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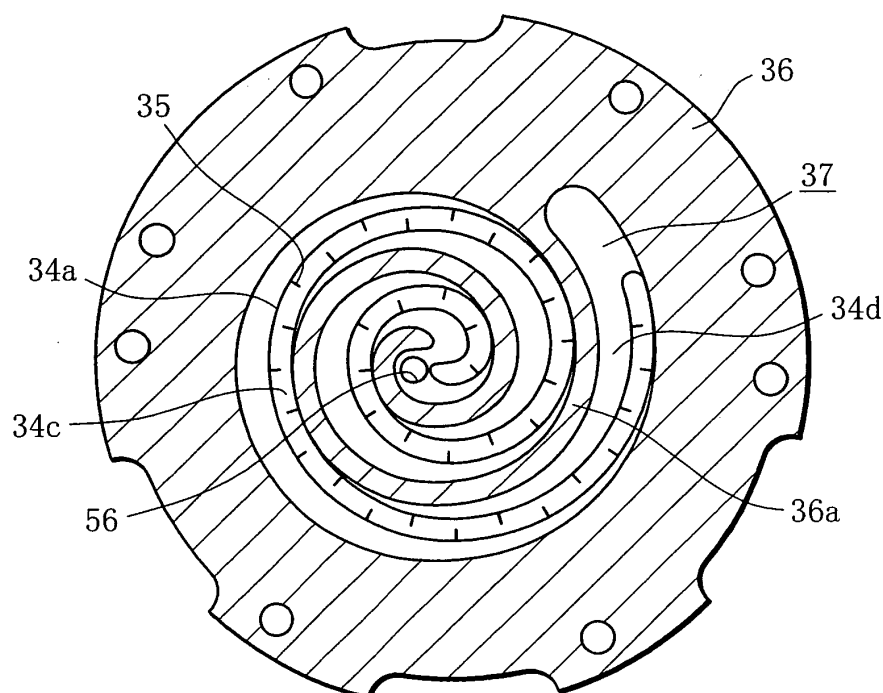
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(54) **Fluid machine**

(57) In a spiral wrap (34a) of at least a movable scroll, grooves (35) are formed at given intervals to extend from a halfway point of a top face (34c) of the spiral wrap

through the lateral face of the spiral wrap, substantially perpendicular to the lateral face in a direction of formation of the spiral wrap.

FIG. 3



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a fluid machine, and more specifically, to a fluid machine suitable for a refrigeration air conditioning unit and a heat pump water heater.

Description of the Related Art

[0002] A fluid machine of this type, for example, a scroll compressor, has a container accommodating a scroll unit that carries out a sequence of processes including the suction, compression and discharge of a refrigerant. More concretely, the scroll unit includes fixed and movable scrolls that engage with each other. A boss is formed in the back face of the movable scroll. This boss is coupled with a crank pin that is formed integrally with a rotary shaft. When driven by the rotary shaft through the boss, the movable scroll orbits around the axis of the fixed scroll without rotating on its axis while being supported by a spindle frame. This reduces the capacity of a gap formed between the spiral wraps of the scrolls. The sequence of the processes is then conducted.

[0003] It is important for the fluid machine to prevent a refrigerant from leaking out by surely engaging the spiral wraps of the scrolls with each other to seal the gap formed between the spiral wraps. On the other hand, if the gap formed between the spiral wraps is sealed in this manner, friction that is caused in the engaged portions of the movable and fixed scrolls is increased. This could incur seizing or the like, and is therefore unfavorable.

[0004] Given this factor, lubrication oil is usually supplied to the engaged portions of the movable and fixed scrolls so that a sealed condition may be retained by the sealing performance of the lubrication oil, and that seizing or the like may be prevented at the same time.

[0005] As the lubrication oil supply easily breaks off especially between the upper surface of the spiral wrap of the movable scroll and the fixed scroll, various technologies have been suggested, which improve the lubrication oil supply to this particular portion. For example, in a well known configuration, a sloping face or the like is formed in the upper surface of a spiral wrap of a movable scroll to expand in an extending direction of the spiral wrap, and lubrication oil is directed to the upper surface of the spiral wrap by using a wedge effect (see Unexamined Japanese Patent Publication No. 2005-171952).

[0006] The technology disclosed in the above publication, however, has the problem that, since the sloping face or the like is formed to expand in the direction of formation of the spiral wrap, the pressure in the compression chamber located in between spiral wraps is prone to decrease as it escapes along the sloping face to low-pressure portions other than the compression chamber

due to the configuration of the scroll compressor.

[0007] The decrease of the pressure in the compression chamber is not desirable because it leads to a reduction in sealing performance using lubrication oil, and then the compressor cannot provide sufficient compression efficiency.

SUMMARY OF THE INVENTION

[0008] The present invention has been made in light of the above-described problems. It is an object of the invention to provide a fluid machine that is capable of surely supplying lubrication oil to engaged surfaces of movable and fixed scrolls, and constantly and successfully maintaining a compression chamber, which is formed between spiral wraps, in a liquid-tight state.

