



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.05.2011 Bulletin 2011/21

(51) Int Cl.:
F04C 18/02 (2006.01)

(21) Application number: **09810073.8**

(86) International application number:
PCT/JP2009/065144

(22) Date of filing: **25.08.2009**

(87) International publication number:
WO 2010/024427 (04.03.2010 Gazette 2010/09)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

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(30) Priority: **01.09.2008 JP 2008223427**

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(54) **SCROLL FLUID MACHINE**

(57) There is provided a scroll fluid machine in which sealability is improved by uniforming a deformed shape of a fastened face of a spindle frame with respect to a fixed scroll, and compression performance is improved. The machine is **characterized by** comprising a scroll unit disposed in a container, a spindle frame that is interfitted in the container, fastened to the fixed scroll by fastening means at an outer circumferential portion, and houses the movable scroll in a space created between

the spindle frame and the fixed scroll, a refrigerant path that is formed in the outer circumferential portion to penetrate the fixed scroll and the spindle frame in an axial direction to open in a rear face of the spindle frame, and guides a high-pressure refrigerant compressed and discharged by the scroll unit to the rear face side of the spindle frame, and a countersunk section that is formed in an opening rim of the refrigerant path of the spindle frame.

FIG. 2

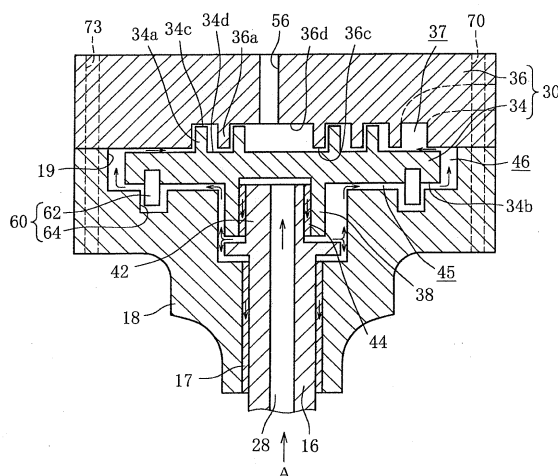
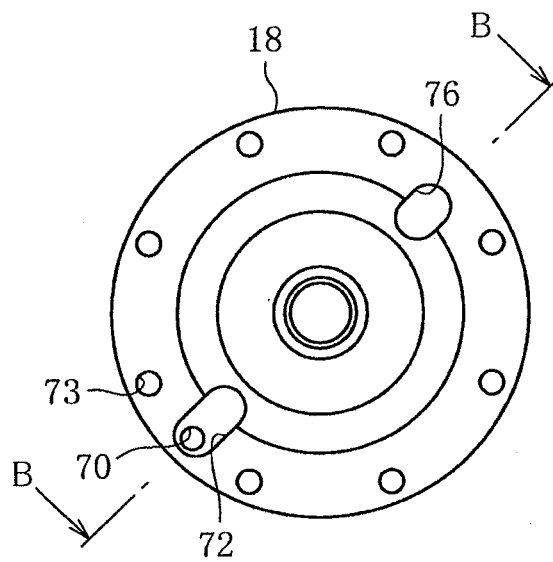


FIG. 3



Description

Technical Field

[0001] The present invention relates to a scroll fluid machine that is suitable as a compressor of a refrigeration circuit used for vehicle air conditioning.

Background Art

[0002] A scroll fluid machine of this type is equipped in its airtight container with a scroll unit that performs a series of processes including the suction, compression and discharge of a refrigerant. This unit specifically has a fixed and a movable scroll engaged with each other. The fixed scroll is fixed to the airtight container with a spindle frame intervening therebetween. The movable scroll includes a boss formed in its rear face, and a crank pin formed integrally with a rotary shaft is interlocked with the boss.

[0003] The movable scroll is thus driven by the rotary shaft via the boss. As a result, the movable scroll orbits around the axis of the fixed scroll while being supported by the spindle frame, without rotating on its axis. The volume of a space created between the spiral wraps of the scrolls is decreased, and a series of the processes including compression and discharge is carried out. The spindle frame is fixed onto the inner wall of the airtight container, for example, by welding. In general, the fixed scroll is integrally fastened to the spindle frame by bolts or the like which are arranged in the outer circumferential portion of the fixed scroll. The movable scroll is housed in a space between the spindle frame and the fixed scroll so as to be capable of making orbital motion while being supplied with lubricant (see Patent Documents 1 and 2).

