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(54) **ROTARY COMPRESSOR AND REFRIGERATION CYCLE APPARATUS**

(57) To provide a rotary compressor easy to manufacture and highly reliable, and a refrigeration cycle apparatus equipped with this compressor. The rotary compressor (2) includes: a hermetic casing (11); an electric motor (12) accommodated in the hermetic casing and including a stator (18) and a rotor (19); and a compression mechanism (13) coupled to the rotor by a rotating shaft (14). The compression mechanism includes a cylinder (32) including a cylindrical-shaped cylinder chamber (31), and a blade groove (64) opening to the cylinder chamber, a roller (33) eccentrically rotatable in the cylinder chamber, and a blade (61) provided in the blade groove, contacting an outer peripheral surface of the roller, and disposed to be reciprocally movable along with eccentric rotation of the roller in a radial direction of the cylinder chamber and dividing the cylinder chamber into a suction chamber and a compression chamber. The blade groove has sliding surfaces inclined with respect to an axial direction of the rotating shaft, and guiding reciprocal movement of the blade.

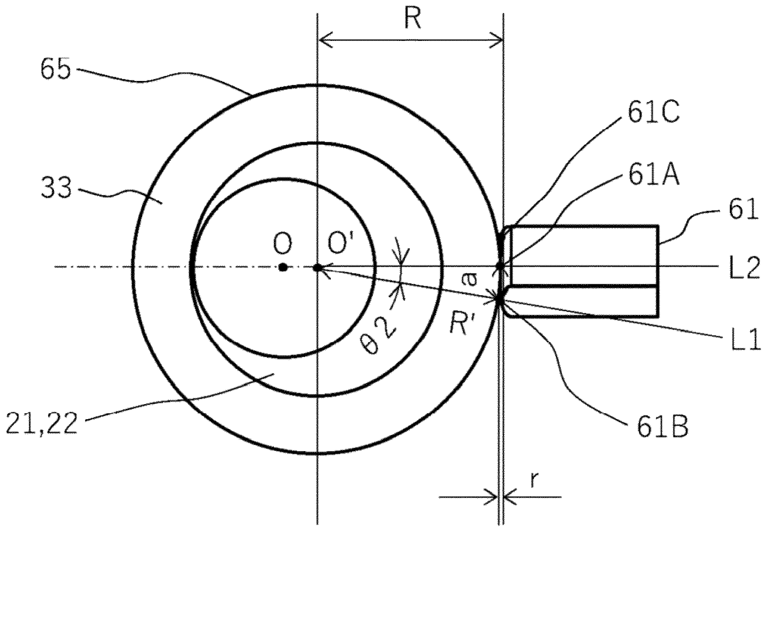

FIG. 3

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] An embodiment of the present invention relates to a rotary compressor and a refrigeration cycle apparatus.

Description of the Related Art

[0002] A refrigeration cycle apparatus including a rotary compressor, such as an air conditioner, is known. The rotary compressor includes an electric motor accommodated in a hermetic casing, a compression mechanism, a cylinder having a cylindrical-shaped cylinder chamber and a blade groove, a roller eccentrically rotatable in the cylinder chamber, and a blade that is disposed in the blade groove, contacts an outer peripheral surface of the roller along with eccentric rotation of the roller, and divides the cylinder chamber into a suction chamber and a compression chamber.

[0003] In order to prevent local abnormal wear due to unilateral touch between the tip end surface of the blade and the outer peripheral surface of the roller, there are known techniques for providing crowning on at least either one of the tip end surface of the blade or the outer peripheral surface of the roller as described in Patent Document 1 (JP H06-147152 A), and providing a curved blade groove as described in Patent Document 2 (JP 2005-30232 A).

[0004] However, the techniques disclosed by Patent Document 1 and Patent Document 2 require the tip end surface of the blade or the blade groove to be specially processed into a curved shape, which may lead to reduction in production capacity.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a rotary compressor easy to manufacture and highly reliable, and a refrigeration cycle apparatus equipped with this compressor.

[0006] To achieve the above object, an aspect of the present invention provides the rotary compressor includes a hermetic casing (11), an electric motor (12) accommodated in the hermetic casing and including a stator (18) and a rotor (19), and a compression mechanism (13) coupled to the rotor by a rotating shaft (14). The compression mechanism includes a cylinder (32) including a cylindrical-shaped cylinder chamber (31), and a blade groove (64) opening to the cylinder chamber, a roller (33) eccentrically rotatable in the cylinder chamber, and a blade (61) provided in the blade groove, contacting an outer peripheral surface of the roller, and disposed to be reciprocally movable along with eccentric rotation of the roller in a radial direction of the cylinder chamber, and dividing the cylinder chamber into a suction chamber and a compression chamber. The blade groove has sliding surfaces inclined with respect to an axial direction of the rotating shaft, and guiding reciprocal movement of the blade.

[0007] To achieve the above object, an aspect of the present invention provides the refrigeration cycle apparatus includes the rotary compressor, a condenser, an expansion device, an evaporator (5), and a refrigerant pipe connecting the rotary compressor, the condenser, the expansion device, and the evaporator to circulate a refrigerant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a view illustrating a vertical section of a rotary compressor and an overview of a refrigeration cycle apparatus according to a first embodiment;
Fig. 2 is a sectional view taken along line A-A in Fig. 1, illustrating a cylinder of the rotary compressor according to the first embodiment;
Fig. 3 is a view illustrating a positional relationship between a roller and a blade in Fig. 2;
Fig. 4 is a sectional view taken along line B-B in Fig. 2 of the rotary compressor according to the first embodiment;
Fig. 5A, 5B, and 5C are contact states diagrams between a tip end surface of the blade and an outer peripheral surface of the roller of the rotary compressor according to the first embodiment; and
Fig. 6 is a sectional view taken along line B-B in Fig. 2 of a rotary compressor according to a second embodiment.

DETAILED DESCRIPTION

(First Embodiment)

[0009] Hereinafter, a first embodiment of a rotary compressor and a refrigeration cycle apparatus according to the present invention will be described with reference to Fig. 1 to Fig. 5.

