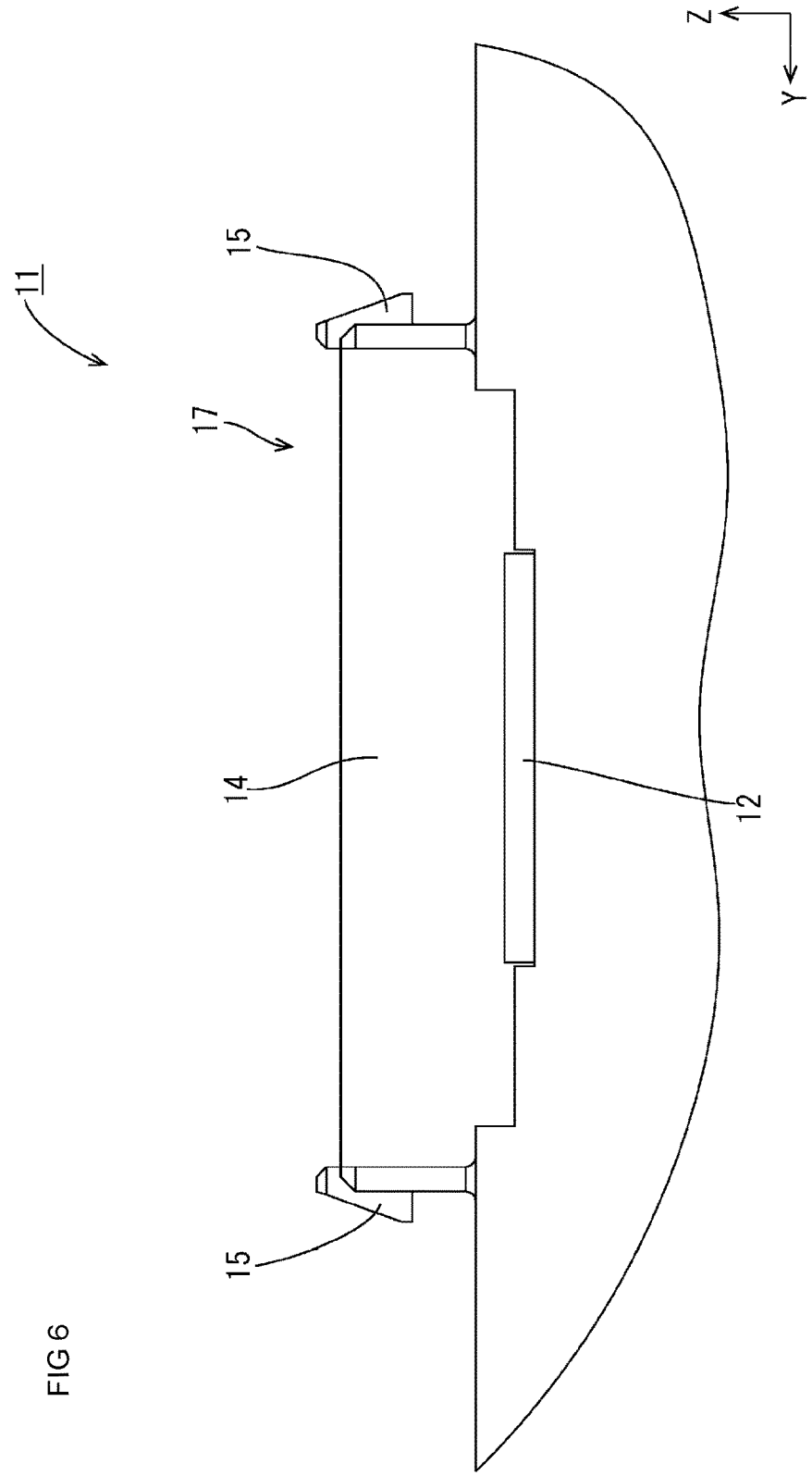



FIG 6

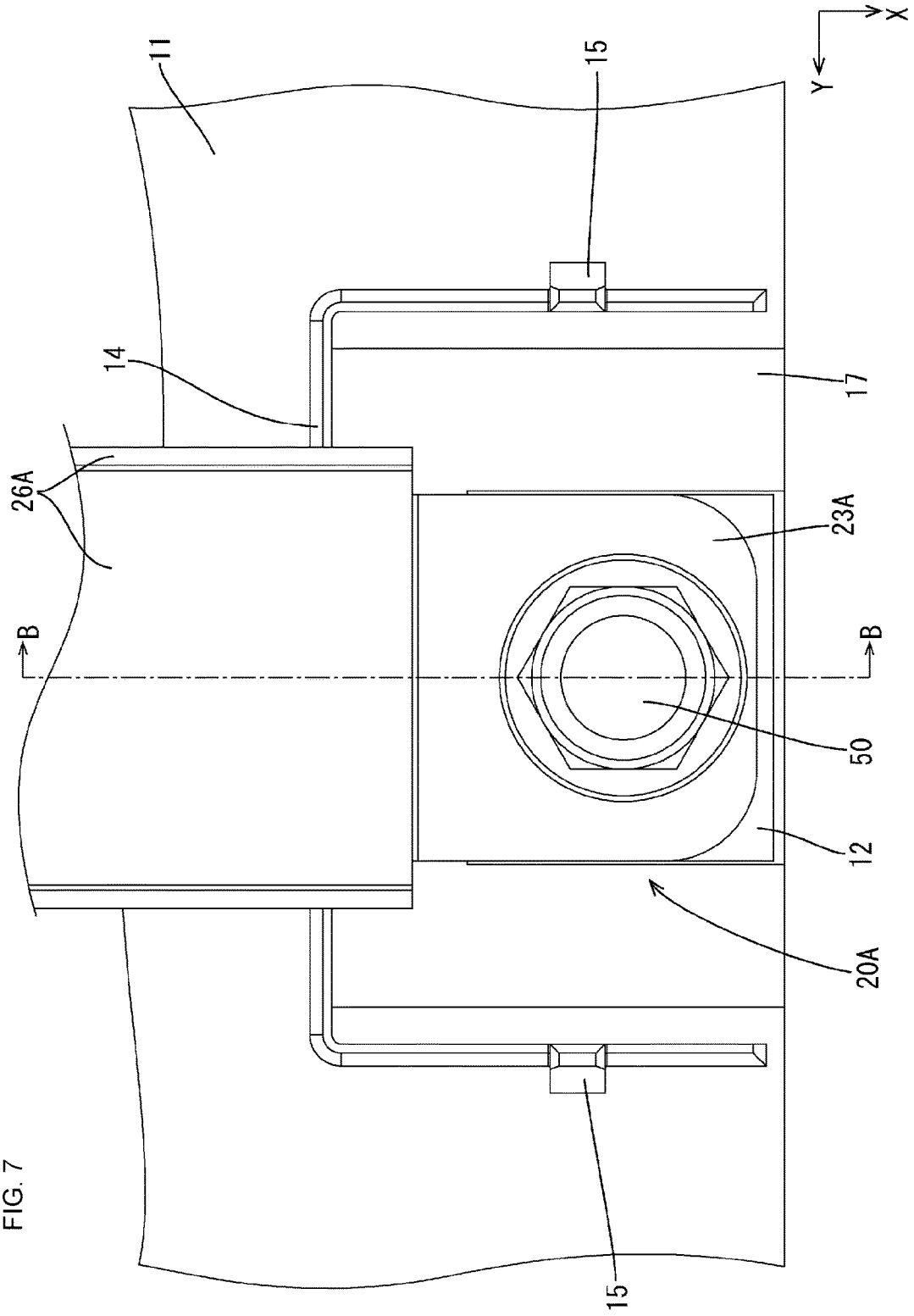



FIG. 7

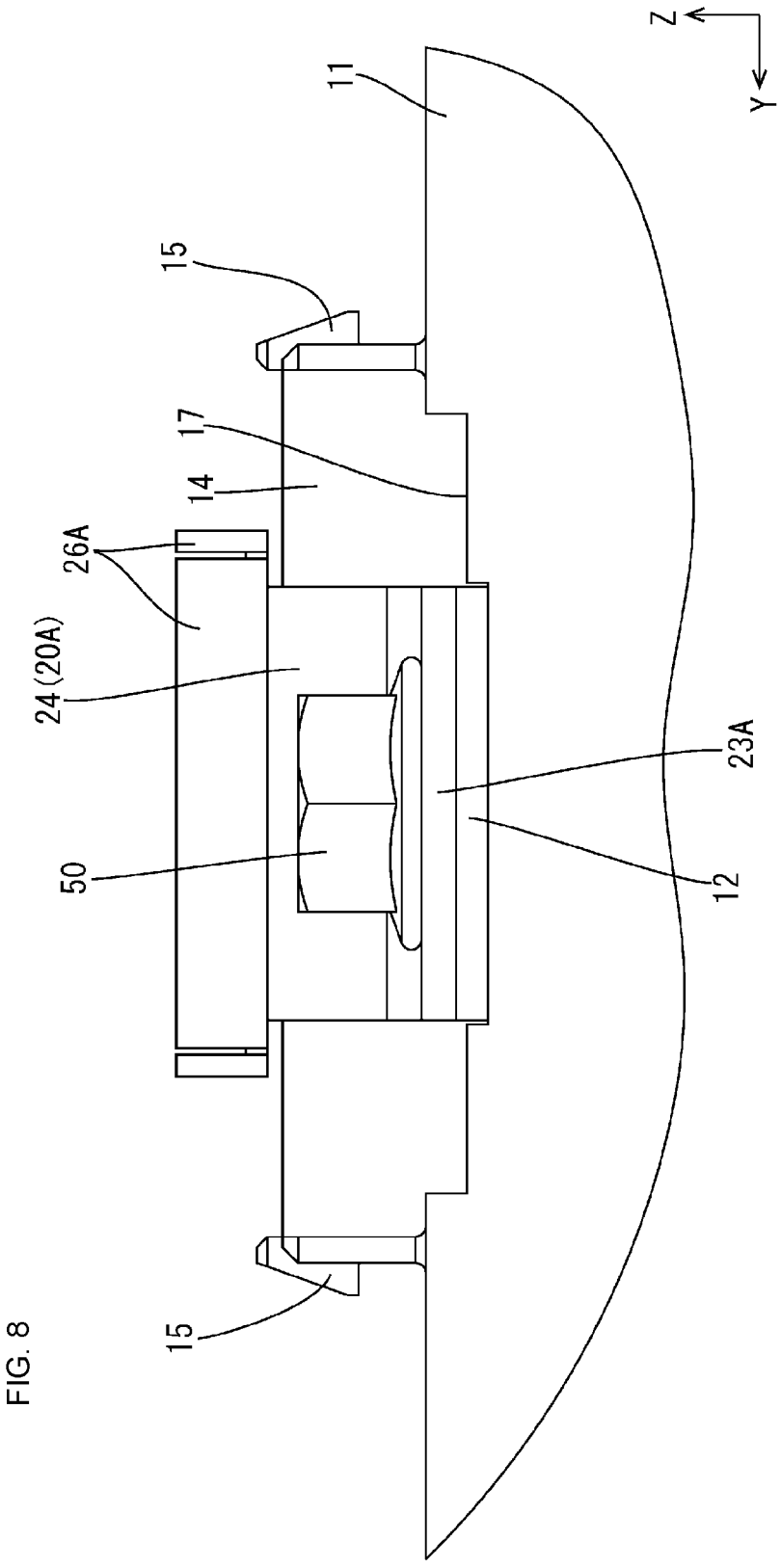



