



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

(43) Date of publication:
23.12.2020 Bulletin 2020/52

(51) Int Cl.:
F25B 43/00 ^(2006.01) **F04B 39/00** ^(2006.01)
F04B 39/12 ^(2006.01) **F04B 39/16** ^(2006.01)
F04C 29/12 ^(2006.01)

(21) Application number: **18906496.7**

(22) Date of filing: **03.12.2018**

(86) International application number:
PCT/JP2018/044426

(87) International publication number:
WO 2019/159497 (22.08.2019 Gazette 2019/34)

(84) Designated Contracting States:
AL 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 RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **YAKUSHIJI, Shunsuke**
Tokyo 108-8215 (JP)
• **TERASAKI, Shohei**
Tokyo 108-8215 (JP)
• **OGAWA, Makoto**
Tokyo 108-8215 (JP)
• **SHIMAYA, Hirofumi**
Tokyo 108-8215 (JP)
• **UNO, Masanari**
Tokyo 108-8215 (JP)

(30) Priority: **13.02.2018 JP 2018023105**

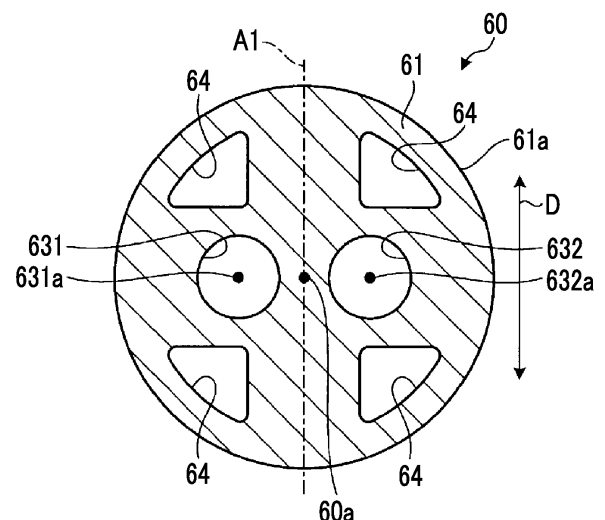
(74) Representative: **Studio Torta S.p.A.**
Via Viotti, 9
10121 Torino (IT)

(71) Applicant: **MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD.**
108-8215 Tokyo (JP)

(54) **ACCUMULATOR, AND COMPRESSOR FOR AIR CONDITIONING**

(57) This compressor for air conditioning is provided with an accumulator which is provided adjacent to a container body, and which supplies a refrigerant gas that has been subjected to gas-liquid separation, from a container body to the compressor body by means of a first pipe and a second pipe. The accumulator is provided with a support member 60, an outer edge 61a of which is attached to an inner wall of the container body, the support member 60 having a first support hole 631 that supports the first pipe and a second support hole 632 that supports the second pipe inside the container body. The center 631a of the first support hole 631 and the center 632a of the second support hole 632 are positioned away from a center line A1 that passes through the center 60a of the support member 60 along the direction D of the most dominant exciting force transmitted from the compressor body 4.

FIG. 2



Description

Technical Field

5 **[0001]** The present invention relates to an accumulator and a compressor for air conditioning.

Background Art

10 **[0002]** In the related art, there is a known technique related to an accumulator for separating a refrigerant gas from lubricant, a foreign substance, or the like through gas-liquid separation and supplying the refrigerant gas to a compressor body in a compressor for air conditioning. For example, PTL 1 discloses a structure in which a pipe for supplying a refrigerant gas from an accumulator to a compressor body is supported by a support member (connecting member) provided in the accumulator.

15 Citation List

Patent Literature

20 **[0003]** [PTL 1] Japanese Unexamined Patent Application Publication No. 2011-169183

Summary of Invention

Technical Problem

25 **[0004]** In a case where the accumulator as described in PTL 1 is provided adjacent to the compressor body, an exciting force caused by magnetism of a motor driving the compressor body or an exciting force caused by pulsation of the compressor body acts thereon. Particularly, the exciting force caused by pulsation of the compressor body may cause vibration of a pipe in the accumulator and the vibration may be transmitted to the accumulator via the support member, which may cause noise.

30 **[0005]** The present invention has been made in view of such circumstances and an object thereof is to suppress vibration generated in an accumulator provided adjacent to a compressor body of a compressor for air conditioning and to reduce noise generated in the compressor for air conditioning.