[0010] Fig. 1 is a view illustrating a vertical section of the rotary compressor and an overview of the refrigeration cycle apparatus according to the first embodiment of the present invention.

[0011] As illustrated in Fig. 1, a refrigeration cycle apparatus 1 according to the first embodiment of the present invention includes a rotary compressor 2, a condenser 3 as a radiator, an expansion device 4, and an evaporator 5 as a heat absorber, an accumulator 6, and a refrigerant pipe 7. The refrigerant pipe 7 connects the rotary compressor 2, the condenser 3, the expansion device 4, the evaporator 5 and the accumulator 6 in sequence to circulate a refrigerant.

[0012] The rotary compressor 2 according to the first embodiment of the present invention includes a hermetic casing 11, an electric motor 12 provided at an upper part in the hermetic casing 11, a compression mechanism 13 provided at a lower part in the hermetic casing 11, a rotating shaft 14 that transmits a rotational driving force generated by the electric motor 12 to the compression mechanism 13, a main bearing 15 that rotatably supports the rotating shaft 14, and a secondary bearing 16 that rotatably supports the rotating shaft 14 in corporation with the main bearing 15.

[0013] The hermetic casing 11 is cylindrical. The hermetic casing 11 includes hemispherical end plates provided above and below, and a tubular body part. A suction pipe 7b that leads a refrigerant to the rotary compressor 2 is connected to the body part of the hermetic casing 11. A discharge pipe 7a for discharging the refrigerant from the rotary compressor 2 is connected to the top end plate of the hermetic casing 11.

[0014] The electric motor 12 generates a driving force that rotationally drives the compression mechanism 13. The electric motor 12 includes a stator 18 fixed to an inner wall of the hermetic casing 11, and a rotor 19 surrounded by the stator 18 and provided on the rotating shaft 14.

[0015] The rotary compressor 2 includes an oil separation portion 17 provided on a top surface of the rotor 19, that is, a surface facing the top end plate of the hermetic casing 11. The oil separation portion 17 separates lubricating oil mixed in a gaseous refrigerant compressed by the compression mechanism 13 to be discharged into the hermetic casing 11.

[0016] The rotating shaft 14 couples the electric motor 12 and the compression mechanism 13 to each other. The rotating shaft 14 transmits the driving force generated by the electric motor 12 to the compression mechanism 13. A middle portion 14a of the rotating shaft 14 is rotatably supported by the main bearing 15. A lower end portion 14b of the rotating shaft 14 is rotatably supported by the secondary bearing 16. The main bearing 15 and the secondary bearing 16 are also part of the compression mechanism 13, and sandwich the compression mechanism 13 from above and below. In other words, the rotating shaft 14 penetrates through the compression mechanism 13.

[0017] The rotating shaft 14 includes a plurality of eccentric portions 21 between the middle portion 14a supported by the main bearing 15 and the lower end portion 14b supported by the secondary bearing 16. Of the plurality of eccentric portions 21, the eccentric portion 21 close to the main bearing 15 is referred to as a first eccentric portion 22, and the eccentric portion 21 close to the secondary bearing 16 is referred to as a second eccentric portion 23. Each of the eccentric portions 21 is a disk, or a circular column having a center that does not coincide with a center of the rotating shaft 14. The center of each of the eccentric portions 21 is eccentric from the rotating shaft 14 with a phase difference of about 180° (degrees). The first eccentric portion 22 is disposed on an upper side close to the electric motor 12, and the second eccentric portion 23 is disposed on a lower side far from the electric motor 12.

[0018] The compression mechanism 13 sucks and compresses a gaseous refrigerant and then discharges the refrigerant, by the electric motor 12 rotationally driving the rotating shaft 14. The compression mechanism 13 is accommodated in the hermetic casing 11 and is disposed at a lower part of the hermetic casing 11. A lubricating oil (not illustrated) is stored in the lower part of the hermetic casing 11, and a lower part of the compression mechanism 13 is immersed in the lubricating oil.

[0019] The compression mechanism 13 includes a plurality of compression mechanisms. In other words, the compression mechanism 13 includes a first compression mechanism 25, a second compression mechanism 26, and a partition plate 27 provided between the first compression mechanism 25 and the second compression mechanism 26.

[0020] The first compression mechanism 25 includes a first cylinder 32 having a cylindrical-shaped first cylinder chamber 31, and an annular first roller 33 disposed in the first cylinder chamber 31. The second compression mechanism 26 includes a second cylinder 42 having a cylindrical-shaped second cylinder chamber 41, and an annular second roller 43 disposed in the second cylinder chamber 41.

[0021] The first cylinder 32 and the second cylinder 42 are disposed so as to be stacked in an axial direction of the rotating shaft 14. The first cylinder 32 on the upper side is disposed on a side close to the electric motor 12. The first cylinder 32 is fixed to the hermetic casing 11 via a frame 24.

[0022] The frame 24 is fixed to the hermetic casing 11 by welded portions 51 at a plurality of spots. The first cylinder

32 is fixed to the frame 24 by a fastening member such as a bolt. The welded portion 51 is formed by spot welding, for example.

[0023] Center of the first cylinder chamber 31 and center of the second cylinder chamber 41 substantially overlap a center of the rotating shaft 14. These cylinder chambers 31 and 41 have substantially a same diameter dimensions and a same height dimension, that is, a dimension in the axial direction of the rotating shaft 14. The first cylinder chamber 31 is a space inside of the first cylinder 32, and is closed by the main bearing 15 and the partition plate 27. The first eccentric portion 22 of the rotating shaft 14 is disposed in the first cylinder chamber 31. The second cylinder chamber 41 is a space inside of the second cylinder 42, and is closed by the partition plate 27 and the secondary bearing 16. The second eccentric portion 23 of the rotating shaft 14 is disposed in the second cylinder chamber 41.

