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(54) **SCROLL COMPRESSOR**

SPIRALVERDICHTER

COMPRESSEUR À SPIRALE

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Description

Technical Field

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

Background Art

[0002] As disclosed in PTL 1, a scroll compressor used in an air conditioning device, a refrigerating device, or the like to compress a refrigerant is generally known. In this scroll compressor, the refrigerant is compressed by the Oldham ring causing an orbiting scroll to orbit with respect to a fixed scroll. PTL 2 and PTL 3 disclose scroll compressors.

[0003] By the way, at present, the use of a non-fluorocarbon refrigerant is required from the viewpoint of environmental protection, and the demand for a compressor using carbon dioxide that is a natural refrigerant is increasing.

Citation List

Patent Literature

[0004]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2009-030514
[PTL 2] International Patent Application publication No. WO 2014 196774
[PTL 3] Japanese Patent Application publication No. 2019 027406

Summary of Invention

Technical Problem

[0005] In a case where carbon dioxide is used as a refrigerant, it is necessary to compress the refrigerant to high pressure, so that it is necessary for the components of the compressor to support high pressure. Further, the demand for increasing the capacity of the compressor that uses a natural refrigerant is also increasing. However, simply supporting high pressure and increasing the capacity increase not only the external dimension but also the weight of each component, and in particular, if the weight of the orbiting scroll that is an orbiting part is heavy, vibration is increased, power is increased, and thereby the operating efficiency is reduced.

[0006] The present invention provides a scroll compressor which can improve the efficiency while supporting high pressure and increasing the capacity.

Solution to Problem

[0007] A scroll compressor according to an aspect of the present invention is defined in claim 1. The scroll compressor includes a rotating shaft that extends along an axis; a motor that rotates the rotating shaft; a scroll compression portion that compresses a refrigerant by the rotation of the rotating shaft; and a housing that houses the rotating shaft, the motor, and the scroll compression portion, in which the scroll compression portion includes a fixed scroll that has a fixed end plate fixed to the housing, and a fixed wrap that protrudes from the fixed end plate in a direction of the axis, an orbiting scroll that is provided to the rotating shaft, and has an orbiting end plate disposed to face the fixed end plate in the direction of the axis, and an orbiting wrap that protrudes from the orbiting end plate toward the fixed end plate and forms a compression chamber for the refrigerant together with the fixed wrap, and an Oldham ring that is interposed between the fixed end plate and the orbiting end plate, and supports the orbiting scroll such that the orbiting scroll orbits around the axis without rotating, the Oldham ring has a ring body that has an annular shape to surround the axis, and a plurality of keys that protrude from a front surface of the ring body and are inserted into key grooves provided in the orbiting end plate and the fixed end plate, the orbiting end plate has a thick portion that has a disk shape and is provided with the orbiting wrap, and a thin portion which is integrally provided with the thick portion on an outer side of the thick portion in a radial direction, has an annular shape, and has a smaller thickness dimension in the direction of the axis than a thickness dimension of the thick portion, and of which an end face facing the fixed end plate side is disposed at a position away from the fixed end plate as compared with the thick portion, and the ring body is provided to be placed on the end face of the thin portion.

[0008] In such a scroll compressor, the orbiting end plate of the orbiting scroll has the thick portion and the thin portion. Further, the thin portion is provided on the outer side of the orbiting end plate in the radial direction. Therefore, the weight of the outer end portion of the orbiting end plate in the radial direction can be reduced, and the moment of inertia when the orbiting end plate orbits around the axis of the rotating shaft can be reduced. Thus, even if the orbiting end plate is enlarged in order to support high pressure and increase the capacity of the scroll compressor, an increase in vibration and an increase in power can be suppressed. The outer end portion of the orbiting end plate in the radial direction is less affected by a compressive load at the time of compressing the refrigerant, than the central portion of the orbiting end plate, and therefore, even in a case where the thin portion is provided, a problem in strength is unlikely to occur.

[0009] In order to support high pressure and increase the capacity of the scroll compressor, it is necessary to improve the strength of the Oldham ring. In this case, even if the thickness dimension of the Oldham ring in the direction of the axis is increased, the amount of the Oldham ring protruding toward the fixed scroll can be reduced by placing the ring body of the Oldham ring on the thin portion of the orbiting end plate, and the fixed end plate can be brought closer to the orbiting end plate. Therefore, while the thickness dimension of the Oldham ring is increased to secure the strength, the dimension of the scroll compression portion in the direction of the axis be reduced, and the scroll compression portion can be made compact.

[0010] In the scroll compressor described above, a thickness dimension of the ring body in the direction of the axis may be larger than a distance between an end face of the thick portion facing the fixed end plate side and an end face of the thin portion facing the fixed end plate side in the direction of the axis.

[0011] With such a configuration, the Oldham ring can be provided such that the ring body protrudes in the direction of the axis from the end face of the thick portion facing the fixed end plate side. Accordingly, since the strength of the Oldham ring is improved, the thickness dimension of the Oldham ring in the direction of the axis can be increased.

[0012] The scroll compressor may further include a bearing that is provided to the housing, rotatably supports the rotating shaft, and is disposed on a side opposite to the compression chamber in the direction of the axis with respect to the orbiting end plate; and a thrust plate that is provided between the bearing and the orbiting end plate, and supports the orbiting end plate in the direction of the axis, in which the thrust plate may have an annular shape to surround the axis, and may be disposed at a position at which at least a part of the thrust plate supports the thick portion.

[0013] The thrust plate is provided at such a position, so that the thick portion that receives many thrust loads due to the compressive load can be supported by the thrust plate. Thus, even when the thin portion is provided to the orbiting end plate, it is possible to sufficiently cope with the compressive load.

[0014] Further, in the scroll compressor, the key groove, into which the key is inserted, in the orbiting end plate may be provided over the thin portion and the thick portion.

[0015] The key groove is provided as described above, so that the dimension of the key in the radial direction can be increased. Accordingly, the surface pressure of the surfaces where the key slides with respect to the key groove can be reduced, and the strength of the Oldham ring can be improved. Further, even when the key groove extends to the thick portion, since the thickness dimension of the thick portion in the direction of the axis is larger than that of the thin portion, a problem in strength is unlikely to occur.

Advantageous Effects of Invention

[0016] With the scroll compressor described above, it is possible to improve the efficiency while supporting high pressure and increasing the capacity.

Brief Description of Drawings

[0017]

Fig. 1 is a vertical sectional view of a scroll compressor according to an embodiment of the present invention.

Fig. 2 is an enlarged view of a scroll compression portion in the scroll compressor according to the embodiment of the present invention.

Fig. 3 is a plan view illustrating a fixed scroll in the scroll compressor according to the embodiment of the present invention.

Fig. 4 is a plan view illustrating an orbiting scroll in the scroll compressor according to the embodiment of the present invention.

Fig. 5 is a plan view illustrating an Oldham ring in the scroll compressor according to the embodiment of the present invention.

Fig. 6 is a view illustrating the Oldham ring in the scroll compressor according to the embodiment of the present invention, and is a sectional view taken along line A-A of Fig. 5.

Fig. 7 is a view illustrating the Oldham ring in the scroll compressor according to the embodiment of the present invention, and is a sectional view taken along line B-B of Fig. 5.

