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Rotary electric machine, stator thereof and manufacturing method of rotary electric machine

Abstract

A rotary electric machine has a rotor and a stator. The stator comprises a stator coil. The stator coil has a bus bar made of a conductive member that is electrically connected to a coil terminal included in a coil end. The stator has a holder which accommodates the bus bar and is made of an insulating member. The holder is positioned so that the opening or the resin member faces towards the stator core.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) The present application is a continuation application of International Patent Application No. PCT/JP2019/027830 filed on Jul. 15, 2019, which designated the U.S. and claims the benefit of priority from Japanese Patent

Application No. 2018-171801 filed in Japan filed on Sep. 13, 2018, the entire disclosure of the above application is incorporated herein by reference.

TECHNICAL FIELD

(1) The disclosure in this specification relates to a rotary electric machine, a stator thereof, and a manufacturing method of the rotary electric machine.

BACKGROUND

(2) A rotary electric machine may have at least one electrical conductive member to provide at least one electrical connection. It is required to keep electrical insulation of the conductive member. In the above aspects, or in other aspects not mentioned, there is a need for further improvements in a rotary electric machine, a stator thereof, and a manufacturing method of the rotary electric machine.

SUMMARY

(3) A disclosed stator of a rotary electric machine, comprised: a stator core which provides a plurality of slots; and a stator coil mounted on a stator core, wherein the stator coil includes: a coil end positioned at an end of the stator core; a bus bar made of a conductive member electrically connected to a coil terminal included in the coil end; a holder which is a container made of an insulating member for accommodating the bus bar, is arranged in an axial direction of the stator core, and has an opening facing the stator core.

(4) According to the stator of the rotating electric machine disclosed, the holder is positioned so that the opening faces the stator core. As a result, the wall surface of the holder is positioned on the outside of the stator core. This improves insulation performance.

(5) The rotary electric machine disclosed herein includes the stator of the rotary electric machine, a rotor magnetically coupled to the stator, and a housing that accommodates the stator and the rotor and faces the wall surface of the holder.

(6) A disclosed manufacturing method of a rotary electric machine comprises: mounting a stator coil on a stator core providing a plurality of slots; positioning the coil end at an end of the stator core; assembling a bus bar unit by mounting a bus bar made of a conductive member from an opening of a holder made of an insulating member; positioning the bus bar unit so that the opening faces an axial end of the stator core; electrically connecting the coil terminal included in the coil end and the bus bar; and positioning a housing in a radial direction outside and/or an axial direction outside of a wall of the holder.

(7) According to the manufacturing method of the rotary electric machine disclosed herein, the housing is positioned on an outside in the radial direction and/or an outside in the axial direction of the wall of the holder. This improves insulation performance.

(8) The disclosed aspects in this specification adopt different technical solutions from each other in order to achieve their respective objectives. Reference numerals in parentheses described in claims and this section exemplarily show corresponding relationships with parts of embodiments to be described later and are not intended to limit technical scopes. The objects, features, and advantages disclosed in this specification will become apparent by referring to following detailed descriptions and accompanying drawings.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) The disclosure is further described with reference to the accompanying drawings in which:

(2) FIG. **1** is a cross-sectional view of a rotary electric machine according to a first embodiment;

(3) FIG. **2** is a circuit diagram of a stator coil;

(4) FIG. **3** is a perspective view of a stator;

(5) FIG. **4** is a perspective view of a bus bar unit;

(6) FIG. **5** is a perspective view of a plurality of bus bars;
(7) FIG. **6** is a plan view of the bus bar unit;
(8) FIG. **7** is a plan view of the plurality of bus bars;
(9) FIG. **8** is a plan view of one bus bar;
(10) FIG. **9** is a perspective view of the bus bar unit;
(11) FIG. **10** is a cross-sectional view on a line X-X of FIG. **6**;
(12) FIG. **11** is a cross-sectional view on a line XI-XI of FIG. **6**;
(13) FIG. **12** is a cross-sectional view on a line XII-XII of FIG. **6**;
(14) FIG. **13** is a perspective view of a neutral point bus bar;
(15) FIG. **14** is a perspective view of a neutral point bus bar;
(16) FIG. **15** is a circuit diagram of a stator coil of a second embodiment;
(17) FIG. **16** is a perspective view of a stator;
(18) FIG. **17** is a perspective view of a bus bar unit;
(19) FIG. **18** is a perspective view of a plurality of bus bars;
(20) FIG. **19** is a plan view of the bus bar unit;
(21) FIG. **20** is a plan view of the plurality of bus bars;
(22) FIG. **21** is a plan view of one bus bar;
(23) FIG. **22** is a cross-sectional view of a bus bar unit of a third embodiment;
(24) FIG. **23** is a cross-sectional view of a bus bar unit of a fourth embodiment;
(25) FIG. **24** is a cross-sectional view of a bus bar unit of a fifth embodiment;
(26) FIG. **25** is a cross-sectional view of a bus bar unit of a sixth embodiment; and
(27) FIG. **26** is a circuit diagram of a stator coil of a seventh embodiment.

DETAILED DESCRIPTION

(28) Patent Literature 1: JP2017-153261A, Patent Literature 2: JP2000-166150A, and Patent Literature 3: JP2018-125924A disclose a stator of a rotary electric machine. The contents of literatures are incorporated by reference as explanation of technical elements in this specification.
(29) These stators have a variety of coil ends. In particular, Patent Literature 1 discloses a holder accommodating a plurality of bus bars. The plurality of bus bars provide connecting members at a coil end. The plurality of bus bars are fixed to the holder by an adhesive resin. In the above-mentioned configuration, bubbles may be generated in the adhesive resin. In addition, the bubbles can become pinholes. Bubbles and pinholes may impair insulation performance. From another view point, the adhesive resin may be more easily damaged than the holder.
(30) It is an object disclosed to provide a rotary electric machine, a stator thereof, and a manufacturing method of the rotary electric machine which have improved insulation performance. It is another object disclosed to provide a rotary electric machine, a stator thereof, and a manufacturing method of the rotary electric machine which have improved insulation performance for a plurality of bus bars. It is yet another object disclosed to provide a rotary electric machine, a stator thereof, and a manufacturing method of the rotary electric machine which have improved insulation performance between a housing and a bus bar.
(31) Hereinafter, a plurality of embodiments are described with reference to the drawings. In some embodiments, functionally and/or structurally corresponding and/or associated parts may be given the same reference numerals, or reference numerals with different digit placed on equal to or higher than a hundred place. For corresponding parts and/or associated parts, it is possible to make reference to the description of other embodiments.

First Embodiment

(32) In FIG. **1**, the rotary electric machine **1** is a motor generator. The rotary electric machine **1** is operatively connected to the internal combustion engine **2** (ENG). The internal combustion engine **2** provides power for various devices. In this specification, the devices may include a vehicle, an air conditioner, a pumping device, or the like. Furthermore, the term vehicle includes a car, a ship, an aircraft, a simulation device, and an amusement device.

