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(54) **SCROLL COMPRESSOR**

SPIRALVERDICHTER

COMPRESSEUR À SPIRALES

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a scroll compressor.

Description of Related Art

[0002] A scroll compressor has a main shaft rotationally driven by an electric motor, an eccentric shaft installed at a position offset with respect to the main shaft, a turning scroll supported by the eccentric shaft via a bearing apparatus, and a fixed scroll configured to form a displaceable compression chamber by opposing the turning scroll. The turning scroll performs revolution, i.e., turning movement, about an axis of the main shaft without auto-rotation. Accordingly, a fluid introduced into the compression chamber is compressed.

[0003] As a specific example of the above-mentioned scroll compressor, an apparatus disclosed in the following Japanese Unexamined Patent Application, First Publication No. S59-115488 is known. In particular, in the scroll compressor of Japanese Unexamined Patent Application, First Publication No. S59-115488, as the bearing apparatus, a sliding bearing is employed at an end portion of an eccentric shaft (a crankshaft). Further, in order to lubricate the sliding bearing, an oil supply hole configured to introduce lubricating oil from an oil reservoir section of a lower section is installed at the crankshaft. As the crankshaft rotates, the lubricating oil arrives at a crankshaft eccentric shaft section through an oil supply hole. An oil supply hole in communication with the oil supply hole and an oil supply groove extending from the oil supply hole in an axial direction of the crankshaft are formed in an outer circumferential surface of the eccentric shaft supported by the sliding bearing. Accordingly, the lubricating oil lubricates a surface of the sliding bearing. The lubricating oil provided to lubricate the sliding bearing is discharged into a space formed in a bearing member that supports the main shaft. The above-mentioned space functions as an accommodating space of a balance weight provided to offset a centrifugal force of the turning scroll. Document US5531578A discloses a scroll compressor with the features of the preamble of claim 1.

SUMMARY OF THE INVENTION

[0004] However, in the above-mentioned scroll compressor, since the lubricating oil is discharged to the space through a narrow gap formed between the balance weight and the turning scroll, when the rotational speed of the crankshaft is increased, a flow resistance is increased, and the lubricating oil cannot be smoothly discharged. As a result, the lubricating oil cannot be sufficiently cooled, the sliding bearing may burn, and thus stable operation of the scroll compressor may become difficult.

[0005] In consideration of the above-mentioned circumstances, the present invention is directed to provide a scroll compressor that enables stable operation.

[0006] In order to solve the problems, the present invention employs the following means.

[0007] According to the first aspect of the present invention, there is provided a scroll compressor including a rotary shaft extending along an axis and rotating about the axis; a turning scroll which is capable of revoluting around the axis at a position offset with respect to the axis; a fixed scroll opposite to the turning scroll and configured to form a compression chamber that compresses a coolant; and a bush assembly installed at the rotary shaft and configured to rotatably support the turning scroll, wherein the bush assembly includes: a bush fixed to the rotary shaft and configured to rotatably support the turning scroll at a position offset with respect to the axis; a ring section formed at an outer circumferential side to overhang from an outer circumferential surface of the bush; and a weight section formed at the outer circumferential side of the ring section and extending in an arc shape in a circumferential direction of the bush, wherein a first groove section is formed so as to recess inward in the radial direction of the axis from the outer circumferential surface of the bush and extending along the axis, a second groove section is formed so as to extend from the inside in the radial direction to the outside in the radial direction of the ring section and in communication with the first groove section, and a discharge section is formed so as to pass through the weight section in the radial direction and in communication with an end portion of the outside in the radial direction of the second groove section.

[0008] According to the above-mentioned configuration, lubricating oil provided for lubrication of the bush assembly is trapped by the first groove section formed in the outer circumferential surface of the bush and then flows toward the second groove section formed in the ring section. The lubricating oil that has flowed into the second groove section is discharged to the outside of the bush assembly through the discharge section formed in the weight section. Accordingly, for example, in comparison with the case in which only the first groove section is formed, since the lubricating oil can be more smoothly discharged, deterioration of performance of the bush assembly (the bush) due to inferior discharge of the oil can be suppressed.

[0009] According to the second aspect of the present invention, the second groove section may extend rearward in the rotational direction of the rotary shaft from the inside in the radial direction toward the outside in the radial direction of the axis.

[0010] According to the above-mentioned configuration, before discharge of the lubricating oil by the second groove section, a region of a forward side in the rotational direction of the second groove section can be sufficiently lubricated. Further, since the second groove section extends from the forward side toward a rearward side in the rotational direction of the rotary shaft, the lubricating oil can be smoothly introduced into the second groove section according to rotation of the rotary shaft.

[0011] According to the third aspect of the present invention, the discharge section may be a through-hole passing through the weight section in the radial direction.

[0012] According to the above-mentioned configuration, reduction in weight of the weight section by the through-hole can be minimized. Accordingly, in addition to the smooth discharge of the lubricating oil, centrifugal whirling or vibrations around the axis due to turning of the turning scroll can be suppressed.

[0013] According to the fourth aspect of the present invention, the discharge section may be a notch section passing through the weight section in the radial direction and passing through the weight section toward an opposite side of the side at which the first groove section in the axis direction is formed.

[0014] According to the above-mentioned configuration, since a sufficiently high flow rate of the lubricating oil in the discharge section can be secured, probability of inferior discharge of the oil in the bush assembly can be reduced.

[0015] According to the scroll compressor of the present invention, stable operation can be realized for a long time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

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

FIG. 2 is an enlarged view of a major part of the scroll compressor according to the first embodiment of the present invention.

FIG. 3A is a view of a bush assembly according to the first embodiment of the present invention when seen from one side of an axis.

FIG. 3B is a cross-sectional view taken along line B-B of FIG. 3A.

FIG. 4 is a view of the bush assembly according to the first embodiment of the present invention when seen from the other side of the axis.

FIG. 5 is a perspective view of the bush assembly according to the first embodiment of the present invention.

FIG. 6 is a perspective view of the bush assembly according to the first embodiment of the present invention.

FIG. 7 is a perspective view of a bush assembly according to a second embodiment of the present invention.

FIG. 8 is a cross-sectional view showing a variant of the scroll compressor and the bush assembly according to the first embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[First embodiment]

[0017] A scroll compressor 100 according to a first embodiment of the present invention will be described with reference to the accompanying drawings. As shown in FIG. 1, the scroll compressor 100 has a housing 1 that forms a contour of an apparatus, a compression section 2 formed in the housing 1, and a driving section 3 configured to drive the compression section 2. The compression section 2 and the driving section 3 are connected to each other by a rotary shaft 4 extending along an axis O1. That is, rotational energy from the driving section 3 is instantly transmitted to the compression section 2 through the rotary shaft 4. The compression section 2 compresses a working fluid to eject the working fluid to the outside in a high pressure state using the rotational energy. The high pressure working fluid is used as a coolant, for example, in an air conditioner or the like. Hereinafter, configurations of the respective parts will be described in detail.

[0018] A suction pipe 11 configured to suction a coolant gas serving as a working fluid from the outside and an discharge pipe 12 configured to discharge the coolant gas under the high pressure state in an discharge chamber 67 through compression by the compression section 2 are installed at the housing 1.

[0019] The rotary shaft 4 has a columnar shape about the axis O1. Although this will be described in detail later, the rotary shaft 4 is supported by a main bearing member 9 and a sub-bearing member 77 in the housing 1. A main bearing 75 is attached between the main bearing member 9 and an outer circumferential surface of the rotary shaft 4. A sub-bearing 76 is attached between the sub-bearing member 77 and the outer circumferential surface of the rotary shaft 4.

[0020] In an end portion of one side of the rotary shaft 4, an eccentric shaft 5 that forms a columnar shape about an eccentric axis 02 different from the axis O1 is installed at a position offset (slanted) with respect to the axis O1. The eccentric axis 02 is parallel to the axis O1. More specifically, the eccentric shaft 5 has a columnar shape protruding from the end portion of the rotary shaft 4 toward one side in the axis O1 direction. Accordingly, in a state in which the rotary shaft 4 is rotated about the axis O1, the eccentric shaft 5 revolves around the axis O1 of the rotary shaft 4. In addition, as shown in FIG. 3A, when seen in a direction of the eccentric axis 02, a portion of the outer circumferential surface of the eccentric shaft 5 is formed in a flat shape to form a shaft-side key surface 51. As it will be described below in detail, a portion of an inner circumferential surface of a bush 101 in a bush assembly 10 (to be described below) abuts the shaft-side key surface 51.

