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

(72) Inventor: **DEGUCHI, Hironobu**  
**Kumagaya-shi**  
**Saitama 360-0193 (JP)**

(74) Representative: **Tran, Chi-Hai**  
**Valeo Systèmes Thermiques**  
**8, rue Louis Lormand**  
**CS 80517 La Verrière**  
**78322 Le Mesnil Saint Denis Cedex (FR)**

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(54) **ELECTRICALLY DRIVEN SCROLL COMPRESSOR**

(57) [Object]

To improve the accuracy of the supporting surface for an orbiting scroll by suppressing the deformation of an end plate.

[Solution]

An electrically driven scroll compressor 1 includes a compression mechanism accommodation housing member 5 for accommodating a compression mechanism 3 that is a combination of a fixed scroll 11 and an orbiting scroll 21 and a motor accommodation housing member 6 for accommodating an electric motor 4 for driving the compression mechanism 3. The motor accommodation housing member 6 includes a motor fixing part 12 to which a stator 16 of the electric motor 4 is fixed by close-fitting, an end plate 13 having an orbiting scroll side end surface 22 that is a support surface for the orbiting scroll 21, and a low rigidity part 14 for making connection between the motor fixing part 12 and the end plate 13. The low rigidity part 14 has rigidity lower than in the motor fixing part 12 and the end plate 13. When the stator 16 is fixed to the motor fixing part 12 by close-fitting and the motor fixing part 12 undergoes diameter expansion deformation, the low rigidity part 14 is elastically deformed to absorb the elastic deformation of the motor fixing part 12.

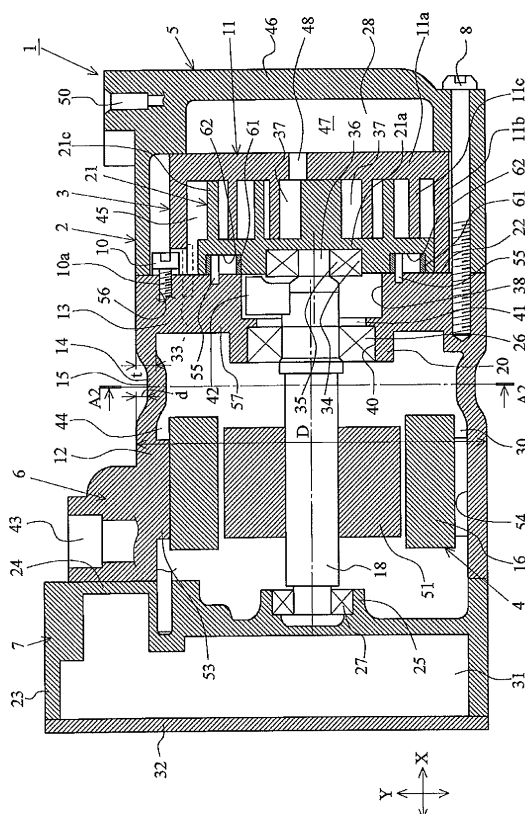


Fig. 1

## Description

## Technical Field

**[0001]** The present invention relates to an electrically driven scroll compressor used for the refrigerating cycle or the like of a vehicle air conditioning apparatus.

## Background Art

**[0002]** The known structure of a conventional electrically driven scroll compressor is disclosed in PTL 1. The conventional electrically driven scroll compressor includes a discharge housing that has a discharge port and accommodates a compression part (compression mechanism) including a fixed scroll and a movable scroll facing each other, a suction housing provided with a suction port, and an intermediate housing that is present between the discharge housing and the suction housing and accommodates an electric motor together with the suction housing. The intermediate housing includes a motor fixing part that accommodates and fixes part of the electric motor and a bearing support part (end plate) that is formed integrally on the discharge housing side of the motor fixing part and supports a driving shaft via a bearing.

**[0003]** The compression mechanism used in the conventional electrically driven scroll compressor is already known and includes a fixed scroll having a board and a spiral wall erected from the board and an orbiting scroll, disposed facing the fixed scroll, that has a board and a spiral wall erected from the board. By combining the spiral walls of the pair of scrolls with each other and the orbiting scroll is engaged with and revolved (revolving motion) by the eccentric shaft provided on the driving shaft rotated and driven by the electric motor accommodated in the housing, and the compression chamber formed between the spiral walls of both scrolls is moved toward the center while being reduced in volume to compress the compressed fluid.

**[0004]** In such an electrically driven scroll compressor, since a rotation force is generated in the orbiting scroll as the driving shaft rotates, a rotation prevention mechanism for preventing the rotation of the orbiting scroll is provided. As this rotation prevention mechanism, an Oldham coupling, a pin and ring coupling, a ball coupling, or the like is used between the board (bottom plate) of the orbiting scroll (movable scroll) and the end plate of the intermediate housing. The orbiting scroll is revolved so as to be supported by the end plate of the intermediate housing via the rotation prevention mechanism or revolved so as to be supported directly by the end plate of the intermediate housing.

## Citation List

## Patent Literature

5 **[0005]** PTL 1: JP-A-2000-291557

## Summary of Invention

## Technical Problem

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**[0006]** In an electrically driven scroll compressor in which an electric motor is fixed within an intermediate housing by close-fitting of electrically driven scroll compressors having been generally known conventionally, when the electric motor is fixed within the intermediate housing via close-fitting, the intermediate housing undergoes diameter expansion deformation by the electric motor, the diameter expansion deformation of the intermediate housing deforms the end plate of the intermediate housing supporting an orbiting scroll, the accuracy of the supporting surface for the orbiting scroll is reduced, the revolution accuracy of the orbiting scroll is reduced or the smooth revolving motion of the orbiting scroll becomes difficult, possibly affecting the performance and reliability of the compressor.

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**[0007]** An object of the invention is to provide an electrically driven scroll compressor capable of suppressing the deformation of the end plate, improving the accuracy of the supporting surface for the orbiting scroll, enabling the accurate revolution of the orbiting scroll, and improving the performance and reliability of the compressor.