(33) The rotary electric machine **1** is electrically connected to the control device **3** (CNT). The control device **3** includes an inverter circuit. The rotary electric machine **1** is driven by the internal combustion engine **2** and outputs electric power, when functioning as a generator. The control device **3** functions as a rectifier circuit that rectifies the electric power output from the rotary electric machine **1** when the rotary electric machine **1** is used as a generator. The rotary electric machine **1** may assist a rotation of the internal combustion engine **2** when functioning as an electric motor. The control device **3** supplies multiphase AC power to the rotary electric machine **1** when the rotary electric machine **1** is used as an electric motor. In this embodiment, the multiphase AC power is three-phase power.
(34) The control device **3** is an electronic control unit. The control device **3** provides a control system. The control system has at least one arithmetic processing unit (CPU) and at least one memory device (MMR) as a storage medium for storing programs and data. The control system is provided by a microcomputer comprising a computer readable storage medium. The storage medium is a non-transitional tangible storage medium that non-temporarily stores a computer readable program. The storage medium may be provided as a semiconductor memory, a magnetic disk, or the like. The control system may be provided by one computer or a group of computer resources linked via a data communication device. Means and/or functions provided by the control system can be provided by software recorded in a substantive memory device and a computer that can execute the software, software only, hardware only, or some combination of them. For example, the control system can be provided by a logic called if-then-else type, or a neural network tuned by machine learning. Alternatively, for example, if the control system is provided by an electronic circuit that is hardware, the control system may be provided by a digital circuit or an analog circuit that includes a large number of logic circuits.
(35) The rotary electric machine **1** has a rotor **4** and a stator **10**. The rotor **4** is rotatable around an axis AX. The stator **10** is a cylindrical shape having the axis AX. In the following description, terms of an axial direction, a radial direction, and a circumferential direction are defined based on the axis AX. The rotor **4** and the stator **10** are accommodated in a housing **6**. The housing **6** fixes the stator **10** and supports the rotor **4** in a rotatable manner. The housing **6** may provide components for the internal combustion engine **2**. For example, the housing **6** may provide a part of a crankcase or a part of a transmission case. The housing **6** has a first housing **7** with a bottomed cylindrical shape and a second housing **8** with a bottomed cylindrical shape. The rotor **4** and the stator **10** are housed between a first housing **7** and a second housing **8**.
(36) The rotor **4** is magnetically coupled with the stator **10**. The rotor **4** is supported by a shaft **5** so as to be rotatable with respect to the housing **6**. The shaft **5** provides a rotational shaft. The rotational shaft is connected to the internal combustion engine **2**. The rotor **4** is disposed in a radial direction inside of the stator **10**. The rotor **4** has a plurality of magnetic poles arranged along the circumferential direction. The plurality of magnetic poles are formed by a plurality of permanent magnets embedded in the rotor **4**. The rotor **4** can be provided by various structures. The rotor **4** has, for example, 8 magnetic poles, i.e., N pole: 4 pieces and S pole: 4 pieces.
(37) The rotary electric machine **1** has a power terminal member **9**. The rotary electric machine **1** has a plurality of power terminal members **9**. The power terminal member **9** is a terminal for electrically connecting the rotary electric machine **1** and the control device **3**. The power terminal member **9** is used as an output terminal member when outputting electric power, and as an input terminal member when receiving electric power. The power terminal member **9** can also be called an external connection terminal member of the rotary electric machine **1**.
(38) The stator **10** has a stator core **11**. The stator core **11** is a cylindrical shape. The stator core **11** is an annular shape. The stator core **11** has a plurality of steel plates laminated along the axial direction. The stator core **11** has a plurality of slots arranged in the circumferential direction. The plurality of slots are arranged at an equal pitch with respect to the circumferential direction. The plurality of slots may be arranged at several different pitches. The plurality of slots extend in the

axial direction so as to penetrate the plurality of steel plates. Further, the plurality of slots extend in the radial direction. A typical stator core **11** has an annular back core. The stator core **11** has a plurality of teeth extending out in the radial direction inside from the back core. The plurality of teeth form a plurality of slots between them. For example, the stator core **11** has 48 slots.

(39) The stator **10** has a stator coil **12**. The stator coil **12** is attached to the stator core **11**. The stator coil **12** has straight portions **13** and coil ends **14** and **15**. The straight portion **13** extends straight. The straight portion **13** is housed in the slot. The coil ends **14** and **15** are positioned at ends of the stator core **11**. The coil ends **14** and **15** protrude from the stator core **11** in the axial direction. The coil ends **14** and **15** are bundles of a plurality of conductors included in the stator coil **12**. At the coil ends **14** and **15**, one conductor connects one straight portion **13** positioned in one slot to one straight portion **13** positioned in another different slot. The coil ends **14** and **15** may be provided by continuous turn portions of the conductor. The coil ends **14** and **15** may be provided by joint portions joining different conductors. These examples are disclosed in Patent Literature 2: JP2000-166150A or Patent Literature 3: JP2018-125924A.

(40) The stator coil **12** has coil terminals **16**. The coil terminals **16** are leader wires extending from the coil end **14**. The stator coil **12** includes a plurality of coil terminals **16**. The coil terminals **16** provide both ends of a plurality of coils as multiphase windings. In this embodiment, since the three-phase winding is provided, at least six coil terminals **16** are provided. Further, in this embodiment, one phase is provided by the parallel connection of (n) coils. Therefore, the stator coil **12** has a (6×n) coil terminals **16**. In this embodiment, one phase is provided by the parallel connection of four coils. Therefore, the stator coil **12** includes 24 coil terminals **16**.

(41) One coil can be provided by a continuous wire or by joining multiple segments. In this embodiment, a single coil is provided by a plurality of joined segments. Note that the plurality of segments can be joined by various joining methods. As a joining method, for example, TIG welding, electric resistance welding, solder joining, or the like can be used. In addition, one coil is a coil that can be regarded as one phase. One coil may include a plurality of coil elements having different electrical angles. For example, one coil can include a plurality of coil elements having electrical angles that differ by several degrees.

(42) The stator coil **12** has a bus bar unit **20**. The bus bar unit **20** electrically connects the stator coil **12** so as to form a multiphase connection. The bus bar unit **20** connects a plurality of coil terminals **16** to provide a star connection or a delta connection. In this embodiment, the bus bar unit **20** provides the star connection. The bus bar unit **20** includes a plurality of bus bars **30**. The plurality of bus bars **30** are made of conductive members. The bus bar unit **20** has end bus bars that provide three input or output terminals, i.e., power terminals in the star connection. The bus bar unit **20** has a neutral point bus bar that provides a neutral point in the star connection.