[0021] The compression section 2 has a fixed scroll 6 and a turning scroll 7. A discharge cover 8 and the main bearing member 9 are substantially disk-shaped members that divide a space in the housing 1 in the axis O1 direction. The discharge cover 8 and the main bearing member 9 are arranged at an interval in the axis 01 direction. That is, a space is formed between the discharge cover 8 and the main bearing member 9. The fixed scroll 6 and the turning scroll 7 are disposed in the space in a state in which they are opposite to each other in the axis O1 direction. Further, a discharge valve 66 configured to prevent a countercurrent of a high pressure gas from the discharge chamber 67 is installed at a central portion of the discharge cover 8.

[0022] The fixed scroll 6 is a substantially disk-shaped member fixed in the housing 1. The turning scroll 7 is opposite to the fixed scroll 6 in the axis O1 direction to form a compression chamber C therebetween. More specifically, the fixed scroll 6 has a disk-shaped end plate 61, and a fixed lap 62 standing up from a surface of one side of the end plate 61 in the axis O1 direction. The end plate 61 extends along a surface roughly perpendicular to the axis O1. The fixed lap 62 is a wall body formed in a spiral shape when seen from the axis O1 direction. More specifically, the fixed lap 62 is formed of a plate-shaped member wound around a center of the end plate 61. As an example, the fixed lap 62 may be configured to form an involute curve about the axis O1 when seen from the axis 01 direction.

[0023] An outer circumferential wall 63 extending in a cylindrical shape along an outer circumference of the end plate 61 is formed outside in a radial direction of the fixed lap 62. Further, an annular flange section 64 widened toward the outside from the inside in the radial direction is formed at an edge of the other side in the axis O1 direction of the outer circumferential wall 63. The fixed scroll 6 is fixed to the main bearing member 9 via the flange section 64 by a bolt or the like. Further, a fixed scroll discharge port 65 is formed at a spiral central portion of the fixed scroll 6.

[0024] The turning scroll 7 has a disk-shaped end plate 71, and a spiral turning lap 72 formed at a surface of the other side in the axis 01 direction of the end plate 71. The turning lap 72 may also be configured to form an involute curve about the axis 01.

[0025] Further, the turning lap 72 is disposed to be opposite to the fixed lap 62 in the axis O1 direction and overlap the fixed lap 62 in a direction crossing the axis O1. In other words, the fixed lap 62 and the turning lap 72 are meshed with each other. In the meshed state, a certain space is formed between the fixed lap 62 and the turning lap 72. Although this will be described below in detail, a capacity of the space is varied according to the turning of the turning lap 72. Accordingly, the working fluid can be compressed.

[0026] The turning scroll 7 having the above-mentioned configuration is connected to the rotary shaft 4 from one side in the axis O1 direction via the bush assembly 10 (to be described below). A cylindrical boss section 73 is formed at a surface of the other side in the axis O1 direction of the end plate 71 of the turning lap 72. A central axis of the boss section 73 is coaxial with the eccentric axis 02. The eccentric shaft 5 formed at the rotary shaft 4 is fitted into the space inside the boss section 73 via the bush assembly 10 from the axis O1 direction.

[0027] The bush assembly 10 includes the bush 101 having a cylindrical shape attached to surround the outer circumferential surface of the eccentric shaft 5, a ring section 102 overhanging from the outer circumferential surface of the bush 101 outward in the radial direction (toward an outer circumferential side), and a weight section 103 installed at a further outer circumferential side of the ring section 102.

[0028] In a state in which the bush assembly 10 is attached to the eccentric shaft 5, the bush 101 forms a cylindrical shape that is coaxial with the eccentric axis 02. Further, as shown in FIG. 3A, a bush-side key surface 104 is formed at an inner circumferential side of the bush 101. The bush-side key surface 104 abuts the shaft-side key surface 51 formed at the eccentric shaft 5. That is, in the bush assembly 10 (the bush 101) attached to the eccentric shaft 5, as the shaft-side key surface 51 and the bush-side key surface 104 abut each other, pivotal movement around the eccentric axis 02 of the bush assembly 10 (the bush 101) is restricted.

[0029] As shown in FIG. 3A or FIG. 3B, the ring section 102 overhangs from the outer circumferential surface of the other side in the eccentric axis 02 of the bush 101 toward the outer circumferential side (outward in the radial direction). In the embodiment, the end surface of the other side in the eccentric axis 02 direction of the ring section 102 is roughly flush with an end surface of the other side in the eccentric axis 02 direction of the bush 101.

[0030] The weight section 103 is a member installed at an edge of the outer circumferential side of the ring section 102. As it will be described below in detail, in a state in which the turning scroll 7 is attached to the rotary shaft 4 (the eccentric shaft 5), the turning scroll 7 can be turned about the axis O1 of the rotary shaft 4. A centrifugal force from the turning of the turning scroll 7 is applied to the lap section (the fixed lap 62 and the turning lap 72). For this reason, when the number of revolutions is increased, damage to the lap section may occur. Here, the weight section 103 having a relatively large weight is installed at the bush assembly 10 according to the embodiment in order to reduce the centrifugal force.

[0031] The weight section 103 is integrally formed with the outer circumferential surface of the ring section 102. As shown in FIG. 3A and FIG. 3B, a cross section of the weight section 103 is formed in a rough arc shape when seen from the eccentric axis 02 direction. Specifically, the inner circumferential surface of the weight section 103 roughly extends to an arc formed in the outer circumferential surface of the ring section 102. Meanwhile, the outer circumferential surface of the weight section 103 extends from the inner circumferential surface in the same arc shape at a position spaced apart therefrom in the radial direction.

[0032] Further, the weight section 103 extends at both sides in the eccentric axis 02 direction with respect to the ring section 102. In the embodiment, a region of one side in the eccentric axis 02 direction of the weight section 103 is set to have a larger dimension in the eccentric axis 02 direction than a region of the other side.

[0033] Further, in a state in which the bush assembly 10 is attached to the eccentric shaft 5, the weight section 103 is disposed at a side spaced apart from the eccentric shaft 5 on an end surface of one side in the axis O1 direction of the rotary shaft 4. More specifically, the weight section 103 is disposed at a position opposite to the eccentric axis 02 with the axis O1 interposed therebetween on a straight line that connects the eccentric axis 02 of the eccentric shaft 5 and the axis 01 of the rotary shaft 4. Accordingly, a centrifugal force around the axis O1 according to the turning of the turning scroll 7 is reduced.

[0034] As shown in FIG. 2, the bush assembly 10 having the above-mentioned configuration is attached to the eccentric shaft 5. More specifically, the bush 101 of the bush assembly 10 is fitted onto the eccentric shaft 5. Here, as the shaft-side key surface 51 of the eccentric shaft 5 abuts the bush-side key surface 104 formed at the bush 101, the bush 101 (the bush assembly 10) is non-rotatably fixed to the eccentric shaft 5.

[0035] Further, the bush 101 is inserted into a bearing 74 installed inside the boss section 73 of the turning scroll 7. As shown in FIG. 2, the bearing 74 has a cylindrical shape extending in the axis O1 direction. In the embodiment, while the bearing 74 is fixed to the boss section 73 of the turning scroll 7, the inner circumferential surface of the bearing 74 can slidably contact with the outer circumferential surface of the bush 101. That is, the bush assembly 10 (the bush 101) is rotatable with respect to the boss section 73 of the turning scroll 7.

[0036] Since the inner circumferential surface of the bearing 74 and the outer circumferential surface of the bush 101 are in sliding contact with each other, these members should be appropriately lubricated. Here, in the embodiment, lubricating oil flow paths 106 configured to supply or discharge lubricating oil are formed at the respective parts of the bush assembly 10.

[0037] The lubricating oil flow paths 106 have a first groove section 107 formed in the outer circumferential surface of the bush 101, a second groove section 108 formed in the ring section 102, and a discharge section 109 formed in the weight section 103.

[0038] As shown in FIGS. 3A, 4 and 5, the first groove section 107 is a groove recessed from the outer circumferential surface of the bush 101 inward in the radial direction. The first groove section 107 extends linearly from the one side to the other side in the eccentric axis 02 direction of the bush 101. In particular, as shown in FIG. 3A, both edges of the first groove section 107 in the circumferential direction of the bush 101 (i.e., ridge sections formed by the sidewall of the first groove section 107 and the outer circumferential surface of the bush 101) form chamfered sections R that are chamfered slightly inward in the radial direction. The lubricating oil interposed between the outer circumferential surface of the bush 101 and the inner circumferential surface of the bearing 74 is introduced into the first groove section 107 through the chamfered section R.