Patent Document 1: Unexamined Japanese Patent Publication No. 2005-201168

Patent Document 2: Unexamined Japanese Patent Publication No. 11-82327

Disclosure of the Invention

Problem to be Solved by the Invention

[0004] When a scroll fluid machine is constructed as described above, and the fixed scroll is fastened to the spindle frame by bolts or the like, a space between the spindle frame and the fixed scroll is usually filled with lubricant. This requires good sealability (hermetic seal performance) to be ensured in a fastened face of the spindle frame with respect to the fixed scroll.

[0005] In many cases, however, the spindle frame is not completely uniform in its sectional shape around a shaft, and occasionally, the axial thickness of the spindle frame is partially uneven. When the fixed scroll and the spindle frame are fastened together by bolts or the like, the partial uneven thickness of the spindle frame makes

non-uniform a deformed shape of the fastened face over the whole circumference of the spindle frame, and also makes non-uniform the deformed shape of the fastened face in regions where the thickness of the spindle frame is uneven. This causes the problem that good sealability cannot be ensured.

[0006] In a scroll fluid machine of this type, for example, one refrigerant path or two adjacent refrigerant paths that circulate a discharged high-pressure refrigerant are formed to penetrate from the fixed scroll through the spindle frame. In some cases, countersinking is applied to an outlet region of the path in the spindle frame to ensure a smooth circulation of the refrigerant. In such a case, the countersunk region becomes uneven in axial thickness, and the deformed shape of the fastened face becomes non-uniform in the countersunk region, making it difficult to ensure good sealability.

[0007] It is not preferable that good sealability cannot be ensured in the fastened face of the spindle frame with respect to the fixed scroll because there is a possibility that the scroll unit fails to carry out a good compression performance.

[0008] The invention has been made in light of the foregoing circumstances. It is an object of the invention to provide a scroll fluid machine in which sealability is improved by uniforming the deformed shape of a fastened face of a spindle frame with respect to a fixed scroll, and compression performance is thus improved.

Means for Solving the Problem

[0009] In order to achieve the object, a scroll fluid machine claimed in claim 1 has a rotary shaft that stretches in a container and is freely supported by the container; a crank pin that is eccentrically and integrally formed in an upper end side of the rotary shaft; a scroll unit that is disposed in the container, includes a fixed scroll and a movable scroll that orbits around an axis of the fixed scroll by being connected with the crank pin and driven by the rotary shaft, engages a spiral wrap of the movable scroll with a spiral wrap of the fixed scroll by causing the movable scroll to make the orbital motion, and carries out a series of process including the compression and discharge of a working fluid while reducing the volume of a space created between the spiral wraps; a spindle frame that is interfitted in the container, fastened to the fixed scroll by fastening means at an outer circumferential portion, penetrates to support the rotary shaft at the center, and houses the movable scroll connected to the crank pin in a space created between the spindle frame and the fixed scroll so as to allow the movable scroll to make the orbital motion; a refrigerant path that is formed in the outer circumferential portion to penetrate the fixed scroll and the spindle frame in an axial direction to open in a rear face of the spindle frame, and guides a high-pressure refrigerant compressed and discharged by the scroll unit to the rear face side of the spindle frame; and a countersunk section that is formed in an opening rim of the re-

frigerant path of the spindle frame, in which a recessed section is formed in a predetermined position symmetric to the countersunk section across the axis.

[0010] In the scroll fluid machine claimed in claim 2 according to claim 1, the recessed section is formed to be on a concentric circle and point-symmetric relative to the countersunk section across the axis.

[0011] In the scroll fluid machine claimed in claim 3 according to claim 1 or 2, the refrigerant path and the countersunk section are plurally formed, and the predetermined position is plurally provided to be symmetric to the countersunk sections across the axis.

[0012] In the scroll fluid machine claimed in claim 4 according to claim 1, the refrigerant path and the countersunk section are plurally formed, and the predetermined position is located in a given area between positions symmetric to the countersunk sections across the axis.

Effective Advantages of the Invention

[0013] According to the scroll fluid machine claimed in claim 1, since the recessed section is formed in the predetermined position symmetric to the countersunk section across the axis, the deformed shape of the fastened face between the spindle frame and the fixed scroll is uniform. It is then possible to improve the sealability of the fastened face and improve the compression performance in the scroll unit.

[0014] According to the scroll fluid machine claimed in claim 2, since the recessed section is formed to be on a concentric circle and point-symmetric relative to the countersunk section across the axis, it is possible to position the recessed section without difficulty, and at the same time, improve the sealability of the fastened face between the spindle frame and the fixed scroll and improve the compression performance in the scroll unit.

