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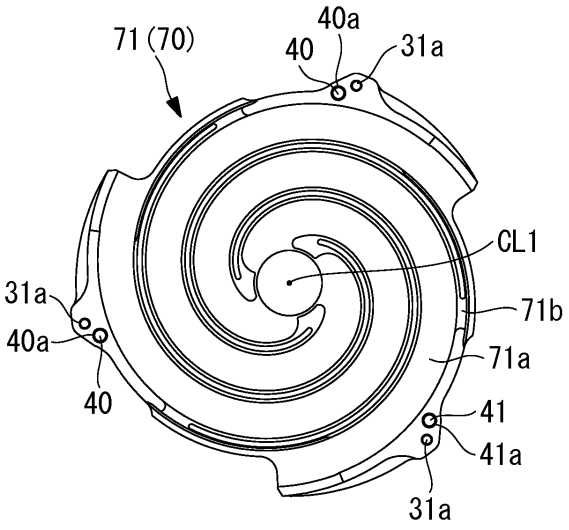
(54) **TWO-WAY-ROTATING SCROLL COMPRESSOR AND METHOD FOR ASSEMBLING SAME**

(57) A co-rotating scroll compressor includes a driving-side scroll member (70) that is rotationally driven by a driving unit and includes a spiral driving-side wall (71b) disposed on a driving-side end plate (71a), and a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall (71b), the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall (71b) to form a compression chamber. Positioning pins (40) that position a phase of the driving-side scroll member (70) around a driving-side rotation axis (CL1) are provided at two positions around the driving-side rotation axis (CL1) at a front end of the driving-side wall (71b) in an axis direction, and dummy pins (41) that are provided at equal angular intervals around the driving-side rotation axis (CL1) with the positioning pins (40) are provided.

FIG. 2

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## Description

[Technical Field]

**[0001]** The present invention relates to a co-rotating scroll compressor and a method of assembling the co-rotating scroll compressor.

[Background Art]

**[0002]** A co-rotating scroll compressor has been well-known (refer to PTL 1). The co-rotating scroll compressor includes a driving-side scroll and a driven-side scroll that rotates in synchronization with the driving-side scroll, and causes a drive shaft causing the driving-side scroll to rotate and a driven shaft supporting rotation of the driven-side scroll to rotate in the same direction at the same angular velocity while the driven-shaft is offset by a revolving radius from the drive shaft.

[Citation List]

[Patent Literature]

**[0003]** [PTL 1] the Publication of Japanese Patent No. 5443132

[Summary of Invention]

[Technical Problem]

**[0004]** The co-rotating scroll compressor adopts a configuration in which each of the driving-side scroll and the driven-side scroll is divided in an axis direction in some cases. Further, the co-rotating scroll compressor adopts a configuration in which a front end of a spiral wall of each of the driving-side scroll and the driven-side scroll is supported by a support member in some cases. In a case where such a configuration is adopted, it is necessary to accurately position phases of the driving-side scroll and the driven-side scroll around a rotation axis in order to ensure engagement of the spiral walls. Such a configuration to perform positioning of the phase is provided at each of at least two positions around the rotation axis. A centroid may be deviated from the rotation axis depending on an installing way of the positioning configuration, which causes noise and vibration.

**[0005]** The present invention is made in consideration of such circumstances, and an object of the present invention is to provide a co-rotating scroll compressor that can suppress generation of noise and vibration caused by centroid deviation of the scroll member as much as possible, and to provide a method of assembling the co-rotating scroll compressor.

[Solution to Problem]

**[0006]** To solve the above-described issues, a co-rotating scroll compressor a method of assembling the co-rotating scroll compressor according to the present invention adopts the following solutions.

**[0007]** A co-rotating scroll compressor according to an aspect of the present invention includes: a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate; a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity. Positioning pins that position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions, and/or positioning pins that position a phase of the driven-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions.

**[0008]** The driving-side wall disposed on the end plate of the driving-side scroll member and the corresponding driven-side wall of the driven-side scroll member engage with each other. The driving-side scroll member is rotationally driven by the driving unit, and the driving force transmitted to the driving-side scroll member is transmitted to the driven-side scroll member through the synchronous driving mechanism. As a result, the driven-side scroll member rotates as well as performs rotational movement in the same direction at the same angular velocity with respect to the driving-side scroll member. As described above, the co-rotating scroll compressor in which both of the driving-side scroll member and the driven-side scroll member rotate is provided.

**[0009]** The positioning of the phase around the rotation axis is performed by using the positioning pins at two positions. Further, the dummy pins are provided at equal angular intervals around the rotation axis with the positioning pins, which makes it possible to fix the centroid around the rotation axis. This makes it possible to achieve low noise and low vibration.

**[0010]** A co-rotating scroll compressor according to another aspect of the present invention includes: a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate; a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-

side end plate and engaging with the driving-side wall to form a compression chamber; and a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity. Assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions, and/or assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driven-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions.

**[0011]** The positioning of the phase around the rotation axis is performed by using the two assembly reference holes in assembly. Further, the dummy holes are provided at equal angular intervals around the rotation axis with the assembly reference holes, which makes it possible to fix the centroid around the rotation axis. This makes it possible to achieve low noise and low vibration.

**[0012]** A co-rotating scroll compressor according to still another aspect of the present invention includes: a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate; a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity. Positioning pins that position a phase of the driving-side scroll member around a rotation axis and are made of a material same as a material of the driving-side wall are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and/or positioning pins that position a phase of the driven-side scroll member around a rotation axis and are made of a material same as a material of the driven-side wall are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction.

**[0013]** The positioning of the phase around the rotation axis is performed by using the two positioning pins. Since the positioning pins are made of the material same as the material of the wall, it is possible to fix the centroid around the rotation axis. This makes it possible to achieve low noise and low vibration.

**[0014]** A co-rotating scroll compressor according to still another aspect of the present invention includes: a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate; a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity. Assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driving-side scroll member around a rotation axis are provided at two positions symmetric with respect to the rotation axis on a surface opposite to a surface provided with the driving-side wall of the driving-side end plate, and/or assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driven-side scroll member around a rotation axis are provided at two positions symmetric with respect to the rotation axis on a surface opposite to a surface provided with the driven-side wall of the driven-side end plate.

**[0015]** Since the two assembly reference holes are provided on the surface of the end plate opposite to the surface provided with the wall, the positioning of the phase around the rotation axis is performed in assembly. Further, since the assembly reference holes are provided symmetrically with respect to the rotation axis, it is possible to fix the centroid around the rotation axis. This makes it possible to achieve low noise and low vibration.

**[0016]** Further, the assembly reference holes are provided on the end plate, which eliminates necessity of providing the assembly reference holes on the wall. Accordingly, it is possible to optionally determine the positions of the assembly reference holes irrespective of the shape of the wall.