[0039] Further, as shown in FIGS. 3A, and 4, the first groove section 107 is formed at a position offset to one side in the circumferential direction of an arc formed by the weight section 103 when seen from the axis O1 direction (the eccentric axis 02 direction). Although this will be described below in detail, in the scroll compressor 100 according to the embodiment, the rotary shaft 4 is rotated counterclockwise when seen from the one side in the axis 01 direction. When the rotational direction of the rotary shaft 4 is used as a reference, the first groove section 107 is formed in a region of a forward side in the rotational direction of the weight section 103 when seen from the one side in the axis O1 direction.

[0040] The second groove section 108 is a concave groove extending from the inside in the radial direction toward the outside in the radial direction of the ring section 102. More specifically, as shown in FIG. 4 or 6, the second groove section 108 is formed from the surface of the other side in the axis O1 direction of the ring section 102 toward the one side. Further, the second groove section 108 extends linearly from the end portion of the other side in the axis 01 direction of the first groove section 107.

[0041] In particular, in the embodiment, the second groove section 108 is inclined toward the rear side in the rotational direction with respect to the radial direction of the eccentric axis 02. In other words, the second groove section 108 extends to be inclined toward the rear side in the rotational direction of the bush assembly 10 from the inside to the outside in the radial direction of the eccentric axis 02. The second groove section 108 is inclined at an angle θ with respect to a tangential line L at a position at which the first groove section 107 is formed on the outer circumferential surface of the bush 101, and a value of the angle θ is greater than 90°. In the embodiment, the second groove section 108 is inclined roughly 100° with respect to the tangential line L.

[0042] The discharge section 109 is a notch (a notch section 109A) in communication with the end portion outside in the radial direction of the second groove section 108 and passing through the weight section 103 in the radial direction. Specifically, as shown in FIG. 5 or 6, the discharge section 109 passes through the weight section 103 from the edge outside in the radial direction of the second groove section 108 in the eccentric axis 02 direction toward the other side in the eccentric axis 02 direction. In other words, the second groove section 108 and the discharge section 109 form roughly an L shape when seen in a cross-sectional view in a direction crossing the eccentric axis 02.

[0043] Further, the lubricating oil is supplied into the rotary shaft 4 (the eccentric shaft 5) from an oil feed pump 80.

[0044] The lubricating oil lubricates between the bush 101 of the bush assembly 10 and the bearing 74 of the turning scroll 7, and then is collected and discharged by the lubricating oil flow path 106.

[0045] The turning scroll 7 is supported on the rotary shaft 4 by the bush assembly 10 having the above-mentioned configuration.

[0046] Further, an Oldham ring 91 configured to restrict auto-rotation of the turning scroll 7 (rotation about the eccentric axis 02) is installed at the main bearing member 9. While not shown in detail, a protrusion fitted into a groove formed in the end plate 71 of the turning scroll 7 is formed at the Oldham ring 91. Further, a thrust bearing 92 is installed inside in the radial direction when seen from the Oldham ring 91. The thrust bearing 92 supports a load in the axis O1 direction by the turning scroll 7.

[0047] The compression section 2 having the above-mentioned configuration is driven by the driving section 3 disposed in the housing 1 with the main bearing member 9 interposed therebetween. As shown in FIG. 1, an electric motor configured to be rotated by electric power supplied from the outside is appropriately used as the driving section 3.

[0048] Next, an operation of the scroll compressor 100 according to the embodiment will be described. In starting an operation of the scroll compressor 100, first, the rotary shaft 4 is rotated about the axis O1 by applying electricity to the driving section 3. Further, in the embodiment, the rotary shaft 4 is rotated counterclockwise when seen from the one side in the axis O1 direction.

[0049] As the rotary shaft 4 rotates, the eccentric shaft 5 revolves around the axis 01, and the turning scroll 7 attached thereto turns about the axis O1. Here, auto-rotation of the turning scroll 7 is restricted by the above-mentioned Oldham ring 91. Accordingly, the turning scroll 7 moves circularly (turns) about the axis 01 of the rotary shaft 4 along a trajectory drawn by the eccentric axis 02. According to the turning, the turning lap 72 of the turning scroll 7 repeats continuous relative movement with respect to the fixed lap 62 of the fixed scroll 6. According to the relative movement, a capacity of the compression chamber C formed between the fixed lap 62 and the turning lap 72 is varied as time elapses.

[0050] While not shown in detail, first, during the turning of the turning scroll 7, a coolant gas serving as a working fluid is introduced into the compression chamber C from an opening generated outside in the radial direction of the turning lap 72 (and the fixed lap 62). According to the turning of the turning scroll 7, the opening is closed. Accordingly, the coolant gas is enclosed in the compression chamber C. Furthermore, the coolant gas moves inward in the radial direction (i.e., toward the eccentric axis 02) as the turning scroll 7 is turned. Here, since the turning lap 72 and the fixed lap 62 form the spiral shape, the capacity of the compression chamber C formed by both of these is reduced toward the inside in the radial direction. Accordingly, the coolant gas is compressed. Finally, after the coolant gas arrives at the highest pressure in the vicinity of the center of the turning scroll 7 (or the fixed scroll 6), the coolant gas is supplied to the outside through the fixed scroll discharge port 65 and the discharge pipe 12 of the housing 1.

[0051] Next, an operation of the bush assembly 10 according to the embodiment will be described in detail.

[0052] The lubricating oil is continuously supplied into the bush assembly 10 from the oil feed pump 80 as described above. Accordingly, in particular, a space between the outer circumferential surface of the bush 101 and the inner circumferential surface of the bearing 74 in the bush assembly 10 is lubricated.

[0053] Here, the space between the outer circumferential surface of the bush 101 and the inner circumferential surface of the bearing 74 is normally in a sliding contact state throughout the operation of the scroll compressor 100. For this reason, an increase in temperature of the lubricating oil and thus a corresponding decrease in viscosity may occur. However, in the scroll compressor 100 according to the embodiment, since new lubricating oil is continuously supplied into the bush assembly 10, probability of the increase in temperature or the decrease in viscosity occurring can be reduced.

[0054] Meanwhile, in order to continuously supply the lubricating oil as described above, the lubricating oil provided for lubrication of the bush assembly 10 should be continuously discharged to the outside. In the bush assembly 10 according to the embodiment, since the above-mentioned lubricating oil flow path 106 is formed, the lubricating oil can be continuously and smoothly discharged.

[0055] Specifically, first, some of the lubricating oil interposed between the outer circumferential surface of the bush 101 and the inner circumferential surface of the bearing 74 is trapped by the first groove section 107 formed in the bush 101. The lubricating oil introduced into the first groove section 107 flows toward the other side in the eccentric axis 02 direction by the action of the gravity, and then arrives at the end portion inside in the radial direction of the second groove section 108 of the ring section 102.

[0056] The lubricating oil that has arrived at the second groove section 108 flows toward the outside in the radial direction due to a centrifugal force from rotation of the bush assembly 10. The lubricating oil that has arrived at the end portion outside in the radial direction of the second groove section 108 flows to the other side in the eccentric axis 02 direction along the discharge section 109 formed at the weight section 103, and then is discharged to the outside (for example, on the main bearing member 9). Further, in the embodiment, a hole that passes through the main bearing member 9 from the inside to the outside in the radial direction of the axis 01 (an oil discharge hole 93) is formed. The lubricating oil discharged from the discharge section 109 via the oil discharge hole 93 is accumulated at a lower portion in the housing 1, and then re-circulated by the oil feed pump 80.

[0057] As described above, the lubricating oil can be smoothly discharged through the first groove section 107, the second groove section 108 and the discharge section 109.

[0058] In particular, since the chamfered section R is formed at a ridge section in the opening of the first groove section 107 as described above, the lubricating oil interposed between the inner circumferential surface of the bearing 74 and the first groove section 107 can be smoothly introduced into the first groove section 107. Meanwhile, when the chamfered section R is not formed (i.e., when the ridge of the opening of the first groove section 107 is sharply formed), not only can the lubricating oil not be easily introduced into the first groove section 107 but the ridge may also be abraded according to a continuous operation and cause misalignment of the bush assembly 10. However, in the embodiment, as the chamfered section R is formed, probability of the above-mentioned abrasion, misalignment, or the like occurring can be reduced.