[0015] According to the scroll fluid machine claimed in claim 3, the refrigerant path and the countersunk section are plurally formed, and the predetermined position of the recessed section is plurally provided to be symmetric to the countersunk sections across the axis. For this reason, if the refrigerant path and the countersunk section are plurally formed, the deformed shape of the fastened face between the spindle frame and the fixed scroll is uniform, and it is possible to improve the sealability of the fastened face and improve the compression performance in the scroll unit.

[0016] According to the scroll fluid machine claimed in claim 4, the refrigerant path and the countersunk section are plurally formed, and the predetermined position of the recessed section is located in the given area between the positions symmetric to the countersunk sections across the axis. For this reason, if the refrigerant path and the countersunk section are plurally formed, it is possible to increase the degree of freedom in disposition of the recessed section, and at the same time, improve the sealability of the fastened face and improve the compression

performance in the scroll unit.

Brief Description of the Drawings

[0017]

FIG. 1 is a longitudinal sectional view of a scroll fluid machine according to an embodiment of the invention;

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

FIG. 3 is a rear view of a spindle frame according to a first example as viewed in a direction of arrow A of FIG. 2;

FIG. 4 is a sectional view taken along line B-B of FIG. 3;

FIG. 5 is a rear view of the spindle frame according to a second example; and

FIG. 6 is a rear view of the spindle frame according to a third example.

Reference Marks

[0018]

1	scroll fluid machine
2	housing (container)
16	rotary shaft
18	spindle frame
30	scroll unit
34	movable scroll
36	fixed scroll
70	refrigerant path
72	countersunk section
74	bolt
75	nut
76, 76'	recessed section

Best Mode of Carrying out the Invention

[0019] The mode of carrying out the invention will be described below in detail with reference to the drawings.

Examples

[0020] FIG. 1 is a longitudinal sectional view of a scroll fluid machine according to the invention.

[0021] A scroll fluid machine 1 is a fluid machine of a longitudinal-mounted type which is installed in a refrigeration circuit, such as a refrigeration and air-conditioning system and a heat-pump water heater. The circuit includes a path through which a carbon dioxide refrigerant (hereinafter, referred to as a refrigerant) that is one example of a working fluid. The scroll fluid machine 1 sucks in the refrigerant from the path, and compresses and discharges the refrigerant toward the path.

[0022] As shown in FIG. 1, the scroll fluid machine 1 has a housing (container) 2. A body 4 of the housing 2

is airtightly fitted by an upper lid 6 and a lower lid 8 at upper and lower sides, respectively. The inside of the body 4 is thus sealed, and a high-pressure discharge pressure acts thereon. A suction pipe 10 that sucks in the refrigerant drawn in from the circuit is connected to the body 4. A discharge pipe 12 that delivers a compressed refrigerant in the housing 2 to the circuit is connected to a proper position of the upper lid 6.

[0023] An electric motor 14 is housed in the body 4. Disposed in the motor 14 is a rotary shaft 16, which is driven by energization of the motor 14. The rotary shaft 16 is rotatably supported at an upper end side by a spindle frame 18 with a bearing 17 intervening therebetween.

[0024] The rotary shaft 16 is rotatably supported at a lower end side by a countershaft frame 22 with a bearing 20 intervening therebetween. An oil pump 24 is mounted on the lower end side of the rotary shaft 16. The pump 24 sucks in lubricant L in a storage chamber 26 formed in an inner side of the lower lid 8, that is, at a bottom of the housing 2. The lubricant L flows through an oil supply path 28 formed through the rotary shaft 16 in an axial direction and functions to lubricate sliding areas, bearings, etc., and seal sliding surfaces.

[0025] Discharge pressure of the refrigerant acts upon an oil level of the lubricant L in the storage chamber 26. The refrigerant's discharge pressure acting upon the oil level of the lubricant L also contributes to the rise of the lubricant L in the oil supply path 28. This creates a high-pressure environment around an outlet of the oil supply path 28, under which pressure is virtually equal to the discharge pressure of the refrigerant.

[0026] An entrance 32 of the lubricant L is formed in a proper position of the countershaft frame 22. The lubricant L supplied to each sliding area of the scroll fluid machine is stored in the storage chamber 26 through the entrance 32.

[0027] The scroll unit 30 is disposed above the motor 14 within the body 4, and performs a series of processes including the suction, compression and discharge of the refrigerant.