**[0017]** Further, in any of the co-rotating scroll compressors according to the respective aspects of the present invention, the driving-side scroll member includes a first driving-side scroll portion and a second driving-side scroll portion. The first driving-side scroll portion includes a first driving-side end plate and a first driving-side wall and is driven by the driving unit. The second driving-side scroll portion includes a second driving-side end plate and a second driving-side wall. Positioning of the phase of the driving-side scroll member around the rotation axis is performed between a front end of the first driving-side wall in the axis direction and a front end of the second driving-side wall in the axis direction.

**[0018]** The positioning pins and the dummy pins are provided at the front end of the driving-side wall. Further, the assembly reference holes and the dummy holes are

provided at the front end of the driving-side wall.

**[0019]** Further, in the co-rotating scroll compressor according to the aspect of the present invention, the driven-side scroll member includes a first driven-side wall and a second driven-side wall. The first driven-side wall is provided on one side surface of the driven-side end plate and engages with the first driving-side wall, and the second driven-side wall is provided on another side surface of the driven-side end plate and engages with the second driving-side wall. The co-rotating scroll compressor includes a first support member and a second support member. The first support member is fixed to a front end side of the first driven-side wall in the axis direction with the first driving-side end plate in between and rotates together with the first driven-side wall. The second support member is fixed to a front end side of the second driven-side wall in the axis direction with the second driving-side end plate in between and rotates together with the second driven-side wall. The positioning of the phase of the driven-side scroll member around the rotation axis is performed between the first driven-side wall and the first support member and between the second driven-side wall and the second support member.

**[0020]** The positioning pins and the dummy pins are provided between the driven-side wall and the support member. Further, the assembly reference holes and the dummy holes are provided between the driven-side wall and the support member.

**[0021]** A method of assembling a co-rotating scroll compressor according to an aspect of the present invention is a method of assembling any of the above-described co-rotating scroll compressors, and the method includes: performing positioning by inserting the assembly pins into the respective assembly reference holes; assembling the driving-side scroll member and/or the driven-side scroll member in a positioned state; and removing the assembly pins.

**[0022]** The assembly pins are removed after the assembly pins are inserted into the respective assembly reference holes to perform positioning in assembly. Accordingly, the pins are not inserted into the assembly reference holes and the dummy holes in the assembled co-rotating scroll compressor.

[Advantageous Effects of Invention]

**[0023]** The centroid of each of the scroll members is located on the rotation axis, which makes it possible to suppress generation of noise and vibration as much as possible.

[Brief Description of Drawings]

**[0024]**

[Fig. 1]
Fig. 1 is a vertical cross-sectional view illustrating a co-rotating scroll compressor according to one embodiment of the present invention.

[Fig. 2]
Fig. 2 is a plan view illustrating a driving-side scroll portion according to a first embodiment.

[Fig. 3]
Fig. 3 is a side view as viewed from an arrow III-III in Fig. 1.

[Fig. 4]
Fig. 4 is a plan view illustrating a driving-side scroll portion according to a second embodiment.

[Fig. 5]
Fig. 5 is a side view corresponding to Fig. 3, according to the second embodiment.

[Fig. 6]
Fig. 6 is a plan view illustrating a driving-side scroll portion according to a third embodiment.

[Fig. 7]
Fig. 7 is a side view corresponding to Fig. 3, according to the third embodiment.

[Fig. 8A]
Fig. 8A is a back view illustrating a first driving-side scroll portion according to a fourth embodiment.

[Fig. 8B]
Fig. 8B is a back view illustrating a second driving-side scroll portion according to a fourth embodiment.

[Description of Embodiments]

**[0025]** Some embodiments of the present invention are described below.

[First Embodiment]

**[0026]** Fig. 1 illustrates a co-rotating scroll compressor 1 according to a first embodiment. The co-rotating scroll compressor 1 can be used as, for example, a supercharger that compresses combustion air (fluid) to be supplied to an internal combustion engine such as a vehicle engine.

**[0027]** The co-rotating scroll compressor 1 includes a housing 3, a motor (driving unit) 5 accommodated on one end side in the housing 3, and a driving-side scroll member 70 and a driven-side scroll member 90 that are accommodated on the other end side in the housing 3.

**[0028]** The housing 3 has a substantially cylindrical shape, and includes a motor accommodation portion 3a that accommodates the motor 5, and a scroll accommodation portion 3b that accommodates the scroll members 70 and 90.

**[0029]** A cooling fin 3c to cool the motor 5 is provided on an outer periphery of the motor accommodation portion 3a. A discharge opening 3d from which compressed air (working fluid) is discharged is provided at an end part of the scroll accommodation portion 3b. Note that, although not illustrated in Fig. 1, the housing 3 includes an air suction opening from which air (working fluid) is sucked in.

**[0030]** The motor 5 is driven by being supplied with

power from an unillustrated power supply source. Rotation of the motor 5 is controlled by an instruction from an unillustrated control unit. A stator 5a of the motor 5 is fixed to an inner periphery of the housing 3. A rotor 5b of the motor 5 rotates around a driving-side rotation axis CL1. A driving shaft 6 that extends on the driving-side rotation axis CL1 is connected to the rotor 5b. The driving shaft 6 is connected to a first driving-side shaft portion 7c of the driving-side scroll member 70.

**[0031]** The driving-side scroll member 70 includes the first driving-side scroll portion 71 on the motor 5 side, and the second driving-side scroll portion 72 on the discharge opening 3d side.

**[0032]** The first driving-side scroll portion 71 includes the first driving-side end plate 71a and the first driving-side walls 71b.

**[0033]** The first driving-side end plate 71a is connected to the first driving-side shaft portion 7c connected to the driving shaft 6, and extends in a direction orthogonal to the driving-side rotation axis CL1. The first driving-side shaft portion 7c is provided so as to be rotatable with respect to the housing 3 through the first driving-side bearing 11 that is a ball bearing.

**[0034]** The first driving-side end plate 71a has a substantially disc shape in a planar view. The plurality of first driving-side walls 71b each formed in a spiral shape are provided on the first driving-side end plate 71a. The first driving-side walls 71b are disposed at equal intervals around the driving-side rotation axis CL1.

**[0035]** The second driving-side scroll portion 72 includes the second driving-side end plate 72a and the second driving-side walls 72b. The plurality of second driving-side walls 72b each formed in a spiral shape are provided similarly to the above-described first driving-side walls 71b.

**[0036]** The cylindrical second driving-side shaft portion 72c that extends in the driving-side rotation axis CL1 is connected to the second driving-side end plate 72a. The second driving-side shaft portion 72c is provided so as to be rotatable with respect to the housing 3 through the second driving-side bearing 14 that is a ball bearing. The second driving-side end plate 72a includes the discharge port 72d extending along the driving-side rotation axis CL1.

**[0037]** Two seal members 16 are provided on a front end side (left side in Fig. 1) of the second driving-side shaft portion 72c relative to the second driving-side bearing 14, between the second driving-side shaft portion 72c and the housing 3. The two seal members 16 and the second driving-side bearing 14 are disposed to include a predetermined interval in the driving side rotation axis CL1. For example, a lubricant that is a grease as a semi-solid lubricant is sealed between the two seal members 16. Note that only one seal member 16 may be provided. In this case, the lubricant is sealed between the seal member 16 and the second driving-side bearing 14.