Solution to Problem

35 **[0006]** In order to solve the above-described problems and achieve the object, according to the present invention, there is provided an accumulator which is provided adjacent to a compressor body of a compressor for air conditioning and which supplies a refrigerant gas subjected to gas-liquid separation from a container body to the compressor body via a pipe. The accumulator includes a support member of which an outer edge is attached to an inner wall of the container body, the support member including a support hole that supports the pipe inside the container body and a center of the support hole is positioned away from a center line that passes through a center of the support member along a direction of a most dominant exciting force transmitted from the compressor body.

40 **[0007]** According to the configuration, a portion of the most dominant exciting force transmitted from the pipe to the support member is dispersed in a direction in which the support member is twisted. As a result, an exciting force that is transmitted to the container body of the accumulator from the pipe via the support member can be reduced. Therefore, according to the accumulator in the present invention, vibration generated at the accumulator provided adjacent to the compressor body of the compressor for air conditioning can be suppressed and noise generated at the compressor for air conditioning can be reduced.

45 **[0008]** In addition, it is preferable that the support member includes a plurality of through-holes provided at positions different from the support hole, a rib portion extending from the outer edge extends between the through-holes of the support member that are adjacent to each other, and the center of the support hole is positioned away from a center line along an extending direction in which the rib portion extends toward the center of the support member from the outer edge.

50 **[0009]** According to the configuration, regardless of the direction of the exciting force transmitted from the compressor body, a portion of an exciting force transmitted from the pipe to the rib portion is dispersed in a direction in which the rib portion is twisted. As a result, an exciting force that is transmitted from the pipe to the container body of the accumulator via the rib portion of the support member can be reduced and vibration generated at the accumulator can be suppressed.

55 **[0010]** In addition, it is preferable that a plurality of the pipes are disposed in the container body to correspond to the

number of compression chambers of the compressor body, a plurality of the support holes are provided to correspond to the disposed plurality of pipes, and all of centers of the support holes are positioned away from the center line.

[0011] According to the configuration, even in a case where there are a plurality of the pipes, an exciting force that is transmitted from each of the pipes to the container body of the accumulator via the support member can be reduced and vibration generated at the accumulator can be suppressed.

[0012] In order to solve the above-described problems and achieve the object, according to the present invention, there is provided a compressor for air conditioning including the accumulator described above and the compressor body to which the refrigerant gas is supplied from the accumulator via the pipe.

[0013] According to the configuration, it is possible to suppress vibration generated in the accumulator provided adjacent to the compressor body of the compressor for air conditioning and to reduce noise generated in the compressor for air conditioning.

Brief Description of Drawings

[0014]

Fig. 1 is a schematic view showing an accumulator and a compressor for air conditioning according to an embodiment.

Fig. 2 is a cross-sectional view showing a support member.

Fig. 3 is a cross-sectional view showing a modification example of the support member.

Description of Embodiments

[0015] Hereinafter, an embodiment of an accumulator and a compressor for air conditioning according to the present invention will be described in detail based on the drawings. Note that, the present invention is not limited by the embodiment.

[0016] The compressor for air conditioning 1 according to the embodiment is applied to, for example, an air conditioner for a room. Although not explicitly shown in the drawings, the air conditioner is configured to include an outdoor unit disposed outdoors and an indoor unit disposed indoors. The air conditioner circulates a refrigerant between the outdoor unit and the indoor unit and performs heat exchange outdoors and indoors to perform cooling, heating, or cooling and heating indoors. In the air conditioner, the compressor for air conditioning 1 is disposed in the outdoor unit, sucks and compresses a refrigerant, and supplies the refrigerant to the outdoor unit or an external element of the indoor unit. Note that, the compressor for air conditioning 1 is not limited to an air conditioner for a room and may be applied to an air conditioner having any use.

[0017] As shown in Fig. 1, the compressor for air conditioning 1 is configured to include a housing 2, a drive unit 3, a compressor body 4, and an accumulator 5.

[0018] The housing 2 has a substantially cylindrical shape of which a top and a bottom are sealed and the drive unit 3 and the compressor body 4 are accommodated therein. The housing 2 is disposed with a cylinder thereof standing upright and a discharge pipe 21 is provided at a top thereof. In addition, a bottom portion of the housing 2 is configured as an oil reservoir 22 and lubricant L to be supplied to the compressor body 4 is stored in the oil reservoir 22.

[0019] The drive unit 3 is a slot motor and includes a stator 31, a rotor 32, and a shaft 33. The drive unit 3 is fixed to an inner wall surface of the housing 2 at the stator 31. The rotor 32 is provided to be rotatable with respect to the stator 31 and the shaft 33 is provided to face a vertically lower side. A lower end portion of the shaft 33 is connected to the compressor body 4. Power is supplied to the drive unit 3 from the outside of the housing 2 via a wire (not shown).