FIG. 8

FIG. 9

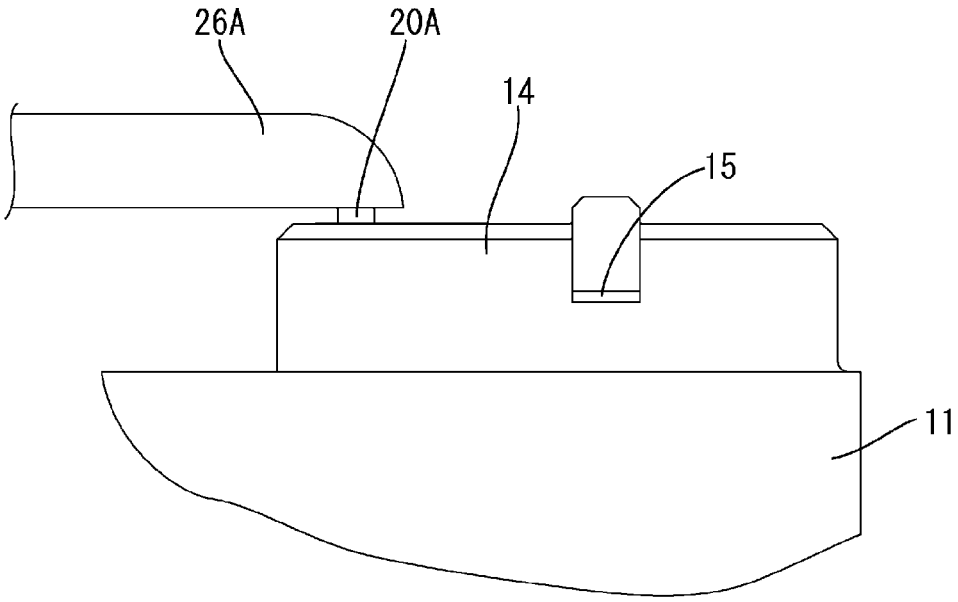
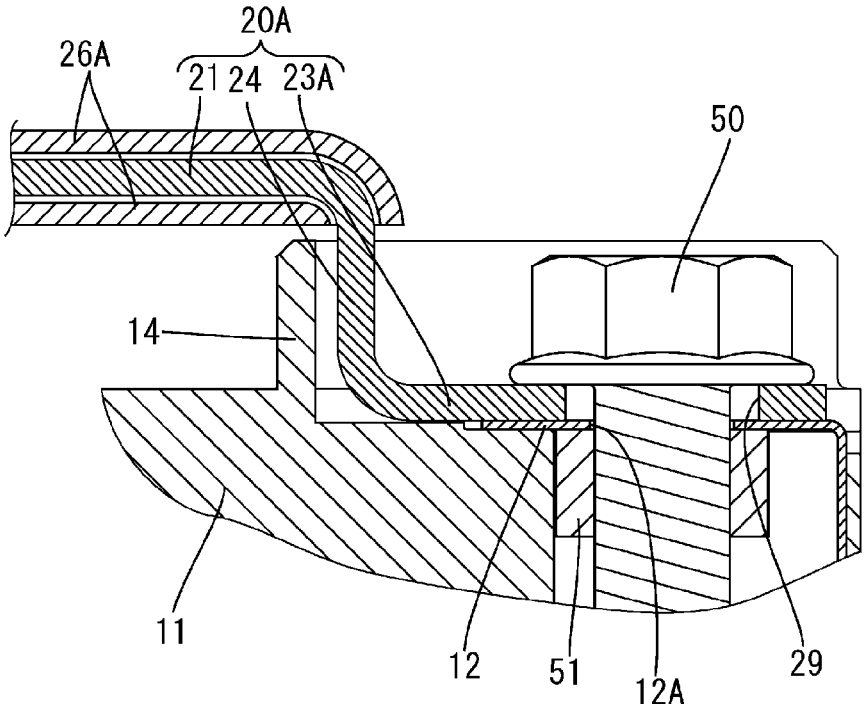