**[0038]** The first driving-side scroll portion 71 and the second driving-side scroll portion 72 are fixed while the front ends (free ends) of the walls 71b and 72b corresponding to each other face each other. The first driving-side scroll portion 71 and the second driving-side scroll portion 72 are fixed by the wall fixing bolts (wall fixing parts) 31 that are fastened to the flange portions 73 provided at a plurality of positions in the circumferential direction. The flange portions 73 are provided so as to protrude outward in the radial direction.

**[0039]** Fig. 2 is a plan view illustrating the first driving-side scroll portion 71. Note that the second driving-side scroll portion 71 also has a similar shape. As illustrated in the figure, a bolt hole 31a into which a wall fixing bolt 31 is inserted is provided at a winding end of each of the walls 71b. Since the three walls 71b are provided in the present embodiment, the wall fixing bolt 31 is provided at each of three positions.

**[0040]** A positioning pin hole 40a into which a positioning pin 40 is fitted is provided at a side of each of two of the three bolt holes 31a. A dummy pin hole 41a into which a dummy pin 41 is inserted is provided at a side of one remaining bolt hole 31a. The dummy pin 41 is made of the material same as the material of the positioning pins 40, and the dummy pin 41 is loosely fitted into the dummy pin hole 41a so as not to perform positioning.

**[0041]** The two positioning pins 40 and the one dummy pin 41 are provided at equal intervals around the driving-side rotation axis CL1.

**[0042]** As illustrated in Fig. 1, the driven-side scroll member 90 includes the driven-side end plate 90a that is located at a substantially center in the axis direction (horizontal direction in figure). The discharge through hole (through hole) 90h is provided at a center of the driven-side end plate 90a, and causes the compressed air to flow toward the discharge port 72d.

**[0043]** The first driven-side walls 91b are provided on one side surface of the driven-side end plate 90a, and the second driven-side walls 92b are provided on the other side surface of the driven-side end plate 90a. The first driven-side walls 91b provided on the motor 5 side from the driven-side end plate 90a engage with the first driving-side walls 71b of the first driving-side scroll portion 71. The second driven-side walls 92b provided on the discharge opening 3d side from the driven-side end plate 90a engage with the second driving-side walls 72b of the second driving-side scroll portion 72.

**[0044]** A first support member 33 and a second support member 35 are provided at respective ends of the driven-side scroll member 90 in the axis direction (horizontal direction in figure). The first support member 33 is disposed on the motor 5 side, and the second support member 35 is disposed on the discharge opening 3d side.

**[0045]** The first support member 33 is fixed to the front ends (free ends) of the respective first driven-side walls 91b on the outer peripheral side by first support fixing bolts 34, and the second support member 35 is fixed to the front ends (free ends) of the respective second driven-side walls 92b on the outer peripheral side by second support fixing bolts 36.

**[0046]** The shaft portion 33a is provided on the center axis side of the first support member 33, and the shaft portion 33a is fixed to the housing 3 through the first support member bearing 37. The shaft portion 35a is provided on the center axis side of the second support member 35, and the shaft portion 35a is fixed to the housing 3 through the second support member bearing 38. As a result, the driven-side scroll member 90 rotates around the driven-side rotation axis CL2 through the support members 33 and 35.

**[0047]** The pin-ring mechanism (synchronous driving mechanism) 15 is provided between the first support member 33 and the first driving-side end plate 71a. More specifically, a rolling bearing (ring) is provided on the first driving-side end plate 71a, and the pin member 15b is provided on the first support member 33. The pin-ring mechanism 15 transmits the driving force from the driving-side scroll member 70 to the driven-side scroll member 90, and causes the scroll members 70 and 90 to perform rotational movement in the same direction at the same angular velocity.

**[0048]** Fig. 3 is a side view as viewed from an arrow III-III in Fig. 1. The first support fixing bolts 34 are provided at three positions on the first support member 33. A positioning pin hole 42a into which a positioning pin 42 is fitted is provided at a side of each of two of the three first support fixing bolts 34. A dummy pin hole 43a into which a dummy pin 43 is inserted is provided at a side of one remaining first support fixing bolt 34. The dummy pin 43 is made of the material same as the material of the positioning pins 42, and the dummy pin 43 is loosely fitted into the dummy pin hole 43a so as not to perform positioning.

**[0049]** The two positioning pins 42 and the one dummy pin 43 are provided at equal intervals around the driven-side rotation axis CL2.

**[0050]** Note that the second support member 35 also has a similar configuration.

**[0051]** The co-rotating scroll compressor 1 including the above-described configuration operates in the following manner.

**[0052]** When the driving shaft 6 rotates around the driving-side rotation axis CL1 by the motor 5, the first driving-side shaft portion 7c connected to the driving shaft 6 also rotates, and the driving-side scroll member 70 accordingly rotates around the driving-side rotation axis CL1. When the driving-side scroll member 70 rotates, the driving force is transmitted from the support members 33 and 35 to the driven-side scroll member 90 through the pin-ring mechanism 15, and the driven-side scroll member 90 rotates around the driven-side rotation axis CL2. At this time, when the pin member 15b of the pin-ring mechanism 15 moves while being in contact with the inner peripheral surface of the circular hole, the both scroll members 70 and 90 perform rotational movement in the same direction at the same angular velocity.

**[0053]** When the scroll members 70 and 90 perform rotational movement, the air sucked through the air suction opening of the housing 3 is sucked in from outer peripheral side of each of the scroll members 70 and 90, and is taken into the compression chambers formed by the scroll members 70 and 90. Further, compression is separately performed in the compression chambers formed by the first driving-side walls 71b and the first driven-side walls 91b and in the compression chambers formed by the second driving-side walls 72b and the second driven-side walls 92b. A volume of each of the compression chambers is reduced as each of the compression chambers moves toward the center, which compresses the air. The air compressed by the first driving-side walls 71b and the first driven-side walls 91b passes through the discharge through hole 90h provided in the driven-side end plate 90a, and is joined with the air compressed by the second driving-side walls 72b and the second driven-side walls 92b. The resultant air passes through the discharge port 72d and is discharged to outside from the discharge opening 3d of the housing 3. The discharged compressed air is guided to an unillustrated internal combustion engine, and is used as combustion air.

**[0054]** The present embodiment achieves the following action effects.

**[0055]** As illustrated in Fig. 2, the positioning of the phase around the driving-side rotation axis CL1 is performed by using the positioning pins 40 at the two positions on the driving-side scroll member 70. Further, the centroid is fixed around the driving-side rotation axis CL1 by providing the dummy pin 41 at the equal angular intervals around the driving-side rotation axis CL1 with the positioning pins 40.

**[0056]** As illustrated in Fig. 3, the positioning of the phase around the driven-side rotation axis CL2 is performed by using the positioning pins 42 at the two positions on the driven-side scroll member 90. Further, the centroid is fixed around the driven-side rotation axis CL2 by providing the dummy pin 43 at the equal angular intervals around the driven-side rotation axis CL2 with the positioning pins 42.