Description of Embodiments

[0018] Hereinafter, a scroll compressor 1 according to an embodiment of the present invention will be described.

[0019] In the embodiment, a vertical sealed two stage compressor having two compression portions 4 and 5 is described as an example of the scroll compressor 1, but the scroll compressor 1 is not limited to such a compressor, and the scroll compressor 1 may be a single stage compressor having only one compression portion, or may be a horizontal compressor, for example.

[0020] The scroll compressor 1 includes a rotating shaft 2, a motor 3 that rotates the rotating shaft 2, and a rotary compression portion 4 and a scroll compression portion 5 that compress a refrigerant by the rotation of the rotating shaft 2. The scroll compressor 1 further includes a housing 6 that seals and houses the rotating shaft 2, the motor 3, the rotary compression portion 4, and the scroll compression portion 5.

[0021] The rotating shaft 2 has a columnar shape centered on an axis O1 extending in a vertical direction. An eccentric shaft 8 having a columnar shape centered on an axis 02 disposed at a position shifted from the axis O1 in a radial direction is integrally provided at the upper end of the rotating shaft 2.

[0022] The housing 6 has a tubular shape extending in the vertical direction along the axis O1 of the rotating shaft 2. The housing 6 is formed by casting, for example. The housing 6 has a housing main body 10 that has a cylindrical shape, an upper lid 11 that closes the upper opening of the housing main body 10, and a lower lid 12 that closes the lower opening of the housing main body 10. Thereby, the housing 6 has a sealed space S extending in the vertical direction inside. Oil (lubricant) is stored from the lower portion of the housing main body 10 to the bottom portion of the lower lid 12, and an oil reservoir OL is formed at this position.

[0023] A suction pipe 13 that introduces the refrigerant from the outside into the space S is connected to the lower portion of the housing 6. Further, a discharge pipe 14 that discharges the refrigerant from the space S to the outside is connected to the upper portion of the housing 6.

[0024] A rotary lower bearing 20, a rotary upper bearing 21, and a scroll bearing 22 which rotatably support the rotating shaft 2 with respect to the housing 6 are provided inside the housing 6. The rotary lower bearing 20 and the rotary upper bearing 21 are provided to the rotary compression portion 4, and the scroll bearing 22 is provided to the scroll compression portion 5.

[0025] The motor 3 is provided to be above the rotary upper bearing 21 and below the scroll bearing 22 in the space S of the housing 6 such that the outer circumference of the motor 3 is surrounded by the housing main body 10. A power supply (not illustrated) is connected to the motor 3 via a terminal 15 provided to the housing 6. The motor 3 rotates the rotating shaft 2 using power from the power supply.

[0026] The rotary compression portion 4 is provided to be interposed between the rotary lower bearing 20 and the rotary upper bearing 21, in the lower portion of the motor 3. More specifically, the rotary compression portion 4 has cylinders 30 that are disposed at the upper portion of the rotary lower bearing 20 and the lower portion of the rotary upper bearing 21. The cylinder 30 is disposed in the oil reservoir OL. The suction pipe 13 is connected to the cylinder 30. The cylinder 30 has inside a compression chamber C1 that compresses the refrigerant introduced from the suction pipe 13. The rotating shaft 2 is inserted into the compression chamber C1. A piston 31 is provided to the rotating shaft 2. The piston 31 is rotated in the compression chamber C1 with the rotation of the rotating shaft 2 so that the refrigerant is compressed. The refrigerant compressed in the compression chamber C1 of the rotary compression portion 4 passes through the rotary upper bearing 21 and flows upward toward the motor 3.

[0027] The rotary compression portion 4 of the embodiment has a twin rotary structure in which, for example, the cylinders 30 are provided in two stages vertically, but may have a single rotary structure in which, for example, only one cylinder 30 is provided. Further, the connection position of the suction pipe 13 to the rotary compression portion 4 is not limited to the case illustrated in Fig. 1.

[0028] Next, the scroll compression portion 5 will be described with reference to Figs. 2 to 4.

[0029] The scroll compression portion 5 is provided above the motor 3 in the space S. More specifically, as illustrated in Fig. 2, the scroll compression portion 5 has a fixed scroll 40 that is above the scroll bearing 22 and is fixed to the housing 6, and an orbiting scroll 43 that is provided to be vertically interposed between the fixed scroll 40 and the scroll bearing 22.

[0030] Further, the scroll compression portion 5 has an Oldham ring 50 that engages the fixed scroll 40 and the orbiting scroll 43.

[0031] The fixed scroll 40 has a fixed end plate 41 that is below the discharge pipe 14, is fixed to the housing 6, and has a disk shape centered on the axis O1, and a fixed wrap 42 that protrudes downward from the fixed end plate 41 and has a spiral shape with reference to the axis O1.

[0032] As illustrated in Fig. 3, the fixed end plate 41 has a contact surface 41a on the outer side of the fixed wrap 42 in the radial direction, and the contact surface 41a faces downward in the direction of the axis O1, and is in surface contact with the scroll bearing 22. An annular groove 41b that has an annular shape centered on the axis O1 is provided between the fixed wrap 42 and the contact surface 41a. The annular groove 41b is recessed upward in the direction of the axis O1 with respect to the contact surface 41a and an edge 42a of the tip of the fixed wrap 42. In the embodiment, the contact surface 41a of the fixed end plate 41 and the edge 42a of the fixed wrap 42 are disposed on the same plane. However, since the fixed wrap 42 thermally elongates during the operation of the compressor 1, in order to allow the thermal elongation, the contact surface 41a and the edge 42a of the fixed wrap 42 are not arranged exactly on the same plane, and the edge 42a of the fixed wrap 42 may be disposed above the contact surface 41a.

[0033] Further, the fixed end plate 41 is provided with a pair of fixed-side key grooves 41c at intervals of 180 degrees in the circumferential direction. The fixed-side key groove 41c extends from a position close to the fixed wrap 42 to a position in the middle of the contact surface 41a in the radial direction. The fixed-side key groove 41c is formed to be further recessed upward in the direction of the axis O1 than the annular groove 41b. Each fixed-side key groove 41c is formed such that the section orthogonal to the radial direction has a rectangular shape. Each fixed-side key groove 41c has a pair of planar key sliding surfaces 41d which are disposed in parallel at intervals in the circumferential direction and extend along the direction of the axis O1 and the radial direction.

[0034] A pair of suction flow paths 41e that communicate with a compression chamber C2 that is formed by the fixed wrap 42 are formed in the fixed end plate 41. The pair of suction flow paths 41e are provided between the pair of fixed-side key grooves 41c, at positions where the suction flow paths 41e do not interfere with the fixed-side key grooves 41c. That is, the respective suction flow paths 41e are provided one by one between the respective fixed-side key grooves 41c, at positions apart from the pair of fixed-side key grooves 41c in the circumferential direction. Each suction flow path 41e is further recessed upward than the annular groove 41b in the direction of the axis O1, extends from the fixed wrap 42 through the annular groove 41b to the contact surface 41a, and is open on the outer peripheral surface of the fixed end plate 41.

