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(54) SCROLL COMPRESSOR AND METHOD FOR PRODUCING SCROLL COMPRESSOR

SPIRALVERDICHTER UND VERFAHREN ZUR HERSTELLUNG EINES SPIRALVERDICHTERS

COMPRESSEUR À SPIRALE ET PROCÉDÉ DE PRODUCTION DE COMPRESSEUR À SPIRALE

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Description

Technical Field of the Invention

[0001] The present invention, a scroll compressor, and a method of producing the scroll compressor.

Description of the Related Art

[0002] The scroll compressor includes a main axis that is rotationally driven by an electric motor, an eccentric shaft that is provided on a position offset with respect to the main axis, and an orbiting scroll that is supported on the eccentric shaft via a bearing device, a fixed scroll that forms a compression chamber variable in volume by facing an orbiting scroll, and a housing that houses the above members. The orbiting scroll performs orbiting motion centering on an axis of the main axis, without rotation. As a result, the fluid introduced into the compression chamber is compressed. Here, the above main axis and eccentric shaft are supported on both sides in an axial direction of the main axis by a main bearing (upper bearing) provided inside the housing, and a sub bearing (lower bearing).

[0003] As a specific example of such the scroll compressor, an apparatus described in the following Patent Document 1 is known. In the scroll compressor described in Patent Document 1, a second frame supporting the main axis from below is fixed by a spot welding with respect to an inner peripheral surface of an attachment via a plurality of ribs. Patent Document 2 relates to a hermetic compressor and refrigeration cycle equipment using the same. Patent Document 3 relates to a compressor having a counterweight shield. Patent Document 4 relates to a support member for optimizing dynamic load distribution and attenuating vibration. Patent Document 5 relates to a scroll compressor.

[Prior Art Document]

[Patent document]

[0004]

Patent Document 1: Japanese Unexamined Patent Application, First Publication No. H05-231345
Patent Document 2: United States Patent Application Publication N° US 2012/174620 A1
Patent Document 3: United States Patent Application Publication N° US 2004/057857 A1
Patent Document 4: United States Patent Application Publication N° US 2009/269192 A1
Patent Document 5: United States Patent Application Publication N° US 2015/152864 A1

BRIEF SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0005] In the scroll compressor, the orbiting scroll performs an orbiting motion about the axis of the main axis as the center by the eccentric shaft that is offset relative to the main axis as described above, and compressing a refrigerant gas. Therefore, the main bearing and the sub bearing are continuously subjected to a load caused by reaction force of the refrigerant compressor and moment caused by members, such as a rotor balance weight, for adjusting a balance during rotation. Furthermore, in association with enlargement in capacity and augmentation in output of the scroll compressor which has been conducted in recent years, the load also tends to increase.

[0006] However, in the scroll compressor described in patent document 1, since the spot welding of the ribs is performed at only one location, when an excessive load as described above is continuously applied, there is a possibility to cause fatigue failure or the like by stress concentration. As a result, there is a possibility in that a stable operation of the scroll compressor is disturbed.

[0007] The present invention has been made in view of such circumstances, and an object thereof is to provide a scroll compressor capable of stable operation.

Means for Solving the Problem

[0008] In order to solve the above problem, the present invention employs the means of claim 1 or claim 3.

(1) A first aspect of the present disclosure and not as claimed provides a scroll compressor including: an electric motor; a rotary shaft rotationally driven about an axis thereof by the electric motor; a scroll compressor body driven by a rotation of the rotary shaft; a main bearing rotatably supporting the rotary shaft between the electric motor and the scroll compressor body; a sub bearing supporting the rotary shaft at opposite side of the main bearing of the electric motor, and provided with a plurality of arms at intervals in a peripheral direction of the rotary shaft, the plurality of arms extending along a radial direction of the rotary shaft; a housing having a tubular shape extending along the axis, and housing the electric motor, the rotary shaft, the scroll compressor body, the main bearing, and the sub bearing; a harness having a ring shape and fitted onto an inner peripheral surface of the housing; and a fixed portion in which the arms of the sub bearing are fixed to the harness.

According to the above-described configuration, the arm is fixed to the harness by the fixed portion, and the harness is fitted into the inner peripheral surface of the housing. Accordingly, even when vibration is propagated from the scroll compressor body to the

arm, it is possible to substantially eliminate the possibility of falling the arm and the harness out from the housing.

(2) A second aspect of the present disclosure and as claimed provides the scroll compressor according to (1), and the fixed portion is a fastening bolt that is inserted through a first hole formed in the arm and a second hole formed in the harness, and an inner diameter of the first hole is larger than an outer diameter of the fastening bolt.

According to the above-described configuration, when fixing the arm to the harness, it is possible to easily carry out centering (the coaxial work) of the arm and the rotary shaft.

(3) A third aspect of the present disclosure provides the scroll compressor according to (1) or (2), and the scroll compressor further includes a shim for an alignment of each arm in an axial direction by interposing the shim between the arm and the harness.

According to the above-described configuration, by interposing the shim between the arm and the harness, it is possible to easily carry out positioning of the arm in the axial direction.

(4) A fourth aspect of the present disclosure and as claimed provides a method for producing a scroll compressor that includes: an electric motor; a rotary shaft rotationally driven about an axis thereof by the electric motor; a scroll compressor body driven by a rotation of the rotary shaft; a main bearing rotatably supporting the rotary shaft between the electric motor and the scroll compressor body; a sub bearing supporting the rotary shaft at opposite side of the main bearing of the electric motor, and provided with a plurality of arms at intervals in a peripheral direction of the rotary shaft, the plurality of arms extending along a radial direction of the rotary shaft; a housing having a tubular shape extending along the axis, and housing the electric motor, the rotary shaft, the scroll compressor body, the main bearing, and the sub bearing; a harness having a ring shape and fitted onto an inner peripheral surface of the housing; and a fixed portion in which the arms of the sub bearing are fixed to the harness, and the method includes: an assembling process that houses the electric motor, the rotary shaft, the scroll compressor body, the main bearing within the housing; a shrink fitting process that fixes the harness to the inner peripheral surface of the housing by shrink fitting; and a fixing process that fixes the sub bearing to the harness via the fixed portion.

[0009] According to the method as described above, it is possible to firmly fix the harness to the inner peripheral surface of the housing by shrink fitting.

Effects of the Invention

[0010] According to the scroll compressor according to the present invention, it is possible to realize stable operation for a long-term.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a cross-sectional view of a scroll compressor according to a first embodiment of the present disclosure.

FIG. 2 is an enlarged cross sectional view of a main part of the scroll compressor according to a first embodiment of the present disclosure.

FIG. 3 is a cross-sectional view of an axial direction of the scroll compressor according to a first embodiment of the present disclosure.

FIG. 4 is an enlarged cross sectional view of a main part of a scroll compressor according to a second embodiment of the present disclosure.

FIG. 5 is a view showing a modification example of a scroll compressor according to an embodiment of the present disclosure.

FIG. 6 is a view showing another modification of a scroll compressor according to an embodiment of the present disclosure.

FIG. 7 is a process diagram showing processes of a method for producing the scroll compressor according to an embodiment of the present disclosure.

Detailed Description of the Invention

[First Embodiment]

[0012] A scroll compressor 100 according to a first embodiment of the present disclosure will be described with reference to the drawings. As shown in FIG. 1, the scroll compressor 100 includes a housing 1 forming the outer shape of the device, and a drive unit 3 (an electric motor 3) provided in the housing 1, a rotary shaft 4 rotationally driven by the drive unit 3, a compression unit 2 (a scroll compressor body 2) driven by a rotation of the rotary shaft 4, a main bearing 9A and a sub bearing 9B rotatably supporting the rotary shaft 4, a harness 40 fitted within the housing 1, and a fixed portion (a bolt B, see FIG. 2) configured to fix the sub bearing 9B to the harness 40.