(43) The bus bar unit **20** has a holder **21**. The holder **21** is made of an insulating material. The holder **21** has an arc shape. The holder **21** may be a polyhedron. The holder **21** may be annular. The holder **21** is arranged along the coil end **14**. The holder **21** is arranged outer side than the coil end **14** in the axial direction. In addition, at least a portion of the holder **21** is arranged outer side than the coil end **14** in the radial direction. The holder **21** faces a corner of the outside in the radial direction of the coil end **14**. The holder **21** is a container for accommodating the bus bar **30** in an inside.

(44) In FIG. **1**, a plurality of bus bars **30** are exemplified as one bus bar **30**. In FIG. **1**, the inside of the holder **21** is schematically shown. The plurality of bus bars **30** provide a plurality of dispersive terminal members **31**. The dispersive terminal members **31** are also called coil connection terminals. The dispersive terminal members **31** extend from the holder **21**. The dispersive terminal member **31** has a shape that can be called a J-shape or a U-shape. The dispersive terminal member **31** extends toward the coil end **14** in the axial direction from the holder **21**, then extends outward in the radial direction, and further extends in the axial direction along the radial direction outside of the holder **21**. The plurality of dispersive terminal members **31** are electrically connected to the

plurality of coil terminals **16**. The plurality of dispersive terminals **31** are electrically connected to the plurality of coil terminals **16** in the radial direction outside of the holder **21**. The coil terminals **16** and the dispersive terminal members **31** are electrically connected at joint portions **17**. The joint portion **17** can be provided by various joining methods. As a joining method, for example, TIG welding, electric resistance welding, solder joining, or the like can be used.

(45) The plurality of bus bars **30** provide a plurality of collective terminal members **31**. The collective terminal member **32** is also called a power connection terminal member. The plurality of collective terminal members **32** are electrically connected to the plurality of power terminal members **9**. The collective terminal member **32** extend from the holder **21**. The collective terminal member **32** has a shape that can be called a J-shape or a U-shape. The collective terminal member **32** extends towards the coil end **14** in the axial direction from the holder **21**, then extends outward in the radial direction, and further extends in the axial direction along the radial direction outside of the holder **21**. The plurality of collective terminal members **32** are electrically connected to the plurality of power terminal members **9** in the radial direction outside of the holder **21**. The collective terminal member **32** and the power terminal member **9** are electrically connected at the joint portion **18**. The joint portion **18** can be provided by various joining methods. As a joining method, for example, TIG welding, electric resistance welding, solder joining, or the like can be used.

(46) FIG. **2** shows a multi-phase connection of the stator coil **12**. The stator coil **12** employs the star connection as a multi-phase connection. The stator coil **12** has a U phase, a V phase, and a W phase. The stator coil **12** has a plurality of U-phase coils **12***u* that provide U-phase. The stator coil **12** has a plurality of V-phase coils **12***v* that provide V-phase. The stator coil **12** has a plurality of W-phase coils **12***w* that provide W-phase. In this embodiment, the stator coil **12** has four U-phase coils **12***u*, four V-phase coils **12***v*, and four W-phase coils **12***w*.

(47) The plurality of bus bars **30** have a U-phase bus bar **30***u* that provides a U-phase power terminal. The U-phase bus bar **30***u* has four dispersive terminal members **31**. The U-phase bus bar **30***u* is connected to each of the four U-phase coils **12***u* at the four joint portions **17***u*. The U-phase bus bar **30***u* is connected to the power terminal member **9** at the joint portion **18***u*. Therefore, the U-phase bus bar **30***u* provides a so-called crossover wire that connects four U-phase coils **12***u* to the power terminal.

(48) The plurality of bus bars **30** have a V-phase bus bar **30***v* that provides a V-phase power terminal. The V-phase bus bar **30***v* has four dispersive terminal members **31**. The V-phase bus bar **30***v* is connected to each of the four V-phase coils **12***v* at the four joint portions **17***v*. The V-phase bus bar **30***u* is connected to the power terminal member **9** at the joint portion **18***v*. Therefore, the V-phase bus bar **30***v* provides a so-called crossover wire that connects four V-phase coils **12***v* to the power end.

(49) The plurality of bus bars **30** have a W-phase bus bar **30***w* that provides a W-phase power terminal. The W-phase bus bar **30***w* has four dispersive terminal members **31**. The W-phase bus bar **30***w* is connected to each of the four W-phase coils **12***w* at the four joint portions **17***w*. The W-phase bus bar **30***u* is connected to the power terminal member **9** at the joint portion **18***w*. Therefore, the W-phase bus bar **30***w* provides a so-called crossover wire that connects four W-phase coils **12***w* to the power end.

(50) The plurality of bus bars **30** have a plurality of neutral point bus bars **41**. The two neutral point bus bars **41***a* and **41***b* provide two star connections. One neutral point bus bar **41***a* has six terminal members. Two neutral point bus bars **41***a* and **41***b* provide twelve terminal members. The neutral point bus bar **41***a* is joined to the coil terminals for the neutral point at two joint portions **19***u*, two joint portions **19***v*, and two joint portions **19***w*. The neutral point bus bar **41***b* is connected to the coil terminals for the neutral point at two joint portions **19***u*, two joint portions **19***v*, and the two joint portions **19***w*.

(51) FIG. **3** shows an appearance of one end of the stator **10**. The stator core **11** has one end surface

11*a* and the other end surface **11***b*. The coil end **14** extends in the axial direction from one end surface **11***a*. The coil end **14** extends in the axial direction from the other one end surface **11***b*. The bus bar unit **20** is positioned in the axial direction of the coil end **14**. The bus bar unit **20** is positioned in a predetermined angle range including the angle range in which the power terminal members **9** is positioned. The holder **21** is positioned away from the coil end **14** with respect to the axial direction.

(52) In the drawings, 12 joint portions **17** are shown. One joint portion **17** electrically connects one coil terminal **16** and one dispersive terminal member **31**. The coil terminal **16** is L-shaped. The coil terminals **16** are drawn out from the radial direction outside surface of the coil end **14**. The coil terminals **16** extend towards the axial direction outside from the coil end **14**. The dispersive terminal member **31** extends towards the radial direction outside from the holder **21** and then extends in the axial direction outside at the radial direction outer end. The coil terminals **16** and the dispersive terminal members **31** both form the joint portion **17** at end portions extending along the axial direction.

(53) The stator **10** has six collective terminal members **32**. A group of collective terminal members **32**, i.e., two collective terminal members **32** adjacent to each other in a short distance with respect to the circumferential direction provide substantially one collective terminal member **32** of one bus bar. The three groups of collective terminal members **32** provide the power terminals for the U-phase, the V-phase, and the W-phase. In other words, the bus bar unit **20** has 3 groups and 6 collective terminal members **32**.