[0035] The orbiting scroll 43 has an orbiting end plate 44 that is disposed below the fixed end plate 41 and faces the fixed end plate 41 in the direction of the axis O1, and an orbiting wrap 45 that protrudes from the orbiting end plate 44 upward in the direction of the axis O1 toward the fixed end plate 41.

[0036] The orbiting end plate 44 has a disk shape centered on the axis O2 of the eccentric shaft 8, and is attached to the eccentric shaft 8. As illustrated in Figs. 2 and 4, the orbiting end plate 44 has a thick portion 44a that has a disk shape centered on the axis O2 of the eccentric shaft 8, and a flange-shaped thin portion 44b that is integrated with the thick portion 44a and protrudes outward in the radial direction from the thick portion 44a.

[0037] The thick portion 44a is connected to the eccentric shaft 8 so as to be rotatable around the eccentric shaft 8. Specifically, a cylindrical part 46 that covers the eccentric shaft 8 from the outer circumference is integrally provided to the lower portion of the thick portion 44a. A bearing 46a is provided in the cylindrical part 46 as illustrated in Fig. 1, and the thick portion 44a is rotated together with the cylindrical part 46 around the axis O2 of the eccentric shaft 8.

[0038] The thin portion 44b has an annular shape centered on the axis O2 of the eccentric shaft 8. The thin portion 44b has a smaller thickness dimension in the directions of the axes O1 and O2 than the thick portion 44a, and is arranged at a position where the end face (upper surface) facing the fixed end plate 41 side is apart from the fixed end plate 41 as compared with the thick portion 44a. Accordingly, the orbiting end plate 44 has a surface facing the radial direction at the outer end portion in the radial direction, and a step is provided to the outer end portion of the orbiting end plate 44 in the radial direction.

[0039] The orbiting end plate 44 is provided with a pair of orbiting-side key grooves 44c at intervals of 180 degrees in the circumferential direction. The orbiting-side key groove 44c is open on the outer peripheral surface of the thin portion 44b, and extends inward in the radial direction from the outer peripheral surface of the thin portion 44b to the thick portion 44a. Thus, the orbiting-side key groove 44c is provided between the thin portion 44b and the thick portion 44a. The orbiting-side key groove 44c penetrates the thin portion 44b in the direction of the axis O1, has the same dimension in the direction of the axis O1 as the thickness dimension of the thin portion 44b in the direction of the axis O1, and extends in the radial direction to the thick portion 44a. Thus, when the orbiting end plate 44 is viewed from above, the orbiting-side key groove 44c is provided to enter the back side of the thick portion 44a. Each orbiting-side key groove 44c is formed such that the section orthogonal to the radial direction has a rectangular shape. Each orbiting-side key groove 44c has a pair of planar key sliding surfaces 44d which are disposed in parallel at intervals in the circumferential direction and extend along the direction of the axis O1 and the radial direction.

[0040] A thrust plate 47 that receives a load in the direction of the axis O1 from the scroll compression portion 5, that is, a thrust load is provided between the orbiting end plate 44 and the scroll bearing 22. The thrust plate 47 has an annular shape to surround the axis O1 of the rotating shaft 2 as illustrated in Fig. 2. The thrust plate 47 is provided between the thin portion 44b and the thick portion 44a. That is, at least a part of the thrust plate 47 is provided at a position that supports the thick portion 44a from below in the direction of the axis O1.

[0041] More specifically, in a case where the inner diameter of the thrust plate 47 is set as din, the outer diameter of the thrust plate 47 is set as dout, and the outer diameter of the thick portion 44a is set as D, a relationship of din < D ≤ dout is established.

[0042] The orbiting wrap 45 is provided in an overlapping manner in the radial direction so as to face the fixed wrap 42 in the radial direction. A space between the orbiting wrap 45 and the fixed wrap 42 is the compression chamber C2 in which the refrigerant is compressed. The refrigerant that has flowed from the compression chamber C1 of the rotary compression portion 4 is introduced to the compression chamber C2 after passing around the motor 3 and through the scroll bearing 22.

[0043] Next, the Oldham ring 50 will be described with reference to Figs. 5 to 7.

[0044] The Oldham ring 50 has a ring body 51 that has an annular shape to surround the axis O1 of the rotating shaft 2, and a pair of fixed-side keys 52 and a pair of orbiting-side keys 53 that are provided to the ring body 51.

[0045] The ring body 51 has a substantially constant thickness, that is, a substantially constant dimension in the direction of the axis O1. The ring body 51 is provided to be placed on the end face (upper surface) of the thin portion 44b of the orbiting end plate 44, the end face facing the fixed end plate 41 side. In a state where the ring body 51 is placed on the thin portion 44b of the orbiting end plate 44, the front surface (upper surface) of the ring body 51 facing the fixed end plate 41 side is positioned above the front surface (upper surface) of the thick portion 44a facing the fixed end plate 41 side, so that a part of the ring body 51 is in a state of protruding upward from the thick portion 44a.

[0046] A part of the ring body 51 which protrudes upward from the thick portion 44a is disposed in the annular groove 41b of the fixed end plate 41. Further, a fine gap SS is provided between the front surface (upper surface) of the ring body 51 facing the fixed end plate 41 side and the bottom surface of the annular groove 41b, so that the front surface of the ring body 51 and the bottom surface of the annular groove 41b are provided with an interval.

[0047] The pair of fixed-side keys 52 are provided at intervals of 180 degrees in the circumferential direction, and are members which protrude upward from the front surface of the ring body 51 facing upward and have a rectangular section. Each fixed-side key 52 has the same dimension in the radial direction as the width dimension of the ring body 51 in the radial direction, and is integrally provided with the ring body 51 so as not to substantially protrude from the ring body 51 in the radial direction. The pair of fixed-side keys 52 are inserted to engage with the pair of fixed-side key grooves 41c provided to the fixed end plate 41, respectively. Each fixed-side key 52 has planar side surfaces 52a on both sides in the circumferential direction, and the side surfaces 52a slide with respect to the key sliding surfaces 41d of the fixed-side key groove 41c. The fixed-side key 52 is configured to reciprocate in the radial direction in the fixed-side key groove 41c.

[0048] The pair of orbiting-side keys 53 are provided at intervals of 180 degrees in the circumferential direction, and are members which protrude downward from the front surface of the ring body 51 facing downward at positions shifted 90 degrees in the circumferential direction from the fixed-side keys 52 and have a rectangular section. Each orbiting-side key 53 has a larger dimension in the radial direction than the width dimension of the ring body 51 in the radial direction, and is integrally provided with the ring body 51 so as to protrude inward from the ring body 51 in the radial direction. The outer end face of each orbiting-side key 53 in the radial direction and the outer end face of the ring body 51 in the radial direction are disposed at substantially the same position. Thus, each orbiting-side key 53 is provided to the ring body 51 so as not to substantially protrude outward in the radial direction from the ring body 51. The pair of orbiting-side keys 53 are inserted to engage with the pair of orbiting-side key grooves 44c provided to the orbiting end plate 44, respectively. Each orbiting-side key 53 has planar side surfaces 53a on both sides in the circumferential direction, and the side surfaces 53a slide with respect to the key sliding surfaces 44d of the orbiting-side key groove 44c. The orbiting-side key 53 is configured to reciprocate in the radial direction in the orbiting-side key groove 44c.

