



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

(43) Date of publication:
16.11.2016 Bulletin 2016/46

(51) Int Cl.:
F04C 18/02 ^(2006.01)

(21) Application number: **14856504.7**

(86) International application number:
PCT/JP2014/074358

(22) Date of filing: **16.09.2014**

(87) International publication number:
WO 2015/060038 (30.04.2015 Gazette 2015/17)

(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

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

(30) Priority: **25.10.2013 JP 2013221732**

(74) Representative: **Tran, Chi-Hai**
Valeo Systèmes Thermiques
Propriété Industrielle
8, Rue Louis Lormand
BP 517 - La Verrière
78321 Le Mesnil Saint-Denis Cedex (FR)

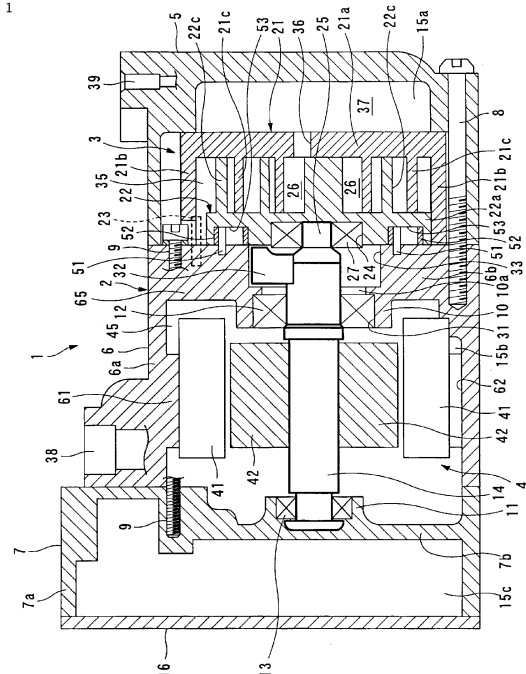
(71) Applicant: **Valeo Japan Co., Ltd.**
Saitama 360-0193 (JP)

(54) **ELECTRIC SCROLL COMPRESSOR**

(57) [Task] In a case in which a configuration in which a pin is engaged is adopted as a rotation preventing mechanism of a swing scroll, an electric scroll compressor is provided in which accuracy during assembly of a pin increases and performance or reliability of a compressor can be improved.

[Solution] In an electric scroll compressor 1, a housing member (motor accommodation housing member 6) is configured such that a motor fixing portion 6a to which an electric motor 4 is fixed, and an end plate 6b which supports an axial load of a swing scroll 22 and rotatably supports a drive shaft 14 are integrally formed, a rotation preventing mechanism is configured, between a substrate 22a of the swing scroll 22 and the end plate 6b, of a plurality of pins 51 which are arranged circumferentially and a plurality of cylindrical recessed portions 53 engaging with the pins 51, the cylindrical recessed portions 53 are formed on the substrate 22a of the swing scroll 22, and the pins 51 are fixed to the end plate 6b.

Fig. 1



Description

Technical Field

[0001] The present invention relates to an electric scroll compressor which is used in a refrigeration cycle of a vehicular air conditioner, or the like, and particularly, to an electric scroll compressor in which a rotation preventing mechanism of a swing scroll is configured so as to have a pin and a recessed portion engaging with the pin or a ring member accommodated in the recessed portion.

Background Art

[0002] In the related art, for example, as an electric scroll compressor, a configuration described in PTL 1 below is known. The electric scroll compressor includes a discharge housing which includes a discharge port and in which a compression portion (compression mechanism) configured such that a fixing scroll and a movable scroll are disposed so as to face each other is accommodated, a suction housing which includes a suction port, and an intermediate housing which interposed between the discharge housing and the suction housing and in which an electric motor is accommodated along with the suction housing, in which the intermediate housing is configured so as to include a motor fixing portion in which a portion of the electric motor is accommodated and fixed, and a bearing support portion (end plate) which is integrally formed on the discharge housing side of the motor fixing portion and supports a drive shaft via a bearing.

[0003] The compression mechanism used in the electric scroll compressor is well known, and includes a fixing scroll which includes a substrate and a spiral wall erected from the substrate, and a swing scroll which is disposed so as to face the fixing scroll and includes a substrate and a spiral wall erected from the substrate, and in the pair of scrolls, the spiral walls are combined with each other, and the swing scroll engages with an eccentric shaft provided on the drive shaft rotated by the electric motor accommodated in the housing and is turned (revolved). Accordingly, the swing scroll moves toward the center while the volume of a compression chamber formed between the spiral walls of both scrolls is decreased, and a fluid to be compressed is compressed.

[0004] In the electric scroll compressor, since a rotation force is generated in the swing scroll according to the rotation of the drive shaft, a rotation preventing mechanism for preventing rotation of the swing scroll is provided.

[0005] In the related art, as the rotation preventing mechanism, an Oldham coupling, a pin and ring coupling, a ball coupling, or the like is used between the bottom plate (substrate) of the movable scroll (swing scroll) and one end surface of the intermediate housing. However, in the electric scroll compressor, as understood from the

drawings of PTL 1, a ball coupling in which a ball serves as a rolling member is used, and particularly, a coupling is used which includes two plates in which a race and a ring are integrally molded, and steel balls (balls) disposed between the two plates (refer to NPL 1).

Citation List

Patent Literature

[0006] PTL 1: JP-A-2000-291557

Non Patent Literature

[0007] NPL 1: NTN TECHNICAL REVIEW, No. 68 (2000), p. 67-70, "With respect to EM coupling for scroll compressor", KATAGIRI, Tsutomu, et al.

Summary of Invention

Technical Problem

[0008] However, in a case in which the coupling is used as the rotation preventing mechanism of the movable scroll (swing scroll), even when variation is generated in the attachment state of the plate supporting the steel balls with respect to the bottom plate (substrate) of the movable scroll (swing scroll) or the one end surface of the intermediate housing, a certain amount of variation can be allowed, and the variation does not largely influence the performance of a compressor. However, in a case in which a configuration in which a pin is engaged is adopted as the rotation preventing mechanism, there is a disadvantage that the performance or the reliability of the compressor is largely influenced by the fixing state of the pin.

[0009] Particularly, in a case where the pin is press-fitted to the substrate of the swing scroll so as to be fixed, since drivability of the swing scroll is important, the swing scroll is lightly and thinly formed, and stiffness of the swing scroll is lower than that of a fixing member such as the housing. Accordingly, when the pin is press-fitted, there is a disadvantage that the press-fitted location of the swing scroll is deformed and the pin is tilted, or when the pin comes into contact with a portion engaging with the pin and receives a radial load, there is a disadvantage that the pin is tilted by the radial load.