[0059] Further, as described above, the second groove section 108 is inclined from the forward side toward the rearward side in the rotational direction of the bush assembly 10. In particular, the second groove section 108 is inclined at an angle of a value greater than 90° with respect to the tangential line L of the bush 101. Accordingly, the end portion inside in the radial direction of the second groove section 108 is directed toward the forward side in the rotational direction of the bush assembly 10. Accordingly, according to the rotation of the bush assembly 10, the lubricating oil can be smoothly introduced into the second groove section 108.

[0060] Further, the discharge section 109 passes through the weight section 103 in the radial direction, and forms the notch section 109A extending in the axis 01 direction (or the eccentric axis 02 direction). According to the above-mentioned configuration, for example, in comparison with the case in which the discharge section 109 is formed by the hole formed in the weight section 103, a sufficiently high flow rate of the lubricating oil passing through the discharge section 109 can be secured. Accordingly, probability of inferior discharge of the oil in the bush assembly 10 can be reduced more.

[0061] On the other hand, when the second groove section 108 and the discharge section 109 are not formed, since the lubricating oil introduced into the first groove section 107 cannot be easily discharged to the outside and the lubricating oil cannot be sufficiently supplied to cool the bearing 74, the temperature of the bearing 74 is gradually increased according to the rotation of the bush assembly 10, and finally, the bearing 74 may burn and cause a failure of the compressor.

[0062] However, in the scroll compressor 100 according to the embodiment, since the second groove section 108 and the discharge section 109 in communication with the first groove section 107 are formed, smooth discharge of the lubricating oil can be maintained. Accordingly, the scroll compressor 100 can be stably operated for a long time.

[Second embodiment]

[0063] Next, a second embodiment of the present invention will be described with reference to FIG. 7. In the embodiment, a hole passing through the weight section 103 (a through-hole 109B) forms the discharge section 109 in the lubricating oil flow path 106. That is, the edge of the other side in the eccentric axis 02 direction of the discharge section 109 is not opened.

[0064] According to the above-mentioned configuration, in comparison with the case in which the notch section 109A of the first embodiment is the discharge section 109, reduction in weight of the weight section 103 can be minimized. That is, a greater weight of the weight section 103 can be secured. Accordingly, in addition to the smooth discharge of the lubricating oil, centrifugal whirling or vibrations around the axis 01 due to the turning of the turning scroll 7 can be further suppressed.

[0065] Hereinabove, embodiments of the present invention have been described with reference to the accompanying drawings. However, these embodiments are merely exemplary, and configurations of the respective parts can be modified and improved according to necessity.

[0066] For example, in these embodiments, the example in which the second groove section 108 is formed at the other side in the eccentric axis 02 direction of the ring section 102 and the discharge section 109 is similarly formed toward the other side of the eccentric axis 02 has been described. However, the position at which the second groove section 108 and the discharge section 109 are formed is not limited to this configuration. As an example, a configuration in which the second groove section 108 is formed at one side (i.e., a side facing the turning scroll 7) in the eccentric axis 02 direction of the ring section 102 and the discharge section 109 is formed from the second groove section 108 toward the one side in the eccentric axis 02 direction may be employed.

[0067] Further, in these embodiments, the configuration in which the lubricating oil flow paths 106 (the first groove section 107, the second groove section 108 and the discharge section 109) are formed at the bush assembly 10 one by one has been described. However, the plurality of lubricating oil flow paths 106 can also be formed according to environmental conditions and specifications such as the number of revolutions, an operating time, and so on, of the scroll compressor 100. Specifically, a configuration in which the other lubricating oil flow paths 106 are formed at intervals with respect to the lubricating oil flow path 106 described in the embodiment in the circumferential direction of the bush 101 (the weight section 103) is considered.

[0068] According to the above-mentioned configuration, since discharge of the lubricating oil provided for lubrication of the bush assembly 10 and replacement with new lubricating oil supplied from the oil feed pump 80 can be performed within a relatively fast cycle, better lubrication performance can be obtained.

[0069] In addition, in these embodiments, the configuration in which the weight section 103 extends at both sides in the eccentric axis 02 direction with respect to the ring section 102 has been described. However, the configuration of the weight section 103 is not limited thereto, and for example, as shown in FIG. 8, a configuration in which the weight section 103 extends from the outer circumferential edge of the ring section 102 toward only one side in the eccentric axis 02 direction can also be provided. In conclusion, while a shape and dimensions of the above-mentioned weight section 103 are appropriately selected according to various design conditions and specifications, in any aspect, the lubricating oil flow path 106 according to each of the embodiments may be formed.

[0070] While preferred embodiments of the invention have been described and illustrated above, it should be understood that these are exemplary of the invention and are not to be considered as limiting. Additions, omissions, substitutions, and other modifications can be made without departing from the scope of the present invention. Accordingly, the invention is not to be considered as being limited by the foregoing description, and is only limited by the scope of the appended claims.

[Reference Signs List]

[0071] 1... housing 2... compression section 3... driving section (electric motor) 4... rotary shaft (main shaft) 5... eccentric shaft 6... fixed scroll 7... turning scroll 8... discharge cover 9... main bearing member 10... bush assembly 11... suction pipe 12... discharge pipe 31...rotor balance weight 51... shaft-side key surface 61...end plate 62... fixed lap 63... outer circumferential wall 64... flange section 65... fixed scroll discharge port 66... discharge valve 67... discharge chamber 71... end plate 72... turning lap 73...boss section 74...bearing (turning scroll) 75...main bearing 76...sub-bearing 77...sub-bearing member 80...oil feed pump 91... Oldham ring 92...thrust bearing 93...oil discharge hole 100...scroll compressor 101... bush 102... ring section 103... weight section 104... bush-side key surface 106...lubricating oil flow path 107... first groove section 108... second groove section 109... discharge section 109A... notch section 109B... through-hole C... compression chamber L... tangential line O1... axis 02... eccentric axis R... chamfered section θ...angle

Claims

1. A scroll compressor (100) comprising:

    a rotary shaft (4) extending along an axis and rotating about the axis;
    a turning scroll (7) which is capable of revoluting around the axis at a position offset with respect to the axis;
    a fixed scroll (6) opposite to the turning scroll (7) and configured to form a compression chamber (C) that compresses a coolant; and
    a bush assembly (10) installed at the rotary shaft (4) and configured to rotatably support the turning scroll (7),
    wherein the bush assembly (10) comprises:

        a bush (101) fixed to the rotary shaft (4) and configured to rotatably support the turning scroll (7) at a position offset with respect to the axis;
        a ring section (102) formed at an outer circumferential side to overhang from an outer circumferential surface of the bush (101); and
        a weight section (103) formed at the outer circumferential side of the ring section (102) and extending in an arc shape in a circumferential direction of the bush (101), **characterised in that** a first groove section (107) is formed so as to recess inward in the radial direction of the axis from the outer circumferential surface of the bush (101) and extending in the axis,
        a second groove section (108) is formed so as to extend from the inside in the radial direction to the outside in the radial direction of the ring section (102) and in communication with the first groove section (107), and
        a discharge section (109) is formed so as to pass through the weight section (103) in the radial direction and in communication with an end portion and of the outside in the radial direction of the second groove section (108).

2. The scroll compressor (100) according to claim 1, wherein the second groove section (108) extends rearward in the rotational direction of the rotary shaft (4) from the inside in the radial direction toward the outside in the radial direction of the axis.

3. The scroll compressor (100) according to claim 1 or 2, wherein the discharge section (109) is a through-hole (109B) passing through the weight section (103) in the radial direction.

4. The scroll compressor (100) according to claim 1 or 2, wherein the discharge section (109) is a notch section (109A) passing through the weight section (103) in the radial direction and passing through the weight section (103) toward an opposite side of the side at which the first groove section (107) in the axis

direction is formed.

