(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 875 761 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**08.09.2021 Bulletin 2021/36**

(21) Application number: **19878881.2**

(22) Date of filing: **28.10.2019**

(51) Int Cl.:
***F04B 39/00*** *(2006.01)* ***F04C 29/00*** *(2006.01)*

(86) International application number:
**PCT/JP2019/042087**

(87) International publication number:
**WO 2020/090701 (07.05.2020 Gazette 2020/19)**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **30.10.2018 JP 2018203462**

(71) Applicant: **Valeo Japan Co., Ltd**
**360-0193-Saitama (JP)**

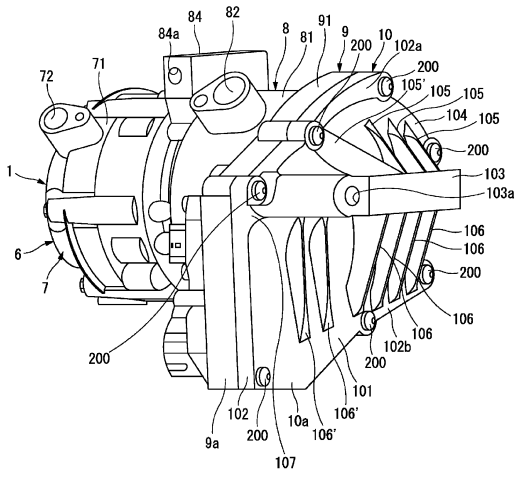
(72) Inventors:
- **ASAMI, Yoichi**
  **Kumagaya-shi Saitama 360-0193 (JP)**
- **KISO, Norikatsu**
  **Kumagaya-shi Saitama 360-0193 (JP)**
- **KISHIKAWA, Keigo**
  **Kumagaya-shi Saitama 360-0193 (JP)**

(74) Representative: **Valeo Systèmes Thermiques**
**Service Propriété Intellectuelle**
**ZA l'Agiot, 8 rue Louis Lormand**
**CS 80517**
**La Verrière**
**78322 Le Mesnil-Saint-Denis Cedex (FR)**

# (54) REINFORCEMENT STRUCTURE FOR ELECTRICALLY DRIVEN COMPRESSOR

(57) An object is to provide an electric compressor reinforcement structure such that when a mounting leg is formed on an outer face of a cover that an inverter housing has on an endmost side in an axial direction of an electric compressor, a space in the inverter housing is not crushed even when a strong force acts on the electric compressor due to a collision or the like at a front of a vehicle. A housing 6 of an electric compressor 1 has an inverter housing 9 that is formed of a side wall portion 91 and a partitioning wall 92 and in which an inverter device 5 is housed, the inverter housing 9 is closed to a front of the electric compressor 1 by a cover 10 on which a mounting leg 103 is formed, and a hollow protruding portion 104 protruding in a dome form centered on the mounting leg 103 is provided on an outer face of the cover 10, whereby a load exerted from the front of the electric compressor 1 is dispersed to prevent the space in the inverter housing 9 from being crushed.

FIG. 3




EP 3 875 761 A1

## Description

Technical Field

**[0001]** The present invention relates to an electric compressor having a compressing mechanism that compresses a refrigerant, a motor that drives the compressing mechanism, and an inverter control device that controls the motor, wherein the inverter control device is housed in an inverter housing, and relates in particular to an electric compressor reinforcement structure wherein a mounting leg for mounting on a mounting target is formed on an outer face of a cover that closes an aperture of the inverter housing to the front of the electric compressor.

Background Art

**[0002]** As shown in, for example, Patent Literature 1, this kind of electric compressor is of a configuration such that a compressing unit that compresses a refrigerant, an electric motor that drives the compressing unit, and a motor drive circuit that controls the electric motor are disposed in order in an axial direction of a drive shaft, and the compressing unit and the electric motor are housed in a housing member, and a mounting leg for mounting the electric compressor on a mounting target is formed integrally on each of a compressing unit housing side and an electric motor housing side of a side wall portion of the housing member.

**[0003]** As opposed to this, an electric compressor shown in Patent Literature 2 is of a configuration such that a compressing unit and an electric motor are housed in a first housing constituent body, and a motor drive circuit is housed in a housing space formed by both the first housing constituent body and a second housing constituent body joined to the first housing constituent body, and a mounting leg for mounting the electric compressor on a mounting target is of a configuration formed integrally on a side wall portion of the first housing constituent member, and on a flat outer face of a cover that closes an aperture of the second housing constituent body.

Citation List

Patent Literature

**[0004]**

Patent Literature 1: JP-A-2015-105578
Patent Literature 2: JP-A-2009-150236

Summary of Invention

Technical Problem

**[0005]** When a mounting leg for mounting on a mounting target is formed on a flat outer face of a cover that closes a second housing constituent body of an electric compressor, as in the case of the electric compressor described in Patent Literature 2, a forwardmost cover of the electric compressor is a place supported by a vehicle when the electric compressor is mounted on the vehicle in a form supported via the mounting leg of the cover, in such a way that the second housing constituent body is on a rear side of the vehicle, as an instrument configuring a refrigeration cycle of a vehicle-use air conditioning device. This means that when a front of the vehicle is damaged due to a collision or the like of the vehicle, the whole of the outer face of the cover is subjected to a strong load from the front in an axial direction of the electric compressor due to direct contact caused by the damage, and/or due to an indirect effect of a part in an engine room that has moved due to the collision, and there is concern that the cover will buckle, be distorted, or the like, whereby a motor drive circuit housing space will be crushed.

**[0006]** When a motor drive circuit housing space is crushed, a part configuring a motor drive circuit housed in the second housing constituent body is damaged in an energized state, and danger such as a short circuit or an electrocution accident may occur.

**[0007]** The invention, having been contrived in order to resolve the heretofore described problem, has an object of providing an electric compressor reinforcement structure such that when a mounting leg is formed on an outer face of a cover that an inverter housing has on an endmost side in an axial direction of an electric compressor, concern that a space in the inverter housing may be crushed, causing danger such as a short circuit, is reduced, even when a strong force acts on the electric compressor due to a collision or the like at a front of a vehicle.

Solution to Problem

**[0008]** In order to achieve the heretofore described object, an electric compressor reinforcement structure according to claim 1 is characterized in that, in an electric compressor including a compressing mechanism that compresses a refrigerant, a motor that drives the compressing mechanism, an inverter control device that controls the motor, and a housing, wherein the housing has an inverter housing in which the inverter control device is housed, and the inverter housing is such that a side opposite to that of the motor is closed by a cover and a mounting leg that is mounted on a mounting target is formed on an outer face of the cover, a hollow protruding portion protruding in a dome form centered on the mounting leg is provided in the cover. The mounting leg is also provided in a side wall portion of a member (for example, a motor housing) configuring a housing other than the inverter housing. The mounting target is, for example, an automobile or other vehicle.

**[0009]** This means that even when adopting a configuration wherein the electric compressor is supported on a mounting target such as a vehicle by the mounting leg of the cover positioned on a front side of the electric compressor, the hollow protruding portion protruding in the

dome form centered on the mounting leg is provided, rather than a whole of an outer face of the cover on which the mounting leg is formed being flat. Because of this, a load from a front of the electric compressor is dispersed by the hollow protruding portion of the cover when a strong force is exerted from two directions in an axial direction of the electric compressor due to a collision or the like at the front of the vehicle, because of which the cover is prevented from buckling or becoming distorted, and a space inside the inverter housing can be prevented from being crushed.