[0024] The main bearing 15 on the upper side is fixed to the first cylinder 32 by a fastening member 52 such as a bolt. The compression mechanism 13 includes a first discharge valve mechanism (not illustrated) provided at the main bearing 15 on the upper side, and has a discharge port and a discharge valve for discharging a refrigerant compressed in the first cylinder chamber 31, and a first discharge muffler 53. The first discharge muffler 53 has a discharge hole (not illustrated). The first discharge muffler 53 covers the first discharge valve mechanism. The discharge port of the first discharge valve mechanism is connected to the first cylinder chamber 31. When the inside of the first cylinder chamber 31 reaches a predetermined pressure along with a compression action of the compression mechanism 13, the discharge valve opens the discharge port to discharge the compressed refrigerant into the first discharge muffler 53.

[0025] The secondary bearing 16 on the lower side is fixed to the first cylinder 32 by the fastening member 52 such as a bolt. The fastening member 52 penetrates through the second cylinder 42 and the partition plate 27 to reach the first cylinder 32. The compression mechanism 13 includes a second discharge valve mechanism (not illustrated) provided at the secondary bearing 16 on the lower side and has a discharge port and a discharge valve for discharging the refrigerant compressed in the second cylinder chamber 41, and a second discharge muffler 54. The second discharge muffler 54 covers the second discharge valve mechanism. The discharge port of the second discharge mechanism is connected to the second cylinder chamber 41. When an inside of the second cylinder chamber 41 reaches a predetermined pressure along with a compression action of the compression mechanism 13, the discharge valve opens the discharge port to discharge the compressed refrigerant into the second discharge muffler 54.

[0026] The first roller 33 is fitted onto a peripheral surface of the first eccentric portion 22 and accommodated in the first cylinder chamber 31. Along with the rotation of the rotating shaft 14, the first roller 33 eccentrically rotates while a part of its outer peripheral surface is in line contact with the first cylinder 32 along the inner peripheral surface of the first cylinder 32. The second roller 43 is fitted onto a peripheral surface of the second eccentric portion 23 and accommodated in the second cylinder chamber 41. Along with the rotation of the rotating shaft 14, the second roller 43 eccentrically rotates while a part of its outer peripheral surface is in line contact with the second cylinder 42 along the inner peripheral surface of the second cylinder 42.

[0027] Note that the contact between the first roller 33 and the first cylinder 32, and the contact between the second roller 43 and the second cylinder 42 are not direct contact, but indirect contact with an oil film (not illustrated) therebetween. However, for convenience of explanation, the contact with the oil film inbetween is simply expressed as "contact". The same applies to contact between the first roller 33 and the first eccentric portion 22, between the second roller 43 and the second eccentric portion 23, between the first roller 33 and the main bearing 15, between the second roller 43 and the secondary bearing 16, between the first roller 33 and the partition plate 27, and between the second roller 43 and the partition plate 27.

[0028] The first cylinder 32 of the first compression mechanism 25 of the compression mechanism 13 will be described in detail.

[0029] Fig. 2 illustrates a sectional view taken along line A-A in Fig. 1 illustrating the cylinder of the rotary compressor according to the first embodiment. Note that since the first compression mechanism 25 and the second compression mechanism 26 have substantially a same configuration, explanation of the second cylinder 42 of the second compression mechanism 26 will be omitted.

[0030] As illustrated in Fig. 2, the first cylinder 32 has a blade groove 64 recessed radially outward. The blade groove 64 extends over the entire axial direction of the rotating shaft 14 in the first cylinder 32. An outer end portion (also referred to as a rear end portion) in a radial direction of the blade groove 64 leads to an inside of the hermetic casing 11. That is, the blade groove 64 opens to the cylinder chamber 31.

[0031] The blade groove 64 accommodates a blade 61 reciprocally movable along a radial direction of the first cylinder chamber 31. The blade 61 receives a force inwardly in the radial direction of the first cylinder chamber 31 by a biasing means, for example, a coil spring. An inner end surface (also called a tip end surface) of the blade 61 in the radial direction of the first cylinder chamber 31 is in contact with an outer peripheral surface 65 of the first roller in the first cylinder chamber 31. Along with eccentric rotation of the first roller 33, the blade 61 reciprocally moves in the first cylinder chamber 31 while being in contact with the outer peripheral surface 65 of the first roller.

[0032] The first cylinder chamber 31 is divided into a suction chamber and a compression chamber by the first roller 33 and the blade 61. In the compression mechanism 13, a compression operation is performed in the first cylinder chamber 31 by the eccentric rotation of the first roller 33 and the reciprocal movement of the blade 61.

[0033] The first cylinder 32 has a suction hole 62 positioned on a back side of the blade groove 64 along a rotation direction of the first roller 33. The suction hole 62 penetrates through the first cylinder 32 in the radial direction. An outer end portion in the radial direction, of the suction hole 62 is connected to the suction pipe 7b. An inner end portion in the radial direction of the suction hole 62 opens to the first cylinder chamber 31. An inner peripheral surface of the first cylinder 32 has a discharge groove 63 positioned on a front side of the blade groove 64 along the rotation direction of the first roller 33. The discharge groove 63 leads to the discharge pipe 7a via the discharge port, the first discharge muffler 53, and the space in the hermetic casing 11 that are described above.

[0034] An operation of the compression mechanism 13 will be described.

[0035] When electric power is supplied to the stator 18 of the electric motor 12, the rotating shaft 14 rotates around a shaft center line 0 together with the rotor 19. Then, along with the rotation of the rotating shaft 14, the first eccentric portion 22 and the first roller 33 eccentrically rotate in the first cylinder chamber 31. At this time, the first roller 33 contacts the inner peripheral surface of the first cylinder 32, whereby the refrigerant is taken into the first cylinder chamber 31 through the suction pipe 7b, and the refrigerant taken in is compressed in the first cylinder chamber 31.

[0036] The blade 61 reciprocally moves in the radial direction of the first cylinder chamber 31 along with the eccentric rotation of the first roller 33.

[0037] Specifically, in the first cylinder chamber 31, the refrigerant is sucked into the suction chamber through the suction pipe 7b and the suction hole 62, and the refrigerant sucked from the suction hole 62 is compressed in the compression chamber. The compressed refrigerant is discharged outside of the first cylinder chamber 31 through the discharge groove 63 of the main bearing 15, and thereafter, discharged into the hermetic casing 11 through a coupling hole (not illustrated) outside of the first cylinder chamber 31. Note that the refrigerant discharged into the hermetic casing 11 is sent to the condenser 3 through the discharge pipe 7a.