**[0057]** As a result, it is possible to achieve low noise and low vibration.

[Second Embodiment]

**[0058]** A second embodiment is different from the first embodiment in that no positioning pin is provided in the second embodiment, and the other configurations of the second embodiment are similar to the configurations of the first embodiment. Therefore, only difference is described.

**[0059]** As illustrated in Fig. 4, an assembly reference hole 44a is provided at a side of each of the three wall fixing bolts 31. The three assembly reference holes 44a are provided at equal angular intervals around the driving-side rotation axis CL1. The assembly reference holes 44a are holes into which respective assembly pins are inserted when the first driving-side scroll portion 71 and

the second driving-side scroll portion 72 are assembled. Since the positioning around the driving-side rotation axis CL1 is performed by the two assembly pins, one of the three assembly reference holes 44a becomes a dummy hole not used in assembly. Note that the three assembly reference holes 44a have the same shape.

**[0060]** To assemble the first driving-side scroll portion 71 and the second driving-side scroll portion 72, the assembly pins are first inserted into the two assembly reference holes 44a, and the both scroll portions 71 and 72 are combined and positioned. The both scroll portions 71 and 72 are then fixed by the wall fixing bolts 31. Thereafter, the assembly pins are removed to complete assembly of the both scroll portions 71 and 72.

**[0061]** As illustrated in Fig. 5, an assembly reference hole 45a is provided at a side of each of the three first support fixing bolts 34. The three assembly reference holes 45a are provided at equal angular intervals around the driven-side rotation axis CL2. The assembly reference holes 45a are holes into which the respective assembly pins are inserted when the first support member 33 and the driven-side scroll member 90 are assembled. Since the positioning around the driven-side rotation axis CL2 is performed by the two assembly pins, one of the three assembly reference holes 45a becomes a dummy hole not used in assembly. Note that the three assembly reference holes 45a have the same shape.

**[0062]** Note that the second support member 35 also has a similar configuration.

**[0063]** To assemble the driven-side scroll member 90 and the first support member 33, the assembly pins are first inserted into the two assembly reference holes 45a, and the driven-side scroll member 90 and the first support member 33 are combined and positioned. The driven-side scroll member 90 and the first support member 33 are then fixed by the first support fixing bolts 34. Thereafter, the assembly pins are removed to complete assembly of the driven-side scroll member 90 and the first support member 33. Note that the driven-side scroll member 90 and the second support member 35 are assembled in a similar manner.

**[0064]** The present embodiment achieves the following action effects.

**[0065]** The positioning of the phases around the rotation axes CL1 and CL2 is performed in assembly by respectively using the two assembly reference holes 44a and the two assembly reference holes 45a. Further, the centroids around the rotation axes CL1 and CL2 can be fixed by providing the dummy holes (holes same as assembly reference holes 44a and 45a) at equal angular intervals around the rotation axes CL1 and CL2 with the assembly reference holes 44a and 45a, respectively. This makes it possible to achieve low noise and low vibration.

[Third Embodiment]

**[0066]** A third embodiment is different from the first embodiment in configuration of each of the positioning pins, and the other configurations of the third embodiment are similar to the configurations of the first embodiment. Therefore, only difference is described.

**[0067]** As illustrated in Fig. 6, the positioning pin 40 is provided at a side of each of two of the three wall fixing bolts 31, as with the first embodiment. No positioning pin 40 is provided at a side of one remaining wall fixing bolt 31 and no pin hole is provided. The positioning pins 40 are made of the material same as the material of the driving-side scroll member 70. In other words, when the driving-side scroll member 70 is made of an aluminum alloy, the positioning pins 40 are also made of the aluminum alloy.

**[0068]** As illustrated in Fig. 7, the positioning pin 42 is provided at a side of each of two of the three first support fixing bolts 34, as with the first embodiment. No positioning pin 42 is provided at a side of one remaining first support fixing bolt 34, and no pin hole is provided. The positioning pins 42 are made of the material same as the material of the driven-side scroll member 90. In other words, when the driven-side scroll member 90 is made of an aluminum alloy, the positioning pins 42 are also made of the aluminum alloy.

**[0069]** The present embodiment achieves the following action effects.

**[0070]** The positioning of the phases around the rotation axes CL1 and CL2 are performed by respectively using the two positioning pins 40 and the two positioning pins 42. The positioning pins 40 and 42 are respectively made of the materials same as the materials of the scroll members 70 and 90, which make it possible to fix the centroids around of the rotation axes CL1 and CL2. As a result, it is possible to achieve low noise and low vibration.

[Fourth Embodiment]

**[0071]** A fourth embodiment is different from the first embodiment in that the positioning is performed at the front end of each of the walls 71b, 72b, 91b, and 92b in the first embodiment whereas the positioning is performed with the end plates in the fourth embodiment. The other configurations of the fourth embodiment are similar to the configurations of the first embodiment. Therefore, only difference is described.

**[0072]** As illustrated in Fig. 8A, two assembly reference holes 46a are provided with the driving-side rotation axis CL1 in between, on a surface opposite to the surface provided with the walls 71b, of the end plate 71a of the first driven-side scroll portion 71. The bolt holes 31a are provided at three positions on the first driven-side scroll portion 71; however, the positioning pin hole 40a and the dummy pin hole 41a are not provided at the sides of the respective bolt holes 31a, unlike the first embodiment. Note that a reference numeral 15b1 in the figure indicates a pin hole into which the pin member 15b illustrated in Fig. 1 is inserted.

**[0073]** As illustrated in Fig. 8B, the two assembly reference holes 46a are provided with the driving-side rotation axis CL1 in between, on a surface opposite to the surface provided with the walls 72b, of the end plate 72a of the second driven-side scroll portion 72. The bolt holes 31a are provided at three positions on the second driven-side scroll portion 72; however, the positioning pin hole 40a and the dummy pin hole 41a are not provided at the sides of the respective bolt holes 31a, unlike the first embodiment.

**[0074]** To assemble the first driving-side scroll portion 71 and the second driving-side scroll portion 72, the assembly pins are first inserted into the two assembly reference holes 46a, and the both scroll portions 71 and 72 are combined and positioned. The both scroll portions 71 and 72 are then fixed by the wall fixing bolts 31. Thereafter, the assembly pins are removed to complete assembly of the both scroll portions 71 and 72.

**[0075]** The present embodiment achieves the following action effects.

**[0076]** The assembly reference holes 46a are provided at the two positions on the surface of each of the end plates 71a and 72a opposite to the surface provided with the walls 71b and 72b. Therefore, the positioning of the phase around the rotation axis CL1 is performed in assembly. Further, since the assembly reference holes 46a are provided symmetrically with respect to the rotation axis CL1, it is possible to fix the centroid around the rotation axis CL1. This makes it possible to achieve low noise and low vibration.

**[0077]** Further, the assembly reference holes 46a are provided on each of the end plates 71a and 72a, which eliminates necessity of providing the assembly reference holes on the walls 71b and 72b. Accordingly, it is possible to optionally determine the positions of the assembly reference holes irrespective of the shapes of the walls 71b and 72b.