[0010] Accordingly, as the rotation preventing mechanism, in a case where the configuration in which the pin is engaged is adopted such as the pin and ring coupling, particular consideration is necessary.

[0011] In addition, as described in PTL 1, in the compressor in which the electric motor is fixed into the housing, the diameter of the housing may be deformed to be increased when the electric motor is fixed to the housing. Accordingly, in order to increase assembly accuracy of the pin (in order to prevent tilting of the pins), preferably, the fixing location of the pin is influenced by the deformation of the housing as little as possible.

[0012] The present invention is made in consideration of the above-described circumstances, and a main object thereof is to provide an electric scroll compressor provided in which accuracy during assembly of a pin increases and the performance or the reliability of a compressor can be improved in a case in which a configuration in which the pin is engaged is adopted as a rotation preventing mechanism of a swing scroll.

Solution to Problem

[0013] In order to achieve the object, according to an aspect of the present invention, there is provided an electric scroll compressor, including: a housing member; a compression mechanism which is accommodated in the housing member, and in which a fixing scroll having a substrate and a spiral wall and a swing scroll having a substrate and a spiral wall mesh with each other to form a compression chamber; a drive shaft by which the swing scroll is revolved; a rotation preventing mechanism which prevents rotation of the swing scroll; and an electric motor which is accommodated in the housing member and rotates the drive shaft, in which in the housing member, a motor fixing portion to which the electric motor is fixed, and an end plate which supports an axial load of the swing scroll and rotatably supports the drive shaft are integrally formed, the rotation preventing mechanism is configured, between the substrate of the swing scroll and the end plate, of a plurality of pins which are arranged circumferentially and a plurality of cylindrical recessed portions engaging with the pins, the cylindrical recessed portions are formed on the substrate of the swing scroll, and the pins are fixed to the end plate.

[0014] Accordingly, since the pins of the rotation preventing mechanism are fixed to the end plate of the housing member having higher stiffness than that of the swing scroll, deformation at locations of the fixed pins when the pins are fixed by pressure-fitting of the pins or deformation at the locations of the fixed pins due to a radial load applied to the pins decreases, and it is possible to increase accuracy during assembly of the pins. In addition, since the end plate is integrated with the motor fixing portion, errors due to accuracy of each component or assembling errors of the end plate can be decreased.

[0015] In addition, a hole may be formed in the end plate on the outside in a radial direction from the portions to which the pins are fixed.

[0016] By forming the hole, since the hole is disposed between the motor fixing portion of the housing member and the portions to which the pins are pressure-fitted so as to be fixed, it is possible to prevent influences of deformation of the motor fixing portion due to pressure-fitting or shrinkage-fitting (tightly fitted) of the electric motor from being applied to the locations of the pins fixed to the end plate, and it is possible to prevent a decrease in accuracy during assembly of the pins (to prevent tilting of the pin).

[0017] Here, the hole may be formed of a long hole

which is long in a circumferential direction of the end plate. According to this configuration, the deformation of the motor fixing portion is not easily transmitted to the end plate.

[0018] Moreover, the hole may be configured of a fluid passage through which a fluid to be compressed, which is compressed in the compression chamber, flows. In this way, since the hole is the passage of the fluid to be compressed, it is not necessary to form a hole for preventing deformation in addition to the hole of the fluid passage.

[0019] Moreover, a rib extending in the radial direction may be formed on the end plate, and the pins may be fixed to the portion in which the rib is formed.

[0020] In this way, since the pin is fixed to the portion in which the rib of the end plate is formed, the pin is fixed to the portion having higher stiffness, and it is possible to further suppress the deformation of the end plate.

[0021] Assuming the above-described configuration, a positioning pin which positions the fixing scroll with respect to the end plate may be disposed on the end plate, and the positioning pin may be provided on a virtual circle including the hole.

[0022] From the viewpoint of accurately performing the positioning between the end plate and the fixing scroll using the positioning pin, preferably, the pins are provided at locations away from the shaft center if possible. Meanwhile, the influence (deformation) due to the pressure-fitting (tightly fitting) of the motor with respect to the end plate is decreased at the portion on the virtual circle in which the holes are provided or the portion inside the virtual circle. Accordingly, the most suitable disposition location of the positioning pin at which both conditions are satisfied is the location positioned on the virtual circle including the holes, and if the positioning pin is provided at this position, it is possible to prevent tilting of the positioning pin and it is possible to increase positioning accuracy.

Advantageous Effects of Invention

[0023] As described above, according to the present invention, a housing member is provided in which a motor pressure-fitting portion to which an electric motor is pressure-fixed, and an end plate which supports an axial load of a swing scroll and rotatably supports a drive shaft are integrally formed, a rotation preventing mechanism is configured, between a substrate of the swing scroll and the end plate, of a plurality of pins which are arranged circumferentially and a plurality of cylindrical recessed portions engaging with the pins or ring members accommodated in the cylindrical recessed portions, the cylindrical recessed portions are formed on the substrate of the swing scroll, and the pins are fixed to the end plate. Accordingly, the housing member in which a motor fixing portion of the housing and the end plate are integrated with each other is provided, and in the configuration in which the pins are engaged as the rotation preventing mechanism, it is possible to increase in accuracy during

assembly of the pins (it is possible to prevent tilting of the pins), and it is possible to improve the performance or the reliability of a compressor.

[0024] In addition, since a hole is formed in the end plate on the outside in the radial direction from the portions to which the pins are pressure-fitted so as to be fixed, it is possible to prevent influences of deformation of the motor fixing portion during fixing of the electric motor from being applied to the locations of the pins fixed to the end plate, it is possible to prevent a decrease in accuracy during assembly of the pins (it is possible to prevent tilting of the pins), and it is possible to improve the performance or the reliability of the compressor.

[0025] In addition, since the pin is fixed to the portion of the end plate in which the rib extending in the radial direction is formed, it is possible to fix the pin to a portion having higher stiffness, and it is possible to further suppress the deformation of the end plate.

[0026] Moreover, since the positioning pin which positions the fixing scroll is provided on the virtual circle including the hole of the end plate, it is possible to increase positioning accuracy while preventing tilting of the positioning pin.

Brief Description of Drawings

[0027]

Fig. 1 is a section view showing an electric scroll compressor according to the present invention.

Fig. 2A is a rear view of a swing scroll.

Fig. 2B is sectional view of a swing scroll taken along line A-A of Fig. 2A.