## Solution to Problem

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**[0008]** The invention relates to an electrically driven scroll compressor 1 including a compression mechanism accommodation housing member 5 for accommodating a compression mechanism 3 that is a combination of a fixed scroll 11 and an orbiting scroll 21, a motor accommodation housing member 6 for accommodating an electric motor 4 for driving the compression mechanism 3, and an inverter accommodation housing member 7 for accommodating an inverter device for driving and controlling the electric motor 4. In the invention, the motor accommodation housing member 6 includes a cylindrical motor fixing part 12 to which a stator 16 of the electric motor 4 is fixed by close-fitting, an end plate 13 having an orbiting scroll side end surface 22, which is a supporting surface for the orbiting scroll 21, and a low rigidity part 14 making connection between the motor fixing part 12 and the end plate 13. In addition, the low rigidity part 14 has rigidity smaller than in the motor fixing part 12 and the end plate 13.

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## Advantageous Effects of Invention

**[0009]** In the electrically driven scroll compressor according to the invention, when the stator of the electric

motor is fixed to the motor fixing part of the motor accommodation housing member by close-fitting and the motor fixing part undergoes diameter expansion deformation by the stator, the low rigidity part having rigidity smaller than in the motor fixing part and the end plate is elastically deformed by the diameter expansion deformation of the motor fixing part, the diameter expansion deformation of the motor fixing part is absorbed by the low rigidity part, and the stress caused in the connection part between the low rigidity part and the end plate becomes smaller than in the case in which the low rigidity part is not provided. As a result, in the electrically driven scroll compressor according to the invention, since the deformation of the end plate caused by the diameter expansion deformation of the motor fixing part can be suppressed and the accuracy of the supporting surface supporting the revolving motion of the orbiting scroll can be improved, the orbiting scroll can revolve at high accuracy and the performance and reliability of the compressor can be improved.

#### Brief Description of Drawings

##### [0010]

[Fig. 1] Fig. 1 is a cross sectional view illustrating the electrically driven scroll compressor according to the invention.

[Fig. 2A] Fig. 2A is a back view illustrating the orbiting scroll.

[Fig. 2B] Fig. 2B is a cross sectional view illustrating the orbiting scroll taken along line A1-A1 in Fig. 2A.

[Fig. 3A] Fig. 3A illustrates the motor accommodation housing member with which the end plate is integrated, and the end plate seen in the shaft direction from the motor fixing part.

[Fig. 3B] Fig. 3B illustrates the end plate in the shaft direction from the compressor mechanism.

[Fig. 4] Fig. 4 is a cross sectional view illustrating the motor accommodation housing member taken along line A2-A2 in Fig. 1.

#### Description of Embodiments

[0011] The electrically driven scroll compressor according to the invention will be described below with reference to the drawings.

[0012] The electrically driven scroll compressor 1 illustrated in Fig. 1 is an electrically driven compressor suitable for a refrigerating cycle that uses a refrigerant as a working fluid. In Fig. 1, the compression mechanism 3 is disposed on the right side in the drawing of a housing 2 made of aluminum alloy, the electric motor 4 for driving the compression mechanism 3 is disposed in the middle of the housing 2, and an inverter device (not illustrated) is disposed on the left side of the housing 2. In Fig. 1, the left side in the drawing is the front of the compressor and the right side is the rear of the compressor.

[0013] The housing 2 includes the compression mechanism accommodation housing member 5 in which the compression mechanism 3 is accommodated, the motor accommodation housing member 6 in which the electric motor 4 for driving the compression mechanism 3 is accommodated, and the inverter accommodation housing member 7 in which the inverter device (not illustrated) for driving and controlling the electric motor 4 is accommodated. The compression mechanism accommodation housing member 5 and the motor accommodation housing member 6 adjacent to each other are positioned by a positioning pin (not illustrated) and fixed in the shaft direction (X-axis direction in Fig. 1) by a tightening bolt 8. In addition, the motor accommodation housing member 6 and the inverter accommodation housing member 7 adjacent to each other are positioned by a positioning pin (not illustrated) and fixed in the shaft direction by a tightening bolt 10.

[0014] The compression mechanism housing member 5 accommodates the fixed scroll 11 of the compression mechanism 3, which will be described later, and is formed in a bottomed cylinder having an opening at the end facing the motor accommodation housing member 6.

[0015] The motor accommodation housing member 6 includes the cylindrical motor fixing part 12 to which the electric motor 4 is fixed, the end plate 13 positioned on the side facing the compression mechanism accommodation housing member 5, and the low rigidity part 14 that is positioned between the motor fixing part 12 and the end plate 13 and makes connection between one end side in the shaft direction of the motor fixing part 12 and the radially outer end side of the end plate 13. The motor fixing part 12, the low rigidity part 14, and the end plate 13 are formed integrally with each other and the low rigidity part 14 has rigidity smaller than in the motor fixing part 12 and the end plate 13.

[0016] The low rigidity part 14 is formed across the entire circumference in the circumferential direction of the motor accommodation housing member 6 and has a constriction part 15 formed by recessing a part between the motor fixing part 12 and the end plate 13 radially inward. As described later, when the stator 16 of the electric motor 4 is fixed to the motor fixing part 12 by close-fitting (such as press-fitting or shrink-fitting) and the motor fixing part 12 undergoes diameter expansion deformation, the low rigidity part 14 is elastically deformed by the diameter expansion deformation of the motor fixing part 12, absorbs the deformation of the motor fixing part 12, and suppresses the deformation of the end plate 13 caused by the diameter expansion deformation of the motor fixing part 12. In addition, bolt accommodation parts 17 are formed on the low rigidity part 14 so as to project radially outward as described later. In the embodiment, when the diameter of the motor fixing part 12 is assumed to be D, the constriction part 15 is recessed radially inward so that a recession amount d equals approximately 0.05D from the outer surface of the motor fixing part 12. Alternatively, when the wall thickness of

the low rigidity part 14 is assumed to be  $t$ , the constriction part 15 is recessed radially inward so that the recession amount  $d$  of the motor fixing part 12 from the outer surface of the motor fixing part 12 equals  $t/2$  or more. However, the amount of recession of the constriction part 15 is not limited to this amount of recession illustrated above and the optimum amount of recession is determined in consideration of the amount of diameter expansion deformation of the motor fixing part 12 and the like.

**[0017]** The end plate 13 is formed integrally with a shaft supporting part 20 supporting one end side of a driving shaft 18 so that the orbiting scroll side end surface 22 can support loads in the shaft direction of the orbiting scroll 21 of the compression mechanism 3.