[0009] In order to achieve the object, the fluid machine of the invention has a rotary shaft that extends within a container and is rotatably supported by the container; a crank pin that is formed integrally with the rotary shaft so as to be eccentrically located in an upper end of the rotary shaft; and a scroll unit that is installed in the container, has a fixed scroll formed integrally with the container and a movable scroll that orbits around an axis of the fixed scroll when coupled with the crank pin and driven by the rotary shaft, engages a lateral face of a spiral wrap formed upright in an end plate face of the movable scroll with a lateral face of a spiral wrap formed upright in an end plate face of the fixed scroll by using the orbiting motion of the movable scroll, engages a top face of the spiral wrap of the movable scroll with the end plate face of the fixed scroll, engages a top face of the spiral wrap of the fixed scroll with the end plate face of the movable scroll, and carries out a sequence of processes of compression and expansion of working fluid by increasing and decreasing the capacity of gaps formed between the spiral wraps. Lubrication oil is supplied to between the movable scroll and the fixed scroll. In the spiral wrap of at least the movable scroll, if not both the movable and fixed scrolls, grooves are formed at given intervals to extend from a halfway point of the top face of the spiral wrap through the lateral face of the spiral wrap, substantially perpendicular to the lateral face in a direction of formation of the spiral wrap.

[0010] Consequently, working oil is stored in the grooves, and the stored lubrication oil is drawn out due to sliding movement of the top face of the spiral wrap and the end plate face and then supplied to between the top face of the spiral wrap and the end plate face. As a result, a minute gap between the top face of the spiral wrap and the end plate face is well sealed with the lubrication oil.

[0011] Accordingly, all the minute gaps between the movable scroll and the fixed scroll, which are the engaged surfaces, can be well sealed with the lubrication oil. This makes it possible to successfully maintain the compression chamber, which is formed between the spiral wraps, in a liquid-tight state all the time.

[0012] Preferably, each of the grooves is formed in the

spiral wrap to extend halfway across the lateral face of the spiral wrap.

[0013] Consequently, the minute gap between the top face of the spiral wrap and the end plate face can be well sealed by simple machining.

[0014] Preferably, each of the grooves is formed to extend to the end plate face.

[0015] It is then possible to successfully seal the minute gap between the top face of the spiral wrap and the end plate face of the fixed scroll while sufficiently storing the lubrication oil in the grooves by sucking up the lubrication oil from the vicinity of the end plate face in which a large amount of the lubrication oil is relatively likely to exist.

[0016] Further preferably, the grooves are formed in at least either one of an inner circumferential surface and an outer circumferential surface of the spiral wrap.

[0017] If the grooves are formed both in the inner and outer circumferential surfaces of the spiral wrap, the minute gap between the top face of the spiral wrap and the end plate face can be sufficiently well sealed. If the grooves are formed both in the inner and outer circumferential surfaces of the spiral wrap, the minute gap between the top face of the spiral wrap and the end plate face can be fully sealed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a longitudinal sectional view of an enclosed compressor according to the invention;

FIG. 2 is a view showing a scroll unit section of FIG. 1 in an enlarged scale;

FIG. 3 is a cross sectional view, taken along line AA of FIG. 2;

FIG. 4 is an enlarged perspective view of a spiral wrap of a movable scroll;

FIG. 5 is a longitudinal sectional view, taken along line B--B of FIG. 4;

FIG. 6 is an enlarged perspective view of a spiral wrap of a movable scroll according to a second embodiment; and

FIG. 7 is a longitudinal sectional view, taken along line B'--B' of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] One embodiment of the invention will be described below with reference to the attached drawings.

[0020] FIG. 1 is a longitudinal sectional view of an enclosed compressor (fluid machine) according to the invention. An enclosed compressor (hereinafter, referred to as compressor) 1 is a vertical scroll compressor that is interposed in a refrigeration circuit, such as a refrigeration air conditioning unit and a heat pump water heater. The circuit includes a path through which a carbon diox-

ide refrigerant (hereinafter, referred to as a refrigerant) that is one of working fluids circulates. The compressor 1 sucks the refrigerant from the path, and compresses and discharges the refrigerant toward the path.

5 [0021] As illustrated in FIG. 1, the compressor 1 has a housing (container) 2. The housing 2 has a body 4, upper and lower sides of which are airtightly interfitted with an upper cover 6 and a lower cover 8, respectively. The body 4 is thus made airtight, so that high discharge pressure works within the body 4. The body 4 is connected with a suction pipe 10 for sucking the refrigerant retrieved from the circuit. A discharge pipe 12 for sending the compressed refrigerant in the housing 2 to the circuit is connected to a proper position of the upper cover 6.

15 [0022] An electric motor 14 is accommodated in the body 4. A rotary shaft 16 is disposed in the motor 14 and driven when the power of the motor 14 is turned on. The rotary shaft 16 is rotatably supported by a spindle frame 18 at an upper end thereof through a bearing 17.