Fig. 3A is a view showing a housing member into which an end plate is integrated, when viewed in an axial direction from a motor fixing portion side.

Fig. 3B is a view showing a housing member into which an end plate is integrated, when viewed in the axial direction from a compression mechanism side.

Fig. 4 is a side sectional view showing the housing member into which the end plate is integrated.

Fig. 5 is a partially cut perspective view showing the housing member into which the end plate is integrated. Description of Embodiments

[0028] Hereinafter, an electric scroll compressor according to the present invention will be described with reference to the drawings.

[0029] In Fig. 1, an electric scroll compressor 1 is an electric compressor suitable for a refrigeration cycle which has a refrigerant as a working fluid, and in a housing 2 formed of aluminum alloy, a compression mechanism 3 is disposed on the right side of the drawing, and an electric motor 4 which drives the compression mechanism 3 is disposed on the left side of the drawing. In addition, in Fig. 1, the left side of the drawing is referred to as a front side of the compressor 1, and the right side of the drawing is referred to as a rear side of the com-

pressor 1.

[0030] The housing 2 includes a compression mechanism accommodation housing member 5 in which the compression mechanism 3 is accommodated, a motor accommodation housing member 6 in which the electric motor 4 driving the compression mechanism 3 is accommodated, and an inverter accommodation housing member 7 in which an inverter device (not shown) which drives and controls the electric motor 4 is accommodated, and the housing members are positioned by positioning pins (not shown) and fastened in the axial direction by fastening bolts 8 and 9.

[0031] The compression mechanism accommodation housing member 5 fixes a fixing scroll of the compression mechanism described below, and is formed in a bot-tomed tubular shape in which a side facing the motor accommodation housing member is opened. In the motor accommodation housing member 6, a tubular motor fixing portion 6a to which the electric motor is fixed, and an end plate 6b are integrally formed with each other, and the end plate 6b is provided on a side facing the compression mechanism accommodation housing member 5 and supports an axial load of a swing scroll 22 of the compression mechanism 3 described below, and a shaft support portion 10 is integrally provided with the end plate 6b. In addition, in the inverter accommodation housing member 7, an inverter accommodation portion 7a, which is formed in a tubular shape, and an end plate 7b in which a shaft support portion 11 is integrally formed on a side facing the motor accommodation housing member 6, are integrally provided.

[0032] In addition, a drive shaft 14 is rotatably supported by the shaft support portion 10 of the end plate 6b of the motor accommodation housing member 6 and the shaft support portion 11 of the end plate 7b of the inverter accommodation housing member 7 via bearings 12 and 13. The inner portion of the housing 2 is divided into a compression mechanism accommodation portion 15a in which the compression mechanism 3 is accommodated, a motor accommodation portion 15b in which the electric motor 4 is accommodated, and an inverter accommodation portion 15c in which the inverter device is accommodated, from the rear side by the end plates 6b and 7b which are formed in the motor accommodation housing member 6 and the inverter accommodation housing member 7.

[0033] Moreover, in this example, the inverter accommodation portion 15c is defined by fixing a cover 16 to the inverter accommodation housing member 7 using a bolt (not shown) or the like.

[0034] The compression mechanism 3 is a scroll type mechanism which includes a fixing scroll 21 and the swing scroll 22 which is disposed so as to face the fixing scroll, movement in an axial direction of the fixing scroll 21 with respect to the housing 2 (compression mechanism accommodation housing member 5) is allowed, and movement in a radial direction of the fixing scroll 21 is regulated by positioning pins 23 described below. The

fixing scroll 21 is configured of a disk-shaped substrate 21a, a cylindrical outer circumferential wall 21b which is provided over the entire circumference along the outer edge of the substrate 21a and is erected toward the front side, and a spiral wall 21c having a spiral shape which extends toward the front side from the substrate 21a inside the outer circumferential wall 21b.

[0035] Moreover, also as shown in Fig. 2, the swing scroll 22 is configured of a disk-shaped substrate 22a and a spiral wall 22c having a spiral shape which is erected toward the rear side from the substrate 22a, an eccentric shaft 25, which is provided on the rear end portion of the drive shaft 14 and is eccentrically provided with respect to the shaft center of the drive shaft 14, is supported via a radial bearing 27 by a fitting recessed portion 24 which is provided at the center on the rear surface of the substrate 22a, and the eccentric shaft 25 is provided so as to revolve about the shaft center of the drive shaft 14.

[0036] In the fixing scroll 21 and the swing scroll 22, the spiral walls 21c and 22c mesh with each other, and a compression chamber 26 is defined by a space which is surrounded by the substrate 21a and the spiral wall 21c of the fixing scroll 21 and the substrate 22a and the spiral wall 22c of the swing scroll 22.

[0037] Moreover, positions in the radial direction of the fixing scroll 21 and the end plate 6b of the motor accommodation housing member 6 are regulated by the positioning pins 23.

[0038] In addition, in this example, the fixing scroll 21 is directly assembled to the end plate 6b of the motor accommodation housing member 6 and the axial load of the swing scroll 22 is directly supported by the end plate 6b. However, an annular thrust race having a thin plate shape may be interposed between the outer circumferential wall 21b of the fixing scroll 21 and the end plate 6b, the fixing scroll 21 and the end plate 6b may be abutted against each other via the thrust race, and the axial load of the swing scroll 22 may be also supported by the end plate via the thrust race.

[0039] The shaft support portion 10 which is integrally formed with the end plate 6b of the motor accommodation housing member 6 has a through hole 10a at the center, and in the shaft support portion 10, a bearing accommodation portion 31 in which the bearing 12 is accommodated, and a weight accommodation portion 33 in which a balance weight 32 which is rotated so as to be integrated with the drive shaft 14 is accommodated are formed in the order from the front side farthest from the swing scroll 22.

[0040] A suction chamber 35, into which a refrigerant introduced from a suction port 38 described below is sucked via a suction passage 45, is formed between the outer circumferential wall 21b of the above-described fixing scroll 21 and the outermost circumferential portion of the spiral wall 22c of the swing scroll 22, and a discharge chamber 37, to which refrigerant gas compressed in the compression chamber 26 is discharged via a discharge

hole 36 formed at approximately the center of the fixing scroll 21, is formed between the rear side of the fixing scroll 21 in the housing and the rear end wall of the compression mechanism accommodation housing member 5. The refrigerant gas which is discharged to the discharge chamber 37 is pressure-fed to an external refrigerant circuit via a discharge port 39.