[0013] The compression unit 2 and the drive unit 3 are connected to each other by the rotary shaft 4 extending along an axis O1. That is, rotational energy by the drive unit 3 is transmitted immediately to the compression unit 2 through the rotary shaft 4. The compression unit 2 compresses a working fluid by this rotational energy and discharges it to the outside in a high pressure state. The working fluid in a high pressure state is used, for example, as a refrigerant in air conditioners and the like. Hereinafter, the configuration of each element will be described in detail.

[0014] The housing 1 is provided with a suction pipe 11 for sucking a refrigerant gas as the working fluid from

the outside, and a discharge pipe 12 for discharging the refrigerant gas that is in a high pressure state in a discharge chamber 67 after being compressed by the compression unit 2.

[0015] The rotary shaft 4 has a columnar shape centering on the axis O1. The rotary shaft 4 rotatably supported within the housing 1 by the main bearing 9A provided at an end portion (first end portion) on one side of the rotary shaft 4 in an axis O1 direction and the sub bearing 9B provided at the other end portion (second end portion) on the other side of the rotary shaft 4 which is the opposite side in the axis O1 direction when viewed from the main bearing 9A. The main bearing 9A has a main bearing body 75 which rotatably supports the rotary shaft 4.

[0016] In the one end portion on one side of the rotary shaft 4, an eccentric shaft 5 having a columnar shape and centering on an eccentric axis O2 that is different from the axis O1 is provided at an offset (eccentric) position with respect to the axis O1. The eccentric axis O2 is parallel to the axis O1. The eccentric shaft 5 has a columnar shape protruding from the end portion of the rotary shaft 4 toward the one side in the axis O1 direction. Accordingly, in a state in which the rotary shaft 4 is rotating about the axis O1, the eccentric shaft 5 revolves around the axis O1 of the rotary shaft 4.

[0017] The main bearing 9A is provided with an Oldham ring 91 for restricting a rotation (a rotation about the eccentric axis O2) of an orbiting scroll 7. Although the details are not shown, the Oldham ring 91 has projections that are fitted in a groove formed in an end plate 71 of the orbiting scroll 7.

[0018] The compression unit 2 includes a fixed scroll 6 and the orbiting scroll 7. A discharge cover 8 is a member having a substantially disc shape and partitioning a space inside the housing 1 in the axis O1 direction; and at a central portion of the discharge cover 8, a discharge port 68 which communicates the refrigerant gas after compression to the above the discharge chamber 67 and a discharge valve 66 for preventing backflow of the refrigerant from the high pressure side are provided.

[0019] The fixed scroll 6 is a member having a substantially disc shape and fixed inside the housing 1. The orbiting scroll 7 faces the fixed scroll 6 from the axis O1 direction to form a compression chamber C therebetween. More particularly, the fixed scroll 6 includes an end plate 61 having a disc shape, and a fixed wrap 62 erected on a surface of the other side in the axis O1 direction of the end plate 61 from the one side toward the other side in the axis O1 direction. The end plate 61 extends along a plane substantially perpendicular to the axis O1. The fixed wrap 62 is a wall body which is formed in a spiral shape when viewed from the axis O1 direction. More specifically, the fixed wrap 62 is formed in a plate-like member that is wound about a center of the end plate 61. As an example, the fixed wrap 62 may desirably be configured to form an involute curve centering on the axis O1 when viewed from the axis O1 direction.

[0020] On an outer side in radial direction of the fixed wrap 62, an outer peripheral wall 63 extending in a tubular shape along an outer periphery of the end plate 61 is formed. Further, on an edge at the other side in the axis O1 direction of the outer peripheral wall 63, a flange 64 having an annular shape and extending outward in a radial direction is provided. The fixed scroll 6 is fixed to the main bearing 9A by bolts or the like via the flange 64. Furthermore, a fixed scroll discharge port 65 is formed in a center portion of the spiral of the fixed scroll 6 is.

[0021] The orbiting scroll 7 includes the end plate 71 having the disc shape, and the orbiting wrap 72 having a spiral shape and provided on a surface on one side in the axis O1 direction in the end plate 71. The orbiting wrap 72 may also desirably be configured to form an involute curve centering on the axis O2.

[0022] Furthermore, the orbiting wrap 72 faces the fixed wrap 62 from the axis O1 direction and is disposed so as to overlap each other in a direction intersecting with the axis O1. In other words, the fixed wrap 62 and the orbiting wrap 72 are engaged with each other. In such engaging state, a predetermined space is formed between the fixed wrap 62 and the orbiting wrap 72. The volume of this space varies while the orbiting wrap 72 orbits. Thereby, it is possible to compress the refrigerant gas.

[0023] The orbiting scroll 7 configured as described above is connected to one side in the axis O1 direction of the above rotary shaft 4 via a bushing assembly 10. A boss 73 having a cylindrical shape is formed on a surface at the other side in the axis O1 direction of the end plate 71 of the orbiting wrap 72. A central axis of the boss 73 is coaxial with the axis O2. The eccentric shaft 5 formed on the rotary shaft 4 is fitted into an internal space of the boss 73 from the axis O1 direction through the bushing assembly 10.

[0024] In addition, lubricant oil is supplied to the rotary shaft 4 (the eccentric shaft 5) from a lubrication pump 80. After lubricating a portion between the bush 101 of the bushing assembly 10 and the bearing 74 of the orbiting scroll 7, the lubricating oil is collected downwardly in the housing 1.

[0025] Next, a detail structure of the sub bearing 9B will be described with reference to FIG. 2 or FIG. 3. As shown in the figures, the sub bearing 9B includes a sub-bearing body 76, a holder 78 having a tubular shape and supporting the sub-bearing body 76 from the outer peripheral side of the sub-bearing body 76, and a plurality (three) of arms 79 that extends radially so that the holder 78 is provided as a center.

[0026] The holder 78 is provided at a position substantially coaxial with the axis O1. The arm 79 is a rod-like member that connects an inner peripheral surface 1A of the housing 1 and an outer peripheral surface of the holder 78. The three arms 79 in the present embodiment have substantially the same shape and size with each other. Furthermore, the end portion (an outer peripheral end 79A) at the outer side in the radial direction of the arm 79 has a first hole 79H through which a fastening bolt B

is inserted. In addition, the first hole 79H has an inner diameter that is slightly larger than a shaft diameter of the fastening bolt B. That is, when the fastening bolt B is inserted into the first hole 79H, a slight gap is formed between the outer peripheral surface of the fastening bolt B and an inner peripheral surface of the first hole 79H.

[0027] The sub bearing 9B configured as described above is fixed to the housing 1 via the harness 40. The harness 40 is a member having a substantially ring shape centering on the axis O1. An outer diameter of the harness 40 is substantially set equal to or slightly smaller than an inner diameter of the housing 1.

[0028] The harness 40 is fixed to the inner peripheral surface of the housing 1 by shrink fitting. More specifically, the harness 40 is fixed to the housing 1 by the following method (a method for producing the scroll compressor). The method includes an assembling process, a shrink fitting process, and a fixation process. In the assembling process, the electric motor 3 (the drive unit 3), the rotary shaft 4, the scroll compressor body 2 (the compression unit 2), and the main bearing 9A are housed within the housing 1. Then, in the shrink fitting process, the harness 40 is fixed by shrink fitting with respect to the inner peripheral surface of the housing 1.

[0029] More specifically, in a shrink fitting process, the housing 1 is thermally expanded by heating by a heat source, and the inner diameter of the housing 1 is expanded. In a state where the inner diameter of the housing 1 is expanded, the harness 40 is fitted to the inside of the housing 1. Thereafter, by removing heat of the housing 1, the housing 1 shrinks to restore the initial size. As the result, the harness 40 is firmly fixed on the inner peripheral side of the housing 1. Thereafter, the sub bearing 9B is fixed to the harness 40 by the bolt B as the fixed portion described later (the fixing process).