[0038] Fig. 3 is a view illustrating a positional relationship between the roller and the blade in Fig. 2. Fig. 4 is a view illustrating a partially section taken along line B-B in Fig. 2 of the rotary compressor according to the first embodiment.

[0039] The case in which the first roller 33 in the first cylinder chamber 31 is positioned at a top dead center or a bottom dead center will be described. Fig. 2 and Fig. 3 illustrate a state where the roller is positioned at the top dead center.

[0040] As illustrated in Fig. 2 to Fig. 4, the blade groove 64 has sliding surfaces that guide reciprocal movement of the blade 61. The sliding surfaces are provided to be inclined with respect to the axial direction of the rotating shaft 14. In other words, a first wall surface 91 and a second wall surface 92 of the first cylinder 32 that are the sliding surfaces of the blade groove 64 are inclined with respect to the axial direction of the rotating shaft 14.

[0041] An upper end side of the sliding surface of the blade groove 64 may be inclined to either one of the rotation direction and a reverse rotation direction of the first roller 33.

[0042] The blade groove 64 is easily manufactured by performing broaching and polishing in a state where the first cylinder 32 is inclined.

[0043] The first wall surface 91 and the second wall surface 92 are inclined with respect to the axial direction of the rotating shaft 14. Therefore, the blade 61 is accommodated in the blade groove 64 in a state of being inclined with respect to the axial direction of the rotating shaft 14.

[0044] As illustrated in Fig. 2 to Fig. 4, the blade 61 is in a rectangular parallelepiped shape extending in the radial direction of the first cylinder 32, and has a first end surface 71 and a second end surface 72 that face each other in a circumferential direction of the first roller 33, and a third end surface 81 and a fourth end surface 82 that face each other in the axial direction of the rotating shaft 14. The first end surface 71, the second end surface 72, and the first wall surface 91 and the second wall surface 92 of the first cylinder 32 are substantially parallel.

[0045] With Fig. 3 and Fig. 4, a basic dimensional relationship of the roller and the blade will be described.

[0046] The sliding surface of the blade groove 64 is inclined with respect to the axial direction of the rotating shaft 14. Therefore, a gap r occurs to upper and lower end portions of a site where the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller contact each other. In other words, the tip end surface of the blade 61 is in contact with the outer peripheral surface 65 of the first roller only by a part of an entire length, and the upper and lower end portions of the tip end surface of the blade 61 are not in contact with the outer peripheral surface 65 of the first roller.

[0047] Here, if the tip end surface of the blade 61 is orthogonal to the axial direction of the rotating shaft 14, the tip end surface of the blade 61 comes in point contact with the outer peripheral surface 65 of the first roller. If a center of the tip end surface of the blade 61 is in point contact with the outer peripheral surface 65 of the first roller, the portion closer to the two ends of the tip end surface of the blade 61 will be farther from the outer peripheral surface 65 of the first roller, and both ends of the tip end surface of the blade 61 will be farthest from the outer peripheral surface 65 of the first roller. The more erected the tip end surface of the blade 61 is in the axial direction of the rotating shaft 14, the longer a contact distance will be between the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller. When the tip end surface of the blade 61 is made parallel to the axial direction of the rotating shaft 14, the tip end surface of the blade 61 contacts the outer peripheral surface 65 of the first roller over an entire height.

[0048] Since the respective upper and lower end portions of the tip end surface of the blade 61 do not locally contact the outer peripheral surface 65 of the first roller, no extreme pressure occurs to the tip end surface of the blade 61. Accordingly, the oil film on the sliding portion between the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller does not break, and there is no risk of occurrence of seizure or abnormal wear.

[0049] An inclination angle θ1 of the sliding surface of the blade groove 64 is preferably 1° to 3°. Here, θ1 is an angle at which the sliding surface of the blade groove 64 is inclined to the axial direction (shaft center line 0) of the rotating shaft 14.

[0050] The tip end surface of the blade 61 has a center portion 61A of the blade, that is, a contact portion between the first roller 33 and the blade 61, an upper end portion 61B of the blade, and a lower end portion 61C of the blade. A gap r is provided between the upper end portion 61B and the outer peripheral surface 65 of the first roller, and between the lower end portion 61C and the outer peripheral surface 65 of the first roller. The gap r becomes maximum when the position of the first roller 33 eccentrically rotating in the first cylinder chamber 31 of the first cylinder 32 is at the top dead center or the bottom dead center. In other words, the upper end portion 61B of the blade and the lower end portion 61C of the blade each has the maximum gap r by which the upper end portion 61B and the lower end portion 61C are farthest from the outer peripheral surface 65 of the first roller, when a portion near the center portion 61A of the blade contacts the outer peripheral surface 65 of the first roller.

[0051] Based on Fig. 3, the maximum gap r can be obtained from a difference between a radius R of the first roller 33, and a distance R' from a center O' of the first roller 33 to the upper end portion 61B of the blade.

$$\text{(Maximum gap r)} = \text{(distance R')} - \text{(distance R)} = \text{(distance R')} - a \div \tan\theta 2.$$

[0052] Here, in Fig. 3, an included angle formed by a line segment L1 connecting the center O' of the first roller 33 and the upper end portion 61B of the blade, and a line segment L2 connecting the center O' of the first roller 33 and the center portion 61A of the blade is defined as θ2.

[0053] In a general rotary compressor, the maximum gap r changes by about 0.001 milli-metres to 0.01 milli-metres when the inclination angle θ1 is in a range of 1° to 3°. With such an angle range of θ1, it is possible to reduce an amount of refrigerant leaking from the gap formed by the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller to a very small amount.

[0054] By setting the inclination angle θ1 of the sliding surface of the blade groove 64 to 1° to 3°, the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller are prevented from locally contacting each other while the amount of the refrigerant leaking from the gap r between the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller is minimized.