[0020] The compressor body 4 is disposed below the drive unit 3 inside the housing 2. In the present embodiment, the compressor body 4 is a two-cylinder twin rotary type compression mechanism. In the compressor body 4, a first compression section 41 and a second compression section 42 are configured in multiple stages arranged vertically. The first compression section 41 and the second compression section 42 are arranged along the axis of rotation of the shaft 33. The first compression section 41 includes a rotor 411 and a compression chamber 412. The second compression section 42 includes a rotor 421 and a compression chamber 422. A partition plate 43 is provided between the first compression section 41 and the second compression section 42. The partition plate 43 constitutes a portion of the walls of the compression chambers 412 and 422. An insertion hole 431 into which the shaft 33 is inserted is formed in the partition plate 43. Bearings 44 are provided above and below the first compression section 41 and the second compression section 42. The bearings 44 rotatably support the shaft 33. Regarding the shaft 33, a crank 331 is provided at a position corresponding to the first compression section 41 and a crank 332 is provided at a position corresponding to the second compression section 42. The crank 331 is provided with the rotor 411 and the crank 332 is provided with the rotor 421.

[0021] In addition, inside the lower end portion of the shaft 33, an oil supply passage 333 is provided. A lower end of the shaft 33 is provided to reach the oil reservoir 22 of the housing 2 and from the lower end, the lubricant L is supplied to the compressor body 4 via the oil supply passage 333. Note that, the oil supply passage 333 includes an oil supply

passage 333a penetrating the crank 331 corresponding to the first compression section 41 and an oil supply passage 333b penetrating the crank 332 corresponding to the second compression section 42.

[0022] The accumulator 5 is a separator performing gas-liquid separation of a refrigerant gas as a working fluid. The accumulator 5 is disposed outside the housing 2 while being disposed adjacent to the compressor body 4 (adjacent to housing 2). The accumulator 5 includes a container body 50, a plurality of pipes 51, and a support member 60.

[0023] The container body 50 has a substantially cylindrical shape of which a top and a bottom are sealed. The container body 50 is connected to the housing 2 via a connecting member (not shown). A top of the container body 50 is provided with an inflow pipe 501. The pipes 51 include a first pipe 511 and a second pipe 512. The first pipe 511 and the second pipe 512 extend toward the top portion from a bottom portion of the container body 50, inside the container body 50. One end of the first pipe 511 is connected to the compression chamber 412 of the first compression section 41 and the other end thereof is open inside the container body 50. In addition, the first pipe 511 is supported by the support member 60 which will be described later. The second pipe 512 is a pipe for supplying a fluid to the second compression section 42 of the compressor body 4. One end of the second pipe 512 is connected to the compression chamber 422 of the second compression section 42 and the other end thereof is open inside the container body 50. In addition, the second pipe 512 is supported by the support member 60 which will be described later.

[0024] In the case of the compressor for air conditioning 1 configured as described above, a refrigerant gas that has passed through an external element (for example, evaporator (not shown)) is supplied into the container body 50 of the accumulator 5 via the inflow pipe 501. Furthermore, the refrigerant gas is supplied to the first compression section 41 of the compressor body 4 via the first pipe 511 and is supplied to the second compression section 42 of the compressor body 4 via the second pipe 512. In the compressor body 4, when power is supplied to the drive unit 3 and the shaft 33 is rotated, the rotors 411 and 421 eccentrically rotate inside the compression chambers 412 and 422 due to the cranks 331 and 332 and the refrigerant gas in the compression chambers 412 and 422 is compressed. The refrigerant gas compressed in the compression chambers 412 and 422 is discharged to the outside of the housing 2 from the discharge pipe 21 and is supplied to the external element.

[0025] In addition, as described above, into each of the compression chambers 412 and 422, the lubricant L is supplied. A portion of the lubricant L supplied to the compression chambers 412 and 422 is supplied to the external element in a state of being contained in the compressed refrigerant gas. In the accumulator 5, the lubricant L or dust is separated from the refrigerant gas that has passed through the external element through gas-liquid separation by means of a net-shaped filter 53 provided at an upper portion of the container body 50. Regarding the accumulator 5, the refrigerant gas subjected to the gas-liquid separation is supplied to the compression chambers 412 and 422 and the lubricant L subjected to the gas-liquid separation is accumulated on the bottom portion of the container body 50. Note that, the accumulator 5 is configured such that an oil return hole 511a is formed in the first pipe 511, an oil return hole 512a is formed in the second pipe 512, and the lubricant L accumulated on the bottom portion of the container body 50 is returned to the compression chambers 412 and 422.