FIG. 10



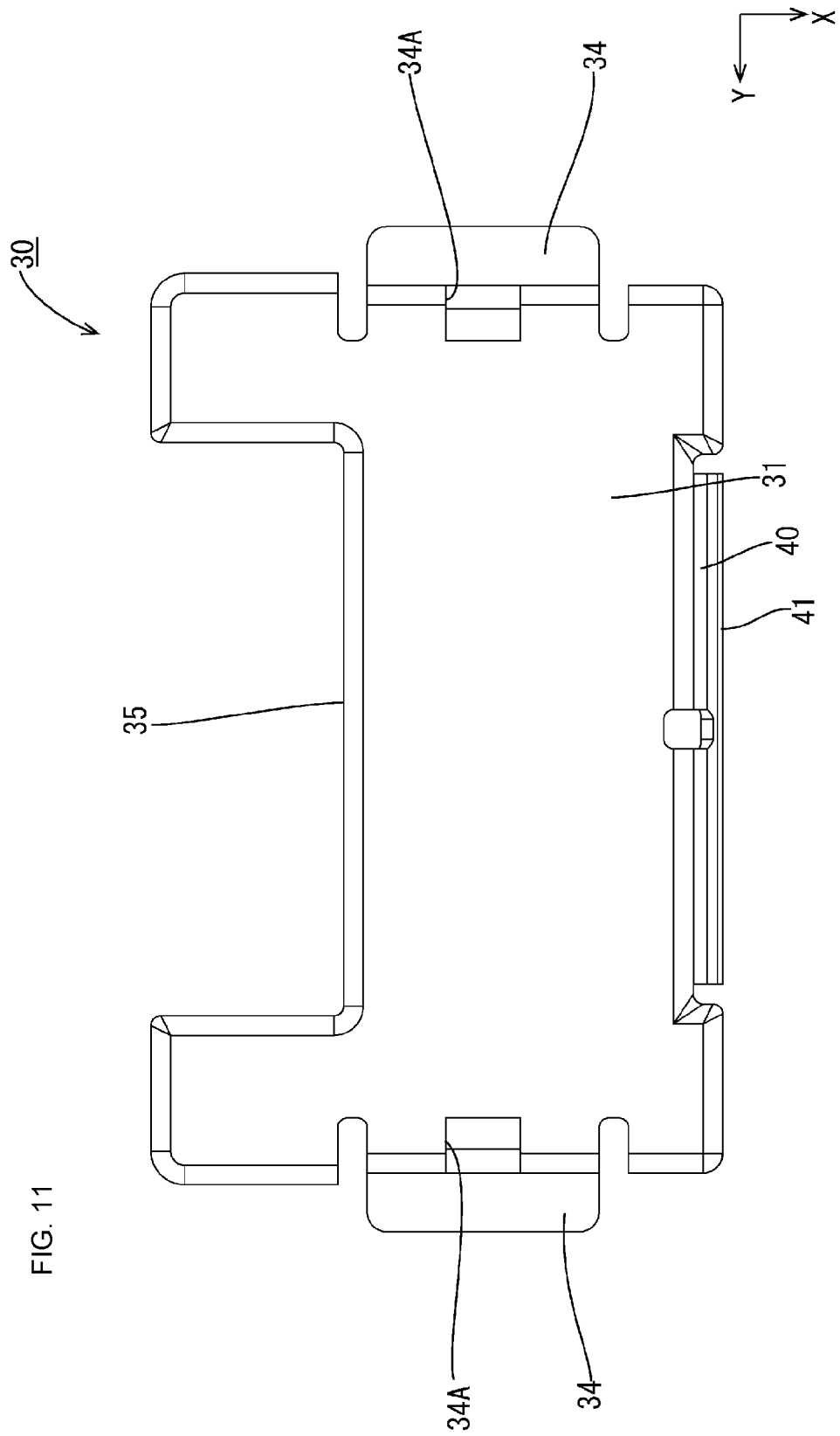



FIG. 11

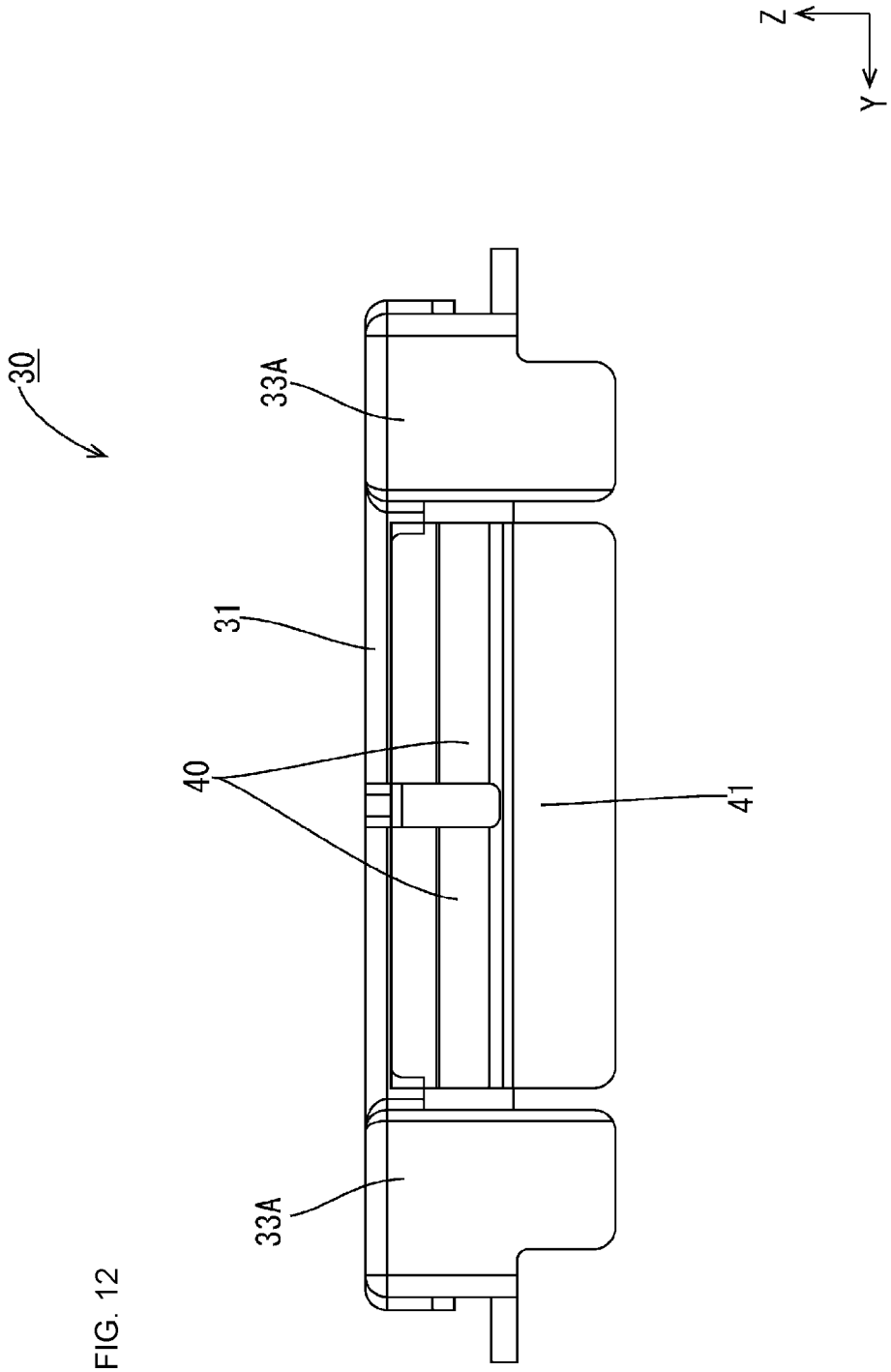
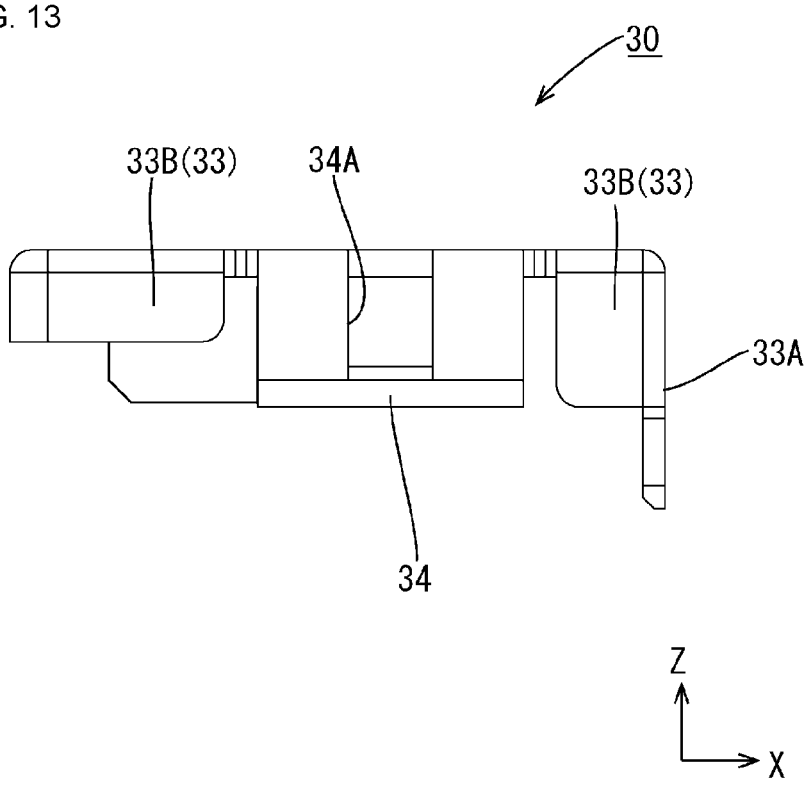