20 [0023] The rotary shaft 16 is also rotatably supported by a countershaft frame 22 at a lower end thereof through a bearing 20. An oil pump 24 is mounted on the lower end of the rotary shaft 16. The pump 24 sucks lubrication oil L stored in an oil storage chamber 26 formed in the inside of the lower cover 8, that is, in a bottom of the housing 2. The lubrication oil L serves to lubricate sliding portions, bearings and the like, and functions as seal of sliding faces, passing through an oil supply path (oil path) 28 that is axially formed through the rotary shaft 16.

25 [0024] Discharge pressure of the refrigerant acts on an oil level of the lubrication oil L contained in the oil storage chamber 26. The discharge pressure acting on the oil level of the lubrication oil L promotes the upward movement of the lubrication oil L through the oil supply path 28. This creates a high-pressure environment having a pressure that is substantially equal to the discharge pressure of the refrigerant at an outlet of the oil supply path 28.

30 [0025] An inlet 32 for the lubrication oil L is formed in a proper position of the countershaft frame 22. The lubrication oil L supplied to the sliding portions of the compressor 1 is stored in the oil storage chamber 26 through the inlet 32.

35 [0026] A scroll unit 30 is set above the motor 14 within the body 4 and carries out a sequence of processes including the suction, compression and discharge of a refrigerant.

40 [0027] More concretely, as illustrated in FIG. 2 in an enlarged scale, the scroll unit 30 is formed of a movable scroll 34 and a fixed scroll 36. The scrolls 34 and 36 have end plate faces 34d and 36d, respectively, facing each other. In the end plate faces 34d and 36d, respective spiral wraps 34a and 36a are integrally formed upright in the end plate faces 34d and 36d, thereby creating a compression chamber in between the spiral wraps 34a and 36a. When the movable scroll 34 orbits around the fixed scroll 36, the spiral wraps 34a and 36a are engaged with each other to create a suction chamber 37 on an outer

circumferential side of the movable scroll 34 in consort with each other. The refrigerant is sucked from the suction chamber 37 through the suction pipe 10 into the compression chamber. The compression chamber is reduced in capacity as it moves toward the center of the spiral wraps 34a and 36a. In this manner, the compression of the refrigerant is conducted.

[0028] To be more specific, as a result of the orbiting motion of the movable scroll 34, lateral faces of the spiral wraps 34a and 36a are engaged with each other with a minute gap therebetween. At the same time, a top face 34c of the spiral wrap 34a and a top face 36c of the spiral wrap 36a are engaged with an end plate face 36d of the fixed scroll 36 and an end plate face 34d of the movable scroll 34, respectively, with minute gaps therebetween. The compression chamber is then increased and decreased in capacity, and the sequence of the processes including the suction, compression and discharge of the refrigerant is carried out.

[0029] In order to allow the orbiting motion of the movable scroll 34, a boss 38 is convexly formed in a back face 34b of the movable scroll 34. The boss 38 is fitted to a crank pin 42 through a bearing 44. The crank pin 42 is integrally formed on the upper end side of the rotary shaft 16 and causes the movable scroll 34 to orbit above the spindle frame 18 along with the rotation of the rotary shaft 16.

[0030] The movable scroll 34 is prevented from rotating on its axis by a rotation-blocking pin (pin) 62. The pin 62 is formed to project from the back face 34b of the movable scroll 34. The pin 62 is interfitted in a blind hole (cylindrical hole) 64 with allowance, which is formed in the spindle frame 18. In other words, a so-called pin hole-type rotation-blocking mechanism 60 is formed in a gap 45 between the back face 34b of the movable scroll 34 and the spindle frame 18. The rotation-blocking mechanism 60 is constructed to include, for example, four sets of pins 62 and holes 64.

[0031] The fixed scroll 36 is fixed to the spindle frame 18 and separates a discharge chamber 54 side, which is formed under the upper cover 6, and the compression chamber from each other. The spindle frame 18 has a cylindrical outer circumferential wall 19 extending toward the fixed scroll 36 concentrically with the rotary shaft 16. The fixed scroll 36 is joined to an upper edge of the outer circumferential wall 19.

[0032] Since the fixed scroll 36 is joined to the upper edge of the outer circumferential wall 19, the movable scroll 34 is surrounded by the outer circumferential wall 19, and there is formed an orbit slide area, in which the movable scroll 34 makes sliding movement, in between the fixed scroll 36 and the spindle frame 18. In the orbit slide area, a gap 46 is so formed as to be surrounded by an upper face of the spindle frame 18, the end plate face of the fixed scroll 36, the movable scroll 34, and the outer circumferential wall 19. The gap 46 communicates with the suction chamber 37 and the gap 45. When the movable scroll 34 orbits in a direction of an arrow as illustrated

in FIG. 3, the gap 46 moves along with the orbiting motion.