**[0018]** The inverter accommodation housing member 7 includes an inverter accommodation cylindrical part 23 formed in a cylindrical shape and an end plate 24, formed integrally with the inverter accommodation cylindrical part 23, that is positioned on the side facing the motor accommodation housing member 6. The end plate 24 is formed integrally with a shaft supporting part 25 for supporting the other end side of the driving shaft 18.

**[0019]** The shaft supporting part 20 of the end plate 13 of the motor accommodation housing member 6 rotatably supports one end side of the driving shaft 18 via a bearing 26. In addition, the shaft supporting part 25 of the end plate 24 of the inverter accommodation housing member 7 rotatably supports the other end side of the driving shaft 18 via a bearing 27. The interior of the housing 2 is partitioned by the end plate 13 of the motor accommodation housing member 6 and the end plate 24 of the inverter accommodation housing member 7 into a compression mechanism accommodation part 28 in which the compression mechanism 3 is accommodated, a motor accommodation part 30 in which the electric motor 4 is accommodated, and an inverter accommodation part 31 in which the inverter device is accommodated, in sequence from the rear side. In this example, the inverter accommodation part 31 is closed by fixing a lid 32 to the opening of the inverter accommodation housing member 7 by a bolt (not illustrated) or the like.

**[0020]** The compression mechanism 3 is a scroll type mechanism having the fixed scroll 11 and the orbiting scroll 21 disposed facing the fixed scroll 11. The fixed scroll 11 is allowed to move in the shaft direction and prevented from moving in the radial direction by positioning pins 33, which will be described later, with respect to the housing 2 (compression mechanism accommodation housing member 5). The fixed scroll 11 includes a discoid board 11a, a cylindrical outer peripheral wall 11b, provided across the entire circumference along the outer edge of the board 11a, that is erected toward the front, and a spiral wall 11c extending toward the front from the board 11a in the outer peripheral wall 11b.

**[0021]** In addition, as illustrated in Figs. 1 and 2, the orbiting scroll 21 includes a discoid board 21a and a spiral wall 21c erected backward from the board 21a. A radial bearing 35 is accommodated in an engagement concave

portion 34 provided at the center of the back of the board 21a and the orbiting scroll 21 is supported by an eccentric shaft 36 formed in the rear end section of the driving shaft 18 via the radial bearing 35. As a result, the orbiting scroll 21 can perform revolving motion about the shaft center of the driving shaft 18 according to the eccentric amount between the shaft center of the driving shaft 18 and the shaft center of the eccentric shaft 36.

**[0022]** The spiral wall 11c of the fixed scroll 11 is engaged with the spiral wall 21c of the orbiting scroll 21 and a compression chamber 37 is formed by the space surrounded by the board 11a and the spiral wall 11c of the fixed scroll 11 and the board 21a and the spiral wall 21c of the orbiting scroll 21. In addition, the fixed scroll 11 and the end plate 13 of the motor accommodation housing member 6 are radially positioned by the positioning pins 33.

**[0023]** Although the fixed scroll 11 is directly assembled to the end plate 13 of the motor accommodation housing member 6 and the loads in the shaft direction of the orbiting scroll 21 are directly supported by the orbiting scroll side end surface 22 of the end plate 13 in the electrically driven scroll compressor 1 according to the embodiment, the invention is not limited to the embodiment and an annular thrust race (not illustrated) like a thin plate may be present between the outer peripheral wall 11b of the fixed scroll 11 and the end plate 13 so that the fixed scroll 11 faces the end plate 13 via the thrust race and the loads in the shaft direction of the orbiting scroll 21 are supported by the end plate 13 via the thrust race.

**[0024]** The shaft supporting part 20 formed integrally with the end plate 13 of the motor accommodation housing member 6 is provided with a weight accommodation part 38, which is an annular concave part opened toward the compressor accommodation part 28, a bearing accommodation part 40, which is an annular concave part opened toward the motor accommodation part 30, and a through hole 41 penetrating through the weight accommodation part 38 and the bearing accommodation part 40 along the driving shaft 18. The weight accommodation part 38 accommodates a balance weight 42 rotating integrally with the driving shaft 18. In addition, the bearing accommodation part 40 accommodates the bearing 26 rotatably supporting one end side of the driving shaft 18. In addition, the through hole 41 accommodates the driving shaft 18 with a sufficient clearance left.

**[0025]** A suction chamber 45 for sucking, via a suction route 44, the refrigerant introduced from a suction opening 43, which will be described later, is formed between the outer peripheral wall 11b of the fixed scroll 11 and the outermost peripheral part of the spiral wall 21c of the orbiting scroll 21. In addition, a discharge chamber 47 is formed between the fixed scroll 11 and a rear end wall 46 of the compression mechanism accommodation housing member 5 in the rear of the fixed scroll 11 in the housing 2. The refrigerant gas compressed by the compression chamber 37 is discharged to this discharge chamber 47 via a discharge hole 48 formed substantially

at the center of the fixed scroll 11. The refrigerant gas having been discharged to the discharge chamber 47 is press-fed to an external refrigerant circuit via a discharge opening 50.

**[0026]** The motor fixing part 12, which is formed ahead of the end plate 13 of the motor accommodation housing member 6, accommodates the stator 16 and a rotor 51 constituting the electric motor 4. The stator 16 includes a cylindrical iron core and a coil wound therearound and the stator 16 is fixed to the inner surface of the housing 2 (motor accommodation housing member 6). In addition, the rotor 51 including a magnet is fixed to the outer peripheral side of the driving shaft 18 and rotatably accommodated within the stator 16. The rotor 51 is rotated integrally with the driving shaft 18 by a rotary magnetic force generated by the stator 16.

**[0027]** The inverter device to be accommodated in the inverter accommodation housing member 7 is electrically connected to the stator 16 via a terminal (airtight terminal) attached to a through hole (not illustrated) formed in the end plate 24 and supplies electricity to the electric motor 4.

**[0028]** The suction opening 43 through which refrigerant gas is sucked to the motor accommodation part 30 is formed in the side surface of the housing 2 (motor accommodation housing member 6). The refrigerant having flowed into the motor accommodation part 30 through the suction opening 43 is introduced to the suction chamber 45 via the suction route 44. The suction route 44 includes the clearance between the stator 16 and the housing 2 (motor accommodation housing member 6), holes 52 formed in the end plate 13, the clearance formed between the fixed scroll 11 and the housing 2, and the like.

