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(54) **COMPRESSOR**

(57) To provide a compressor including: an oil separator configured to separate lubricant; and an oil accumulation chamber configured to accumulate the separated lubricant, wherein the entire space provided for the oil accumulation chamber may be used effectively for accumulating the lubricant.

[Solving Means] In a case where an oil accumulation chamber 35 configured to accommodate lubricant includes a plurality of oil accumulation spaces 35a, 35b, the plurality of oil accumulation spaces communicate with each other at respective lower areas thereof; and the lubricant separated by an oil separator 30 is supplied to the oil accumulation chamber 35 via an oil discharge hole 36 which opens in one of the plurality of oil accumulation spaces 35a, 35b, an upper area of the oil accumulation space 35b where no oil discharge hole 31 opens and an upper area of the oil accumulation space 35a where the oil discharge hole 36 opens communicate with each other via a gas-releasing channel 40, and the gas-releasing channel 40 includes an intermediate section (an upper portions 40a₁ of an annular groove 40a) convexed upward with respect to the connecting portions with respect to the oil accumulation 35a, 35b.

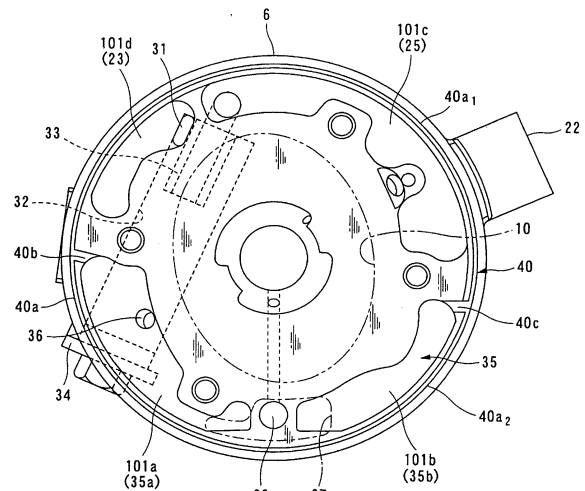


Fig. 3

Description

Technical Field

[0001] The present invention relates to a compressor provided with an oil separator and an oil accumulation chamber for accumulating lubricant separated by the oil separator, and specifically, to a vane-type compressor improved in gas releasing structure of an oil accumulation chamber.

Background Art

[0002] In the refrigerating cycle, lubricant is mixed in a refrigerant gas for lubricating respective sliding portions such as a compression mechanism and bearings in a compressor. However, if the lubricant in a state of being mixed in the refrigerant gas is circulated from the compressor into the refrigerating cycle, the lubricant may be adhered to the interior of a heat exchanger such as an evaporator or a condenser and thus heat exchanging performance of the heat exchanger may disadvantageously be lowered. Therefore, for preventing the lubricant from flowing out from the compressor into the refrigerant circuit, there is a known compressor including a centrifugal type oil separator for separating lubricant from an operation fluid compressed by a compression mechanism and accumulating the separated lubricant in an oil accumulation chamber provided on a lower portion of the compressor.

[0003] For example, a compressor disclosed in PTL1 includes a centrifugal oil separator provided in a rear housing, an oil accumulation chamber formed between a fixed side plate of a fixed scroll and the rear housing, and is configured to accumulate lubricant separated by the oil separator in the oil accumulation chamber. More specifically, a space between the fixed side plate of the fixed scroll and the rear housing is divided into a discharge chamber located on an upper side and the oil accumulation chamber located on a lower side by partition walls extending vertically from the fixed side plate of the fixed scroll and a bottom wall of the rear housing respectively. The partition walls which divide the discharge chamber and the oil accumulation chamber are curved downward to bypass a discharge port opening at a radially center of the fixed side plate of the fixed scroll. Therefore, an upper area in the oil accumulation chamber is divided into left and right upper extended areas by the partition walls curved downward. Connected to one of these two upper expanded areas is an oil discharge hole for dropping down the lubricant separated by the oil separator.

[0004] In this configuration, when a liquid level of the lubricant accumulated in the oil accumulation chamber reaches a lower end of an intermediate section of the partition walls, gas is trapped in the upper expanded area on a side where the oil discharge hole is not opened, so that the upper expanded areas cannot be used effectively

as spaces for accumulating the lubricant.

Therefore, in the compressor disclosed in PTL1, a recessed groove that connects the upper expanded area where the oil discharge hole opens and the upper expanded area to which no oil discharge hole is connected is formed on joint end surfaces of the partition walls to release gas trapped in the upper expanded area where no oil discharge hole opens to the upper expanded area to which the oil discharge hole is connected. Accordingly, the liquid level of the lubricant in the upper expanded area to which no oil discharge hole is connected is allowed to increase, and the upper expanded areas on both sides may be used effectively as the oil accumulation chamber.

Citation List

[0005] PTL1: JP-A-11-82353

Summary of Invention

Technical Problem

[0006] As the above-described gas-releasing channel includes an intermediate section formed to curve downward with respect to the both end portion along an end surface of the partition wall of the rear housing, any lubricant entering the gas-releasing channel may be accumulated in the intermediate section of the gas-releasing channel. The lubricant retained in the intermediate section impairs a flow of gas via the gas-releasing channel, and thus gas in the upper expanded area to which no oil discharge hole is connected cannot be released to the upper expanded area to which the oil discharge hole is connected, and the upper expanded area to which no oil discharge hole is connected cannot be used effectively as the oil accumulation chamber.

[0007] In view of such circumstances, it is a main object of the present invention to provide a compressor configured to use the entire space provided for an oil accumulation chamber effectively for accumulating lubricant.

Solution to Problem

[0008] In order to achieve the above-described object, a compressor according to the present invention includes: a compression mechanism configured to compress a fluid including lubricant; an oil separator configured to separate the lubricant from the fluid discharged from the compression mechanism; an oil accumulation chamber configured to accumulate the lubricant separated by the oil separator and including a plurality of oil accumulation spaces; an oil discharge hole configured to supply the lubricant separated by the oil separator to any one of the plurality of oil accumulation spaces; a communication channel configured to cause respective lower areas of the plurality of oil accumulation spaces to communicate with each other; a gas-releasing channel con-

figured to cause respective upper areas of the plurality of oil accumulation spaces communicate with each other, and the gas-releasing channel includes an intermediate section convexed upward with respect to connecting portions to the plurality of oil accumulation spaces.

