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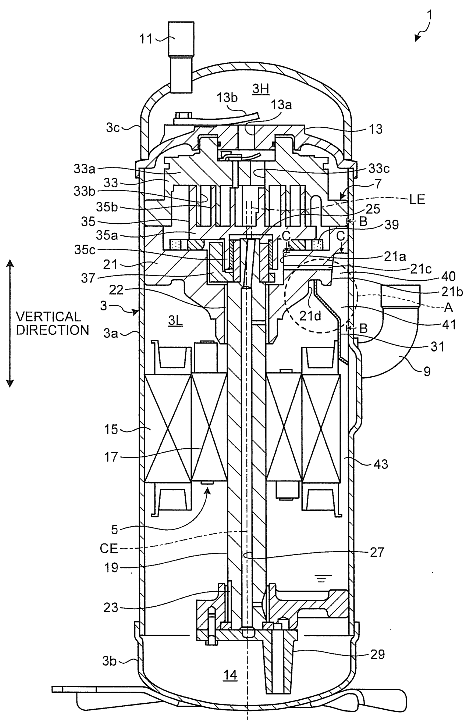
(54) **SCROLL FLUID MACHINE**

(57) A scroll fluid machine includes a housing (3); a pivoting shaft (19) that is disposed in a low-pressure chamber (3L) of the housing and has an oil supply passage (27); a bearing member (21) that is fixed to an inner wall surface of the housing, is provided with an upper bearing (22) configured to pivotally support the pivoting shaft (19) around an axial center (CE), and has an oil discharge passage (21c); and a guide plate (31) that is fixed to the inner wall surface of the housing, and forms a tunnel (41) configured to guide the oil discharged from the oil discharge passage (21c) to an oil reservoir (14) of the housing, between the inner wall surface of the housing and the guide plate (31), a lower surface of the bearing member includes a flat region, and the guide plate has a flat upper surface that faces the flat region.

FIG.1



EP 3 165 771 A1

Description

Field

[0001] The present invention relates to a scroll fluid machine.

Background

[0002] Patent Literature 1 discloses a hermetic scroll compressor as a scroll fluid machine. In the hermetic scroll compressor, oil after lubricating the bearing is discharged from an oil discharge passage provided in a bearing member (a frame), and is sent to an oil reservoir via a tunnel between a housing and a guide plate.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent Application Laid-open No. 11-182477 A

Summary

Technical Problem

[0004] By providing the guide plate as disclosed in Patent Literature 1, even when the scroll compressor operates at high speed and a gas sucked from a suction pipe flows in a low-pressure chamber of the housing at high speed, oil discharged from the oil discharge passage is sent to the oil reservoir, while being suppressed from being raised by the gas. However, when a gap is present between the guide plate and the bearing member, the oil may enter the low-pressure chamber via the gap. When the oil enters the low-pressure chamber, some of the oil to be sent to the oil reservoir is raised by the gas and is sucked into the scroll compression mechanism. As a result, the amount of oil sent to the oil reservoir decreases, and the amount of oil discharged from the housing is not sufficiently suppressed. Thus, there is a possibility that the amount of oil in the oil reservoir decreases and defective lubrication occurs.

[0005] An object of the present invention is to provide a scroll fluid machine in which an amount of oil discharged from the housing is suppressed to allow a high-speed operation.

Solution to Problem

[0006] A scroll fluid machine of a present invention includes:

a housing;
a pivoting shaft that is disposed in a low-pressure chamber of the housing, and has an oil supply passage;
a bearing member that is fixed to an inner wall surface of the housing, is provided with an upper bearing configured to pivotally support the pivoting shaft around an axial center, and has an oil discharge passage; and
a guide plate that is fixed to the inner wall surface of the housing, and forms a tunnel configured to guide the oil discharged from the oil discharge passage to an oil reservoir of the housing, between the inner wall surface of the housing and the guide plate.

[0007] A lower surface of the bearing member includes a flat region, and
the guide plate has a flat upper surface that faces the flat region.

[0008] According to the scroll fluid machine of the present invention, the oil discharged from the oil discharge passage of the bearing member through the oil supply passage of the pivoting shaft is sent to the oil reservoir via the tunnel between the housing and the guide plate. By providing the guide plate, even when the gas flows in the low-pressure chamber of the housing at high speed, the oil discharged from the oil discharge passage is sent to the oil reservoir, while being suppressed from being raised by the gas. Also, the flat region is provided on the lower surface of the bearing member, the flat upper surface is provided on the guide plate, and the flat region and the flat upper surface face each other. Thus, circulation of the oil is suppressed, and the oil discharged from the oil discharge passage can be suppressed from entering the low-pressure chamber. Therefore, even when the scroll fluid machine operates at high speed, the amount of oil discharged from the housing is suppressed.

[0009] Furthermore, in the scroll fluid machine of the present invention, the bearing member has a recess that opens downward, and the lower surface of the recess facing downward is the flat region.

[0010] According to the scroll fluid machine, a part of the guide plate enters the inside of the recess, and the flat region of the lower surface of the recess faces the flat upper surface of the guide plate. Therefore, even when oil leaks from the gap between the flat region and the flat upper surface, the oil is blocked by the recess. Therefore, it is possible to suppress a failure in which the oil enters the low-pressure chamber or is raised by the gas.

[0011] Furthermore, in the scroll fluid machine of the present invention, the flat upper surface of the guide plate is in contact with the flat region of the bearing member.

[0012] According to the scroll fluid machine, since the flat region and the flat upper surface are in contact with each other, and a gap is not formed between the guide plate and the bearing member, the oil discharged from the oil discharge passage can be sufficiently suppressed from entering the low-pressure chamber.

[0013] Furthermore, in the scroll fluid machine of the present invention, the guide plate has a first portion that faces the inner wall surface of the housing via a gap, a second portion that extends toward the housing from one end portion of the first portion in a circumferential direction of the axial center, a third portion that extends toward the housing from the other end portion of the first portion, a first flange portion that is provided at the end portion of the second portion and is fixed to the inner wall surface of the housing, and a second flange portion that is provided at the end portion of the third portion and is fixed to the inner wall surface of the housing, and

all of the first portion, the second portion, the third portion, the first flange portion and the second flange portion are in contact with the flat region.

[0014] According to the scroll fluid machine, the tunnel is formed by the first portion, the second portion and the third portion of the guide plate, and the inner wall surface of the housing. Fixing of the guide plate to the inner wall surface of the housing is stabilized by the first flange portion and the second flange portion. Since all of the flat upper surface of the first portion, the flat upper surface of the second portion, the flat upper surface of the third portion, the flat upper surface of the first flange portion, and the flat upper surface of the second flange portion are in contact with the flat region of the bearing member, the tunnel and the low-pressure chamber are completely separated from each other, and leakage of oil from the gap between the bearing member and the guide plate is sufficiently suppressed.