**[0010]** The electric compressor reinforcement structure according to claim 2 is characterized in that the inverter housing has a protruding portion protruding farther to a radial direction outer side than the hollow protruding portion of the cover. The cover also has a protruding portion extending in the same direction as the protruding portion of the inverter housing.

**[0011]** As the dome-form hollow protruding portion is provided in the cover, this kind of protruding portion can be formed without concern that the space inside the inverter housing will be crushed, and by having the protruding portion, a volume of the space inside the inverter housing increases, and an area of an outer face of the inverter housing facing the motor side increases, because of which freedom of layout of constituent members of the inverter control device and members for connecting to the inverter control device increases.

**[0012]** The electric compressor reinforcement structure according to claim 3 is characterized in that a strip-form rib extending from the mounting leg in a direction that intersects with an axial direction of an insertion hole of the mounting leg is provided on the outer face of the cover. The rib, for example, extends toward a side wall portion side of the cover from both sides of the mounting leg.

**[0013]** By the rib extending from the mounting leg in the direction that intersects with the axial direction of the insertion hole of the mounting leg being provided on the outer face of the hollow protruding portion of the cover in this way, a force that is exerted on the hollow protruding portion, and which attempts to crush the hollow protruding portion, can be restricted by the rib, because of which cover strength increases.

**[0014]** The electric compressor reinforcement structure according to claim 4 is characterized in that a thick portion is formed in part of a region of the side wall portion of the cover extended along a peripheral edge of the hollow protruding portion, wherein a thickness of the thick portion is greater than that of the other region of the side wall portion of the cover, and a thick portion is formed in a region of a side wall portion of the inverter housing that comes into contact with the thick portion of the side wall portion of the cover, wherein a thickness of the thick portion is greater than that of the other region of the side wall portion of the inverter housing. The thick portion of the side wall portion of the cover and the thick portion of the side wall portion of the inverter housing overlap with a region in which an end of the rib reaches an outer edge of the cover.

**[0015]** Because of this, an area of contact between an end face of a region extended along the peripheral edge of the hollow protruding portion of the side wall portion of the cover and an end face of the side wall portion of the inverter housing that comes into contact therewith becomes relatively large, and surface pressure exerted on an end face of the inverter housing from an end face of the cover can be reduced. Further, the thick portions of the side wall portion of the cover and the side wall portion of the inverter housing are disposed in such a way as to overlap with a region in which the end of the rib reaches the outer edge of the cover, because of which a force exerted on the hollow protruding portion can be received by the thick portions of the side wall portion of the cover and the side wall portion of the inverter housing via the rib.

**[0016]** The electric compressor reinforcement structure according to claim 5 is characterized in that a bridge portion is raised from the outer face of the cover, and the bridge portion extends from an axial direction side end of the insertion hole of the mounting leg in the axial direction of the insertion hole of the mounting leg as far as an outer edge of the cover on the side of the inverter housing protruding portion.

**[0017]** This means that owing to the bridge portion extending from the axial direction side end of the insertion hole of the mounting leg as far as the outer edge of the protruding portion, a load exerted on the hollow protruding portion can be borne by the side wall portion of the cover and the side wall portion of the inverter housing, because of which, even when the protruding portion protruding farther to the radial direction outer side than the hollow protruding portion of the cover is formed in the inverter housing, the protruding portion can be prevented from being crushed.

## Advantageous Effects of Invention

**[0018]** As heretofore described, the invention is such that even when adopting a configuration wherein an electric compressor is supported on a vehicle by a mounting leg of a cover positioned on a front side of the electric compressor, a hollow protruding portion protruding in a dome form centered on the mounting leg is provided, rather than a whole of an outer face of the cover on which the mounting leg is formed being flat. Because of this, a load from a front of the electric compressor is dispersed by the hollow protruding portion of the cover when a strong force is exerted from two directions in an axial direction of the electric compressor due to a collision or the like at the front of the vehicle, because of which a space inside the inverter housing can be prevented from being crushed. Therefore, damage to a part such as a switching element configuring an inverter control device is also prevented, and danger such as a short circuit or an electrocution accident caused by damage to an en-

ergized part of the inverter control device can be prevented from occurring.

Brief Description of Drawings

**[0019]**

[Fig. 1] Fig. 1 is a schematic view showing a mounting position on a vehicle of an electric compressor to which the invention is applied.
[Fig. 2] Fig. 2 is a side view of a whole of the electric compressor.
[Fig. 3] Fig. 3 is a perspective view showing a state of the electric compressor seen from the front.
[Fig. 4] Fig. 4 is a sectional view of the whole of the electric compressor.
[Fig. 5] Fig. 5(a) is a front view of a cover that is a component of the electric compressor, and Fig. 5 (b) is a rear view of the cover.
[Fig. 6] Fig. 6 is a perspective view showing a state of the cover seen from a rear face side.
[Fig. 7] Fig. 7 is a perspective view showing a state of the electric compressor with the cover removed.
Description of Embodiments

**[0020]** Hereafter, an embodiment of the invention will be described, while referring to the attached drawings.

**[0021]** An electric compressor 1 to which the invention is applied is shown in Fig. 1 to Fig. 7. In Fig. 1, a left side of the drawing is a front of a vehicle 500, and a right side of the drawing is a rear of the vehicle 500. Further, in Fig. 2, a right side of the drawing is a front of the electric compressor 1, and a left side of the drawing is a rear of the electric compressor 1.

**[0022]** The electric compressor 1 to which the invention is applied is a scroll compressor used in a refrigeration cycle (not shown) of a vehicle-use air conditioning device, is mounted in the front of the vehicle 500, and as seen from a distribution of mounting legs 84, 85, and 103 to be described hereafter, is installed in such a way that the rear of the electric compressor 1 faces the front of the vehicle 500, as shown in Fig. 1.

**[0023]** The electric compressor 1 has a compressing mechanism 2 that compresses a refrigerant, a motor 3 that drives the compressing mechanism 2, a drive shaft 4 that transmits power of the motor 3 to the compressing mechanism 2, an inverter control device 5 that controls the motor 3, and a housing 6 that forms an external form of the electric compressor 1. In this working example, the housing 6 is formed of a compressor housing 7 that houses the electric compressor 2, a motor housing 8 that houses the motor 3, and an inverter housing 9 that houses the inverter control device 5.

**[0024]** The compressor housing 7, which is positioned farthest to the rear of the electric compressor 1, is of a bottomed cylindrical form wherein a side to the rear of the electric compressor 1 is closed and a side to the front of the electric compressor 1 is opened, and has a discharge chamber 11, an oil separator 12, and an oil storage chamber 13 on the side to the rear of the electric compressor 1, and furthermore, an outflow port 72 for causing a refrigerant to flow out to an external refrigeration cycle from the discharge chamber 11 is formed in a side wall portion 71.

**[0025]** The compressing mechanism 2, which is housed farther to the front side than the discharge chamber 11 in the compressor housing 7, is of a scroll form having a fixed scroll 16 and an orbiting scroll 17 disposed opposing the fixed scroll 16.

