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(54) **POWER CONVERSION DEVICE**

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(57) **ABSTRACT**

A power conversion device includes: a power module forming at least a part of a power conversion circuit; a motor connection AC connector configured to be connected to a motor-side connector included in a motor; a motor connection bus bar connecting the motor connection AC connector and the power module; a cover portion configured to come into contact with the motor-side connector and covering the power module; and a connector-fixing portion formed into a separate body from the cover portion and to which the motor connection AC connector is fixed.

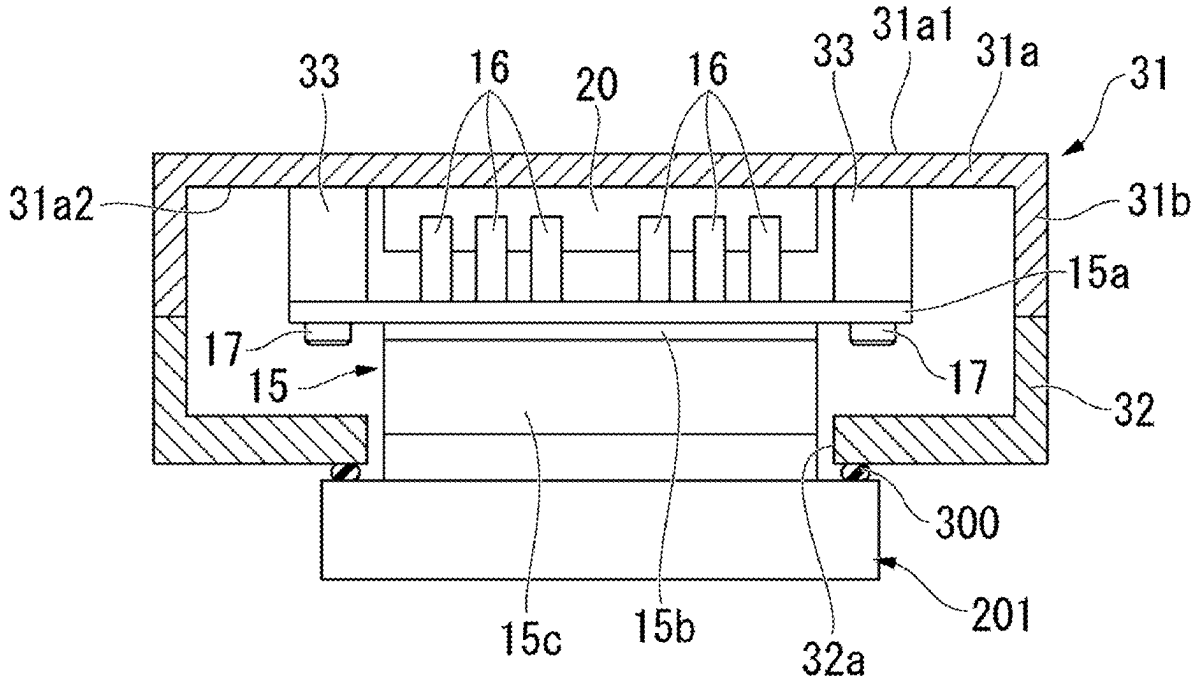
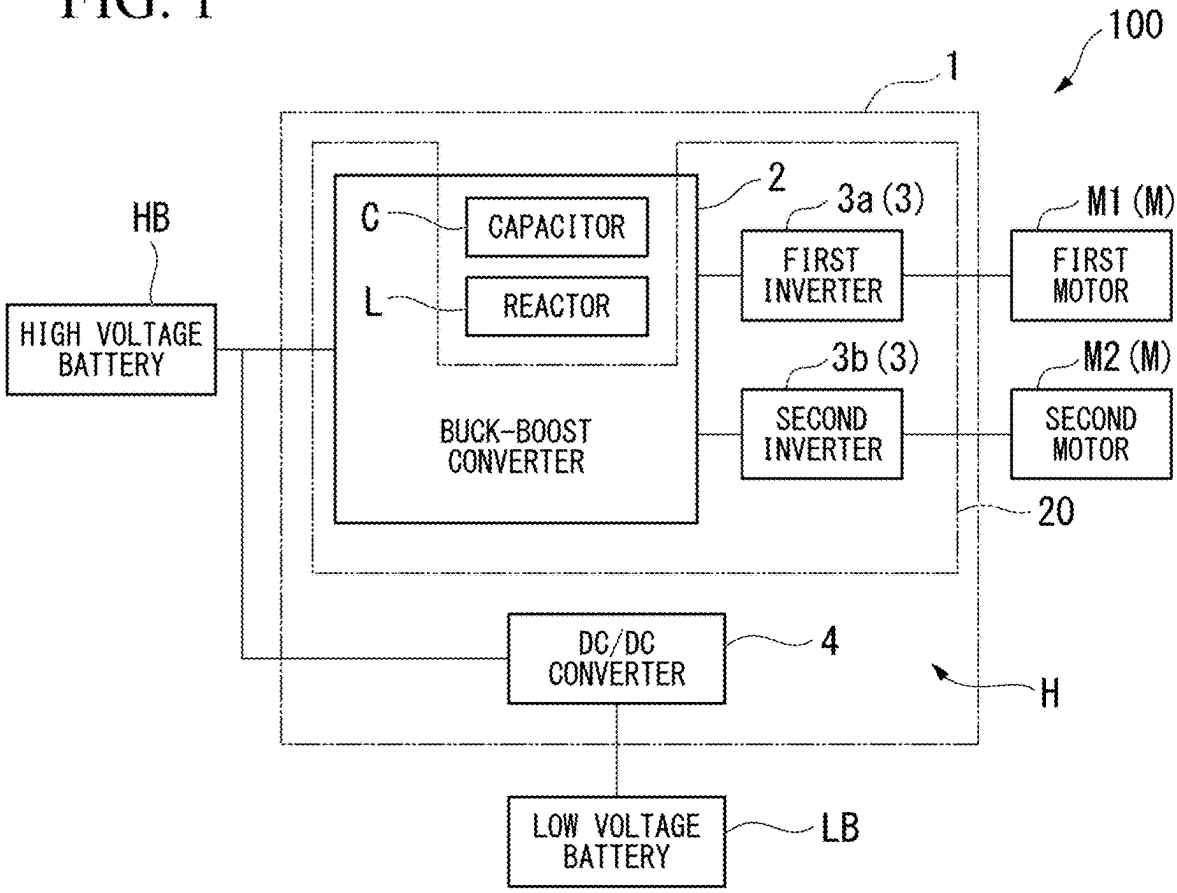