FIG. 12

FIG. 13



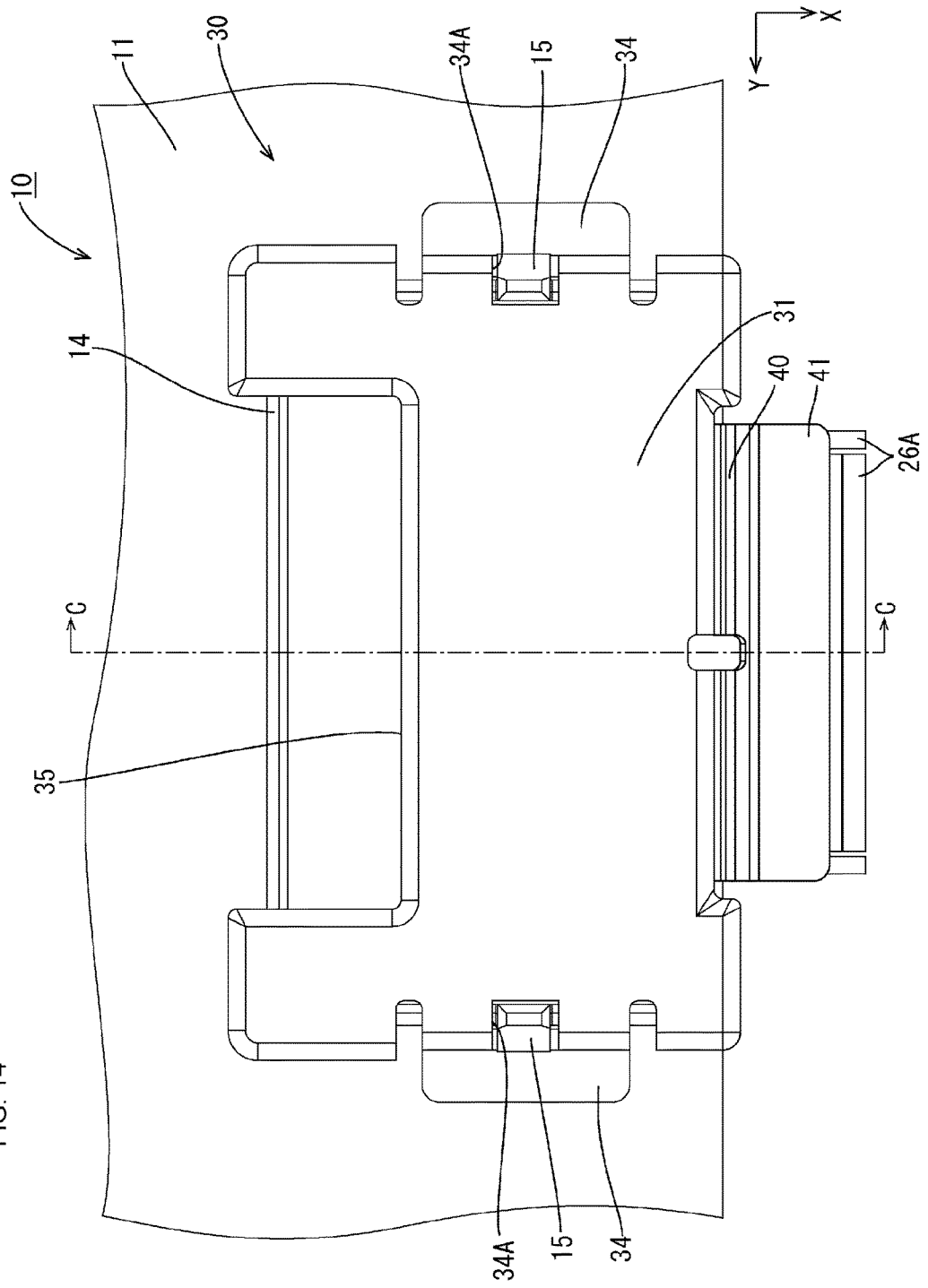



FIG. 14

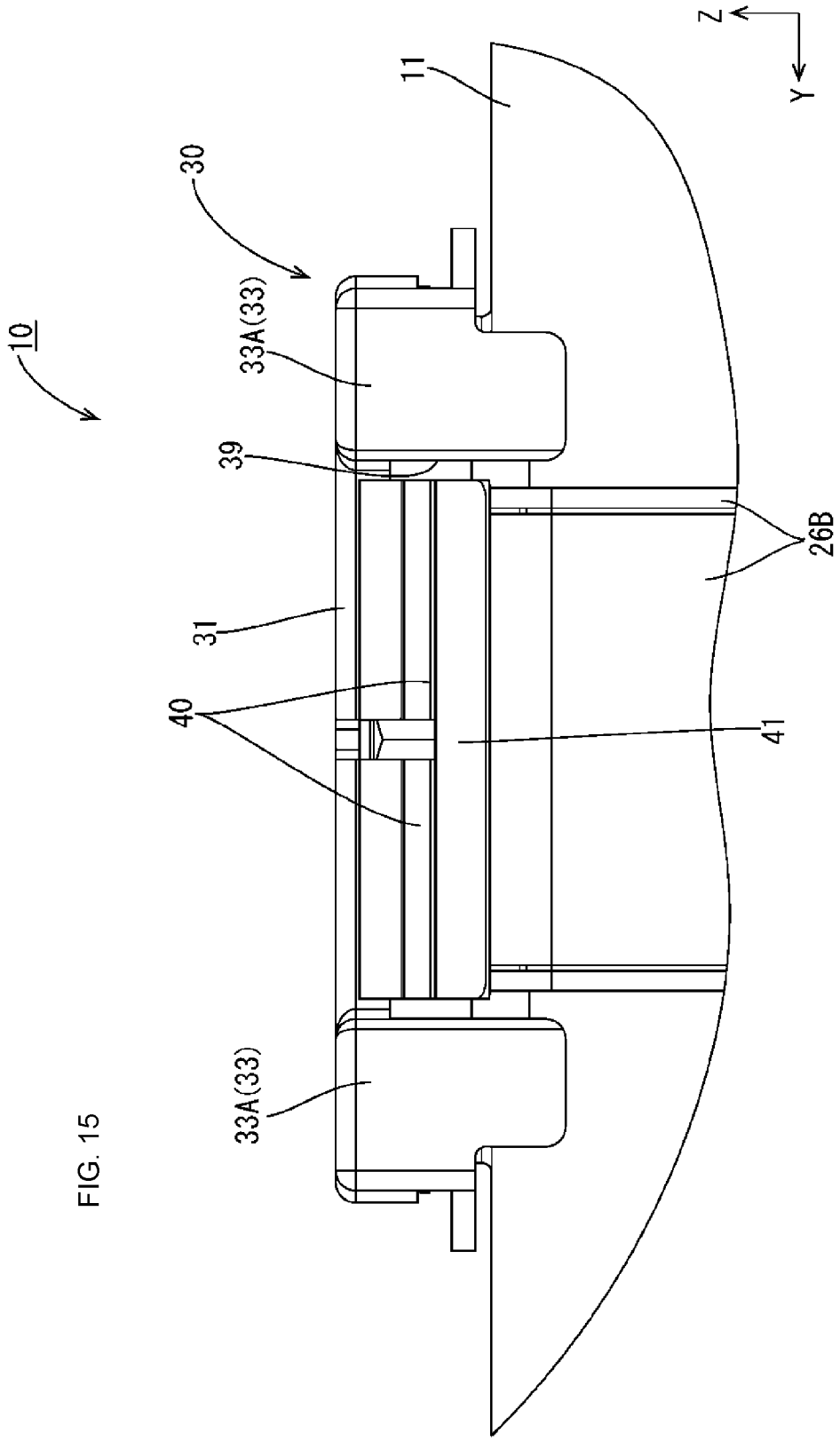