[0055] During actual operation, the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller are in contact with each other with an inclination accompanied by relative fluctuations, as illustrated in Fig. 5(a), Fig. 5(b), and Fig. 5(c). As conceivable patterns of the inclination, for example, Fig. 5(a) shows a state where a relative inclination occurs, and the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller contact each other on a lower end side, Fig. 5(b) shows a state without a relative inclination, and Fig. 5(c) shows a state where a relative inclination occurs, and the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller contact each other on an upper end side.

[0056] In the embodiment of the present invention, even in a pattern in which the contact between the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller are relatively inclined, the sliding surface of the blade groove 64 is inclined with respect to the axial direction of the rotating shaft 14. Accordingly, the tip end surface of the blade 61 gently contacts the outer peripheral surface 65 of the first roller from the center portion to the upper end side or the lower end side, and local contact of the tip end surface of the blade 61 and the outer peripheral surface 65 of the first roller can be relieved.

[0057] Thereby, even with an easy manufacturing method, abnormal wear due to unilateral touch can be prevented, and the rotary compressor with high reliability can be provided.

[0058] Note that in the embodiment of the present invention, the maximum gap r at the top dead center or the bottom dead center is described, but by optimizing the outer diameter dimension of the first roller 33, an eccentric amount of the eccentric portion, the height of the blade 61, a circular arc shape of the tip end surface of the blade 61, and the inclination of the blade 61, local contact is also relieved even when the first roller 33 is in positions other than the top dead center and the bottom dead center.

(Second Embodiment)

[0059] Next, a second embodiment of the rotary compressor and the refrigeration cycle apparatus according to the present invention will be described with reference to Fig. 6. As for respective components of the second embodiment, same components as the respective components of the first embodiment in Fig. 1 to Fig. 5 are denoted by the same reference signs, and explanation thereof will be omitted. What the second embodiment differs from the first embodiment is a shape of the blade 61.

[0060] Fig. 6 illustrates a sectional view taken along line B-B in Fig. 2 of a rotary compressor according to the second embodiment.

[0061] As illustrated in Fig. 6, upper and lower end surfaces of the blade 61, a third end surface 81 and a fourth end surface 82 that face each other in an axial direction of a rotating shaft 14 may be aligned in a same straight line with an upper and lower flat end surfaces of a first cylinder 32. Specifically, the upper and lower end surfaces of the blade 61 and the upper and lower flat end surfaces of the first cylinder 32 are substantially parallel with a lower end surface of a main bearing 15 and an upper end surface of a partition plate 27. In other words, in the blade 61, a sectional shape in the radial direction of the first cylinder chamber 31 may be a parallelogram.

[0062] A rotary compressor 2 in which the upper and lower end surfaces of the blade 61 are aligned in the same straight line with the upper and lower flat end surfaces of the first cylinder 32 prevents degradation of compression performance due to refrigerant leakage from the gaps between the blade 61 and the main bearing 15 and between the blade 61 and the partition plate 27.

[0063] Further, the rotary compressor 2 according to the second embodiment prevents the blade 61 from unilaterally contacting the blade groove 64.

[0064] Furthermore, compared with a work of forming crowning on the tip end surface of the blade 61, making the upper and lower end surfaces of the blade 61 aligned in the same straight line with the upper and lower flat end surfaces of the first cylinder 32 is easier, which does not require additional processing, and has no risk of reducing production capacity.

REFERENCE SIGNS LIST

[0065]

1	refrigeration cycle apparatus
2	rotary compressor
3	condenser
4	expansion device
5	evaporator
6	accumulator
7	refrigerant pipe
7a	discharge pipe
7b	suction pipe
11	hermetic casing
12	electric motor
13	compression mechanism
14	rotating shaft
14a	middle portion
14b	lower end portion
15	main bearing
16	secondary bearing
17	oil separation portion
18	stator
19	rotor
21	eccentric portion
22	first eccentric portion
23	second eccentric portion
24	frame
25	first compression mechanism
26	second compression mechanism
27	partition plate
31	first cylinder chamber
32	first cylinder
33	first roller
41	second cylinder chamber

42 second cylinder
43 second roller
51 welded portion
52 fastening member
53 first discharge muffler
54 second discharge muffler
61 blade
61A center portion of the blade
61B upper end portion of the blade
61C lower end portion of the blade
62 suction hole
63 discharge groove
64 blade groove
65 outer peripheral surface of the first roller
71 first end surface
72 second end surface
81 third end surface
82 fourth end surface
91 first wall surface
92 second wall surface

Claims

1. A rotary compressor (2) comprising:

a hermetic casing (11);
an electric motor (12) accommodated in the hermetic casing and including a stator (18) and a rotor (19); and
a compression mechanism (13) coupled to the rotor by a rotating shaft (14),
wherein the compression mechanism includes

a cylinder (32) including a cylindrical-shaped cylinder chamber (31), and a blade groove (64) opening to the cylinder chamber,
a roller (33) eccentrically rotatable in the cylinder chamber, and
a blade (61) provided in the blade groove, contacting an outer peripheral surface of the roller, and disposed to be reciprocally movable along with eccentric rotation of the roller in a radial direction of the cylinder chamber and dividing the cylinder chamber into a suction chamber and a compression chamber, and

the blade groove has sliding surfaces inclined with respect to an axial direction of the rotating shaft, and guiding reciprocal movement of the blade.

2. The rotary compressor according to claim 1, wherein the sliding surfaces are provided to be inclined at 1° to 3° with respect to the axial direction of the rotating shaft.

3. The rotary compressor according to claim 1 or 2, wherein when the roller is at a top dead center or a bottom dead center, a maximum gap (r) between the blade and the roller and the cylinder chamber is 0.001 milli-metres or more and 0.01 milli-metres or less.

4. The rotary compressor according to any one of claims 1 to 3, wherein in the axial direction of the rotating shaft, an end surface of the blade is aligned on a same surface with an end surface of the cylinder chamber.

5. A refrigeration cycle apparatus (1), comprising:

the rotary compressor (2) according to any one of claims 1 to 4;
a condenser (3);
an expansion device (4);
an evaporator (5); and
a refrigerant pipe (7) connecting the rotary compressor, the condenser, the expansion device, and the evaporator

to circulate a refrigerant.

