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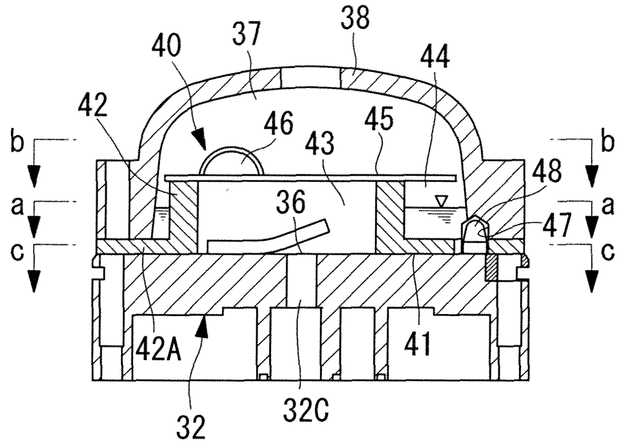
(54) SCROLL COMPRESSOR

(57) A scroll compressor equipped with an oil separation mechanism that can ensure a sufficient capacity of an oil storage chamber even if a discharge reed valve is made long and that can prevent blow-by of compressed gas from an oil ejection port towards a low-pressure side is provided. In a scroll compressor (3) in which an oil separation chamber (37) is formed by providing a discharge cover (38) on a rear surface of a fixed-scroll member (32) provided with a discharge port (32C), and an oil separation mechanism (40) is provided within the oil separation chamber (37), the oil separation mechanism (40) includes a cylindrical partition member (42) that partitions an interior of the oil separation chamber (37) into an inner-peripheral-side gas discharge chamber (43) and an outer-peripheral-side oil storage chamber (44), and a separator plate (45) that closes an upper surface of the partition member (42), and the partition member (42) is disposed eccentrically in a disposed direction of a discharge reed valve (36) provided on the discharge port (32C).

FIG. 2



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Description

Technical Field

[0001] The present invention relates to scroll compressors provided with an oil separation mechanism on a rear surface of a fixed-scroll member that discharges compressed gas.

Background Art

[0002] In gas-compression-type refrigerating/air-conditioning devices, a portion of lubricating oil supplied for lubricating a sliding section of a compressor merges with refrigerant gas compressed in the compressor and is carried away towards a refrigerant circuit. It is known from the past that this lubricating oil inhibits heat exchange in heat exchangers at the refrigerant-circuit side and is a factor that reduces system efficiency, and that too much of this oil carried away towards the refrigerant circuit can cause a shortage of lubricating oil in the compressor. To reduce the oil circulation ratio (OCR) [i.e., the ratio of the mass flow rate of oil to the total mass flow rate (refrigerant flow rate + oil flow rate)] of lubricating oil circulating to the refrigerant-circuit side, many types of compressors having oil separation mechanisms provided therein have been proposed and put into practical use.

[0003] Patent Document 1 discloses a sealed-type scroll compressor in which an oil separation mechanism is provided within a high-pressure chamber. This oil separation mechanism is configured by forming a discharge-valve surrounding chamber by providing a surrounding cover such that it covers a discharge port provided in a discharge cover joined to a fixed-scroll member, attaching an injection pipe to this discharge-valve surrounding chamber, opening one open end of the injection pipe at an acute angle relative to a tangential direction of an inner peripheral wall surface of a high-pressure chamber, and forming an annular oil-reservoir groove where oil separated at the outer peripheral side of the discharge-valve surrounding chamber accumulates.

[0004] Patent Document 1:
Japanese Unexamined Patent Application, Publication No. 2001-248577

Disclosure of Invention

[0005] However, the configuration disclosed in Patent Document 1 has a problem in that, since the annular oil-reservoir groove and the discharge-valve surrounding chamber are provided concentrically with each other on the same axis, if a discharge valve formed of a reed valve is made long, the annular oil-reservoir groove becomes small, making it impossible to ensure a sufficient capacity. Another problem is that, since the oil accumulated in the annular oil-reservoir groove moves in an orbit with an orbiting flow of compressed gas, if the amount of oil is low, the compressed gas blows out toward the low-pressure side through an oil ejection port that returns the separated oil to an oil storage section in a low-pressure area, resulting in a compression loss.