[0049] By the reciprocating movement of the orbiting-side key 53 and the orbiting-side key groove 44c and the reciprocating movement of the fixed-side key 52 and the fixed-side key groove 41c, the orbiting scroll 43 orbits around the axis O1 of the rotating shaft 2 without rotating, and the refrigerant in the compression chamber C2 is compressed by the relative movement between the fixed wrap 42 and the orbiting wrap 45.

[0050] In the scroll compressor 1 of the embodiment described above, the orbiting end plate 44 of the orbiting scroll 43 has the thick portion 44a and the thin portion 44b. Further, the thin portion 44b is provided on the outer side of the orbiting end plate 44 in the radial direction. Therefore, the weight of the outer end portion of the orbiting end plate 44 in the radial direction can be reduced, and the moment of inertia when the orbiting end plate 44 orbits around the axis O1 of the rotating shaft 2 can be reduced. Thus, even if the orbiting end plate 44 is enlarged in order to support high pressure and increase the capacity of the scroll compressor 1, an increase in size of the motor 3 can be suppressed. As a result, it is possible to improve the efficiency while supporting high pressure and increasing the capacity of the scroll compressor 1.

[0051] Here, the outer end portion of the orbiting end plate 44 in the radial direction is less affected by the compressive load than the central portion of the orbiting end plate 44. Therefore, even when the thin portion 44b is provided to the orbiting end plate 44, a problem in strength is unlikely to occur.

[0052] In order to support high pressure and increase the capacity of the scroll compressor 1, it is necessary to improve the strength of the Oldham ring 50. In this case, even if the thickness dimension of the Oldham ring 50 in the direction of the axis O1 is increased, the amount of the Oldham ring 50 protruding from the orbiting end plate 44 toward the fixed scroll 40 can be reduced by placing the ring body 51 of the Oldham ring 50 on the thin portion 44b of the orbiting end plate 44. Thus, the fixed end plate 41 can be brought closer to the orbiting end plate 44. Therefore, while the thickness dimension of the Oldham ring 50 is increased to secure the strength, the dimension of the scroll compression portion 5 in the direction of the axis O1 can be reduced, and the scroll compression portion 5 can be made compact. Thus, it is possible to make the entire scroll compressor 1 compact while supporting high pressure and increasing the capacity.

[0053] In the embodiment, the Oldham ring 50 is provided such that the ring body 51 protrudes in the direction of the axis O1 from the end face of the thick portion 44a facing the fixed end plate 41 side, and further, a part of the ring body 51 is disposed in the annular groove 41b of the fixed end plate 41. Therefore, even when the thickness dimension of the Oldham ring 50 in the direction of the axis O1 is increased in order to support high pressure and increase the capacity, the fixed end plate 41 can be disposed to be closer to the orbiting end plate 44. Thus, the scroll compression portion 5 can be made more compact in the direction of the axis O1.

[0054] When the lubricant is introduced to the scroll compression portion 5, the lubricant can be held in the annular groove 41b, the operation of the scroll compression portion 5 can be smoothed, and the efficiency can be further improved.

[0055] Further, at least a part of the thrust plate 47 is provided at a position that supports the thick portion 44a of the orbiting end plate 44, so that the thick portion 44a that receives many thrust loads due to the compressive load can be supported by the thrust plate 47. Thus, even when the thin portion 44b is provided to the orbiting end plate 44, the load does not act only on the thin portion 44b, and it is possible to sufficiently cope with the compressive load.

[0056] The orbiting-side key groove 44c is provided over the thin portion 44b and the thick portion 44a of the orbiting end plate 44, so that the length dimension of the orbiting-side key 53 in the radial direction can be increased. Accordingly, the surface pressure of the side surfaces 53a of the orbiting-side key 53, which slide with respect to the key sliding surfaces 44d of the orbiting-side key groove 44c, can be reduced, and the strength of the Oldham ring 50 can be improved. In the embodiment, the orbiting-side key groove 44c extends to the thick portion 44a, but the thickness dimension of the thick portion 44a in the direction of the axis O1 is larger than that of the thin portion 44b, and thus a problem in strength is unlikely to occur.

[0057] The fixed-side key groove 41c is provided to extend from the annular groove 41b to the outer side of the annular groove 41b of the fixed end plate 41 in the radial direction. Therefore, in a case where the fixed-side key groove 41c is provided by drilling a hole in the fixed end plate 41 at a position on the outer side of the annular groove 41b in the radial direction and inserting an end mill into the hole, the machining start point of the end mill is formed in an arc shape following the outer shape of the drill. However, when the fixed-side key groove 41c is formed up to the position on the outer side of the annular groove 41b in the radial direction, the key sliding surfaces 41d of the fixed-side key groove 41c can be formed in a planar shape along the radial direction in the annular groove 41b. Therefore, the key sliding surfaces 41d having a planar shape can be easily formed in the annular groove 41b.

[0058] At the position of the fixed-side key groove 41c on the outer side of the annular groove 41b in the radial direction which is the machining start point, the thickness of the fixed end plate 41 in the direction of the axis O1 is larger than the thickness in the direction of the axis O1 at the position where the annular groove 41b is formed. Therefore, even when the fixed-side key groove is formed to extend to the outer side of the annular groove 41b in the radial direction, a problem in strength is unlikely to occur.

[0059] The bottom surface of the annular groove 41b and the front surface of the ring body 51 are provided with an interval in the direction of the axis O1. Therefore, during the operation of the scroll compressor 1, the front surface of the ring body 51 is less likely to come into contact with the bottom surface of the annular groove 41b. Thus, the friction loss between the Oldham ring 50 and the fixed end plate 41 can be reduced.

[0060] Since the contact surface 41a of the fixed end plate 41 and the edge 42a of the fixed wrap 42 are disposed on the same plane, the machining is facilitated.

[0061] The embodiment of the present invention has been described in detail with reference to the drawings, but configurations and combinations thereof in each embodiment are examples, and the addition, omission, replacement, and other changes of the configurations can be made without departing from the scope of the present invention as defined in the appended claims. Further, the present invention is not limited by the embodiments, and is limited only by claims.

[0062] For example, the ring body 51 of the Oldham ring 50 may have a dimension so as not to protrude upward in the direction of the axis O1 from the thick portion 44a.

[0063] The orbiting-side key groove 44c may be formed only on the thin portion 44b.

[0064] The fixed-side key groove may be formed only in the annular groove.

Industrial Applicability

[0065] With the scroll compressor described above, it is possible to improve the efficiency while supporting high pressure and increasing the capacity.