**[0029]** On the inner peripheral surface of the motor accommodation housing member 6, as illustrated in Figs. 1 and 3, stator contact parts 53 in contact with the stator 16 and stator non-contact parts 54 not in contact with the stator 16 are alternately formed in the circumferential direction. The outer peripheral part of the stator 16 is fixed to the stator contact parts 53 by close-fitting (such as press-fitting or shrink-fitting). This fixes the stator 16 to the housing 2 (motor accommodation housing member 6). The clearance between the stator 16 and the housing 2 (motor accommodation housing member 6) that configures part of the suction route 44 is formed by the clearance between the inner walls of the stator non-contact parts 54 and the outer peripheral part of the stator 16.

**[0030]** In the embodiment, six pairs of the stator contact part 53 and the stator non-contact part 54 are formed in the circumferential direction at intervals of 60 degrees. The length in the circumferential direction of the stator contact part 53 is relatively smaller than the length in the circumferential direction of the stator non-contact part 54 (the length of the stator contact part 53 has a center angle of approximately 20 degrees and the length of the stator non-contact part 54 has a center angle of approximately 40 degrees).

**[0031]** In addition, the end plate 13 of the motor accommodation housing member 6 is provided with the holes 52 communicating the motor accommodation part 30 with the compression mechanism accommodation part 28. The refrigerant having flowed through the suction opening 43 into the motor accommodation part 30 is introduced to the suction chamber 45 through the holes 52.

**[0032]** In addition, the holes 52 are formed in the end plate 13 so as to be positioned radially outward of pins 55 of a rotation prevention mechanism, which will be described later. The plurality of holes 52 are formed in positions radially inward of five stator contact parts 53 and substantially aligned with the five stator contact parts 53 in the circumferential direction (positions having substantially the same phase) so as to correspond to the five stator contact parts 53. In this example, the holes 52 correspond to only the five stator contact parts 53 of the six stator contact parts 53 and are formed as long holes extending in the circumferential direction of the end plate 13.

**[0033]** A bolt hole 56 through which a shaft part 10a of the tightening bolt 10 passes is formed between the stator contact parts 53 and 53 adjacent to each other of the end plate 13. The tightening bolts 10 having the shaft parts 10a passing through the bolt holes 56 are used to fix the motor accommodation housing member 6 and the inverter accommodation housing member 7. The shaft parts 10a of the tightening bolts 10 are fitted to the bolt accommodation parts 17 formed partially in the low rigidity part 14 with a clearance left. The bolt accommodation parts 17 are formed in the parts of the low rigidity part 14 into which the shaft parts 10a of the tightening bolts 10 are inserted. The bolt accommodation parts 17 project radially outward of the constriction part 15 of the low rigidity part 14, cover the shaft parts 10a of the tightening bolts 10 so that the shaft parts 10a of the tightening bolts 10 are not exposed to outside air, and protect the shaft parts 10a of the tightening bolts 10. As many bolt accommodation parts 17 as the tightening bolts 10 are formed and have a substantially circular cross section to improve the rigidity in the twist direction of the low rigidity part 14.

**[0034]** The surface of the end plate 13 close to the motor accommodation part 30 is provided integrally with reinforcing ribs 57 for reinforcing the end plate 13 extending from the shaft supporting part 20 to the inner peripheral surface of the low rigidity part 14 in the radial direction. The plurality of reinforcing ribs 57 are formed at substantially regular intervals in the circumferential direction in positions corresponding to the stator non-contact parts 54 in the shaft direction, that is, in the positions substantially aligned with the stator non-contact parts 54 in the circumferential direction (in the positions having substantially the same phase) (six reinforcing ribs 57 are provided in the circumferential direction so as to correspond to the number of the pins 55, which will be described later). Accordingly, the reinforcing ribs 57 are formed so that their positions in the circumferential direction are not aligned with the stator contact parts 53 (so that they do not have the same phase) to prevent the direct transfer

of the stress generated by the deformation of the stator contact parts 53.

**[0035]** As illustrated in Fig. 3(b), the positioning pins 33 for positioning the fixed scroll 11 with respect to the end plate 13 are provided on a virtual circle 58 including the holes 52 and are fixed by being press-fitted into pin mounting holes 60 formed in the end plate 13.

**[0036]** According to the above structure, in the compression mechanism 3, when the rotor 51 and the driving shaft 18 rotate integrally with each other, the orbiting scroll 21 is driven via the eccentric shaft 36 that rotates integrally with the driving shaft 18 and the orbiting scroll 21 revolves about the shaft center of the driving shaft 18. This introduces the refrigerant sucked to the motor accommodation part 30 through the suction opening 43 to the suction chamber 45 via the holes 52 of the end plate 13 after passing through the clearance between the stator non-contact parts 54 around the rotor and the stator 16 and the clearance between the coils of the stator 16. The compression chamber 37 of the compression mechanism 3 is moved from the outer peripheral sides of the spiral wall 11c of the fixed scroll 11 and the spiral wall 21c of the orbiting scroll 21 toward the center while gradually reducing its volume by the revolving motion of the orbiting scroll 21. As a result, the refrigerant gas sucked to the compression chamber 37 from the suction chamber 45 is compressed as the orbiting scroll 21 revolves. The compressed refrigerant gas is discharged to the discharge chamber 47 via the discharge hole 48 formed in the board 11a of the fixed scroll 11 and fed to an external refrigerant circuit through the discharge chamber 47 via the discharge opening 50.

**[0037]** Since a rotation force is generated in the orbiting scroll 21 as the driving shaft 18 rotates in the electrically driven scroll compressor 1 described above, the orbiting scroll 21 needs to be revolved about the shaft center of the driving shaft 18 in the state in which the rotation of the orbiting scroll 21 is restricted. Therefore, the electrically driven scroll compressor 1 according to the embodiment is provided with a rotation prevention mechanism for engaging the pins 55 between the board 21a of the orbiting scroll 21 and the end plate 13 of the motor accommodation housing member 6.

**[0038]** In the embodiment, a pin and ring coupling is adopted as the rotation prevention mechanism and this coupling includes a plurality of the pins 55 disposed in the circumferential direction, a plurality of ring members 61 engaged onto the pins 55, and a plurality of cylindrical concave portions 62 accommodating the ring members 61.