[0030] Here, the harness 40 is formed line-symmetrically with respect to an object axis Os extending in a horizontal plane that intersects the axis O1. Further, when viewed from the axis O1 direction, an outer peripheral portion of the harness 40 is cut out at four portions and the four portions are respectively defined as a cutout portion 41. These four cutout portions 41 are respectively defined as a first cutout 41A and a second cutout 41B which are line symmetrical with respect to the object axis Os described above. The first cutout 41A has a curved edge that curves radially inward from the outer peripheral edge (outer peripheral side) of the harness 40, when viewed from the axis O1 direction. In addition, the second cutout 41B is a straight edge forming a chord of the harness 40.

[0031] Furthermore, the harness 40 according to the present embodiment has a plurality of second holes 40H for fixing the arms 79 of the sub bearing 9B. More specifically, each of the second holes 40H is formed at a position corresponding to the first hole 79H formed in each of the three the arms 79, when viewed from the axis O1 direction. After corresponding the first hole 79H formed in the arm 79 to the second hole 40H of the harness 40 fixed to the inner peripheral surface of the housing 1, the bolt B is inserted so as to penetrate both the first hole 79H and the second hole 40H and is fastened by a nut or the like. In addition, in the state of being fixed in the housing 1, the harness 40 is in a state of substantially abutting the drive unit 3 (the electric motor 3) described above from the axis O1 direction.

[0032] Incidentally, as described above, an inner diameter of the first hole 79H formed in the arm 79 (the sub bearing 9B) is slightly larger than the shaft diameter of the bolt B. Thus, in the stage before completely fastening the bolt B, the sub bearing 9B has a room for slightly pivots around the axis O1 with respect to the harness 40. By using this room, a central axis of the sub bearing 9B (the sub-bearing body 76) is possible to be matched with respect to the axis O1 of the housing 1 (the rotary shaft 4). In other words, the sub bearing 9B is capable of carrying out centering with respect the axis O1.

[0033] Next, the operation of the scroll compressor 100 according to the present embodiment will be described. To start the operation of the scroll compressor 100, first by energizing the above drive unit 3 (the electric motor 3), the rotary shaft 4 is rotationally driven about the axis O1.

[0034] In association with the rotation of the rotary shaft 4, the eccentric shaft 5 described above revolves around the axis O1, and the orbiting scroll 7 attached thereto orbits the axis O1 as the center. Here, the rotation of the orbiting scroll 7 is restricted by the Oldham ring 91 described above. Therefore, the orbiting scroll 7 performs a circular motion (orbits) along a locus drawn by the eccentric axis O2 so that the axis O1 of the rotary shaft 4 is provided as a center. Along with this orbiting, the orbiting wrap 72 of the orbiting scroll 7 repeats a continuous relative movement relative to the fixed wrap 62 of the fixed scroll 6. Due to this relative movement, the volume of the compression chamber C formed between the fixed wrap 62 and orbiting wrap 72 varies with time.

[0035] Although not shown in detail, first, during orbiting of the orbiting scroll 7, the refrigerant gas as the working fluid is introduced into the compression chamber C from an opening created at an outside in the radial direction of the orbiting wrap 72 (and the fixed wrap 62). In association with the orbiting of the orbiting scroll 7, the opening described above is closed. Thus, the refrigerant gas is confined within the compression chamber C. Subsequently, as the orbiting scroll 7 still orbits, the refrigerant gas moves radially inward (i.e., the eccentric axis O2 side). At this time, since the orbiting wrap 72 and the fixed wrap 62 are formed in the spiral shape as described above, the volume of the compression chamber C formed by the both is contracted gradually toward the inner side in the radial direction. As the result, the refrigerant gas is compressed. Eventually, in the vicinity of the center portion of the orbiting scroll 7 (or the fixed scroll 6), the refrigerant gas reaches the maximum pressure, and then is supplied to the outside through the above fixed scroll discharge port 65 and the discharge pipe 12 of the hous-

ing 1.

[0036] Here, as described above, when the arm 79 in the sub bearing 9B is directly fixed to the inner peripheral surface of the housing 1 by for example welding, the arm 79 is subjected to a load acting inwardly or outwardly in the radial direction with a sinusoidal increase and decrease by reaction force when compressing the refrigerant gas and moment of the member such as a balance weight for adjusting balance during rotation.

[0037] When such load is continuously added, the fixation between the arm 79 and the housing 1 is weakened and the operation of the device may be hindered. However, in the scroll compressor 100 according to the present embodiment, the arm 79 (the sub bearing 9B) is fixed to the housing 1 via the harness 40 as described above. Particularly, the harness 40 is fixed by shrink fitting with respect to the inner peripheral surface of the housing 1. That is, the outer peripheral surface of the harness 40 and the inner peripheral surface of the housing 1 abut to each other and are held in a state of interference fit. Thus, it possible to fix firmly and stably the arm 79 (the sub bearing 9B) to the inner peripheral surface 1A of the housing 1. Therefore, even when vibration is propagated from the scroll compressor body to the arm, it is possible to substantially eliminate the possibility of falling the arm and a harness out from a housing.

[0038] Furthermore, according to the above-described structure, the inner diameter of the first hole 79H formed the arm 79 (the sub bearing 9B) is slightly larger relative the shaft diameter of the bolt B. That is, in the stage before tightening complete the bolt B, the sub bearing 9B for the harness 40, there is room for slightly pivots around the axis O1. By using this room, the central axis of the sub bearing 9B (the sub-bearing body 76) is matched against the axis O1 of the housing 1 (the rotary shaft 4). In other words, it is possible to center the sub bearing 9B against the axis O1.

[0039] The first embodiment of the present disclosure has been described with reference to the drawings. The above embodiment is merely an example, and thus, various modifications and the like can be applied to this.

[Second Embodiment]

[0040] Next, a second embodiment of the present disclosure will be described with reference to FIG. 4. As shown in the figure, in the scroll compressor 200 according to the present embodiment, the shape of the arm 79 in the sub bearing 9B and the shape of the harness 40 are different from the first embodiment.

[0041] That is, in the present embodiment, a region including the outer peripheral end 79A of the arm 79 is formed thinner than other portions of the outer peripheral end 79A, and is defined as a thin portion 79B. Specifically, an end face at one side in the axis O1 direction of the arm 79 (the drive unit 3 side) has a counterbore that slightly deepens toward the other side in the axis O1 direction. Thus, a step is formed between the thin portion 79B and the other portions of the arm 79 (the radially inward portion with respect to the axis O1).

[0042] In such thin portion 79B, a shim S having an extremely thin plate-like shape is disposed as needed. By the shim S being interposed, it is possible to easily carry out alignment (the alignment in the axis O1 direction) of the sub bearing 9B with respect to the harness 40. In particular, when the harness 40 is fixed to the inner peripheral surface 1A of the housing 1 by shrink fitting, it is conceivable that the precise alignment of the harness 40 in the axis O1 direction is difficult. That is, by the disposition of the harness 40 in a slightly deviated position in the axis O1 direction with respect to the housing 1, there may be a possibility in that the positional deviation of the sub bearing 9B in the axis O1 direction is occurred.

[0043] However, by disposing the shim S between the sub bearing 9B and the harness 40 as described in the above, such deviation is offset and it is possible to optimize the position of the sub bearing 9B in the axis O1 direction. In addition, as the shim S, a plurality types of shims in different thickness is prepared and it is preferable to appropriately select and used a properly shim S according to the deviation amount between the harness 40 and the sub bearing 9B.

[0044] Furthermore, in the present embodiment, a size in the radial direction (thickness) in a region at one side in the axis O1 direction of the harness 40 is smaller than that in the first embodiment. More particularly, by setting a distance in the radial direction between the outer peripheral surface of the harness 40 and the inner peripheral surface thereof smaller than that in the first embodiment, a constricted part 40C are formed. According to the constricted part 40C, it is possible to ensure a larger gap between an inner peripheral surface 40A of the harness 40 and the drive unit 3.

[0045] Here, in the main bearing 9A and the sub bearing 9B described above, lubricant oil is continuously supplied by the lubrication pump 80. The lubricant oil that has finished lubricating the main bearing 9A, the sub bearing 9B flows downward at below the housing 1 (i.e., the other side in the axis O1 direction), and is stored.