[0015] Furthermore, in the scroll fluid machine of the present invention, the flat region and the flat upper surface are parallel to each other.

[0016] According to the scroll fluid machine, since the flat region and the flat upper surface are parallel to each other, the flat region and the flat upper surface sufficiently come into close contact with each other. Accordingly, leakage of oil from the gap between the bearing member and the guide plate is sufficiently suppressed.

[0017] Furthermore, in the scroll fluid machine of the present invention, at least a part of the guide plate including the flat upper surface is an elastic member.

[0018] According to the scroll fluid machine, by the elastic deformation of the guide plate, the guide plate and the bearing member are in contact with each other with high contact force. Accordingly, leakage of oil from the gap between the bearing member and the guide plate is sufficiently suppressed.

[0019] Furthermore, in the scroll fluid machine of the present invention, the flat upper surface of the guide plate faces the lower surface of the recess of the bearing member via a gap, and

when a dimension of the gap is set as La, and a vertical dimension of the recess is set as Lb, the following requirement is satisfied:

$$0 \leq La \leq Lb/5.$$

[0020] According to the scroll fluid machine, since an overlap dimension between the guide plate and the bearing member is sufficiently larger than a dimension of the gap between the flat upper surface and the lower surface of the recess, the flow of oil is restricted. Thus, even when the oil leaks from the gap between the flat upper surface and the lower surface of the recess, the oil is blocked by the recess. Therefore, it is possible to suppress a failure in which oil enters the low-pressure chamber or is raised by the gas.

Advantageous Effects of Invention

[0021] According to the present invention, a scroll fluid machine is provided in which the amount of oil discharged from the housing is suppressed to allow high-speed operation.

Brief Description of Drawings

[0022]

FIG. 1 is a side sectional view illustrating an example of a scroll fluid machine according to a first embodiment.
FIG. 2 is an enlarged view of a part A of FIG. 1.
FIG. 3 is a sectional view taken along a line B-B of FIG. 1.
FIG. 4 is a sectional view taken along a line C-C of FIG. 1.
FIG. 5 is a side sectional view illustrating an example of a guide plate according to a second embodiment.
FIG. 6 is a side sectional view illustrating an example of a guide plate according to a third embodiment. Description of Embodiments

[0023] Hereinafter, embodiments according to the present invention will be described in detail with reference to the drawings. The invention is not limited by the embodiments. In addition, constituent elements of the embodiments include elements that are easily replaceable by those skilled in the art or substantially the same elements.

<First Embodiment>

[0024] A first embodiment will be described. FIG. 1 is a side sectional view illustrating an example of a scroll fluid machine according to the present embodiment. FIG. 2 is an enlarged view of a part A of FIG. 1. FIG. 3 is a sectional view taken along a line B-B of FIG. 1. FIG. 4 is a sectional view taken along a line C-C of FIG. 1.

[0025] In the present embodiment, an example in which the scroll fluid machine is a scroll compressor 1 configured to compress and discharge the sucked gas will be described. The scroll compressor 1, for example, is disposed in a refrigerant flow passage through which refrigerant gas circulates in an air conditioner or a refrigerator.

[0026] As illustrated in FIG. 1, the scroll compressor 1 includes a housing 3, a motor 5 provided inside the housing 3, a pivoting shaft 19 that is provided inside the housing 3 and is pivotable around an axial center CE by the driving force generated by the motor 5, and a scroll compression mechanism 7 that is connected to the pivoting shaft 19 and is driven by the driving force generated by the motor 5.

[0027] In the present embodiment, a positional relation of each part will be described on the assumption that a direction parallel to the axial center CE is set as a vertical direction, a pivotal direction centered around the axial center CE is set as a circumferential direction of the axial center CE.

[0028] The housing 3 includes a cylindrical housing body 3a extending in the vertical direction, a bottom member 3b that occludes a lower end portion of the housing body 3a, and a lid member 3c that occludes an upper end portion of the housing body 3a, and the housing 3 is an entirely sealed pressure vessel. A suction pipe 9 is provided on the side part of the housing body 3a to introduce a gas into the interior of the housing 3. On the top of the lid member 3c, a discharge pipe 11 is provided to discharge the gas compressed by the scroll compression mechanism 7. An oil reservoir 14 in which the oil is stored is provided at the bottom of the housing 3. A discharge cover 13 is provided between the housing body 3a and the lid member 3c. By the discharge cover 13, the interior of the housing 3 is partitioned into a low-pressure chamber 3L and a high-pressure chamber 3H. The low-pressure chamber 3L is a space on the side lower than the discharge cover 13. The high-pressure chamber 3H is a space on the side upper than the discharge cover 13. The discharge cover 13 has an opening hole 13a that connects the low-pressure chamber 3L with the high-pressure chamber 3H, and a discharge reed valve 13b that opens and closes the opening hole 13a.

[0029] The motor 5 has a stator 15 fixed to the housing body 3a, and a rotor 17 connected with the pivoting shaft 19. The stator 15, the rotor 17 and the pivoting shaft 19 are disposed in the low-pressure chamber 3L of the housing 3. The stator 15 is disposed at substantially the center of the housing body 3a in the vertical direction and is fixed to the inner wall surface of the housing body 3a. The rotor 17 is pivotable with respect to the stator 15. The motor 5 pivots the rotor 17 by the power supplied from an external power source. When the rotor 17 pivots, the pivoting shaft 19 pivots with the rotor 17.

[0030] The pivoting shaft 19 has an upper end portion protruding upward from the rotor 17, and a lower end portion protruding downward from the rotor 17. The upper end portion of the pivoting shaft 19 is pivotally supported by an upper bearing 22. The lower end portion of the pivoting shaft 19 is pivotally supported by a lower bearing 23. The upper bearing 22 and the lower bearing 23 pivotally support the pivoting shaft 19 about the axial center CE. An eccentric pin 25 is provided at the upper end portion of the pivoting shaft 19, and the eccentric pin 25 protrudes upward along an eccentric center LE biased to the axial center CE. The scroll compression mechanism 7 is connected to the upper end portion of the pivoting shaft 19 having the eccentric pin 25.

[0031] The pivoting shaft 19 and the eccentric pin 25 have an oil supply passage 27. The oil supply passage 27 is an internal flow passage formed in the interior of the pivoting shaft 19 and the eccentric pin 25. The oil supply passage 27 is formed to pass through the pivoting shaft 19 and the eccentric pin 25 in the vertical direction. The lower end portion of the pivoting shaft 19 is disposed in the oil reservoir 14. An oil supply pump 29 is provided in the lower end portion of the pivoting shaft 19. The oil supply pump 29 feeds the oil stored in the oil reservoir 14 to the oil supply passage 27 of the pivoting shaft 19, with the pivoting of the pivoting shaft 19.