[0026] Next, the support member 60 included in the accumulator 5 according to the present embodiment will be described in detail with reference to Figs. 1 and 2. Fig. 2 is a cross-sectional view showing the support member. As shown in Fig. 1, the support member 60 includes a bottom portion 61, a wall portion 62, support holes 63, and through-holes 64 (see Fig. 2). The bottom portion 61 is formed in a circular shape as shown in Fig. 2. The wall portion 62 extends vertically upward from an outer edge 61a of the bottom portion 61. That is, the support member 60 is formed in a bowl-like shape by the bottom portion 61 and the wall portion 62. The wall portion 62 and the outer edge 61a of the support member 60 are fixed to an inner wall of the container body 50 through, for example, welding. Note that, although the position of the support member 60 in a height direction in the container body 50 may be any position as long as the first pipe 511 and the second pipe 512 can be appropriately supported, in a case where the container body 50 is divided into a plurality of parts at any position in the vertical direction, it is preferable that the support member 60 is provided at a joint therebetween.

[0027] The support holes 63 are through-holes formed in the bottom portion 61 as shown in Figs. 1 and 2. The support holes 63 include a first support hole 631 and a second support hole 632. The first support hole 631 and the second support hole 632 are formed in the bottom portion 61 at an interval. The first support hole 631 is formed such that the inner diameter thereof becomes slightly larger than the outer diameter of the first pipe 511. As shown in Fig. 1, the first pipe 511 is inserted into the first support hole 631 such that the first pipe 511 is supported in the container body 50. The second support hole 632 is formed such that the inner diameter thereof becomes slightly larger than the outer diameter of the second pipe 512. As shown in Fig. 1, the second pipe 512 is inserted into the second support hole 632 such that the second pipe 512 is supported in the container body 50. As described above, the first pipe 511 and the second pipe 512 are supported by the support member 60 and thus the first pipe 511 and the second pipe 512 are restrained from vibrating inside the container body 50 and coming into contact with each other while generating noise.

[0028] As shown in Fig. 2, a plurality of through-holes 64 are formed at different positions from the first support hole 631 and the second support hole 632 of the bottom portion 61. The plurality of through-holes 64 are hole portions provided such that the refrigerant gas, the lubricant L, or the like in the container body 50 flow therethrough and prevent the

volume of the accumulator 5 from being reduced because of the support member 60. In the present embodiment, the plurality of through-holes 64 are disposed at positions symmetrical with respect to a center (center of bottom portion 61) 60a of the support member 60.

[0029] Here, in a case where the accumulator 5 is provided adjacent to the compressor body 4 (adjacent to housing 2) as with the compressor for air conditioning 1 according to the present embodiment, an exciting force caused by magnetism of the drive unit 3 driving the compressor body 4 or an exciting force caused by pulsation of the compressor body 4 acts on the accumulator 5 via the connecting member (not shown) that connects the first pipe 511, the second pipe 512, the housing 2, and the container body 50 to each other. Particularly, the exciting force caused by pulsation of the compressor body 4 may cause vibration of a pipe in the accumulator 5 and the vibration may be transmitted to the accumulator 5 via the support member 60, which may cause noise.

[0030] Therefore, in the present embodiment, a center 631a of the first support hole 631 and a center 632a of the second support hole 632 formed in the support member 60 are positioned away from a center line A1 passing through the center 60a of the support member 60 as shown in Fig. 2. The center line A1 is a straight line passing through the center 60a along a direction D of the most dominant exciting force from among exciting forces that are transmitted to the first pipe 511 and the second pipe 512 due to pulsation caused by the operation of the compressor body 4, the direction D being shown by a solid arrow in Fig. 2. "Being positioned away from the center line A1" means that the center 631a of the first support hole 631 and the center 632a of the second support hole 632 are disposed at positions (positions separated from center line A1) that do not coincide with the center line A1. Accordingly, when the most dominant exciting force caused by pulsation of the compressor body 4 acts on the first pipe 511 and the second pipe 512 along the direction D, a portion of the most dominant exciting force transmitted from the first pipe 511 and the second pipe 512 to the support member 60 is dispersed in a direction in which the support member 60 is twisted with respect to the center 60a. As a result, an exciting force that is transmitted to the container body 50 of the accumulator 5 from the first pipe 511 and the second pipe 512 via the outer edge 61a of the support member 60 is reduced and vibration of the container body 50 is suppressed. Therefore, generation of noise in the compressor for air conditioning 1 is suppressed.