Patentansprüche

1. Spiralverdichter (100), umfassend:

eine Drehwelle (4), die sich entlang einer Achse erstreckt und sich um die Achse herum dreht,
eine sich drehende Spirale (7), die an einer in Bezug auf die Achse versetzten Position um die Achse umlaufen kann,
eine feststehende Spirale (6), die der sich drehenden Spirale (7) gegenüberliegt und dazu konfiguriert ist, eine Verdichtungskammer (C) zu bilden, in der ein Kühlmittel verdichtet wird, und
eine Buchsenbaugruppe (10), die an der Drehwelle (4) montiert und dazu konfiguriert ist, die sich drehende Spirale (7) drehbar zu stützen, wobei die Buchsenbaugruppe (10) umfasst:

eine Buchse (101), die an der Drehwelle (4) befestigt und dazu konfiguriert ist, die sich drehende Spirale (7) an einer in Bezug auf die Achse versetzten Position drehbar zu stützen,
eine Ringsektion (102), die auf einer Außenumfangsseite so ausgebildet ist, dass sie von einer Außenumfangsfläche der Buchse (101) überhängt, und
eine Gewichtssektion (103), die auf der Außenumfangsseite der Ringsektion (102) ausgebildet ist und sich in einer Bogenform in einer Umfangsrichtung der Buchse (101) erstreckt,

dadurch gekennzeichnet, dass

eine erste Nutsektion (107) so ausgebildet ist, dass sie in der radialen Richtung der Achse von der Außenumfangsfläche der Buchse (101) nach innen eingerückt ist und sich in der Achse erstreckt,
eine zweite Nutsektion (108) so ausgebildet ist, dass sie sich von der Innenseite in der radialen Richtung zur Außenseite in der radialen Richtung der Ringsektion (102) erstreckt und in Strömungsverbindung mit der ersten Nutsektion (107) steht, und
eine Auslasssektion (109) so ausgebildet ist, dass sie durch die Gewichtssektion (103) in der radialen Richtung verläuft und in Strömungsverbindung mit einem Endabschnitt und der Außenseite in der radialen Richtung der zweiten Nutsektion (108) steht.

2. Spiralverdichter (100) nach Anspruch 1, wobei sich die zweite Nutsektion (108) rückwärts in der Drehrichtung der Drehwelle (4) von der Innenseite in der radialen Richtung zur Außenseite in der radialen Richtung der Achse erstreckt.

3. Spiralverdichter (100) nach Anspruch 1 oder 2, wobei die Auslasssektion (109) ein Durchgangsloch (109B) ist, das durch die Gewichtssektion (103) in der radialen Richtung verläuft.

4. Spiralverdichter (100) nach Anspruch 1 oder 2, wobei die Auslasssektion (109) eine Aussparungssektion (109A) ist, die durch die Gewichtssektion (103) in der radialen Richtung verläuft und durch die Gewichtssektion (103) in Richtung einer gegenüberliegenden Seite der Seite, auf der die erste Nutsektion (107) in der Achsenrichtung ausgebildet ist, verläuft.

Revendications

1. Compresseur à spirales (100) comprenant :

un arbre rotatif (4) s'étendant le long d'un axe et tournant autour de l'axe ;
une spirale rotative (7) qui peut tourner autour de l'axe dans une position décalée par rapport à l'axe ;
une spirale fixe (6) opposée à la spirale rotative (7) et configurée pour former une chambre de compression (C) qui comprime un réfrigérant ; et
un ensemble de manchon (10) installé au niveau de l'arbre rotatif (4) et configuré pour supporter en rotation la spirale rotative (7),
dans lequel l'ensemble de manchon (10) comprend :

un manchon (101) fixé à l'arbre rotatif (4) et configuré pour supporter en rotation la spirale rotative (7) dans une position décalée par rapport à l'axe ;
une section annulaire (102) formée du côté circonférentiel externe pour être en surplomb par rapport à une surface circonférentielle externe du manchon (101) ; et
une section de poids (103) formée du côté circonférentiel externe de la section annulaire (102) et s'étendant selon une forme d'arc dans une direction circonférentielle du manchon (101),

caractérisé en ce que :

une première section de rainure (107) est formée afin de s'enfoncer vers l'intérieur dans la direction radiale de l'axe à partir de

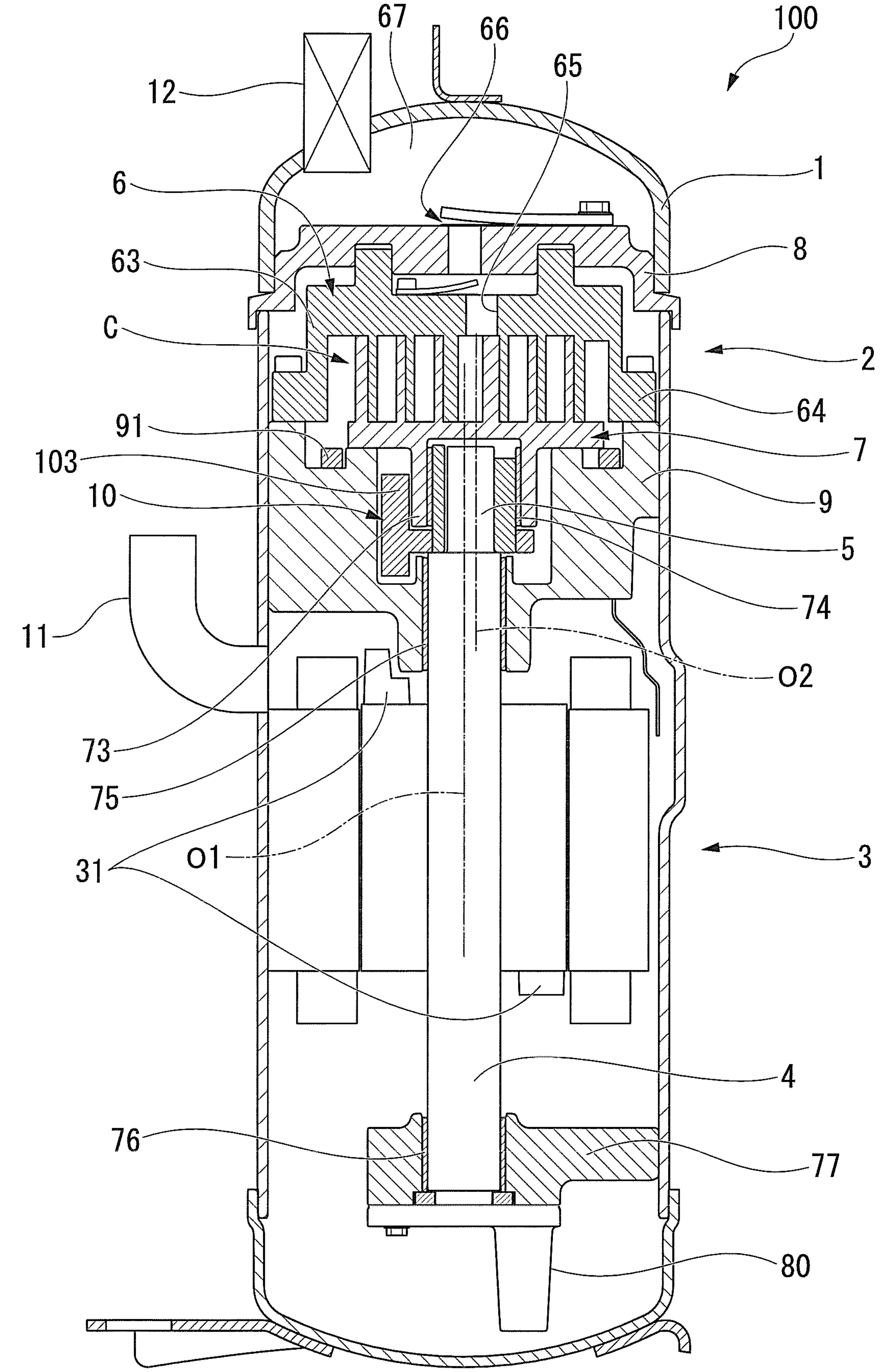
la surface circonférentielle externe du manchon (101) et s'étendant dans l'axe,
une seconde section de rainure (108) est formée afin de s'étendre à partir de l'intérieur dans la direction radiale jusqu'à l'extérieur dans la direction radiale de la section annulaire (102) et en communication avec la première section de rainure (107), et
une section de décharge (109) est formée afin de passer à travers la section de poids (103) dans la direction radiale et en communication avec une partie d'extrémité et de l'extérieur dans la direction radiale de la seconde section de rainure (108).

2. Compresseur à spirales (100) selon la revendication 1, dans lequel la seconde section de rainure (108) s'étend vers l'arrière dans la direction de rotation de l'arbre rotatif (4) de l'intérieur dans la direction radiale vers l'extérieur dans la direction radiale de l'axe.