[0009] For example, the compressor, when a vane-type compressor is used as the compressor, preferably includes: a cylinder configured to be blocked by being clamped at both sides in an axial direction by side members; a rotor housed in the cylinder and including a plurality of vane grooves formed thereon; vanes housed in the vane grooves of the rotor and configured to slide on an inner peripheral surface of the cylinder with distal ends thereof coming out and entering the vane grooves; a drive shaft rotatably supported by the side members at both sides and coupled to the rotor to transmit a rotary power from outside to the rotor; an oil separator provided on one of the side members and configured to separate lubricant from an operation fluid compressed in a compression chamber formed between the vanes; an oil accumulation chamber for accumulating the lubricant separated by the oil separator and including two oil accumulation spaces formed by assembling the one of the side members and the cylinder; an oil discharge hole configured to supply the lubricant separated by the oil separator to one of the two oil accumulation spaces; and a communication channel configured to cause the lower areas of the two oil accumulation spaces to communicate with each other, and in addition, a gas-releasing channel configured to cause upper areas of the two oil accumulation spaces to communicate with each other, and the gas-releasing channel includes an intermediate section convexed upward with respect to connecting portions to the two oil accumulation spaces.

[0010] Therefore, in the configuration described above, as the oil accumulation space where no oil discharge hole opens and the oil accumulation space where the oil discharge hole opens out of the plurality of oil accumulation spaces constituting the oil accumulation chamber communicate with each other via the gas-releasing channel having the intermediate section convexed upward, gas in the oil accumulation space where no oil discharge hole opens may be released to the oil accumulation space where the oil discharge hole opens via the gas-releasing channel.

[0011] Therefore, in the configuration in which lubricant separated by the oil separator is supplied through the oil discharge hole to one of the plurality of oil accumulation spaces, the lubricant is supplied also to the oil accumulation space where no oil discharge hole opens via the communication channel configured to cause the lower areas thereof to communicate with each other to keep the liquid levels of the lubricant in the oil accumulation spaces in line with each other and all the oil accumulation spaces may be functioned effectively as spaces for accumulating the lubricant.

[0012] As the gas-releasing channel includes the intermediate section convexed upward with respect to the

connecting portions to the plurality of oil accumulation spaces, air-ventilation may be ensured between the oil accumulation space where no oil discharge hole opens and the oil accumulation space where the oil discharge hole opens via the intermediate section free from a probability of retention of the lubricant, thereby ensuring introduction of oil into the respective oil accumulation spaces.

[0013] The plurality of oil accumulation spaces may include spaces formed when two members which constitute the compressor are assembled to each other and the gas-releasing channel may include a groove formed on one or both of abutting end surfaces of the two members which constitute the compressor.

For example, for the compressor of the vane type described above, the gas-releasing channel may be formed by a groove or grooves formed on one or both of the abutting end surfaces of one of the side members and the cylinder.

In this configuration, the need for forming the gas-releasing channel on the member which constitutes the compressor is eliminated, and thus formation of the gas-releasing channel is easily achieved.

[0014] Preferably, the gas-releasing channel may include an annular groove or grooves formed on a peripheral edge portion or portions of one or both of the abutting end surfaces of the two members which constitute the compressor and connecting grooves formed to connect the annular groove or grooves to the respective oil accumulation spaces.

For example, for the vane-type compressor, the gas-releasing channel may include an annular groove or grooves formed on a peripheral edge portion or portions of one or both of the abutting end surfaces of one of the side members and the cylinder and connecting grooves formed to connect the annular groove or grooves to the respective oil accumulation spaces. In this configuration, the annular groove may be formed by lathe machining, and thus the gas-releasing channel may be formed further easily.

[0015] An oil supply channel may be connected to the communication channel configured to cause the respective lower areas of the oil accumulation spaces communicate with each other to supply the lubricant accumulated in the oil accumulation chamber from the oil supply channel to the compression mechanism for use.

Advantageous Effects of Invention

[0016] As described thus far, according to the present invention, in a configuration in which the plurality of oil accumulation spaces serve as the oil accumulation chamber for accumulating the lubricant separated by the oil separator, the lower areas of the plurality of oil accumulation spaces communicate with each other by the communication channel, and the lubricant separated by the oil separator is supplied to the oil accumulation chamber via the oil discharge hole which opens in one of the

plurality of oil accumulation spaces, the upper area of the oil accumulation space where no oil discharge hole opens and the upper area of the oil accumulation space where the oil discharge hole opens communicate with each other via the gas-releasing channel, and the gas-releasing channel includes the intermediate section convexed upward with respect to the connecting portions to the plurality of oil accumulation spaces. Therefore, a problem of failing of introduction of the lubricant into the respective oil accumulation spaces is eliminated, and the respective oil accumulation spaces may be functioned effectively as spaces for accumulating the lubricant. Therefore, the need for forming the oil accumulation spaces to significantly protrude sideward of the compressor for securing a sufficient capacity of the oil accumulation chamber is eliminated, and thus a compact sized compressor is achieved.

[0017] In particular, the upper areas of the respective oil accumulation spaces communicate with each other via the gas-releasing channel having the intermediate section convexed upward, so that disturbance of the air-ventilation due to accumulation of the lubricant in the gas-releasing channel is avoided, and gas may be released reliably from the oil accumulation space where no oil discharge hole opens to the oil accumulation space where the oil discharge hole opens. Brief Description of Drawings

[0018]

[Fig. 1] Fig. 1 is a cross-sectional view illustrating an example of a compressor according to the present invention.

[Fig. 2] Fig. 2 is a cross-sectional view taken along the line A-A in Fig. 1.

[Fig. 3] Fig. 3 is a drawing of a rear head (side member on a rear side) viewed from a cylinder side.

[Fig. 4] Fig. 4 is a perspective view illustrating the rear head and a cylinder assembled thereto.

[Fig. 5] Fig. 5 is graph of comparison in oil circulation rate (OCR) between a compressor of the related art including no gas-releasing channel and a compressor including a gas-releasing channel described in an embodiment of the present invention.

Description of Embodiment

[0019] Referring now to the attached drawings, an embodiment of a compressor according to the present invention will be described.