**[0039]** As illustrated in Figs. 1 and 2, the cylindrical concave portions 62 are depressions having a circular cross section formed in the back surface (surface facing the end plate 13) of the board 21a of the orbiting scroll 21 and formed at regular intervals (intervals of 60 degrees in this example) around the periphery of the engagement concave portion 34 of the orbiting scroll 21. The ring members 61 are annular components made of iron, have

an outer diameter smaller than the inner diameter of the cylindrical concave portions 62, and loosely engaged to the cylindrical concave portions 62. In addition, the length in the shaft direction of the ring members 61 is substantially identical to or smaller than the length in the shaft direction of the cylindrical concave portions 62.

**[0040]** The pins 55 are formed in cylinders made of iron, have an outer diameter smaller than the inner diameter of the ring members 61, and are fixed at regular intervals to the orbiting scroll side end surface 22 facing the orbiting scroll 21 around the weight accommodation part 38 of the end plate 13 of the motor accommodation housing member 6 so as to be aligned with the positions of the cylindrical concave portions 62. In the embodiment, the pins 55 are fixed by being press-fitted to pin mount holes 63 formed in the end plate 13 and fixed to the back surface of the part of the end plate 13 in which the reinforcing ribs 57 are formed.

**[0041]** Accordingly, although a rotation force is generated by the rotation of the driving shaft 18, the motion of the orbiting scroll 21 is restricted because the pins 55 fixed to the end plate 13 make contact with the inner peripheral surfaces of the ring members 61 in the cylindrical concave portions 62 and the pins 55 are engaged to the cylindrical concave portions 62 via the ring members 61. As a result, the orbiting scroll 21 is allowed only to revolve about the shaft center of the driving shaft 18 in the state in which rotation is restricted.

**[0042]** As described above, in the electrically driven scroll compressor 1 according to the invention, when the stator 16 of the electric motor 4 is fixed to the motor fixing part 12 of the motor accommodation housing member 6 by close-fitting and the motor fixing part 12 undergoes diameter expansion deformation by the stator 16, the low rigidity part 14 having rigidity smaller than in the motor fixing part 12 and the end plate 13 is elastically deformed by the diameter expansion deformation of the motor fixing part 12, the diameter expansion deformation of the motor fixing part 12 is absorbed by the low rigidity part 14, and the stress (stress caused by the diameter expansion deformation of the motor fixing part 12) caused in the connection part between the low rigidity part 14 and the end plate 13 becomes smaller than in the case in which the low rigidity part 14 is not provided. As a result, in the electrically driven scroll compressor 1 according to the embodiment, since the deformation of the end plate 13 caused by the diameter expansion deformation of the motor fixing part 12 (such as the falling down of the orbiting scroll side end surface 22) can be suppressed and the accuracy of the supporting surface supporting the revolving motion of the orbiting scroll 21 can be improved, the orbiting scroll 21 can be revolved at high accuracy and the performance and reliability of the compressor can be improved.

**[0043]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, since the low rigidity part 14 is formed across the entire circumference in the circumferential direction of the motor accommoda-

tion housing member 6, the diameter expansion deformation of the motor fixing part 12 can be evenly absorbed across the entire circumference in the circumferential direction of the motor accommodation housing member 6 and an imbalanced stress is not generated in the circumferential direction of the end plate 13.

**[0044]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, since the low rigidity part 14 has the constriction part 15 formed by recessing the part between the motor fixing part 12 and the end plate 13 radially inward, the length of the low rigidity part 14 in the cross sectional view in Fig. 1 is longer than the case in which the constriction part 15 is not provided and the low rigidity part 14 is easily deformed following the diameter expansion deformation of the motor fixing part 12. Accordingly, as compared with the case in which the constriction part 15 is not provided in the low rigidity part 14, the electrically driven scroll compressor 1 according to the embodiment can reduce the stress generated in the connection part between the low rigidity part 14 and the end plate 13, further reducing the deformation of the end plate 13 caused by the diameter expansion deformation of the motor fixing part 12.

**[0045]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, the bolt accommodation parts 17 projecting radially outward are formed partially on the constriction part 15 of the low rigidity part 14, cover the shaft parts 10a of the tightening bolts 10 for fixing the motor accommodation housing member 6 and the inverter accommodation housing member 7 with the bolt accommodation parts 17 so that the shaft parts 10a of the tightening bolts 10 are not exposed to outside air, and protect the shaft parts 10a of the tightening bolts 10 using the bolt accommodation parts 17. Accordingly, reduction in durability caused by corrosion or the like of the tightening bolts 10 can be prevented and the rigidity in the twist direction of the low rigidity part 14 of the motor accommodation housing member 6 can be improved.

**[0046]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, since a pin and ring coupling is used as the rotation prevention mechanism and the cylindrical concave portions 62 are formed in the board 21a of the orbiting scroll 21, the weight of the orbiting scroll 21 as a movable member can be reduced and the drivability of the orbiting scroll 21 can be improved. In addition, the pins 55 are press-fitted and fixed to the end plate 13 of the motor accommodation housing member 6, which is a fixing member having rigidity higher than the board 21a of the orbiting scroll 21. As a result, in the electrically driven scroll compressor 1 according to the embodiment, the end plate 13 hardly deforms when the pins 55 are press-fitted and, even when the pins 55 are engaged to the cylindrical concave portions 62 via the ring members 61 and the pins 55 receive loads in the radial direction, the parts to which the pins 55 are press-fitted are not deformed by the loads in the radial direction, thereby enabling the improvement of the assembly accuracy of the pins 55 (the pins 55 can

be prevented from being slanted). Accordingly, in the electrically driven scroll compressor 1 according to the embodiment, combined with the effects of improving the accuracy of the supporting surface for the end plate 13 described above, the orbiting scroll 21 can be revolved at high accuracy and the performance and reliability of the compressor can be further improved.

**[0047]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, the pins 55 are fixed to the parts of the end plate 13 in which the reinforcing ribs 57 are formed. That is, since the pins 55 are fixed to the parts of the end plate 13 having high rigidity, it is possible to surely prevent the parts to which the pins 55 are press-fitted from being deformed when the pins 55 are press-fitted and fixed or loads in the radial direction are received.

