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(54) **COMPRESSOR**

(57) A compressor that reduces the amount of oil circulating in a refrigeration cycle by improving the function of separating oil from a medium in the compressor is provided.

[Solution to Problem]

A discharge chamber 24 is divided, by a dividing wall 6d formed in a rear housing 6 in a vertical direction, into a first discharge chamber 24a in which a discharge outlet 18d is formed and a second discharge chamber 24b in which an introduction passage 25 to an oil separation chamber 28a of an oil separator 28 is formed. A passage 27 that makes the first discharge chamber 24a and the second discharge chamber 24b communicate with each other is formed in an upper part of the discharge chamber 24.

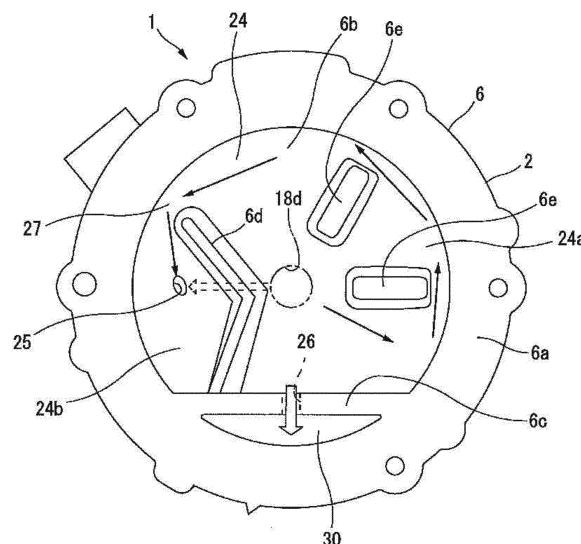


Fig.3

Description

Technical Field

[0001] This invention relates to an oil separation structure of a compressor.

Background Art

[0002] A compressor provided with an oil separator that separates oil from a medium, which is a mixture of refrigerant gas compressed by a compression mechanism and oil, is disclosed in PTL 1, for example.

[0003] The compressor described in PTL 1 separates, by the oil separator, oil from a medium which is a mixture of refrigerant gas and oil and discharged into a discharge chamber from the compression mechanism. Then, the compressor discharges the refrigerant gas of the medium, from which the oil has been separated, into an external refrigeration cycle, and sends the oil separated from the medium to an oil storage chamber and stores the oil in the oil storage chamber and then returns the oil to a sliding portion of the compressor for lubrication via an oil return path.

Citation List

Patent Literature

[0004] PTL 1: JP-A-2007-182774

Summary of Invention

Technical Problem

[0005] However, it is impossible to separate a medium into refrigerant gas and oil completely even by use of the oil separator, and a small amount of oil is discharged into the external refrigeration cycle from the compressor with the refrigerant gas. The oil circulating in the refrigeration cycle becomes a factor in reducing the refrigeration capacity of the refrigeration cycle.

[0006] The present invention has been made to solve the above-described problem and an object thereof is to provide a compressor that can improve oil separation capacity.

Solution to Problem

[0007] To attain the above-described object, a compressor described in this invention is a compressor including: a housing; a compression mechanism that is housed in the housing and compresses a refrigerant; a discharge chamber into which a medium, which is a mixture of the refrigerant compressed by the compression mechanism and oil, is discharged via a discharge outlet; an oil separator that separates the oil from the medium introduced into an oil separation chamber from the dis-

charge chamber through an introduction passage; and an oil storage chamber that stores the oil separated by the oil separator, in the discharge chamber, a dividing wall that divides the discharge chamber into a first discharge chamber, in which the discharge outlet is formed, and a second discharge chamber, in which the introduction passage is formed, is formed in a vertical direction, and a passage that makes the first discharge chamber and the second discharge chamber communicate with each other is formed in an upper part of the discharge chamber.

[0008] Thus, as a result of the medium, which is a mixture of the refrigerant gas compressed by the compression mechanism and the oil, being temporarily discharged into the first discharge chamber, a certain amount of oil is separated from the medium in the first discharge chamber. The medium from which the oil has been separated and removed flows into the second discharge chamber through the passage and reaches the oil separator via the introduction passage, and the oil is further separated from the medium. Therefore, the amount of oil flowing into a refrigeration cycle from the compressor is reduced, which makes it possible to improve the refrigeration capacity of the refrigeration cycle.