FIG. 1


100
1
2
3a (3)
M1 (M)
HB
C
CAPACITOR
FIRST INVERTER
FIRST MOTOR
HIGH VOLTAGE BATTERY
L
REACTOR
3b (3)
M2 (M)
BUCK-BOOST CONVERTER
SECOND INVERTER
SECOND MOTOR
20
DC/DC CONVERTER
4
H
LOW VOLTAGE BATTERY
LB

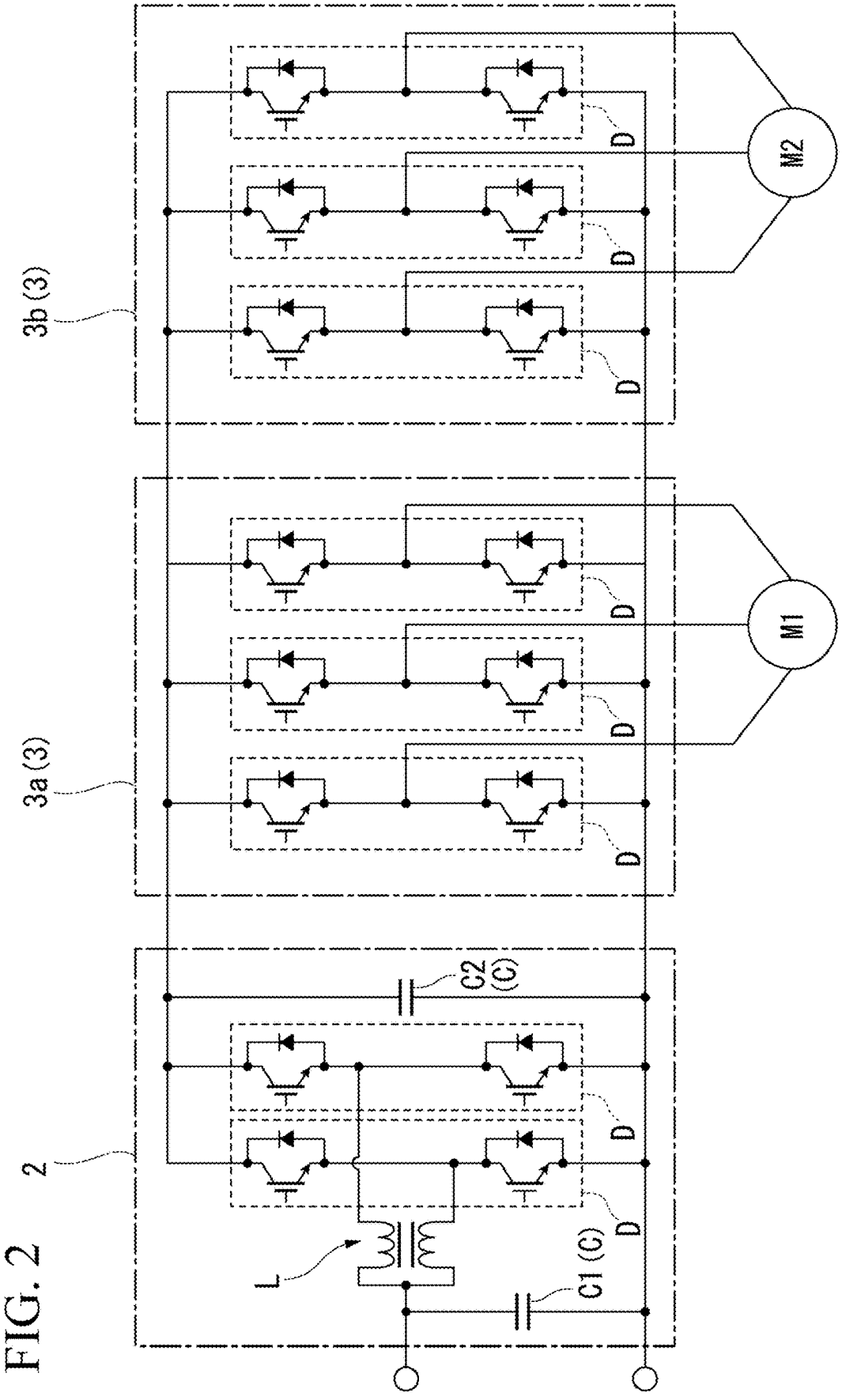



FIG. 2

FIG. 3

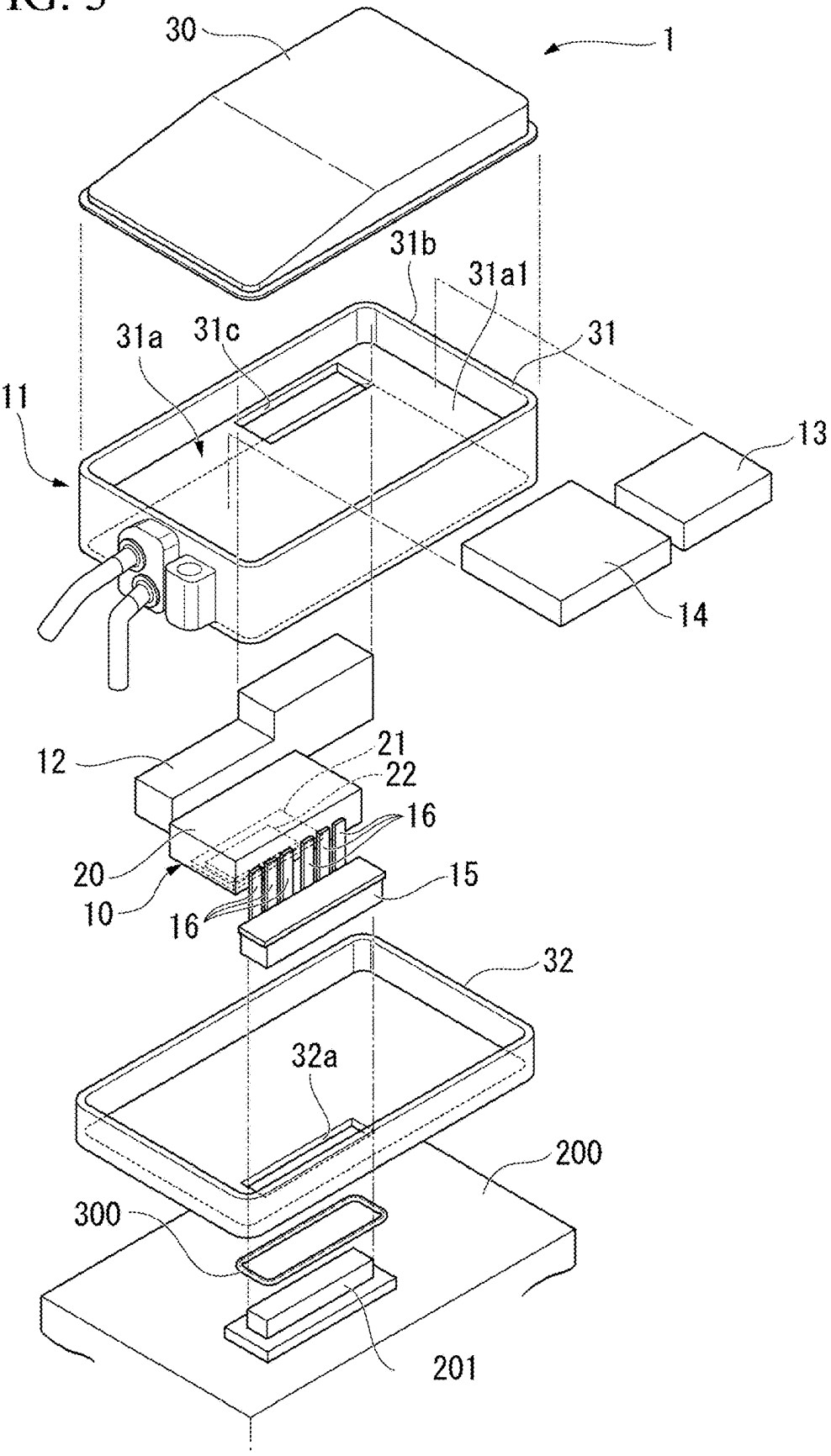

30
1
31b
31a1
31a
31c
31
11
13
14
12
21
22
16
20
10
16
15
32
32a
200
300
201

FIG. 4

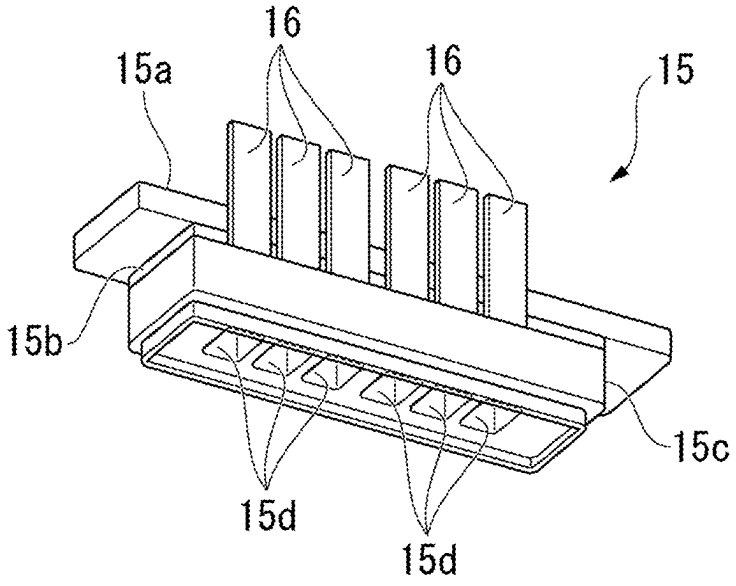
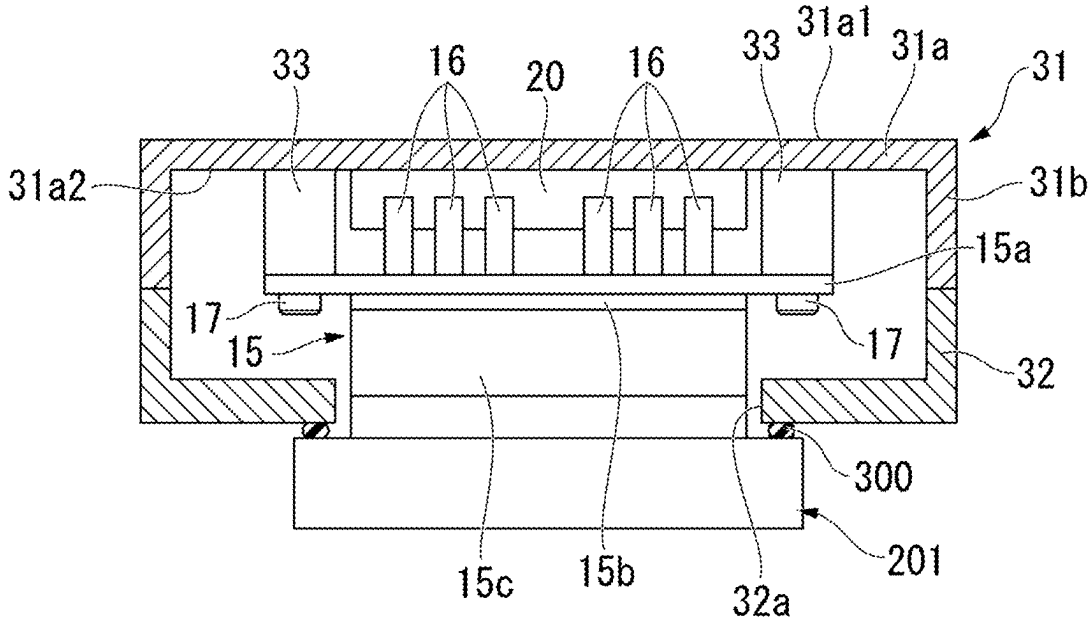

16
16
15a
15
15b
15c
15d
15d

FIG. 5


33
16
20
16
33
31a1
31a
31
31a2
31b
15a
17
15
17
32
300
201
15c
15b
32a

# POWER CONVERSION DEVICE

## CROSS REFERENCE TO RELATED APPLICATIONS

**[0001]** The present invention claims priority under 35 U.S.C. § 119 to Japanese Application No. 2024-022437, filed on Feb. 16, 2024, the entire contents of which being incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### Field of the Invention

**[0002]** The present invention relates to a power conversion device.

### Description of Related Art

**[0003]** For example, Japanese Patent No. 6441095 (hereinafter, referred to as Patent Document 1) discloses a connector device that includes an inverter-side connector.