[0020] In Fig. 1 and Fig. 2, a vane-type compressor suitable for a refrigerating cycle using refrigerant as operation fluid is illustrated. The vane-type compressor includes: a cylinder 1; a rotor 3 rotatably housed in the cylinder and fixed to a drive shaft 2; vanes 5 to be inserted into a plurality of vane grooves 4 provided on the rotor 3; a rear head (side member on a rear side) 6 configured to close a rear-side end surface of the cylinder 1; and a front head (side member on a front side) 7 configured to

close the front-side end surface of the cylinder 1, surround an outer peripheral surface of the cylinder 1, and be fitted to the rear head 6.

[0021] The cylinder 1 includes a hole 10 having an oval shape in cross section, and in this example, a long-diameter portion of the cylinder is oriented in substantially a vertical direction of the compressor. The hole 10 rotatably houses the rotor 3 fixed to the shaft 2. The rotor 3 is formed into a column shape having an exact circle in cross section having substantially the same diameter as the short diameter of the oval of the hole 10. By disposing the rotor 3 at the center of the hole 10 so that an inner peripheral surface of the rotor 3 and a short-diameter portion of the hole 10 come close to each other, two compressing spaces 11 are formed between an inner peripheral surface of the long-diameter portion of the hole 10 and an outer peripheral surface of the rotor 3.

[0022] The plurality of (five in this example) vane grooves 4 provided on the rotor 3 are formed in parallel to the drive shaft 2 at equidistantly in a circumferential direction, and these vane grooves 4 are inclined at a predetermined angle in a direction of rotation of the rotor 3 in a radial direction from the center of rotation of the rotor 3.

[0023] The respective vanes 5 are slidably inserted into the respective vane grooves 4 and are biased radially outward by a centrifugal force in association with the rotation of the rotor 3 and a pressure supplied to bottom portions of the vane grooves to come into sliding contact with an inner wall of the hole 10 of the cylinder 1. Therefore, the compressing spaces 11 are formed into a plurality of compression chambers 12 by being partitioned by the vanes 5, and the capacity of the respective compression chambers 12 gradually decreases as the vanes 5 advance from the long-diameter portion to the short-diameter portion of the hole 10 in association with the rotation of the rotor 3 to compress the operation fluid in the compression chambers 12.

[0024] The drive shaft 2 is rotatably supported by the front head 7 and the rear head 6 via bearings 13, 14, and projects at one end thereof from the front head 7. A drive pulley is coupled to the portion of the drive shaft 2 projecting from the front head 7 via an electromagnetic clutch, not illustrated, to transmit a rotary power from an engine of a vehicle via a drive belt. One end side of the drive shaft 2 is hermetically sealed with respect to the front head 7 via a sealing member 15 provided between the one end side of the drive shaft 2 and the front head 7.

[0025] The front head 7 includes a side block portion 7a coming into contact with the cylinder 1 and a cylindrical portion 7b surrounding part of the cylinder 1 and the rear head 6 integrally with each other, and the front head 7 includes an inlet port 17 configured to intake the working fluid (refrigerant gas) via a check valve 16 and an inlet chamber (low-pressure chamber) 18 communicating with the inlet port 17. The inlet chamber 18 communicates with the compression chambers 12 from the front in the direction of rotation of the rotor 3 to the vicinity of the

long-diameter portion of the hole 10 with respect to the short-diameter portion of the hole 10 of the cylinder 1.

[0026] The cylinder 1 includes flange portions 1a, 1b radially projecting at both ends thereof in an axial direction, and each of the flange portions 1a, 1b is formed into a shape of an inner peripheral shape of the cylindrical portion 7b of the front head 7. In a state in which part of the rear head 6 and the cylinder 1 are inserted into the cylindrical portion 7b of the front head 7, a front-side end surface of the cylinder 1 including the flange portion 1b is in contact with an end surface of the side block portion 7a of the front head 7, and the rear side end surface of the cylinder 1 including the flange portion 1a is in contact with an end surface of the rear head 6.

[0027] The outer peripheral surface of the cylinder 1 is provided with discharge ports 19 which are communicable with the compression chambers 12 in the vicinity of the short-diameter portion of the hole 10 of the cylinder 1. Formed between the outer peripheral surface of the cylinder 1 and the inner peripheral surface of the cylindrical portion 7b of the front head 7 is a discharge valve housing chamber 20 defined between the flange portions 1a, 1b formed at both ends of the cylinder 1. The discharge ports 19 open toward the discharge valve housing chamber 20 to allow the compression chambers 12 formed between the vanes to communicate with the discharge valve housing chamber 20 via the discharge ports 19. The discharge ports 19 are configured to be opened and closed by discharge valves 21 housed in the discharge valve housing chamber 20.

[0028] The rear head 6 includes a discharge chamber (high-pressure chamber) 23 communicating with the discharge valve housing chamber 20 and a discharge outlet 22 for discharging the operation fluid out of the compressor. As illustrated in Fig. 3 and Fig. 4 as well, the rear head 6 includes a plurality of separated recessed portions 101a to 101d extending along the circumferential direction in the vicinity of an outer peripheral edge of an end surface opposing the cylinder 1. The recessed portions 101a to 101d are closed by an area of the rear side end surface of the cylinder 1 including the flange portion 1a except for an opening of the hole 10 to form closed spaces. At least one of the closed spaces (a closed space formed by closing the recessed portion 101d in this example) is utilized to form the discharge chamber 23.

[0029] The discharge chamber 23 and the discharge valve housing chamber 20 are separated by the flange portion 1a provided on the cylinder 1, and communicate with each other via a through hole 24 penetrating through the flange portion 1a. The through hole 24 is formed preferably at a position substantially at the same distance from the respective discharge ports 19.

[0030] In the refrigerating cycle including the vane-type compressor 1 having the configuration described above mounted thereon, the operation fluid containing the refrigerant and the lubricant flows into the inlet chamber 18 via the check valve 16 at the inlet port 17 from an evaporator

of the refrigerating cycle, is compressed in the compression chambers 12, then flows out via the discharge valve housing chamber 20 to the discharge chamber 23, and is discharged from the discharge chamber 23 through the discharge port 22 toward the condenser of the refrigerating cycle.

[0031] In addition, the rear head 6 includes a centrifugal oil separator 30 for separating the lubricant mixed with the discharge gas. The oil separator 30 is formed integrally with the rear head 6, includes an oil separating chamber 32 formed in a column-shaped space communicating with the discharge chamber 23 via an introduction hole 31, and includes a substantially cylindrical-shaped separation cylinder (separator pipe) 33 formed in the oil separating chamber 32 integrally with the rear head 6 disposed coaxially.