[0009] In the compressor according to claim 2, the discharge chamber and the oil storage chamber are disposed above and below a partition respectively by being partitioned by the partition, and an oil communicating path which makes the discharge chamber and the oil storage chamber communicate with each other is formed in the partition.

[0010] This makes it possible to guide the oil separated from the medium in the first discharge chamber and accumulated on the partition to the oil storage chamber via the oil communicating path, which allows the oil to be effectively used for lubrication of the compression mechanism.

[0011] In the compressor according to claim 3, the dividing wall extends using the partition as a starting point, and a passage that makes the first discharge chamber and the second discharge chamber communicate with each other is formed between an inner peripheral surface of a peripheral wall portion forming the discharge chamber and an upper-side end of the dividing wall in a vertical direction.

[0012] This makes it possible to prevent the oil accumulated on the partition from being stirred up and mixed again into the refrigerant gas. Thus, it is possible to reduce the content of oil in the medium which is introduced into the oil separator.

Advantageous Effects of Invention

[0013] As described above, according to the present invention, it is possible to improve oil separation capacity, which makes it possible to reduce the amount of oil flowing into a refrigeration cycle from a compressor and improve the refrigeration capacity of the refrigeration cycle.

Brief Description of Drawings

[0014]

[Fig. 1] Fig. 1 is a diagram illustrating an embodiment of a compressor, to which this invention is applied, and is a sectional view illustrating the overall configuration of the compressor.

[Fig. 2] Fig. 2 is a diagram illustrating the configuration of a discharge chamber which is formed in a rear housing illustrated in Fig. 1.

[Fig. 3] Fig. 3 is a diagram illustrating the flow of refrigerant gas and oil in the discharge chamber illustrated in Fig. 2.

Description of Embodiments

[0015] Hereinafter, an embodiment of this invention will be described with reference to the attached drawings.

[0016] Figs. 1 to 3 illustrate an embodiment of a compressor 1, to which this invention is applied, which is a scroll-type electric compressor. In Fig. 1, a left side in the drawing is assumed to be the front of the compressor 1 and a right side in the drawing is assumed to be the rear of the compressor 1.

[0017] This compressor 1 includes a front housing 5 that houses a compression mechanism 3 and a motor 4 for driving the compression mechanism 3, and a rear housing 6 that includes a discharge chamber 24, an oil separator 28, and an oil storage chamber 30. The housings 5 and 6 are fastened together with an unillustrated fastening bolt in an axial direction, whereby a housing 2 is configured. A gasket (which is not illustrated in the drawing.) is interposed between the end faces at which the front housing 5 and the rear housing 6 are in contact with each other, thus ensuring airtight between the inside and the outside of the compressor 1.

[0018] The front housing 5 has the shape of a tube closed at one end, whose front side is closed by a front wall portion 5a and whose rear side is open. In the side face of this tube-shaped portion, an inlet (which is not illustrated in the drawing.) from which refrigerant gas is introduced into the compressor 1 from a refrigeration cycle is provided.

[0019] Furthermore, the front housing 5 has the shape of a tube whose portion on the side closer to the front than the front wall portion 5a is open, and, by closing this open side with a lid body 8, an inverter housing space 11 that houses an unillustrated inverter device for performing drive control of the motor 4 is formed.

[0020] A block member 7 is in contact with a step portion 5b provided in the inner periphery of the front housing 5 and is assembled thereto with a positioning pin (which is not illustrated in the drawing.) in such a way that the block member 7 cannot rotate. In the front housing 5, a compression mechanism housing space 9 that houses the compression mechanism 3 is formed behind the block member 7 and a motor housing space 10 that houses

the motor 4 for driving the compression mechanism 3 is formed in front of the block member 7.

[0021] Bearings 12 and 13 are held at a rear face-side center of the front wall portion 5a of the front housing 5 and at a front face-side center of the block member 7, respectively. In addition, a drive shaft 14 is rotatably supported by the bearings 12 and 13.

[0022] The motor 4 is configured with a stator 41 fixed to the inner peripheral surface of the front housing 5 and a rotor 42 securely provided so as to rotate with the drive shaft 14 in an integrated manner inside the stator 41, and the rotor 42 rotates by a rotating magnetic force generated in the stator 41.