[0033] As illustrated in FIGS. 1 and 2, the gap 45 leads to the outlet of the oil supply path 28 and also with the suction chamber 37 through the gap 46. The high-pressure lubrication oil L is supplied to the low-pressure suction chamber 37 through the gaps 45 and 46 (shown by arrows in FIG. 2). Consequently, the lubrication oil L seals a minute gap between the lateral faces of the spiral wraps 34a and 36a, which are the engaged surfaces, that between the top face 34c of the spiral wrap 34a and the end plate face 36d of the fixed scroll 36, and that between the top face 36c of the spiral wrap 36a and the end plate face 34d of the movable scroll 34.

[0034] As illustrated in FIG. 3 showing a cross sectional view, taken along line A--A of FIG. 2, a plurality of grooves 35 are formed in all over the spiral wrap 34a of the movable scroll 34 over the length of the spiral wrap 34a in the direction of formation of the spiral wrap 34a.

[0035] As illustrated in FIG. 4 showing an enlarged perspective view of the spiral wrap 34a, the grooves 35 are alternately formed in inner and outer circumferential surfaces of the spiral wrap 34a to obliquely extend from the middle of the top face 34c to the middle of the lateral face of the top face 34c, perpendicular to the inner and outer circumferential surfaces at given intervals in the direction of formation of the spiral wrap 34a. A groove width is set at a very small dimension (several μm , for example).

[0036] As illustrated in FIG. 5 showing a longitudinal sectional view, taken along line B--B of FIG. 4, the length of each of the grooves 35 is set at a given dimension d1 that is shorter than a top-face width D in the top face 34c of the spiral wrap 34a. The given dimension d1 may be properly set in view of the strength of the spiral wrap 34a and the like (for example, $d1/D \leq 1/2$).

[0037] A discharge hole 56 leading to the compression chamber side is formed through the fixed scroll 36 in a proper position of a central section thereof. The discharge hole 56 is opened and closed by a discharge valve 58 that is placed on the back face 36c side of the fixed scroll 36. The discharge valve 58 is covered with a discharge head 50, which reduces noises produced when the discharge valve 58 is opened.

[0038] Operation of the enclosed compressor (fluid machine) according to the invention thus constructed will be described below.

[0039] According to the compressor 1, when the rotary shaft 16 is rotated by the electric motor 14, the movable scroll 34 starts orbiting. The orbiting motion of the movable scroll 34 sucks the refrigerant from the suction pipe 10 into the scroll unit 30 and compresses the refrigerant while reducing the capacity of the compression chamber. The high-pressure refrigerant thus compressed circulates through the housing 2, and is discharged from the discharge chamber 54 through the discharge pipe 12 to the outside of the compressor.

[0040] If the movable scroll 34 starts orbiting, the high-pressure lubrication oil L discharged from the oil supply path 28 is supplied through the gaps 45 and 46 into the

low-pressure suction chamber 37. Therefore, the minute gap between the spiral wraps 34a and 36a, that between the top face 34c and the end plate face 36d, and that between the top face 36c and the end plate face 34d are sealed with the lubrication oil L. Since the spiral wrap 34a is provided with the grooves 35 in the enclosed compressor according to the invention, the lubrication oil L is stored in the grooves 35 as shown by an arrow in FIG. 5.

[0041] If the lubrication oil L is stored in the grooves 35, and the movable scroll 34 makes orbiting motion, the spiral wrap 34a repeatedly moves close to and away from the spiral wrap 36a so as to slide in a direction perpendicular to the lateral face of the spiral wrap 34a, that is, in a direction along the grooves 35. Therefore, the lubrication oil L stored in the grooves 35 is drawn out little by little to be supplied to between the top face 34c of the spiral wrap 34a and the end plate face 36d of the fixed scroll 36. Due to simple machining that forms the grooves 35 obliquely from the halfway point of the top face 34c to the halfway point of the lateral face, the minute gap between the top face 34c and the end plate face 36d is sufficiently well sealed with the lubrication oil L.

[0042] The lubrication oil L is well supplied to the minute gap between the top face 36c of the spiral wrap 36a and the end plate face 34d of the movable scroll 34 as the gap is located below as viewed in a direction of gravitational force. Again, the minute gap between the top face 36c and the end plate face 34d is well sealed with the lubrication oil L.

[0043] Accordingly, all the minute gaps between the movable scroll 34 and the fixed scroll 36, which are the engaged surfaces, can be well sealed with the lubrication oil L. This makes it possible to successfully maintain the compression chamber, which is formed between the spiral wraps 34a and 36a, in a liquid-tight state all the time. The compressor 1 is then increased in compression efficiency, which improves the performance of the compressor 1.

[0044] FIG. 6 is an enlarged perspective view of the spiral wrap 34a according to a second embodiment. FIG. 7 is a longitudinal sectional view, taken along line B'-B' of FIG. 6. The second embodiment will be described below.