**[0026]** The fixed scroll 16 and the orbiting scroll 17 are such that by spiral walls 16c and 17b, which stand upright from substrates 16a and 17a of the fixed scroll 16 and the orbiting scroll 17 respectively, being meshed with each other, a compression chamber 20 is configured in a space enclosed by the substrate 16a and the spiral wall 16c of the fixed scroll 16 and the substrate 17a and the spiral wall 17b of the orbiting scroll 17. Between an outer peripheral wall 16b of the fixed scroll 16 and an outermost peripheral portion of the spiral wall 17b of the orbiting scroll 17, there is a suction chamber 21 that suctions a refrigerant into the compression chamber 20. The fixed scroll 16 is such that a discharge port 16d, which is a through hole, is formed in an approximate center of the substrate 16a, and a refrigerant is discharged into the discharge chamber 11 from the compression chamber 20 via a discharge valve 22 provided on a rear end face of the substrate 16a. The orbiting scroll 17 is such that a fitting hole 17c, into which a radial bearing 26 for installing the drive shaft 4, to be described hereafter, in the orbiting scroll 17 is fitted, is formed in a center of a face of the substrate 17a to the front side of the electric compressor 1.

**[0027]** The motor housing 8 has a tubular side wall portion 81 having an aperture to both the front side and the rear side of the electric compressor 1, and is disposed farther to the inverter housing 9 side than the compressor housing 7. In this working example, a pin and ring coupling type of anti-rotation mechanism 35 is provided between the motor housing 8 and the orbiting scroll 17. Because of this, a rotational movement of the drive shaft 4 is converted into a turning movement of the orbiting scroll 17, whereby a volume of the compression chamber 20 increases and decreases.

**[0028]** The motor 3 is housed in the motor housing 8, and is configured of a stator 31, and a rotor 32 provided securely in such a way as to rotate integrally with the drive shaft 4 on an inner side of the stator 31. The rotor 32 rotates owing to a rotational magnetic force formed in the stator 31.

**[0029]** The motor housing 8 is such that an inflow port 82 for importing a refrigerant gas into the electric compressor 1 from the external refrigerant cycle is provided in a side face of the side wall portion 81. The refrigerant gas flows into a space portion 83 of the motor housing 8 from the inflow port 82, and after cooling the motor 3, reaches the suction chamber 21 of the compressor hous-

ing 7.

**[0030]** The inverter housing 9, which is positioned farthest to the front of the electric compressor 1, is of a bottomed tubular form opened to the front side of the electric compressor 1, and is configured of a tubular side wall portion 91, and a partitioning wall 92 that closes a side of the side wall portion 91 to the rear of the electric compressor 1. The inverter control device 5 is configured to have a substrate 51, a switching element 52 disposed on the substrate 51, and other components, and is housed in an inverter chamber 93 formed by the inverter housing 9 and a cover 10. A gasket 95 is sandwiched between end faces of the inverter housing 9 and the cover 10, securing airtightness inside the inverter chamber 93.

**[0031]** One end of the drive shaft 4 is supported in such a way as to be able to rotate by a bearing 23 held in a recessed portion 92a formed in a central portion of the partitioning wall 92 of the inverter housing 9. The other end of the drive shaft 4 is supported in such a way as to be able to rotate by a bearing 24 held in the space portion 83 of the motor housing 8. Furthermore, an eccentric shaft 4a is provided in a position eccentric with respect to an axial center of the drive shaft 4 in a rear end of the drive shaft 4, and a bush 25 is fitted over the eccentric shaft 4a. An outer peripheral face of the bush 25 is fitted into an inner side of the radial bearing 26, which is fitted into the fitting hole 17c of the orbiting scroll 17.

**[0032]** The heretofore described configuration is such that when the drive shaft 4 is driven so as to rotate by the motor 3, the orbiting scroll 17 carries out a turning movement around an axial center of the fixed scroll 16 via the eccentric shaft 4a. Because of this, a refrigerant that has flowed into the housing 6 from the inflow port 82 is introduced into the compression chamber 20 via the suction chamber 21. The refrigerant compressed in the compression chamber 20 is discharged from the discharge port 16d of the fixed scroll 16 to the discharge chamber 11, after which oil is separated off in the oil separator 12, the refrigerant is sent from the outflow port 72 to the external refrigerant cycle, and the oil separated off is sent to the oil storage chamber 13.

**[0033]** Herein, the inverter housing 9 of the electric compressor 1 to which the invention is applied is such that the side wall portion 91 is of a tubular form opened to the front side of the electric compressor 1, and the aperture is closed by the cover 10, which is separate from the inverter housing 9, as shown in Fig. 4. The cover 10 has a front wall portion 101 positioned to the front side of the electric compressor 1, and a side wall portion 102 that comes into contact with the side wall portion 91 of the inverter housing 9. The inverter housing 9 and the cover 10 are such that bolt mounting holes 94 and 108 are provided in the side wall portions 91 and 102 respectively, and the inverter housing 9 and the cover 10 are assembled by a bolt 200 being inserted through the bolt mounting holes 94 and 108 in a state wherein the bolt mounting hole 94 and the bolt mounting hole 108 communicate as appropriate.

**[0034]** Further, as shown in Fig. 2 to Fig. 4, the electric compressor 1 is such that the mounting legs 84 and 85 for mounting on the vehicle 500 are formed on upper and lower side faces of the motor housing 8, and the mounting leg 103 for mounting on the vehicle 500 is formed on an outer face (a face to the front side of the electric compressor 1) of the front wall portion 101 of the cover 10. Each of the mounting legs 84, 85, and 103 is of a quadrangular prism form, and a longitudinal direction thereof extends in a direction that intersects with the axial direction of the drive shaft 4. Insertion holes 84a, 85a, and 103a through which unshown bolts are inserted are opened in longitudinal direction side faces of the mounting legs 84, 85, and 103 respectively.

**[0035]** When the electric compressor 1 is mounted with the rear of the electric compressor 1 facing the front of the vehicle 500, as shown in Fig. 1, the cover 10, on which the mounting leg 103 is provided, is positioned to the rear side of the vehicle 500. This means that when the front of the vehicle 500 shown in Fig. 1 is damaged due to a collision or the like, a strong force (a white arrow) is exerted on the electric compressor 1 from the front of the vehicle 500 (the rear of the electric compressor 1), as shown in Fig. 2, and the cover 10 mounted on the vehicle 500 using the mounting leg 103 bears the load (a black arrow). Also, there is also a possibility of a component or a part in an engine room moving in accompaniment to a distortion of a chassis of the vehicle 500, coming into contact with the electric compressor 1, and exerting a large force. In this kind of case too, there is concern that a strong force will act on the cover 10, on which the mounting leg 103 that supports the front of the electric compressor 1 is provided.

**[0036]** In the invention, the cover 10 and the inverter housing 9 have the following kinds of configuration in order that the inverter chamber 93 of the electric compressor 1 is not crushed by these strong loads caused by a collision or the like of the vehicle 500.

**[0037]** As shown in Fig. 2 to Fig. 6, the cover 10 is such that a hollow protruding portion 104 protruding in an approximately hemispherical dome form toward the front of the electric compressor 1 is provided centered on the mounting leg 103 in the front wall portion 101. Further, together with the hollow protruding portion 104 being provided in the front wall portion 101 of the cover 10, a protruding portion 9a protruding farther to a radial direction outer side than the hollow protruding portion 104 of the cover 10 is provided in the inverter housing 9 in a state mounted on the vehicle 500 using the mounting leg 103 of the cover 10, as shown in Fig. 2 and Fig. 3. As the aperture of the side wall portion 91 is expanded by the protruding portion 9a of the inverter housing 9 in this way, the cover 10 also has a protruding portion 10a protruding in the same direction as the protruding portion 9a of the inverter housing 9 in order to close the aperture of the side wall portion 91, as shown in Fig. 2, Fig. 3, Fig. 5, and Fig. 6.