[0032] The oil separating chamber 32 is formed to extend in a direction substantially orthogonal to the axial direction of the drive shaft 2 with an axial line thereof inclined with respect to a vertical line. An upper end portion of the oil separating chamber 32 communicates with a buffer space 25 via the separation cylinder 33, and further communicates with the discharge outlet 22 via the buffer space 25. A lower end portion of the oil separating chamber 32 opens from an outer peripheral surface of the rear head 6, and the opening portion is hermetically sealed with a lid member 34. In addition, a lower portion of the oil separating chamber 32 includes an oil discharge hole 36 communicating with an oil accumulation chamber 35 provided in a lower portion of the compressor.

[0033] Therefore, the working fluid flowed into the oil separating chamber 32 turns around the separation cylinder 33 provided in the oil separating chamber 32, and in the course thereof, the lubricant mixed therein is separated. The discharge gas after the separation and removal of the lubricant is introduced into the buffer space 25 through a center hole of the separation cylinder 33, and is sent out to the refrigerating cycle via the discharge outlet 22. The separated lubricant is accumulated in the oil accumulation chamber 35 formed in the lower part of the compressor via the oil discharge hole 36 provided in the lower portion of the oil separating chamber 32.

[0034] The oil accumulation chamber 35 is defined by using two closed spaces disposed in a lower area out of the closed space formed by closing the plurality of recessed portions 101a to 101d formed to extend along the circumferential direction in the vicinity of the outer peripheral edge of the end surface of the rear head 6 opposing the cylinder 1 with the rear side end surface including the flange portion 1a of the cylinder 1 as oil accumulation spaces 35a, 35b.

[0035] The recessed portions 101a, 101b defining the oil accumulation spaces 35a, 35b are formed on both sides of a portion of the rear head 6 where the hole 10 of the cylinder 1 opposes to avoid overlapping with the hole 10 of the cylinder 1 disposed with the long-diameter portion of the oval shape oriented in the vertical direction (illustrating an imaginary line of the hole 10 of the cylinder

1 by two double-dashed chain line in Fig. 3). The recessed portions 101a, 101b extend upward from a portion in the vicinity of a lower end portion along a peripheral edge of the rear head 6. A lower area of the rear side end surface of the cylinder 1 is provided with a communication recess 37 with which lower end portions of the oil accumulation spaces 35a, 35b communicate. In other word, the oil accumulation space 35a and the oil accumulation space 35b communicate with each other via the communication recess 37 as a communication channel, thereby constituting the oil accumulation chamber 35.

[0036] The lowest portion of the oil accumulation chamber 35 (a portion causing the lower end portion of the first oil accumulation space 35a and the lower end portion of the second oil accumulation space 35b to communicate with each other, that is, the communication recess 37) is connected to an oil supply channel 38 provided between the recessed portion 101a and the recessed portion 101b formed on the rear head 6 and connected to a sliding portion of the compression mechanism. With the oil supply channel 38, the lubricant accumulated in the oil accumulation chamber 35 may be supplied to respective lubricating portions based on the pressure difference between the oil accumulation chamber 35 and the respective lubricating portions and may be sent to a space behind the vanes 5 in the vane grooves 4 of the rotor 3. The lubricant sent to the vane grooves 4 presses the vanes 5 against the inner peripheral surface of the cylinder 1, and stable compression is secured.

[0037] The oil discharge hole 36 causing the oil separating chamber 32 and the oil accumulation chamber 35 of the oil separator 30 to communicate with each other is connected to the first oil accumulation space 35a, and thus the lubricant separated by the oil separator 30 is introduced into the first oil accumulation space 35a via the oil discharge hole 36, and then is introduced into the second oil accumulation space 35b via the communication recess 37.

[0038] As described above, the second oil accumulation space 35b is a closed space closed by the rear side end surface of the cylinder 1. Assuming that the second oil accumulation space is a complete dead end having no way out for the gas accumulated in the interior, the second oil accumulation space 35b is kept to be filled with the gas and the lubricant is not introduced from the first oil accumulation space 35a via the communication recess 37 to the second oil accumulation space 35b (the liquid level of the lubricant cannot be increased in the second oil accumulation space 35b), and thus the second oil accumulation space 35b cannot be functioned effectively.

[0039] Therefore, in this example, an abutting portion between the rear head 6 and the cylinder 1 is provided with a gas-releasing channel 40 causing an upper portion of the first oil accumulation space 35a and an upper portion of the second accumulation space 35b to communicate with each other. The gas-releasing channel 40 is formed by forming a groove causing an upper area of the

first oil accumulation space 35a and an upper area of the second oil accumulation space 35b to communicate with each other on an abutting end surfaces of the rear head 6 and the cylinder 1, and closing the groove by an end surface of the flange portion 1a of the cylinder 1.

[0040] More specifically, the gas-releasing channel 40 is formed by an annular groove 40a formed so as to surround radially outside of the oil accumulation spaces 101a to 101d on an end surface of a peripheral edge portion of the rear head 6 coming into contact with the flange portion 1a of the cylinder 1, and connecting grooves 40b, 40c connecting the annular groove 40a and the upper areas of the oil accumulation spaces 35a, 35b. The annular groove 40a may be formed by lathe machining, and the connecting grooves 40b, 40c are formed by molding simultaneously with casting of the rear head 6 or by machining the molded rear head 6 later with an end mill or the like.

[0041] In the configuration described above, the upper areas of the two oil accumulation spaces (the second oil accumulation spaces 35b where no oil discharge hole 36 opens and the first oil accumulation space 35a where the oil discharge hole 36 opens) which constitute the oil accumulation chamber 35 communicate with each other via the gas-releasing channel 40, and the gas in the second oil accumulation spaces 35b may be moved to the first oil accumulation space 35a via the gas-releasing channel 40. Accordingly, even in a configuration including the oil discharge hole 36 of the oil separator 30 connected only to the first oil accumulation space 35a, the lubricant introduced into the first oil accumulation space 35a may be supplied to the oil second accumulation space 35b via the communication recess 37.

[0042] Therefore, the liquid levels of the lubricant introduced into the first oil accumulation space 35a and into the second oil accumulation space 35b may be kept in line, and both of the oil accumulation spaces 35a, 35b may be functioned effectively as spaces for accumulating the lubricant.