[0028] More specifically, as shown in an enlarged scale in FIG. 2, the scroll unit 30 is formed of a movable scroll 34 and a fixed scroll 36. In the scrolls 34 and 36, spiral wraps 34a and 36a are formed integral with and perpendicular to end plate faces 34d and 36d facing each other, thereby forming a compression chamber between the spiral wraps 34a and 36a. When the movable scroll 34 revolves relative to the fixed scroll 36, the spiral wraps 34a and 36a are engaged with each other, and in consort, cause the refrigerant to be sucked from a suction chamber 37 formed on an outer circumferential side of the movable scroll 34 through the suction pipe 10 into the compression chamber. The compression chamber is reduced in volume as it moves toward the center of the spiral wraps 34a and 36a, and the compression of the refrigerant is carried out.

[0029] To be more specific, when the movable scroll 34 makes a revolving motion, the side faces of the spiral

wraps 34a and 36a are engaged together, leaving a minute gap therebetween. At the same time, top faces 34c and 36c of the spiral wraps 34a and 36a are engaged with the end plate faces 36d and 34d of the fixed and movable scrolls 36 and 34, respectively, leaving minute gaps. Simultaneously, the volume of the compression chamber is reduced, and the series of processes including the suction, compression and discharge of the refrigerant is performed.

[0030] In order to provide a revolving motion to the movable scroll 34, a boss 38 is formed in a convex shape in a rear face 34b of the movable scroll 34. The boss 38 is connected to a crank pin 42 with a bearing 44 intervening therebetween. The crank pin 42 is integrally formed in the upper end side of the rotary shaft 16, and causes the movable scroll 34 to make an orbital motion on the spindle frame 18 along with rotation of the rotary shaft 16.

[0031] The movable scroll 34 is prevented from rotating on its axis by a rotation blocking pin 62. The pin 62 is formed in a protruding manner in the rear face 34b of the movable scroll 34, and loosely fitted in a blind hole (cylindrical hole) 64 formed in the spindle frame 18. In other words, a so-called pin-hole rotation blocking mechanism 60 is provided in a gap 45 between the rear face 34b of the movable scroll 34 and the spindle frame 18. The rotation blocking mechanism 60 includes, for example, four pins 62 and their respective holes 64.

[0032] A plurality of bolt through-holes 73 are axially formed through the outer circumferential portion of the fixed scroll 36 and that of the spindle frame 18. The fixed scroll 36 is fastened to the spindle frame 18 by screwing nuts 75 onto bolts 74 penetrating the bolt through-holes 73 (fastening means). Consequently, the fixed scroll 36 separates a discharge chamber 54 formed in an inner side of the upper lid 6 and the compression chamber from each other. The spindle frame 18 has a cylindrical outer circumferential wall 19 being concentric with the rotary shaft 16 and extending towards the fixed scroll 36. The fixed scroll 36 is joined to the spindle frame 18 at an upper edge of the outer circumferential wall 19.

[0033] 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 creates between the fixed scroll 36 and the spindle frame 18 a revolving-sliding area (space) 46 in which the movable scroll 34 makes a sliding motion.

[0034] A discharge hole 56 leading to the compression chamber side is formed through the fixed scroll 36 at a proper position in a central portion of the fixed scroll 36. The discharge hole 56 is opened/closed by a discharge valve 58 placed on the rear face 36b side of the fixed scroll 36. The discharge valve 58 is covered with a discharge head 50. The discharge head 50 muffles noises produced when the discharge valve 58 is opened.

[0035] A refrigerant path 70 is axially formed in the fixed scroll 36 and the spindle frame 18 to penetrate the outer circumferential portions thereof. The refrigerant

path 70 is a path for guiding a high-pressure refrigerant, which is compressed by the scroll unit 30 and discharged from the discharge hole 56, to the rear face side of the spindle frame 18. Although details are omitted here, the refrigerant discharged from the discharge hole 56 can circulate in the housing 2 by passing through the refrigerant path 70.

[0036] FIG. 3 shows the rear face of the spindle frame 18 according to a first example as viewed from arrow A of FIG. 2, and FIG. 4 shows a cross section taken along line B-B of FIG. 3. The first example will be described below.

[0037] As shown in FIGS. 3 and 4, in an opening rim of the refrigerant path 70 of the spindle frame 18, there is formed a countersunk section 72 having an oval planar shape. The countersunk section 72 ensures a smooth circulation of the refrigerant that is guided by the refrigerant path 70.