(54) The bus bar unit **20** has a neutral point bus bar **41**. The neutral point bus bar includes a plurality of neutral point bus bars **41***a* (**41***b*). The neutral point bus bar **41***a* (**41***b*) is independent of the holder **21**. The neutral point bus bar **41***a* (**41***b*) is arranged along the coil end **14** in the radial direction outside of the coil end **14**. The neutral point bus bar **41***a* and the neutral point bus bar **41***b* are arranged in the radial direction outside of the coil end **14** so as not to overlap each other.

(55) FIG. **4** shows the bus bar unit **20**. The illustrated bus bar unit **20** includes a holder **21** and a plurality of bus bars **30** housed in the holder **21**. The illustrated bus bar unit **20** does not include the neutral point bus bar **41***a* (**41***b*). The illustrated bus bar unit **20** provides so-called crossover wires that connect the plurality of coils to the power terminal.

(56) FIG. **5** shows a plurality of bus bars **30**. The plurality of bus bars **30** have three bus bars **35**, **36**, and **37**. The three bus bars **35**, **36**, and **37** each provide a U-phase bus bar **30***u*, a V-phase bus bar **30***v*, and a W-phase bus bar **30***w*. The three bus bars **35**, **36**, and **37** are electrically isolated from each other. The three bus bars **35**, **36**, and **37** are arranged in multiple layers with respect to the radial direction. The bus bar **35** is arranged in a radial direction most inside. The bus bar **35** is also called an inner layer bus bar **35**. The bus bar **37** is arranged in a radial direction most outside. The bus bar **37** is also called an outer layer bus bar **37**. The bus bar **36** is arranged between the inner layer bus bar **35** and the outer layer bus bar **37**. The bus bar **36** is also called a middle layer bus bar **36**.

(57) Each of the plurality of bus bars **30** has a main member **38** extending along the circumferential direction. The main member **38** has an arc shape. The main member **38** may be a polyhedron. The main member **38** has a height H**38** with respect to the axial direction. The main member **38** extends in a ribbon shape along the circumferential direction.

(58) The bus bar **35** has two partial bus bars **35***a* and **35***b* that are independent with respect to the circumferential direction. The partial bus bar **35***a* has an arc shape of 90 degrees or less. The partial bus bar **35***a* has two dispersive terminal members **31**. The partial bus bar **35***a* has one collective terminal member **32**. The partial bus bar **35***b* has an arc shape of 90 degrees or less. The partial bus bar **35***b* has two dispersive terminal members **31**. The partial bus bar **35***b* has one collective terminal member **32**. Both the partial bus bar **35***a* and the partial bus bar **35***b* are arranged in the inner layer. The partial bus bar **35***a* and the partial bus bar **35***b* provide a bus bar **35** that occupies an angle range of 90 degrees or more.

(59) The bus bar **36** has two partial bus bars **36***a* and **36***b* that are independent with respect to the circumferential direction. The partial bus bar **36***a* has an arc shape of 120 degrees or less. The partial bus bar **36***a* has two dispersive terminal members **31**. The partial bus bar **36***b* has one collective terminal member **32**. The partial bus bar **36***b* has an arc shape of 120 degrees or less. The partial bus bar **36***a* has two dispersive terminal members **31**. The partial bus bar **36***b* has one collective terminal member **32**. Both the partial bus bar **36***a* and the partial bus bar **36***b* are arranged in the middle layer. The partial bus bar **36***a* and the partial bus bar **36***b* are arranged continuously in the circumferential direction to provide the bus bar **36** that occupies an angle range of 120 degrees or more.
(60) The bus bar **37** has two partial bus bars **37***a* and **37***b* which are independent with respect to the circumferential direction. The partial bus bar **37***a* has an arc shape of 90 degrees or less. The partial bus bar **37***a* has two dispersive terminal members **31**. The partial bus bar **37***a* has one collective terminal member **32**. The partial bus bar **37***b* has an arc shape of 90 degrees or less. The partial bus bar **37***b* has two dispersive terminal members **31**. The partial bus bar **37***b* has one collective terminal member **32**. Both the partial bus bar **37***a* and the partial bus bar **37***b* are arranged in the outer layer. The partial bus bar **37***a* and the partial bus bar **37***b* provide a bus bar **37** that occupies an angle range of 90 degrees or more.
(61) In this embodiment, the plurality of partial bus bars provide one bus bar. As a result, the size of the partial bus bar can be reduced. The plurality of partial bus bars facilitate the manufacturing process. Further, one bus bar includes a plurality of collective terminal members **32**. As a result, it is possible to avoid current concentration.
(62) FIG. **6** shows the bus bar unit **20**. FIG. **6** shows a plane view viewed from the arrow VI of FIG. **3**. All terminal members **31** and **32** extend towards in the radial direction outside of the holder **21**.
(63) FIG. **7** shows the plurality of bus bars **30**. The plurality of collective terminal members **32** are centrally arranged. The centralized arrangement of the plurality of collective terminal members **32** enables efficient connection work with the plurality of power terminal members **9**. On the other hand, the plurality of dispersive terminal members **31** are arranged in a dispersive manner along the coil end **14**. The dispersive arrangement of the plurality of dispersive terminal members **31** suppresses confusions of the coil terminals **16** at the coil end **14**. Distances between the plurality of dispersive terminal members **31** are associated with the pitch of the plurality of slots or multiples of the pitch.
(64) FIG. **8** shows one bus bar **37**. One bus bar is divided into two pieces at a center position where the collective terminal members **32** and **32** should be disposed. The two partial bus bars **37***a* and **37***b* have a symmetrical shape.
(65) FIG. **9** shows a back surface of the bus bar unit **20**. The holder **21** has an opening **22**. The holder **21** can also be called an arc-shaped container around the axis AX. The opening **22** is open towards the axial direction. The opening **22** is wide open to be able to receive the plurality of bus bars **30** along the axial direction. The plurality of bus bars **35**, **36**, and **37** partially overlap each other with respect to the radial direction. Moreover, the plurality of bus bars **35**, **36**, and **37** are arranged so as to be offset from each other with respect to the circumferential direction. Therefore, the angle range in which the holder **21** extends in the circumferential direction is wider than the angle range of any one of the plurality of bus bars **35**, **36**, and **37**. Further, the holder **21** has a non-arrangement angle range in which no bus bar is accommodated at both ends as an arc shape. The non-arrangement angle range is formed on the inside at one end of the arc. The non-arrangement angle range is formed on the outside at the other one end of the arc. The plurality of terminal members **31** and **32** extend in the radial direction outside from each of the inner layer, the middle layer, and the outer layer. The plurality of terminal members **31** and **32** are arranged radially with respect to the axis AX.
(66) Returning to FIG. **3**, the holder **21** is a container made of an insulating member and houses the

bus bar **30**. The holder **21** is arranged in the axial direction of the stator core **11**. The opening **22** is open toward the stator core **11**. The opening **22** faces the stator core **11**. The bus bar unit **20** is positioned so that the opening **22** faces the one end surface **11***a* of the stator core **11**. The bus bar unit **20** is positioned in the axial direction outside of the coil end **14**. As a result, the bus bar unit **20** is positioned so that the opening **22** faces the coil end **14**. The bus bar unit **20** is positioned on the axial direction outside of the coil end **14** so that the holder **21** is turned down.