FIG. 15

FIG. 16

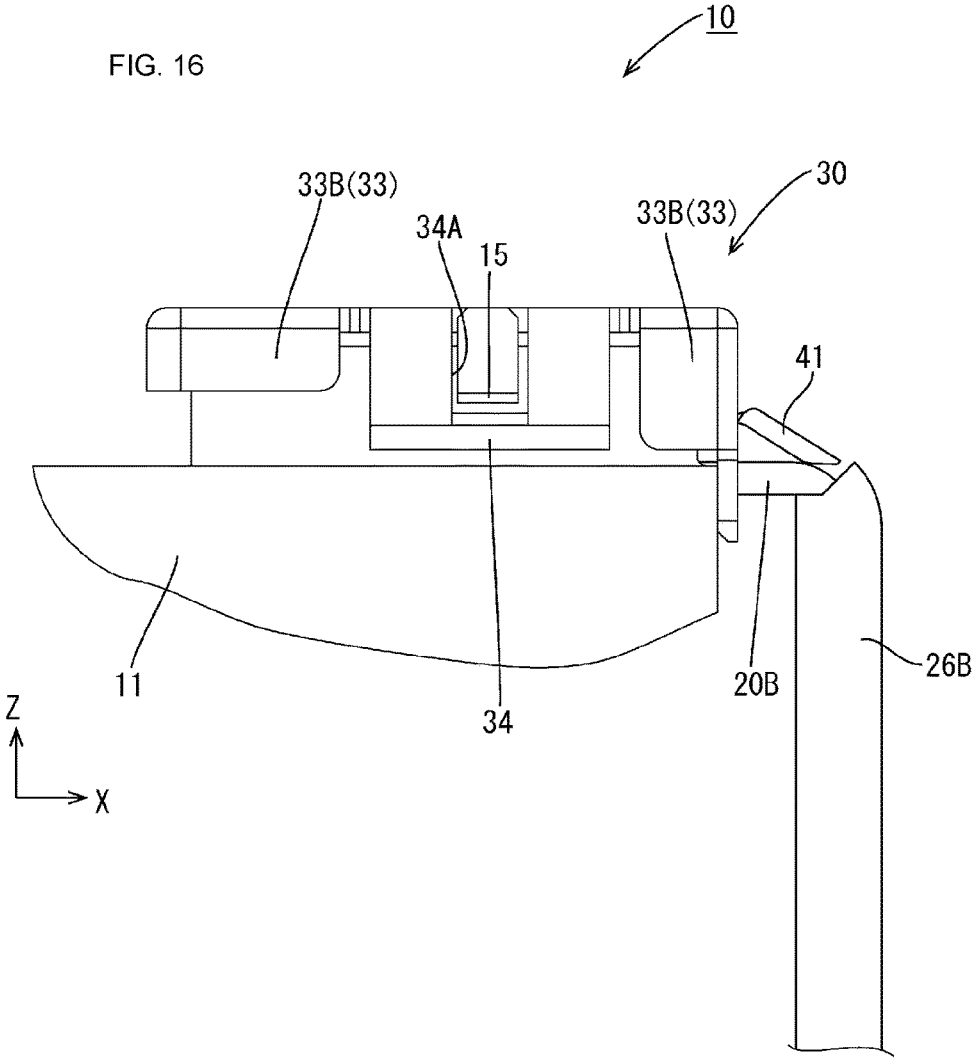
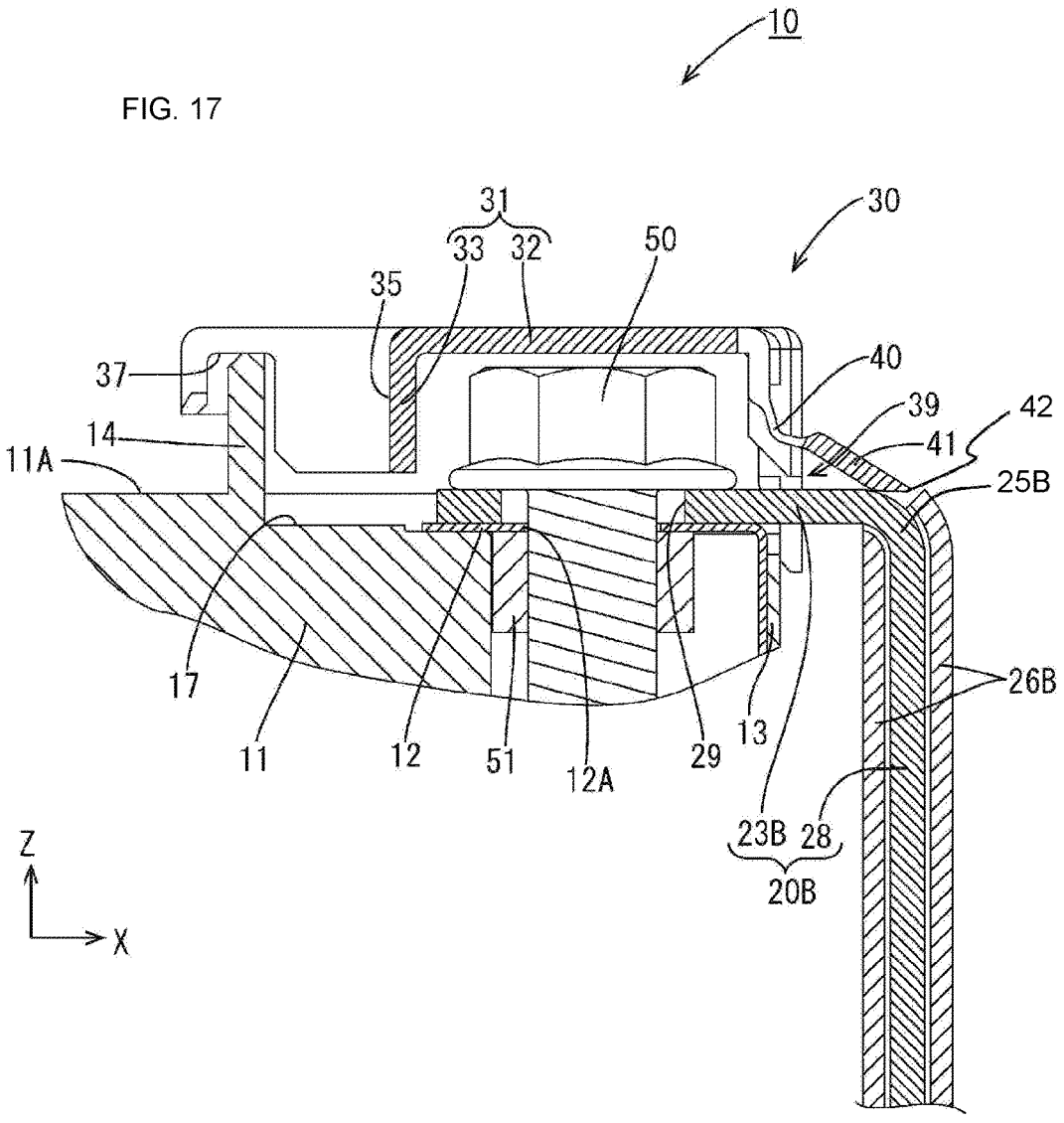