Reference Signs List

[0066]

- 1: scroll compressor
- 2: rotating shaft
- 3: motor
- 4: rotary compression portion
- 5: scroll compression portion
- 6: housing
- 8: eccentric shaft
- 10: housing main body
- 11: upper lid
- 12: lower lid
- 13: suction pipe
- 14: discharge pipe
- 15: terminal
- 20: rotary lower bearing
- 21: rotary upper bearing
- 22: scroll bearing
- 30: cylinder
- 31: piston
- 40: fixed scroll
- 41: fixed end plate
- 41a: contact surface
- 41b: annular groove
- 41c: fixed-side key groove
- 41d: key sliding surface
- 41e: suction flow path
- 42: fixed wrap
- 42a: edge
- 43: orbiting scroll
- 44: orbiting end plate
- 44a: thick portion
- 44b: thin portion
- 44c: orbiting-side key groove
- 44d: key sliding surface
- 45: orbiting wrap
- 46: cylindrical part
- 46a: bearing

47: thrust plate
50: Oldham ring
51: ring body
52: fixed-side key
52a: side surface
53: orbiting-side key
53a: side surface
S: space
SS: fine gap
OL: oil reservoir
O1: axis
O2: axis
C1: compression chamber
C2: compression chamber

Claims

1. A scroll compressor (1) comprising:

a rotating shaft (2) that extends along an axis (O1);
a motor (3) that rotates the rotating shaft;
a scroll compression portion (5) that compresses a refrigerant by the rotation of the rotating shaft; and
a housing (6) that houses the rotating shaft, the motor, and the scroll compression portion,
wherein the scroll compression portion (5) includes

a fixed scroll (40) that has a fixed end plate (41) fixed to the housing, and a fixed wrap (42) that protrudes from the fixed end plate in a direction of the axis (O1),
an orbiting scroll (43) that is provided to the rotating shaft (2), and has an orbiting end plate (44) disposed to face the fixed end plate (41) in the direction of the axis, and an orbiting wrap (45) that protrudes from the orbiting end plate (44) toward the fixed end plate (41) and forms a compression chamber (C2) for the refrigerant together with the fixed wrap (42), and
an Oldham ring (50) that supports the orbiting scroll (43) such that the orbiting scroll orbits around the axis (O1) without rotating,

the Oldham ring (50) has

a ring body (51) that has an annular shape to surround the axis, and
a plurality of keys (52, 53) that protrude from the ring body (51) and are inserted into key grooves (41c, 44c) provided in the orbiting end plate (44) and the fixed end plate (41),

the orbiting end plate (44) has

a thick portion (44a) that has a disk shape and is provided with the orbiting wrap (45), and
a thin portion (44b) which is integrally provided with the thick portion (44a) on an outer side of the thick portion in a radial direction, has an annular shape, and has a smaller thickness dimension in the direction of the axis (O1) than a thickness dimension of the thick portion (44a), and of which an end face facing the fixed end plate (41) side is disposed at a position away from the fixed end plate (41) as compared with the thick portion (44a), and

the ring body (51) is provided to be placed on the end face of the thin portion (44b),

the scroll compressor (1) being **characterized in that** the Oldham ring (50) is interposed between the fixed end plate (41) and the orbiting end plate (44), and **in that** the key groove (44c) provided in the orbiting end plate (44) is open on the outer peripheral surface of the thin portion (44b) and penetrates the thin portion (44b) in the direction (D1) of the axis (O1).

2. The scroll compressor (1) according to claim 1, wherein a thickness dimension of the ring body (51) in the direction of the axis (O1) is larger than a distance between an end face of the thick portion (44a) facing the fixed end plate side and an end face of the thin portion (44b) facing the fixed end plate side in the direction of the axis (O1).

3. The scroll compressor (1) according to claim 1 or 2, further comprising:

a bearing (22) that is provided to the housing (6), rotatably supports the rotating shaft (2), and is disposed on a side opposite to the compression chamber (C2) in the direction of the axis (01) with respect to the orbiting end plate (44); and
a thrust plate (47) that is provided between the bearing (22) and the orbiting end plate (44), and supports the orbiting end plate in the direction of the axis (O1),
wherein the thrust plate (47) has an annular shape to surround the axis (O1), and is disposed at a position at which at least a part of the thrust plate (47) supports the thick portion (44a).

4. The scroll compressor (1) according to any one of claims 1 to 3, wherein the key groove (44c) provided in the orbiting end plate (44) is provided over the thin portion (44b) and the thick portion (44a).

Patentansprüche

1. Spiralverdichter (1), umfassend:

eine drehende Welle (2), die sich entlang einer Achse (01) erstreckt;
einen Motor (3), der die Welle dreht;
einen Spiralverdichtungsabschnitt (5), der durch die Drehung der drehenden Welle ein Kältemittel verdichtet; und
ein Gehäuse (6), das die drehende Welle, den Motor und den Spiralverdichtungsabschnitt aufnimmt,
wobei der Spiralverdichtungsabschnitt (5) Folgendes beinhaltet
eine feststehende Spirale (40), die eine feststehende Endplatte (41) aufweist, die an dem Gehäuse befestigt ist, und eine feststehende Windung (42), die von der feststehenden Endplatte in Richtung der Achse (01) hervorsteht,
eine umlaufende Spirale (43), die an der drehenden Welle (2) bereitgestellt ist und eine umlaufende Endplatte (44) aufweist, die angeordnet ist, um der feststehenden Endplatte (41) in Richtung der Achse zugewandt zu sein, und eine umlaufende Windung (45), die von der umlaufenden Endplatte (44) in Richtung der feststehenden Endplatte (41) hervorsteht und zusammen mit der feststehenden Windung (42) eine Kompressionskammer (C2) für das Kältemittel bildet, und
einen Oldham-Ring (50), der die umlaufende Spirale (43) trägt, sodass die umlaufende Spirale ohne zu drehen um die Achse (01) kreist,
der Oldham-Ring (50) Folgendes aufweist
einen Ringkörper (51), der eine ringförmige Form aufweist, um die Achse zu umgeben, und eine Vielzahl von Passfedern (52, 53), die von dem Ringkörper (51) hervorstehen und in Passnuten (41c, 44c) eingesetzt sind, die in der umlaufenden Endplatte (44) und der feststehenden Endplatte (41) bereitgestellt sind,
die umlaufende Endplatte (44) Folgendes aufweist
einen dicken Abschnitt (44a), der die Form einer Scheibe aufweist, und
mit der umlaufenden Windung (45) versehen ist, und
einen dünnen Abschnitt (44b), der einstückig mit dem dicken Abschnitt (44a) an einer Außenseite des dicken Abschnitts in einer radialen Richtung bereitgestellt ist, eine ringförmige Form aufweist und eine kleinere Dickenabmessung in der Richtung der Achse (01) als eine Dickenabmessung des dicken Abschnitts (44a) aufweist, und von dem eine Endfläche, die der Seite der feststehenden Endplatte (41) zugewandt ist, an einer Position entfernt von der feststehenden Endplatte (41) im Vergleich zu dem dicken Abschnitt (44a) angeordnet ist, und
der Ringkörper (51) bereitgestellt ist, um auf der Endfläche des dünnen Abschnitts (44b) platziert zu sein,
der Spiralverdichter (1) **dadurch gekennzeichnet ist, dass** der Oldham-Ring (50) zwischen der feststehenden Endplatte (41) und der umlaufenden Endplatte (44) angeordnet ist, und dass die in der umlaufenden Endplatte (44) bereitgestellte Passnut (44c) an der äußeren Umfangsfläche des dünnen Abschnitts (44b) offen ist und den dünnen Abschnitt (44b) in der Richtung (D1) der Achse (01) durchdringt.

2. Spiralverdichter (1) nach Anspruch 1,
wobei eine Dickenabmessung des Ringkörpers (51) in der Richtung der Achse (01) größer ist als ein Abstand zwischen einer Endfläche des dicken Abschnitts (44a), die der feststehenden Endplattenseite zugewandt ist, und einer Endfläche des dünnen Abschnitts (44b), die der feststehenden Endplattenseite zugewandt ist, in der Richtung der Achse (01).