[0046] At this time, if the gap between the harness 40 and the drive unit 3 is not large enough, there is a possibility of affecting a flow of the lubricant oil. However, in the present embodiment, since the constricted part 40C is formed in the harness 40, it is possible to reduce the possibility in that the harness 40 affects a flow state of the lubricant oil.

[0047] In addition, in each embodiment described above, the end face at one side in the axis O1 direction of the harness 40 abuts the drive unit 3. However, the aspect of the harness 40 is not limited thereto, and for example, as shown in FIG. 5, a gap along the axis O1 direction may be formed between the harness 40 and the drive unit 3. In this case, it is possible to further reduce the possibility in that the harness 40 affects a flow state of the lubricant oil.

[0048] Further, in each of the embodiments described

above, the sub bearing 9B has been described with three arms 79. However, the aspect of the sub bearing 9B is not limited thereto, and for example, as shown in FIG. 6, four arms 79 extending in a radial fashion in the radial direction from the holder 78 may be provided. In this case, it is desirable to form four second holes 40H in the harness 40 so as to corresponding to the four arms 79.

INDUSTRIAL APPLICABILITY

[0049] According to the scroll compressor of the present disclosure, it is possible to realize stable operation for a long-term.

Brief Description of the Reference Symbols

[0050]

1	Housing
2	Compression unit
3	Drive unit (electric motor)
4	Rotary shaft
5	Eccentric shaft
6	Fixed scroll
7	Orbiting scroll
8	Discharge cover
9A	Main bearing
9B	Sub bearing
10	Bush assembly
11	Suction piping
12	Discharge piping
40	Harness
61	End plate
62	Fixed wrap
63	Outer peripheral wall
64	Flange
65	Fixed scroll discharge port
66	Discharge valve
67	Discharge chamber
68	Discharge port
71	End plate
72	Orbiting wrap
73	Boss
74	Bearing
75	Main bearing body
76	Sub bearing body
79	Arm
80	Lubrication pump
91	Oldham ring
92	Thrust bearing
93	Oil drain hole
100	Scroll compressor
101	Bush
C	Compression chamber
H1	Welding-use opening
H2, H21, H22	Hole
O1	Axis
O2	Eccentric axis
W	Welded portion

Claims

1. A scroll compressor (100) comprising:

an electric motor (3);
a rotary shaft (4) rotationally driven about an axis thereof by the electric motor (3);
a scroll compressor body (2) driven by a rotation of the rotary shaft (4);
a main bearing (9A) rotatably supporting the rotary shaft (4) between the electric motor (3) and the scroll compressor body (2);
a sub bearing (9B) supporting the rotary shaft (4) at an opposite side of the electric motor (3) from the main bearing (9A), and provided with a plurality of arms (79) at intervals in a peripheral direction of the rotary shaft (4), the plurality of arms (79) extending along a radial direction of the rotary shaft (4);
a housing (1) having a tubular shape extending along the axis, and housing the electric motor (3), the rotary shaft (4), the compressor body (2), the main bearing (9A), and the sub bearing (9B);
a harness (40) having a ring shape and fitted onto an inner peripheral surface of the housing (1); and
a fixed portion in which the arms of the sub bearing (9B) are fixed to the harness (40),

characterized in that:

the fixed portion is a fastening bolt (B) that is inserted through a first hole formed in the arm (79) and a second hole formed in the harness (40),
an inner diameter of the first hole is larger than an outer diameter of the fastening bolt (B) in order to make it possible to easily carry out centering of the arm and the rotary shaft;
the sub bearing (9B) is separate from the harness (40).

2. The compressor (100) according to Claim 1, further comprising:
a shim (5) for an alignment of each arm (79) in an axial direction of the rotary shaft (4) by interposing the shim (5) between the arm (79) and the harness (40).

3. A method for producing a scroll compressor (100) including:

an electric motor (3);
a rotary shaft (4) rotationally driven about an axis

thereof by the electric motor (3);
a scroll compressor body (2) driven by a rotation of the rotary shaft (4);
a main bearing (9A) rotatably supporting the rotary shaft (4) between the electric motor(3) and the scroll compressor body (2);
a sub bearing (9B) supporting the rotary shaft (4) at an opposite side of the electric motor (3) from the main bearing (9A), and provided with a plurality of arms (79) at intervals in a peripheral direction of the rotary shaft (4), the plurality of arms (79) extending along a radial direction of the rotary shaft (4);
a housing (1) having a tubular shape extending along the axis, and housing the electric motor (3), the rotary shaft (4), the scroll compressor body (2), the main bearing (9A), and the sub bearing (9B);
a harness (40) having a ring shape and fitted onto an inner peripheral surface of the housing (1); and
a fixed portion in which the arms (79) of the sub bearing (9B) are fixed to the harness (40),
wherein the method comprises:

an assembling process that houses the electric motor (3), the rotary shaft (4), the scroll compressor body (2), the main bearing (9A) within the housing (1);
a shrink fitting process that fixes the harness (40) to the inner peripheral surface of the housing (1) by shrink fitting; and
a fixing process that fixes the sub bearing (9B) to the harness (40) via the fixed portion,
characterized in that the fixed portion is a fastening bolt that is inserted through a first hole formed in the arm and a second hole formed in the harness (40),
an inner diameter of the first hole is larger than an outer diameter of the fastening bolt in order to make it possible to easily carry out centering of the arm and the rotary shaft; and
the sub bearing (9B) and the harness (40) are provided separately from each other.

Patentansprüche

1. Scrollverdichter (100), der Folgendes umfasst:

einen Elektromotor (3);
eine Drehwelle (4), die drehend um eine Achse davon vom Elektromotor (3) angetrieben wird;
einen Scrollverdichterkörper (2), der durch eine Drehung der Drehwelle (4) angetrieben wird;
ein Hauptlager (9A), das die Drehwelle (4) zwischen dem Elektromotor (3) und dem Scrollverdichterkörper (2) drehbar stützt;
ein Unterlager (9B), das die Drehwelle (4) auf einer dem Hauptlager (9A) gegenüberliegenden Seite des Elektromotors (3) stützt und in Intervallen in einer Umfangsrichtung der Drehwelle (4) mit einer Vielzahl von Armen (79) versehen ist, wobei sich die Vielzahl von Armen (79) entlang einer Radialrichtung der Drehwelle (4) erstrecken;
ein Gehäuse (1), das eine Rohrform aufweist, die sich entlang der Achse erstreckt, und in dem der Elektromotor (3), die Drehwelle (4), der Verdichterkörper (2), das Hauptlager (9A) und das Unterlager (9B) untergebracht sind;
einen Gurt (40), der eine Ringform aufweist und an einer inneren Umfangsfläche des Gehäuses (1) befestigt ist; und
einen festen Abschnitt, in dem die Arme des Unterlagers (9B) am Gurt (40) befestigt sind,
dadurch gekennzeichnet, dass:

der feste Abschnitt eine Befestigungsschraube (B) ist, die durch ein erstes Loch, das im Arm (79) gebildet ist, und ein zweites Loch, das im Gurt (40) gebildet ist, eingesteckt ist,
ein Innendurchmesser des ersten Lochs größer ist als ein Außendurchmesser der Befestigungsschraube (B), um es zu ermöglichen, das Zentrieren des Arms und der Drehwelle einfach auszuführen;
das Unterlager (9B) vom Gurt (40) getrennt ist.

2. Verdichter (100) nach Anspruch 1, der ferner Folgendes umfasst:
eine Beilagscheibe (5) für eine Ausrichtung jedes Arms (79) in eine Axialrichtung der Drehwelle (4) durch Einsetzen der Beilagscheibe (5) zwischen dem Arm (79) und dem Gurt (40).