[0032] The upper bearing 22 is provided in a bearing member 21. The bearing member 21 is fixed to the inner wall surface of the housing body 3a. The bearing member 21 has a hole in which the upper end portion of the pivoting shaft 19 is disposed. The upper bearing 22 is provided between the bearing member 21 and the pivoting shaft 19. The bearing member 21 pivotally supports the pivoting shaft 19 via the upper bearing 22. A recess 21a which opens upward is formed on the upper surface of the bearing member 21. The recess 21a is formed so as to surround the upper end portion of the pivoting shaft 19. The recess 21a houses a slide bush 37, and stores the oil supplied via the oil supply passage 27 by the oil supply pump 29. The oil stored in the recess 21a is supplied to the scroll compression mechanism 7.

[0033] The outer peripheral portion of the bearing member 21 is partially notched, and an end surface 21b is formed on the outer peripheral portion of the bearing member 21 by the notch. A space 40 is provided between the end surface 21b of the bearing member 21 formed by the notch and the inner wall surface of the housing body 3a. Further, the bearing member 21 has an oil discharge passage 21c. The oil discharge passage 21c is an internal flow passage formed in the interior of the bearing member 21. The oil discharge passage 21c connects the inner space of the recess 21a with the space 40 between the end surface 21b and the inner wall surface of the housing body 3a. An inlet of the oil discharge passage 21c is formed on the inner surface of the recess 21a. An outlet of the oil discharge passage 21c is formed on the end surface 21b. The oil discharge passage 21c discharges the oil stored in the recess 21a to the space 40. Further, on the lower surface of the bearing member 21, a recess 21d which opens downward is formed.

[0034] The scroll compression mechanism 7 is disposed above the bearing member 21 in the low-pressure chamber 3L. The scroll compression mechanism 7 has a fixed scroll 33, a turning scroll 35 and the slide bush 37.

[0035] The fixed scroll 33 has a fixed side end plate 33a fixed to the inner wall surface of the housing body 3a, and a spiral fixed side wrap 33b provided on an inner surface (a lower surface in FIG. 1) of the fixed side end plate 33a. A discharge passage 33c is formed in the center portion of the fixed side end plate 33a.

[0036] The turning scroll 35 has a movable side end plate 35a having an inner surface (an upper surface in FIG. 1) facing the inner surface of the fixed side end plate 33a, and a spiral movable side wrap 35b provided on the inner surface of the movable side end plate 35a.

[0037] Since the movable side wrap 35b of the turning scroll 35 and the fixed side wrap 33b of the fixed scroll 33 are engaged with each other by shifting the phases, a compression chamber partitioned by each of the end plates 33a and 35a and each of the wraps 33b and 35b is formed. Also, the turning scroll 35 has a cylindrical boss 35c provided on the outer surface (the lower surface in FIG. 1) of the movable side end plate 35a, and the eccentric pin 25 of the pivoting shaft 19 is connected to the cylindrical boss 35c to transfer the eccentric pivoting of the eccentric pin 25 to the cylindrical boss 35c. Also, the turning scroll 35 revolves, while being prevented from rotating based on the eccentric pivoting of the eccentric pin 25, by a rotation preventing mechanism 39 such as an Oldham link disposed between the outer surface of the movable side end plate 35a and the bearing member 21.

[0038] The slide bush 37 is housed in the recess 21a of the bearing member 21, and is interposed between the eccentric pin 25 of the pivoting shaft 19 and the boss 35c of the turning scroll 35 to transfer the pivotal movement of the eccentric pin 25 as a pivotal movement of the turning scroll 35. Further, the slide bush 37 is disposed to slidably move in the radial direction of the eccentric pin 25 so as to maintain the engagement between the movable side wrap 35b of the turning scroll 35 and the fixed side wrap 33b of the fixed scroll 33.

[0039] A guide plate 31 is provided below the bearing member 21. The guide plate 31 is fixed to the inner wall surface of the housing 3, and is disposed in the low-pressure chamber 3L. The guide plate 31 is provided to extend in the vertical direction. The guide plate 31 is provided to surround the space 40. The guide plate 31 is a gutter-shaped member, and both end portions of the guide plate 31 in the circumferential direction of the axial center CE are formed to be curved toward the inner wall surface of the housing body 3a. The lower end portion of the guide plate 31 is formed by bending to approach the inner wall surface of the housing body 3a toward a downward direction. The upper end portion of the guide plate 31 enters the recess 21d.

[0040] The guide plate 31 is fixed to the inner wall surface of the housing body 3a, and a tunnel 41 is formed between the guide plate 31 and the inner wall surface of the housing body 3a to guide the oil discharged from the oil discharge passage 21c to the oil reservoir 14 of the housing 3. The space 40 and the tunnel 41 are connected to each other. The oil discharged to the space 40 from the outlet of the oil discharge passage 21c is supplied to the tunnel 41. The oil flowing into the tunnel 41 passes through the tunnel 41, and is sent to the oil reservoir 14 via a groove-shaped oil passage 43 provided in the stator 15.

[0041] As illustrated in FIGS. 2 and 3, the guide plate 31 is disposed below at least a part of the lower bearing member 21, and has an upper surface 31F which faces the bearing member 21. The upper surface 31F is a flat surface. In the following description, a flat, upper surface 31F of the guide plate 31 is appropriately referred to as the flat upper surface 31F.

[0042] At least a part of the lower surface of the bearing member 21 is a flat surface. When at least a part of the lower surface of the bearing member 21 is machined by a predetermined machining method such as cutting or grinding, the flat surface of the bearing member 21 is formed. In the following description, a region, which is machined to the flat surface, of the lower surface of the bearing member 21 is appropriately referred to as a flat region 21F.

[0043] The flat region 21F of the bearing member 21 faces the flat upper surface 31F of the guide plate 31. In the present embodiment, the flat region 21F of the bearing member 21 is in contact with the flat upper surface 31F of the guide plate 31.

[0044] The bearing member 21 has the recess 21d which opens downward. The inner surface of the recess 21d includes a lower surface 45 facing downward, a first side surface 46 facing outward in the radial direction of the axial center CE, and a second side surface 47 which faces the inside in the radial direction of the axial center CE and is opposite to the first side surface 46 via a gap.

[0045] In the present embodiment, the lower surface 45 of the recess 21d is the flat region 21F which is finished to a flat surface. The lower surface 45, for example, is finished to a flat surface by milling.

[0046] At least a part of the guide plate 31 including the flat upper surface 31F enters the inside of the recess 21d, and the flat upper surface 31F of the guide plate 31 comes into contact with the flat region 21F of the bearing member 21.

[0047] The flat region 21F and the flat upper surface 31F are orthogonal to a virtual line which is parallel to the axial center CE. The flat region 21F and the flat upper surface 31F are parallel to each other.

[0048] In FIG. 3, a hole 48 provided in the bearing member 21 is a hole in which a fixing member for fixing the bearing member 21 and the housing body 3a is disposed.