[0038] A recessed section 76 is formed in the outer circumferential portion of the spindle frame 18 at a position (predetermined position) that is on a concentric circle and point-symmetric relative to the countersunk section 72 across the axis of the rotary shaft 16. The recessed section 76 has, for example, an oval planar shape like the shape of the countersunk section 72.

[0039] An experiment by the inventors confirmed that, if the recessed section 76 was formed at the position point-symmetric to the countersunk section 72 as described above, and the fixed scroll 36 was fastened to the spindle frame 18 by the bolts 74 and the nuts 75, a deformed shape of the fastened face between the spindle frame 18 and the fixed scroll 36 became uniform.

[0040] To put it differently, if there is not the recessed section 76, but only the countersunk section 72, the deformed shape of the fastened face over the whole circumference of the spindle frame 18 does not become uniform, and the deformed shape of the fastened face becomes non-uniform in the countersunk section 72. This causes the problem that good sealability is not ensured. The deformed shape of the fastened face can be uniformed by forming the recessed section 76 at the position point-symmetric to the countersunk section 72 across the axis.

[0041] It is then possible to improve sealability in the fastened face between the fixed scroll 36 and the spindle frame 18 and improve compression performance in the scroll unit 30.

[0042] In this case, since the recessed section 76 is located at the position point-symmetric to the countersunk section 72 across the axis, the recessed section 76 can be positioned without difficulty.

[0043] FIG. 5 shows the rear face of the spindle frame 18 according to a second example. The second example will be described below.

[0044] According to the second example, as shown in FIG. 5, the refrigerant path 70 is plurally (two here) formed. The countersunk section 72 formed in the opening rim of the refrigerant path 70 is accordingly formed

plurally (two here). The recessed sections 76 are formed at positions (predetermined positions) on a concentric circle and point-symmetric relative to the respective countersunk sections 72 across the axis.

[0045] In this manner, when the refrigerant path 70 and the countersunk section 72 are plurally formed, and the recessed sections 76 are formed at the positions point-symmetric to the respective countersunk sections 72 across the axis, the deformed shape of the fastened face between the spindle frame 18 and the fixed scroll 36 is uniform as in the first example. It is then possible to improve the sealability in the fastened face between the fixed scroll 36 and the spindle frame 18, and improve the compression performance in the scroll unit 30. -

[0046] Again, the recessed sections 76 can be positioned without difficulty since the recessed sections 76 are located at the positions point-symmetric to the respective countersunk sections 72 across the axis.

[0047] FIG. 6 shows the rear face of the spindle frame 18 according to a third example. The third example will be described below.

[0048] In the third example, as shown in FIG. 6, the refrigerant path 70 is plurally (two here) formed, and the countersunk section 72 formed in the opening rim of the refrigerant path 70 is accordingly plurally (two here) formed as in the second example. Moreover, a recessed section 76' is formed in a given area (predetermined position) between positions on a concentric circle and point-symmetric relative to the countersunk sections 72 across the axis.

[0049] If the recessed section 76' is formed in the given area between the positions point-symmetric to the respective countersunk sections 72 across the axis as mentioned above, since the recessed section 76' is in a symmetrical position relative to the countersunk section 72 across the axis, it is possible to uniform the deformed shape of the fastened face between the spindle frame 18 and the fixed scroll 36 as in the second example. This also improves the sealability in the fastened face between the fixed scroll 36 and the spindle frame 18, and improves the compression performance in the scroll unit 30.

[0050] The third example has the advantage of providing a high degree of freedom in disposition of the recessed section 76. One embodiment of the invention has been described, but the invention is not limited to the embodiment. The invention may be modified in various ways without deviating from the gist thereof.

[0051] For example, although the embodiment sets the shape of the recessed section 76 to an oval in a planar view in the first and second examples, the planar shape of the recessed section 76 is not limited to an oval. Likewise, the planar shape of the recessed section 76' in the third example is not limited to the shape shown in FIG. 6.

[0052] The embodiment does not particularly mention the depth of the recessed sections 76 and 76', but the depth may also be properly determined.

[0053] In the first and second examples, the embodi-

ment forms the recessed section 76 at the position point-symmetric to the countersunk section 72 across the axis. The predetermined position for forming the recessed section 76, however, does not have to be exactly point-symmetric as long as it is symmetric to the countersunk section 72 across the axis. Likewise, in the third example, the recessed section 76' is formed between the positions point-symmetric to the respective countersunk sections 72 across the axis, but the predetermined position for forming the recessed section 76' may be between positions symmetric to the respective countersunk sections 72.

Industrial Applicability

[0054] As the invention improves compression performance in a scroll unit, it is widely applicable as a compressor for air-conditioning, freezing, refrigeration, hot-water supply, etc.