[0041] A stator 41 and a rotor 42 configuring the electric motor 4 are accommodated in the motor fixing portion 6a which is formed on the front side of the end plate 6b of the motor accommodation housing member 6. The stator 41 is configured of an iron core which is cylindrically formed and a coil which is wound around the iron core, and is fixed to the inner surface of the housing 2 (motor accommodation housing member 6). In addition, the rotor 42, which is configured of a magnet rotatably accommodated inside the stator 41, is mounted so as to be fixed to the drive shaft 14, and the rotor 42 is rotated by a rotation magnetic force formed by the stator 41 so as to rotate the drive shaft 14.

[0042] In addition, the inverter device accommodated in the inverter accommodation housing member 7 is electrically connected to the stator 41 via a terminal (an airtight terminal) attached to a through hole (not shown) formed on the end plate 7b, and power is supplied from the inverter device to the electric motor 4.

[0043] The suction port 38, through which the refrigerant gas is sucked to the motor accommodation portion 15b, is formed on the side surface of the housing 2 (motor accommodation housing member 6), and the suction passage 45, through which the refrigerant flowing from the suction port 38 into the motor accommodation portion 15b is introduced to the suction chamber 35, is configured via a gap between the stator 41 and the housing 2 (motor accommodation housing member 6), holes 63 formed on the end plate 6b, a gap formed between the fixing scroll 21 and the housing 2, or the like.

[0044] As shown in Figs. 3 to 5, stator contact portions 61 which come into contact with the stator 41 and stator non-contact portions 62 which do not come into contact with the stator are alternately formed on the inner circumferential surface of the motor accommodation housing member 6 in the circumferential direction. The stator contact portions 61 and the stator non-contact portions 62 are formed so as to extend in the axial direction, and the stator 41 is fixed to the housing (motor accommodation housing member 6) by tightly fitting the outer circumferential portion of the stator 41 to the stator contact portions 61 by pressure-fitting, shrinkage-fitting, or the like. Accordingly, the gap between the stator 41 and the housing 2 (motor accommodation housing member 6) configuring a portion of the suction passage 45 is formed by gaps between the inner walls of the stator non-contact portions 62 and the outer circumferential portion of the stator 41.

[0045] In this example, six stator non-contact portions 62 and six stator contact portions 61 are formed with intervals of approximately 60° in a center angle in the circumferential direction, and in this example, widths of

the stator contact portions 61 in the circumferential direction are relatively smaller than widths of the stator non-contact portions 62 in the circumferential direction (the width of each of the stator contact portions 61 is formed so as to have approximately 20°, and the width of each of the stator non-contact portions 62 is formed so as to have approximately 40° in a circumferential angle).

[0046] In addition, the holes 63 which communicate with the motor accommodation portion 15b and the compression mechanism accommodation portion 15a are formed on the end plate 6b of the motor accommodation housing member 6, and the refrigerant flowing from the suction port 38 into the motor accommodation portion 15b is introduced into the suction chamber 35 via the holes 63.

[0047] The holes 63 are formed on the outside in the radial direction from pins 51 of the rotation preventing mechanism described below. The plurality of holes 63 are formed in the circumferential direction at positions corresponding to the stator contact portions 61 in the axial direction, that is, positions approximately overlapping with the stator contact portions 61 in the circumferential direction (positions having approximately the same phases), and in this example, the holes 63 are formed in long holes extending in the circumferential direction and are formed at positions (five locations) corresponding to all remaining stator contact portions except for one position corresponding to one stator contact portion.

[0048] In addition, reference numeral 64 indicates bolt holes into which the bolts 9 are inserted.

[0049] Moreover, in this example, reinforcing ribs 65, which reinforce the end plate 6b from the shaft support portion 10 to the inner circumferential surface of the motor fixing portion 6a, integrally extend in the radial direction on the surface of the motor accommodation portion side of the end plate 6b. The plurality of reinforcing ribs 65 are formed with approximately equal intervals in the circumferential direction at positions corresponding to the stator non-contact portions 62 in the axial direction, that is, positions approximately overlapping with the stator non-contact portions 62 in the circumferential direction (positions having approximately the same phases), and in this example, the reinforcing ribs 65 are provided at six locations in the circumferential direction in accordance with the number of the pins 51 described below. Accordingly, the reinforcing ribs 65 are formed so as not to overlap the positions of the stator contact portions 61 in the circumferential direction (so as not to have the same phase), and stress due to deformation of the stator contact portions 61 is not directly transmitted to the reinforcing ribs 65.

[0050] In addition, as shown in Fig. 3(b), the positioning pins 23 which position the fixing scroll 21 with respect to the end plate 6b are provided on a virtual circle α including the holes 63, and the positioning pins 23 are pressure-fitted to pin attachment holes 55 formed on the end plate 6b so as to be fixed to the end plate 6b.

[0051] In the above-described configuration, when the rotor 42 rotates and the drive shaft 14 rotates, in the compression mechanism 3, the swing scroll 22 is driven via the eccentric shaft 25 so as to revolve.

5 [0052] Accordingly, the refrigerant, which is sucked from the suction port 38 to the motor accommodation portion 15b, is introduced into the suction chamber 35 via the holes 63 of the end plate 6b through the gaps between the stator non-contact portions 62 and the stator 41 around the rotor or the gap between the coils of the stator 41.

10 [0053] Since the compression chamber 26 of the compression mechanism moves while the volume of the compression chamber 26 is gradually decreased from the outer circumferential sides of the spiral walls 21c and 22c of both scrolls to the center sides by the revolution of the swing scroll 22, the refrigerant gas sucked from the suction chamber 35 to the compression chamber 26 is compressed, and the compressed refrigerant gas is discharged to the discharge chamber 37 via the discharge hole 36 formed on the substrate 21a of the fixing scroll 21 and is sent to the external refrigerant circuit via the discharge port 39.

15 [0054] However, in the above-described electric scroll compressor 1, since a rotation force is generated in the swing scroll 22 due to the rotation of the drive shaft 14, it is necessary to revolve the swing scroll 22 around the shaft center of the drive shaft 14 while regulating the rotation of the swing scroll 22. Accordingly, in the present compressor, the rotation preventing mechanism in which the pins 51 are engaged is provided between the substrate 22a of the swing scroll 22 and the end plate 6b of the motor accommodation housing member 6.

20 [0055] In this example, for example, the rotation preventing mechanism, in which the pins 51 are engaged, adopts a pin and ring coupling, and is configured of the plurality of pins 51 which are disposed in the circumferential direction, a plurality of ring members 52 which engage with the pins 51, and a plurality of cylindrical recessed portions 53 in which the ring members 52 are accommodated.