[0049] As illustrated in FIG. 4, the guide plate 31 is a gutter-like member. The guide plate 31 has a first portion 51 that faces the inner wall surface of the housing 3 via the gap, a second portion 52 that extends toward the housing 3 from one end portion of the first portion 51 in the circumferential direction of the axial center CE, a third portion 53 that extends toward the housing 3 from the other end portion of the first portion 51 in the circumferential direction of the axial center CE, a first flange portion 54 that is provided at the end portion of the second portion 52 and is fixed to the inner wall surface of the housing 3, and a second flange portion 55 that is provided at the end portion of the third portion 53 and is fixed to the inner wall surface of the housing 3.

[0050] In the present embodiment, all of the first portion 51, the second portion 52, the third portion 53, the first flange portion 54, and the second flange portion 55 have the flat upper surface 31F which is in contact with the flat region 21F of the bearing member 21. That is, the flat upper surface 31F of the guide plate 31 is a continuous surface over the first portion 51, the second portion 52, the third portion 53, the first flange portion 54 and the second flange portion 55. The entire region of the flat upper surface 31F of the guide plate 31 is in contact with the flat region 21F of the bearing member 21.

[0051] As illustrated in FIG. 4, the bearing member 21 is provided with a plurality of gas suction passages 49 in the circumferential direction of the axial center CE for sending the gas of the low-pressure chamber 3L to the high-pressure chamber 3H. In a plane orthogonal to the axial center CE, the guide plate 31 is disposed between the adjacent gas suction passages 49. The guide plate 31 is fixed to the housing 3 so that the entire region of the flat upper surface 31F comes into contact with the flat region 21F of the bearing member 21, without being placed in the gas suction passage 49.

[0052] Next, the operation of the scroll compressor 1 according to the present embodiment will be described. When the motor 5 operates and the pivoting shaft 19 pivots, the turning scroll 35 revolves. In the scroll compression mechanism 7, the low-pressure gas introduced into the low-pressure chamber 3L in the housing 3 via the suction pipe 9 is compressed, while being sucked to the compression chamber between the fixed scroll 33 and the turning scroll 35, by revolution of the turning scroll 35. The compressed high-pressure gas is discharged from the discharge passage 33c of the fixed scroll 33 to the outer surface side of the fixed side end plate 33a, opens the discharge reed valve 13b of the discharge cover 13 by its pressure, reaches the high-pressure chamber 3H from the opening hole 13a, and is discharged to the outside of the housing 3 via the discharge pipe 11.

[0053] Further, in the operation of the scroll compressor 1, the oil of the oil reservoir 14 is pumped up by the oil supply pump 29 to lubricate the lower bearing 23 and the upper bearing 22, through the oil supply passage 27 formed inside the pivoting shaft 19. The oil discharged from the upper end portion of the oil supply passage 27 is stored in the recess 21a provided in the center portion of the upper surface of the bearing member 21, after lubricating the slide bush 37. The oil, which is discharged from the oil supply passage 27 and is superfluously stored in the recess 21a, is discharged into the space 40 from the outlet of the oil discharge passage 21c provided on the end surface 21b, through the oil discharge passage 21c. The oil discharged into the space 40 from the oil discharge passage 21c is supplied to the tunnel 41 between the guide plate 31 and the inner wall surface of the housing body 3a. The tunnel 41 guides the oil discharged from the oil discharge passage 21c to the oil reservoir 14 at the bottom of the housing 3. The oil discharged into the space 40 from the oil discharge passage 21c and supplied to the tunnel 41 is sent to the oil reservoir 14 via the oil passage 43 provided in the stator 15, after passing through the tunnel 41.

[0054] As described above, according to the scroll compressor 1 according to the present embodiment, the flat region 21F is provided on the lower surface of the bearing member 21, the flat upper surface 31F is provided in the guide plate 31, and the flat region 21F comes into contact with the flat upper surface 31F. Accordingly, it is possible to suppress the gap from being formed between the guide plate 31 and the bearing member 21. Thus, the oil discharged into the space 40 from the oil discharge passage 21c is supplied to the tunnel 41, without entering the low-pressure chamber 3L. Therefore, even when the scroll compressor 1 operates at high speed, the amount of oil discharged from the housing 3 can be suppressed.

[0055] In the present embodiment, the flat region 21F and the flat upper surface 31F are machined surfaces that are finished to the flat surfaces by a predetermined machining method. Conventionally, in many cases, the state of the lower surface of the bearing member 21 facing the upper surface of the guide plate 31, and the dimension of the bearing member 21 may not be sufficiently controlled. For example, in the case of a casting surface in which the state of the lower surface of the bearing member 21 is not sufficiently controlled, even when the lower surface of the bearing member 21 and the upper surface of the guide plate 31 are brought into contact with each other, there is a high possibility that a large gap is formed between the bearing member 21 and the guide plate 31. Further, even when the dimension of the bearing member 21 is not sufficiently controlled and the dimensional tolerance of the bearing member 21 is large, there is a high possibility that a large gap is formed between the lower surface of the bearing member 21 and the upper surface of the guide plate 31. In the present embodiment, since the flat machining surface is provided on each of the bearing member 21 and the guide plate 31 and the dimensional tolerances are controlled, it is possible to reduce or eliminate the gap between the bearing member 21 and the guide plate 31.

[0056] Further, according to the present embodiment, the bearing member 21 has a recess 21d which opens downward, and the flat region 21F is provided on the lower surface 45 of the recess 21d facing downward. A part of the guide plate 31 enters the recess 21d, and the first side surface 46 of the recess 21d and the guide plate 31 face each other via a small gap. Therefore, even if the oil of the space 40 leaks into the low-pressure chamber 3L side from the gap between the flat region 21F and the flat upper surface 31F, the oil is blocked at the first side surface 46 of the recess 21d and is held in the gap between the first side surface 46 of the recess 21d and the guide plate 31. That is, since the guide plate 31 and the recess 21d of the bearing member 21 overlap in the vertical direction, even if the oil leaks into the low-pressure chamber 3L side from the space 40, the oil is held in a narrow space between the first side surface 46 of the recess 21d and the guide plate 31. Thus, even if the gas flows in the low-pressure chamber 3L at high speed, the influence of the flow of the gas on the oil is suppressed, and it is possible to suppress the oil from being raised by the gas flowing through the low-pressure chamber 3L at high speed.

[0057] Further, according to the present embodiment, since the guide plate 31 is fixed to the inner wall surface of the housing 3 via the first flange portion 54 and the second flange portion 55, the fixation of the guide plate 31 is stabilized. Further, the guide plate 31 is formed in a gutter shape, and all of the first portion 51, the second portion 52, the third portion 53, the first flange portion 54, and the second flange portion 55 are in contact with the flat region 21F of the bearing member 21. Accordingly, the space 40 in which the oil flows, and the tunnel 41 are completely separated from the low-pressure chamber 3L through which the gas flows, by the guide plate 31. Therefore, it is possible to sufficiently suppress the oil of the space 40 and the tunnel 41 from entering the low-pressure chamber 3L.