**[0048]** In addition, in the electrically driven scroll compressor 1 according to the embodiment, since the positioning pins 33 for positioning the end plate 13 and the fixed scroll 11 are provided in the positions (on the virtual circle 58 including the plurality of the holes 52) radially outward of the shaft center and the positioning pins 33 are fixed to the end plate 13 prevented from being deformed by the function of the low rigidity part 14, the fixed scroll 11 is positioned on the end plate 13 at high accuracy. As a result, the electrically driven scroll compressor 1 according to the embodiment can combine the fixed scroll 11 with the orbiting scroll 21 at high accuracy and, combined with various effects of the above embodiment, the performance and reliability of the compressor can be further improved.

**[0049]** Although the cylindrical concave portions 62 are engaged onto the pins 55 via the ring members 61 in the electrically driven scroll compressor 1 according to the embodiment, the ring members 61 may be omitted to obtain the rotation prevention function. In such a case, the cylindrical concave portions 62 may be directly engaged onto the pins 55. The electrically driven scroll compressor modified to have such a structure can obtain the same working effect as in the electrically driven scroll compressor 1 according to the embodiment.

**[0050]** In addition, although the pins 55 of the rotation prevention mechanism are fixed to the end plate 13 and the cylindrical concave portions 62 of the rotation prevention mechanism are formed in the orbiting scroll 21 in the electrically driven scroll compressor 1 according to the embodiment, the invention is not limited to the embodiment and the pins 55 may be fixed to the orbiting scroll 21 and the cylindrical concave portions 62 may be formed in the end plate 13.

**[0051]** In addition, although a pin and ring coupling is used as the rotation prevention mechanism in the electrically driven scroll compressor 1 according to the embodiment, the rotation prevention mechanism other than a pin and ring coupling may be used.

## Reference Signs List

## [0052]

- 1: electrically driven scroll compressor 5  
 3: compression mechanism  
 4: electric motor  
 5: compression mechanism accommodation housing member  
 6: motor accommodation housing member 10  
 7: inverter accommodation housing member  
 11: fixed scroll  
 12: motor fixing part  
 13: end plate  
 14: low rigidity part 15  
 16: stator  
 21: orbiting scroll  
 22: orbiting scroll side end surface

## Claims

1. An electrically driven scroll compressor (1) comprising:  
 a compression mechanism accommodation housing member (5) for accommodating a compression mechanism (3) that is a combination of a fixed scroll (11) and an orbiting scroll (21) ;  
 a motor accommodation housing member (6) for accommodating an electric motor (4) for driving the compression mechanism (3); and  
 an inverter accommodation housing member (7) for accommodating an inverter device for driving and controlling the electric motor (4),  
 wherein the motor accommodation housing member (7) includes a cylindrical motor fixing part (12) to which a stator (16) of the electric motor (4) is fixed by close-fitting, an end plate (13) having an orbiting scroll side end surface (22) that is a support surface for the orbiting scroll (21), and a low rigidity part (14) for making connection between the motor fixing part (12) and the end plate (13) and  
 wherein the low rigidity part (14) has rigidity lower than in the motor fixing part (12) and the end plate (13).  
 2. The electrically driven scroll compressor (1) according to claim 1,  
 wherein the low rigidity part (14) is formed across the entire circumference in a circumferential direction of the motor accommodation housing member (6).  
 3. The electrically driven scroll compressor (1) according to claim 1 or 2,  
 wherein the low rigidity part (14) has a constriction

(15) part formed by recessing a part between the motor fixing part (12) and the end plate (13) of the motor accommodation housing member (6) radially inward.

4. The electrically driven scroll compressor (1) according to claim 3,  
 wherein the motor accommodation housing member (6) is fixed to the inverter accommodation housing member (7) by a plurality of bolts (10), shaft parts of the bolts (10) are engaged to bolt accommodation parts (17) formed in part of the constriction part (15) with a clearance left, and the bolt accommodation parts (17) project radially outward of the constriction part (15) and cover the shaft parts of the bolts (10).  
 5. The electrically driven scroll compressor (1) according to any one of claims 1 to 4,  
 wherein a pin (55) of a pin and ring coupling is attached to one of a surface facing the end plate (13) of the orbiting scroll (21) and the orbiting scroll side end surface (22) of the end plate (13), the pin and ring coupling being a rotation prevention mechanism for preventing rotation of the orbiting scroll (22), and a cylindrical concave portion (62) is formed in the other of the surface facing the end plate (13) of the orbiting scroll (21) and the orbiting scroll side end surface (22) of the end plate (13), the cylindrical concave portion being engaged onto the pin (55), the cylindrical concave portion and the pin constituting the rotation prevention mechanism.