**[0078]** Although the case where the number of each of walls 71b, 72b, 91b, and 92b is three has been described as an example in the above-described embodiments, the present invention is not limited thereto. The present invention is applicable to a scroll compressor that includes three or more walls, preferably, an odd number of walls on which the positioning pins cannot be provided symmetrically with respect to the rotation axis.

**[0079]** Note that, in the above-described embodiment, the co-rotating scroll compressor is used as the supercharger; however, the present invention is not limited thereto. The co-rotating scroll compressor is widely used to compress fluid, and for example, can be used as a refrigerant compressor used in air conditioner. In addition, the scroll compressor 1 according to the present invention is applicable to an air brake device using air force, as a brake system for a railway vehicle.

[Reference Signs List]

**[0080]**

| | |
|---|---|
| 1 | Co-rotating scroll compressor |
| 3 | Housing |
| 3a | Motor accommodation portion |
| 3b | Scroll accommodation portion (housing) |
| 3c | Cooling fin |
| 3d | Discharge opening |
| 5 | Motor (driving unit) |
| 5a | Stator |
| 5b | Rotor |
| 6 | Driving shaft |
| 7c | First driving-side shaft portion |
| 11 | First driving-side bearing |
| 14 | Second driving-side bearing |
| 15 | Pin-ring mechanism (synchronous driving mechanism) |
| 15b | Pin member |
| 16 | Seal member |
| 31 | Wall fixing bolt (wall fixing part) |
| 31a | Bolt hole |
| 33 | First support member |
| 33a | Shaft portion |
| 34 | First support fixing bolt |
| 35 | Second support member |
| 35a | Shaft portion |
| 36 | Second support fixing bolt |
| 37 | First support member bearing |
| 38 | Second support member bearing |
| 40 | Positioning pin |
| 40a | Positioning pin hole |
| 41 | Dummy pin |
| 41a | Dummy pin hole |
| 42 | Positioning pin |
| 42a | Positioning pin hole |
| 43 | Dummy pin |
| 43a | Dummy pin hole |
| 44a | Assembly reference hole |
| 45a | Assembly reference hole |
| 46a | Assembly reference hole |
| 70 | Driving-side scroll member |
| 71 | First driving-side scroll portion |
| 71a | First driving-side end plate |
| 71b | First driving-side wall |
| 72 | Second driving-side scroll portion |
| 72a | Second driving-side end plate |
| 72b | Second driving-side wall |
| 72c | Second driving-side shaft portion |
| 72d | Discharge port |
| 73 | Flange portion |
| 90 | Driven-side scroll member |
| 90a | Driven-side end plate |
| 90h | Discharge through hole (through hole) |
| 91b | First driven-side wall |
| 92b | Second driven-side wall |
| CL1 | Driving-side rotation axis |
| CL2 | Driven-side rotation axis |

## Claims

**1.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;
a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and
a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein
positioning pins that position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions, and/or
positioning pins that position a phase of the driven-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions.

**2.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;
a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and
a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein
assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions, and/or
assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driven-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions.

**3.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;
a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and
a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein
positioning pins that position a phase of the driving-side scroll member around a rotation axis and are made of a material same as a material of the driving-side wall are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and/or
positioning pins that position a phase of the driven-side scroll member around a rotation axis and are made of a material same as a material of the driven-side wall are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction.

**4.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;

a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and

a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein

assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driving-side scroll member around a rotation axis are provided at two positions symmetric with respect to the rotation axis on a surface opposite to a surface provided with the driving-side wall of the driving-side end plate, and/or

assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driven-side scroll member around a rotation axis are provided at two positions symmetric with respect to the rotation axis on a surface opposite to a surface provided with the driven-side wall of the driven-side end plate.

**5.** The co-rotating scroll compressor according to any one of claims 1 to 4, wherein

the driving-side scroll member includes a first driving-side scroll portion and a second driving-side scroll portion, the first driving-side scroll portion including a first driving-side end plate and a first driving-side wall and being driven by the driving unit, and the second driving-side scroll portion including a second driving-side end plate and a second driving-side wall, and

positioning of the phase of the driving-side scroll member around the rotation axis is performed between a front end of the first driving-side wall in the axis direction and a front end of the second driving-side wall in the axis direction.

**6.** The co-rotating scroll compressor according to claim 5, wherein

the driven-side scroll member includes a first driven-side wall and a second driven-side wall, the first driven-side wall being provided on one side surface of the driven-side end plate and engaging with the first driving-side wall, and the second driven-side wall being provided on another side surface of the driven-side end plate and engaging with the second driving-side wall,

the co-rotating scroll compressor includes a first support member and a second support member, the first support member being fixed to a front end side of the first driven-side wall in the axis direction with the first driving-side end plate in between and rotating together with the first driven-side wall, and the second support member being fixed to a front end side of the second driven-side wall in the axis direction with the second driving-side end plate in between and rotating together with the second driven-side wall, and

positioning of the phase of the driven-side scroll member around the rotation axis is performed between the first driven-side wall and the first support member and between the second driven-side wall and the second support member.

**7.** A method of assembling the co-rotating scroll compressor according to claim 2 or 4, the method comprising:

performing positioning by inserting the assembly pins into the respective assembly reference holes;

assembling the driving-side scroll member and/or the driven-side scroll member in a positioned state; and

removing the assembly pins.

**Amended claims under Art. 19.1 PCT**

**1.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;

a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and

a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein

positioning pins that position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions, and/or

positioning pins that position a phase of the driven-side scroll member around a rotation axis are

provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy pins that are provided at equal angular intervals around the rotation axis with the positioning pins are provided at one or more positions.

**2.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;
a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and
a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein
assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driving-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions, and/or
assembly reference holes into which respective assembly pins are inserted in assembly to position a phase of the driven-side scroll member around a rotation axis are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction, and dummy holes that are provided at equal angular intervals around the rotation axis with the assembly reference holes are provided at one or more positions.

**3.** A co-rotating scroll compressor, comprising:

a driving-side scroll member that is rotationally driven by a driving unit and includes a spiral driving-side wall disposed on a driving-side end plate;
a driven-side scroll member that includes a driven-side wall corresponding to the driving-side wall, the driven-side wall being disposed on a driven-side end plate and engaging with the driving-side wall to form a compression chamber; and
a synchronous driving mechanism that transmits driving force from the driving-side scroll member to the driven-side scroll member to cause the driving-side scroll member and the driven-side scroll member to perform rotational movement in a same direction at a same angular velocity, wherein
positioning pins that position a phase of the driving-side scroll member around a rotation axis and are made of a material same as a material of the driving-side wall are provided at two positions around the rotation axis at a front end of the driving-side wall in an axis direction, and/or
positioning pins that position a phase of the driven-side scroll member around a rotation axis and are made of a material same as a material of the driven-side wall are provided at two positions around the rotation axis at a front end of the driven-side wall in an axis direction.