[0058] Further, in the present embodiment, the flat region 21F and the flat upper surface 31F are parallel to each other. Therefore, the flat region 21F and the flat upper surface 31F stably come into close contact with each other.

<Second Embodiment>

[0059] A second embodiment will be described. The components identical or equivalent to the above-described embodiment are denoted by the same reference numerals, and the description thereof will be simplified or omitted.

[0060] FIG. 5 is a side sectional view illustrating a guide plate 31 according to the present embodiment. As illustrated in FIG. 5, at least a part of the guide plate 31 including the flat upper surface 31F is an elastically deformable elastic member. The guide plate 31 is elastically deformed, while bringing at least a part of the guide plate 31 into contact with the flat region 21F. For example, by setting the thickness of the upper end portion of the guide plate 31 to be thinner than the thickness of the portions other than the upper portion, the guide plate 31 is elastically deformable.

[0061] According to the present embodiment, by the elastic deformation of the guide plate 31, the guide plate 31 and the bearing member 21 are in contact with each other with high contact force. Thus, the oil present in the space 40 or the tunnel 41 is sufficiently suppressed from leaking into the low-pressure chamber 3L from the gap between the bearing member 21 and the guide plate 31.

<Third Embodiment>

[0062] A third embodiment will be described. The components identical or equivalent to the above-described embodiments are denoted by the same reference numerals, and the description thereof will be simplified or omitted.

[0063] FIG. 6 is a side sectional view illustrating a guide plate 31 according to the present embodiment. As illustrated in FIG. 6, in the present embodiment, the flat upper surface 31F of the guide plate 31 faces the flat region 21F of the recess 21d of the bearing member 21 via a gap. At least a part of the guide plate 31 enters the inside of the recess 21d, and at least a part of the bearing member 21 overlaps the guide plate 31.

[0064] When a dimension of the gap between the flat upper surface 31F and the flat region 21F is set as La, and a vertical dimension of the recess 21d is set as Lb, the following condition is satisfied:

$$0 \leq La \leq Lb/5 \quad (1)$$

[0065] The dimension Lb is a vertical distance between the flat region 21F and an opening end of the tunnel 41 side of the recess 21d facing the downward direction, and is equivalent to a dimension of the overlap portion of the bearing member 21 that overlaps the guide plate 31.

[0066] According to this embodiment, since the overlap dimension Lb between the guide plate 31 and the bearing member 21 is sufficiently larger than the dimension La of the gap between the flat upper surface 31F and the flat region 21F as the lower surface of the recess 21d, the flow of oil is restricted. Therefore, even if the oil leaks from the gap between the flat upper surface 31F and the flat region 21F of the recess 21d, the oil is blocked by the recess 21d. Therefore, it is possible to suppress the oil from entering the low-pressure chamber 3L or being raised by the gas.

[0067] There is a possibility that a gap is formed between the flat upper surface 31F and the flat region 21F, in consideration of machining tolerances of the bearing member 21, assembling tolerances between the bearing member 21 and the housing 3, and assembling tolerances between the housing 3 and the guide plate 31. There is a possibility that a gap of a dimension La, for example, 1.5 [mm] or less is formed between the flat upper surface 31F and the flat region 21F. Even when the gap is formed, by satisfying the conditions of formula (1), leakage of oil can be suppressed.

[0068] Furthermore, in the above-described embodiments, the scroll compressor 1 as a type of scroll fluid machine has been described as an example. The scroll fluid machine may be a scroll expander. Although it is not clearly illustrated in the drawings, the scroll expander as a scroll fluid machine generates a pivotal driving force in the pivoting shaft, while the turning scroll engaged with the fixed scroll turns by the compressed fluid to expand the fluid. That is, the configurations of the bearing member 21 and the guide plate 31 can also be applied to a scroll expander.

Reference Signs List

[0069]

1	SCROLL COMPRESSOR
3	HOUSING
3a	HOUSING BODY
3b	BOTTOM MEMBER
3c	LID MEMBER
3H	HIGH-PRESSURE CHAMBER
3L	LOW-PRESSURE CHAMBER
5	MOTOR
7	SCROLL COMPRESSION MECHANISM
9	SUCTION PIPE
11	DISCHARGE PIPE
13	DISCHARGE COVER
13a	OPENING HOLE
13b	DISCHARGE REED VALVE
14	OIL RESERVOIR
15	STATOR
17	ROTOR
19	PIVOTING SHAFT
21	BEARING MEMBER
21a	RECESS
21b	END SURFACE
21c	OIL DISCHARGE PASSAGE
21d	RECESS
21F	FLAT REGION
22	UPPER BEARING
23	LOWER BEARING
25	ECCENTRIC PIN
27	OIL SUPPLY PASSAGE
29	OIL SUPPLY PUMP
31	GUIDE PLATE
33	FIXED SCROLL

33a	FIXED SIDE END PLATE
33b	FIXED SIDE WRAP
33c	DISCHARGE PASSAGE
35	TURNING SCROLL
35a	MOVABLE SIDE END PLATE
35b	MOVABLE SIDE WRAP
35c	BOSS
37	SLIDE BUSH
39	ROTATION PREVENTING MECHANISM
40	SPACE
41	TUNNEL
43	OIL PASSAGE
45	LOWER SURFACE
46	FIRST SIDE SURFACE
47	SECOND SIDE SURFACE
48	HOLE
49	GAS SUCTION PASSAGE
51	FIRST PORTION
52	SECOND PORTION
53	THIRD PORTION
54	FIRST FLANGE PORTION
55	SECOND FLANGE PORTION
CE	AXIAL CENTER
LE	ECCENTRIC CENTER

Claims

1. A scroll fluid machine comprising:

   a housing (3);
   a pivoting shaft (19) that is disposed in a low-pressure chamber (3L) of the housing, and has an oil supply passage (27);
   a bearing member (21) that is fixed to an inner wall surface of the housing, is provided with an upper bearing (22) configured to pivotally support the pivoting shaft (19) around an axial center (CE), and has an oil discharge passage (21c); and
   a guide plate (31) that is fixed to the inner wall surface of the housing, and forms a tunnel (41) configured to guide the oil discharged from the oil discharge passage (21c) to an oil reservoir (14) of the housing, between the inner wall surface of the housing and the guide plate (31),
   wherein a lower surface (45) of the bearing member (21) includes a flat region (21F), and
   the guide plate (31) has a flat upper surface (31F) that faces the flat region (21F).

2. The scroll fluid machine according to claim 1, wherein the bearing member (21) has a recess (21d) that opens downward, and
   the lower surface of the recess facing downward is the flat region (21F).

3. The scroll fluid machine according to claim 1 or 2, wherein the flat upper surface (31F) of the guide plate (31) is in contact with the flat region (21F) of the bearing member (21).