[0006] The present invention has been made in view of these circumstances, and an object thereof is to provide a scroll compressor equipped with an oil separation mechanism that can ensure a sufficient capacity of an oil storage chamber even if a discharge reed valve is made long and that can prevent blow-by of compressed gas from an oil ejection port towards a low-pressure side.

[0007] In order to solve the aforementioned problems, a scroll compressor according to the present invention provides the following solutions.
Specifically, in one aspect of a scroll compressor according to the present invention in which an oil separation chamber is formed by providing a discharge cover on a rear surface of a fixed-scroll member provided with a discharge port, and an oil separation mechanism is provided within the oil separation chamber, the oil separation mechanism includes a cylindrical partition member that partitions an interior of the oil separation chamber into an inner-peripheral-side gas discharge chamber and an outer-peripheral-side oil storage chamber, and a separator plate that closes an upper surface of the partition member, and the partition member is disposed eccentrically in a disposed direction of a discharge reed valve provided on the discharge port.

[0008] According to the above aspect, since the cylindrical partition member that partitions the interior of the oil separation chamber into the gas discharge chamber and the oil storage chamber is disposed eccentrically in the disposed direction of the discharge reed valve provided on the discharge port, the capacity of the oil storage chamber can be sufficiently increased even if the discharge reed valve is made sufficiently long. In consequence, in addition to allowing for smooth operation of the discharge reed valve, a sufficient capacity of the oil storage chamber can be ensured, and the oil separation function of the oil separation mechanism can be enhanced.

[0009] Furthermore, the above aspect may employ a configuration in which the separator plate is provided with an outlet through which compressed gas blows out from the gas discharge chamber towards the oil separation chamber, and the outlet is provided at a position corresponding to an outer peripheral area of a maximum eccentric section of the eccentrically-disposed partition member.

[0010] With the above configuration, since the outlet for compressed gas provided in the separator plate is provided at a position corresponding to the outer peripheral area of the maximum eccentric section of the partition member, the compressed gas can be blown out from the gas discharge chamber towards the oil storage chamber, without using a gas outlet pipe, at a position closer to an inner peripheral wall surface of the discharge cover corresponding to the maximum diameter of the oil storage chamber. Therefore, the configuration of the oil separation mechanism can be simplified and the oil can be centrifugally separated efficiently by utilizing the centrifugal force to the utmost, thereby enhancing the oil separation efficiency.

[0011] Furthermore, in the above configuration, the outlet may be open at a predetermined angle towards an inner peripheral wall surface of the discharge cover.

[0012] With the above configuration, since the outlet is open at a predetermined angle towards the inner peripheral wall surface of the discharge cover, the compressed gas is blown out from the outermost peripheral area of the oil storage chamber at the predetermined angle towards the inner peripheral wall surface of the discharge cover so as to be given an orbiting flow, causing the oil to be centrifugally separated therefrom. In consequence, the centrifugal separation effect for oil is enhanced to the utmost, whereby the oil can be centrifugally separated efficiently.

[0013] Furthermore, the above configuration may be such that, in any one of the above scroll compressors, when the position of the outlet is defined as 0 degrees and an angle relative to an orbiting direction of the compressed gas blown out from the outlet is denoted by θ, an oil ejection port that ejects oil from the oil storage chamber to a low-pressure area may be disposed at a position corresponding to an angle θ of 180 to 360 degrees.

[0014] With the above configuration, since the oil ejection port that ejects oil is disposed at a position of 180 to 360 degrees relative to the orbiting direction of the compressed gas relative to the position of the outlet, the disposed position of the oil ejection port can be set at a position where the oil separated in the oil storage chamber tends to gather the most due to the effect of a pressure drop caused by the eccentric disposition of the partition member. Thus, the oil ejection port can be constantly liquid-sealed by the separated oil, and a compression loss caused by the compressed gas blowing out from the oil ejection port towards the low-pressure side can be suppressed.

[0015] Furthermore, in the above configuration, the oil ejection port may be in communication with the oil storage chamber and be provided on an outer side of an outer periphery thereof.