[0045] According to the second embodiment, grooves 35' are arranged to extend from the middle of the top face 34c through the lateral face up to the end plate face 34d of the movable scroll 34. Similarly to the grooves 35, the grooves 35' are alternately formed in inner and outer circumferential surfaces of the spiral wrap 34a, perpendicular to the inner and outer circumferential surfaces at given intervals in the direction of formation of the spiral wrap 34a. Each of the grooves 35' has a groove width that is set at a very small dimension (several μm , for example).

[0046] To be concrete, as illustrated in FIG. 7, each of the grooves 35' has a length (depth) that is set at a given dimension d_2 shorter than the top-face width D. The given dimension d_2 may be properly set in view of the strength

of the spiral wrap 34a and the like (for example, $d_2/D \leq 1/2$).

[0047] If the grooves 35' are arranged in this fashion, it is possible to successfully seal the minute gap between the top face 34c of the spiral wrap 34a and the end plate face 36d of the fixed scroll 36 while sufficiently storing the lubrication oil L in the grooves 35' by sucking up the lubrication oil L from the vicinity of the end plate face 34d in which a large amount of the lubrication oil L is relatively likely to exist as shown by the arrow in FIG. 7.

[0048] This is the end of the description about the one embodiment of the invention. The invention, however, is not limited to the foregoing embodiments, and may be modified in various ways without deviating from the gist of the invention.

[0049] For example, according to the embodiments, the grooves 35 and 35' are formed only in the spiral wrap 34a. However, if the grooves are also provided to the spiral wrap 36a as well, the minute gap between the top face 36c of the spiral wrap 36a and the end plate face 34d of the movable scroll 34 can be still better sealed.

[0050] Although, in the embodiments, the grooves 35 and 35' are formed in the inner and outer circumferential surfaces of the spiral wrap 34a, the grooves may be provided to either the inner or outer circumferential surface of the spiral wrap 34a. This makes it possible to ensure the strength of the spiral wrap 34a and to successfully seal the minute gap between the top face 34c of the spiral wrap 34a and the end plate face 36d of the fixed scroll 36.

[0051] According to the embodiments, the grooves 35 and 35' are formed in the inner and outer circumferential surfaces of the spiral wrap 34a alternately at the given intervals, the grooves may be provided to the inner and outer circumferential surfaces to be located in the same positions at given intervals as long as the strength of the spiral wrap 34a is ensured.

[0052] The embodiments have been described, referring to the case in which the enclosed compressor is applied as a fluid machine. However, the invention is not limited to this case, and can be suitably applied as well when the fluid machine is an expansion device or the like.

Claims

1. A fluid machine characterized by:

a rotary shaft (16) that extends within a container and is rotatably supported by the container (2);
a crank pin (42) that is formed integrally with the rotary shaft so as to be eccentrically located in an upper end of the rotary shaft; and
a scroll unit (30) that is installed in the container, has a fixed scroll (36) formed integrally with the container and a movable scroll (34) that orbits around an axis of the fixed scroll when coupled with the crank pin and driven by the rotary shaft, engages a lateral face of a spiral wrap formed

upright in an end plate face of the movable scroll with a lateral face of a spiral wrap formed upright in an end plate face of the fixed scroll by using the orbiting motion of the movable scroll, engages a top face of the spiral wrap of the movable scroll with the end plate face of the fixed scroll, engages a top face of the spiral wrap of the fixed scroll with the end plate face of the movable scroll, and carries out a sequence of processes of compression and expansion of working fluid by increasing and decreasing the capacity of gaps formed between the spiral wraps, **characterized in that:**

lubrication oil is supplied to between the movable scroll and the fixed scroll; and in the spiral wrap (34a) of at least the movable scroll, if not both the movable and fixed scrolls, grooves (35) are formed at given intervals to extend from a halfway point of the top face (34c) of the spiral wrap through the lateral face of the spiral wrap, substantially perpendicular to the lateral face in a direction of formation of the spiral wrap.

2. The fluid machine according to claim 1, **characterized in that:**

each of the grooves (35) is formed in the spiral wrap to extend halfway across the lateral face of the spiral wrap.

3. The fluid machine according to claim 1, **characterized in that:**

each of the grooves (35) is formed to extend to the end plate face (34d, 36d).

4. The fluid machine according to any one of claims 1 to 3, **characterized in that:**

the grooves (35) are formed in at least either one of an inner circumferential surface and an outer circumferential surface of the spiral wrap.