[0023] The compression mechanism 3 is a scroll-type compression mechanism including a fixed scroll 18 and an orbiting scroll 19 placed so as to face the fixed scroll 18.

[0024] The fixed scroll 18 is configured with a disk-shaped base plate 18a, a cylindrical outer circumferential wall 18b provided along the entire outer edge of the base plate 18a so as to stand and extend toward the front, and a spiral wall 18c in the shape of a whirlpool, which is provided inside the outer circumferential wall 18b so as to stand and extend toward the front from the base plate 18a. A discharge outlet 18d, which is a through hole, is formed in approximately the center of the base plate 18a, and a medium, which is a mixture of oil and refrigerant gas and compressed by the compression mechanism 3, is discharged into the discharge chamber 24, which will be described later, via a discharge valve 32 provided on the rear end face of the base plate 18a.

[0025] While the fixed scroll 18 is allowed to move in an axial direction, the movement thereof in an axial direction is restricted by the rear housing 6 and the block member 7, and the movement of the fixed scroll 18 in a radial direction and the direction of rotation is restricted by a positioning pin (which is not illustrated in the drawing.).

[0026] The orbiting scroll 19 is configured with a disk-shaped base plate 19a and a spiral wall 19b in the shape of a whirlpool, which is provided so as to stand and extend toward the rear from the base plate 19a, and an engagement hole 19c is formed in the center of the front face of the base plate 19a.

[0027] The spiral walls 18c and 19b of the fixed scroll 18 and the orbiting scroll 19 are made to mesh with each other, and a compression chamber 21 is formed in a space surrounded with the base plate 18a and the spiral wall 18c of the fixed scroll 18 and the base plate 19a and the spiral wall 19b of the orbiting scroll 19. Between the outer circumferential wall 18b of the fixed scroll 18 and an outermost portion of the spiral wall 19b of the orbiting scroll 19, a suction chamber 22 that sucks the refrigerant gas and the oil into the compression chamber 21 is formed.

[0028] At the rear end of the drive shaft 14, an eccentric shaft 15 is provided in a position which is off-centered to the shaft center of the drive shaft 14, and a bushing 16

is fitted onto the eccentric shaft 15.

[0029] A radial bearing 17 is fitted into the engagement hole 19c of the orbiting scroll 19, and the outer peripheral surface of the bushing 16 is fitted into an inner ring of the radial bearing 17.

[0030] An unillustrated pin and ring coupling rotation prevention mechanism is provided between the block member 7 and the orbiting scroll 19. This causes the rotational motion of the drive shaft 14 to be converted into the turning motion of the orbiting scroll 19 and the volume of the compression chamber 21 to be increased and reduced.

[0031] The rear housing 6 has the shape of a cylinder closed at one end, with a peripheral wall portion 6a in the shape of a tube, whose rear side is closed by a bottom wall portion 6b and whose front side is open. As described earlier, the front end face of the rear housing 6 is in contact with the front housing 5 with the gasket interposed therebetween and also faces the rear end face of the base plate 18a of the fixed scroll 18 with a predetermined clearance left therebetween, whereby the movement of the fixed scroll 18 in an axial direction is restricted. A seal member (which is not illustrated in the drawing.) is provided between the rear end face of the base plate 18a of the fixed scroll 18 and the front end face of the rear housing 6, which prevents the passage of air between the suction chamber 22 and the discharge chamber 24 which will be described later.

[0032] The inside of the rear housing 6 is partitioned into the discharge chamber 24 into which the medium compressed in the compression chamber 21 is discharged from the discharge outlet 18d, the oil separator 28 that separates the oil from the medium discharged into the discharge chamber 24, and the oil storage chamber 30 in which the oil separated from the medium by the oil separator 28 is stored.

[0033] More specifically, between the discharge chamber 24 and the oil storage chamber 30, a partition 6c which extends horizontally is placed; the discharge chamber 24 is disposed above the partition 6c and the oil storage chamber 30 is disposed below the partition 6c. The oil separator 28 is formed behind the bottom wall portion 6b in the internal space of a cylindrical portion which is integral with the bottom wall portion 6b. The oil separator 28 and the discharge chamber 24 communicate with each other via an introduction passage 25 provided in the bottom wall portion 6b, and the oil separator 28 and the oil storage chamber 30 communicate with each other via an oil passage 29.