25 [0056] As shown in Figs. 1 and 2, the cylindrical recessed portions 53 are configured so as to form recesses having circular cross-sections on the rear surface of the substrate 22a of the swing scroll 22, and are formed with equal intervals (in this example, an interval of 60°) around the fitting recessed portion 24 of the swing scroll 22. Each of the ring members 52 is formed of iron and has a ring shape, and has a smaller outer diameter than an inner diameter of each of the cylindrical recessed portions 53 so as to be loosely fitted to the cylindrical recessed portion 53. A thickness of the ring member 52 in the axial direction is substantially the same as a width of the cylindrical recessed portion 53 in the axial direction, or is smaller than the width of the cylindrical recessed portion 53.

30 [0057] Each of the pins 51 is formed of iron and has a columnar shape, and is formed so as to have a smaller

outer diameter than the inner diameter of the ring member 52. The pins 51 are fixed with equal intervals around the weight accommodation portion 33 of the end plate 6b of the motor accommodation housing member 6 in accordance with the positions of the cylindrical recessed portions 53. In this example, the pins 51 are pressure-fitted to pin attachment holes 54 formed on the end plate 6b so as to be fixed to the end plate 6b, and are fixed to the rear surface of the portions on which the reinforcing ribs 65 of the end plate 6b are formed.

[0058] Accordingly, even when the rotation force is generated in the swing scroll 22 due to the rotation of the drive shaft 14, the pins 51 fixed to the end plate 6b come into contact with the inner circumferential surfaces of the ring members 52, the pins 51 engage with the cylindrical recessed portions 53 via the ring members, and the movement of the swing scroll is regulated. Therefore, in the swing scroll 22, only the revolution of the swing scroll 22 with respect to the shaft center of the drive shaft 14 is admitted while the rotation of the swing scroll 22 is regulated.

[0059] In addition, in the above-described configuration in which the pin and ring coupling is used as the rotation preventing mechanism, since the cylindrical recessed portions are formed on the substrate of the swing scroll, it is possible to decrease weight of the swing scroll 22 which is a movable member, and it is possible to improve drivability of the swing scroll 22. In addition, since the pins 51 are pressure-fitted and fixed to the end plate 6b of the motor accommodation housing member 6 which is a fixing member having higher stiffness than that of the substrate 22a of the swing scroll 22, deformation of the end plate 6b is little generated during pressure-fitting of the pins 51. Moreover, even in the case in which the pins 51 engage with the cylindrical recessed portions 53 via the ring members 52 and receive the radial load, the locations of the cylindrical recessed portions 53 to which the pins 51 are pressure-fitted are not deformed by the radial load, and it is possible to increase accuracy during assembly of the pins 51 (it is possible to prevent tilting of the pins).

[0060] In addition, in the above-described configuration, since the holes 63 are formed on the outside in the radial direction from the locations of the pins 51 fixed to the end plate 6b, even in a case where the motor fixing portion 6a is pressed and widened when the stator 41 of the electric motor is tightly fitted to the motor fixing portion 6a (the stator contact portions 61) of the motor accommodation housing member 6, deformation of the end plate 6b is prevented by the holes 63, and it is possible to prevent deformation at the locations of the fixed pins 51. Particularly, in the present embodiment, in the case where the holes 63 formed on the end plate 6b are formed in the long holes extending in the circumferential direction and are formed at the positions corresponding to the stator contact portions 61 in the axial direction, it is possible to reliably prevent transmission of stress from the stator contact portions 61, at which deformation of the motor

fixing portion 6a is most significantly generated, by the holes, and it is possible to more effectively prevent deformation of the end plate 6b (deformation at the locations of the fixed pins).

[0061] Moreover, in the above-described configuration, since the pins 51 are fixed to the portions at which the reinforcing ribs 65 provided on the end plate 6b are formed, the pins 51 are fixed to the locations having higher stiffness in the end plate 6b, and it is more reliably prevent the deformation at the locations to which the pins 51 are pressure-fitted when the pins 51 are pressure-fitted so as to be fixed or when the pins 51 receive the radial load.

[0062] Moreover, since the reinforcing ribs 65 are formed at the positions corresponding to the stator non-contact portions 62 in the axial direction, it is possible to prevent the stress due to the deformation of the stator contact portions 61 from being transmitted to the end plate 6b via the reinforcing ribs 65.

[0063] Moreover, in the above-described configuration, since the positioning pins 23 which position the end plate 6b and the fixing scroll 21 are provided on the virtual circle including the holes 63, it is possible to satisfy a demand of providing the positioning pins 23 at locations away from the shaft center if possible to secure positioning accuracy between the end plate 6b and the fixing scroll 21, and a demand of suppressing influences (deformation) of the end plate 6b due to the pressure-fitting (tightly fitting) of the electric motor 4 with respect to the motor accommodation housing member 6, and it is possible to secure accuracy during assembly of the positioning pins 23 while securing positioning accuracy of the fixing scroll 21.

[0064] Moreover, in the above-described configuration example, the example is exemplified in which the cylindrical recessed portions 53 engage with the pins 51 via the ring members 52. However, in order to secure a rotation prevention function, it is also possible to omit the ring member 52, and in this case, the cylindrical recessed portions 53 may directly engage with the pins 52. Also in this configuration, effects similar to those of the above-described configuration example can be obtained.

[0065] In addition, the example is shown in which the pins 51 are pressure-fitted to the pin attachment holes 54 so as to be fixed to the end plate 6b. However, as a case in which the pins 51 are screwed so as to be fixed to the pin attachment holes 54 or the like, when there is a concern that deformation at the locations of the fixed pins may occur during fixing of the pins, the similar configurations may be adopted. Reference Signs List

[0066]

- 1: electric scroll compressor
- 2: housing
- 3: compression mechanism
- 4: electric motor
- 6: motor accommodation housing member
- 6a: motor fixing portion

6b: end plate
 14: drive shaft
 21: fixing scroll
 21a: substrate
 21c: spiral wall
 22: swing scroll
 22a: substrate
 22c: spiral wall
 23: positioning pin
 26: compression chamber
 51: pin
 52: ring member
 53: cylindrical recessed portion
 61: stator contact portion
 62: stator non-contact portion
 63: hole
 65: reinforcing rib

Claims

1. An electric scroll compressor (1), comprising:

a housing member (5, 6, 7);
 a compression mechanism (3) which is accommodated in the housing member (5, 6, 7), and in which a fixing scroll (21) having a substrate (21a) and a spiral wall (21c) and a swing scroll (22) having a substrate (22a) and a spiral wall (22c) mesh with each other to form a compression chamber (26);
 a drive shaft (14) by which the swing scroll (22) is revolved;
 a rotation preventing mechanism which prevents rotation of the swing scroll (22); and
 an electric motor (4) which is accommodated in the housing member (5, 6, 7) and rotates the drive shaft (14),
 wherein in the housing member (5, 6, 7), a motor fixing portion (6a) to which the electric motor (4) is fixed, and an end plate (6b) which supports an axial load of the swing scroll (22) and rotatably supports the drive shaft (14) are integrally formed,
 wherein the rotation preventing mechanism is configured, between the substrate (22a) of the swing scroll (22) and the end plate (6b), of a plurality of pins (51) which are arranged circumferentially and a plurality of cylindrical recessed portions (53) engaging with the pins (51),
 wherein the cylindrical recessed portions (53) are formed on the substrate (22a) of the swing scroll (22), and
 wherein the pins (51) are fixed to the end plate (6b).