3. Verfahren zum Herstellen eines Scrollverdichters (100), der Folgendes beinhaltet:

einen Elektromotor (3);
eine Drehwelle (4), die drehend um eine Achse davon vom Elektromotor (3) angetrieben wird;
einen Scrollverdichterkörper (2), der durch eine Drehung der Drehwelle (4) angetrieben wird;
ein Hauptlager (9A), das die Drehwelle (4) zwischen dem Elektromotor (3) und dem Scrollverdichterkörper (2) drehbar stützt;
ein Unterlager (9B), das die Drehwelle (4) auf einer dem Hauptlager (9A) gegenüberliegenden Seite des Elektromotors (3) stützt und in Intervallen in einer Umfangsrichtung der Drehwelle (4) mit einer Vielzahl von Armen (79) versehen ist, wobei sich die Vielzahl von Armen (79) ent-

lang einer Radialrichtung der Drehwelle (4) erstrecken;
ein Gehäuse (1), das eine Rohrform aufweist, die sich entlang der Achse erstreckt, und in dem der Elektromotor (3), die Drehwelle (4), der Scrollverdichterkörper (2), das Hauptlager (9A) und das Unterlager (9B) untergebracht sind;
einen Gurt (40), der eine Ringform aufweist und an einer inneren Umfangsfläche des Gehäuses (1) befestigt ist; und
einen festen Abschnitt, in dem die Arme (79) des Unterlagers (9B) am Gurt (40) befestigt sind, wobei das Verfahren Folgendes umfasst:

einen Montageprozess, der den Elektromotor (3), die Drehwelle (4), den Scrollverdichterkörper (2), das Hauptlager (9A) im Gehäuse (1) unterbringt;
einen Aufschrumpfprozess, der den Gurt (40) durch Aufschrumpfen an der inneren Umfangsfläche des Gehäuses (1) befestigt; und
einen Befestigungsprozess, der das Unterlager (9B) via den festen Abschnitt am Gurt (40) befestigt,
dadurch gekennzeichnet, dass der feste Abschnitt eine Befestigungsschraube ist, die durch ein erstes Loch, das im Arm gebildet ist, und ein zweites Loch, das im Gurt (40) gebildet ist, eingesteckt ist,
ein Innendurchmesser des ersten Lochs größer ist als ein Außendurchmesser der Befestigungsschraube, um es zu ermöglichen, das Zentrieren des Arms und der Drehwelle einfach auszuführen; und
das Unterlager (9B) und der Gurt (40) separat voneinander bereitgestellt sind.

Revendications

1. Compresseur à spirale (100) comprenant :

un moteur électrique (3) ;
un arbre de rotation (4) entraîné en rotation autour de son axe par le moteur électrique (3) ;
un corps de compresseur à spirale (2) entraîné par une rotation de l'arbre de rotation (4) ;
un palier principal (9A) supportant, en rotation, l'arbre de rotation (4) entre le moteur électrique (3) et le corps de compresseur à spirale (2) ;
un palier auxiliaire (9B) supportant l'arbre de rotation (4) d'un côté opposé du moteur électrique (3) à partir du palier principal (9A), et prévu avec une pluralité de bras (79) à intervalles dans une direction périphérique de l'arbre de rotation (4), la pluralité de bras (79) s'étendant le long d'une direction radiale de l'arbre de rotation (4) ;
un boîtier (1) ayant une forme tubulaire s'étendant le long de l'axe, et logeant le moteur électrique (3), l'arbre de rotation (4), le corps de compresseur (2), le palier principal (9A) et le palier auxiliaire (9B) ;
un faisceau (40) ayant une forme annulaire et monté sur une surface périphérique interne du boîtier (1) ; et
une partie fixe dans laquelle les bras du palier auxiliaire (9B) sont fixés sur le faisceau (40),
caractérisé en ce que :

la partie fixe est un boulon de fixation (B) qui est inséré à travers un premier trou formé dans le bras (79) et un second trou formé dans le faisceau (40),
un diamètre interne du premier trou est supérieur à un diamètre externe du boulon de fixation (B) afin de permettre de réaliser facilement le centrage du bras et de l'arbre de rotation ;
le palier auxiliaire (9B) est séparé du faisceau (40).

2. Compresseur (100) selon la revendication 1, comprenant en outre :
une cale (5) pour un alignement de chaque bras (79) dans une direction axiale de l'arbre de rotation (4) en intercalant la cale (5) entre le bras (79) et le faisceau (40).

3. Procédé pour produire un compresseur à spirale (100) comprenant :

un moteur électrique (3) ;
un arbre de rotation (4) entraîné en rotation autour de son axe par le moteur électrique (3) ;
un corps de compresseur à spirale (2) entraîné par une rotation de l'arbre de rotation (4) ;
un palier principal (9A) supportant, en rotation, l'arbre de rotation (4) entre le moteur électrique (3) et le corps de compresseur à spirale (2) ;
un palier auxiliaire (9B) supportant l'arbre de rotation (4) d'un côté opposé du moteur électrique (3) à partir du palier principal (9A), et prévu avec une pluralité de bras (79) à intervalles dans une direction périphérique de l'arbre de rotation (4), la pluralité de bras (79) s'étendant le long d'une direction radiale de l'arbre de rotation (4) ;
un boîtier (1) ayant une forme tubulaire s'étendant le long de l'axe, et logeant le moteur électrique (3), l'arbre de rotation (4), le corps de compresseur (2), le palier principal (9A) et le palier auxiliaire (9B) ;
un faisceau (40) ayant une forme annulaire et monté sur une surface périphérique interne du boîtier (1) ; et
une partie fixe dans laquelle les bras (79) du

palier auxiliaire (9B) sont fixés sur le faisceau (40),
dans lequel le procédé comprend :

un processus d'assemblage qui loge le moteur électrique (3), l'arbre de rotation (4), le corps de compresseur à spirale (2), le palier principal (9A) à l'intérieur du boîtier (1) ;
un processus d'assemblage par contraction qui fixe le faisceau (40) sur la surface périphérique interne du boîtier (1) par assemblage par contraction ; et
un processus de fixation qui fixe le palier auxiliaire (9B) sur le faisceau (40) via la partie fixe,
caractérisé en ce que la partie fixe est un boulon de fixation qui est inséré à travers un premier trou formé dans le bras et un second trou formé dans le faisceau (40),
un diamètre interne du premier trou est supérieur à un diamètre externe du boulon de fixation afin de permettre de réaliser facilement le centrage du bras et de l'arbre de rotation ; et
le palier auxiliaire (9B) et le faisceau (40) sont prévus séparément l'un de l'autre.