4. The scroll fluid machine according to claim 3, wherein the guide plate (31) has a first portion (51) that faces the inner wall surface of the housing (3) via a gap, a second portion (52) that extends toward the housing from one end portion of the first portion (51) in a circumferential direction of the axial center (CE), a third portion (53) that extends toward the housing from the other end portion of the first portion (51), a first flange portion (54) that is provided at the end portion of the second portion and is fixed to the inner wall surface of the housing (3), and a second flange portion (55) that is provided at the end portion of the third portion (53) and is fixed to the inner wall surface of the housing (3), and
   all of the first portion (51), the second portion (52), the third portion (53), the first flange portion (54) and the second flange portion (55) are in contact with the flat region (21F).

5. The scroll fluid machine according to claim 3 or 4, wherein the flat region (21F) and the flat upper surface (31F) are parallel to each other.

6. The scroll fluid machine according to any one of claims 1 to 5, wherein at least a part of the guide plate (37) including the flat upper surface (31F) is an elastic member.

7. The scroll fluid machine according to claim 2, wherein the flat upper surface (31F) of the guide plate (31) faces the lower surface (45) of the recess (21d) of the bearing member (21) via a gap, and when a dimension of the gap is set as La, and a vertical dimension of the recess is set as Lb, the following requirement is satisfied:

$$0 \leq La \leq Lb/5.$$

FIG.1

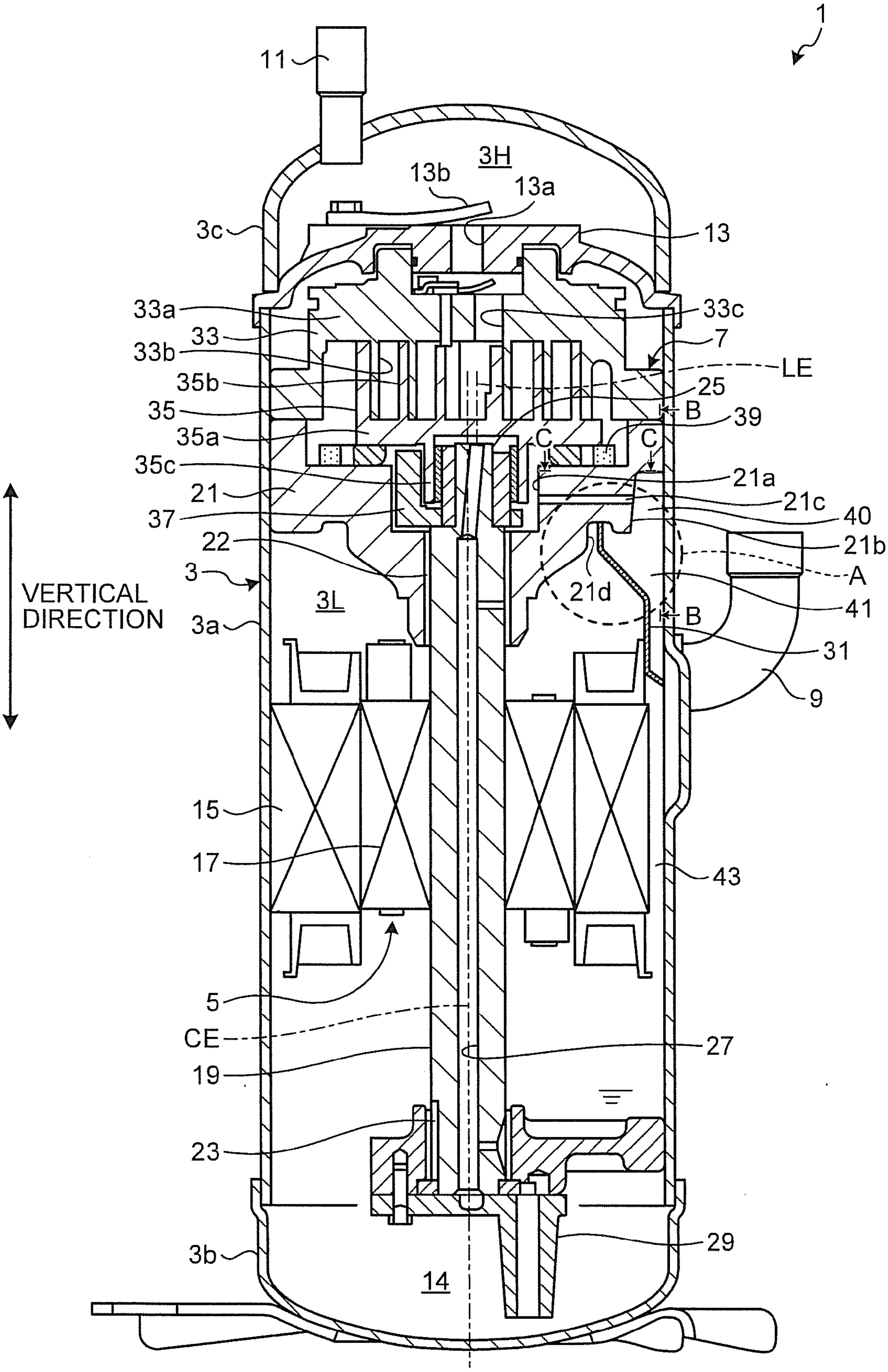

1
11
3H
13b
13a
3c
13
33a
33c
33
7
33b
LE
35b
25
35
B
39
35a
C
C
35c
21a
21
21c
37
40
22
21b
3
A
VERTICAL DIRECTION
3L
21d
41
3a
B
31
9
15
17
43
5
CE
27
19
23
29
3b
14