(67) FIG. **10** shows an end face of a cut surface portion in an X-X line of FIG. **6**. The holder **21** has a plurality of partition walls **26** for defining an inner layer, a middle layer, and an outer layer in the inside. The holder **21** has an opening **22**. The holder **21** has a bottom wall **23**, an outer wall **24** in the radial direction outside, and an inner wall **25** in the radial direction inside. The outer wall **24** provides an outer surface **24***a* in the radial direction outside. The inner wall **25** provides an inner surface **25***a* in the radial direction inside. Further, the holder **21** has one or more partition walls **26**. The partition wall **26** divides the inside of the holder **21** into a plurality of layers, i.e., grooves with respect to the radial direction. The illustrated embodiment has two partition walls **26***a* and **26***b*. The outer wall **24** and the inner wall **25** have heights H**24** and H**25**. The height H**24** and the height H**25** are equal (H**24**=H**25**). The partition walls **26***a* and **26***b* have a height H**26**. The height H**26** is lower than the height H**24** or the height H**25** (H**26**<H**24**, H**26**<H**25**). Thicknesses of the partition walls **26***a* and **26***b* in the radial direction are thicker than thicknesses of the outer wall **24** and the inner wall **25** in the radial direction. This difference in thickness satisfies the electrical insulation performance. The partition wall **26** is a wall that is continuous along the circumferential direction. However, the partition wall **26** may be provided by a plurality of walls intermittently provided along the circumferential direction. Further, the partition wall **26** may have one or more openings that penetrate in the radial direction. The partition wall **26** may be also called a rib.

(68) The outer wall **24**, the inner wall **25**, and the plurality of partition walls **26***a* and **26***b* form a plurality of slit-shaped bus bar chambers. The illustrated embodiment forms three bus bar chambers. Each of the bus bars **35**, **36**, and **37** is inserted in each bus bar chamber. Also in this embodiment, the plurality of partition walls **26***a* and **26***b* provide a long creep distance among the plurality of bus bars **35**, **36**, and **37** arranged in a multiple layered manner in the radial direction. Therefore, the plurality of partition walls **26***a* and **26***b* suppress creep discharge.

(69) The bus bars **35**, **36**, and **37** may be press-fitted into the bus bar chamber. Further, a gap may be positively formed between the holder **21** and the bus bars **35**, **36**, and **37**. Further, contact portions and gaps may be alternately formed between the holder **21** and the bus bars **35**, **36**, and **37**. The gap allows the presence of a resin member described later.

(70) The holder **21** has an insulating resin member **27** applied to the opening **22**. The resin member **27** is applied from the opening **22**. The resin member **27** is applied to the inside of the holder **21**. The resin member **27** adheres the inner surface of the holder **21** to the surfaces of the bus bars **35**, **36**, and **37**. The resin member **27** is filled in the inside of the holder **21**. The resin member **27** covers the main member **38** of the bus bars **35**, **36**, and **37**.

(71) The resin member **27** is a potting resin. The resin member **27** is dropped from the opening **22** and cured in the holder **21**. The surface **27***a* of the resin member **27** is in contact with the side surfaces of the plurality of walls **24**, **25**, and **26** at a boundary line **27***b*. The surface **27***a* is curved in a concave shape. A height of the resin member **27** is lower than the heights of the plurality of walls **24**, **25**, and **26**. The resin member **27** has a surface **27***a* lower than apexes of the plurality of walls **24**, **25**, and **26**.

(72) Focusing on the bus bar **35**, the holder **21** has the partition wall **26***b* positioned in the radial direction inside and the inner wall **25** positioned in the radial direction outside. The bus bar **35** is housed in a groove surrounded by the bottom wall **23**, the partition wall **26***b*, and the inner wall **25**. The resin member **27** covers the bus bar **35**.

(73) Focusing on the bus bar **36**, the holder **21** has the partition wall **26***a* positioned in the radial direction inside and the partition wall **26***b* positioned in the radial direction outside. The bus bar **36**

is housed in a groove surrounded by the bottom wall **23**, the partition wall **26***a*, and the partition wall **26***b*. The resin member **27** covers the bus bar **36**.
(74) Focusing on the bus bar **37**, the holder **21** has the partition wall **26***a* positioned in the radial direction inside and the outer wall **24** positioned in the radial direction outside. The bus bar **37** is housed in a groove surrounded by the bottom wall **23**, the outer wall **24** and the partition wall **26***a*. The resin member **27** covers the bus bar **37**.
(75) Further, the holder **21** has an inner wall **25** positioned in the radial direction most inside and an outer wall **24** positioned in the radial direction most outside. The resin member **27** has a surface **27***a* lower than apexes of the inner wall **25** and the outer wall **24**. As a result, the resin member **27** is separately arranged in each of the plurality of grooves provided by the holder **21**.
(76) The holder **21** is made of resin. The holder is a resin molded product molded by injection molding. The resin member **27** is made of a soft resin that is softer than the resin forming the holder **21**. The resin member **27** is also an adhesive resin member that adheres the bus bar **30** and the holder **21**. The resin member **27** embeds the bus bar **30** in the inside the opening **22** of the holder **21**. The resin member **27** is a thermosetting resin.
(77) Returning to FIG. **3**, the resin member **27** faces one end surface **11***a* of the stator core **11**. The resin member **27** faces the coil end **14**.
(78) FIG. **11** shows an end face of a cut surface portion in the X-X line of FIG. **6**. A cut surface of one dispersive terminal member **31** is shown. The dispersive terminal member **31** has a first portion **31***a*. The first portion **31***a* extends from the main member **38** along the axial direction. The first portion **31***a* protrudes from the opening **22**. The dispersive terminal member **31** has a second portion **31***b*. The second portion **31***b* extends in the radial direction outside from the end of the first portion **31***a* along the radial direction. The second portion **31***b* projects in the radial direction outside from the holder **21**. The dispersive terminal member **31** has a third portion **31***c*. The third portion **31***c* extends from a distal end of the second portion **31***b* along the axial direction so as to overlap with the radial direction outside of the holder **21**. The third portion **31***c* reaches a position overlapping with the holder **21** with respect to the radial direction. The third portion **31***c* faces the outer surface **24***a* of the holder **21**. At the position of FIG. **11**, the outer layer bus bar **37** does not exist. The plurality of bus bars **35**, **36**, and **37** partially overlap each other with respect to the radial direction. Moreover, the plurality of bus bars **35**, **36**, and **37** are arranged so as to be offset from each other with respect to the circumferential direction.
(79) FIG. **12** shows an end surface of a cut surface portion in a XII-XII of FIG. **6**. A cut surface of one collective terminal member **32** is shown. The collective terminal member **32** has a first portion **32***a*. The first portion **32***a* extends from the main member **38** along the axial direction. The first portion **32***a* protrudes from the opening **22**. The collective terminal member **32** has a second portion **32***b*. The second portion **32***b* extends towards the radial direction outside from the end of the first portion **32***a* along the radial direction. The second portion **32***b* projects in the radial direction outside from the holder **21**. The collective terminal member **32** has a third portion **32***c*. The third portion **32***c* extends from a distal end of the second portion **32***b* along the axial direction so as to overlap the radial direction outside of the holder **21**. The third portion **32***c* reaches a position overlapping with the holder **21** with respect to the radial direction. The third portion **32***c* faces the outer surface **24***a* of the holder **21**.
(80) FIG. **11** and FIG. **12** show the plurality of terminal members **31** and **32** included in one bus bar **36**. The plurality of terminal members **31** and **32** extend from the opening **22** of the holder **21**. These terminal members **31** and **32** extend from the surface of the resin member **27**. The bus bar **30** has a main member **38** extending in the circumferential direction. The holder **21** has a groove deeper than the height H**38** of the main member **38**. The opening **22** is also the opening of the groove.
(81) FIG. **13** shows one of the neutral point bus bars **41**. FIG. **14** shows the bus bar **44** of the neutral point bus bars **41**. The neutral point bus bar **41** is intended to be mounted on the side