**4.** (deleted)

**5.** (amended) The co-rotating scroll compressor according to any one of claims 1 to 3, wherein
the driving-side scroll member includes a first driving-side scroll portion and a second driving-side scroll portion, the first driving-side scroll portion including a first driving-side end plate and a first driving-side wall and being driven by the driving unit, and the second driving-side scroll portion including a second driving-side end plate and a second driving-side wall, and
positioning of the phase of the driving-side scroll member around the rotation axis is performed between a front end of the first driving-side wall in the axis direction and a front end of the second driving-side wall in the axis direction.

**6.** The co-rotating scroll compressor according to claim 5, wherein
the driven-side scroll member includes a first driven-side wall and a second driven-side wall, the first driven-side wall being provided on one side surface of the driven-side end plate and engaging with the first driving-side wall, and the second driven-side wall being provided on another side surface of the driven-side end plate and engaging with the second driving-side wall,
the co-rotating scroll compressor includes a first support member and a second support member, the first support member being fixed to a front end side of the first driven-side wall in the axis direction with the first driving-side end plate in between and rotating together with the first driven-side wall, and the second support member being fixed to a front end side of the second driven-side wall in the axis direction with the second driving-side end plate in between

and rotating together with the second driven-side wall, and
positioning of the phase of the driven-side scroll member around the rotation axis is performed between the first driven-side wall and the first support member and between the second driven-side wall and the second support member.

**7.** (amended) A method of assembling the co-rotating scroll compressor according to claim 2, the method comprising:

performing positioning by inserting the assembly pins into the respective assembly reference holes;
assembling the driving-side scroll member and/or the driven-side scroll member in a positioned state; and
removing the assembly pins.

FIG. 1

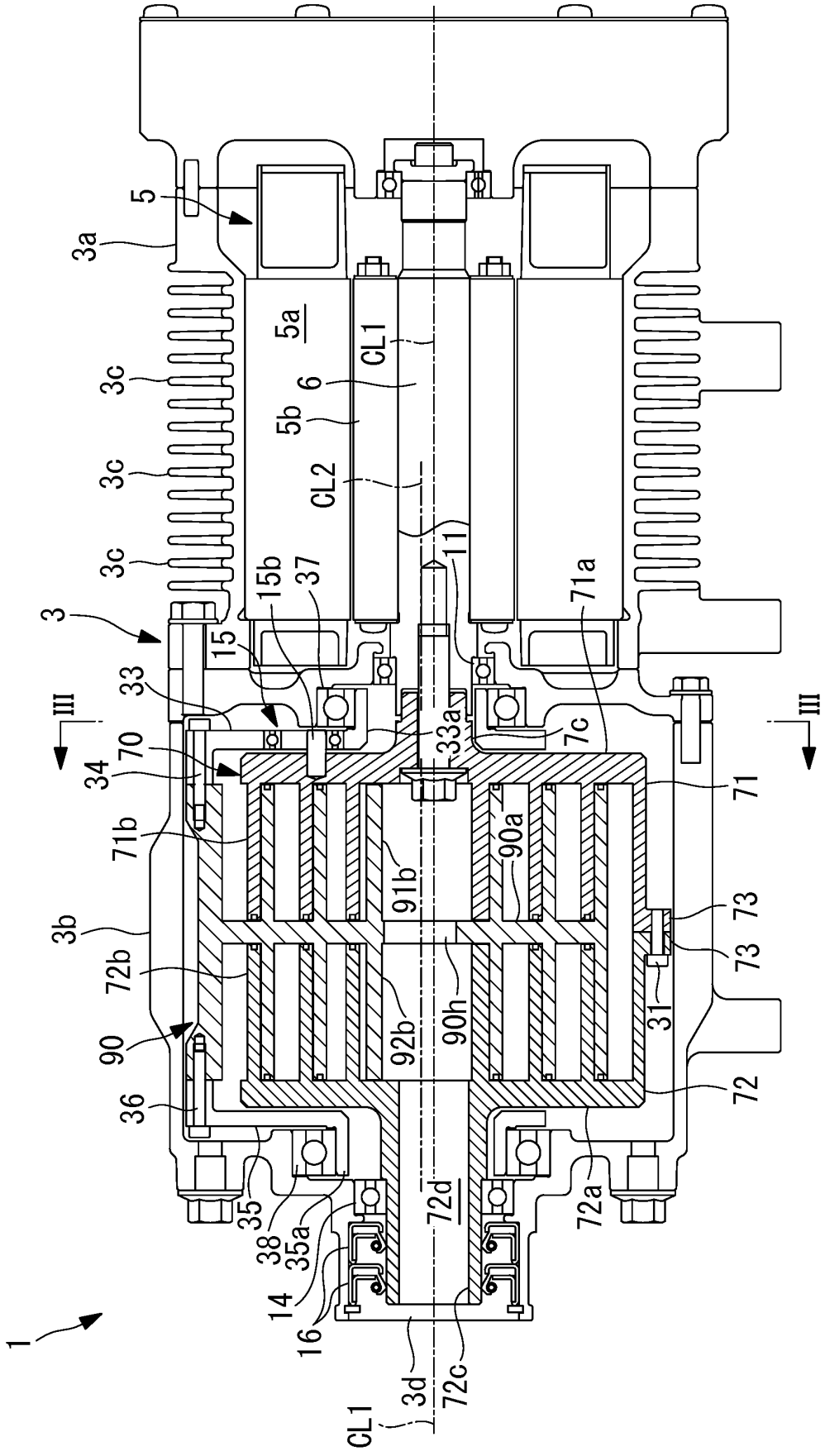
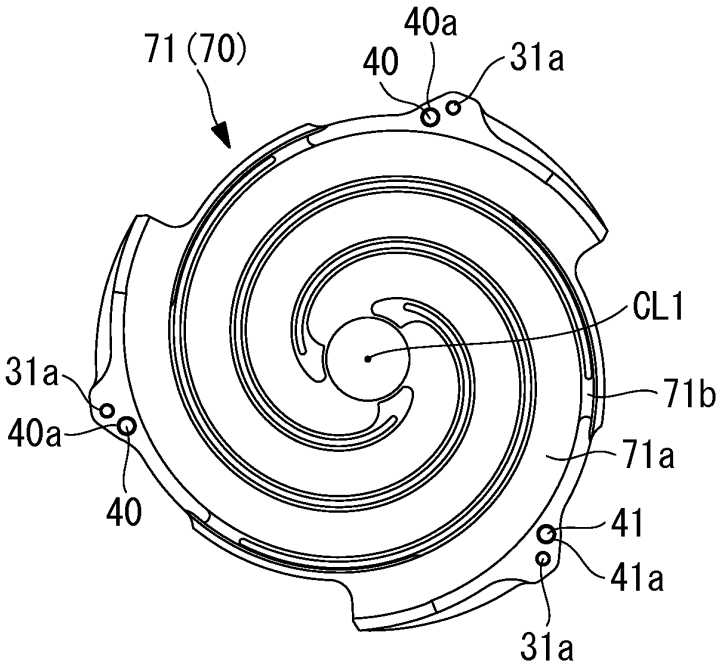