[0034] In the partition 6c, an oil communicating path 26 that makes the discharge chamber 24 (more specifically, a first discharge chamber 24a, which will be described later) and the oil storage chamber 30 communicate with each other is formed. In the present embodiment, the oil communicating path 26 is a hole passing through the partition 6c.

[0035] The oil separator 28 is a centrifugal oil separator and includes an oil separation chamber 28a that com-

municates with the introduction passage 25 located in an upper part of the discharge chamber 24 and a cylindrical oil separation pipe 28b housed in the oil separation chamber 28a. The space inside the oil separation pipe 28b communicates with an outlet portion 31 leading to the refrigeration cycle.

[0036] Here, as illustrated in Figs. 1 and 2, the discharge chamber 24 is divided into the first discharge chamber 24a and a second discharge chamber 24b by a dividing wall 6d that extends upward in a vertical direction using the partition 6c as a starting point and is provided so as to stand and extend toward the front from the bottom wall portion 6b. The first discharge chamber 24a communicates with the discharge outlet 18d, and the second discharge chamber 24b communicates with the introduction passage 25.

[0037] A clearance is created between the upper end of the dividing wall 6d in a vertical direction and the inner peripheral surface of the peripheral wall portion 6a, and this clearance is a passage 27 that makes the first discharge chamber 24a and the second discharge chamber 24b communicate with each other.

[0038] A predetermined clearance is provided between the dividing wall 6d and the rear end face of the fixed scroll 18, so that the discharge valve 32 does not interfere with the dividing wall 6d when the discharge valve 32 is opened.

[0039] Moreover, in the first discharge chamber 24a, a rib 6e that extends in a radial direction and is provided so as to stand and extend toward the front side is formed on the bottom wall portion 6b in two places near the peripheral wall portion 6a.

[0040] In the above-described configuration, when the drive shaft 14 is driven and rotated by the motor 4, the orbiting scroll 19 turns about the shaft center of the fixed scroll 18 via the eccentric shaft 15. This causes the refrigerant gas (specifically, the medium into which a small amount of oil is mixed) sucked into the motor housing space 10 from the inlet to be introduced into the compression chamber 21 via a gap or the like between the stator 41 and the front housing 5 and via the suction chamber 22. At the same time, the oil circulating in the compression mechanism 3 is also introduced into the compression chamber 21 via the suction chamber 22, and the medium which is a mixture of the refrigerant gas and the oil is compressed. The compressed medium is discharged into the discharge chamber 24 from the discharge outlet 18d.

[0041] The medium discharged into the discharge chamber 24 moves upward in the first discharge chamber 24a along the inner peripheral surface of the peripheral wall portion 6a as indicated by solid arrows of Fig. 3. That is, while a flow (a dashed arrow of Fig. 3) of the refrigerant gas from the discharge outlet 18d toward the introduction passage 25 is generated when the dividing wall 6d is not provided, a flow (solid arrows of Fig. 3) thereof going around the dividing wall 6d along the inside of the peripheral wall portion 6a is generated as a result of the

dividing wall 6d being provided, whereby a certain amount of oil is separated from the medium in the first discharge chamber 24a.

[0042] Furthermore, since there are the ribs 6e in the flow of the medium in the first discharge chamber 24a, the medium collides with the ribs 6e, which promotes separation of oil.

[0043] The medium, from which a certain amount of oil has been removed in the first discharge chamber 24a, flows into the second discharge chamber 24b via the passage 27 and is guided to the oil separator 28 through the introduction passage 25. The oil is further separated from the medium in the oil separator 28, and the medium, from which the oil has been suitably removed, is discharged into the unillustrated refrigeration cycle from the outlet portion 31.

[0044] On the other hand, the oil separated from the medium in the first discharge chamber 24a and accumulated on the partition 6c is guided to the oil storage chamber 30 via the oil communicating path 26 as indicated by a hollow arrow of Fig. 3. Moreover, the oil separated from the medium by the oil separator 28 is guided to the oil storage chamber 30 via the oil passage 29. The oil stored in the oil storage chamber 30 in this manner is returned to the compression mechanism 3 for lubrication via an unillustrated oil return passage.