3. Compresseur à spirales (100) selon la revendication 1 ou 2, dans lequel la section de décharge (109) est un trou débouchant (109B) passant par la section de poids (103) dans la direction radiale.

4. Compresseur à spirales (100) selon la revendication 1 ou 2, dans lequel la section de décharge (109) est une section d'encoche (109A) passant par la section de poids (103) dans la direction radiale et passant par la section de poids (103) vers un côté opposé du côté au niveau duquel est formée la première section de rainure (107) dans la direction axiale.

FIG. 1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12
1
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8
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C
2
64
91
7
103
9
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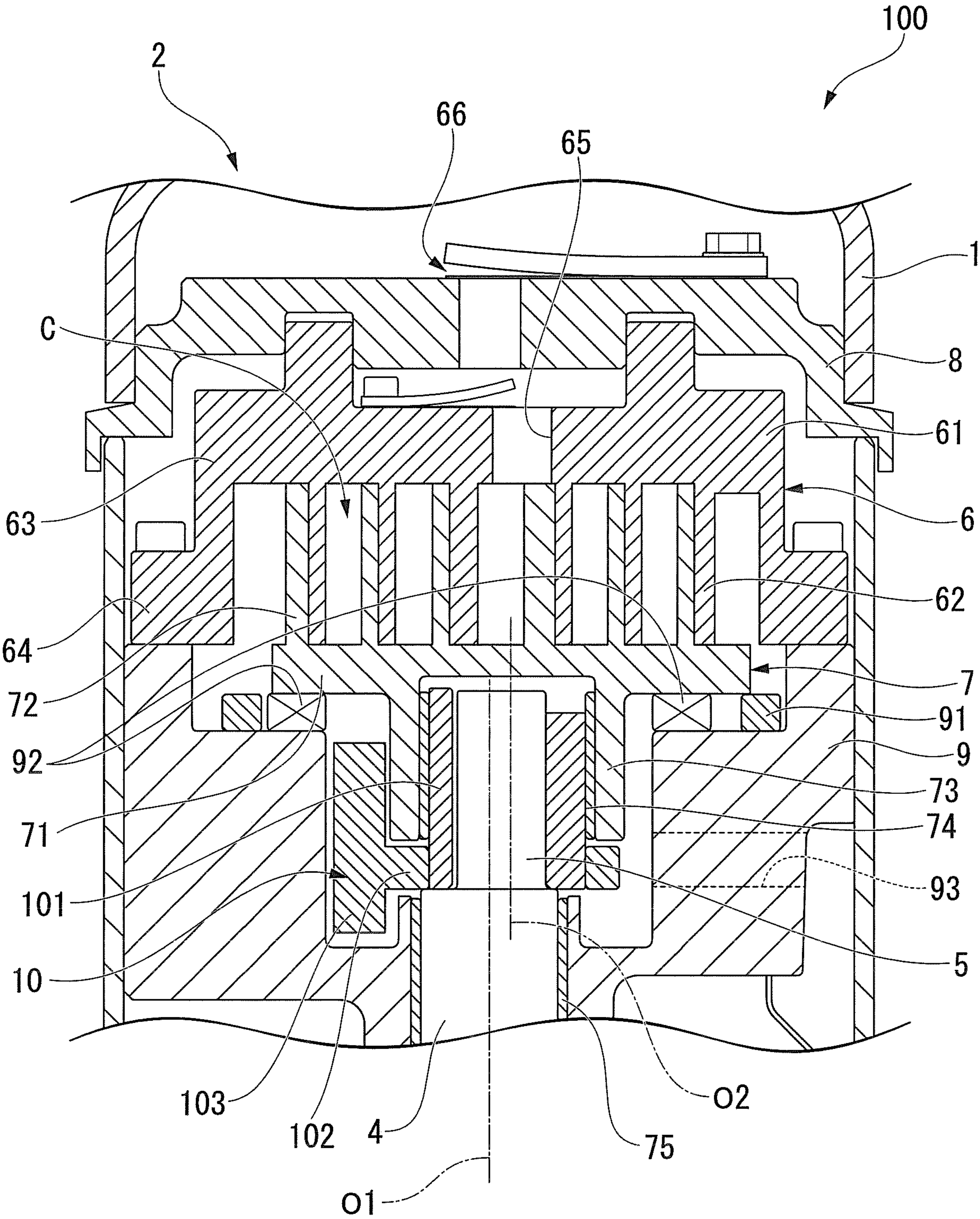
74
11
O2
73
75
31
O1
3
4
76
77
80

FIG. 2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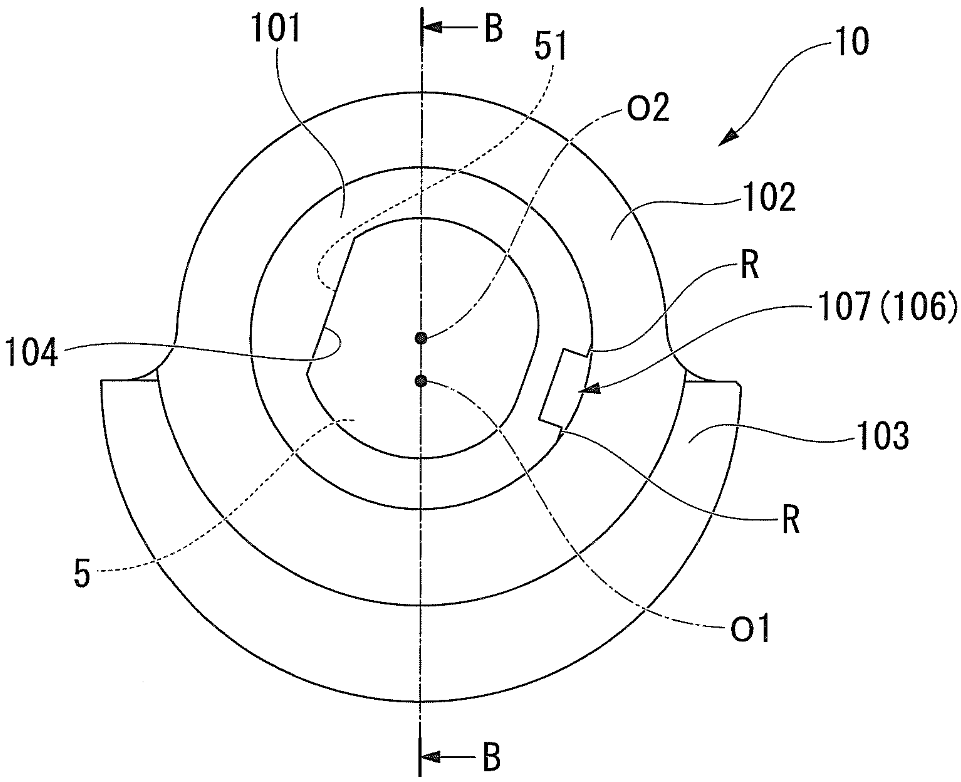
93
5
10
103
102
4
O2
75
O1

FIG. 3A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B
51
10
O2
102
R
107(106)
104
103
R
5
O1
B