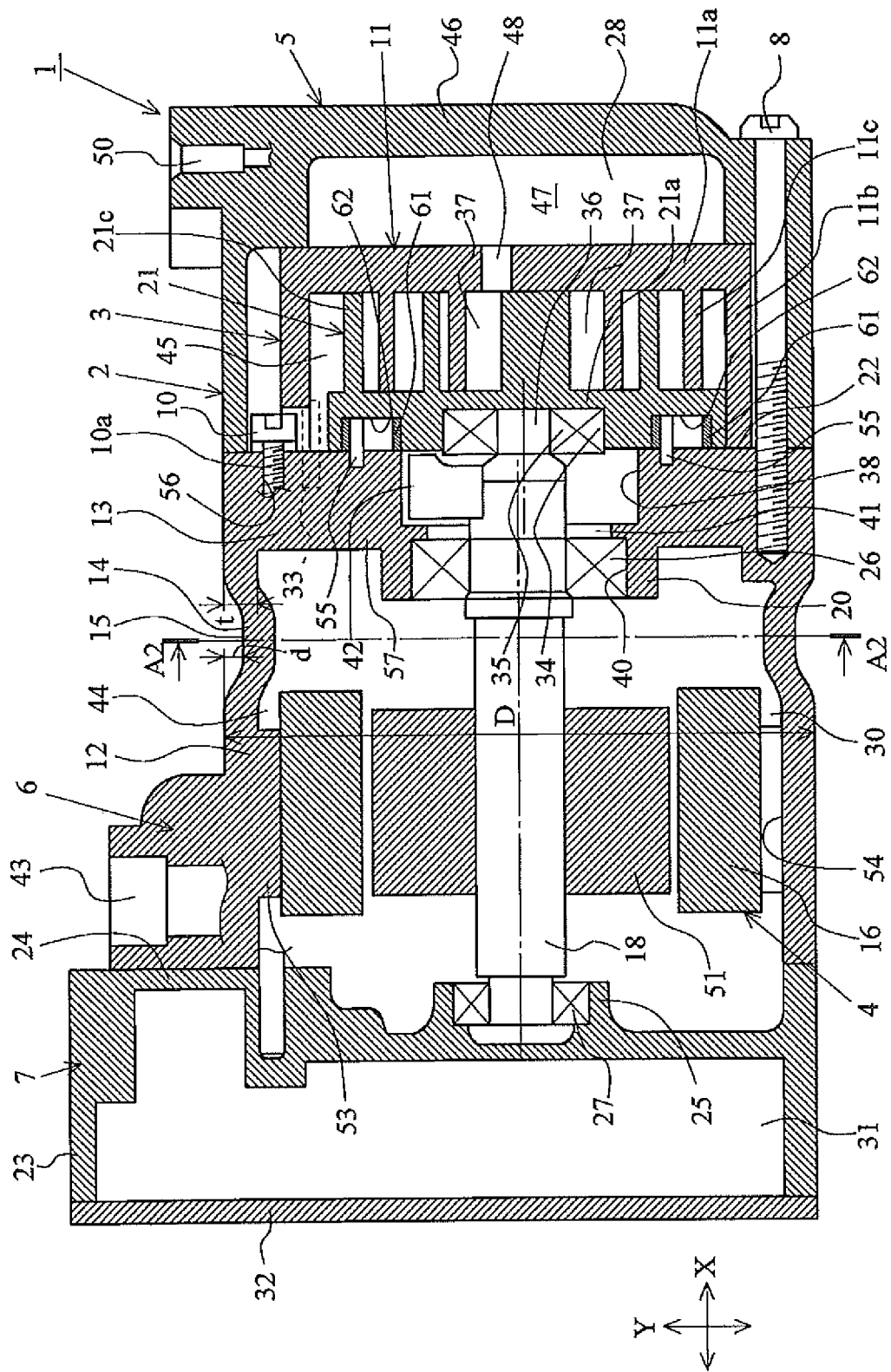


Fig. 1

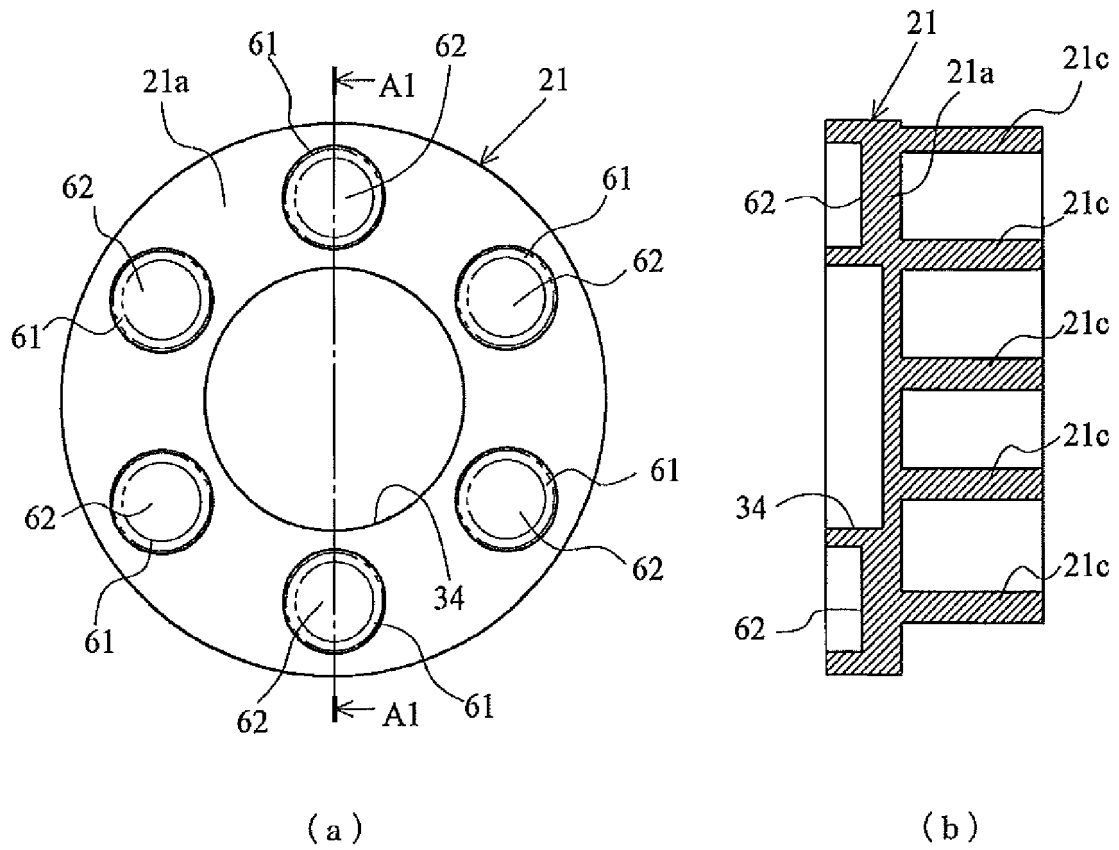


Fig. 2

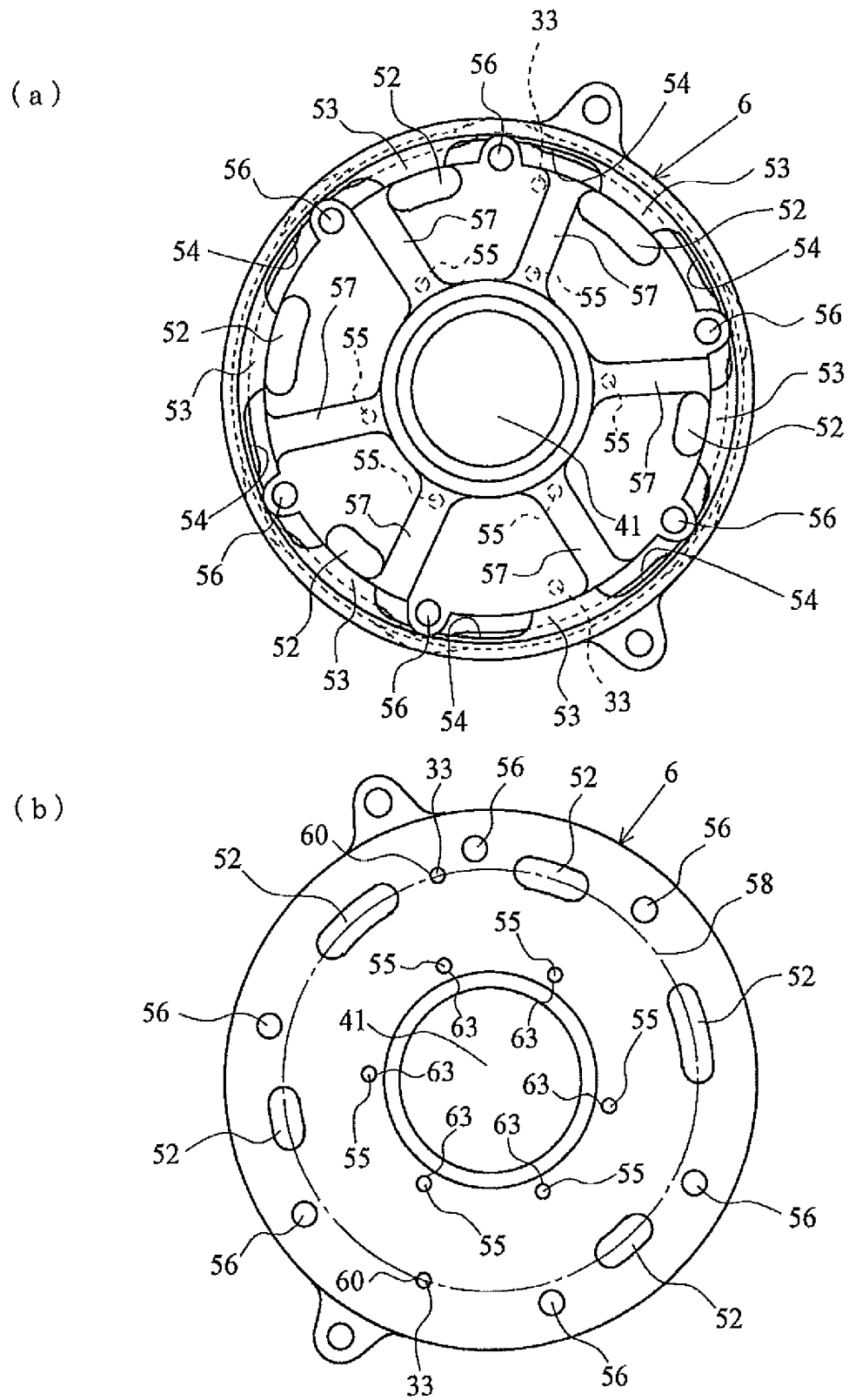


Fig. 3

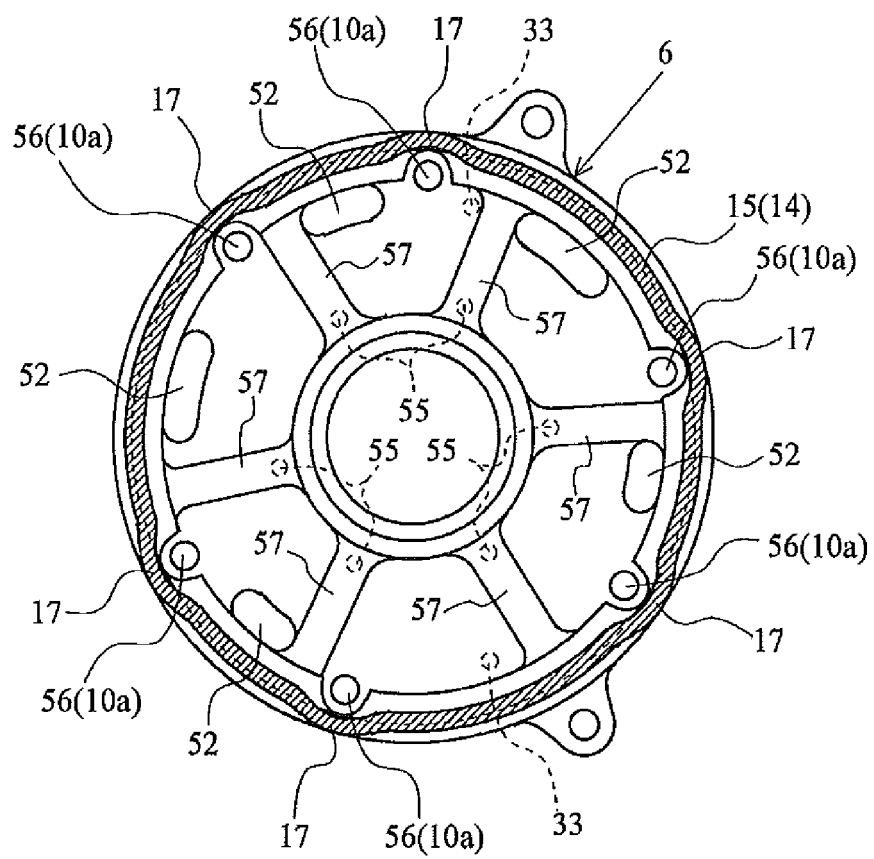


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/085398

A. CLASSIFICATION OF SUBJECT MATTER  
F04C18/02(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)  
F04C18/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016  
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | JP 2014-66148 A (Valeo Japan Co., Ltd.),<br>17 April 2014 (17.04.2014),<br>entire text; all drawings<br>(Family: none)                             | 1-5                   |
| A         | JP 2013-100735 A (Mitsubishi Heavy Industries,<br>Ltd.),<br>23 May 2013 (23.05.2013),<br>entire text; all drawings<br>(Family: none)               | 1-5                   |
| A         | WO 2010/104582 A2 (EMERSON CLIMATE<br>TECHNOLOGIES, INC.),<br>16 September 2010 (16.09.2010),<br>entire text; all drawings<br>& US 2010/0233001 A1 | 1-5                   |

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

☐ See patent family annex.

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"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

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Date of the actual completion of the international search  
23 February 2016 (23.02.16)

Date of mailing of the international search report  
08 March 2016 (08.03.16)

Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2000291557 A [0005]