**[0004]** In the connector device disclosed in Patent Document 1, a motor and an inverter are connected to each other by connecting a motor-side connector included in the motor to the inverter-side connector. In the connector device disclosed in Patent Document 1, the inverter-side connector is fixed to an inverter case.

**[0005]** In Patent Document 1, the inverter-side connector is fixed to a cover-shaped inverter case bottom wall portion (hereinafter, referred to as a cover portion) that covers a power module and the like. When the inverter-side connector is inserted into the motor-side connector, the inverter-side connector receives a reaction force from the motor-side connector. Such a reaction force is generated all the time and is received by the cover portion to which the inverter-side connector is fixed. Further, the motor-side connector is pressed against the cover portion. In order to seal the connection between the inverter-side connector and the motor-side connector, the motor-side connector is strongly pressed against the cover portion through a sealing member. Therefore, in the configuration disclosed in Patent Document 1, the force received by the cover portion after manufacturing becomes large, and thus it is difficult to reduce the stiffness of the cover portion.

**[0006]** The present invention has been made in view of the above-described circumstances, and an object of the present invention is to reduce a load on a cover portion and to be able to reduce the stiffness of the cover portion in a power conversion device that includes a motor connection AC connector to which a motor is connected.

## SUMMARY OF THE INVENTION

**[0007]** The present invention adopts the following configuration as means for obtaining the above object.

**[0008]** A power conversion device of an aspect of the present invention includes: a power module forming at least a part of a power conversion circuit; a motor connection AC connector configured to be connected to a motor-side connector included in a motor; a motor connection bus bar connecting the motor connection AC connector and the power module; a cover portion configured to come into contact with the motor-side connector and covering the power module; and a connector-fixing portion formed into a separate body from the cover portion and to which the motor connection AC connector is fixed.

**[0009]** According to the present invention, the motor connection AC connector to which the motor is connected is fixed to the connector-fixing portion formed into a separate body from the cover portion configured to come into contact with the motor-side connector. Therefore, the reaction force acting on the motor connection AC connector by inserting the motor connection AC connector into the motor-side connector is received by the connector-fixing portion. Thus, according to the present invention, it is possible to reduce a load on the cover portion. Consequently, the present invention can reduce the load on the cover portion and reduce the stiffness of the cover portion in the power conversion device that includes the motor connection AC connector to which the motor is connected.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** FIG. **1** is a schematic configuration diagram of a vehicle on which a power conversion device according to an embodiment of the present invention is mounted.

**[0011]** FIG. **2** is a circuit diagram showing an electrical schematic configuration of a buck-boost converter and an inverter included in the power conversion device according to the embodiment of the present invention.

**[0012]** FIG. **3** is an exploded perspective view showing a structural schematic configuration of the power conversion device according to the embodiment of the present invention.

**[0013]** FIG. **4** is a schematic perspective view of a connector unit included in the power conversion device according to the embodiment of the present invention.

**[0014]** FIG. **5** is a schematic cross-sectional view including the connector unit included in the power conversion device according to the embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0015]** In the following, an embodiment of a power conversion device according to the present invention will be described with reference to the drawings.

**[0016]** FIG. **1** is a schematic configuration diagram of a vehicle **100** on which a power conversion device **1** of the present embodiment is mounted. The vehicle **100** is, for example, an electric vehicle or a hybrid vehicle. As shown in FIG. **1**, the vehicle **100** includes, for example, a high voltage battery HB, a low voltage battery LB, a motor M, and the power conversion device **1** of the present embodiment.

**[0017]** The high voltage battery HB is a secondary battery, such as a lithium ion battery, and outputs relatively high voltage DC power of, for example, about several hundred volts. The high voltage battery HB is a battery that outputs driving electric power to be supplied to the motor M and is a so-called driving battery. The low voltage battery LB is a secondary battery, such as a lead-acid battery, and outputs relatively low voltage DC power of, for example, about 12 V. The low voltage battery LB is a battery that outputs power for auxiliary devices to be supplied to auxiliary devices (not shown) and is a so-called auxiliary device battery.

**[0018]** The motor M generates rotational motive power by the driving electric power being supplied thereto from the high voltage battery HB through the power conversion device **1**. The rotational motive power generated by the

motor M is transmitted to drive wheels of the vehicle **100** through a transmission mechanism (not shown). In the present embodiment, the motor M includes a first motor M**1** and a second motor M**2**. For example, the first motor M**1** generates motive power to be supplied to front wheels of the vehicle **100**. In addition, for example, the second motor M**2** generates motive power to be supplied to rear wheels of the vehicle **100**.

**[0019]** The power conversion device **1** of the present embodiment is a device that performs power conversion. For example, the power conversion device **1** converts DC power into AC power, converts AC power into DC power, or converts voltage. Specifically, the power conversion device **1** of the present embodiment steps up the driving electric power output from the high voltage battery HB, converts it into alternating current, and supplies the alternating current to the motor M. In addition, the power conversion device **1** of the present embodiment converts regenerative power output from the motor M into direct current, steps down it, and supplies it to the high voltage battery HB. Further, the power conversion device **1** of the present embodiment steps down the driving electric power output from the high voltage battery HB to generate power for auxiliary devices and supplies the power for auxiliary devices to the low voltage battery LB.

**[0020]** As shown in FIG. **1**, the power conversion device **1** of the present embodiment includes a buck-boost converter **2**, an inverter **3**, and a DC/DC converter **4**. The buck-boost converter **2**, the inverter **3**, and the DC/DC converter **4** constitute a power conversion circuit H that performs power conversion. The buck-boost converter **2** steps up or steps down the electric power. For example, the buck-boost converter **2** steps up the driving electric power supplied from the high voltage battery HB and outputs it to the inverter **3**. In addition, the buck-boost converter **2** steps down the regenerative power supplied from the inverter **3** and outputs it to the high voltage battery HB.