[0031] As described above, according to the accumulator 5 and the compressor for air conditioning 1 in the present embodiment, it is possible to suppress vibration generated in the accumulator 5 provided adjacent to the compressor body 4 of the compressor for air conditioning 1 and to reduce noise generated in the compressor for air conditioning 1.

[0032] In addition, the plurality of pipes 51 (first pipe 511 and second pipe 512) are disposed in the container body 50 to correspond to the number of compression chambers 412 and 422 of the compressor body 4, the plurality of support holes 63 (first support hole 631 and second support hole 632) are provided to correspond to the pipes 51, and all of the centers of the support holes 63 (center 631a of first support hole 631 and center 632a of second support hole 632) are positioned away from the center line A1.

[0033] According to the configuration, even in a case where there are a plurality of the pipes 51, an exciting force that is transmitted from each of the pipes 51 (first pipe 511 and second pipe 512) to the container body 50 of the accumulator 5 via the support member 60 can be reduced and vibration generated at the accumulator 5 can be suppressed.

[0034] Fig. 3 is a cross-sectional view showing a modification example of the support member. A support member 600 shown in Fig. 3 includes a plurality of through-holes 640 instead of the plurality of through-holes 64 of the support member 60 shown in Fig. 2. Since other constituent elements of the support member 600 are the same as those of the support member 60, the constituent elements are denoted by the same reference numerals and description thereof will be omitted.

[0035] The plurality of through-holes 640 include a pair of large-diameter holes 641 and 642 and a pair of small-diameter holes 643 and 644, in the present embodiment. The pair of large-diameter holes 641 and 642 are disposed with the center 60a interposed therebetween in the vertical direction in the drawing. The pair of small-diameter holes 643 and 644 are disposed with the center 60a interposed therebetween in the lateral direction in the drawing. Note that, the shapes and the positions of the through-holes 64 and 640 shown in Figs. 2 and 3 are merely examples and if the first support hole 631 and the second support hole 632 are formed at different positions, various shapes and positions corresponding to a performance required for the accumulator 5 can be adopted.

[0036] Accordingly, a rib portion 65 extends from the outer edge 61a between the through-holes 640 of the support member 600 that are adjacent to each other. The rib portions 65 include rib portions 651, 652, 653, and 654 as shown in the drawing. The rib portion 651 is a portion that extends between the large-diameter hole 641 and the small-diameter hole 643. The rib portion 652 is a portion that extends between the large-diameter hole 641 and the small-diameter hole 644. The rib portion 653 is a portion that extends between the large-diameter hole 642 and the small-diameter hole 643. The rib portion 654 is a portion that extends between the large-diameter hole 642 and the small-diameter hole 644.

[0037] Here, two-dot chain lines in Fig. 3 show a center line B1 along an extending direction of the rib portion 651, a center line B2 along an extending direction of the rib portion 652, a center line B3 along an extending direction of the rib portion 653, and a center line B4 along an extending direction of the rib portion 654, respectively. The "extending directions" are directions in which the rib portions 651, 652, 653, and 654 extend toward the center 60a of the support member 600 from the outer edge 61a. In the support member 600, the center 631a of the first support hole 631 and the

center 632a of the second support hole 632 are positioned away from the center lines B1, B2, B3, and B4 as shown in the drawing. "Being positioned away from the center lines B1, B2, B3, and B4" means that the center 631a of the first support hole 631 and the center 632a of the second support hole 632 are disposed at positions (positions separated from center lines B1, B2, B3, and B4) that do not coincide with the center lines B1, B2, B3, and B4.

[0038] According to the configuration, regardless of the direction of an exciting force transmitted from the compressor body 4, a portion of an exciting force transmitted from the first pipe 511 and the second pipe 512 to the rib portions 651, 652, 653, and 654 is dispersed in directions in which the rib portions 651, 652, 653, and 654 are twisted. As a result, an exciting force that is transmitted from the first pipe 511 and the second pipe 512 to the container body 50 of the accumulator 5 via the rib portions 651, 652, 653, and 654 of the support member 600 can be reduced and vibration generated at the accumulator 5 can be suppressed.

[0039] Note that, the shapes of the support members 60 and 600 are not limited to those in the present embodiment. For example, the support members 60 and 600 may include no wall portion 62 as long as the support members 60 and 600 can be stably fixed to the container body 50. In addition, a configuration in which the support members 60 and 600 are provided with cylindrical portions that protrude in at least any one of vertical directions from edge portions of the first support hole 631 and the second support hole 632 and the cylindrical portions widely support outer peripheries of the first pipe 511 and the second pipe 512 may also be adopted. In addition, in a case where the container body 50 does not have a substantially cylindrical shape, the bottom portions 61 of the support members 60 and 600 may be formed in a shape other than a circular shape to correspond to the shape of an inner surface of the container body 50.