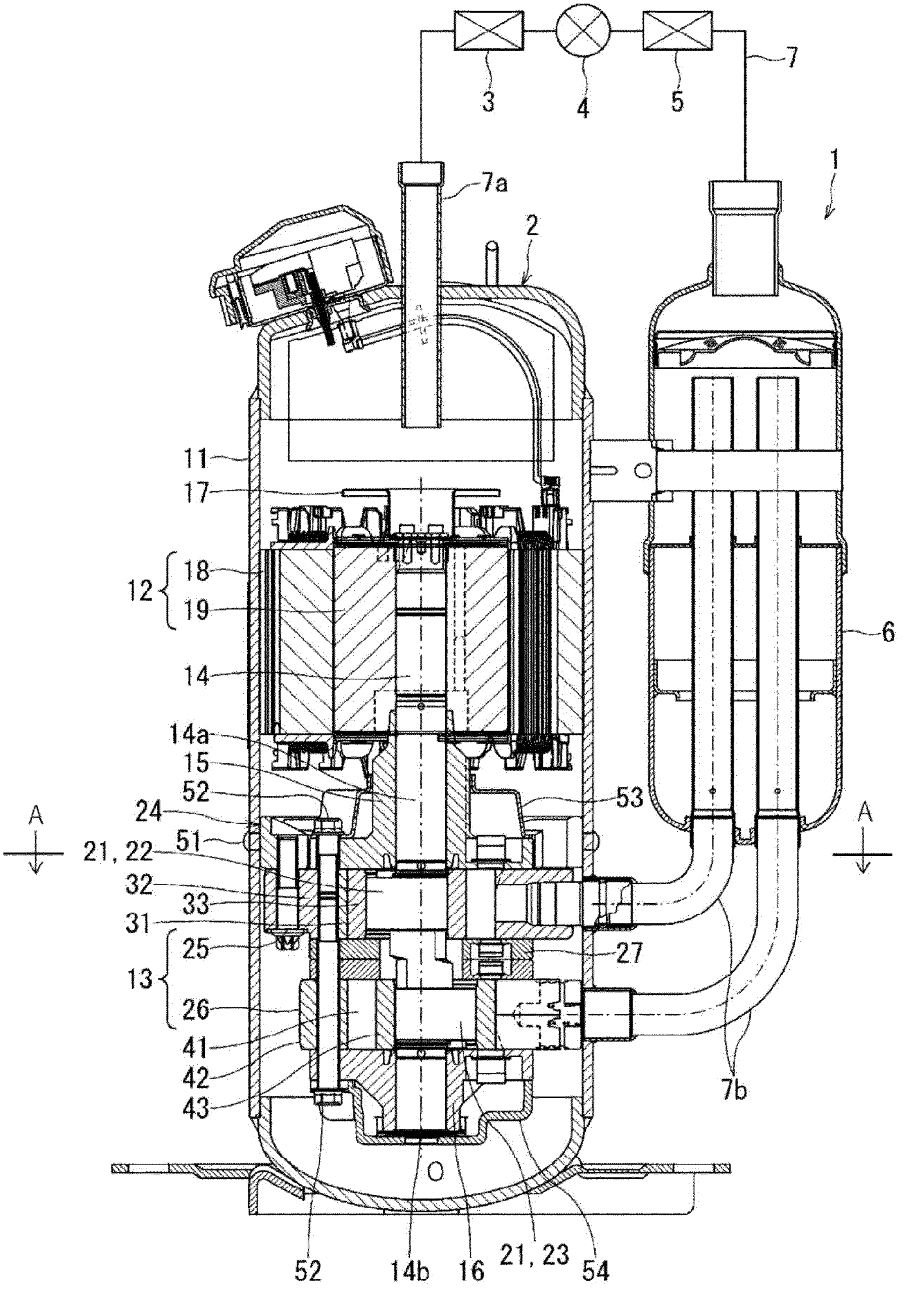
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FIG. 1