**[0038]** As shown in Fig. 5, the cover 10 is such that a

multiple (three in this working example) of strip-form ribs 105 extending in a direction that intersects with an axial direction of the mounting leg insertion hole 103a, and a multiple (four in this working example) of strip-form ribs 106, are formed on an outer face of the hollow protruding portion 104 of the front wall portion 101.

**[0039]** The ribs 105 extend linearly in a direction inclined to a protruding portion 10a side, with a side on an upper side of the mounting leg 103 (higher in the electric compressor 1) as a base end. Further, in this working example, a rib 105' wider than any of the three ribs 105 is formed farther to the protruding portion 10a side than the rib 105 positioned farthest to the protruding portion 10a side. The rib 105' extends linearly in a form inclined farther to the protruding portion 10a side than the three ribs 105 as far as a bolt mounting hole 108 side of an end on the protruding portion 10a side of a thick portion 102a, to be described hereafter, with a side on the upper side of the mounting leg 103 as a base end.

**[0040]** The ribs 106 extend linearly in a direction inclined to a side opposite to that of the protruding portion 10a, with a side on a lower side of the mounting leg 103 (lower in the electric compressor 1) as a base end. Further, in this working example, two ribs 106' extending in the same direction and at the same inclination as the ribs 106 are formed farther to the protruding portion 10a side than the rib 106 positioned farthest to the protruding portion 10a side. The ribs 106' extend with a bridge portion 107, to be described hereafter, as a base end, and are positioned on an outer face of the front wall portion 101 other than in the hollow protruding portion 104, at least from a leading end to an intermediate portion in a direction of extension.

**[0041]** Furthermore, as shown in Fig. 5 and Fig. 6, the side wall portion 102 of the cover 10 is such that the thick portion 102a, which is thicker than other regions of the side wall portion 102, is formed in a region positioned on lines of extension of the multiple of ribs 105 in a region extended along a peripheral edge of the hollow protruding portion 104. The thick portion 102a is formed higher in the electric compressor 1 than the hollow protruding portion 104. Further, as shown in Fig. 5 and Fig. 6, the side wall portion 102 of the cover 10 is such that a thick portion 102b, which is thicker than other regions of the side wall portion 102, is formed in a region positioned on lines of extension of the multiple of ribs 106 in a region extended along a peripheral edge of the hollow protruding portion 104. The thick portion 102b is formed lower in the electric compressor 1 than the hollow protruding portion 104.

**[0042]** Together with this, as shown in Fig. 7, the side wall portion 91 of the inverter housing 9 is also such that thick portions 91a and 91b, which are thicker than other regions of the side wall portion 91, are formed in positions corresponding to the thick portions 102a and 102b of the side wall portion 102 of the cover 10. That is, the thick portions 91a and 91b of the inverter housing 9 are such that regions positioned on the lines of extension of the ribs 105 or 106 in a region extended along a peripheral edge of the hollow protruding portion 104 are thicker than other regions of the side wall portion 91.

**[0043]** Meanwhile, the gasket 95 sandwiched between the side wall portion 91 of the inverter housing 9 and the side wall portion 102 of the cover 10 has a uniform width around the whole periphery in order that surface pressure is uniform, as shown by a two-dot chain line in Fig. 5 (b). Because of this, a portion on an outer face side of a thick portion of the side wall portion 102 protrudes from the gasket 95 in the thick portions 102a and 102b of the cover 10.

**[0044]** Further still, the cover 10 has the bridge portion 107, which is raised from the outer face of the front wall portion 101. The bridge portion 107 extends in the axial direction of the mounting leg insertion hole 103a from the protruding portion 10a side of the mounting leg 103, and an end thereof extends as far as an outer edge (the side wall portion 102) of the protruding portion 9a of the cover 10. Further, the bridge portion 107 is cut away into an arc form so as not to hinder an insertion of a bolt into the mounting leg insertion hole 103a.

**[0045]** This means that by the mounting leg 103 being provided on the cover 10, a force received by the cover 10 from the front of the electric compressor 1 via the mounting leg 103 is firstly caused to disperse by the hemispherical dome-form hollow protruding portion 104, centered on the mounting leg 103, of the front wall portion 101 of the cover 10 . The force dispersed by the hollow protruding portion 104 is transmitted to the thick portions 102a and 102b positioned on the upper side and the lower side of the side wall portion 102 of the cover 10 by the ribs 105, which are disposed on the upper side of the mounting leg 103, and extend from the mounting leg 103 toward an upper side of the electric compressor 1, on the outer face of the hollow protruding portion 104, and the ribs 106, which are disposed on the lower side of the mounting leg 103, and extend from the mounting leg 103 toward a lower side of the electric compressor 1, on the outer face of the hollow protruding portion 104. Further, as the thick portions 102a and 102b of the side wall portion 102 of the cover 10 and the thick portions 91a and 91b of the side wall portion 91 of the inverter housing 9 are in contact, the force from the front of the electric compressor 1 is eventually borne by the side wall portion 102 of the cover 10 and the side wall portion 91 of the inverter housing 9.

**[0046]** Furthermore, as the bridge portion 107 extending in the axial direction of the insertion hole 103a of the mounting leg 103 is formed, and the bridge portion 107 reaches the side wall portion 102 from a longitudinal direction end of the mounting leg 103, a force dispersed toward a side of the electric compressor 1 from the hollow protruding portion 104 is borne by the bridge portion 107, an end of which reaches the side wall portion 102.

**[0047]** Therefore, the front wall portion 101 of the cover 10 buckling or becoming deformed, and the inverter chamber 93 being crushed, is prevented.

**[0048]** Also, the thick portions 102a and 102b of the side wall portion 102 of the cover 10 protruding from the gasket 95 means that even when a strong force acts from the front of the electric compressor 1, the protruding portion of the side wall portion 102 can become deformed as far as coming into contact with the side wall portion 91 of the opposing inverter housing 9, because of which a strong force caused by a collision can be alleviated.

Reference Signs List

**[0049]**

| | |
|---|---|
| 1 | Electric compressor |
| 2 | Compressing mechanism |
| 3 | Motor |
| 5 | Inverter control device |
| 6 | Housing |
| 9 | Inverter housing |
| 9a | Protruding portion |
| 91 | Side wall portion |
| 91a | Thick portion |
| 91b | Thick portion |
| 93 | Inverter chamber |
| 10 | Cover |
| 10a | Protruding portion |
| 101 | Front wall portion |
| 102 | Side wall portion |
| 102a | Thick portion |
| 102b | Thick portion |
| 103 | Mounting leg |
| 103a | Insertion hole |
| 104 | Hollow protruding portion |
| 105 | Rib |
| 106 | Rib |
| 107 | Bridge portion |
| 500 | Vehicle (mounting target) |

## Claims

**1.** An electric compressor reinforcement structure of an electric compressor (1) comprising:

a compressing mechanism (2) that compresses a refrigerant;
a motor (3) that drives the compressing mechanism (2);
an inverter control device (5) that controls the motor (3); and
a housing (6), wherein
the housing (6) has an inverter housing (9) in which the inverter control device (5) is housed, and
the inverter housing (9) is such that a side opposite to that of the motor (3) is closed by a cover (10), and a mounting leg (103) that is mounted on a mounting target (500) is formed on an outer face of the cover, **characterized in that**
a hollow protruding portion (104) protruding in a dome form centered on the mounting leg (103) is provided in the cover (10).

**2.** The electric compressor reinforcement structure according to claim 1, wherein the inverter housing (9) has a protruding portion (9a) protruding farther to a radial direction outer side than the hollow protruding portion (104) of the cover (10).