2. The electric scroll compressor (1) according to claim 1,

wherein a hole (63) is formed in the end plate (6b) on the outside in a radial direction from the portion to which each of the pins (51) is fixed.

3. The electric scroll compressor (1) according to claim 2,
 wherein the hole (63) is a long hole which is long in a circumferential direction of the end plate (6b).

4. The electric scroll compressor (1) according to claim 2 or 3,
 wherein the hole (63) is a fluid passage through which a fluid to be compressed, which is compressed in the compression chamber (26), flows.

5. The electric scroll compressor (1) according to any one of claims 1 to 4,
 wherein a rib (65) extending in the radial direction is formed on the end plate (6b), and each of the pins (51) is fixed to the portion in which the rib (65) is formed.

6. The electric scroll compressor (1) according to any one of claims 1 to 5,
 wherein a ring member (52) is accommodated in each of the cylindrical recessed portions (53) formed on the substrate (22a) of the swing scroll (22), and the cylindrical recessed portion (53) engages with the pin (51) via the ring member (52).

7. The electric scroll compressor (1) according to any one of claims 2 to 6,
 wherein a positioning pin (23) which positions the fixing scroll (21) with respect to the end plate (6b) is disposed on the end plate (6b), and the positioning pin (23) is provided on a virtual circle (α) including the hole (63).