surface of the coil end **14**. The neutral point bus bar **41** has an arc shape. The neutral point bus bar **41** has a main body portion **42** covered with an insulating member. The main body portion **42** extends along the circumferential direction. The main body portion **42** accommodates a bus bar **44** made of a conductive material. The neutral point bus bar **41** has a plurality of terminal members **43** extending in the axial direction. In the illustrated example, the neutral point bus bar **41** has six terminal members **43**. The terminal member **43** is joined to the coil terminal **16** for neutral point connection. In this embodiment, since the two neutral point bus bars **41** are used, a total of 12 terminal members are provided.

(82) A manufacturing method of the rotary electric machine **1** is described. The method for manufacturing the rotary electric machine **1** includes a step of assembling the rotor **4**, a step of assembling the stator **10**, and a step of accommodating the rotor **4** and the stator **10** in the housing **6**. The rotor assembling step and the stator assembling step may be in a reverse order. The assembling step of the stator **10** includes a step of manufacturing the stator core **11** that provides a plurality of slots, a step of mounting the stator coil **12** on the stator core **11**, and a step of positioning the coil end **14** at an end of the stator core **11**. The step of positioning the coil end **14** includes a step of arranging the plurality of coil terminals **16** at predetermined positions by pulling out the plurality of coil terminals **16** from the coil end **14**.

(83) The assembling step of the stator **10** includes a step of assembling the bus bar unit **20**. The bus bar unit assembling step includes a step of molding the holder **21** by injection molding of an insulating resin. At this step, the holder **21** having the opening **22** is formed. A plurality of partition walls **26***a* and **26***b* are formed in the inside the holder **21** so as to form a plurality of grooves. The bus bar unit assembling step includes a step of mounting the bus bar **30** made of a conductive member from the opening **22** of the holder **21** made of an insulating member.

(84) The bus bar unit assembling step includes a step of applying the insulating resin member **27** from the opening **22**. This step is a step in which the resin member **27** is dropped from the opening **22** by potting and cured. At this step, the holder **21** is positioned with the opening **22** facing upward in a direction of gravity. The resin member **27** is dropped from above into the opening **22**. The resin member **27** forms a concave surface **27***a* due to shrinkage during the curing or surface tension. The resin member **27** is applied so as to embed the plurality of bus bars **30**.

(85) The bus bar unit assembling steps may be performed independently. The bus bar unit assembling step may be performed before the other steps. The bus bar unit assembling step may include a step of coating an adhesive to the inside of the holder **21** and a step of mounting the bus bar **30** after that. In the bus bar unit assembling step, the resin member **27** may be applied after that.

(86) The assembling step of the stator **10** includes a step of positioning the bus bar unit **20** so that the opening **22** faces the one end surface **11***a* in the axial direction of the stator core **11**. At this time, the bus bar unit **20** is inverted from the posture at the step of applying the resin member **27**. In a typical method of manufacturing a stator, the stator **10** is positioned so that the coil end **14** is on top, and the bus bar unit **20** is placed on the coil end **14**. At this time, the bus bar unit **20** is positioned so that the opening **22** faces downward. This step is also a step in which the resin member **27** is positioned so as to face one end surface **11***a* of the stator core **11**. From another point of view, this step is also a step of positioning the bus bar unit **20** so that the opening **22** faces the coil end **14**. Further, in other words, this step is also a step in which the bus bar unit **20** is positioned so that the resin member **27** faces the coil end **14**. As a result, the bottom wall **23** of the holder **21** is positioned in the axial direction outside of the stator **10**.

(87) The assembling step of the stator **10** includes a step of electrically connecting the plurality of coil terminals **16** included in the coil end **14** and the plurality of terminal members **31** and **32**. The plurality of terminal members **31** and **32** and the plurality of coil terminals **16** are positioned in the radial direction outside of the holder **21**. Further, one of the terminal members **31** and **32** and one of the coil terminals **16** to be electrically joined are positioned at the same angular position in the circumferential direction. Therefore, a plurality of joining operations can be easily performed. At

this time, the bus bar unit **20** is positioned so as to be separated from the coil end **14**, and in that state, the plurality of coil terminals **16** and the plurality of terminal members **31** and **32** are joined. As a result, the bus bar unit **20** is supported by the plurality of coil terminals **16** and the plurality of terminal members **31** and **32**. Further, this step includes joining the coil terminals **16** for the neutral point and the neutral point bus bars **41***a* and **41***b*.

(88) The step of accommodating the rotor **4** and the stator **10** in the housing **6** includes a step of positioning the housing **8** on the radial direction outer side and/or the axial direction outer side of the bottom wall **23** of the holder **21**.

(89) According to the embodiment described above, a rotary electric machine having improved insulation performance, a stator thereof, and a method for manufacturing the rotary electric machine are provided. Since the opening **22** faces one end surface **11***a*, the exposure of the bus bar **30** housed in the holder **21** is suppressed. Therefore, lowering of the insulation performance in the assembling step or the maintenance step is suppressed.