FIG. 1

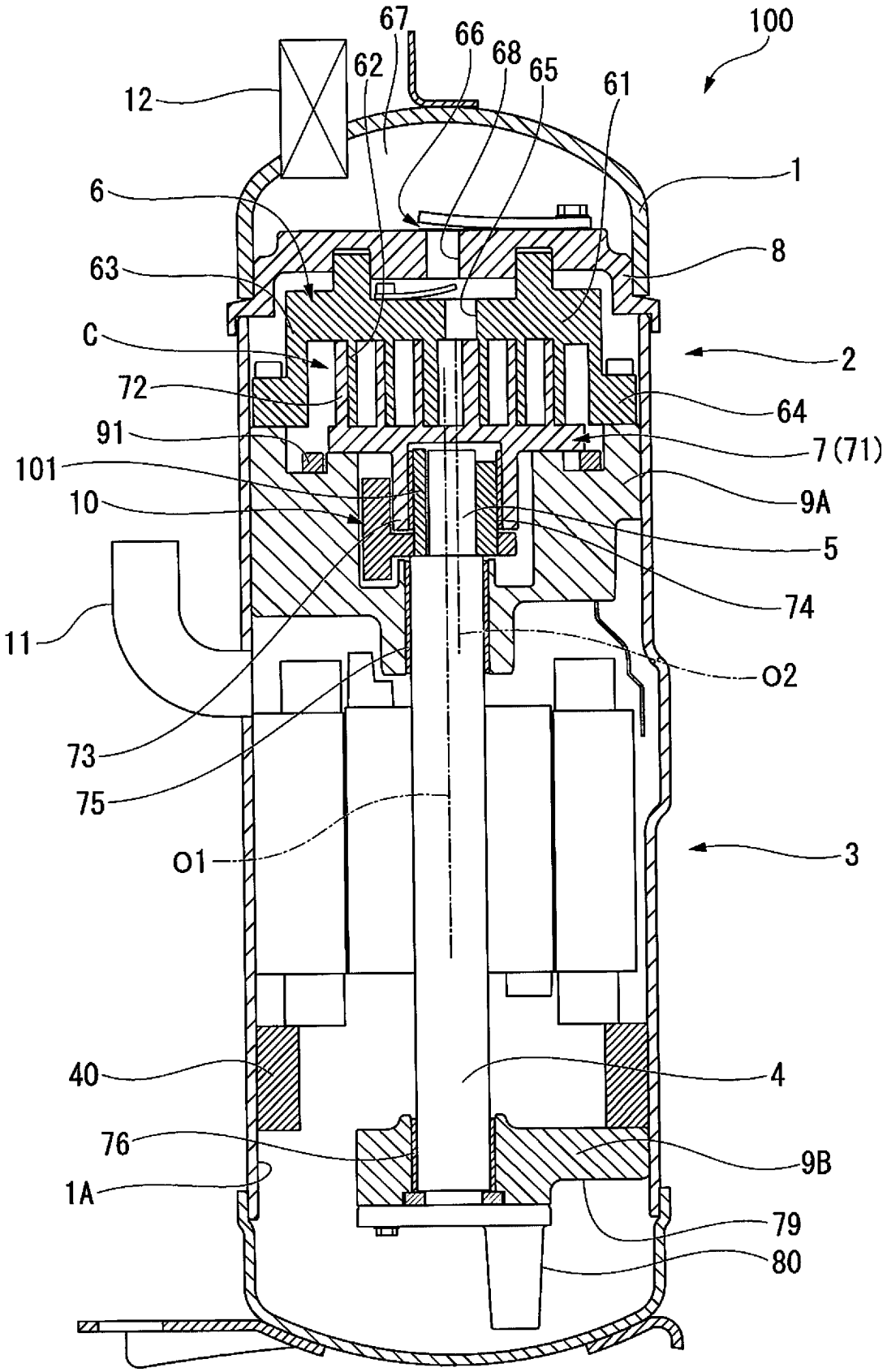

100
67
66
68
65
62
61
12
1
6
8
63
C
2
72
64
91
7 (71)
101
9A
10
5
74
11
O2
73
75
O1
3
40
4
76
9B
1A
79
80

FIG. 2

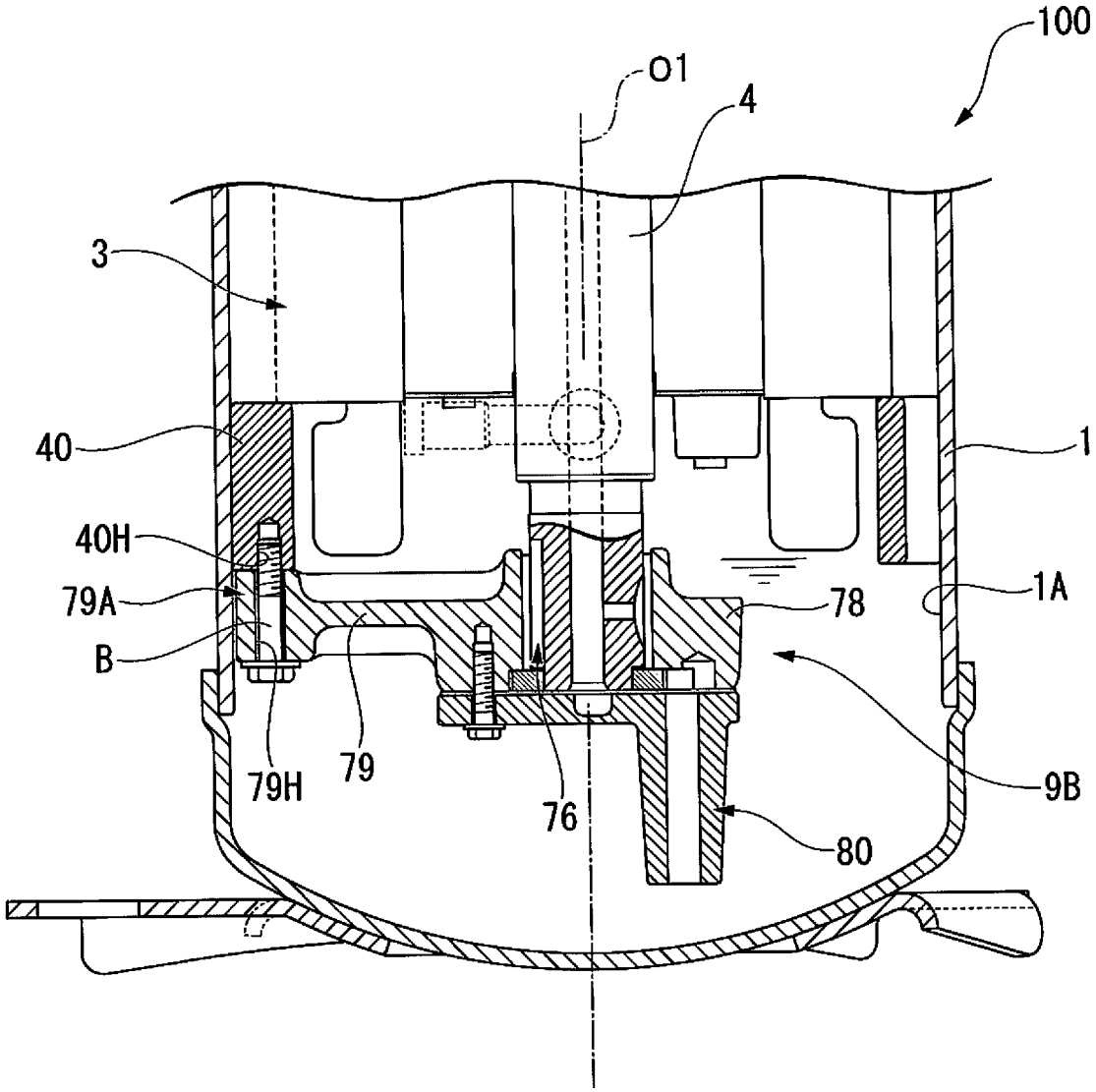


FIG. 3

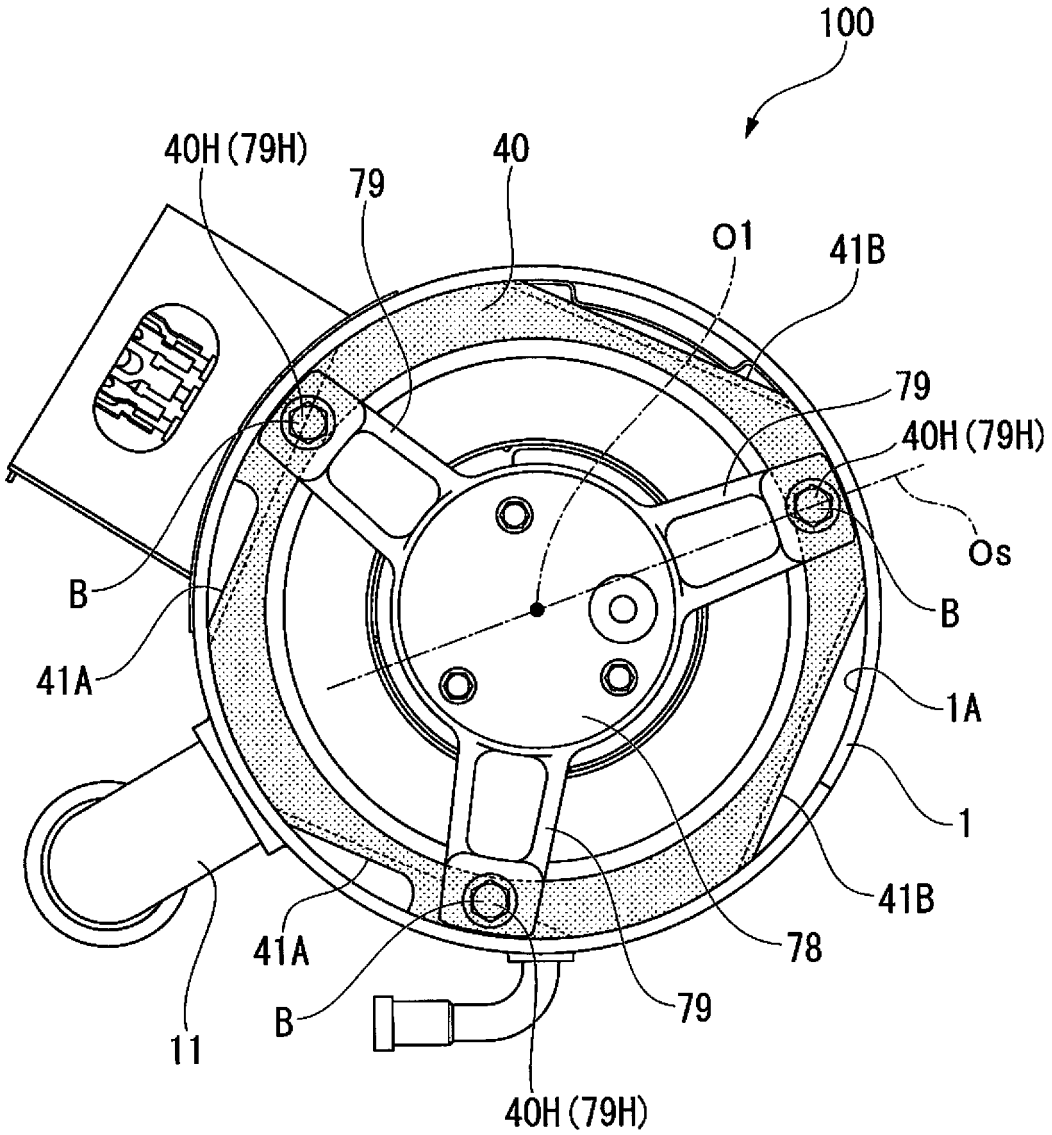

100
40H (79H)
79
40
O1
41B
79
40H (79H)
Os
B
41A
B
1A
1
41B
78
41A
B
79
11
40H (79H)