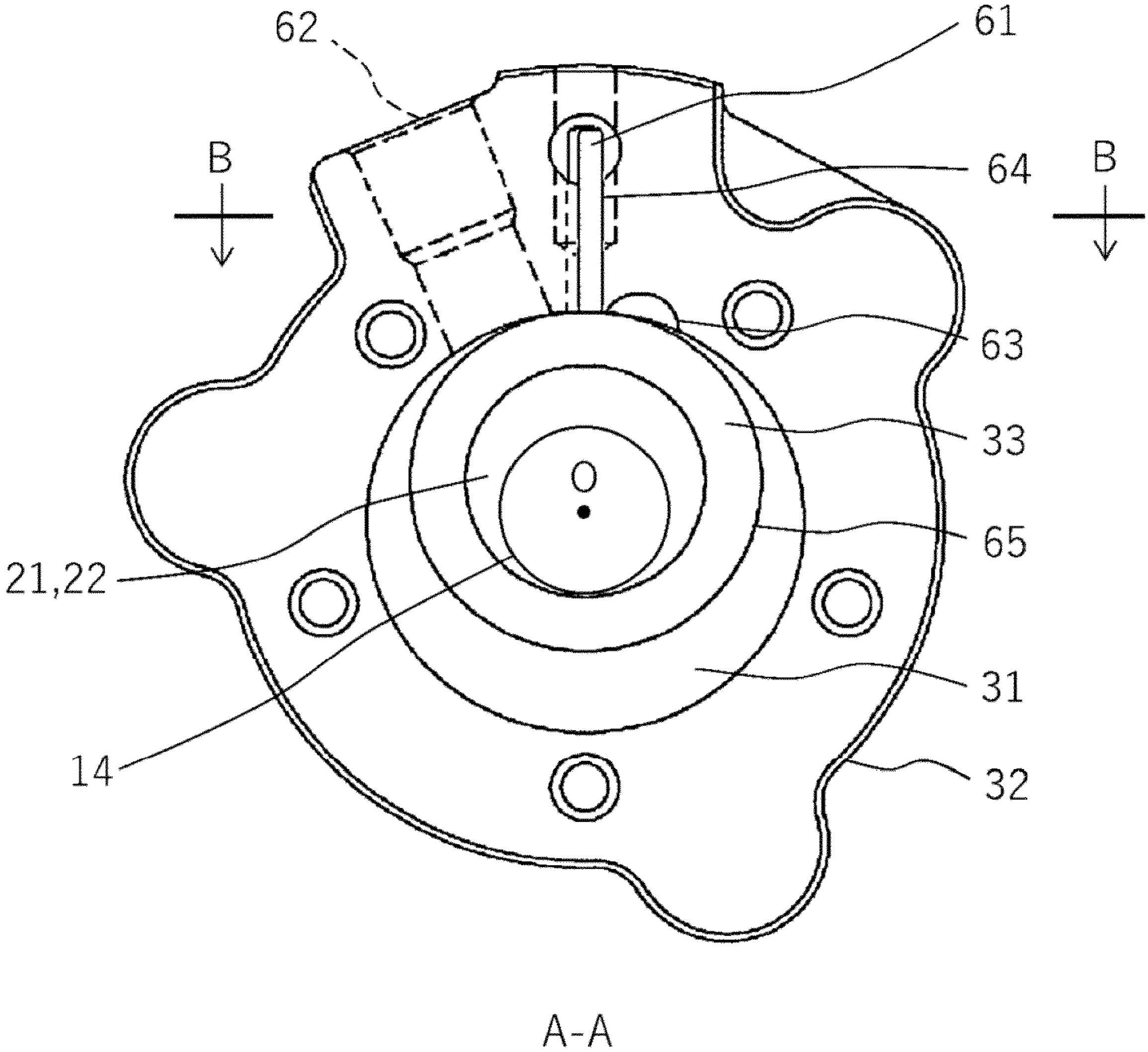


FIG. 2

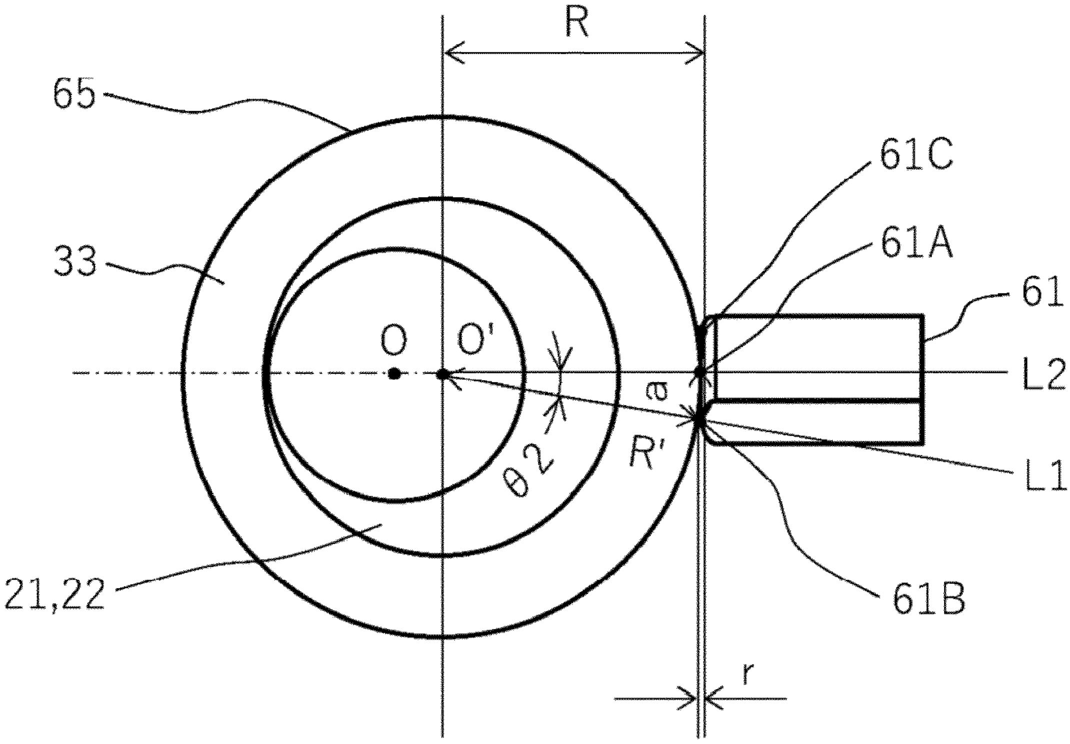


FIG. 3

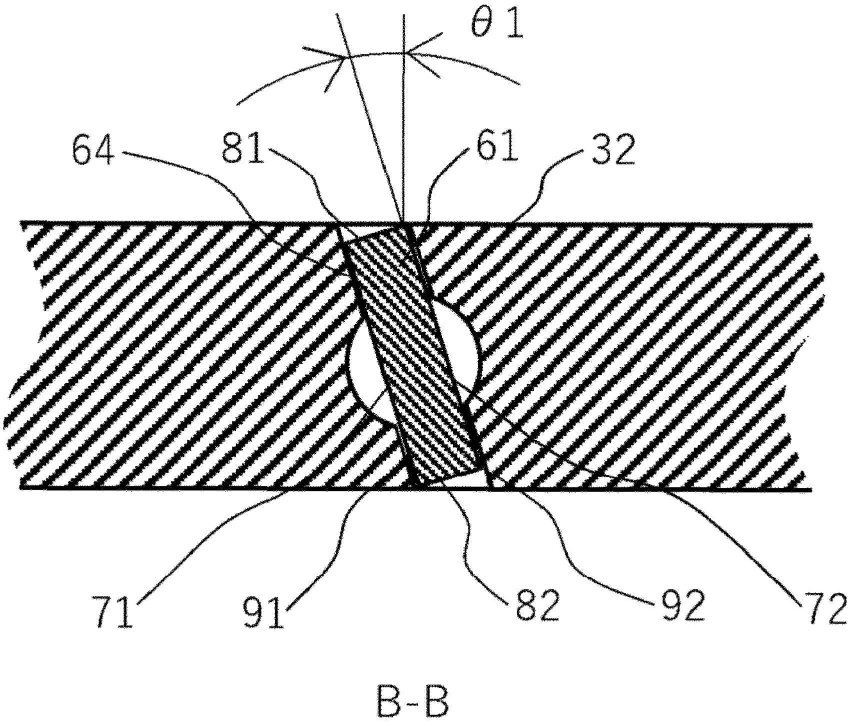


FIG. 4

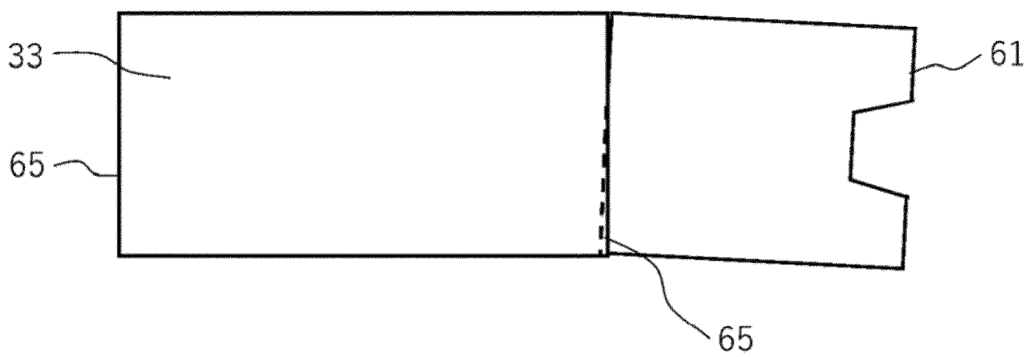


FIG. 5A

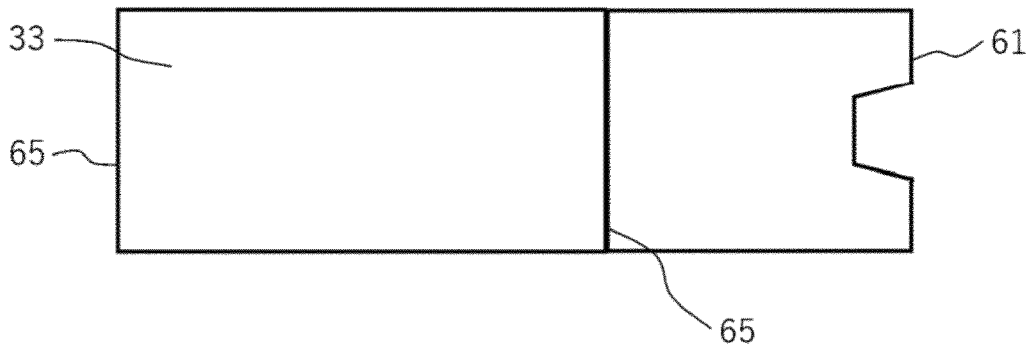


FIG. 5B

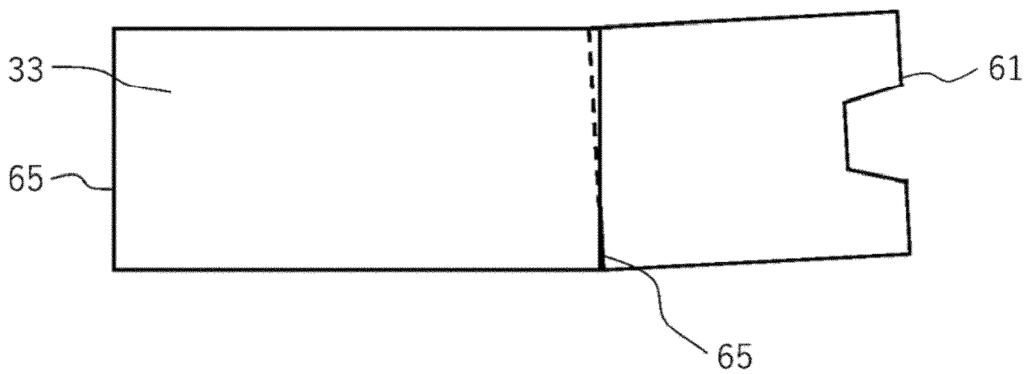
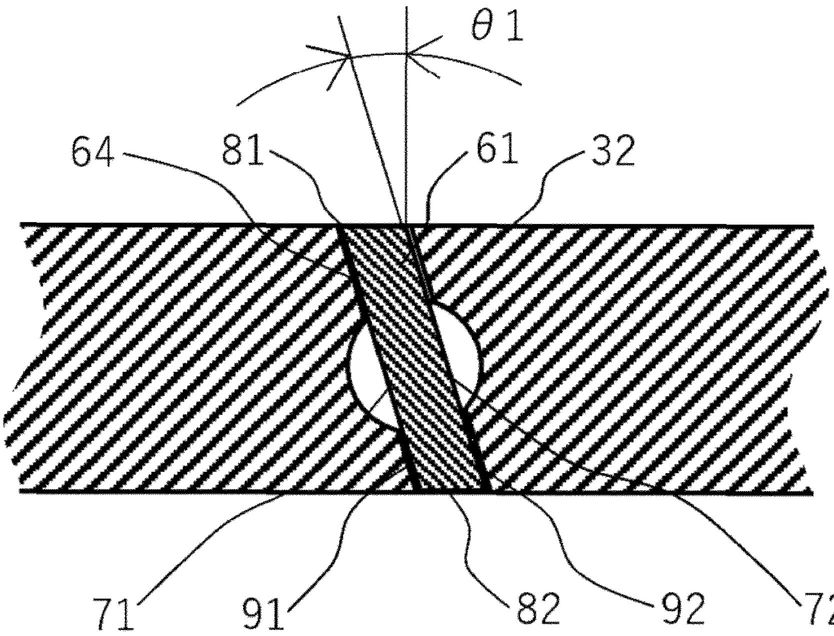


FIG. 5C



B-B

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	JP H06 147152 A (MITSUBISHI HEAVY IND LTD) 27 May 1994 (1994-05-27) * abstract * * figures 1-8 * -----	1-5	INV. F01C21/08 F04C18/356 F04C23/00
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TECHNICAL FIELDS SEARCHED (IPC)
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F04C

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	17 January 2024	Sbresny, Heiko

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