(90) Further, the holder **21** is positioned in the outside by the resin member **27** facing the one end surface **11***a*. As a result, the resin member **27** is protected at the assembling step or the maintenance step. Since the holder **21** having relatively few defects in the insulating member faces the outside, the insulating performance is improved. On the other hand, since the resin member **27**, which is relatively prone to defects, is positioned to face the stator core **11**, deterioration of insulation performance due to defects is suppressed. Defects include, for example, air bubbles, pinholes, foreign matter and the like. When the resin member **27** is a potting resin or a soft resin, the protective effect is remarkable. As a result, deterioration of insulation performance is suppressed.

(91) According to this embodiment, the bus bar **30** can be protected from cooling medium, i.e., fluid for the stator **10**. The cooling medium reaches the surface of the opening **22** or the resin member **27**. At the same time, the cooling medium brings foreign matter. In this embodiment, the holder **21** is arranged so that the opening **22** or the resin member **27** faces one end surface **11***a*. Therefore, a strong flow of the cooling medium does not reach the opening **22**. Further, direct arrival and arrival of foreign matter to the opening **22** are suppressed. As a result, deterioration of insulation performance is suppressed. In particular, when a liquid such as water or oil is used as the cooling medium, the effect of suppressing the arrival of foreign matter and the effect of protecting the resin member **27** are remarkable.

Second Embodiment

(92) This embodiment is a modification based on the preceding embodiment. In the above embodiment, four phase coils are connected as one phase. Alternatively, one phase may include one or more phase coils. For example, two, three, five, six and the like are possible. In this embodiment, two phase coils are connected.

(93) In FIG. **15**, one phase is provided by a parallel connection of two phase coils. FIG. **16** shows the stator **10**. FIG. **17** shows the bus bar unit **20**. FIG. **18** shows a plurality of bus bars **30**. FIG. **19** shows the bus bar unit **20**. FIG. **20** shows a plurality of bus bars **30**. FIG. **21** shows one bus bar. In this embodiment, a bus bar unit **20** which is half of the above embodiment is used. There is only one neutral point bus bar **41**. In this embodiment, the plurality of bus bars **235**, **236**, and **237** are provided by the partial bus bars **35***a*, **36***a*, and **37***a* of the above embodiment.

Third Embodiment

(94) This embodiment is a modification based on the preceding embodiment. In the above embodiment, the resin member **27** is separately arranged in each of the plurality of grooves. Alternatively, the resin member **27** may be continuously arranged across the plurality of grooves.

(95) FIG. **22** shows an end face of the bus bar unit **20**. The resin member **27** is continuously arranged over a plurality of grooves. The surface **327***a* extends beyond the partition walls **26***a* and **26***b* and is continuous over adjacent grooves. In this embodiment, a boundary line **327***b* is positioned on the side surface of the outer wall **24** and the side surface of the inner wall **25**.

Fourth Embodiment

(96) This embodiment is a modification based on the preceding embodiment. In the above embodiment, the resin member **27** is only a potting resin. Alternatively, the resin member **27** may contain a plurality of resin materials.

(97) FIG. **23** shows an end face of the bus bar unit **20**. The assembling step of the bus bar unit **20** includes a step of applying the adhesive **427** to the inner surface of the holder **21** before mounting the bus bar **30**. The assembling step of the bus bar unit **20** includes a step of arranging the bus bar **30** in the holder **21**, a step of adhering the bus bar **30** with the adhesive **427**, and a step of applying the resin member **27** thereafter. A portion of the adhesive **427** is extruded between the holder **21** and the bus bar **30**. The adhesive **427** provides an adhesive resin member. Therefore, the bus bar **30** is covered with both the adhesive **427** and the resin member **27**.

Fifth Embodiment

(98) This embodiment is a modification based on the preceding embodiment. In the above embodiment, the bus bar unit **20** accommodates a plurality of bus bars **35**, **36**, **37** for crossover wires. Alternatively, the bus bar unit **20** may accommodate the neutral point bus bar **41**.

(99) FIG. **24** shows the bus bar unit **20**. The holder **21** has a partition wall **526***c* in addition to the above embodiment. A groove for accommodating the neutral point bus bar **41** is defined between the partition wall **526***c* and the inner wall **25**. The neutral point bus bar **41** is housed between the partition wall **526***c* and the inner wall **25**.

(100) Further, in the above embodiment, the resin member **27** provides a concave surface **27***a*. Alternatively, the resin member **27** may have a variety of surfaces.

(101) In FIG. **24**, the resin member **27** has a surface **527***a* inclined with respect to the bottom wall **23**. The inclination of the surface **527***a* depends on a posture of the holder **21** at a time of curing. The surface **527***a* is linear.

Sixth Embodiment

(102) This embodiment is a modification based on the preceding embodiment. In the above embodiment, the bus bar unit **20** has a resin member **27**. Alternatively, the bus bar unit **20** may not include the resin member **27**.

(103) FIG. **25** shows an end face of the bus bar unit **20**. The bus bar unit **20** accommodates a plurality of bus bars **35**, **36**, and **37** in a plurality of grooves. The bus bar unit **20** has a cavity **628**. Also in this embodiment, the plurality of partition walls **26***a* and **26***b* provide a long creep distance among the plurality of bus bars **35**, **36**, and **37** arranged in multiple layers in the radial direction. Therefore, the plurality of partition walls **26***a* and **26***b* suppress creep discharge.

Seventh Embodiment

(104) This embodiment is a modification based on the preceding embodiment. In the above embodiment, two neutral point bus bars **41***a* and **41***b* are used. Alternatively, one neutral point bus bar may be used.

(105) In FIG. **26**, the stator coil **12** has one neutral point bus bar **741**. The neutral point bus bar **741** connects 12 phase coils.

(106) Further, the plurality of phase coils forming one phase may be dispersed in one phase. The four phase coils **712***u*, **712***v*, and **712***w* include two groups of phase coils having different electric angles. The two groups of phase coils have dispersed electrical angles in a range of several degrees to several tens of degrees.

Other Embodiments

(107) The disclosure in this specification, the drawings, and the like is not limited to the illustrated embodiments. The disclosure encompasses the illustrated embodiments and variations thereof by those skilled in the art. For example, the present disclosure is not limited to the combinations of components and/or elements shown in the embodiments. The present disclosure may be implemented in various combinations. The present disclosure may have additional portions which may be added to the embodiments. The present disclosure encompasses omission of the components and/or elements of the embodiments. The present disclosure encompasses the

replacement or combination of components and/or elements between one embodiment and another. The disclosed technical scope is not limited to the description of the embodiment. Several technical scopes disclosed are indicated by descriptions in the claims and should be understood to include all modifications within the meaning and scope equivalent to the descriptions in the claims.

(108) The disclosure in the specification, drawings and the like is not limited by the description of the claims. The disclosures in the specification, the drawings, and the like encompass the technical ideas described in the claims, and further extend to a wider variety of technical ideas than those in the claims. Therefore, various technical ideas can be extracted from the disclosure of the specification, the drawings and the like without being limited to the description of the claims.