3. Spiralverdichter (1) nach Anspruch 1 oder 2, ferner umfassend:

ein Lager (22), das an dem Gehäuse (6) bereitgestellt ist, die drehende Welle (2) drehbar trägt und auf einer Seite gegenüber dem Kompressionsraum (C2) in Richtung der Achse (01) in Bezug auf die umlaufende Endplatte (44) angeordnet ist; und
eine Druckplatte (47), die zwischen dem Lager (22) und der umlaufenden Endplatte (44) bereitgestellt ist und die umlaufende Endplatte in Richtung der Achse (01) trägt,
wobei die Druckplatte (47) eine ringförmige Form aufweist, um die Achse (01) zu umgeben, und an einer Position angeordnet ist, an der zumindest ein Teil der Druckplatte (47) den dicken Abschnitt (44a) trägt.

4. Spiralverdichter (1) nach einem der Ansprüche 1 bis 3,
wobei die Keilnut (44c), die in der umlaufenden Endplatte (44) bereitgestellt ist, über dem dünnen Abschnitt (44b) und dem dicken Abschnitt (44a) bereitgestellt ist.

Revendications

1. Compresseur à spirales (1) comprenant :

un arbre rotatif (2) qui s’étend le long d’un axe (01) ;
un moteur (3) qui fait tourner l’arbre rotatif ;

une partie de compression de spirale (5) qui comprime un réfrigérant par la rotation de l'arbre rotatif ; et
un boîtier (6) qui loge l'arbre rotatif, le moteur et la partie de compression de spirale,
dans lequel la partie de compression de spirale (5) comprend :

une spirale fixe (40) qui a une plaque d'extrémité fixe (41) fixée sur le boîtier, et une spire fixe (42) qui fait saillie de la plaque d'extrémité fixe dans une direction de l'axe (01),
une spirale orbitale (43) qui est prévue sur l'arbre rotatif (2) et a une plaque d'extrémité orbitale (44) disposée pour faire face à la plaque d'extrémité fixe (41) dans la direction de l'axe et une spire orbitale (45) qui fait saillie de la plaque d'extrémité orbitale (44) vers la plaque d'extrémité fixe (41) et forme une chambre de compression (C2) pour le réfrigérant conjointement avec la spire fixe (42), et
une bague de Oldham (50) qui supporte la spirale orbitale (43) de sorte que la spirale orbitale décrit une orbite autour de l'axe (01) sans tourner,
la bague de Oldham (50) a :

un corps de bague (51) qui a une forme annulaire pour entourer l'axe, et
une pluralité de clavettes (52, 53) qui font saillie du corps de bague (51) et sont insérées dans des gorges de clavette (41c, 44c) prévues dans la plaque d'extrémité orbitale (44) et la plaque d'extrémité fixe (41),
la plaque d'extrémité orbitale (44) a :

une partie épaisse (44a) qui a une forme de disque et est prévue avec la spire orbitale (45), et
une partie fine (44b) qui est prévue, de manière solidaire, avec la partie épaisse (44a) sur un côté externe de la partie épaisse dans une direction radiale, a une forme annulaire et a une plus petite dimension d'épaisseur dans la direction de l'axe (01) qu'une dimension d'épaisseur de la partie épaisseur (44a) et dont une face d'extrémité faisant face au côté de la plaque d'extrémité fixe (41) est disposée dans une position à l'opposé de la plaque d'extrémité fixe (41) par rapport à la partie épaisse (44a), et
le corps de base (51) est prévu pour être placé sur la face d'extrémité de la partie fine (44b),

le compresseur à spirales (1) étant **caractérisé en ce que** la bague de Oldham (50) est intercalée entre la plaque d'extrémité fixe (41) et la plaque d'extrémité orbitale (44), et **en ce que** la gorge de clavette (44c) prévue dans la plaque d'extrémité orbitale (44) est ouverte sur la surface périphérique externe de la partie fine (44b) et pénètre dans la partie fine (44b) dans la direction (D1) de l'axe (01).

2. Compresseur à spirales (1) selon la revendication 1, dans lequel une dimension d'épaisseur du corps de bague (51) dans la direction de l'axe (01) est supérieure à une distance entre une face d'extrémité de la partie épaisse (44a) faisant face au côté de plaque d'extrémité fixe et une face d'extrémité de la partie fine (44b) faisant face au côté de plaque d'extrémité fixe dans la direction de l'axe (01).

3. Compresseur à spirales (1) selon la revendication 1 ou 2, comprenant en outre :

un palier (22) qui est prévu sur le boîtier (6), supporte, de manière rotative, l'arbre rotatif (2) et est disposé sur un côté opposé à la chambre de compression (C2) dans la direction de l'axe (01) par rapport à la plaque d'extrémité orbitale (44) ; et
une plaque de poussée (47) qui est prévue entre le palier (22) et la plaque d'extrémité orbitale (44) et supporte la plaque d'extrémité orbitale dans la direction de l'axe (01),
dans lequel la plaque de poussée (47) a une forme annulaire pour entourer l'axe (01) et est disposée dans une position dans laquelle au moins une partie de la plaque de poussée (47) supporte la partie épaisse (44a).

4. Compresseur à spirales (1) selon l'une quelconque des revendications 1 à 3,
dans lequel la gorge de clavette (44c) prévue dans la plaque d'extrémité orbitale (44) est prévue sur la partie fine (44b) et la partie épaisse (44a).