**3.** The electric compressor reinforcement structure according to claim 1 or claim 2, wherein a rib (105, 106) extending from the mounting leg (103) in a direction that intersects with an axial direction of an insertion hole (103a) of the mounting leg (103) is provided on the outer face of the cover (10).

**4.** The electric compressor reinforcement structure according to claim 1, claim 2, or claim 3, wherein

a thick portion (102a, 102b) is formed in part of a region of the side wall portion (102) of the cover (10) extended along a peripheral edge of the hollow protruding portion (104), wherein a thickness of the thick portion (102a, 102b) is greater than that of the other region of the side wall portion (102) of the cover (10), and
a thick portion (91a, 91b) is formed in a region of a side wall portion (91) of the inverter housing (9) that comes into contact with the thick portion (102a, 102b) of the side wall portion (102) of the cover (10), wherein a thickness of the thick portion (91a, 91b) is greater than that of the other region of the side wall portion (91) of the inverter housing (9) .

**5.** The electric compressor reinforcement structure according to claim 2, wherein a bridge portion (107) is raised from the outer face of the cover (10), and the bridge portion (107) extends from an axial direction side end of an insertion hole (103a) of the mounting leg (103) in an axial direction of the insertion hole (103a) of the mounting leg (103) as far as an outer edge of the cover (10) on the side of the inverter housing protruding portion (10a).