(109) In the above embodiments, the rotary electric machine **1** provides an electric motor. Alternatively, the rotary electric machine **1** may provide an electric motor. In this case, the stator coil **12** is also called a field winding. Alternatively, the rotary electric machine **1** may provide a generator. In this case, the stator coil **12** is also called an armature winding.

(110) In the above embodiment, the stator coil **12** has coil ends **14** and **15** at both ends of the stator core **11**. The coil end **14** is arranged so as to face the opening **22**. The coil end **14** can be provided in various forms. In one form, the stator coil **12** may be formed by winding a plurality of continuous conductors. In this case, the coil end **14** is provided by a group of bend portions of continuous wires. In one other form, the stator coil **12** may be provided by a plurality of segment conductors. In this case, the coil end **14** is provided by turn portions of the segment conductors or joint portions joining a plurality of segment conductors. The segment conductor is U-shaped or I-shaped. The shape of such a coil end is disclosed in, for example, Patent Literature 2: JP2000-166150A. JP2000-166150A is incorporated by reference in its entirety in this application. The plurality of segment conductors may be connected by a plurality of connecting conductors arranged at the coil end **14**. The shape of such a coil end is disclosed in, for example, Patent Literature 3: JP2018-125924A. JP2018-125924A is incorporated by reference in its entirety in this application.

(111) In the above embodiment, the holder **21** is made of resin. Alternatively, the holder **21** may be made of an insulating member such as ceramic.

(112) In the above embodiment, the holder **21** is arranged outer side than the coil end **14** in the axial direction. Alternatively or additionally, the holder **21** may be arranged outer side than the coil end **14** in the radial direction. In the above embodiment, the holder **21** faces the corner on the radial direction outside of the coil end **14**. Alternatively, the holder **21** may be arranged only in the axial direction of the coil end **14**.

(113) In the above embodiment, one phase is provided by a plurality of phase coils connected in parallel. Alternatively, a series connection may be included in one phase. For example, one phase may be provided by connecting two phase coils connected in parallel and two phase coils connected in parallel in series.

(114) In the above embodiment, the plurality of terminal members **31** and **32** in the bus bar unit **20** have a shape that can be called a J-shape or a U-shape. Alternatively, the plurality of terminal members **31** and **32** can be provided in various shapes such as an I-shape and an L-shape. For example, the plurality of terminal members **31** and **32** may be provided by only the first portions **31***a* and **32***a* in FIG. **11** and FIG. **12**. Further, the plurality of terminal members **31** and **32** may be provided by the first portions **31***a* and **32***a* and the second portions **31***b* and **32***b* in FIG. **11** and FIG. **12**.

(115) In the above embodiment, the bus bar unit **20** is supported by a plurality of coil terminals **16**. Alternatively, the bus bar unit **20** may be connected to the stator core **11** or the coil end **14**. The holder **21** may have, for example, a plurality of legs for contacting the stator core **11** or the coil end **14**. The plurality of legs may be formed by projecting a part of the walls **24**, **25**, and **26** in the axial direction. The plurality of legs may be fixed to the stator core **11** or the coil end **14** by a fixing mechanism such as adhesion, snap fit, or screwing.

(116) In the above embodiment, the coil terminals **16** and the bus bar unit **20** are illustrated so as to

be exposed. Alternatively, the coil terminals **16** and/or the bus bar unit **20** may have a powder coating layer applied to them. The powder coating layer can be provided, for example, so as to cover the coil terminals **16**, the joints **17** and **18** and the terminal members **31** and **32**. The powder coating layer may cover the entire coil end **14**. The powder coating layer may cover the bus bar unit **20**.

Claims

1. A stator of a rotary electric machine, comprising: a stator core which provides a plurality of slots; and a stator coil mounted on a stator core, the stator coil comprising: a coil end positioned at an end of the stator core; bus bars made of conductive members electrically connected to coil terminals included in the coil end; and a holder, which is a container made of an insulating member for accommodating the bus bars, is arranged in an axial direction of the stator core, and has an opening facing the stator core, wherein the holder comprises a plurality of partition walls between an outer wall and an inner wall of the holder, the bus bars include a plurality of phase bus bars each having two partial bus bars, each one of the partial bus bars has dispersive terminal members electrically connected to the coil terminals and a collective terminal member electrically connected to a power terminal, all terminal members including the dispersive terminal members and the collective terminal member extend towards a radial direction outside from the opening of the holder, the dispersive terminal members are disposed on a first end region of each one of the partial bus bars and are circumferentially adjacent to each other, and the collective terminal member is disposed on a second end region of each one of the partial bus bars.
2. The stator of a rotary electric machine according to claim 1, wherein each one of the bus bars has a main member extending in a circumferential direction, the holder has a groove deeper than a height of the main member, the opening is also an opening of the groove, and the opening and the stator core face each other.
3. The stator of a rotary electric machine according to claim 1, wherein the holder is arranged outer side than the coil end in an axial direction or outer side than the coil end in a radial direction.
4. The stator of a rotary electric machine according to claim 1, further comprising: an insulating resin member applied to the opening.
5. The stator of a rotary electric machine according to claim 4, wherein the holder is made of resin, and the insulating resin member is made of a soft resin which is softer than the resin forming the holder.
6. The stator of a rotary electric machine according to claim 4, wherein the insulating resin member includes an adhesive resin member adhering each one of the bus bars and the holder.
7. The stator of a rotary electric machine according to claim 4, wherein the insulating resin member embeds the bus bars in the opening of the holder.
8. The stator of a rotary electric machine according to claim 4, wherein the terminal members extend from a surface of the insulating resin member.
9. The stator of a rotary electric machine according to claim 4, wherein the insulating resin member is a potting resin.
10. The stator of a rotary electric machine according to claim 9, wherein the holder has a first wall positioned in a radial direction inside and a second wall positioned in a radial direction outside, and the potting resin has a surface lower than apexes of the first wall and the second wall.
11. The stator of a rotary electric machine according to claim 9, wherein the holder has a first wall positioned in a radial direction most inside and a second wall positioned in a radial direction most outside, and the potting resin has a surface lower than apexes of the first wall and the second wall.
12. The stator of a rotary electric machine according to claim 4, wherein the insulating resin member is a thermosetting resin.
13. The stator of a rotary electric machine according to claim 1, wherein the holder is a resin

molded product molded by injection molding.

14. A rotary electric machine comprising: the stator of the rotary electric machine according to claim 1; a rotor magnetically coupled to the stator; and a housing which accommodates the stator and the rotor and faces a wall surface of the holder.

15. The stator of the rotary electric machine according to claim 1, wherein each of the partition walls has a thickness in a radial direction thicker than a thickness of each of the outer wall and the inner wall in the radial direction.

16. The stator of the rotary electric machine according to claim 1, wherein the two partial bus bars including the dispersive terminal members and the collective terminal member are arranged in a line symmetry.