[0043] An upper portion 40a₁ of the annular groove 40a with respect to positions where the connecting grooves 40b, 40c are connected to the respective oil accumulation spaces 35a, 35b has a shape convexed upward. In other words, the gas-releasing channel 40 includes an intermediate section 40a₁ convexed upward with respect to the connecting portions with respect to the oil accumulation spaces 35a, 35b. Therefore, even if the lubricant is accumulated in a lower portion 40a₂ of the annular groove 40a, no lubricant is trapped in the upper portion 40a₁ of the annular groove 40, and thus a problem of disturbance of air-ventilation between the first oil accumulation space 35a and the second accumulation space 35b is eliminated, and introduction of oil into the respective oil accumulation spaces 35a, 35b may be ensured.

[0044] Fig. 5 illustrates a result of comparison of an oil circulation ratio (OCR) during the operation between the compressors including the oil accumulation chambers

having the same shape, that is, between the compressor of the related art including no gas-releasing channel 40 and the compressor including the gas-releasing channel 40 described above. As apparent from Fig. 5, it was found that the oil circulation ratio of the compressor including the gas-releasing channel 40 described above was substantially half that of the compressor of the related art including no gas-releasing channel 40, that the lubricant was sufficiently accumulated in the compressor, and that the two oil accumulation spaces 35a, 35b functioned effectively as spaces for accumulating the lubricant.

[0045] In addition, as the gas-releasing channel 40 is defined by a groove formed on the rear hand side of the abutting end surfaces of the two members (the cylinder 1 and the rear head 6) which constitute the compressor, the need for formation of a hole on the cylinder or the rear head for forming the gas-releasing channel is eliminated, and formation of the gas-releasing channel 40 is facilitated.

[0046] In particular, in the above-described configuration example, as the gas-releasing channel 40 includes the annular groove 40a formed on the peripheral edge portion of the abutting end surface of the rear head 6, and the connecting grooves 40b, 40c connecting the annular groove 40a with the respective oil accumulation spaces, the annular groove 40a may be formed by lathe machining and thus formation of the gas-releasing channel 40 may further be facilitated.

[0047] The gas-releasing channel 40 causing the first oil accumulation space 35a and the second oil accumulation space 35b to communicate with each other, being formed by the groove formed on the rear head side of the abutting end surfaces of the cylinder 1 and the rear head 6 in the configuration described above, may be formed by a groove formed on the cylinder side or may be formed by overlapping the grooves formed on the rear head side and the cylinder head side.

[0048] The first oil accumulation space 35a and the second oil accumulation space 35b, which communicate with each other via the communication recess 37 formed in the cylinder 1 at the lower portions thereof in the configuration described above, may be brought into communication by depressing the diaphragm portion of the rear head 6 where the oil supply channel 38 is formed.

[0049] Furthermore, although an example in which the oil accumulation chamber 35 is formed by causing the two oil accumulation spaces 35a, 35b to communicate with each other at the lower portions thereof has been described in the configuration described above, in the case where three or more oil accumulation spaces are brought into communication with each other by connecting the lower portions thereof, upper portions of the oil accumulation spaces where no oil discharge hole 36 opens and the oil accumulation spaces where the oil discharge hole 36 opens may communicate with each other via the gas-releasing channel bypassing the respective upper portions and passing along further upper part also so that all the oil accumulation spaces are functioned

effectively as spaces for accumulating the lubricant.

[0050] In the configuration described above, an application to the vane-type compressor has been exemplified. However, the same configuration may be employed for other compressors such as a scroll compressor including an accumulation chamber.

Reference Signs List

10 [0051]

1	cylinder
2	drive shaft
3	rotor
15 4	vane groove
5	vane
6	rear head
12	compression chamber
30	oil separator
20 35	oil accumulation chamber
35a	first oil accumulation space
35b	second oil accumulation space
36	oil discharge hole
37	communication recess
25 38	oil supply channel
40	gas-releasing channel
40a	annular groove
40a ₁	intermediate section (convexed upward)
40b, 40c	connecting groove

Claims

1. A compressor comprising:
a compression mechanism configured to compress a fluid containing lubricant;

an oil separator (30) configured to separate the lubricant from the fluid discharged from the compression mechanism;

an oil accumulation chamber (35) configured to accumulate the lubricant separated by the oil separator (30) and including a plurality of oil accumulation spaces (35a, 35b);

an oil discharge hole (36) configured to supply the lubricant separated by the oil separator (30) to any one of the plurality of oil accumulation spaces (35a, 35b);

a communication channel (37) configured to cause the plurality of oil accumulation spaces (35a, 35b) to communicate with each other at respective lower areas thereof;

a gas-releasing channel (40) configured to cause the plurality of oil accumulation spaces (35a, 35b) to communicate with each other at respective upper areas thereof,

characterized in that the gas-releasing channel (40) includes an intermediate section (40a₁)

convexed upward with respect to connecting portions to the plurality of oil accumulation spaces (35a, 35b).

2. The compressor according to Claim 1, wherein the plurality of oil accumulation spaces (35a, 35b) include a space formed by assembling two members (1, 6) which constitute the compressor, and wherein the gas-releasing channel (40) is formed by a groove or grooves formed on one or both of abutting end surfaces of the two members (1, 6) which constitute the compressor. 5
3. The compressor according to Claim 2, wherein the gas-releasing channel (40) is formed by an annular groove or grooves (40a) formed on a peripheral edge portion or portions of one or both of the abutting end surfaces of the two members (1, 6) which constitute the compressor and connecting grooves (40b) formed to connect the annular groove or grooves (40a) to the respective oil accumulation spaces (35a, 35b). 10
4. A compressor comprising: 15
 - a cylinder (1) configured to be blocked by being clamped at both sides in an axial direction by side members (6, 7);
 - a rotor (3) housed in the cylinder (1) and including a plurality of vane grooves (4) formed thereon; 20
 - vanes (5) housed in the vane grooves (4) of the rotor (3) and configured to slide on an inner peripheral surface of the cylinder (1) with distal ends thereof coming out and entering the vane grooves (4); 25
 - a drive shaft (2) rotatably supported by the side members (6, 7) at both sides and coupled to the rotor (3) to transmit a rotary power from outside to the rotor (3); 30
 - an oil separator (30) provided on one of the side members (6, 7) and configured to separate lubricant from working fluid compressed in a compression chamber (12) formed between the vanes (5); 35
 - an oil accumulation chamber (35) for accumulating the lubricant separated by the oil separator (30) and including two oil accumulation spaces (35a, 35b) formed by assembling the one of the side members (6, 7) and the cylinder (1); 40
 - an oil discharge hole (36) configured to supply the lubricant separated by the oil separator (30) to one of the two oil accumulation spaces (35a, 35b); and 45
 - a communication channel (37) configured to cause the lower areas of the two oil accumulation spaces to communicate with each other, 50

characterized in that a gas-releasing channel

(40) configured to cause upper areas of the two oil accumulation spaces (35a, 35b) to communicate with each other is further provided, and the gas-releasing channel (40) includes an intermediate section (40a1) convexed upward with respect to connecting portions to the two oil accumulation spaces (35a, 35b) .