[0045] As described above, according to the embodiment of the present invention, before the oil is separated from the medium by the oil separator 28, the oil is also separated in the discharge chamber 24, in particular, in the first discharge chamber 24a, which makes it possible to reduce the amount of oil flowing into the refrigeration cycle and improve the refrigeration capacity of the refrigeration cycle.

[0046] Furthermore, the passage 27 from the first discharge chamber 24a to the second discharge chamber 24b is provided in an upper part of the discharge chamber 24, which makes it possible to prevent the oil accumulated on the partition 6c from being stirred up and mixed again into the refrigerant gas. This makes it possible to reduce the content of oil in the medium which is introduced into the oil separator 28.

[0047] Moreover, the oil separated in the discharge chamber 24, in particular, in the first discharge chamber 24a and accumulated on the partition 6c can be guided to the oil storage chamber 30 via the oil communicating path 26, which makes it possible to use this oil effectively for lubrication of the compression mechanism 3.

[0048] The present invention is not limited to the present embodiment and changes can be made thereto without departing from the spirit of the present invention. For example, the present invention can also be applied to, in addition to a scroll-type compression mechanism as the configuration of the compression mechanism 3, a vane-type or piston-type compression mechanism or a compressor, a pump, or the like as an auxiliary machine of an engine.

[0049] Furthermore, the oil communicating path 26 on-

ly has to be a path that can make the first discharge chamber 24a and the oil storage chamber 30 communicate with each other, and the position and shape of the oil communicating path 26 are not limited to those of the present embodiment. For instance, the oil communicating path 26 may communicate with the second discharge chamber 24b, or the front end face of the rear housing 6 and the surface of the partition 6c may be made flush with each other and a clearance which is created by the thickness of the above-described gasket placed between the end faces at which the front housing 5 and the rear housing 6 are in contact with each other may be used as the oil communicating path 26.

[0050] Moreover, the rib 6e only has to be a rib that makes the flow of the refrigerant go around it and the number and shape thereof are not limited to those of the present embodiment.

Reference Signs List

[0051]

1	compressor
2	housing
3	compression mechanism
4	motor
5	front housing
6	rear housing
6a	peripheral wall portion
6b	bottom wall portion
6c	partition
6d	dividing wall
6e	rib
17	orbiting scroll
18	fixed scroll
18d	discharge outlet
24	discharge chamber
24a	first discharge chamber
24b	second discharge chamber
25	introduction passage
26	oil communicating path
27	passage
28	oil separator
28a	oil separation chamber
30	oil storage chamber

Claims

1. A compressor (1) comprising:

a housing (2);
a compression mechanism (3) that is housed in the housing (2) and compresses a refrigerant;
a discharge chamber (24) into which a medium, which is a mixture of the refrigerant compressed by the compression mechanism (3) and oil, is discharged via a discharge outlet (18d);

an oil separator (28) that separates the oil from the medium introduced into an oil separation chamber (28a) from the discharge chamber (24) through an introduction passage (25); and an oil storage chamber (30) that stores the oil separated by the oil separator (28),

characterized in that

in the discharge chamber (24), a dividing wall (6d) that divides the discharge chamber (24) into a first discharge chamber (24a), in which the discharge outlet (18d) is formed, and a second discharge chamber (24b), in which the introduction passage (25) is formed, is formed in a vertical direction, and a passage (27) that makes the first discharge chamber (24a) and the second discharge chamber (24b) communicate with each other is formed in an upper part of the discharge chamber (24) .

2. The compressor (1) according to claim 1, characterized in that

the discharge chamber (24) and the oil storage chamber (30) are disposed above and below a partition (6c) respectively by being partitioned by the partition (6c), and an oil communicating path (26), which makes the discharge chamber (24) and the oil storage chamber (30) communicate with each other, is formed in the partition (6c).

3. The compressor (1) according to claim 2, wherein the dividing wall (6d) extends using the partition (6c) as a starting point, and a passage (27) that makes the first discharge chamber (24a) and the second discharge chamber (24b) communicate with each other is formed between an inner peripheral surface of a peripheral wall portion (6b) forming the discharge chamber (24) and an upper-side end of the dividing wall (6d) in a vertical direction.