**[0021]** The inverter **3** converts the DC power into the AC power or converts the AC power into the DC power. For example, the inverter **3** converts DC driving electric power supplied from the buck-boost converter **2** into three-phase AC power and outputs the three-phase AC power to the motor M. In addition, the inverter **3** converts AC regenerative power supplied from the motor M into DC power and outputs the DC power to the high voltage battery HB. In the present embodiment, the inverter **3** includes a first inverter **3***a* and a second inverter **3***b*. The first inverter **3***a* is connected to the first motor M**1**. Further, the second inverter **3***b* is connected to the second motor M**2**.

**[0022]** The DC/DC converter **4** steps down the driving electric power output from the high voltage battery HB to convert it into power for auxiliary devices. The DC/DC converter **4** converts DC driving electric power into DC power for auxiliary devices.

**[0023]** FIG. **2** is a circuit diagram showing an electrical schematic configuration of the buck-boost converter **2** and the inverter **3**. As shown in FIG. **2**, the power conversion device **1** of the present embodiment includes the buck-boost converter **2** and the inverter **3** that are connected to each other.

**[0024]** The buck-boost converter **2** includes two power devices D, two capacitors C, and a reactor L. One capacitor C (hereinafter, referred to as a first capacitor C**1**) of the two capacitors C stores electric power before the step-up in a case where electric power is supplied from the high voltage battery HB to the motor M. In addition, the other capacitor C (hereinafter, referred to as a second capacitor C**2**) of the two capacitors C stores electric power after the step-up in a case where electric power is supplied from the high voltage battery HB to the motor M. Each of the first capacitor C**1** and the second capacitor C**2** is not limited to being formed of a single element. The first capacitor C**1** may be formed of a plurality of elements, or the second capacitor C**2** may be formed of a plurality of elements.

**[0025]** In addition, each inverter **3** includes three power devices D. Each power device D has a power transistor. These power transistors have semiconductor elements and are mounted on an insulated circuit board. In the present embodiment, one power device D includes two power transistors. However, a power device having a single power transistor may be provided. In this case, four power devices are provided in the buck-boost converter **2**, and six power devices are provided in the inverter **3**. For example, each power transistor includes a plurality of semiconductor elements formed of, for example, silicon carbide (SIC). The power transistor may include a semiconductor element formed of other materials such as silicon (Si) or gallium nitride (GaN).

**[0026]** FIG. **3** is an exploded perspective view showing a structural schematic configuration of the power conversion device **1** of the present embodiment. As shown in FIG. **3**, the power conversion device **1** of the present embodiment includes an intelligent power module **10**, a main body case **11**, a capacitor unit **12**, a reactor unit **13**, a DC/DC converter unit **14**, a connector unit **15**, and a motor connection bus bar **16**.

**[0027]** In the following description, for convenience of description, a side on which the DC/DC converter unit **14** and the like are positioned with respect to a partition wall portion **31***a* of a central plate **31**, which will be described later, of the main body case **11** is referred to as an upper side, and a side on which the intelligent power module **10** is positioned with respect to the partition wall portion **31***a* of the central plate **31**, which will be described later, of the main body case **11** is referred to as a lower side. However, the installation posture of the power conversion device **1** is not particularly limited.

**[0028]** The intelligent power module **10** includes a power module **20**, a gate driver board **21**, an ECU board **22**, and the like. The power module **20** includes a plurality of power devices D having semiconductor elements, a power module case made of a resin that accommodates the plurality of power devices D, and the like.

**[0029]** The gate driver board **21** is a board provided with gate drivers that generate drive signals for the buck-boost converter **2** or the inverter **3**, which are formed of the power devices D. Such a gate driver board **21** is stacked on the power module **20**. The ECU board **22** is a board provided with an electronic control unit (ECU) that controls the gate driver board **21**. The ECU board **22** is stacked on the gate driver board **21**. The gate driver board **21** and the ECU board **22** may be integrated together.

**[0030]** The intelligent power module **10** includes the power devices D that constitute the buck-boost converter **2** or the inverter **3**. That is, the intelligent power module **10** forms at least a part of the buck-boost converter **2** or the inverter **3**.

**[0031]** The main body case **11** is a case that accommodates the intelligent power module **10**, the capacitor unit **12**, the reactor unit **13**, the DC/DC converter unit **14**, the connector unit **15**, the motor connection bus bar **16**, and the like. The main body case **11** includes an upper cover **30**, the central plate **31** (support plate, connector-fixing portion), and a lower cover **32** (cover portion). The upper cover **30**, the central plate **31**, and the lower cover **32** are formed to be separable in the up-down direction.

**[0032]** The upper cover **30** is a portion that covers, from above, the DC/DC converter unit **14** and the reactor unit **13** fixed to the central plate **31** from above. That is, the upper cover **30** is fastened to the central plate **31** through bolts (not shown) or the like.

**[0033]** The central plate **31** is a support plate positioned between the upper cover **30** and the lower cover **32**. The central plate **31** includes the flat plate-shaped partition wall portion **31***a* and a surrounding wall portion **31***b* provided to surround the partition wall portion **31***a* from the side of the partition wall portion **31***a*.

**[0034]** The partition wall portion **31***a* is disposed such that one surface (hereinafter, referred to as an upper surface **31***a***1**) thereof faces upward and the other surface (hereinafter, referred to as a lower surface **31***a***2**) thereof faces downward. The lower surface **31***a***2** is shown in FIG. **5**. Such a partition wall portion **31***a* supports, for example, the intelligent power module **10**, the capacitor unit **12**, the reactor unit **13**, and the DC/DC converter unit **14**.

**[0035]** In the present embodiment, the reactor unit **13** and the DC/DC converter unit **14** are disposed above the partition wall portion **31***a*. That is, the reactor unit **13** and the DC/DC converter unit **14** are disposed to face the upper surface **31***a***1** of the partition wall portion **31***a* from above. In addition, in the present embodiment, the intelligent power module **10** is disposed below the partition wall portion **31***a*. That is, the intelligent power module **10** is disposed to face the lower surface **31***a***2** of the partition wall portion **31***a* from below. In addition, in the present embodiment, part of the capacitor unit **12** is provided to penetrate the partition wall portion **31***a* in the up-down direction. Therefore, the partition wall portion **31***a* is provided with an insertion opening **31***c* through which the capacitor unit **12** is inserted.

**[0036]** The intelligent power module **10**, the capacitor unit **12**, the reactor unit **13**, the DC/DC converter unit **14**, and the connector unit **15** are fastened by bolts (not shown) or the like to bosses or the like provided in the partition wall portion **31***a*.