FIG. 1

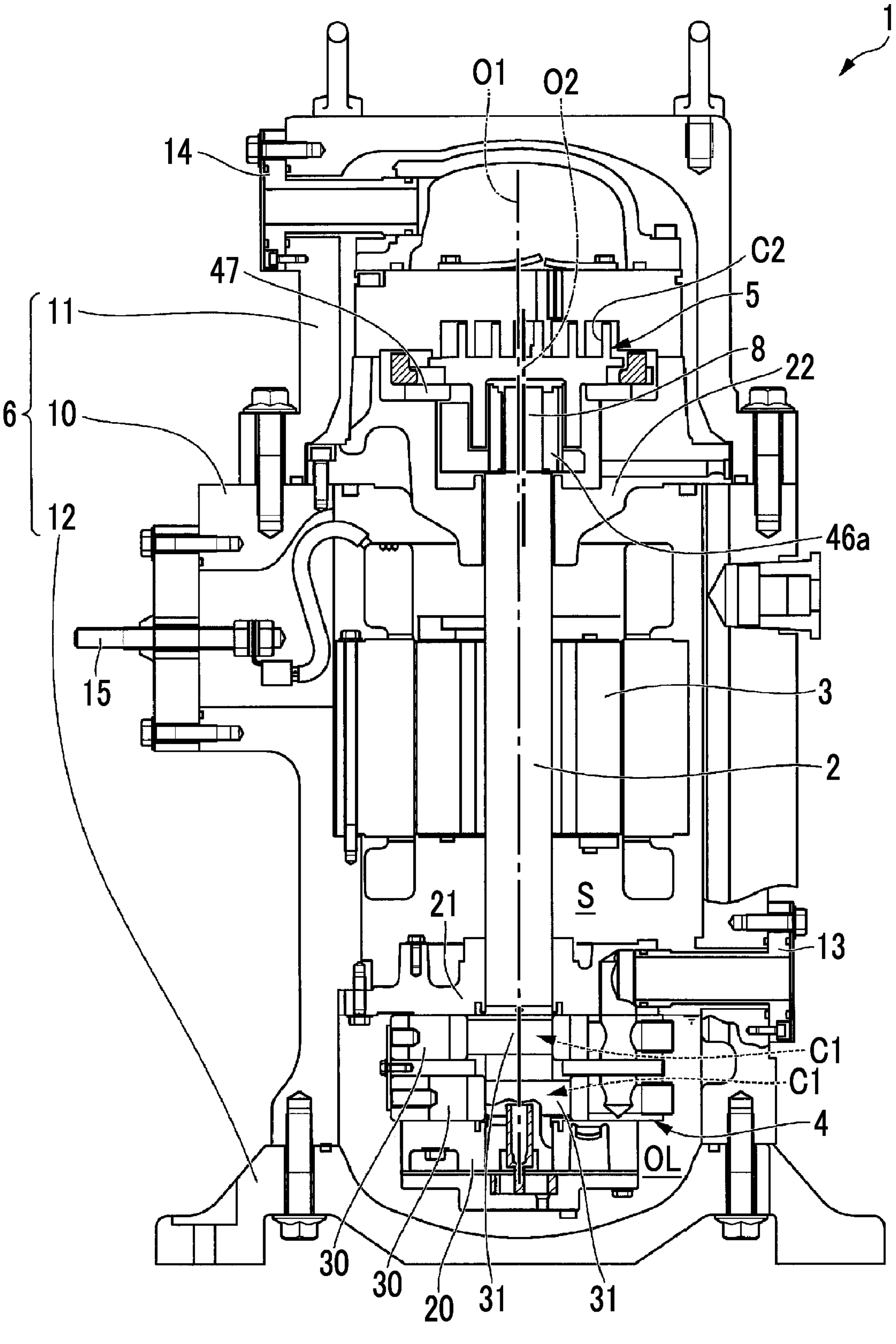

1
O1
O2
14
C2
47
5
11
8
22
6
10
12
46a
15
3
2
S
21
13
C1
C1
4
OL
30
30
20
31
31

FIG. 2

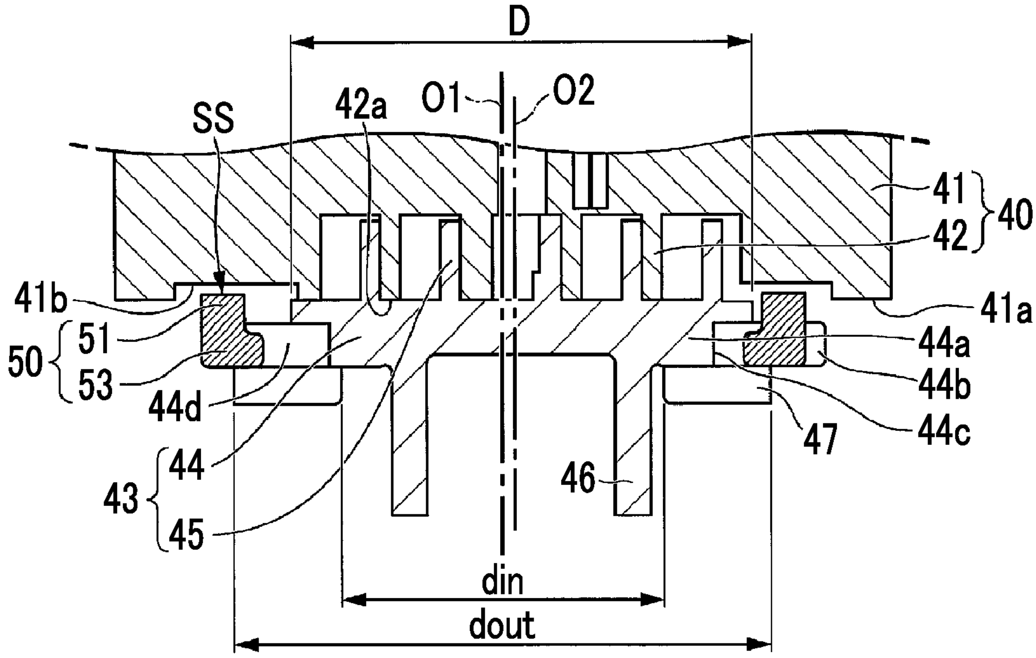

D
O1
O2
SS
42a
41
40
42
41b
41a
51
50
53
44d
44
43
45
46
47
44a
44b
44c
din
dout

FIG. 3

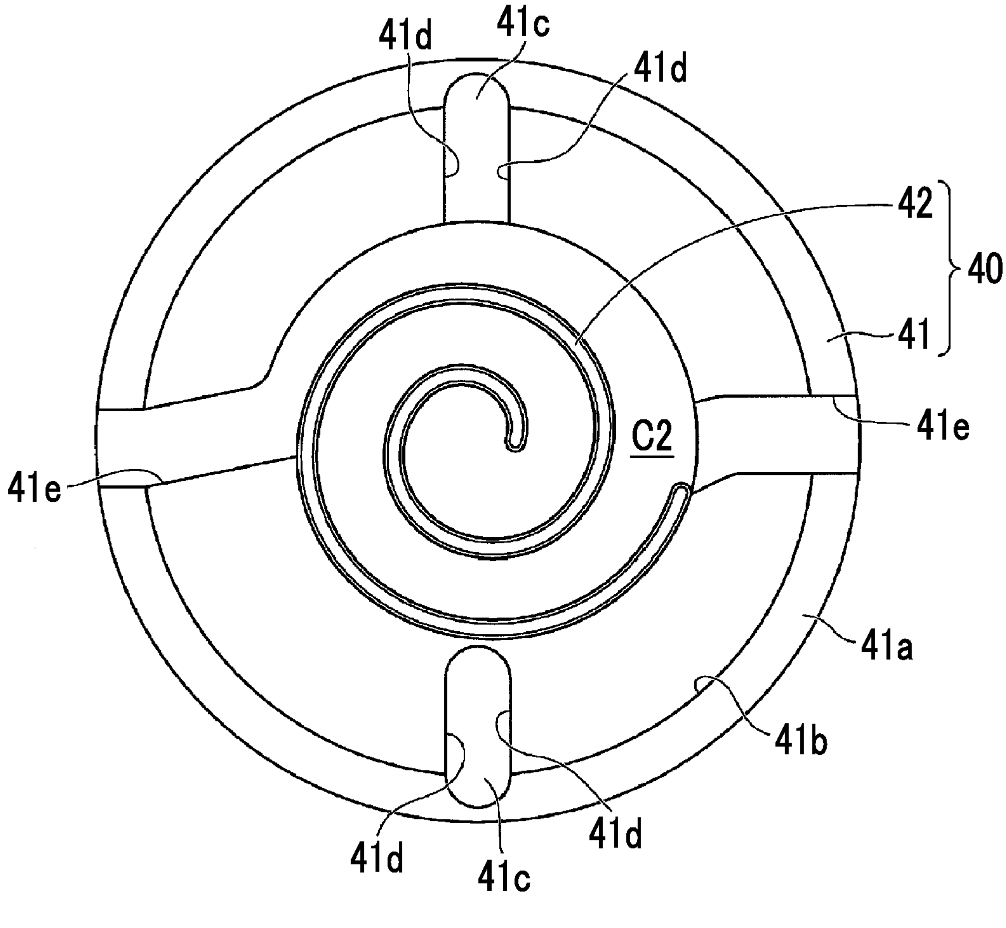

41d
41c
41d
42
40
41
41e
C2
41e
41a
41b
41d
41c
41d

FIG. 4

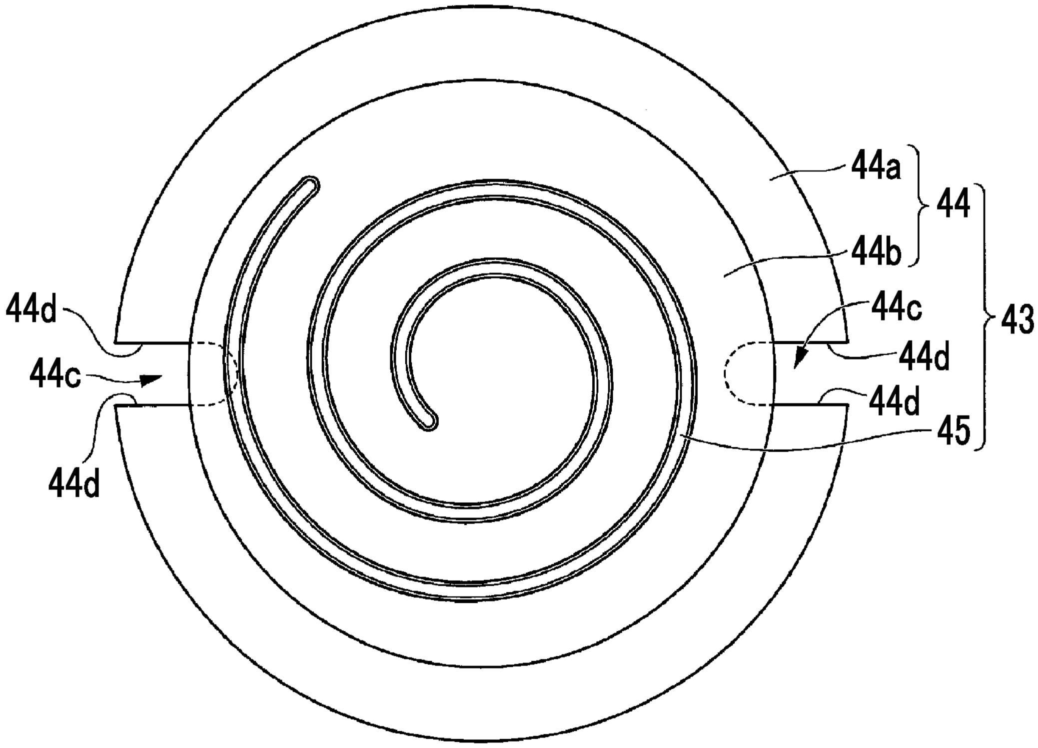