[0016] With the above configuration, since the oil ejection port is in communication with the oil storage chamber and is provided on the outer side of the outer periphery thereof, the oil can be reliably guided to the oil ejection port even as the oil moves in an orbit with the orbiting flow of the compressed gas within the oil storage chamber, whereby the oil ejection port can be liquid-sealed by the oil. In consequence, blow-by of the compressed gas from the oil ejection port can be reliably prevented.

[0017] Furthermore, the above configuration may be configured such that, in any one of the above scroll compressors, the separator plate is concentric with an inner peripheral wall surface of the discharge cover and is provided so as to cover an upper surface of the oil storage chamber.

[0018] With the above configuration, since the separator plate is concentric with the inner peripheral wall surface of the discharge cover and is provided so as to cover the upper surface of the oil storage chamber, the separator plate can uniformly cover the upper surface of the oil storage chamber while maintaining a uniform gap therearound, regardless of whether the partition member is eccentrically disposed. This can suppress lifting of the separated oil within the oil storage chamber caused by the compressed gas, thereby enhancing the oil separation efficiency.

[0019] Furthermore, in the above configuration, a gap of 1 mm to 2 mm may be formed between the separator plate and the inner peripheral wall surface of the discharge cover.

[0020] With the above configuration, since the gap of 1 mm to 2 mm is formed between the separator plate and the inner peripheral wall surface of the discharge cover, the gap can be reliably ensured and can compensate for an installation error, if any, in the separator plate and allow the separated oil to fall into the oil storage chamber. Consequently, while ensuring an oil drop gap, lifting of the oil within the oil storage chamber caused by the compressed gas can be minimized.

[0021] Furthermore, any one of the above scroll compressors may employ a configuration in which the partition member is formed as a separate component from the fixed-scroll member and a decompression mechanism that decompresses the oil ejected from the oil ejection port to the low-pressure area is provided between mating surfaces of the partition member and the fixed-scroll member.

[0022] With the above configuration, since the partition member is formed as a separate component from the fixed-scroll member and the decompression mechanism that decompresses the oil ejected from the oil ejection port to the low-pressure area is provided between the mating surfaces of the partition member and the fixed-scroll member, the decompression mechanism that decompresses high-pressure oil separated in the oil separation chamber to a low-pressure state before ejecting the oil can be disposed by utilizing the mating surfaces of the separately-formed partition member and fixed-scroll member. This eliminates the need to ensure an extra space for installing the decompression mechanism and allows for compactness as well as a simplified rear-surface configuration of the fixed-scroll member, whereby machining of the fixed-scroll member, which requires high machining accuracy, can be facilitated.

[0023] Furthermore, in the above configuration, the decompression mechanism may be constituted of a fine groove provided in a gasket that is interposed between the partition member and the fixed-scroll member and that forms a seal between the two members.

[0024] With the above configuration, since the decompression mechanism is constituted of the fine groove provided in the sealing gasket interposed between the partition member and the fixed-scroll member, the decompression mechanism can be formed using the sealing gasket. This eliminates the need to provide a dedicated component as the decompression mechanism, thereby achieving a simplified configuration and cost reduction.

[0025] Furthermore, in the above configuration, the fine groove may be provided around substantially the entire circumference along a cylindrical segment of the partition member.

[0026] With the above configuration, since the fine groove provided in the gasket is provided around substantially the entire circumference along the cylindrical segment of the partition member, a sealing effect can be expected from the oil flowing through the fine groove in addition to the sealing effect by the gasket. In consequence, the sealability by the gasket between the partition member and the fixed-scroll member can be further enhanced.

[0027] According to the present invention, since the capacity of the oil storage chamber can be sufficiently increased, even if the discharge reed valve is made sufficiently long, by disposing the cylindrical partition member, which partitions the interior of the oil separation chamber into the gas discharge chamber and the oil storage chamber, eccentrically in the disposed direction of the discharge reed valve, the discharge reed valve can be smoothly operated, as well as ensuring a sufficient capacity of the oil storage chamber and enhancing the oil separation function of the oil separation mechanism.