**[0037]** Flow paths (not shown) that guide a cooling liquid are provided inside the partition wall portion **31***a*. By flowing the cooling liquid through the flow paths, the partition wall portion **31***a* functions as a cooling jacket, and the intelligent power module **10**, the capacitor unit **12**, the reactor unit **13**, the DC/DC converter unit **14**, and the connector unit **15** are cooled.

**[0038]** The surrounding wall portion **31***b* is provided to surround the intelligent power module **10**, the capacitor unit **12**, the reactor unit **13**, and the DC/DC converter unit **14** from the side of them. The surrounding wall portion **31***b* is connected to the edge portion of the partition wall portion **31***a* and is provided to protrude upward and downward from the partition wall portion **31***a*. The upper end of the surrounding wall portion **31***b* is in contact with the upper cover **30**. In addition, the lower end of the surrounding wall portion **31***b* is in contact with the lower cover **32**.

**[0039]** The lower cover **32** is a portion that covers, from below, the intelligent power module **10** fixed to the central plate **31** from below. In addition, the lower cover **32** also covers the capacitor unit **12** and the motor connection bus bar **16** from below. Such a lower cover **32** is fastened to the central plate **31** through bolts (not shown) or the like.

**[0040]** In addition, in the present embodiment, the lower cover **32** comes into contact with a motor-side connector **201** included in a motor unit **200**. The motor-side connector **201** comes into contact with the lower cover **32** through a seal member **300**. In addition, the lower cover **32** is provided with an opening portion **32***a* for exposing a motor connection AC connector **15***c* (refer to FIG. **5**), which will be described later, of the connector unit **15**. The motor-side connector **201** is inserted into the motor connection AC connector **15***c* through the opening portion **32***a*.

**[0041]** The motor unit **200** is a unit including the first motor M**1** and the second motor M**2**. The first motor M**1** and the second motor M**2** are three-phase AC motors and are driven by electric power supplied from the power conversion device **1** through the motor-side connector **201**. Such a motor-side connector **201** is a six-phase connector having terminals for three phases of the first motor M**1** and terminals for three phases of the second motor M**2**.

**[0042]** The capacitor unit **12** is connected to the intelligent power module **10** and is disposed on a side of the power module **20**. The capacitor unit **12** is a unit including the capacitors C provided in the buck-boost converter **2**. The capacitor unit **12** includes elements that form the capacitors C and a housing that covers the elements.

**[0043]** In the present embodiment, the capacitor unit **12** includes the first capacitor C**1** and the second capacitor C**2** provided in the buck-boost converter **2**. In the capacitor unit **12**, the elements forming the first capacitor C**1** are disposed inside the capacitor unit **12** to be positioned above the partition wall portion **31***a*. In addition, the elements forming the second capacitor C**2** are disposed inside the capacitor unit **12** to be positioned below the partition wall portion **31***a*.

**[0044]** The reactor unit **13** is fixed to the central plate **31**. The reactor unit **13** is connected to the intelligent power module **10** through a bus bar (not shown) and is disposed above the central plate **31** in the present embodiment. The reactor unit **13** is a unit including the reactor L provided in the buck-boost converter **2**.

**[0045]** The DC/DC converter unit **14** is fixed to the central plate **31**. The DC/DC converter unit **14** is connected to the intelligent power module **10** through a bus bar (not shown) and is disposed above the central plate **31** in the present embodiment. The DC/DC converter unit **14** is a unit forming the DC/DC converter **4** shown in FIG. **1**.

**[0046]** The connector unit **15** is a unit to which the motor-side connector **201** of the motor unit **200** is connected. In the present embodiment, the connector unit **15** is disposed below the partition wall portion **31***a* of the central plate **31**. In addition, the connector unit **15** is disposed further below the intelligent power module **10**. FIG. **4** is a schematic perspective view of the connector unit **15**. In addition, FIG. **5** is a schematic cross-sectional view including the connector unit **15**. As shown in FIGS. **4** and **5**, the connector unit **15** includes a metal plate **15***a*, a resin plate **15***b*, and the motor connection AC connector **15***c*.

**[0047]** The metal plate **15***a* is a plate-shaped strength member that supports the resin plate **15***b* and the motor connection AC connector **15***c*. As shown in FIG. **5**, the lower

surface **31***a***2** of the partition wall portion **31***a* of the central plate **31** is a connector-facing surface, which the motor connection AC connector **15***c* is disposed to face through the metal plate **15***a* and the resin plate **15***b*. A plurality of bosses **33** formed to protrude downward from the lower surface **31***a***2** are provided on the lower surface **31***a***2** of the partition wall portion **31***a*. The bosses **33** are portions to which the connector unit **15** (that is, the motor connection AC connector **15***c*) is fixed. The metal plate **15***a* is fastened to the distal end of each boss **33** by a bolt **17**. The stiffness of the connector unit **15** is improved by such a metal plate **15***a*.

**[0048]** The plurality of bosses **33** may have different shapes as viewed in the protruding direction thereof (from below). When the shapes of the plurality of bosses **33** are different from each other, for example, an operator can easily visually recognize the bosses **33**. In addition, when the shapes of the plurality of bosses **33** are different from each other, for example, it is possible to physically prevent the connector unit **15** from being fastened in a posture different from the correct attachment posture. Therefore, it is possible to suppress incorrect assembly of the connector unit **15**.

**[0049]** The resin plate **15***b* is interposed between the metal plate **15***a* and the motor connection AC connector **15***c*. That is, the resin plate **15***b* is interposed between a surface (in the present embodiment, the lower surface) of the metal plate **15***a* and the motor connection AC connector **15***c*. Such a resin plate **15***b* secures an insulation distance between the metal plate **15***a*, and the motor connection AC connector **15***c* and the motor-side connector **201**.

**[0050]** The motor connection AC connector **15***c* is a connector to which the motor-side connector **201** is connected. In the present embodiment, the motor-side connector **201** is a six-phase connector as described above. Therefore, the motor connection AC connector **15***c* to be connected to the motor-side connector **201** is also a six-phase connector. That is, the motor connection AC connector **15***c* is a six-phase connector to which the first motor M**1** and the second motor M**2** are connected. As shown in FIG. **4**, the motor connection AC connector **15***c* includes insertion slots **15***d*, and each insertion slot **15***d* corresponds to each phase. These insertion slots **15***d* are linearly arranged as shown in FIG. **4**.