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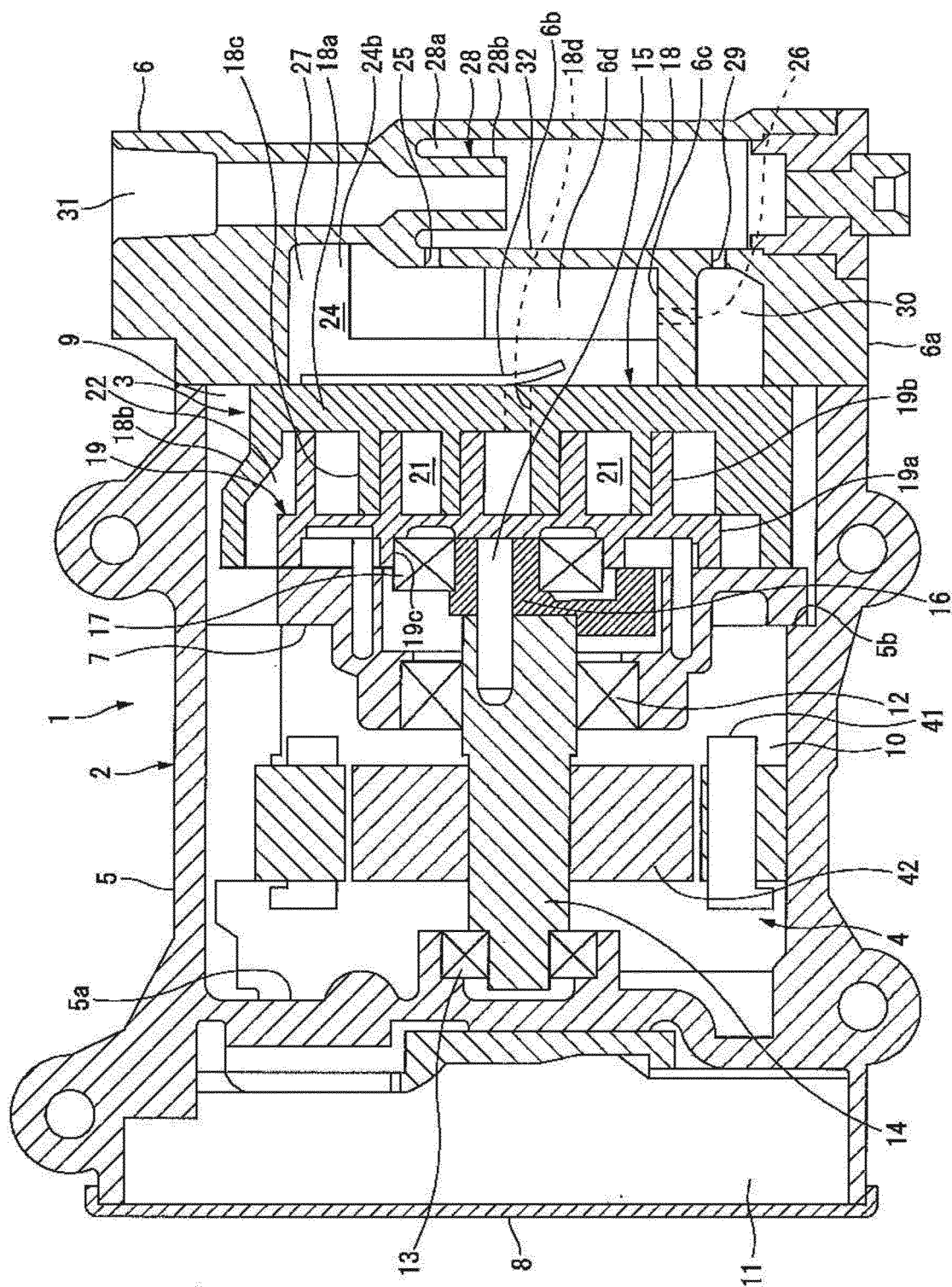