FIG. 17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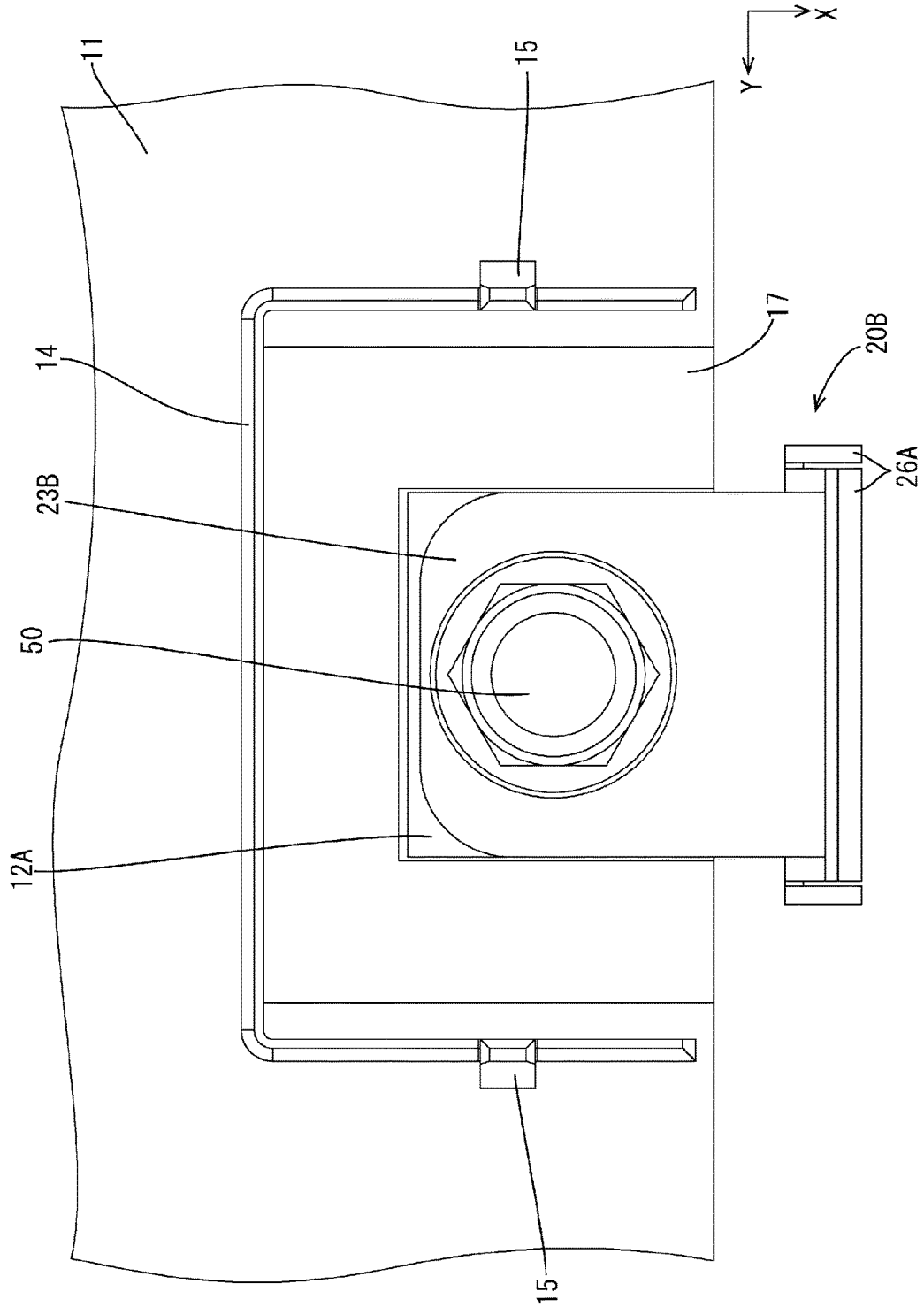


FIG. 18

# INSULATING PROTECTOR AND ELECTRICITY STORAGE MODULE

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application is the U.S. national stage of PCT/JP2017/005238 filed Feb. 14, 2017, which claims priority of Japanese Patent Application No. 2016-027684 filed on Feb. 17, 2016, which is incorporated herein by reference in its entirety.

## FIELD OF THE INVENTION

**[0002]** The present description discloses technology related to an insulating protector.

## BACKGROUND OF THE INVENTION

**[0003]** In an electricity storage module of an electric vehicle, a hybrid vehicle, or the like, electrode terminals that are adjacent to each other, of a plurality of electricity storage elements, each having positive and negative electrode terminals, are connected to each other by bus bars, and thus the plurality of electricity storage elements are connected in series or in parallel.

**[0004]** In JP2000-149909A, a battery connection plate, in which a plurality of bus bars are embedded in a substrate part that is made of a synthetic resin, is attached to a battery assembly that includes a plurality of rectangular batteries. Electrodes that are adjacent to each other, of the plurality of rectangular batteries are connected to each other by the bus bars of the battery connection plate, and thus the plurality of rectangular batteries are connected in series. Covers that are openable and closable are connected to the substrate part of the battery connection plate with hinges.

## SUMMARY OF THE INVENTION

**[0005]** It is envisaged that bus bars that are to be connected to electrodes may be desired to be connected to different paths depending on the locations of connection paths between a plurality of batteries and the locations of external devices or the like that are to be connected to the electrodes at the ends of the series connection. In the battery connection plate according to JP2000-149909A, a plurality of bus bars are fixed at predetermined positions relative to a plurality of electrodes, and thus one predetermined connection path is formed by the bus bars. Therefore, if the bus bars are desired to be connected so as to form a different path, a new battery connection plate with a different shape needs to be prepared, which causes manufacturing costs to increase.

**[0006]** The technology disclosed in the present description has been completed in view of the above-described situation, and aims to provide an insulating protector with which bus bars can be connected to a plurality of paths, while suppressing an increase in manufacturing costs.

**[0007]** The technology disclosed in the present description is an insulating protector that is to be attached to an electricity storage module that has positive and negative electrode terminals, the insulating protector including: a main cover portion that is configured to allow a bus bar that is connected to an electrode terminal, to be led out, and to allow a bus bar that is connected to an electrode terminal, to be led out via a path that is different from a path via which the aforementioned bus bar is led out; and a sub cover that is pivotable about a hinge portion relative to the main cover portion, and covers a bus bar.

**[0008]** With this configuration, the sub cover portion pivots about the hinge portion relative to the main cover portion, and thus the sub cover portion can cover a bus bar that is connected to an electrode terminal via a different path. Therefore, there is no need to prepare different insulating protectors for bus bars that are connected to a plurality of paths, and it is possible to suppress an increase in manufacturing costs. Thus, it is possible to allow bus bars to be connected to a plurality of paths, while suppressing an increase in manufacturing costs.

**[0009]** The following are preferable modes in which the technology disclosed in the present description is carried out. The sub cover portion abuts against a bus bar. With this configuration, it is possible to reliably suppress degradation of insulation properties regarding a part against which the sub cover portion abuts.

**[0010]** The hinge portion is elastically deformable, and the sub cover portion biases a bus bar, using an elastic force generated by the hinge portion. With this configuration, it is possible to suppress degradation of insulation properties, using an elastic force generated by the hinge portion.

**[0011]** The path that is different from the path via which the aforementioned bus bar is led out extends along an outer surface of the electricity storage module, the outer surface being different from an electrode terminal-side outer surface of the electricity storage module. If the path of a bus bar is three-dimensional, a gap is likely to occur, from which the bus bar is exposed, and there is a concern that insulation properties will degrade. However, in such a configuration, due to the sub cover portion pivoting, it is possible to suppress degradation of insulation properties.

**[0012]** An electricity storage module including: the insulating protector; and the bus bars may be provided.

**[0013]** With the technology disclosed in the present description, it is possible to connect the bus bars to a plurality of paths, while suppressing an increase in manufacturing costs.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0014]** FIG. **1** is a partially-enlarged plan view of an electricity storage module according to a first embodiment in a state where a first bus bar is connected to an electrode terminal.

**[0015]** FIG. **2** is a partially-enlarged front view of the electricity storage module in a state where the first bus bar is connected to an electrode terminal.

**[0016]** FIG. **3** is a partially-enlarged left side view of the electricity storage module in a state where the first bus bar is connected to an electrode terminal.

**[0017]** FIG. **4** is a cross-sectional view along a line A-A in FIG. **1**.

**[0018]** FIG. **5** is a plan view showing an electricity storage body.

**[0019]** FIG. **6** is a partially-enlarged front view of the electricity storage body.

**[0020]** FIG. **7** is a plan view showing a state in which the first bus bar is connected to an electrode terminal of the electricity storage body.

**[0021]** FIG. **8** is a front view showing a state in which the first bus bar is connected to an electrode terminal of the electricity storage body.

**[0022]** FIG. **9** is a left side view showing a state in which the first bus bar is connected to an electrode terminal of the electricity storage body.

**[0023]** FIG. **10** is a cross-sectional view along a line B-B in FIG. **7**.

**[0024]** FIG. **11** is a plan view showing an insulating protector.

**[0025]** FIG. **12** is a front view showing an insulating protector.

**[0026]** FIG. **13** is a left side view showing an insulating protector.

**[0027]** FIG. **14** is a partially-enlarged plan view of the electricity storage module in a state where a second bus bar is connected to an electrode terminal.

**[0028]** FIG. **15** is a partially-enlarged front view of the electricity storage module in a state where the second bus bar is connected to an electrode terminal.

**[0029]** FIG. **16** is a partially-enlarged left side view of the electricity storage module in a state where the second bus bar is connected to an electrode terminal.

**[0030]** FIG. **17** is a cross-sectional view along a line C-C in FIG. **14**.

**[0031]** FIG. **18** is a plan view showing a state in which the second bus bar is connected to an electrode terminal of the electricity storage body.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

### First Embodiment

**[0032]** The following describes a first embodiment with reference to FIGS. **1** to **18**. An electricity storage module **10** according to the present embodiment is mounted on a vehicle such as an electric vehicle or a hybrid vehicle, and is used as a power supply for driving the vehicle. In the following description, "X direction" indicates a forward direction, "Y direction" indicates a direction to the left, and "Z direction" indicates an upward direction.