FIG. 1

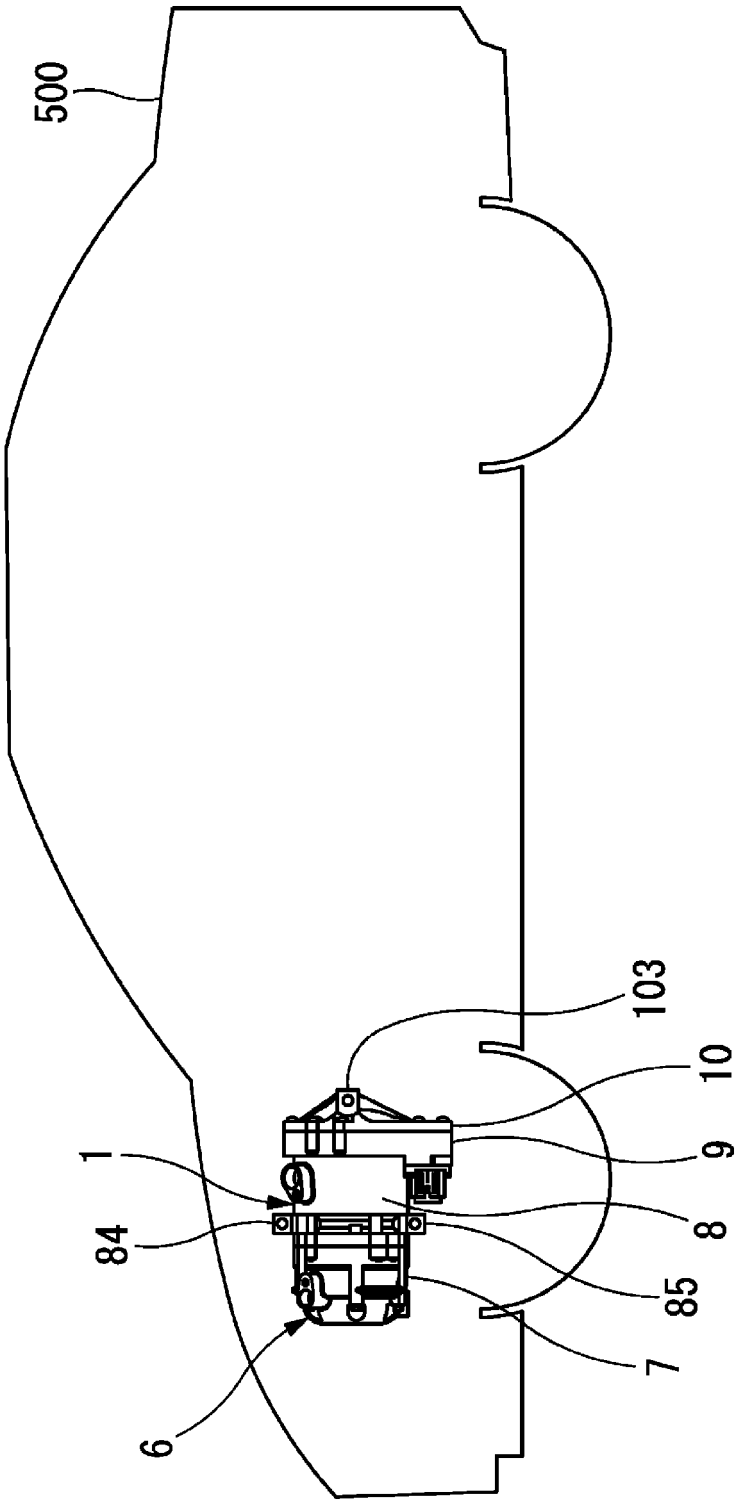


FIG. 2

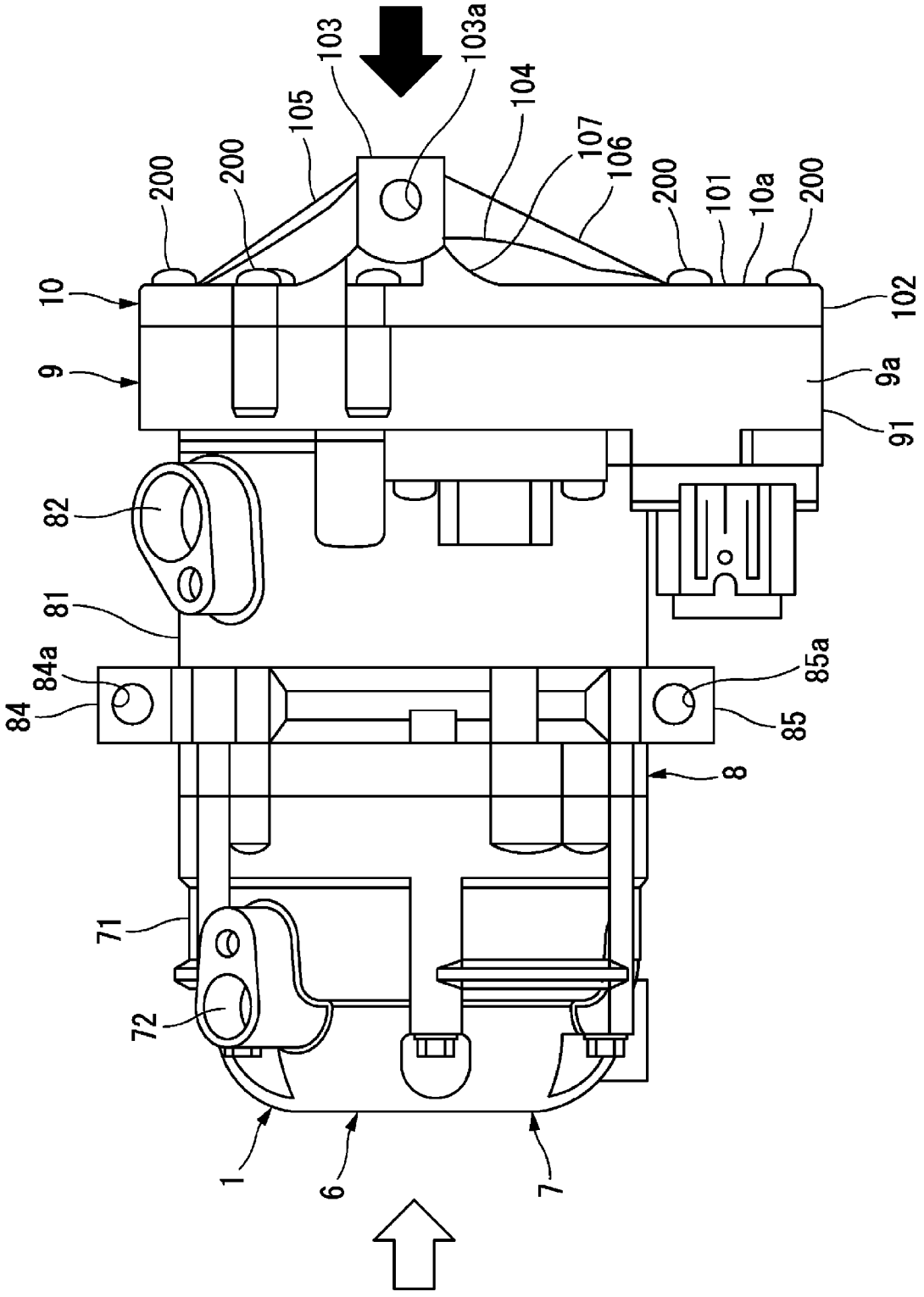

103
103a
105
104
107
106
200
200
200
101
10a
200
10
102
9
9a
91
82
81
84a
84
85a
85
8
71
72
1
6
7

FIG. 3

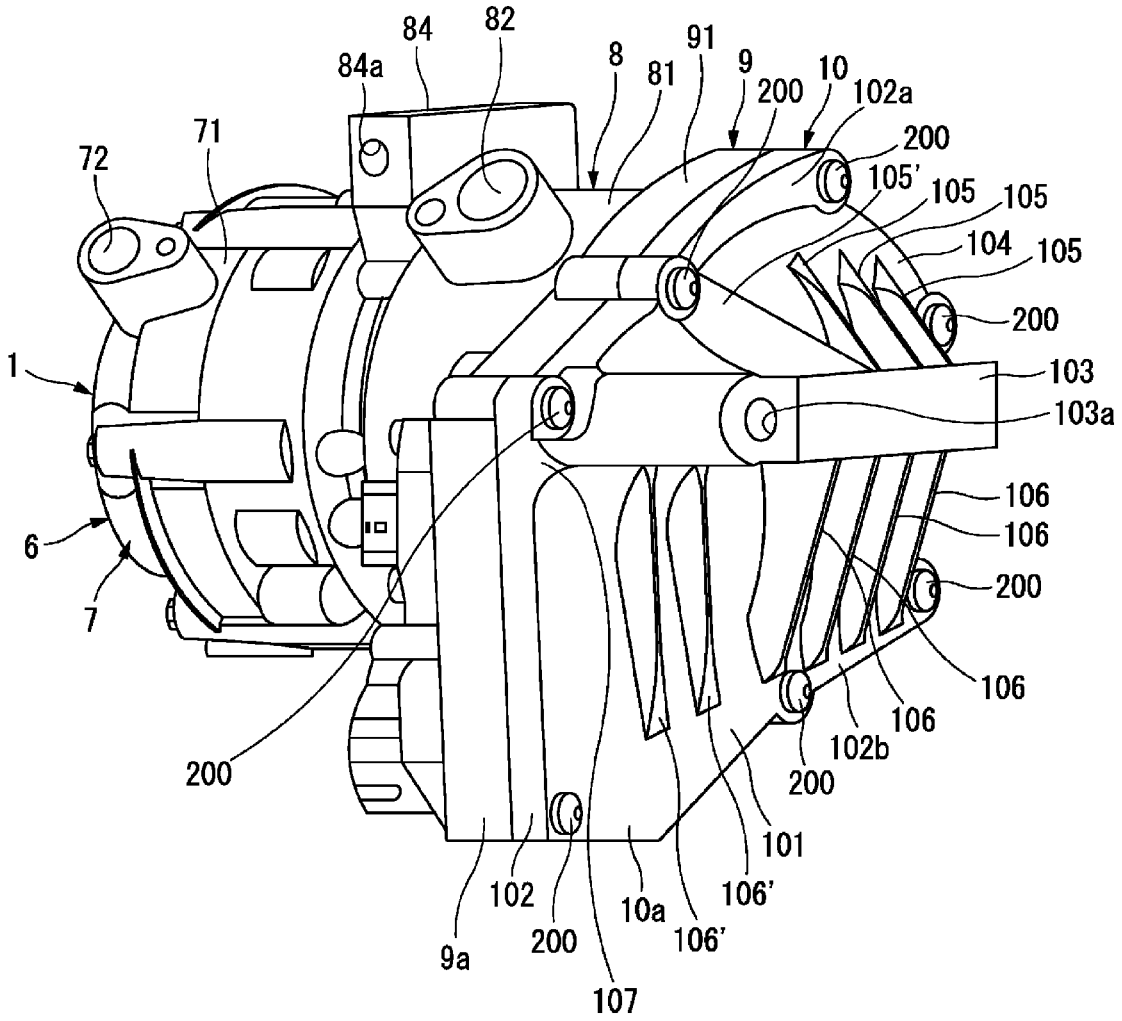

84
82
84a
8
81
91
9
200
10
102a
72
71
200
105'
105
105
104
105
200
1
103
103a
106
106
6
200
7
106
106
102b
200
200
101
102
106'
10a
200
106'
9a
107