[0040] In the present embodiment, a configuration of the accumulator 5 according to the embodiment has been described with the twin rotary type compressor for air conditioning 1 as a target. However, the accumulator 5 according to the embodiment may be applied to any compressor for air conditioning such as a single rotary type compressor for air conditioning or a scroll type compressor for air conditioning.

[0041] For example, in the case of a configuration in which the compressor body 4 includes only one compression chamber and there is only one pipe 51 connecting the accumulator 5 and the compression chamber to each other, the support member 60 may include one support hole 63 for supporting the one pipe 51. In this case as well, the center of the support hole 63 may be positioned away from at least the center line A1 shown in Fig. 2 and more preferably positioned away from the center lines B1, B2, B3, and B4 shown in Fig. 3.

[0042] In addition, for example, in the case of a configuration in which the compressor body 4 includes three or more compression chambers and there is three or more pipes 51 connecting the accumulator 5 and the compression chambers to each other, the support member 60 may include three or more support holes 63 to correspond to the number of the plurality of pipes 51. In this case as well, the centers of the three or more support holes 63 may be positioned away from at least the center line A1 shown in Fig. 2 and more preferably positioned away from the center lines B1, B2, B3, and B4 shown in Fig. 3.

Reference Signs List

[0043]

1	compressor for air conditioning
2	housing
21	discharge pipe
22	oil reservoir
3	drive unit
31	stator
32	rotor
33	shaft
331, 332	crank
333, 333a, 333B	oil supply passage
4	compressor body
41	first compression section
411, 421	rotor
412, 422	compression chamber
42	second compression section
43	partition plate
44	bearing
431	insertion hole
5	accumulator
50	container body

	501	inflow pipe
	51	pipe
	511a, 512a	oil return hole
	511	first pipe
5	512	second pipe
	53	filter
	60, 600	support member
	60a, 631a, 632a	center
	61a	outer edge
10	61	bottom portion
	62	wall portion
	63	support hole
	64, 640	through-hole
	65	rib portion
15	631	first support hole
	632	second support hole
	641, 642	large-diameter hole
	643, 644	small-diameter hole
	651, 652, 653, 654	rib portion
20	A1, B1, B2, B3, B4	center line
	L	lubricant

Claims

- 25
1. An accumulator which is provided adjacent to a compressor body of a compressor for air conditioning and which supplies a refrigerant gas subjected to gas-liquid separation from a container body to the compressor body via a pipe, the accumulator comprising:

30 a support member of which an outer edge is attached to an inner wall of the container body, the support member including a support hole that supports the pipe inside the container body, wherein a center of the support hole is positioned away from a center line that passes through a center of the support member along a direction of a most dominant exciting force transmitted from the compressor body.
 2. The accumulator according to Claim 1,

35 wherein the support member includes a plurality of through-holes provided at positions different from the support hole, wherein a rib portion extending from the outer edge extends between the through-holes of the support member that are adjacent to each other, and wherein the center of the support hole is positioned away from a center line along an extending direction in which

40 the rib portion extends toward the center of the support member from the outer edge.
 3. The accumulator according to any one of Claims 1 to Claim 2,

45 wherein a plurality of the pipes are disposed in the container body to correspond to the number of compression chambers of the compressor body, wherein a plurality of the support holes are provided to correspond to the disposed plurality of pipes, and wherein all of centers of the support holes are positioned away from the center line.
 4. An compressor for air conditioning comprising:

50 the accumulator according to any one of Claims 1 to 3; and the compressor body to which the refrigerant gas is supplied from the accumulator via the pipe.