**[0033]** Electricity Storage Module **10**

**[0034]** As shown in FIGS. **4** and **17**, the electricity storage module **10** includes an electricity storage body **11** that has electrode terminals **12**, a first bus bar **20**A (an example of a "bus bar") or a second bus bar **20**B (an example of a "bus bar") that is selectively connected to an electrode terminal **12**, and insulating protectors **30** that are attached to the electricity storage body **11**. The electricity storage body **11** is constituted by arranging a plurality of electricity storage elements (not shown) that each have positive and negative electrodes. The electrodes of electricity storage elements that are adjacent to each other are connected by a connection member that is made of metal, and thus the plurality of electricity storage elements are connected in series. Also, as shown in FIG. **5**, for example, a pair of positive and negative electrode terminals **12** at the ends of the series connection are exposed from an upper surface **11**A so as to be connectable to external elements.

**[0035]** Areas that are close to the electrode terminals **12**, of the upper surface **11**A of the electricity storage body **11** are configured as attachment parts **17** to which the insulating protectors **30** are attached. In each attachment part **17**, a standing wall **14** that is insulative stands upright around an electrode terminal **12**. The standing wall **14** extends so as to have a U-like shape to surround the electrode terminal **12**, and claw-shaped locking parts **15** for locking an insulating protector **30** respectively protrude from the left and right outer surfaces of the standing wall **14**. As shown in FIG. **4**, each electrode terminal **12** has a connection surface that is parallel with the upper surface **11**A of the electricity storage body **11**. Each electrode terminal **12** is bent downward inside a front wall **13** of the electricity storage body **11** so as to have an L-like shape, and is connected to an internal electricity storage element. A circular through hole **12**A, into which the shaft of a bolt **50** is inserted, is formed in each electrode terminal **12** so as to penetrate therethrough. A space into which the shaft part of a bolt **50** and a nut **51** can be inserted is formed below each electrode terminal **12**.

**[0036]** First Bus Bar **20**A and Second Bus Bar **20**B

**[0037]** The first bus bar **20**A and the second bus bar **20**B are selectively connected to the electrode terminals **12** at the ends of the series connection, and both bus bars are plate-shaped members that each have a length corresponding to the position of a partner terminal that is provided on an external device (e.g. an inverter or a motor) or another electricity storage module, for example, and are made of metal such as copper, a copper alloy, aluminum, an aluminum alloy, or stainless steel (SUS). An electrode terminal **12**—side portion of the first bus bar **20**A is bent so as to have a crank-like shape, and the first bus bar **20**A includes a bus bar body **21**, which is elongated, a connection portion **23**A that is provided at an end in the lengthwise direction and is placed on and connected to the upper surface of an electrode terminal **12**, and a level-difference portion **24** by which the bus bar body **21** and the connection portion **23**A are coupled to each other so as to form a step-like shape.

**[0038]** The bus bar body **21** is covered by a bus bar protector **26**A that is made of an insulative synthetic resin. The bus bar protector **26**A has a tubular shape that can be divided into an upper part and a lower part. The first bus bar **20**A is inserted into the bus bar protector **26**A, and includes a curved portion **27** that is curved so as to match the shape of the outer surface of a bent portion **25**A that is bent between the bus bar body **21** and the level-difference portion **24**. The lower end of the curved portion **27** (an end of the bus bar protector **26**A) is located slightly below the upper surface of the insulating protector **30**. When the connection portion **23**A of the first bus bar **20**A is connected to an electrode terminal **12**, the first bus bar **20**A extends along the upper surface **11**A of the electricity storage body **11** toward the rear side of the electrode terminal **12**. A circular through hole **29**, into which the shaft of a bolt **50** is inserted, is formed in the connection portion **23**A so as to penetrate therethrough.

**[0039]** As shown in FIG. **17**, the second bus bar **20**B includes a bus bar body **28**, which is elongated, and a connection portion **23**B that is bent from the bus bar body **28** so as to have an L-like shape, and is placed on and connected to the upper surface of an electrode terminal **12**. The bus bar body **28** is covered by a bus bar protector **26**B that is made of an insulative synthetic resin. The bus bar protector **26**B has a tubular shape that can be divided into a front part and a rear part. The second bus bar **20**B is inserted into the bus bar protector **26**B, and the upper end of the bus bar protector **26**B is located in the vicinity of a bent portion **25**B that is bent between the bus bar body **28** and the connection portion **23**B. A circular through hole **29**, into which the shaft of a bolt **50** is inserted, is formed in the connection portion **23**B so as to penetrate therethrough.

**[0040]** When the connection portion **23**B of the second bus bar **20**B is connected to an electrode terminal **12**, the second bus bar **20**B extends along the front surface of the electricity storage body **11** toward the front side of the electrode terminal **12**. Note that a voltage detection terminal (not shown) for detecting the voltage across the electricity storage elements may be placed on the first bus bar **20**A and the second bus bar **20**B. An electrical wire connected to the voltage detection terminal is connected to an external ECU (Electronic Control Unit) (not shown). The ECU is equipped with a microcomputer, elements, etc., and has a well-known configuration that is provided with the functions of detecting the voltage, current, temperature, and so on of the electricity storage elements, and performing charging/discharging control on each electricity storage element.

**[0041]** Insulating Protectors **30**

**[0042]** Each insulating protector **30** is made of an insulative synthetic resin, and includes a main cover portion **31** that covers an electrode terminal **12**, and a sub cover portion **41** that is pivotable about a hinge portion **40** relative to the main cover portion **31**. The main cover portion **31** has a box shape that covers an electrode terminal **12** and a bolt **50**, and includes a top plate **32** that has a plate shape, and a partition wall **33** that protrudes from a peripheral portion of the top plate **32** toward the electricity storage module **10**.

**[0043]** Main Cover Portion **31**

**[0044]** A first lead-out portion **35** that allows the first bus bar **20**A to be led out of an insulating protector **30** is formed in a rear portion of the main cover portion **31** of the insulating protector **30**. The first lead-out portion **35** is formed in an intermediate portion, in a left-right direction, of the rear ends of the top plate **32** and the partition wall **33** so as to be recessed. When the insulating protector **30** is attached to the electricity storage body **11**, the first bus bar **20**A is located between the first lead-out portion **35** and the standing wall **14**, at a position near the standing wall **14**. A recessed portion **37** whose bottom surface side is recessed is formed in a rear end portion of the main cover portion **31**. The upper end of the standing wall **14** abuts against the recessed portion **37**, and thus the insulating protector **30** is held at a predetermined height.

**[0045]** As shown in FIG. **15**, a front wall portion **33**A of the partition wall **33** is cut out, and thus a second lead-out portion **39** that allows the second bus bar **20**B to be led out is formed. In a state where the sub cover portion **41** is closed, an opening that is formed by the second lead-out portion **39** and allows the second bus bar **20**B to be led out is almost entirely covered by the sub cover portion **41** (see FIG. **2**). As shown in FIG. **3**, left and right side wall portions **33**B of the partition wall **33** each have a lock-target part **34** that can bend and deform and is locked to a locking part **15** of a standing wall **14**. Each lock-target part **34** has a frame shape in which a lock-target hole **34**A is formed so as to penetrate therethrough, and each lock-target part **34** is formed by cutting out a side wall portion **33**B.

**[0046]** When an insulating protector **30** is attached to an attachment part **17** of the electricity storage body **11**, the upper end of the standing wall **14** abuts against the recessed portion **37** as shown in FIG. **4**, and the lock-target parts **34** are locked to the locking parts **15**. Thus, the position of the insulating protector **30** in the top-bottom direction is held within the range of a predetermined clearance. Also, an upper end portion of the standing wall **14** is held in the recessed portion **37**, and thus the position of the insulating protector **30** in the front-rear direction is held. Also, the left and right side wall portions **33**B are located opposite to each other outside the standing wall **14**, and thus the position of the insulating protector **30** in the left-right direction is held.

**[0047]** Sub Cover Portion **41**

**[0048]** As shown in FIG. **2**, the sub cover portion **41** has a rectangular plate shape, and extends further downward compared to the side wall portions **33**B, as with the front wall portion **33**A. A lower end **41**A of the sub cover portion **41** is located below the upper surface **11**A of the electricity storage body **11**. As shown in FIG. **17**, a lower end portion of the sub cover portion **41** is configured as a taper portion **42** whose inner side (rear side) is cut out so that the taper portion **42** tapers. When the insulating protector **30** is attached, the tapered portion **42** abuts against the second bus bar **20**B, and thus the sub cover portion **41** pivots to open forward.