FIG. 4

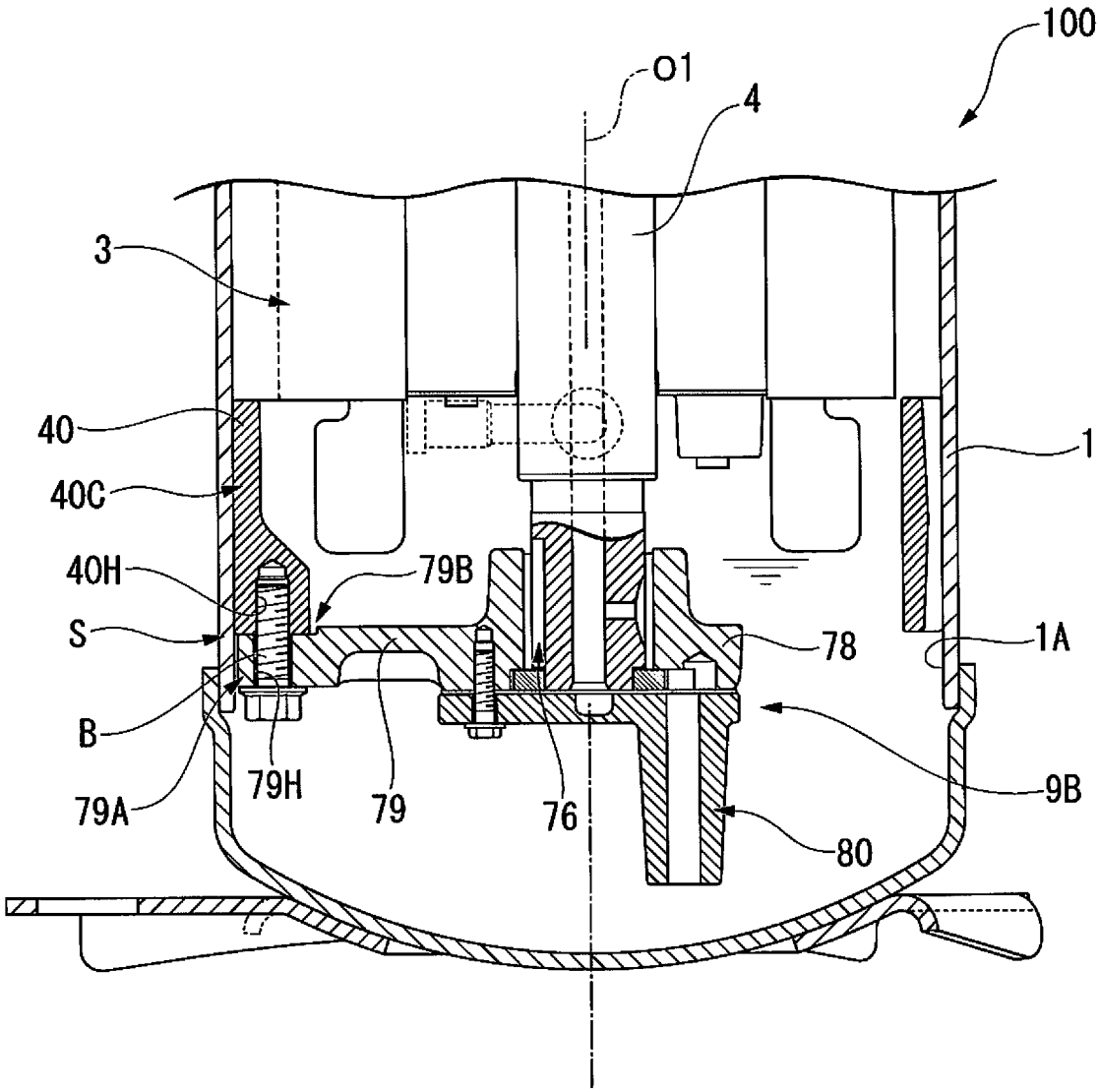


FIG. 5

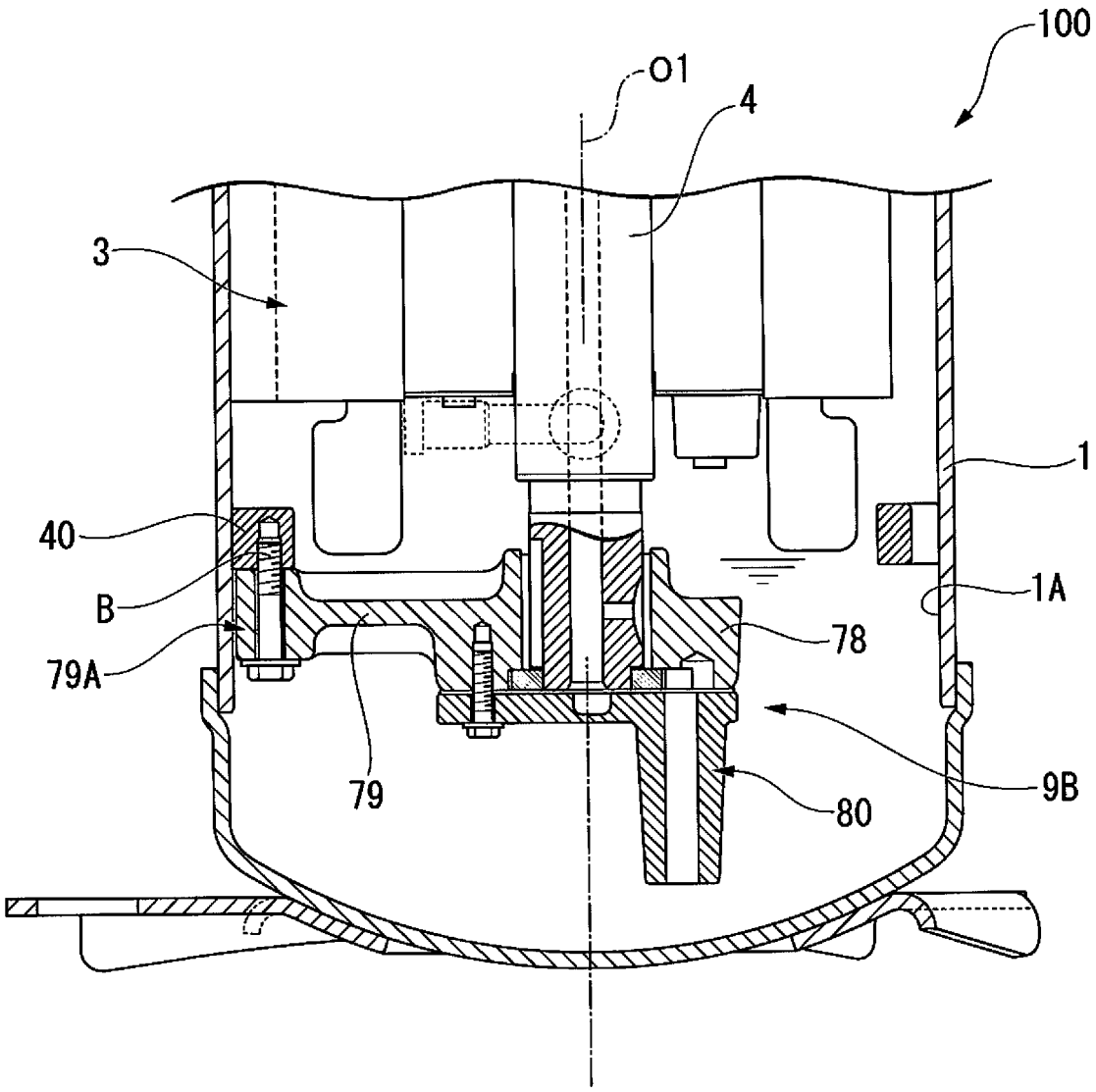


FIG. 6

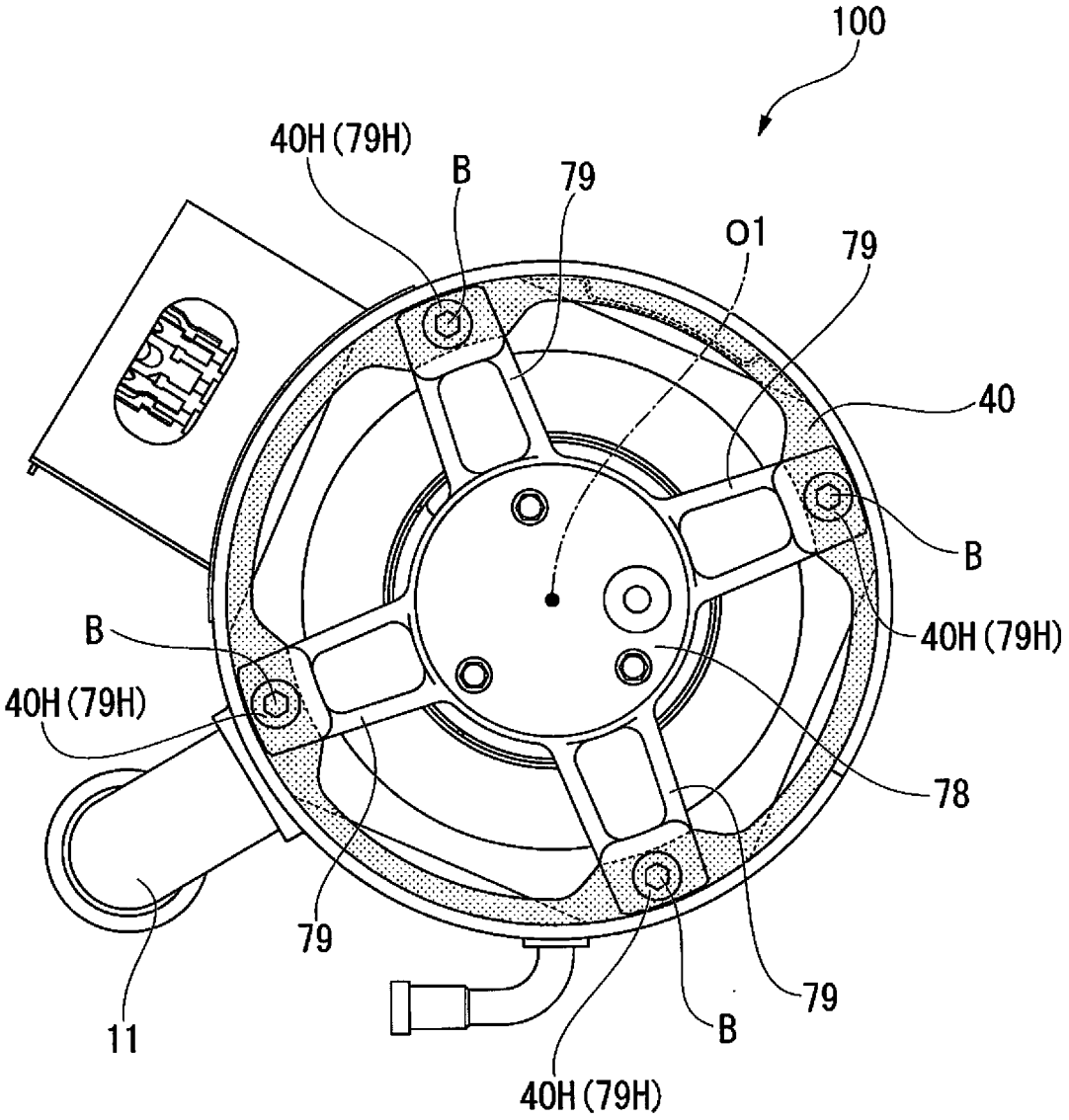
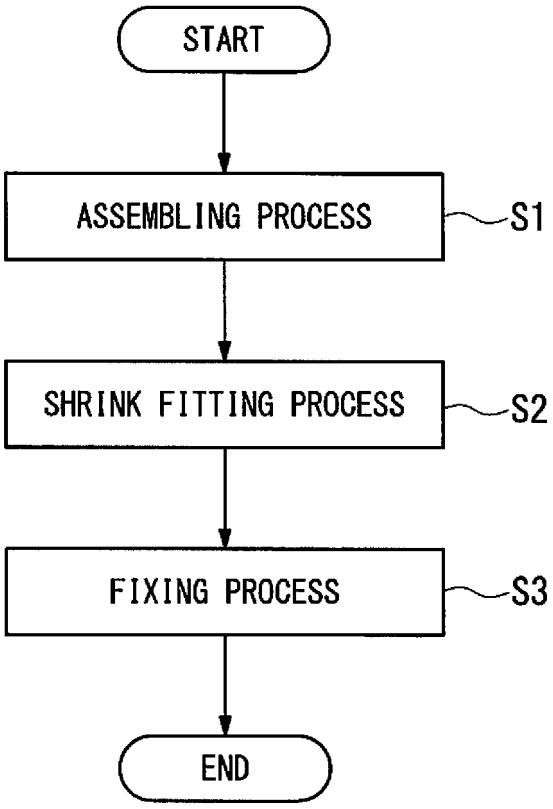


FIG. 7


START
ASSEMBLING PROCESS
S1
SHRINK FITTING PROCESS
S2
FIXING PROCESS
S3
END

REFERENCES CITED IN THE DESCRIPTION

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