Claims

1. A scroll fluid machine comprising:

a rotary shaft that stretches in a container and is freely supported by the container;
 a crank pin that is eccentrically and integrally formed in an upper end side of the rotary shaft;
 a scroll unit that is disposed in the container, includes a fixed scroll and a movable scroll that orbits around an axis of the fixed scroll by being connected with the crank pin and driven by the rotary shaft, engages a spiral wrap of the movable scroll with a spiral wrap of the fixed scroll by causing the movable scroll to make the orbital motion, and carries out a series of process including the compression and discharge of a working fluid while reducing the volume of a space created between the spiral wraps;
 a spindle frame that is interfitted in the container, fastened to the fixed scroll by fastening means at an outer circumferential portion, penetrates to support the rotary shaft at the center, and houses the movable scroll connected to the crank pin in a space created between the spindle frame and the fixed scroll so as to allow the movable scroll to make the orbital motion;
 a refrigerant path that is formed in the outer circumferential portion to penetrate the fixed scroll and the spindle frame in an axial direction to open in a rear face of the spindle frame, and guides a high-pressure refrigerant compressed and discharged by the scroll unit to the rear face side of the spindle frame; and
 a countersunk section that is formed in an opening rim of the refrigerant path of the spindle frame, the scroll fluid machine **characterized**

in that:

a recessed section is formed in a predetermined position symmetric to the countersunk section across the axis.

2. The scroll fluid machine according to claim 1, **characterized in that** the recessed section is formed to be on a concentric circle and point-symmetric relative to the countersunk section across the axis.

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

the refrigerant path and the countersunk section are plurally formed, and
 the predetermined position is plurally provided to be symmetric to the countersunk sections across the axis.

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

the refrigerant path and the countersunk section are plurally formed, and
 the predetermined position is located in a given area between positions symmetric to the countersunk sections across the axis.