Fig. 1

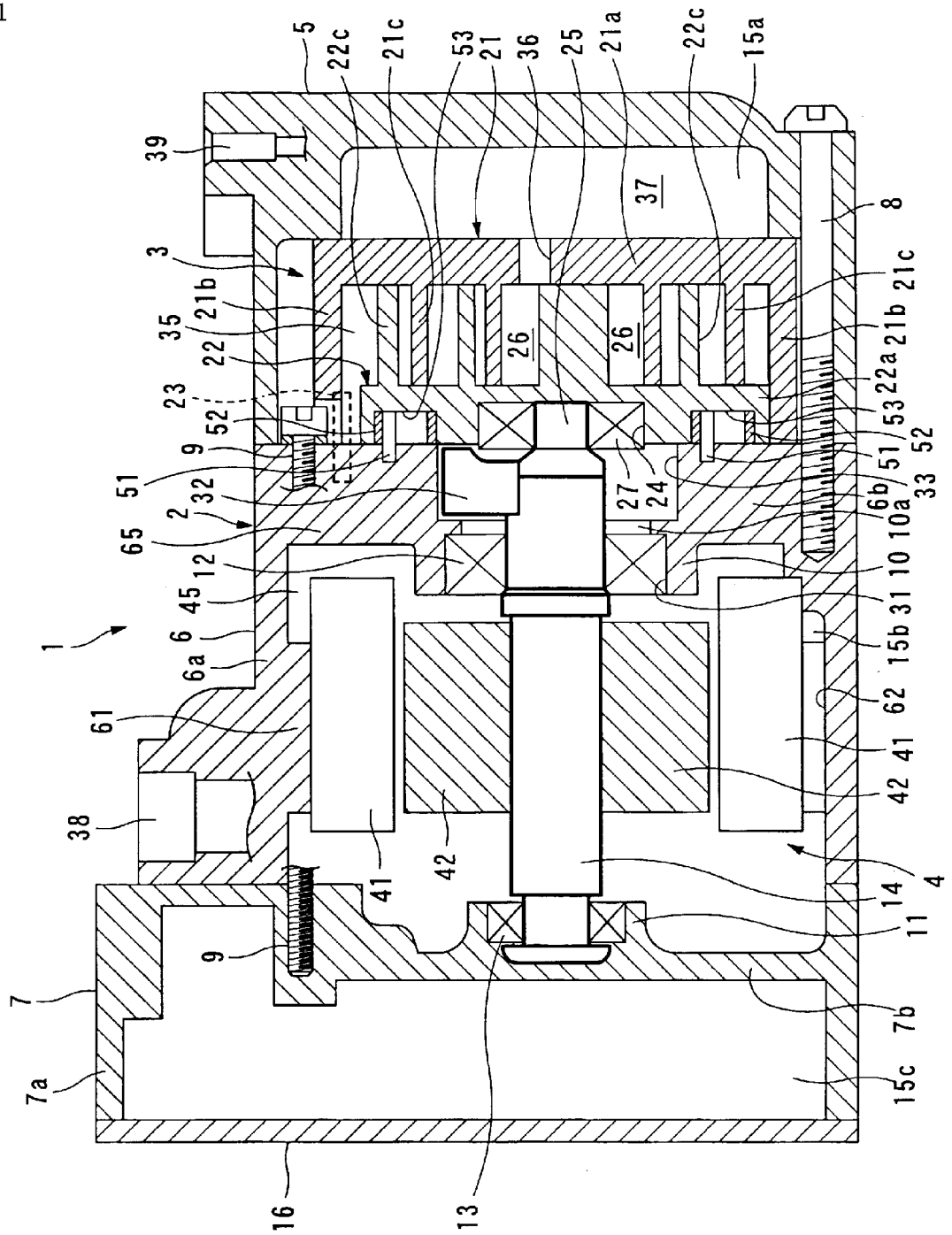


Fig. 2

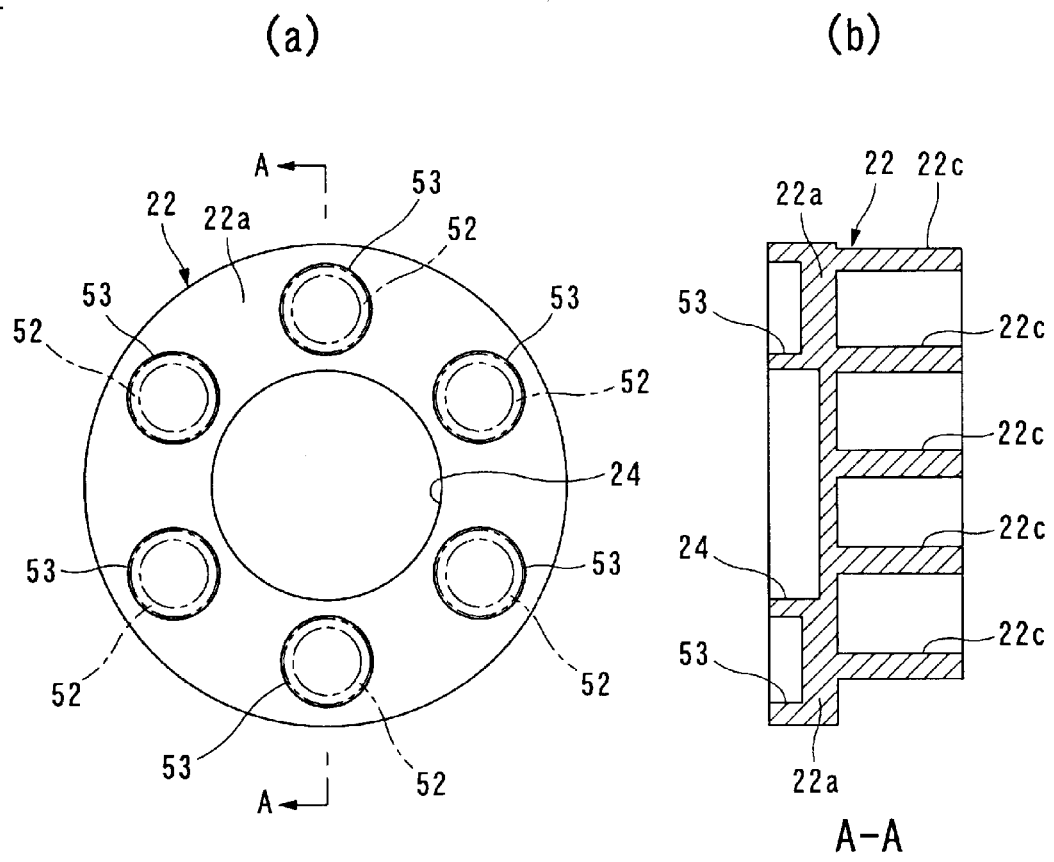
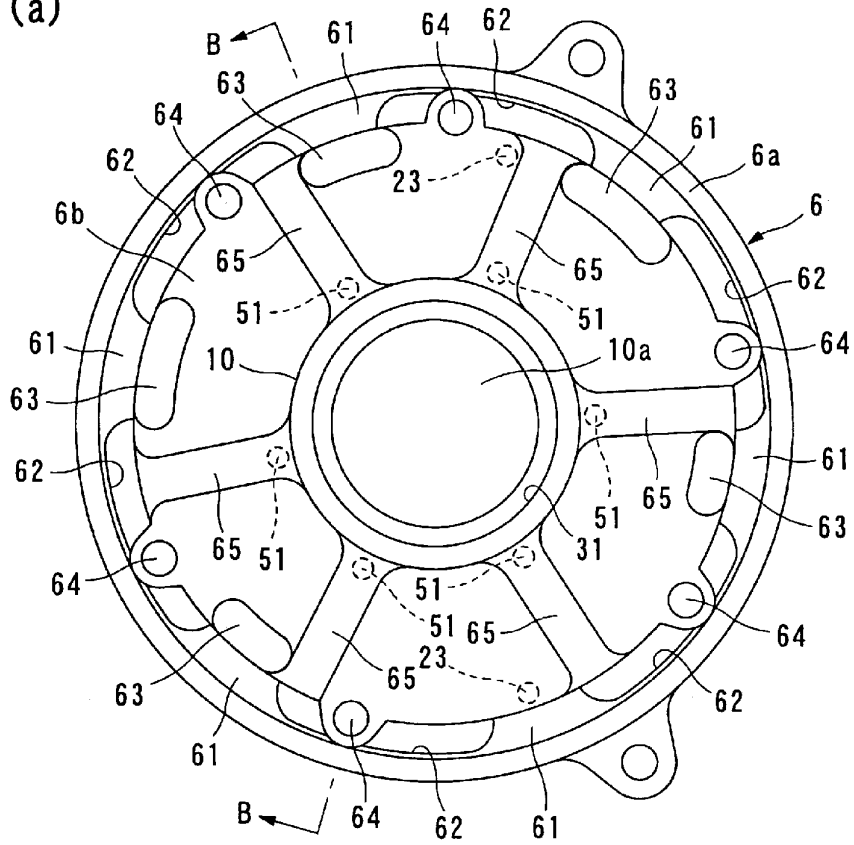


Fig. 3

(a)



(b)