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FIG. 1

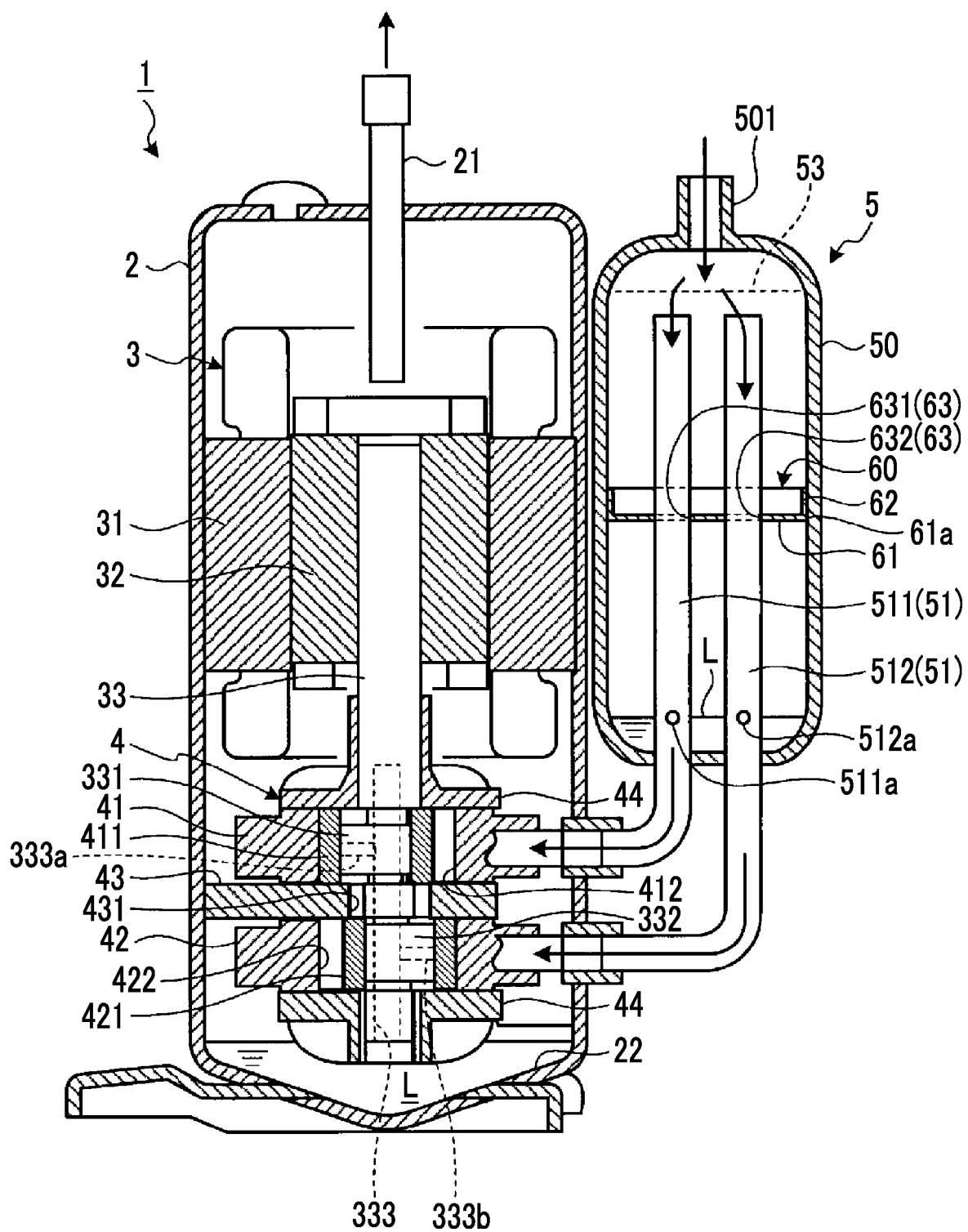


FIG. 2

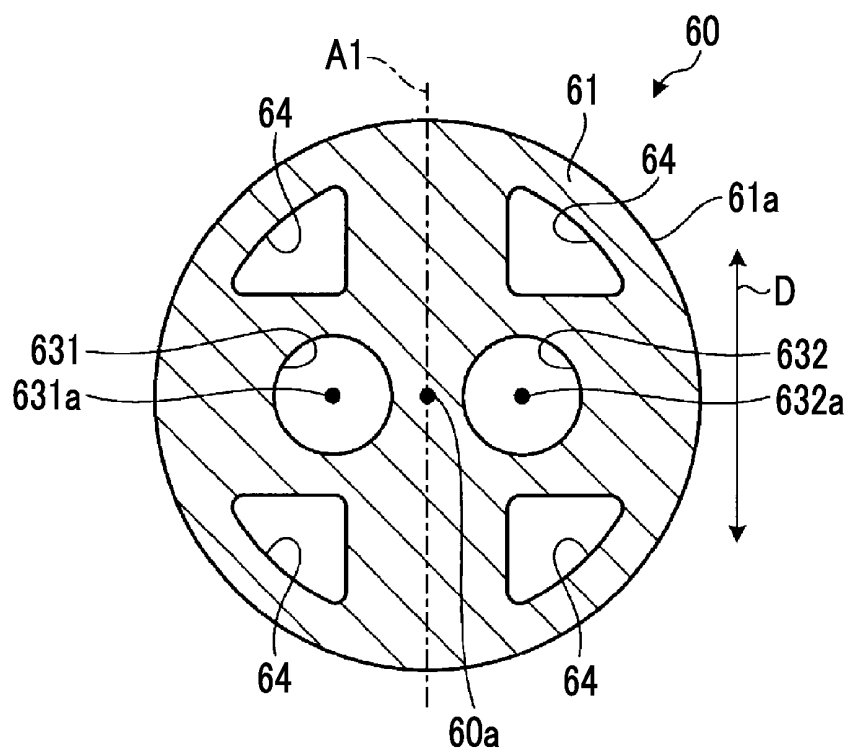
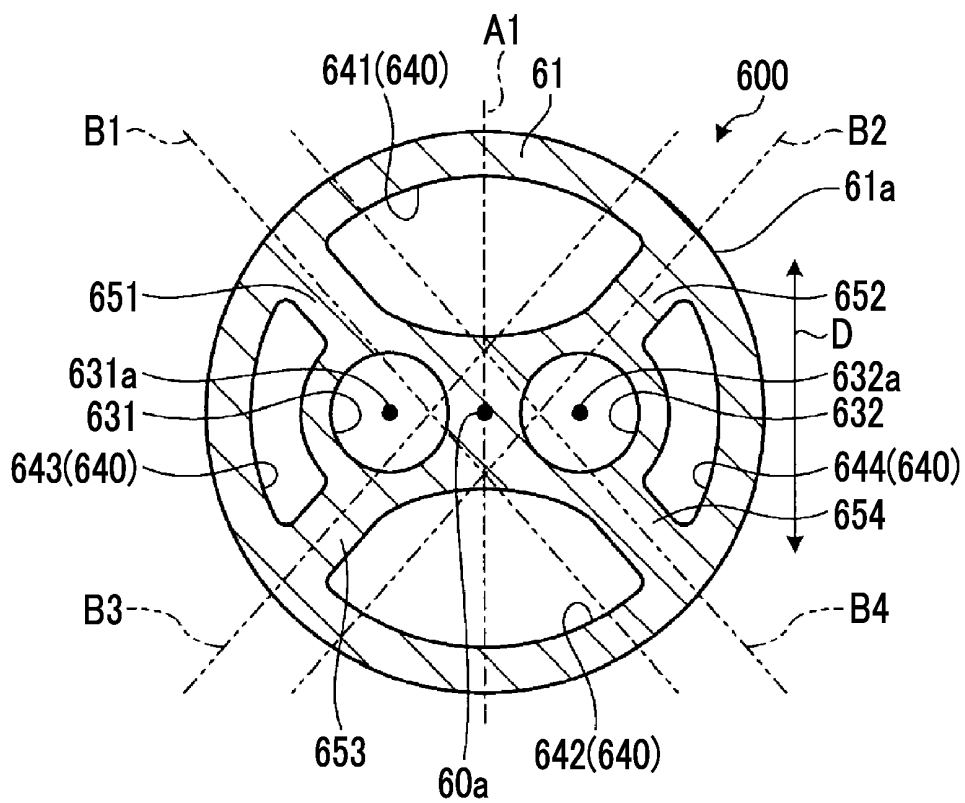


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/044426

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F25B43/00 (2006.01) i, F04B39/00 (2006.01) i, F04B39/12 (2006.01) i,
F04B39/16 (2006.01) i, F04C29/12 (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)

Int.Cl. F25B43/00, F04B39/00, F04B39/12, F04B39/16, F04C29/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2019

Registered utility model specifications of Japan 1996-2019

Published registered utility model applications of Japan 1994-2019

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.
X	JP 2016-44965 A (DAIKIN INDUSTRIES, LTD.) 04 April 2016, paragraph [0069], fig. 17, 21 & US 2017/0234588 A1, fig. 17, 21, paragraph [0115] & WO 2016/027700 A1 & EP 3184940 A1 & CN 106662383 A	1-4
Y A	JP 8-128746 A (SANYO ELECTRIC CO., LTD.) 21 May 1996, fig. 2, 3 (Family: none)	1-2, 4 3



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search
25.01.2019

Date of mailing of the international search report
05.02.2019

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/044426

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 2014/0069140 A1 (INJE UNIVERSITY INDUSTRY- ACADEMIC COOPERATION FOUNDATION) 13 March 2014, fig. 1-4 & WO 2013/089382 A1 & KR 10-1109634 B1	1-2, 4 3
A	CN 206037515 U (GUANGDONG MEIZHI PREC MFG CO.) 22 March 2017, fig. 1-3 (Family: none)	1-4
A	CN 205373177 U (QINGDAO KAITUO LONGHAI REFRIGERATION FITTINGS CO., LTD.) 06 July 2016, fig. 1-3 (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011169183 A [0003]