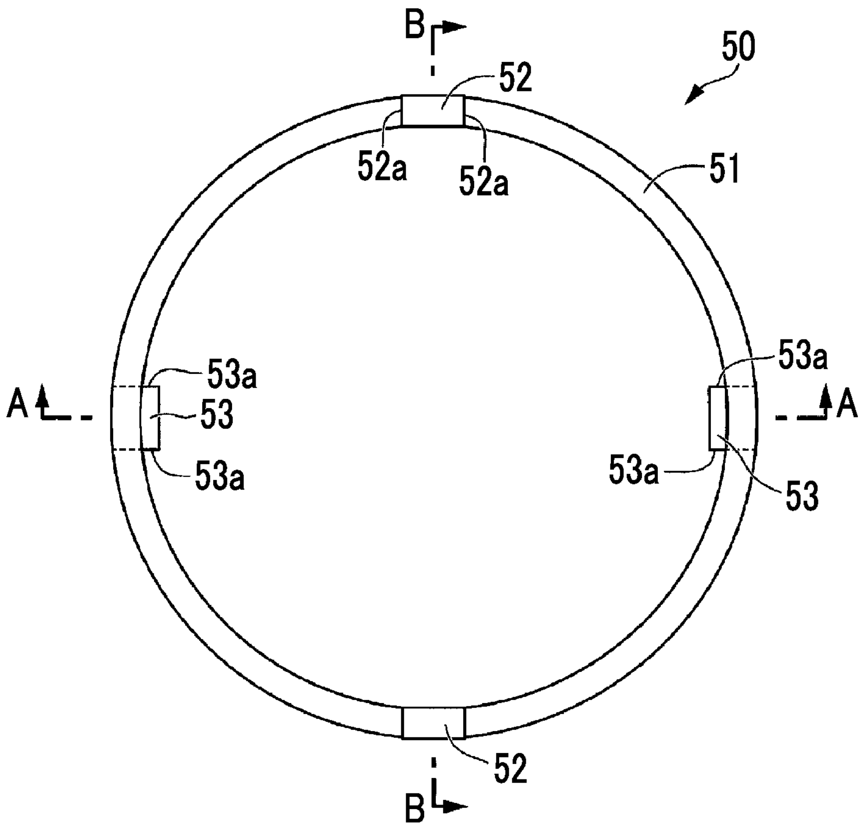

44a
44
44b
44d
44c
43
44d
44c
44d
44d
45
44d

FIG. 5


B
50
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52a
52a
51
53a
53a
A
53
A
53a
53a
53
52
B

FIG. 6

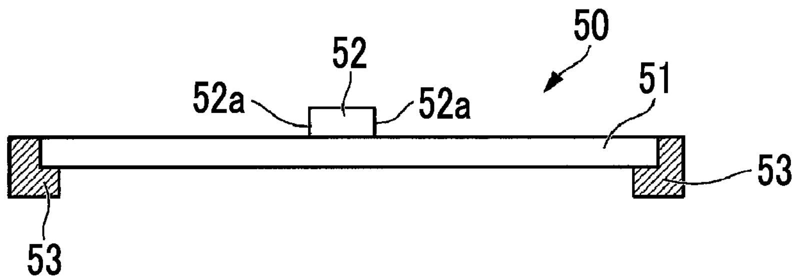
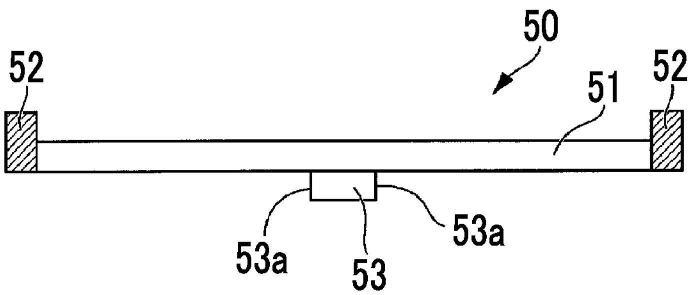


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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