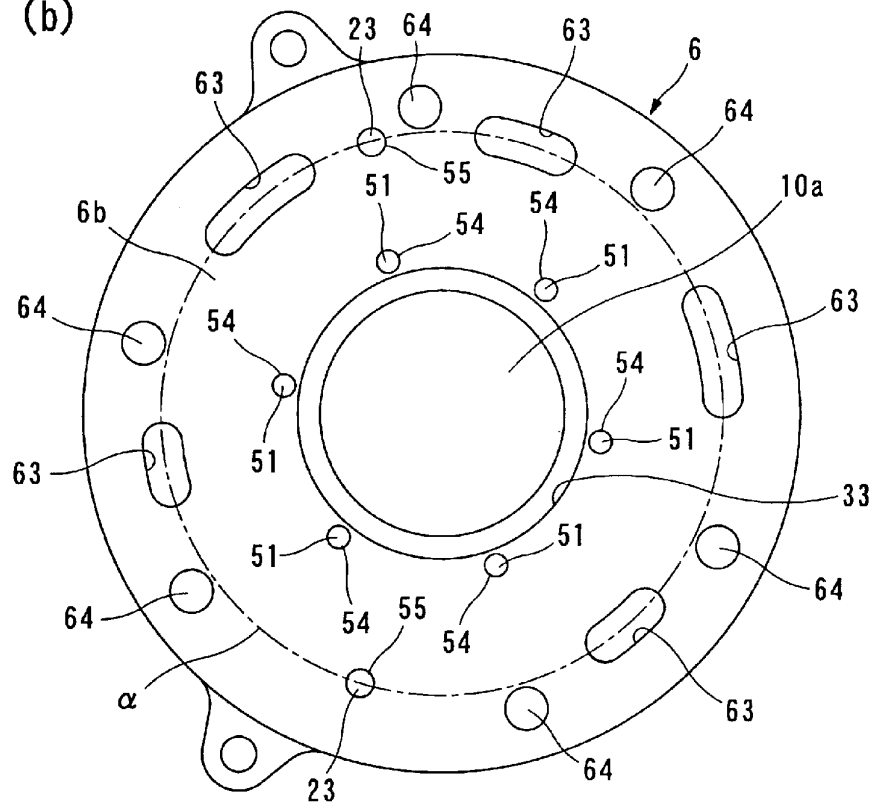


Fig. 4

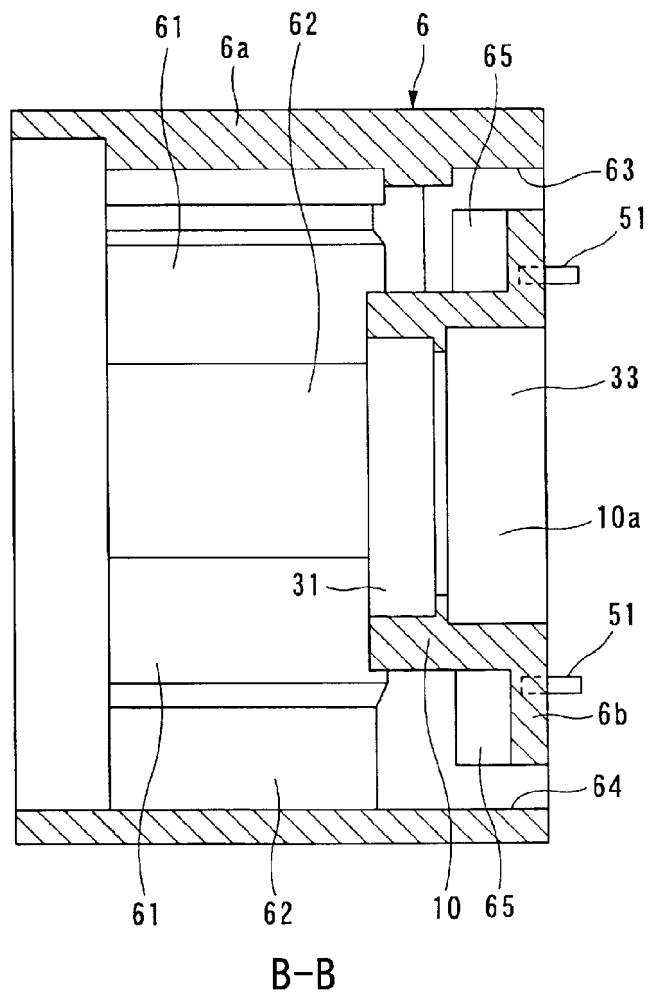
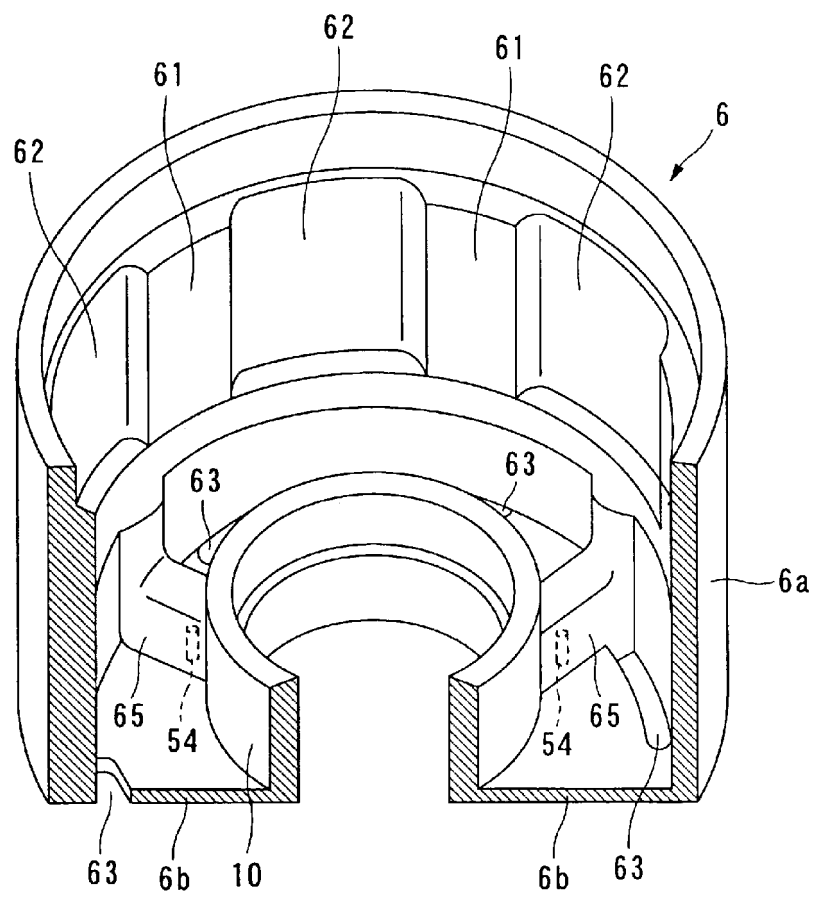


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/074358

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 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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 A	JP 2002-371977 A (Ebara Corp.), 26 December 2002 (26.12.2002), paragraphs [0018] to [0039]; fig. 1 & WO 2002/038960 A1	1, 2, 6, 7 3-5
Y	JP 2006-183527 A (Mitsubishi Heavy Industries, Ltd.), 13 July 2006 (13.07.2006), paragraphs [0031] to [0033]; fig. 2, 3 (Family: none)	1, 2, 6, 7
Y	JP 2002-180976 A (Denso Corp.), 26 June 2002 (26.06.2002), paragraphs [0045] to [0073]; fig. 1, 2, 7 (Family: none)	2, 6, 7

☒ 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
02 December, 2014 (02.12.14)Date of mailing of the international search report
16 December, 2014 (16.12.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/074358

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-329416 A (Denso Corp., Nippon Soken, Inc.), 30 November 2000 (30.11.2000), paragraphs [0073] to [0075]; fig. 11 & US 6321564 B1 & US 2001/0037653 A1 & DE 10010864 A1	1-7

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

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 2000291557 A [0006]

Non-patent literature cited in the description

- **KATAGIRI, TSUTOMU.** With respect to EM coupling for scroll compressor. *NTN TECHNICAL REVIEW*, 2000, 67-70 [0007]