**[0051]** As shown in FIG. **5**, the motor connection AC connector **15***c* is fixed to the boss **33** through the resin plate **15***b* and the metal plate **15***a*. Therefore, the motor connection AC connector **15***c* is fixed to the central plate **31** formed into a separate body from the lower cover **32** that comes into contact with the motor-side connector **201**. That is, in the present embodiment, the central plate **31** functions as a connector-fixing portion formed into a separate body from the lower cover **32** and to which the motor connection AC connector **15***c* is fixed.

**[0052]** In addition, in the present embodiment, as shown in FIG. **5**, the power module **20** is supported to face the connector-facing surface (the lower surface **31***a***2**) that is a surface of the partition wall portion **31***a* included in the central plate **31** on the motor connection AC connector **15***c*-side. Further, the intelligent power module **10** (that is, the power module **20**) is positioned between the connector-facing surface (the lower surface **31***a***2**) and the distal end of the boss **33** in the protruding direction of the boss **33**. That is, the intelligent power module **10** is disposed in a space between the connector unit **15**, which is fastened to the distal end of the boss **33** from below, and the partition wall portion **31***a*.

**[0053]** The motor connection bus bar **16** is an electric power transmission member that connects the motor connection AC connector **15***c* and the power module **20**. The motor connection bus bar **16** is provided for each phase of the motor M. That is, in the present embodiment, six motor connection bus bars **16** are provided for a total of six phases, including three phases of the first motor M**1** and three phases of the second motor M**2**. Each motor connection bus bar **16** connects each insertion slot **15***d* of the motor connection AC connector **15***c* to an output terminal (not shown) of the power module **20**.

**[0054]** The power conversion device **1** of the present embodiment is connected to the motor unit **200** by connecting the motor connection AC connector **15***c* to the motor-side connector **201** of the motor unit **200**. At this time, the motor-side connector **201** is brought into contact with the lower cover **32** through the seal member **300**. Therefore, the pressing force added from the motor-side connector **201** is received by the lower cover **32**. On the other hand, when the motor connection AC connector **15***c* is connected to the motor-side connector **201**, the motor connection AC connector **15***c* receives a reaction force from the motor-side connector **201**. Here, the motor connection AC connector **15***c* is fixed to the central plate **31**. Therefore, the reaction force described above is received by the central plate **31**.

**[0055]** The power conversion device **1** of the present embodiment as described above includes the power module **20**, the motor connection AC connector **15***c*, the motor connection bus bar **16**, the lower cover **32**, and the connector-fixing portion (the central plate **31**). The power module **20** forms at least a part of the power conversion circuit H. The motor connection AC connector **15***c* is configured to be connected to the motor-side connector **201** included in the motor M. The motor connection bus bar **16** connects the motor connection AC connector **15***c* and the power module **20**. The lower cover **32** is configured to come into contact with the motor-side connector **201** and covers the power module **20**. The connector-fixing portion (the central plate **31**) is formed into a separate body from the lower cover **32**, and the motor connection AC connector **15***c* is fixed thereto.

**[0056]** According to the power conversion device **1** of the present embodiment, the motor connection AC connector **15***c* to which the motor M is connected is fixed to the connector-fixing portion (the central plate **31**) formed into a separate body from the lower cover **32** that is configured to come into contact with the motor-side connector **201**. Therefore, the reaction force acting on the motor connection AC connector **15***c* by inserting the motor connection AC connector **15***c* into the motor-side connector **201** is received by the connector-fixing portion (the central plate **31**). Therefore, according to the power conversion device **1** of the present embodiment, it is possible to reduce the load on the lower cover **32**. Thus, the power conversion device **1** of the present embodiment is a power conversion device including the motor connection AC connector **15***c* to which the motor M is connected, which can reduce the load on the lower cover **32** and reduce the stiffness of the lower cover **32**. Further, the stiffness of the lower cover **32** is reduced, so the power conversion device **1** of the present embodiment is small and lightweight.

**[0057]** In addition, the power conversion device **1** of the present embodiment includes the central plate **31** that supports the power module **20**. In addition, the connector-fixing portion is the central plate **31**. According to the present embodiment, the central plate **31** having stiffness enough to support the power module **20** can receive the reaction force acting on the motor connection AC connector **15***c*. Therefore, the reaction force acting on the motor connection AC connector **15***c* can be stably received. In addition, it is not necessary to provide the connector-fixing portion as a new member by using the central plate **31** as the connector-fixing portion. Accordingly, the power conversion device **1** of the present embodiment can prevent an increase in size and an increase in weight due to the provision of the connector-fixing portion.

**[0058]** In addition, in the power conversion device **1** of the present embodiment, the power module **20** is supported to face the connector-facing surface (the lower surface **31***a***2**) that is a surface of the central plate **31** on the motor connection AC connector **15***c*-side.

**[0059]** According to the power conversion device **1** of the present embodiment, the power module **20** and the motor connection AC connector **15***c* can be disposed to be closer to each other than a case where the power module **20** is positioned on the upper surface **31***a***1**-side of the central plate **31**. Therefore, according to the power conversion device **1** of the present embodiment, it is possible to shorten the motor connection bus bar **16** and to realize size reduction and weight reduction.

**[0060]** In addition, the central plate **31** of the power conversion device **1** of the present embodiment includes the plurality of bosses **33** formed to protrude from the connector-facing surface (the lower surface **31***a***2**) and to which the motor connection AC connector **15***c* is fixed. In addition, the power module **20** is positioned between the connector-facing surface (the lower surface **31***a***2**) and the distal end of the boss **33** in the protruding direction of the boss **33**.

**[0061]** According to the power conversion device **1** of the present embodiment, the power module **20** is disposed in a space between the connector unit **15** that is fastened to the distal end of the boss **33** from below and the partition wall portion **31***a*. Therefore, it is possible to effectively use the space between the connector unit **15** and the partition wall portion **31***a* and to realize size reduction and weight reduction.

**[0062]** In addition, the power conversion device **1** of the present embodiment includes the metal plate **15***a* and the resin plate **15***b*. The metal plate **15***a* is fastened to the distal ends of the plurality of bosses **33**. The resin plate **15***b* is interposed between a surface of the metal plate **15***a* and the motor connection AC connector **15***c*. Further, the motor connection AC connector **15***c* is fixed to the boss **33** through the resin plate **15***b* and the metal plate **15***a*.