FIG. 4

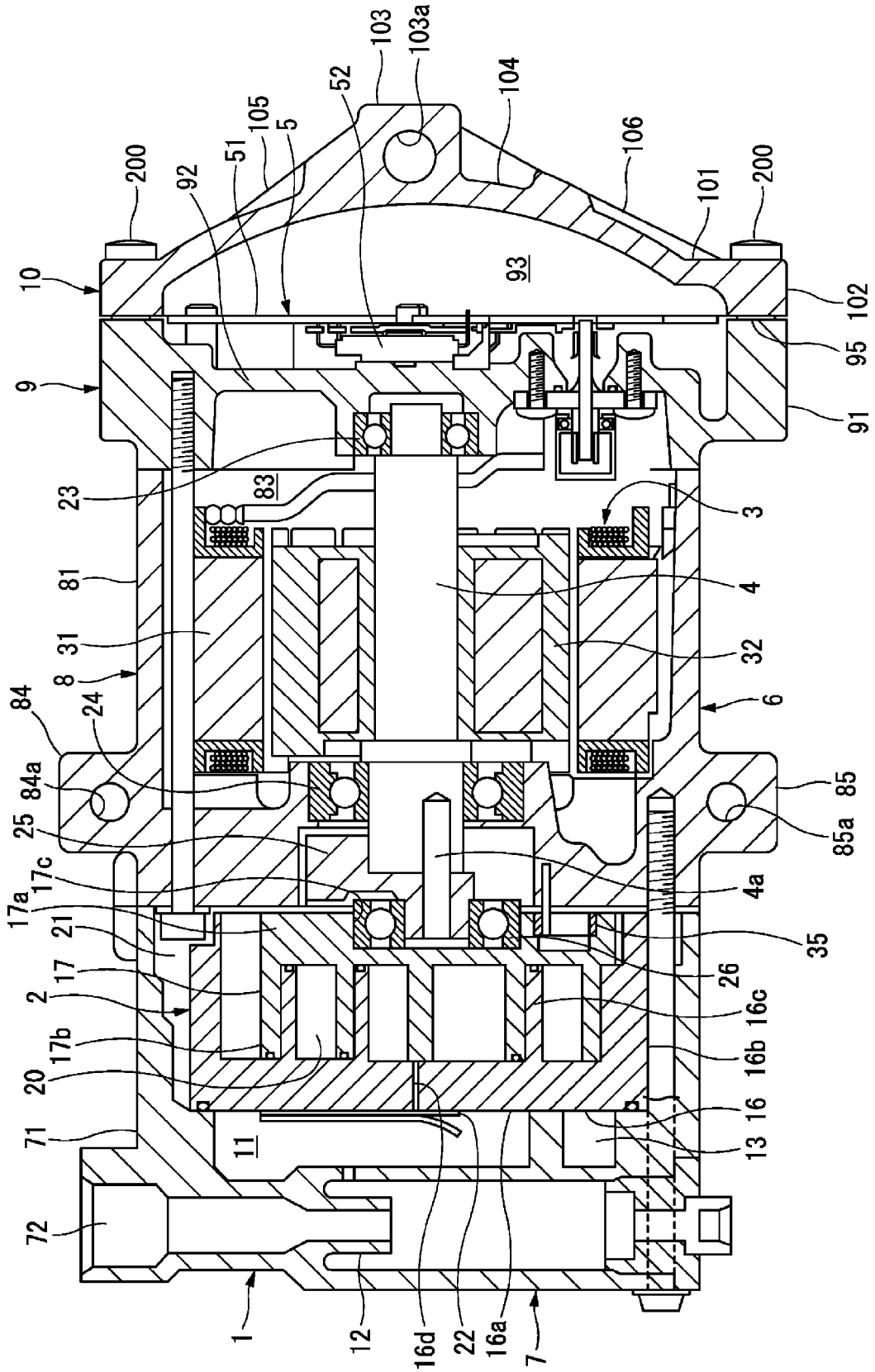

103
103a
52
104
105
5
106
200
92
51
101
200
10
93
102
95
9
91
23
83
3
81
4
31
32
8
6
84
24
84a
85
85a
25
4a
17c
17a
35
21
26
17
2
16c
17b
16b
20
16
71
11
13
72
1
12
16d
22
16a
7

FIG. 5

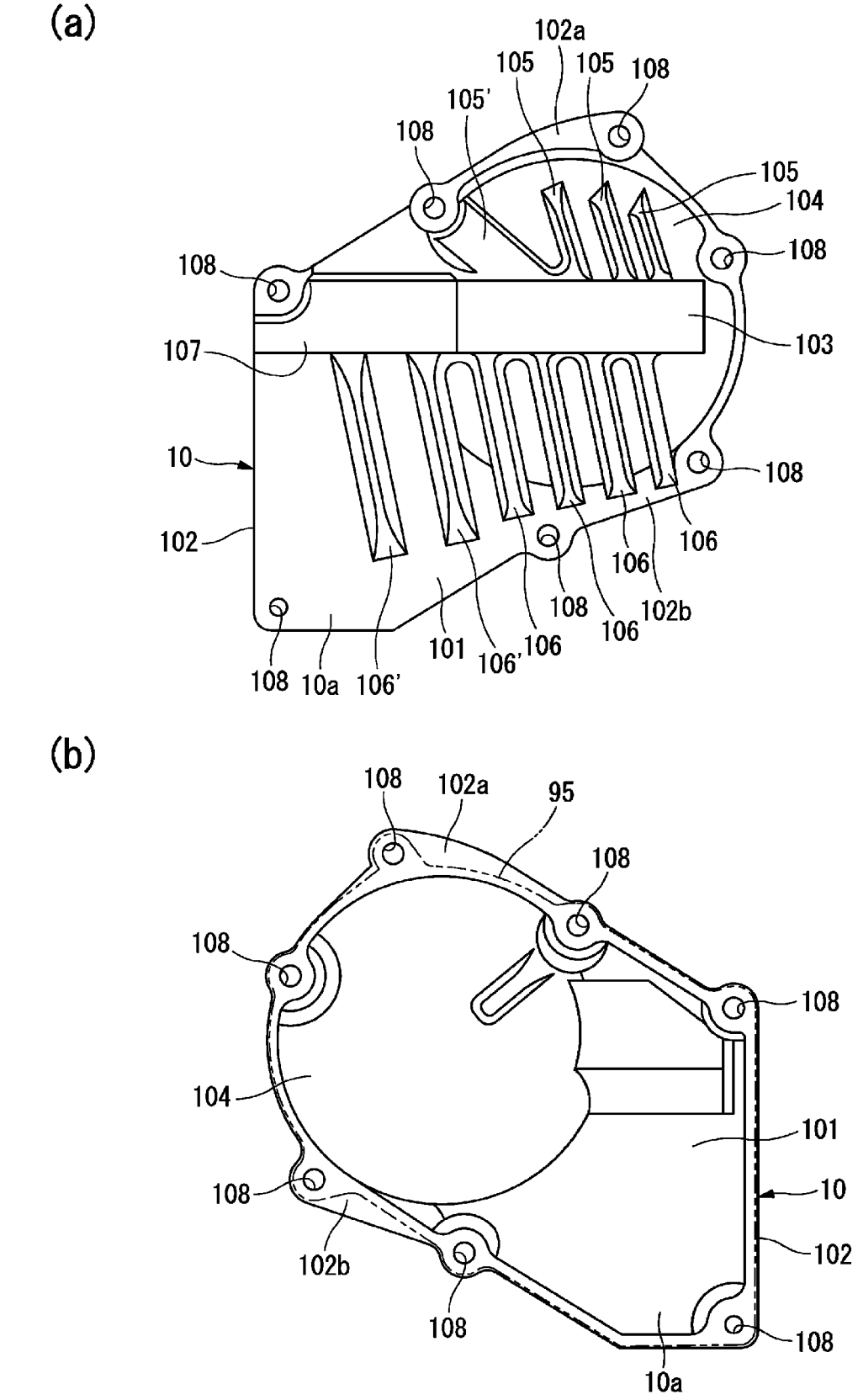

(a)
102a
105
105
108
105'
108
105
104
108
108
103
107
10
108
102
106
106
108
102b
106
101
106'
106
108
108
10a
106'
(b)
108
102a
95
108
108
108
104
101
108
10
102b
102
108
108
10a