FIG. 1

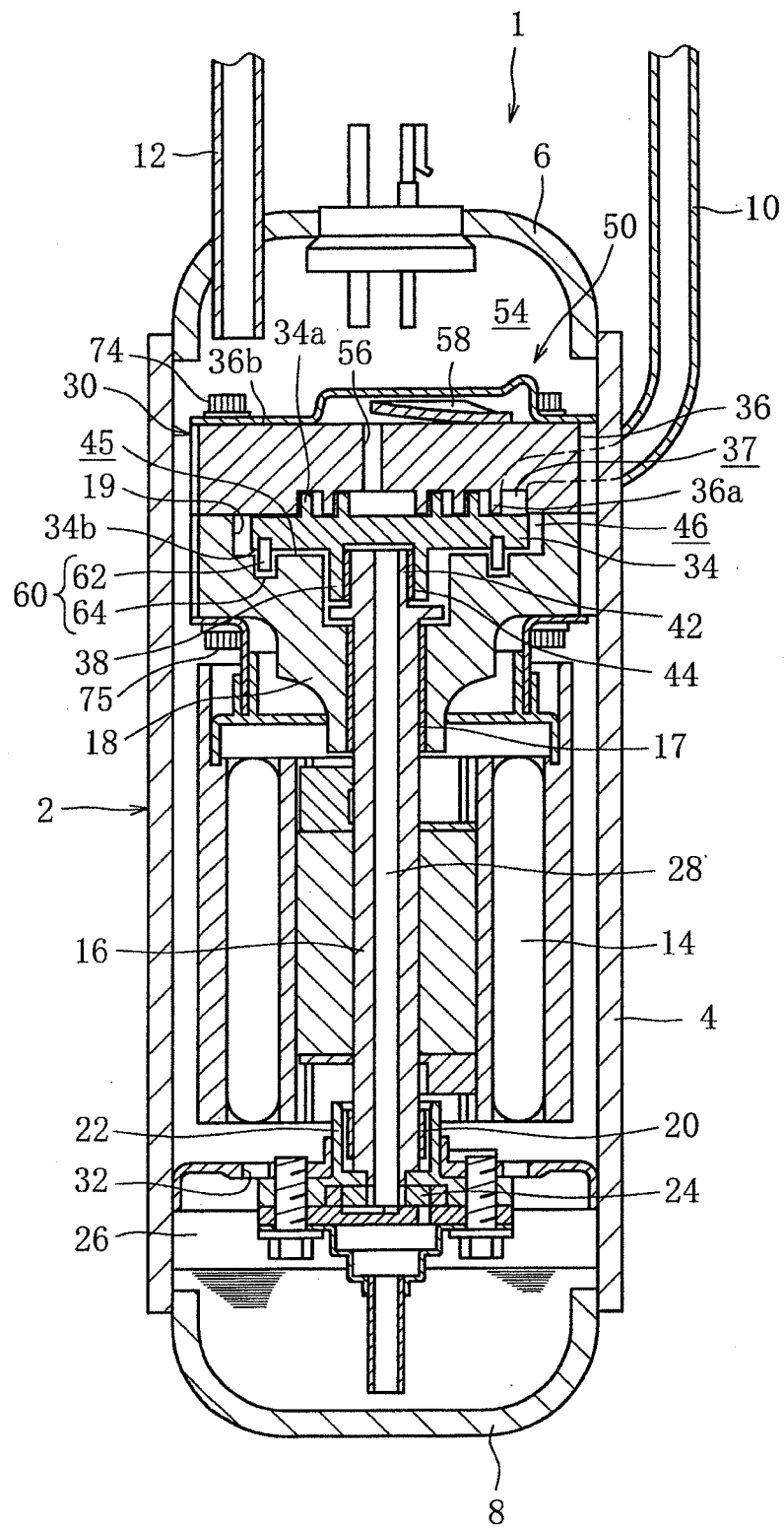


FIG. 2

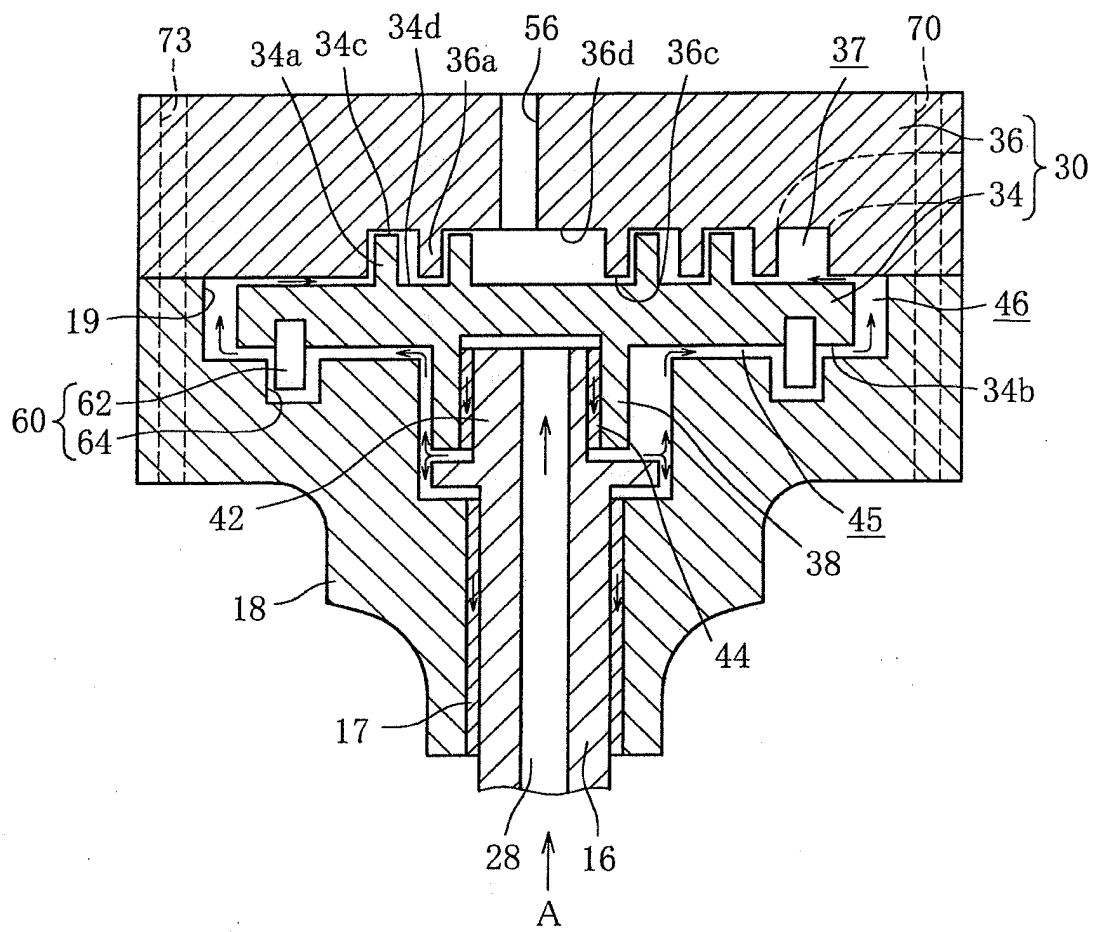


FIG. 3

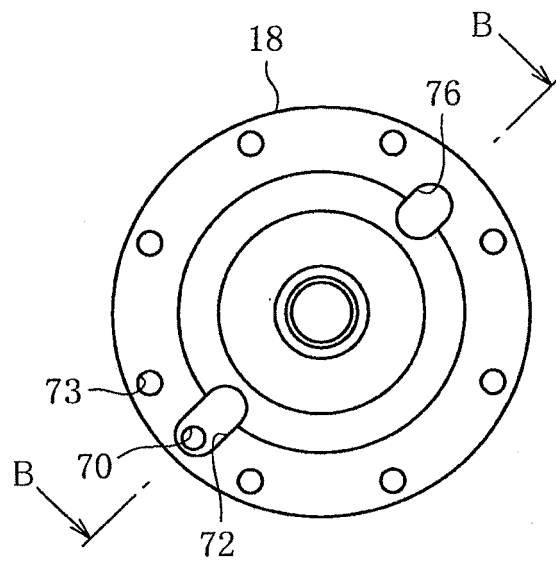


FIG. 4

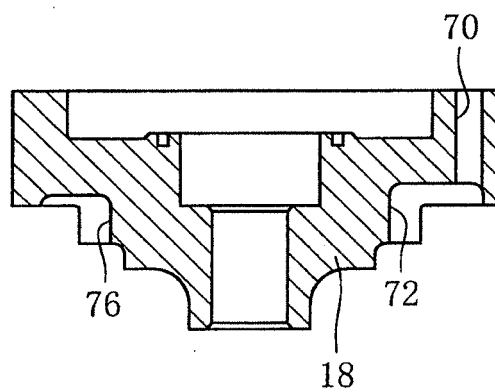


FIG. 5

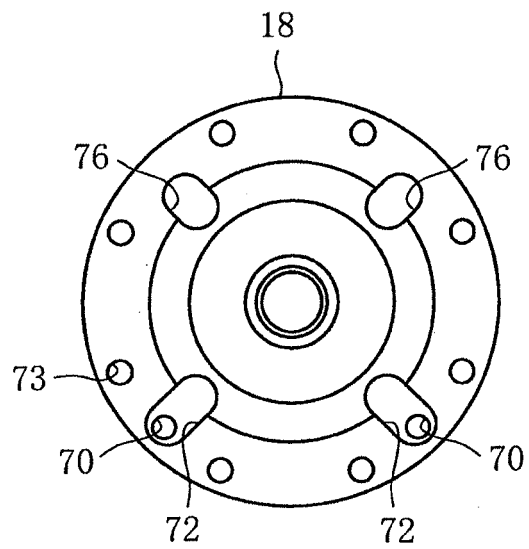
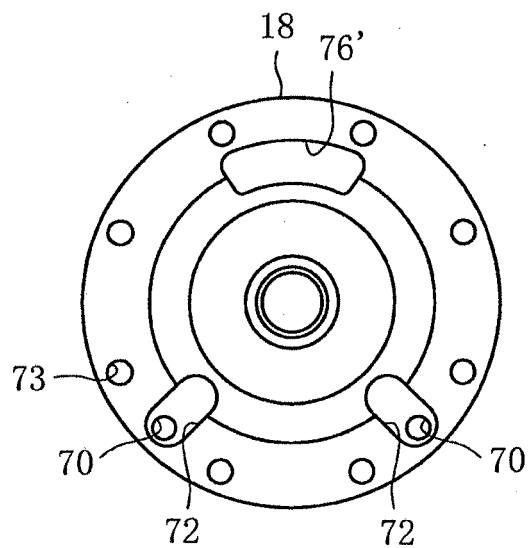


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/065144

A. CLASSIFICATION OF SUBJECT MATTER F04C18/02 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) F04C18/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009 Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008-128021 A (Hitachi Appliances, Inc.), 05 June 2008 (05.06.2008), fig. 1 to 6 (Family: none)	1-4
A	JP 7-151078 A (Zexel Corp.), 13 June 1995 (13.06.1995), fig. 2 (Family: none)	1-4
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Date of the actual completion of the international search 20 October, 2009 (20.10.09)		Date of mailing of the international search report 02 November, 2009 (02.11.09)
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005201168 A [0003]
- JP 11082327 A [0003]