1
3
3a
3b
3c
3d
5
5a
5b
6
CL1
CL2
11
14
15
15b
16
31
33
33a
34
35
35a
36
37
38
70
71
71a
71b
72
72a
72b
72c
72d
73
7c
90
90a
90h
91b
92b
III
III

FIG. 2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CL1
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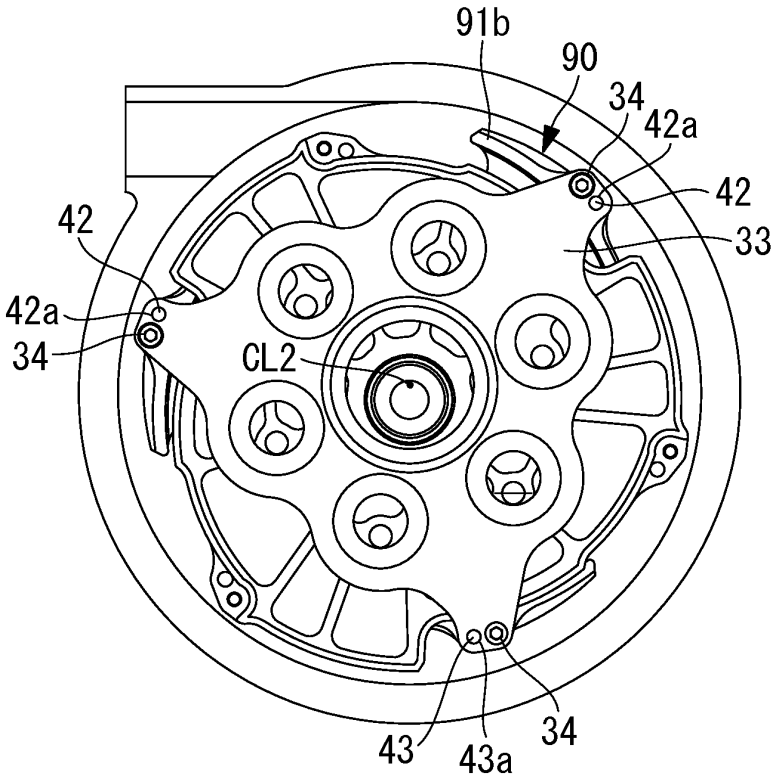
41
41a
31a

FIG. 3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42a
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42a
34
CL2
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43a
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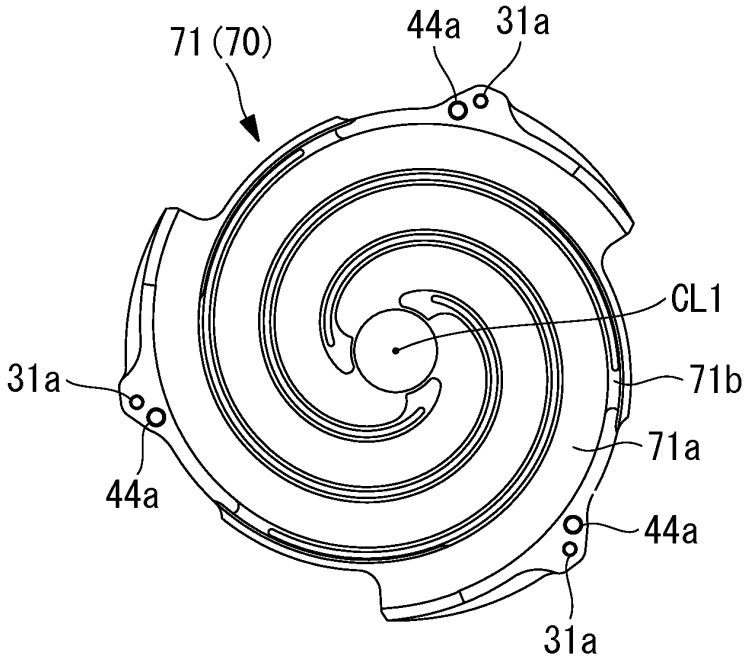
FIG. 4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CL1
71b
71a
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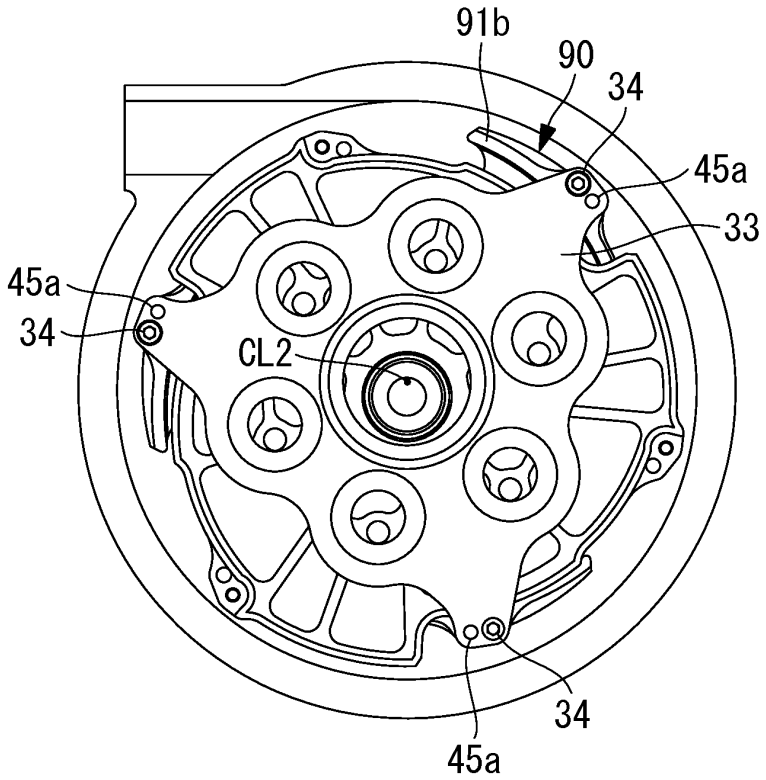
31a

FIG. 5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45a
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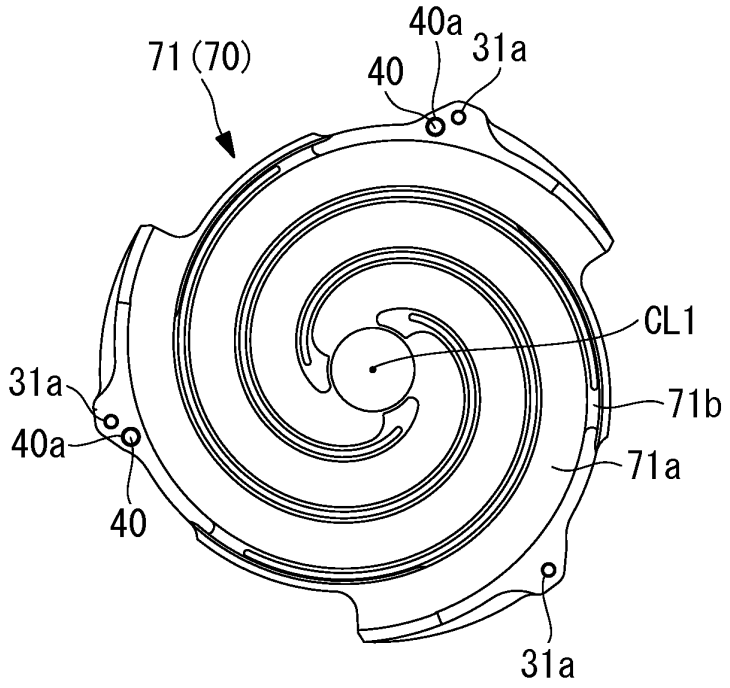
45a
34
CL2
34
45a