FIG.2

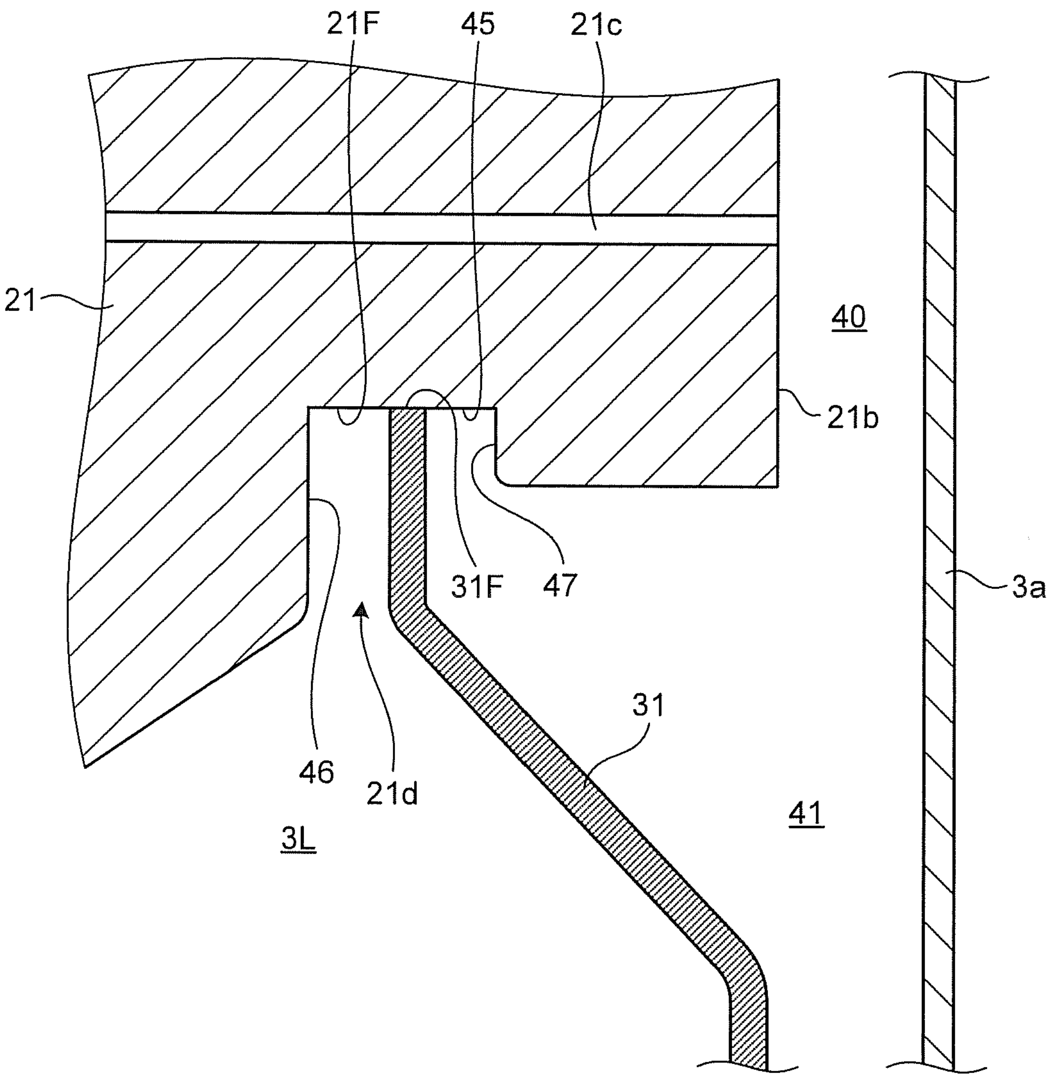


FIG.3

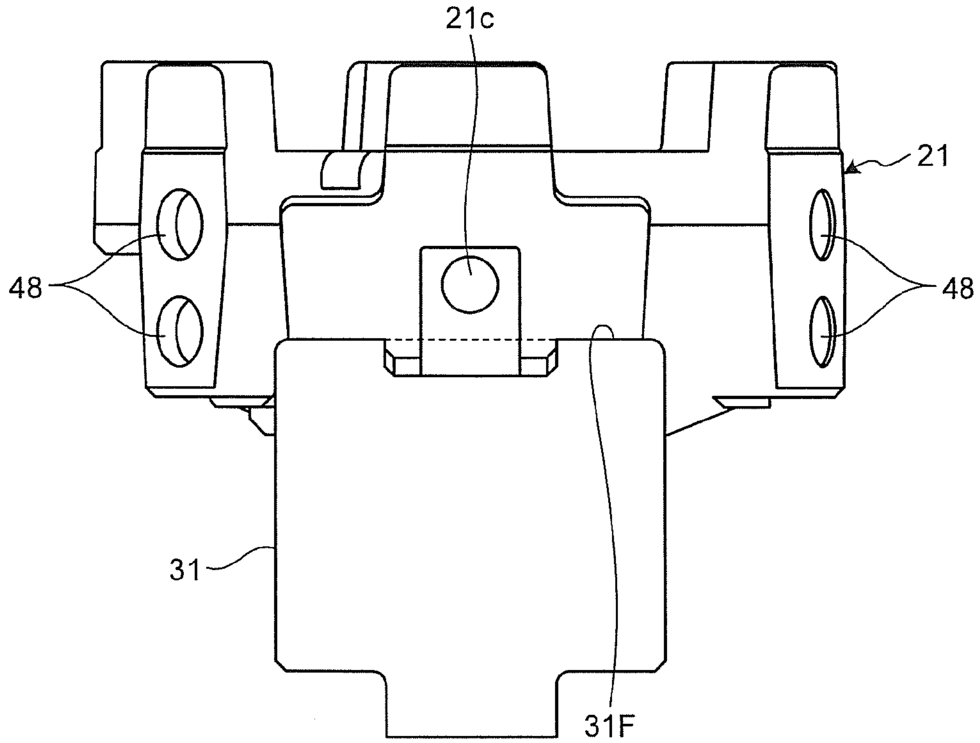

21c
21
48
48
31
31F

FIG.4

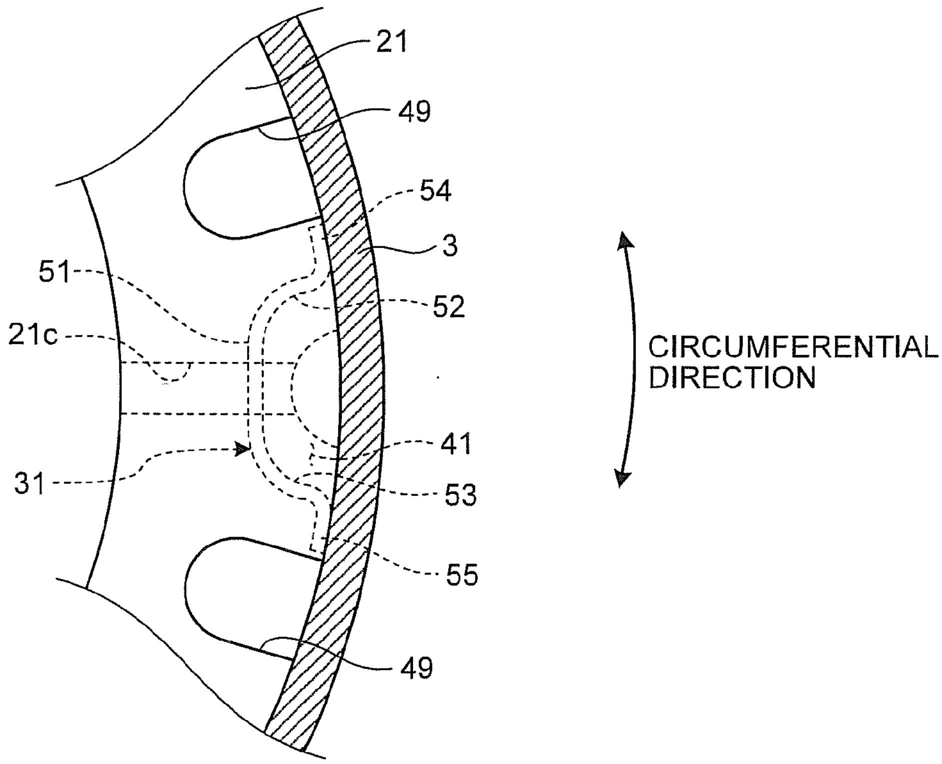

21
49
54
3
51
52
21c
CIRCUMFERENTIAL
DIRECTION
41
31
53
55
49

FIG.5

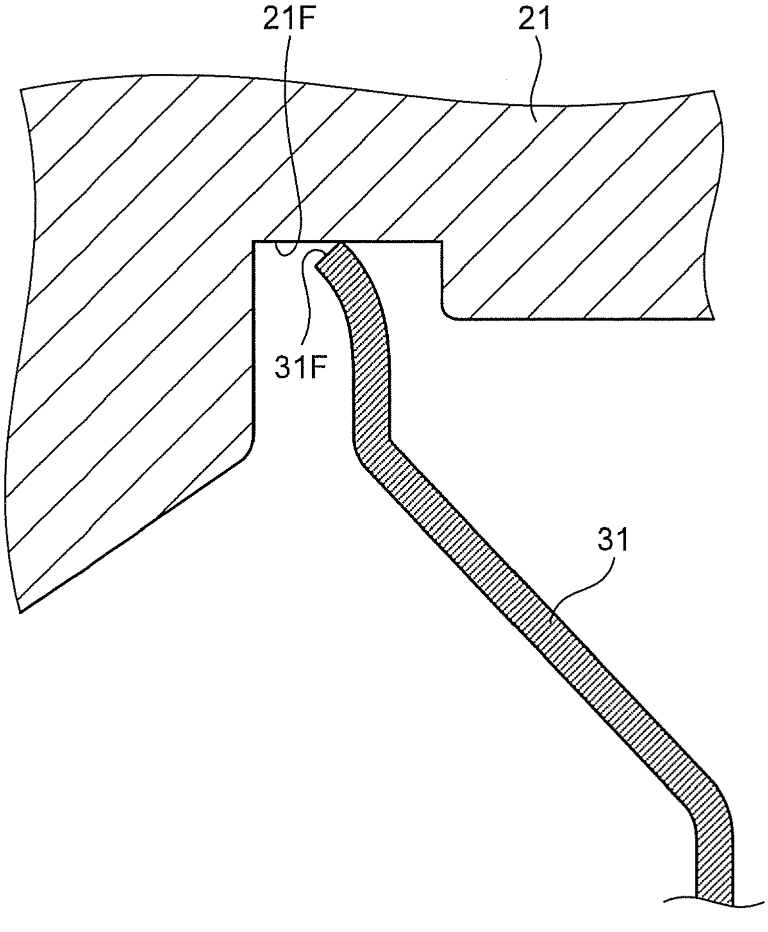