5. The vane-type compressor according to Claim 4, wherein the gas-releasing channel (40) is formed by a groove or grooves formed on one or both of abutting end surfaces of the one of the side members (6, 7) and the cylinder (1). 55
6. The compressor according to Claim 5, wherein the gas-releasing channel (40) is formed by an annular groove or grooves (40a) formed on a peripheral edge portion or portions of one or both of the abutting end surfaces of the one of the side members (6, 7) and the cylinder (1) and connecting grooves (40b) formed to connect the annular groove or grooves (40a) to the respective oil accumulation spaces (35a, 35b). 60
7. The compressor according to any one of Claims 1 to 6, wherein an oil supply channel (38) for supplying the lubricant accumulated in the oil accumulation chamber (35) to the compression mechanism is connected to the communication channel (37) configured to cause the lower areas of the oil accumulation spaces (35a, 35b) to communicate with each other. 65

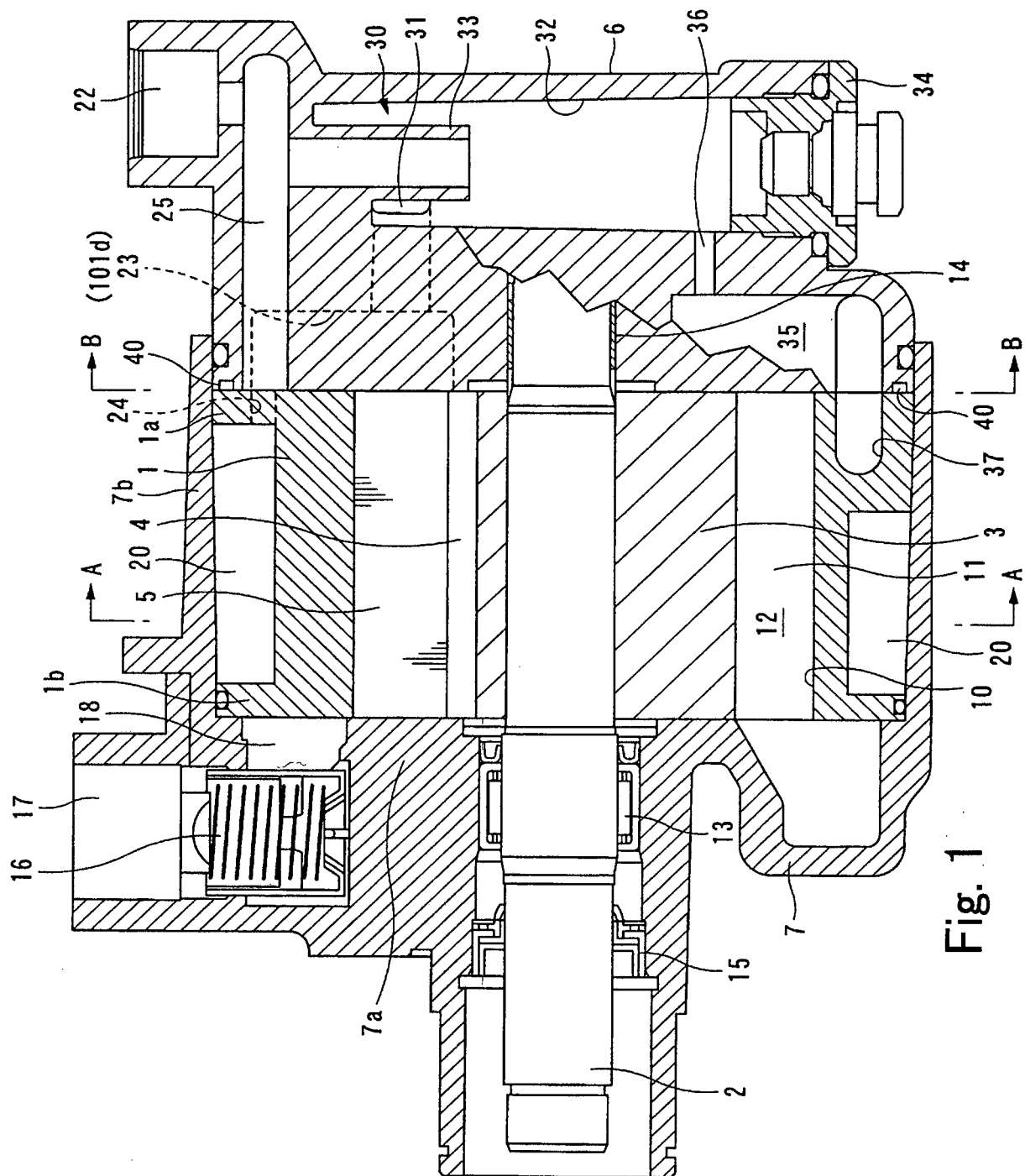


Fig. 1

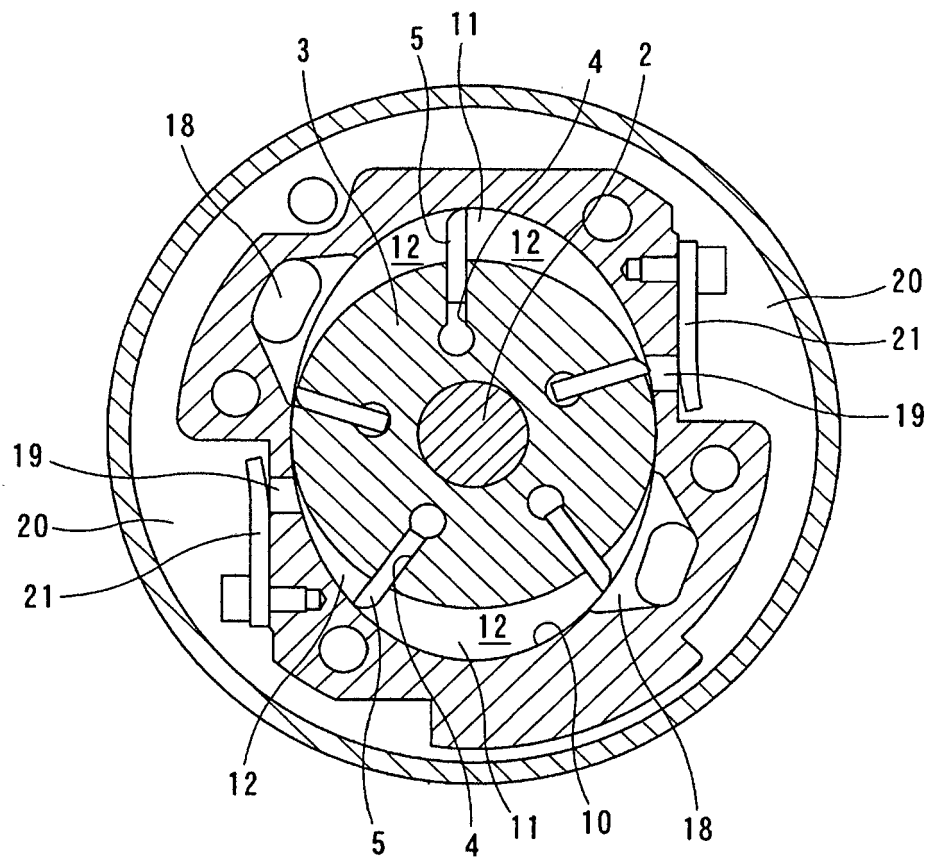


Fig. 2

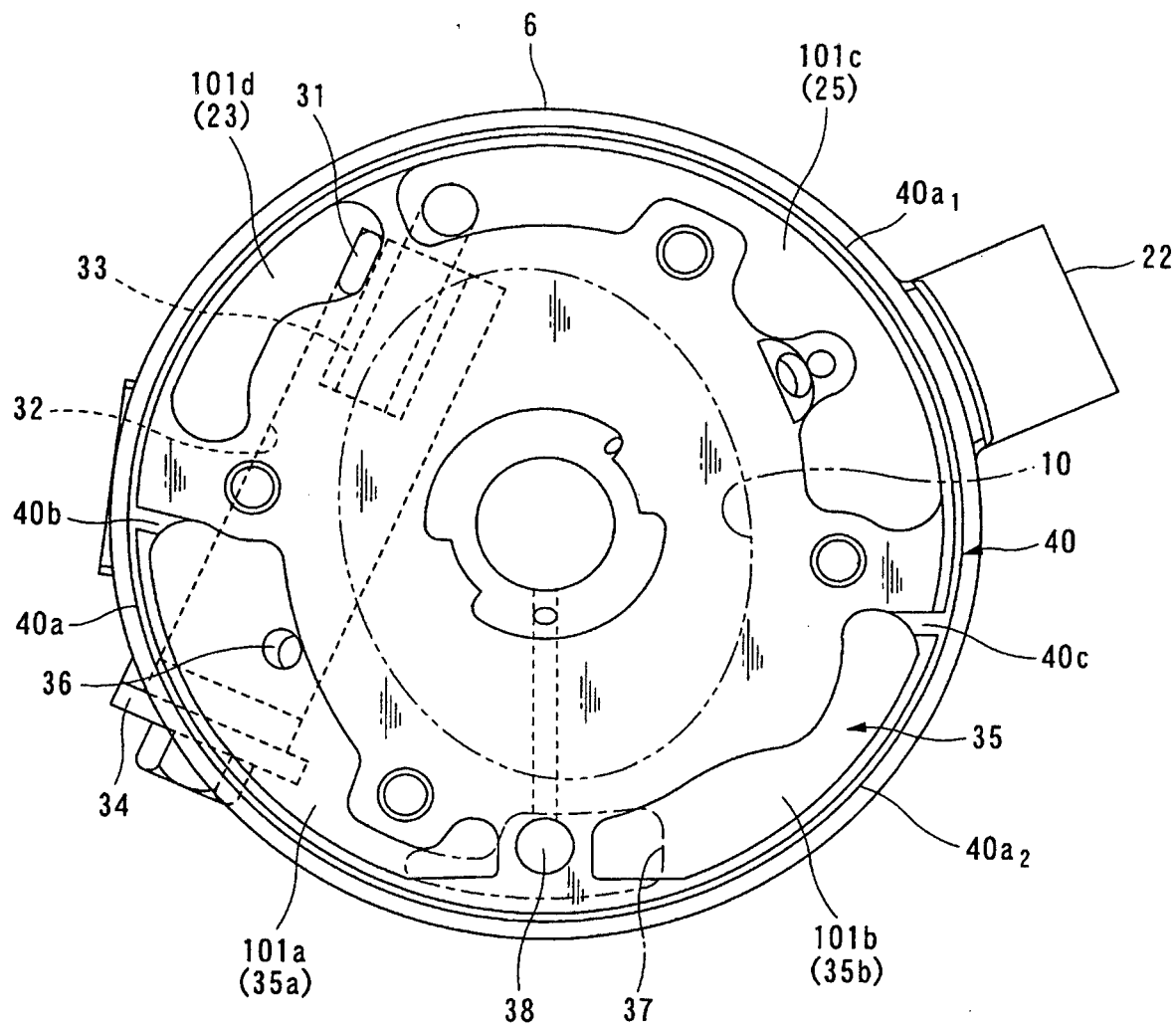
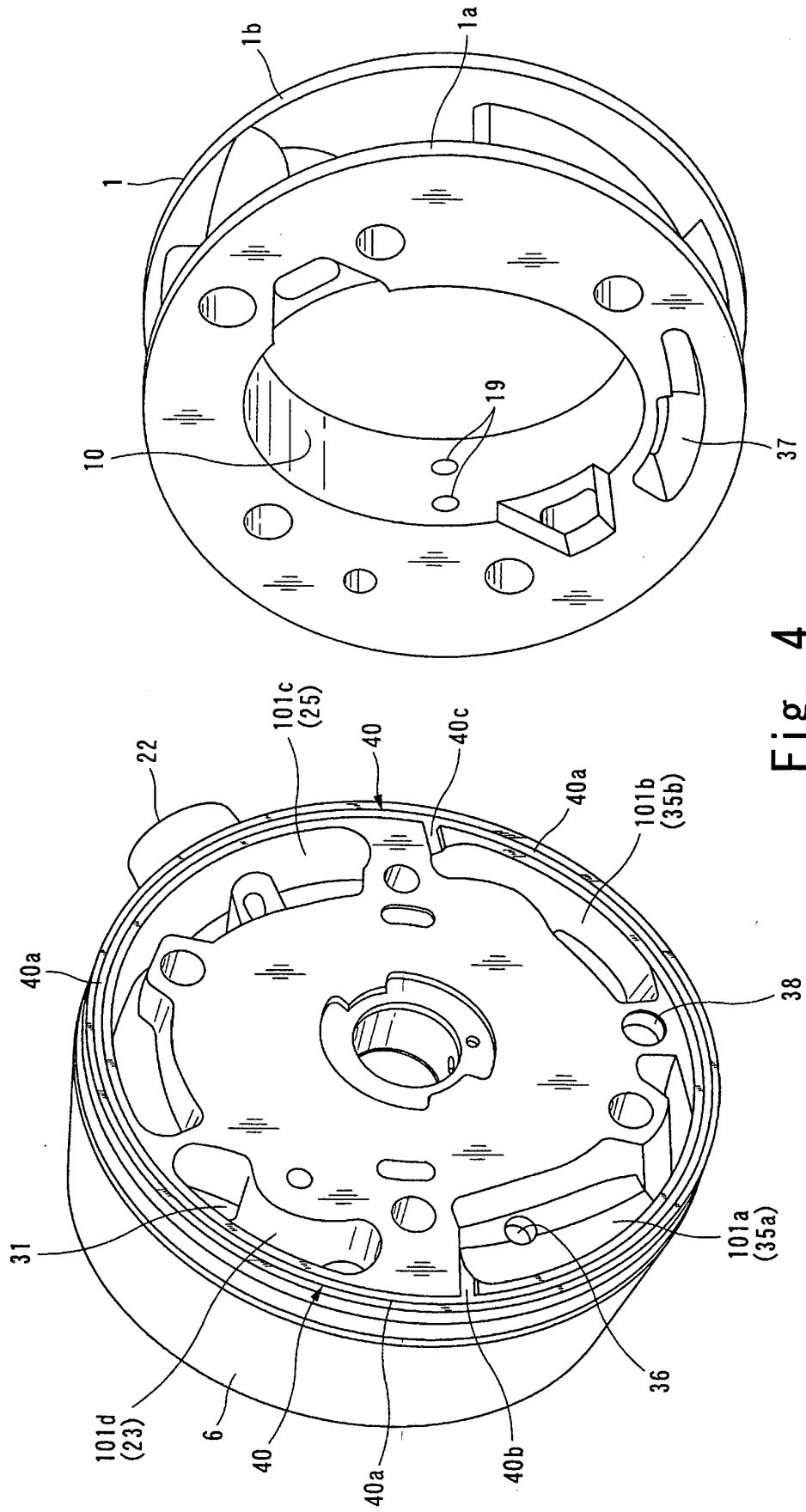