Fig.1

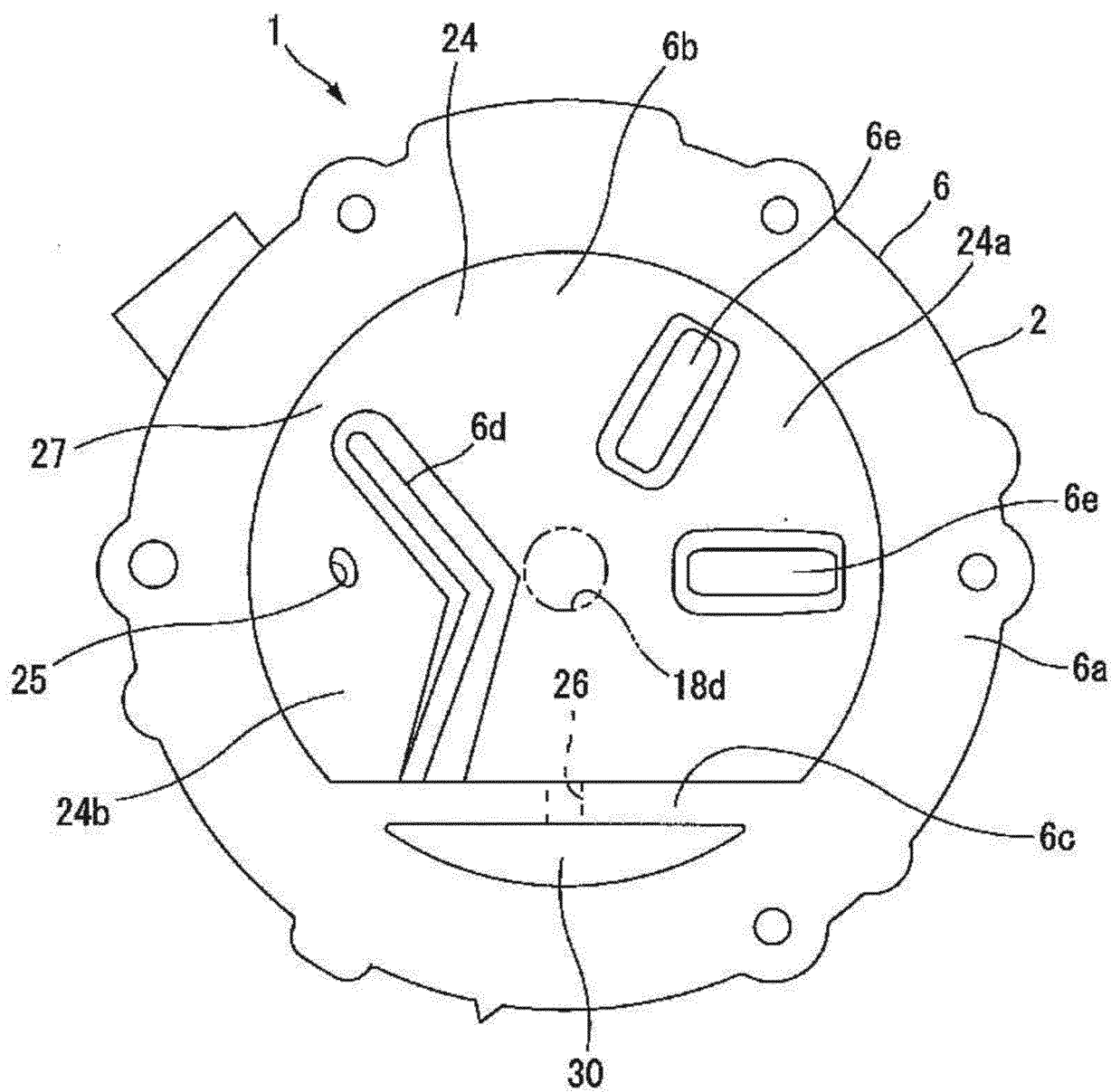


Fig.2

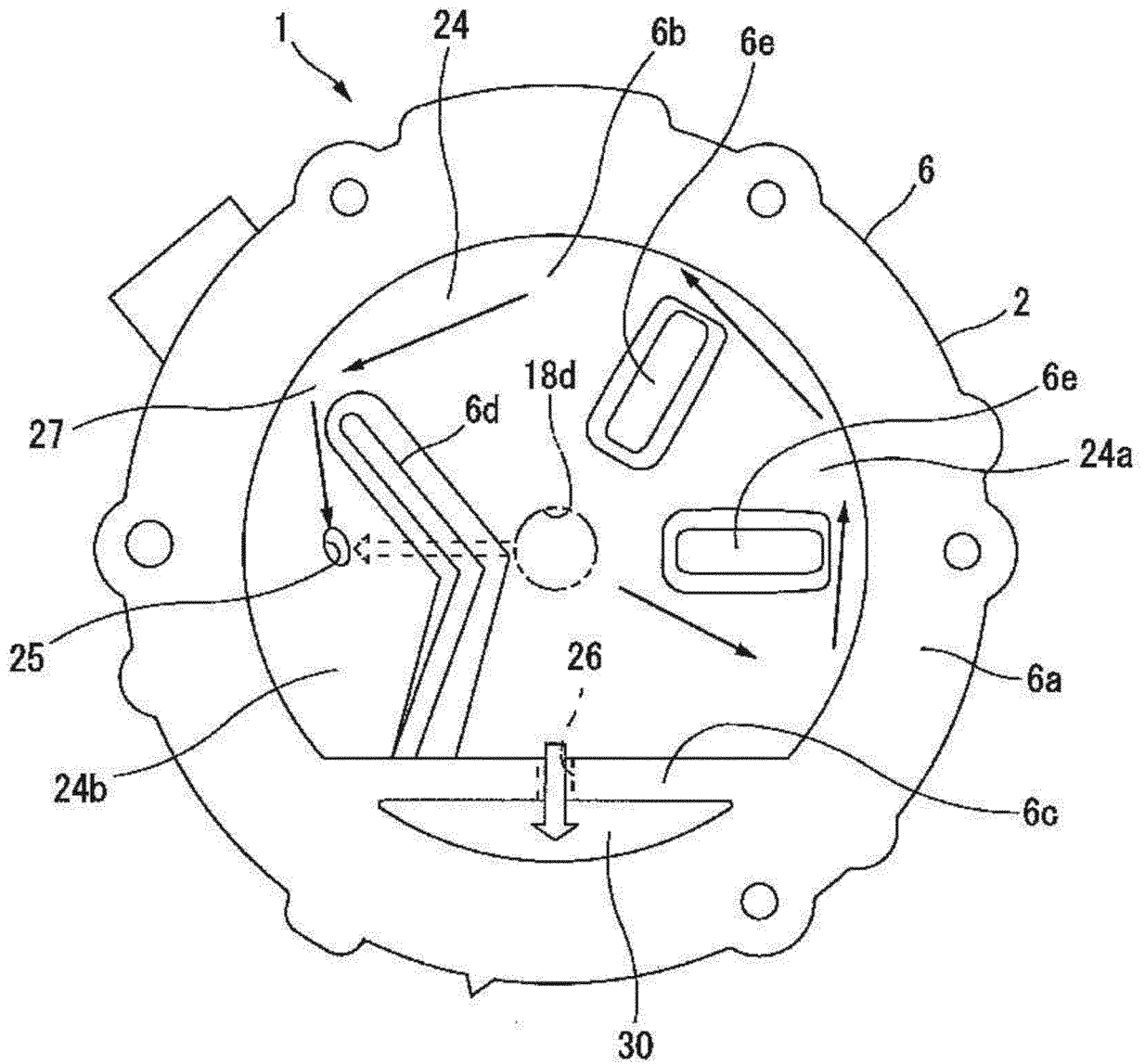


Fig.3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/004769

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F04B39/04 (2006.01) i, F04C18/02 (2006.01) i, F04C29/02 (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)

Int.Cl. F04B39/04, F04C18/02, F04C29/02

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 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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 2015-132196 A (TOYOTA INDUSTRIES CORPORATION) 23 July 2015, entire text, all drawings & US 2015/0198159 A1, entire text, all drawings	1-3
A	JP 2008-88945 A (TOYOTA INDUSTRIES CORPORATION) 17 April 2008, entire text, all drawings (Family: none)	1-3



Further documents are listed in the continuation of Box C.



See patent family annex.

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27.04.2018

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Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/004769

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2010-106731 A (SANDEN CORPORATION) 13 May 2010, entire text, all drawings & WO 2010/050623 A1	1-3
A	WO 2016/143951 A1 (HANON SYSTEMS) 15 September 2016, entire text, all drawings & KR 10-2016-0108036 A & CN 106133324 A	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007182774 A [0004]