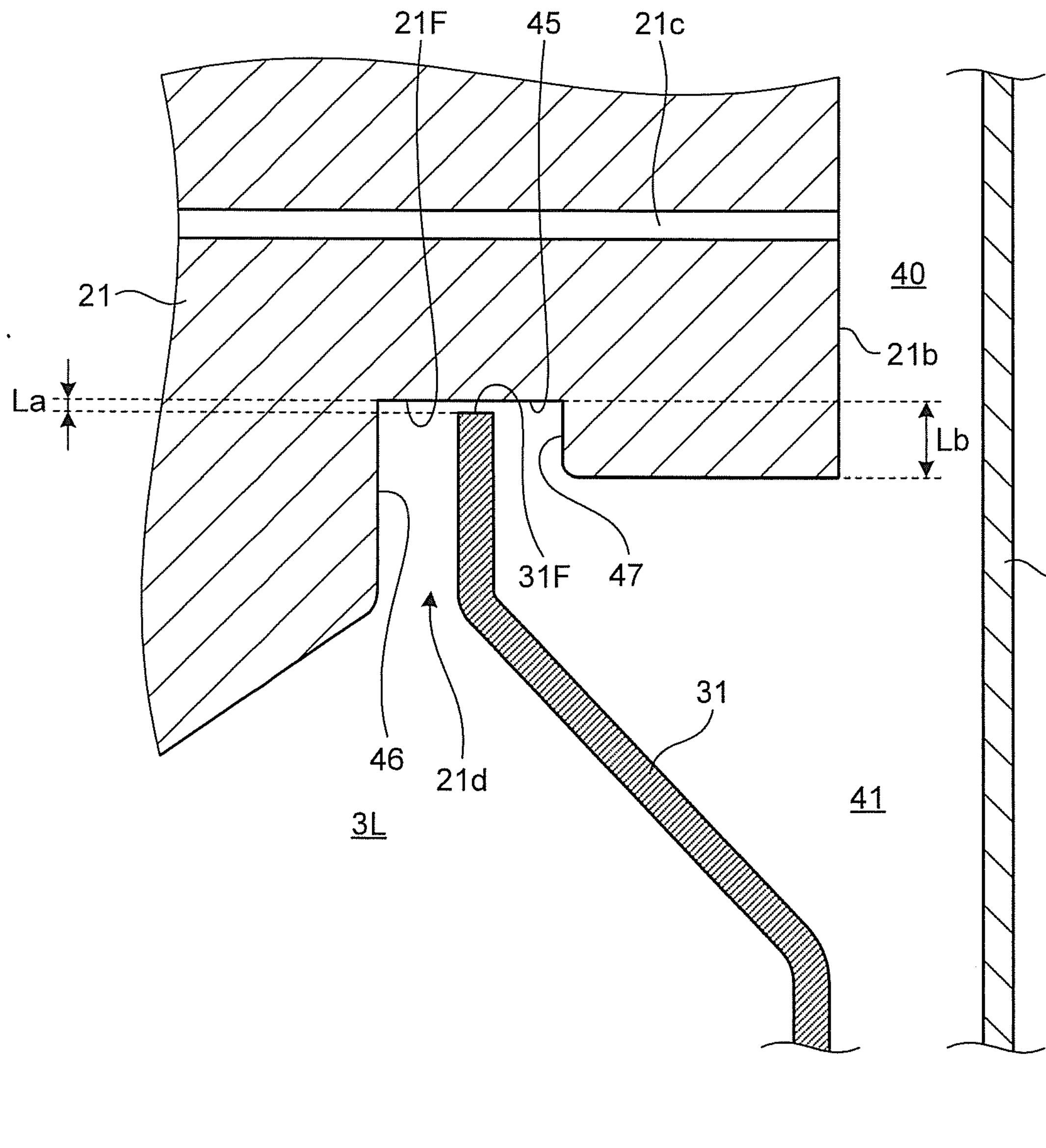


FIG.6



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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 5196

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	27 February 2017	Sbresny, Heiko

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