FIG. 6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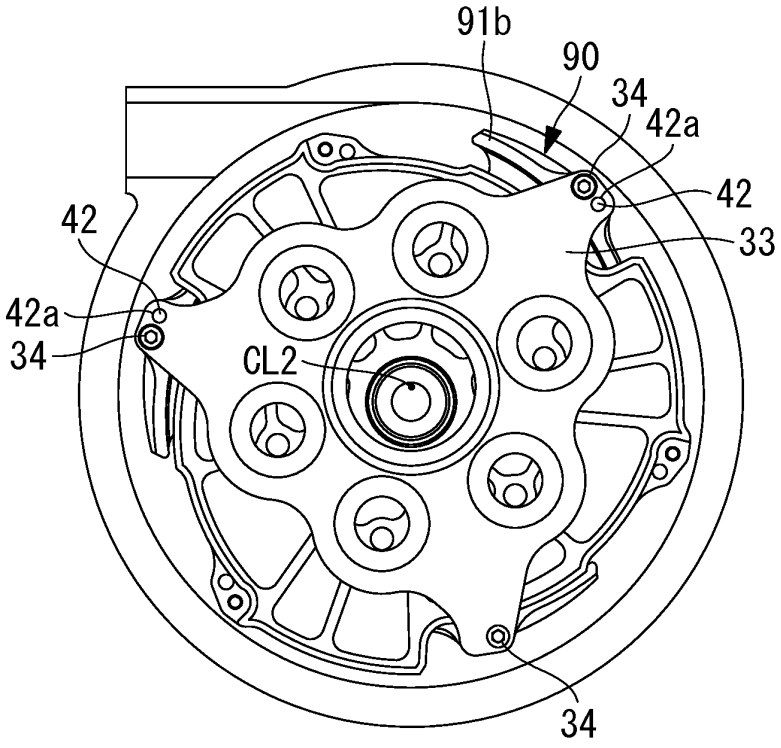
CL1
31a
71b
40a
71a
40
31a

FIG. 7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90
34
42a
42
42
33
42a
34
CL2
34

FIG. 8A

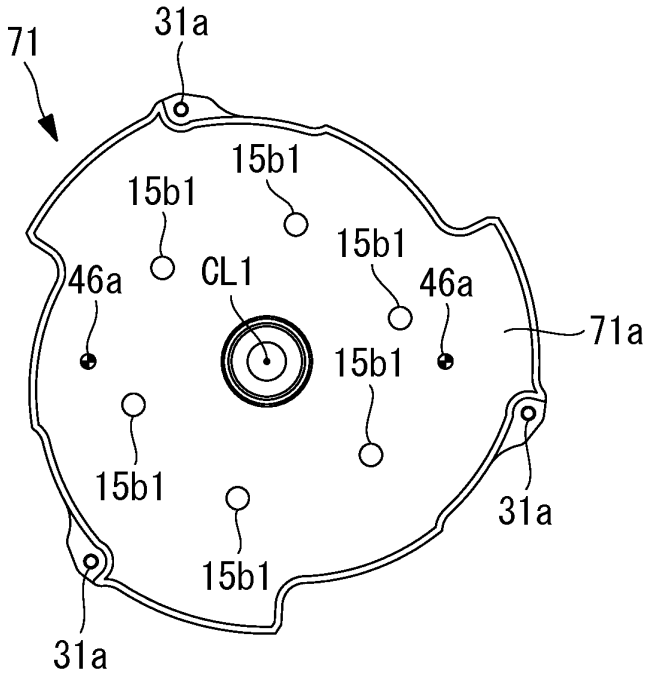
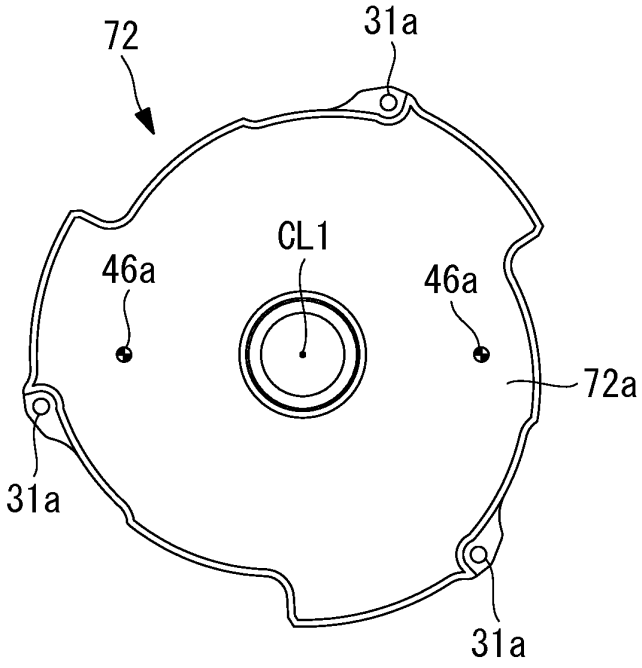

71
31a
15b1
15b1
15b1
46a
CL1
46a
71a
15b1
15b1
31a
15b1
31a

FIG. 8B


72
31a
CL1
46a
46a
72a
31a
31a

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/004225

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F04C18/02(2006.01)i, F04C29/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F04C18/02, F04C29/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y<br>A | JP 3-47492 A (MITSUBISHI ELECTRIC CORPORATION) 28 February 1991, page 3, upper left column, line 5 to page 4, upper left column, line 5, fig. 1-4 (Family: none) | 4-7<br>1-3 |
| Y | JP 2014-231749 A (SCROLL GIKEN KK) 11 December 2014, paragraphs [0017]-[0027], fig. 1-5 (Family: none) | 4-7 |
| Y | JP 2010-71226 A (SCROLL GIKEN KK) 02 April 2010, paragraphs [0008], [0013], [0014], fig. 1 (Family: none) | 4-7 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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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
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 11.04.2018 | 24.04.2018 |
| Name and mailing address of the ISA/<br>Japan Patent Office<br>3-4-3, Kasumigaseki, Chiyoda-ku,<br>Tokyo 100-8915, Japan | Authorized officer<br><br>Telephone No. |

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

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### Patent documents cited in the description


- JP 5443132 B **[0003]**