Fig. 3



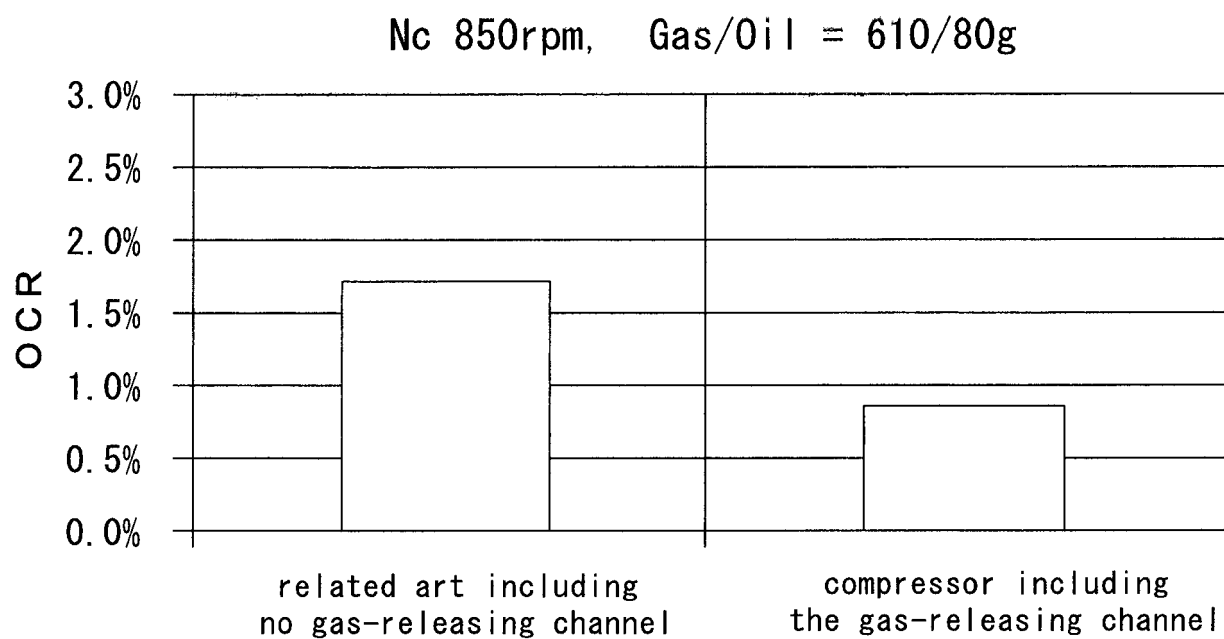


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/065538

A. CLASSIFICATION OF SUBJECT MATTER

F04C29/02(2006.01)i, F04C18/344(2006.01)i, F04C29/00(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)

F04C29/02, F04C18/344, F04C29/00

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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 A	JP 2008-196421 A (Sanden Corp.), 28 August 2008 (28.08.2008), paragraphs [0065] to [0068]; fig. 26 to 28 & US 2010/0095702 A1 paragraphs [0123] to [0126]; fig. 26 to 28	1-3, 7 4-6
A	JP 2005-171859 A (Sanden Corp.), 30 June 2005 (30.06.2005), & US 2005/0129536 A1	1-7
A	JP 2006-29280 A (Mitsubishi Heavy Industries, Ltd.), 02 February 2006 (02.02.2006), (Family: none)	1-7

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
09 August 2016 (09.08.16)Date of mailing of the international search report
16 August 2016 (16.08.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 11082353 A [0005]