**[0063]** According to the power conversion device **1** of the present embodiment, the motor connection AC connector **15***c* can be stably supported by the metal plate **15***a*, and the motor connection AC connector **15***c* and the metal plate **15***a* can be insulated from each other by the resin plate **15***b*.

**[0064]** In addition, the central plate **31** of the power conversion device **1** of the present embodiment may include the plurality of bosses **33** having different shapes as viewed in the protruding direction. According to the power conversion device **1** of the present embodiment, it is possible to prevent incorrect assembly of the connector unit **15**.

**[0065]** In addition, the motor connection AC connector **15***c* of the power conversion device **1** of the present embodiment is a six-phase connector to which the first motor M**1** included in the motor M and the second motor M**2** different from the first motor M**1** and included in the motor M are connected and includes the insertion slots **15***d* that are linearly arranged.

**[0066]** In the power conversion device **1** of the present embodiment, the motor connection AC connector **15***c* can be supported by the connector-fixing portion that is formed into a separate body from the lower cover **32**. In a case where the insertion slots **15***d* are linearly disposed, the motor connection AC connector **15***c* is thinned. Therefore, the posture of the motor connection AC connector **15***c* is more likely to be unstable than a case where the insertion slots **15***d* are disposed in parallel. On the other hand, according to the power conversion device **1** of the present embodiment, the motor connection AC connector **15***c* can be firmly fixed by supporting the motor connection AC connector **15***c* by the connector-fixing portion formed into a separate body from the lower cover **32**. Therefore, as in the power conversion device **1** of the present embodiment, it is also possible to linearly arrange the insertion slots **15***d*, and the degree of freedom of the shape of the motor connection AC connector **15***c* can be improved.

**[0067]** Although the appropriate embodiments of the present invention have been described above with reference to the accompanying drawings, the present invention is not limited to the above embodiments. The shapes, combinations and the like of the constituent members shown in the above-described embodiment are merely examples and can be variously changed based on design requirements and the like within the scope of the present invention.

**[0068]** For example, in the above-described embodiment, the configuration in which the motor connection AC connector **15***c* is a six-phase connector has been described. However, the present invention is not limited to this. For example, the motor connection AC connector **15***c* may be a three-phase connector. In such a case, two motor connection AC connectors **15***c* may be provided. In addition, the motor M may be one.

**[0069]** In addition, in the above-described embodiment, the configuration in which the power module **20** is positioned below the partition wall portion **31***a* has been described. However, the present invention is not limited to this. For example, it is also possible to adopt a configuration in which the power module **20** is disposed above the partition wall portion **31***a*.

**[0070]** In addition, in the above-described embodiment, the configuration in which the power device D forming the buck-boost converter **2** is included in the power module **20** has been described. However, the present invention is not limited to this. For example, it is also possible to adopt a configuration in which a buck-boost converter unit forming the buck-boost converter **2** is provided separately from the power module **20**.

**[0071]** The above-described embodiments can also be described as, for example, the following appendices.

## Appendix 1

**[0072]** A power conversion device includes: a power module forming at least a part of a power conversion circuit; a motor connection AC connector configured to be connected to a motor-side connector included in a motor; a motor

connection bus bar connecting the motor connection AC connector and the power module; a cover portion configured to come into contact with the motor-side connector and covering the power module; and a connector-fixing portion formed into a separate body from the cover portion and to which the motor connection AC connector is fixed.

Appendix 2

**[0073]** The power conversion device according to Appendix 1, further includes: a support plate supporting the power module, in which the support plate is the connector-fixing portion.

Appendix 3

**[0074]** The power conversion device according to Appendix 2 is in which the power module is supported to face a connector-facing surface that is a surface of the support plate on the motor connection AC connector-side.

Appendix 4

**[0075]** The power conversion device according to Appendix 3 is in which the support plate includes a plurality of bosses formed to protrude from the connector-facing surface and to which the motor connection AC connector is fixed, and the power module is positioned between the connector-facing surface and a distal end of a boss of the plurality of bosses in a protruding direction of the boss.

Appendix 5

**[0076]** The power conversion device according to Appendix 4, further includes: a metal plate fastened to distal ends of the plurality of bosses; and a resin plate interposed between a surface of the metal plate and the motor connection AC connector, in which the motor connection AC connector is fixed to the boss through the resin plate and the metal plate.

Appendix 6

**[0077]** The power conversion device according to Appendix 4 or 5 is in which the support plate includes the plurality of bosses having different shapes as viewed in the protruding direction.

Appendix 7

**[0078]** The power conversion device according to any one of Appendixes 1 to 6 is in which the motor connection AC connector is a six-phase connector to which a first motor and a second motor different from the first motor, which are included in the motor, are connected, and includes insertion slots linearly arranged.

What is claimed is:

**1**. A power conversion device comprising:

a power module forming at least a part of a power conversion circuit;

a motor connection AC connector configured to be connected to a motor-side connector included in a motor;

a motor connection bus bar connecting the motor connection AC connector and the power module;

a cover portion configured to come into contact with the motor-side connector and covering the power module; and

a connector-fixing portion formed into a separate body from the cover portion and to which the motor connection AC connector is fixed.

**2**. The power conversion device according to claim **1**, further comprising:

a support plate supporting the power module,

wherein the support plate is the connector-fixing portion.

**3**. The power conversion device according to claim **2**,

wherein the power module is supported to face a connector-facing surface that is a surface of the support plate on the motor connection AC connector-side.

**4**. The power conversion device according to claim **3**,

wherein the support plate includes a plurality of bosses formed to protrude from the connector-facing surface and to which the motor connection AC connector is fixed, and

the power module is positioned between the connector-facing surface and a distal end of a boss of the plurality of bosses in a protruding direction of the boss.

**5**. The power conversion device according to claim **4**, further comprising:

a metal plate fastened to distal ends of the plurality of bosses; and

a resin plate interposed between a surface of the metal plate and the motor connection AC connector,

wherein the motor connection AC connector is fixed to the boss through the resin plate and the metal plate.

**6**. The power conversion device according to claim **4**,

wherein the support plate includes the plurality of bosses having different shapes as viewed in the protruding direction.

**7**. The power conversion device according to claim **1**,

wherein the motor connection AC connector is a six-phase connector to which a first motor and a second motor different from the first motor, which are included in the motor, are connected, and includes insertion slots linearly arranged.

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