FIG. 3B

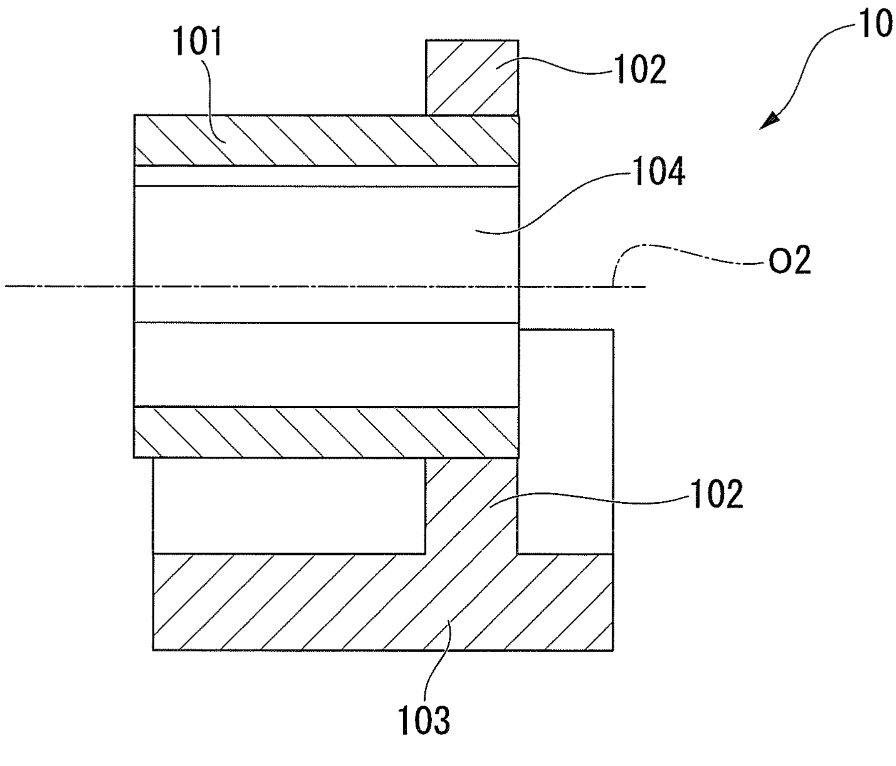

10
101
102
104
O2
102
103

FIG. 4

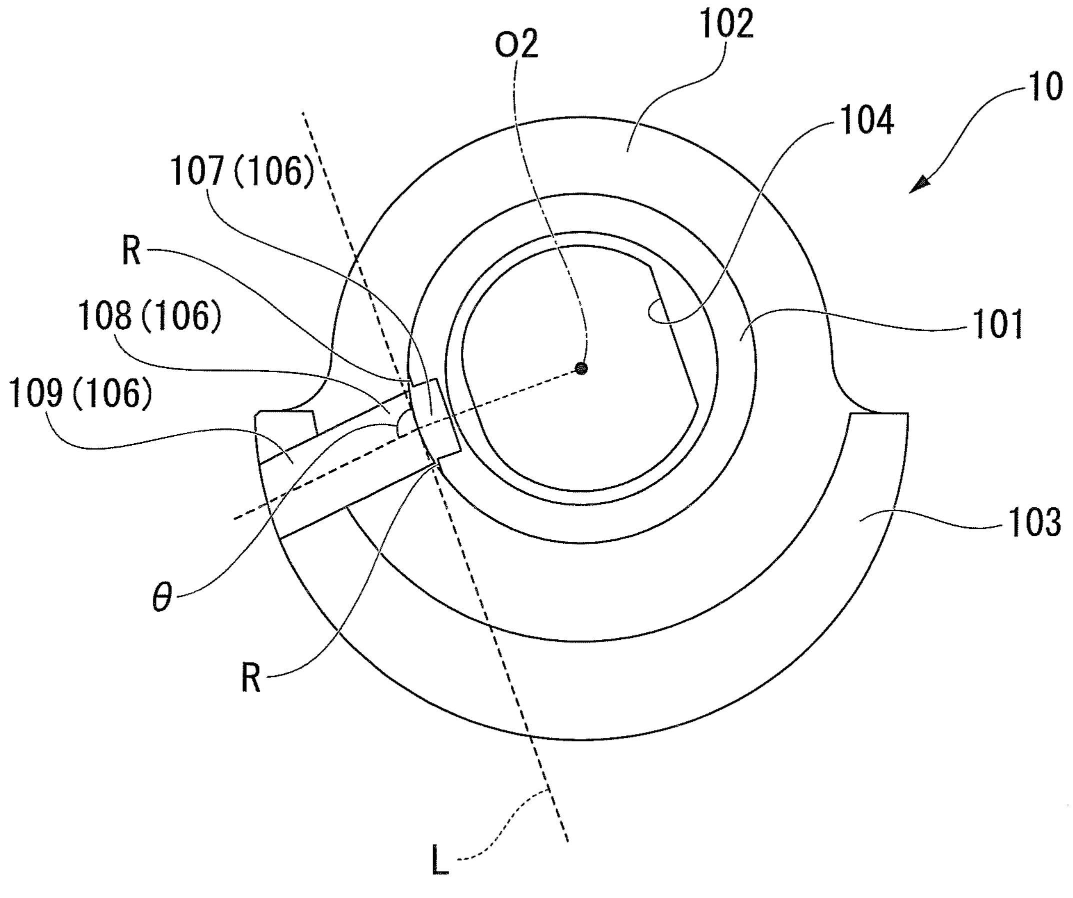


FIG. 5

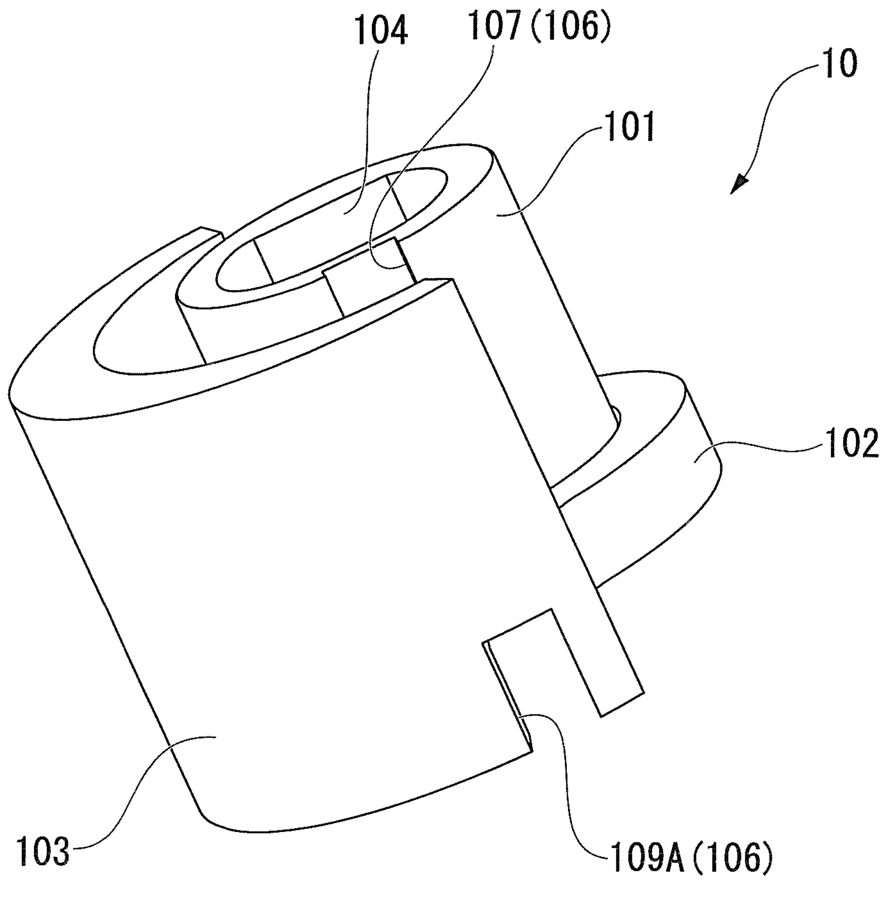


FIG. 6

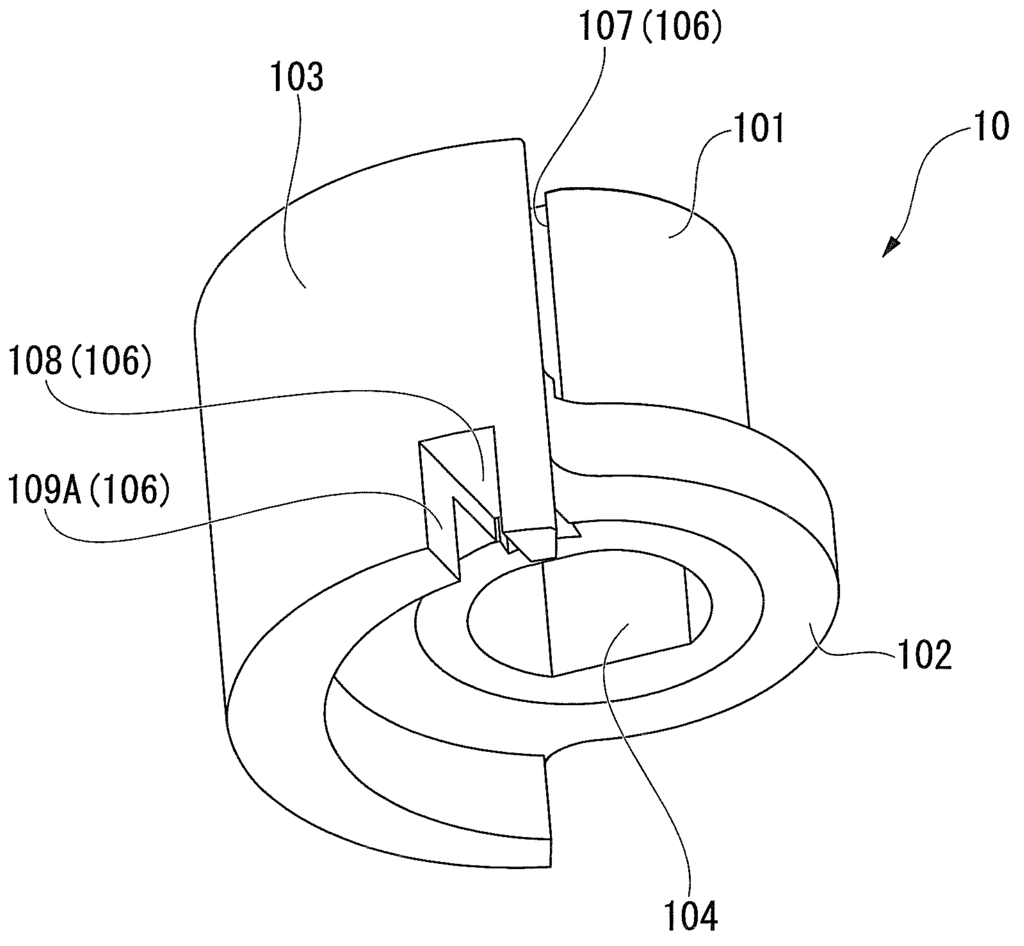


FIG. 7

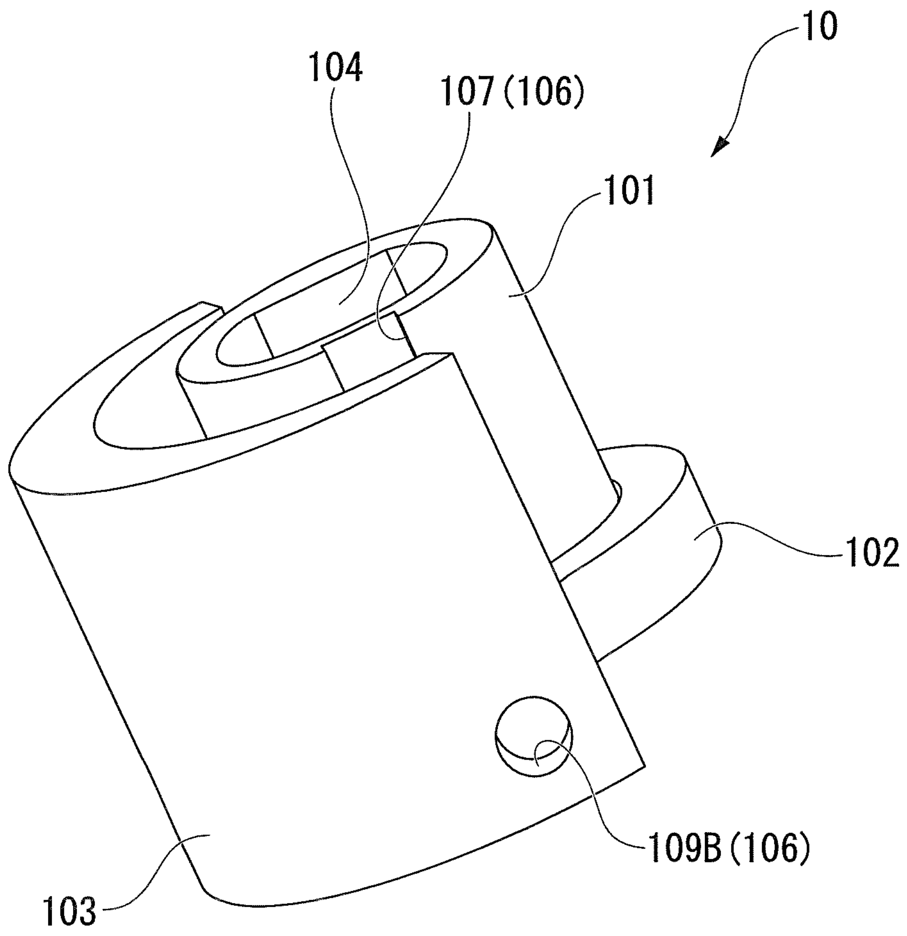
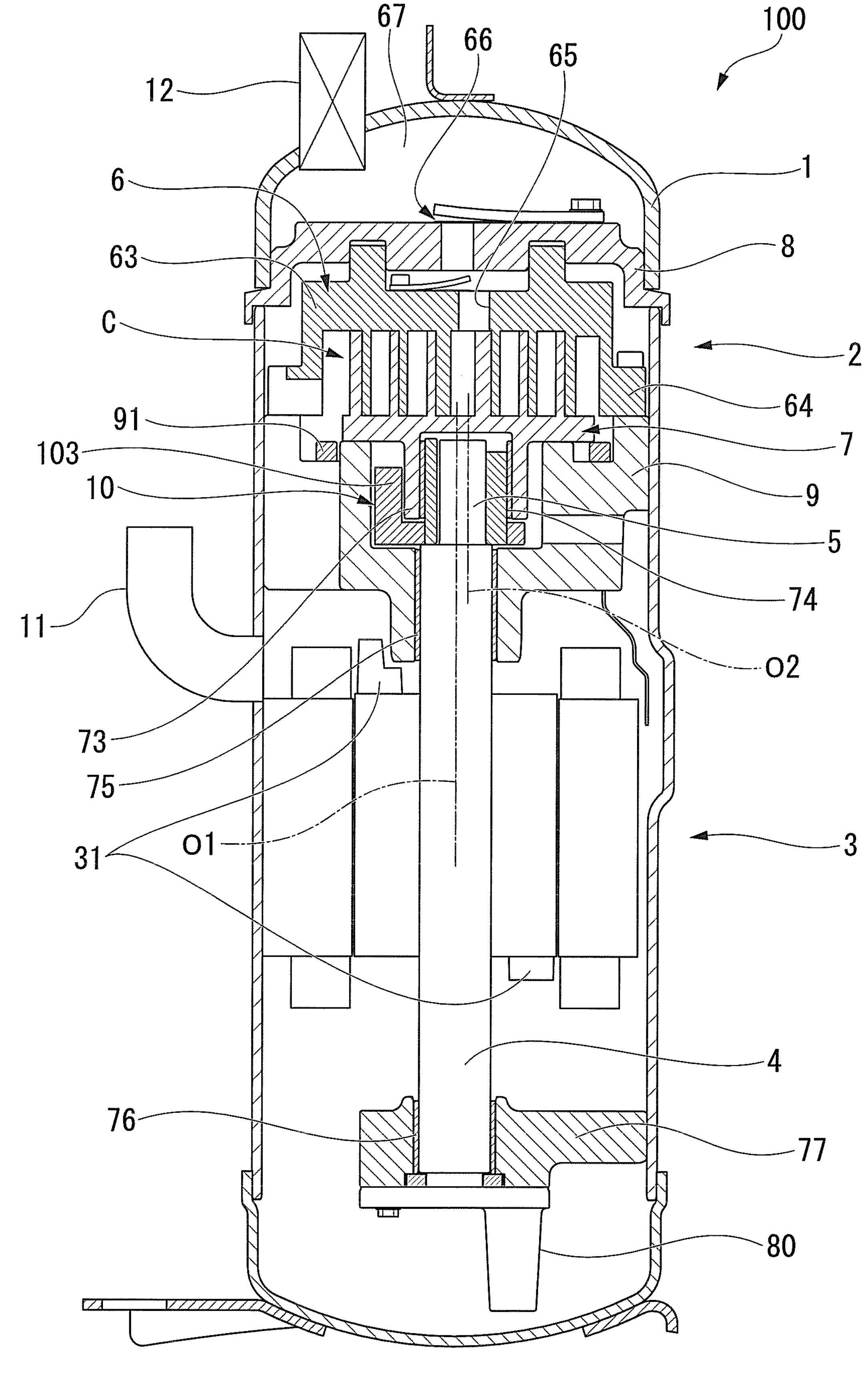


FIG. 8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C
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9
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5
74
11
O2
73
75
31
O1
3
4
76
77
80

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- JP S59115488 B **[0003]**
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