FIG. 6

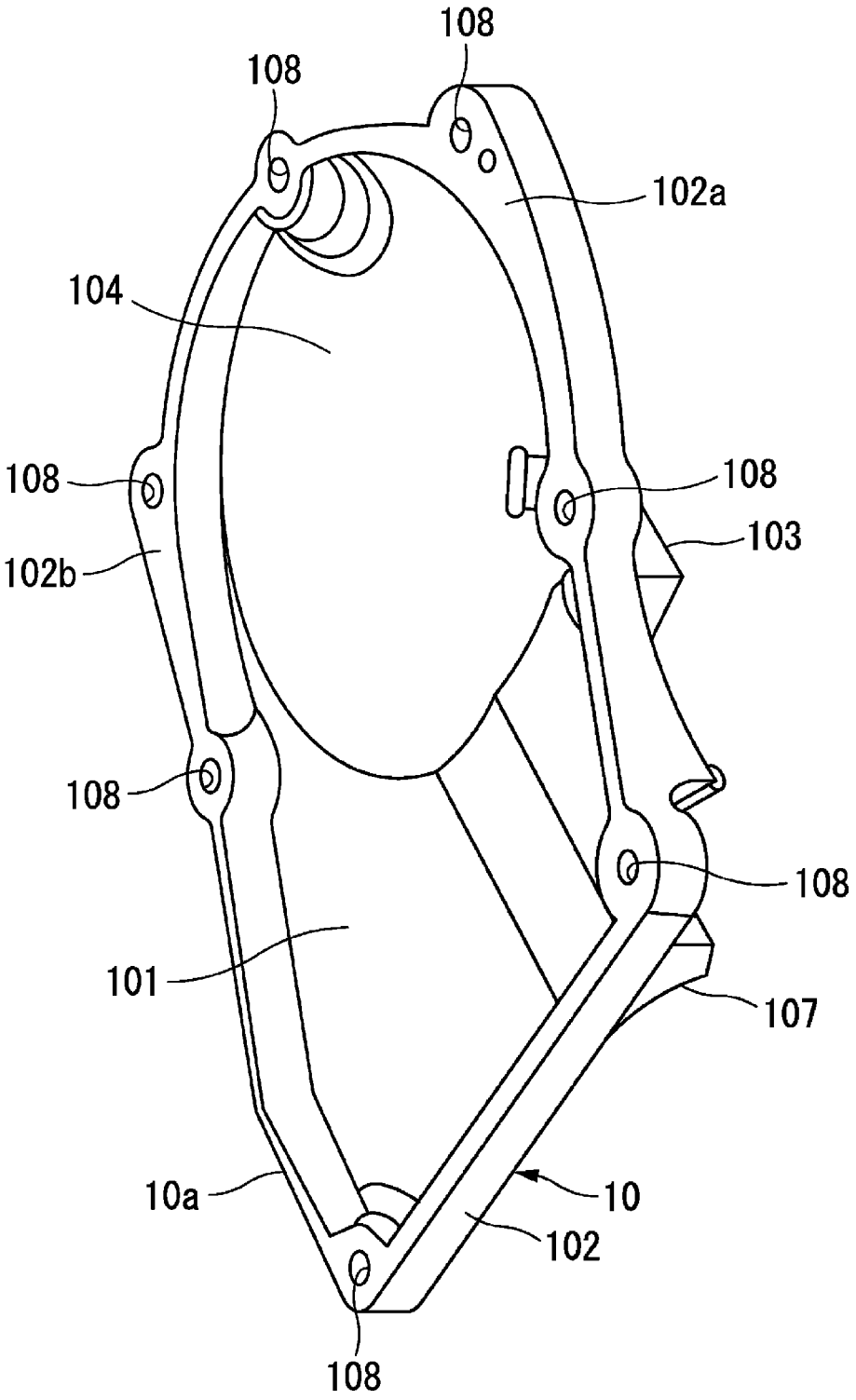
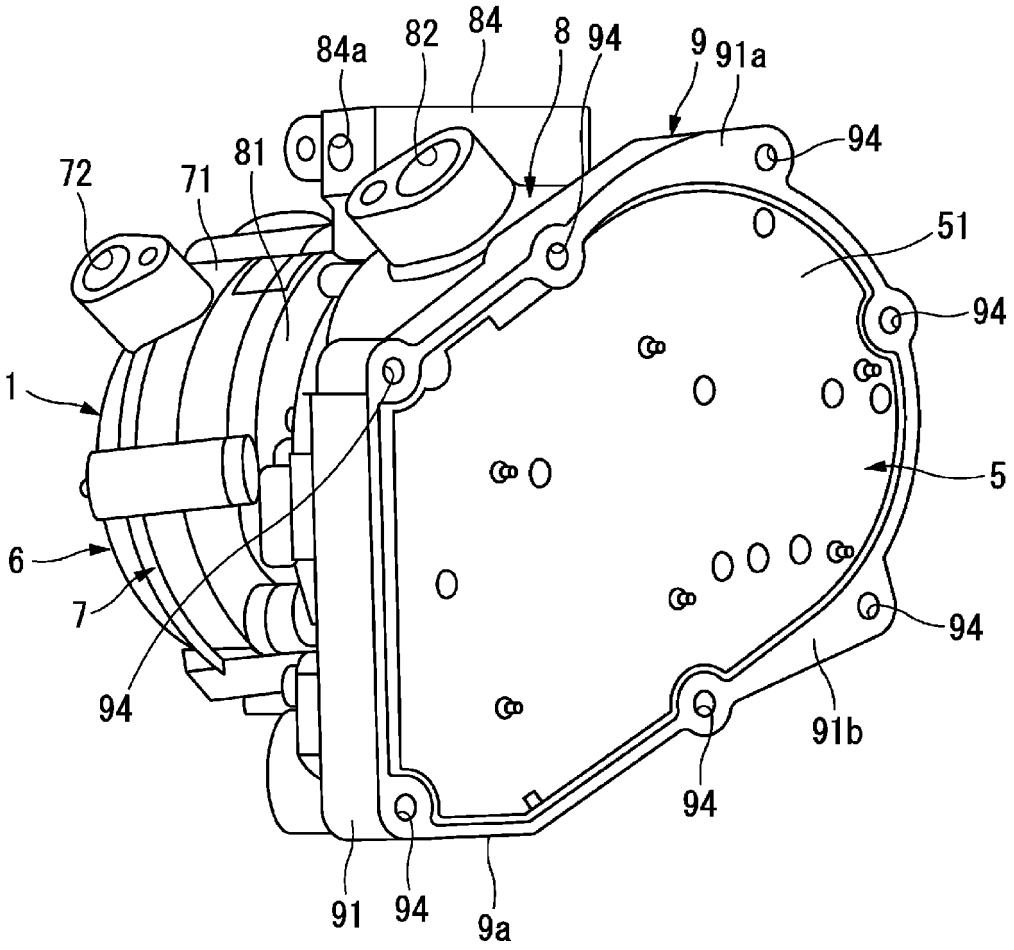

108
108
108
102a
104
108
108
103
102b
108
108
101
107
10a
10
102
108

FIG. 7



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2019/042087

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F04B39/00(2006.01)i, F04C29/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F04B39/00-39/16 F04C23/00-29/12

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

| | |
|---|---|
| Published examined utility model applications of Japan | 1922-1996 |
| Published unexamined utility model applications of Japan | 1971-2019 |
| Registered utility model specifications of Japan | 1996-2019 |
| Published registered utility model applications of Japan | 1994-2019 |

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y<br>A | JP 2009-150236 A (TOYOTA INDUSTRIES CORPORATION) 09 July 2009, paragraphs [0012]-[0025], fig. 1 & US 2009/0151389 A1, paragraphs [0012]-[0025], fig. 1 & EP 2075470 A2, paragraphs [0009]-[0022], fig. 1 & CN 101463814 A | 1, 3<br>2, 4-5 |
| Y | CN 203430779 U (FUJIAN SNOWMAN COMPRESSOR TECHNOLOGY CO., LTD.) 12 February 2014, paragraph [0008], fig. 1-2 (Family: none) | 1, 3 |

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 19 December 2019 (19.12.2019) | 07 January 2020 (07.01.2020) |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| Japan Patent Office<br>3-4-3, Kasumigaseki, Chiyoda-ku,<br>Tokyo 100-8915, Japan | Telephone No. |

Form PCT/ISA/210 (second sheet) (January 2015)

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- JP 2015105578 A **[0004]**
- JP 2009150236 A **[0004]**