FIG. 1

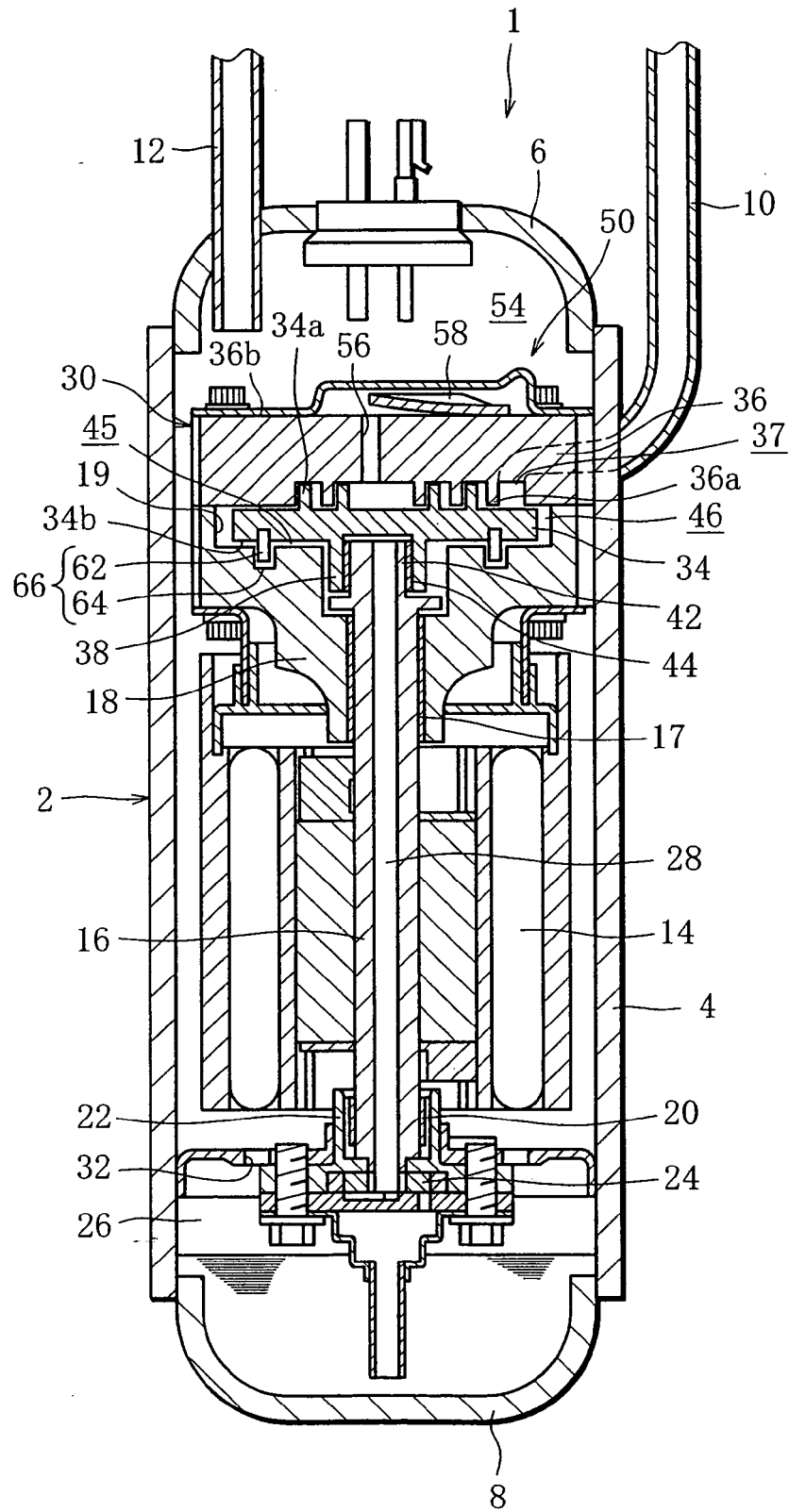


FIG. 2

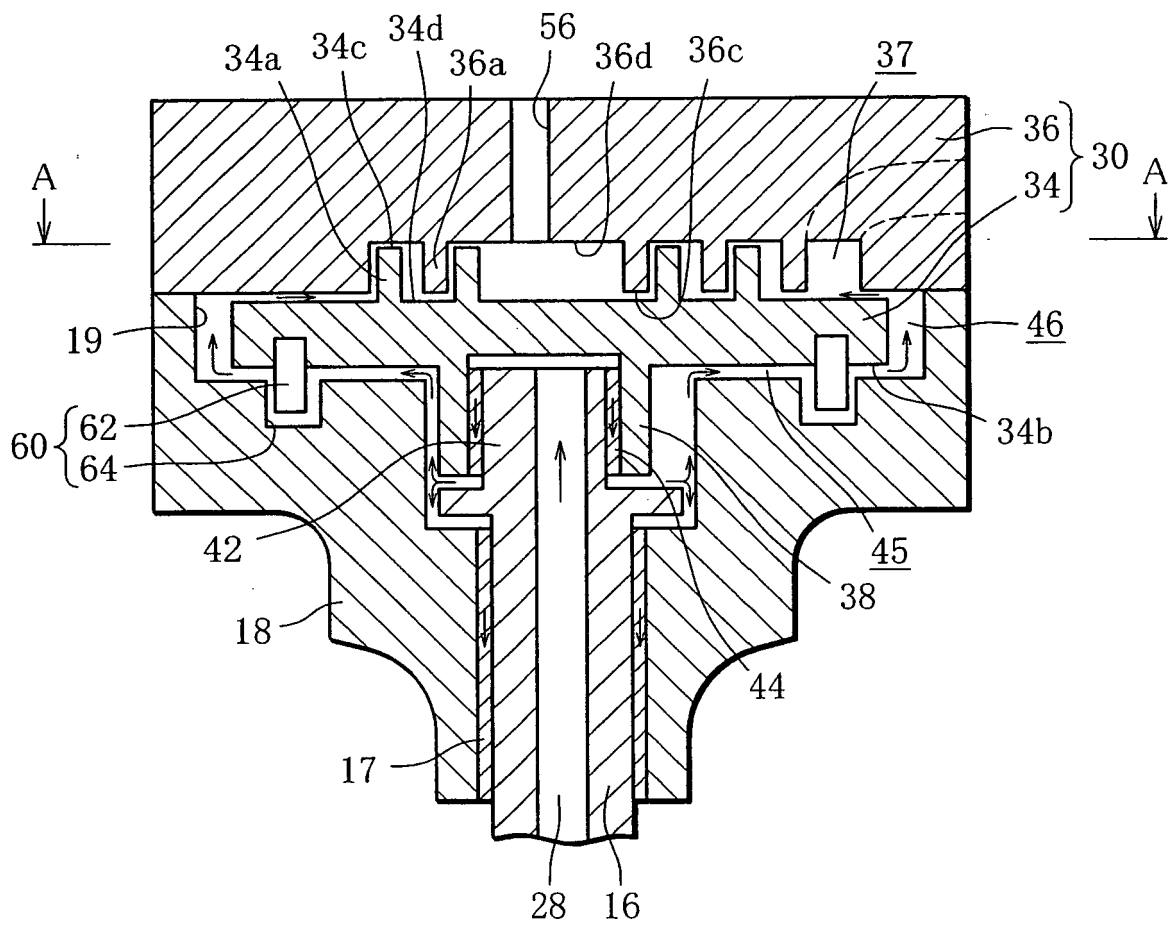


FIG. 3

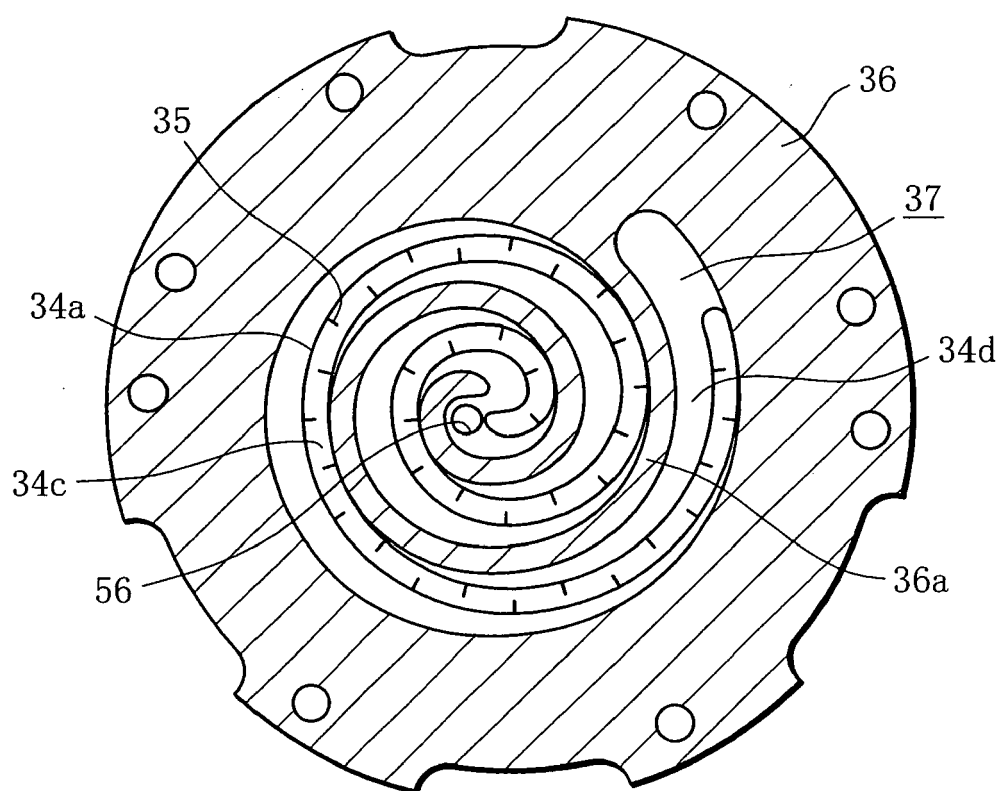


FIG. 4

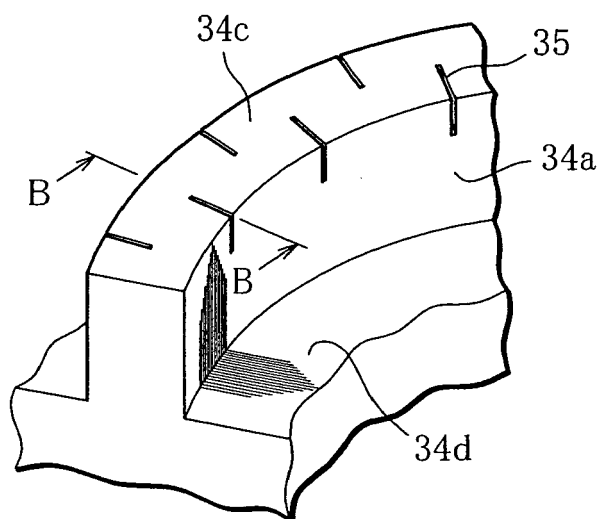


FIG. 5

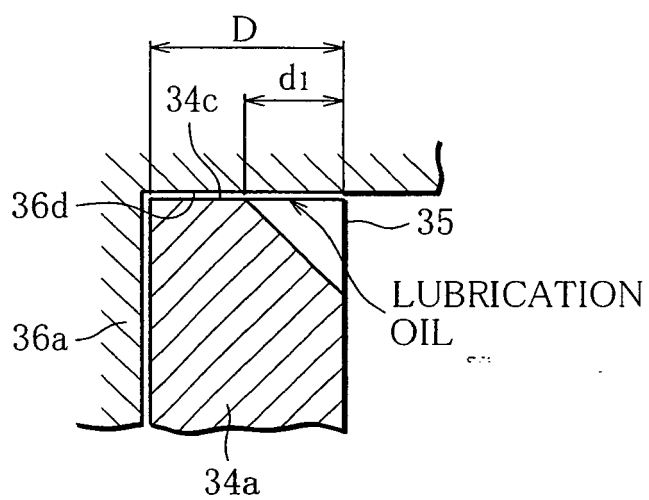


FIG. 6

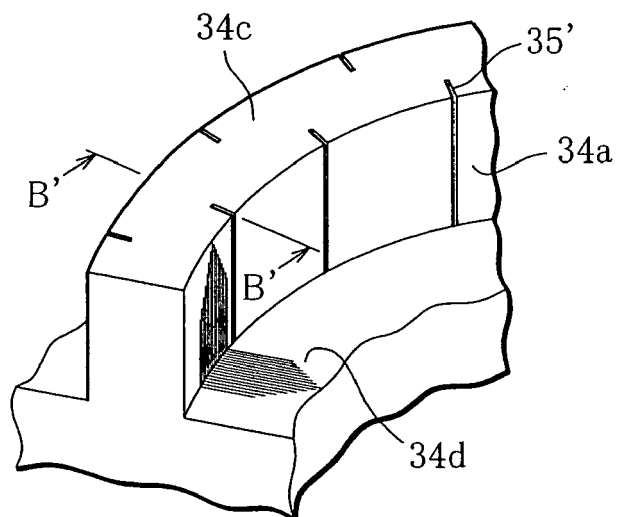
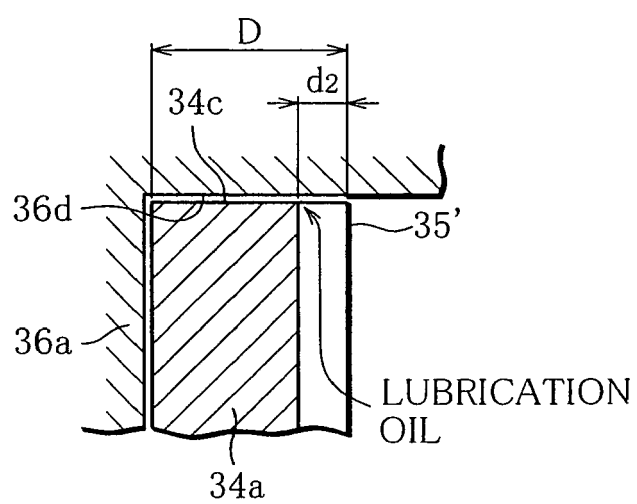


FIG. 7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 7227

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 873 711 A (LIFSON ALEXANDER [US]) 23 February 1999 (1999-02-23) * abstract; figures 6,7 *	1-4	INV. F04C18/02 F04C27/00
A,D	JP 2005 171952 A (MATSUSHITA ELECTRIC IND CO LTD) 30 June 2005 (2005-06-30) * abstract *	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
			F04C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 August 2008	Examiner Descoubes, Pierre
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 00 7227

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20-08-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5873711 A	23-02-1999	BR 9706217 A	14-09-1999
		CN 1185540 A	24-06-1998
		DE 69720368 D1	08-05-2003
		DE 69720368 T2	19-02-2004
		EG 20872 A	31-05-2000
		EP 0840012 A1	06-05-1998
		ES 2191814 T3	16-09-2003
		JP 2963886 B2	18-10-1999
		JP 10141254 A	26-05-1998
		US 5833443 A	10-11-1998

JP 2005171952 A	30-06-2005	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005171952 A [0005]