**[0049]** The hinge portion **40** has a thin band-like shape, and is elastically deformable due to the thickness thereof. An intermediate portion of the hinge portion **40** in the left-right direction is cut out, and thus the hinge portion **40** is divided into a left part and a right part. In a natural state where the hinge portion **40** is not elastically deformed, the sub cover portion **41** has a shape that extends in the top-bottom direction. When the sub cover portion **41** is pivoted from such a state, the hinge portion **40** generates an elastic force in a direction in which the hinge portion **40** restores to the original shape thereof. Each insulating protector **30** can be formed by hardening resin that has been injected in a mold.

**[0050]** Next, attachment of the electricity storage module **10** will be described. A plurality of electricity storage elements are connected in series by connecting electrode terminals **12** that are adjacent to each other, of the plurality of electricity storage elements, using connection members. Then, one of the first bus bar **20**A and the second bus bar **20**B is connected to an electrode terminal **12**, depending on the partner device or the like. In Cases where First Bus Bar **20**A is Connected to Electrode Terminal **12**. The bus bar body **21** is positioned rearward of an electrode terminal **12**, the connection portion **23**A of the first bus bar **20**A is placed on the electrode terminal **12**, and the connection portion **23**A and the electrode terminal **12** are fastened to each other using a bolt (FIG. **7**).

**[0051]** Next, when an insulating protector **30** is attached to the attachment part **17** from above, the lock-target parts **34** are locked to the locking parts **15**. At this time, the first bus bar **20**A is led out of the first lead-out portion **35**, the sub cover portion **41** extends in a top-bottom direction and abuts against an upper end portion of the front surface of the body of the electricity storage module **10** to close the second lead-out portion **39** (FIG. **4**).

**[0052]** In Cases where Second Bus Bar **20**B is Connected to Electrode Terminal **12**

**[0053]** The bus bar body **28** is positioned forward of an electrode terminal **12**, the connection portion **23**B of the second bus bar **20**B is placed on the electrode terminal **12**, and the connection portion **23**B and the electrode terminal **12** are fastened to each other using a bolt (FIG. **18**).

**[0054]** Next, when an insulating protector **30** is attached to the attachment part **17** from above, the lock-target parts **34** are locked to the locking parts **15**. At this time, the second bus bar **20**B is led out of the second lead-out portion **39** and the sub cover portion **41** abuts against the second bus bar **20**B, and the hinge portion **40** elastically deforms in a

direction in which the sub cover portion **41** opens, while generating an elastic repulsive force (FIG. **17**).

**[0055]** The present embodiment achieves the following actions and effects. An insulating protector **30** that is to be attached to an electricity storage module **10** that has positive and negative electrode terminals **12**, the insulating protector **30** including: a main cover portion **31** that is configured to allow a first bus bar **20**A (a bus bar) that is connected to an electrode terminal **12**, to be led out, and to allow a second bus bar **20**B (a bus bar) that is connected to an electrode terminal **12**, to be led out via a path that is different from a path via which the first bus bar **20**A is led out; and a sub cover portion **41** that is pivotable about a hinge portion **40** relative to the main cover portion **31**, and covers the bus bar **20**B.

**[0056]** According to the present embodiment, the sub cover portion **41** pivots about the hinge portion **40** relative to the main cover portion **31**, and thus the sub cover portion **41** can cover the second bus bar **20**B that is connected to an electrode terminal **12** via a path that is different from a path via which the first bus bar **20**A is connected to an electrode terminal **12**. With this configuration, there is no need to prepare different insulating protectors for the bus bars **20**A and **20**B that are connected to a plurality of paths, and therefore it is possible to suppress an increase in manufacturing costs. Thus, it is possible to allow the bus bars **20**A and **20**B to be connected to a plurality of paths, while suppressing an increase in manufacturing costs.

**[0057]** Also, the sub cover portion **41** abuts against the second bus bar **20**B. With this configuration, it is possible to reliably suppress degradation of insulation properties regarding a part against which the sub cover portion **41** abuts.

**[0058]** Also, the hinge portion **40** is elastically deformable, and the sub cover portion **41** biases the second bus bar **20**B, using an elastic force generated by the hinge portion **40**. With this configuration, it is possible to suppress degradation of insulation properties, using an elastic force generated by the hinge portion **40**.

**[0059]** Also, the path that is different from the path via which the bus bar **20**B is led out extends along the front surface of the front wall **13** of the electricity storage module **10** (an outer surface that is different from the electrode terminal **12**-side outer surface).

**[0060]** If the path of the bus bar **20**B is three-dimensional, a gap is likely to occur, from which the bus bar **20**B is exposed, and there is a concern that insulation properties degrade. However, in such a configuration, due to the sub cover portion **41** pivoting, it is possible to suppress degradation of insulation properties.

## Other Embodiments

**[0061]** The present description is not limited to the embodiment that has been described based on the descriptions above and the drawings. For example, the following embodiments are included in the technology described in the present description.

**[0062]** (1) Although the first bus bar **20**A and the second bus bar **20**B are described as being to be connected to the same electrode terminal **12**, they may be connected to different electrode terminals **12**.

**[0063]** (2) Although the first bus bar **20**A and the second bus bar **20**B are connected to the electrode terminals **12** so as to be orientated in opposite directions that are 180° different from each other, the present description is not limited to such a configuration. For example, the first bus bar **20**A and the second bus bar **20**B may be connected to the same electrode terminal **12** so as to form a given angle with each other, or connected to a plurality of different electrode terminals **12** such that the first bus bar **20**A and the second bus bar **20**B are parallel with each other.

**[0064]** (3) The shapes of the first bus bar **20**A and the second bus bar **20**B are not limited to the shapes described in the embodiment above, and may be variously modified. The shapes are not necessarily different from each other, and may be the same. Also, the first bus bar and the second bus bar are not necessarily separate members, and may be realized using a shared member.

**[0065]** (4) In the embodiment above, the first bus bar **20**A and the second bus bar **20**B are fastened using a bolt **50** and a nut **51** that serve as fastening members. However, the present description is not limited to such a configuration. For example, the bus bars may be connected to the electrode terminal **12** through laser welding, ultrasonic welding, resistance welding, or the like.

**[0066]** (5) in the embodiment above, there is only one sub cover portion **41**. However, a plurality of sub cover portions **41** may be provided. For example, the first lead-out portion **35** may also be provided with a sub cover portion **41**.

**[0067]** (6) The insulating protectors **30** insulate not only the upper surface sides of both the first bus bar **20**A and the second bus bar **20**B, but also the lower surface side thereof. For example, the insulating protectors **30** may each be provided with an insulative mounting portion on which the first bus bar **20**A or the second bus bar **20**B are mounted.

**[0068]** (7) The electricity storage elements are not necessarily batteries, and may be capacitors or the like.

## List of Reference Numerals

**[0069]** **10**: Electricity Storage Module
**[0070]** **12**: Electrode Terminal
**[0071]** **20**A: First Bus Bar (Bus Bar)
**[0072]** **20**B: Second Bus Bar (Bus Bar)
**[0073]** **30**: Insulating protector
**[0074]** **31**: Main Cover Portion
**[0075]** **35**: First Lead-out Portion
**[0076]** **39**: Second Lead-out Portion
**[0077]** **40**: Hinge Portion
**[0078]** **41**: Sub Cover Portion

**1**. An insulating protector that is to be attached to an electricity storage module that has positive and negative electrode terminals, the insulating protector comprising:

a main cover portion that is configured to allow a bus bar that is connected to an electrode terminal, to be led out, and to allow a bus bar that is connected to an electrode terminal, to be led out via a path that is different from a path via which the aforementioned bus bar is led out; and

a sub cover that is pivotable about a hinge portion relative to the main cover portion, and covers a bus bar.

**2**. The insulating protector according to claim **1**, wherein the sub cover portion abuts against a bus bar.

**3**. The insulating protector according to claim **1**, wherein the hinge portion is elastically deformable, and the sub cover portion biases a bus bar, using an elastic force generated by the hinge portion.

**4**. The insulating protector according to claim **1**, wherein the path that is different from the path via which the

aforementioned bus bar is led out extends along an outer surface of the electricity storage module, the outer surface being different from an electrode terminal-side outer surface of the electricity storage module.

**5**. An electricity storage module comprising: the insulating protector according to claim **1**; and the bus bars.

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