Brief Description of Drawings

[0028]

[FIG. 1] Fig. 1 is a longitudinal sectional view of a multistage compressor to which a scroll compressor according to an embodiment of the present invention is applied.

[FIG. 2] Fig. 2 is enlarged longitudinal sectional view of a part of an oil separation mechanism of the scroll compressor shown in Fig. 1.

[FIG. 3] Fig. 3 is a diagram corresponding to a cross section taken along line a-a in the part of the oil separation mechanism shown in Fig. 2.

[FIG. 4] Fig. 4 is a diagram corresponding to a cross section taken along line b-b in the part of the oil separation mechanism shown in Fig. 2.

[FIG. 5] Fig. 5 is a diagram corresponding to a cross section taken along line c-c in the part of the oil separation mechanism shown in Fig. 2.

Explanation of Reference:

[0029]

1: multistage compressor
3: scroll compressor
32: fixed-scroll member
32C: discharge port
36: discharge reed valve
37: oil separation chamber
38: discharge cover
40: oil separation mechanism
41: gasket
42: partition member
43: gas discharge chamber
44: oil storage chamber
45: separator plate
46: outlet
47: oil ejection port
49: fine groove
50: decompression mechanism

Best Mode for Carrying Out the Invention

[0030] An embodiment according to the present invention will be described below with reference to Figs. 1 to 5. Fig. 1 is a longitudinal sectional view of a multistage compressor 1 for refrigerating/air-conditioning, to which a scroll compressor according to an embodiment of the present invention is applied. In this embodiment, although a scroll compressor 3 according to an embodiment of the present invention is described as being used in a multistage compressor 1 configured by applying a rotary compressor 2 for the low-stage side and the scroll compressor 3 for the high-stage side as an example for the sake of convenience, the present invention can also be applied to a single-stage scroll compressor or to a multistage scroll compressor with scroll compressors for both the low-stage side and the high-stage side.

[0031] The multistage compressor 1 using the scroll compressor 3 includes a sealed housing 10. The sealed housing 10 is constituted of a cylindrical center housing 10A, an annular bearing bracket 11 provided above the center housing 10A by welding around the entire circumference, a lower housing 10B that seals a lower section of the center housing 10A, and an upper housing 10C that is provided above the bearing bracket 11 by welding around the entire circumference and that seals an upper section of the center housing 10A.

[0032] An electric motor 4 formed of a stator 5 and a rotor 6 is fixedly disposed in a substantially central section inside the center housing 10A. A rotary shaft (crankshaft) 7 is integrally joined to the rotor 6. The low-stage rotary compressor 2 is disposed below the electric motor 4. The low-stage rotary compressor 2 is configured by including a cylinder body 21 having a cylinder chamber 20 and fixedly disposed inside the center housing 10A, an upper bearing 22 and a lower bearing 23 fixedly disposed above and below the cylinder body 21, respectively, so as to seal upper and lower sections of the cylinder chamber 20, a rotor 24 fitted to a crank portion 7A of the rotary shaft 7 and rotating within an inner peripheral surface of the cylinder chamber 20, and a blade retaining spring and a blade (not shown) that partition the interior of the cylinder chamber 20 into an intake side and a discharge side.

[0033] This low-stage rotary compressor 2 is configured to take low-pressure refrigerant gas (working gas) into the cylinder chamber 20 through an intake pipe 25, compress this refrigerant gas to intermediate pressure by rotating the rotor 24, then discharge the refrigerant gas into upper and lower discharge chambers 26 and 27 by using the upper bearing 22 and the lower bearing 23, and discharge the refrigerant gas into the center housing 10A after the refrigerant gas merges inside the discharge chamber 26. This intermediate-pressure refrigerant gas is guided to a space above the electric motor 4 by flowing through a gas channel hole 6A or the like provided in the rotor 6 of the electric motor 4, and is then taken in by the high-stage scroll compressor 3 so as to be compressed in two stages.

[0034] The high-stage scroll compressor 3 is provided inside the upper housing 10C. The scroll compressor 3 includes a bearing member 31 (also called a frame member or a supporting member) fixedly disposed on an upper surface of the bearing bracket 11 with a bolt 12 and provided with a bearing 30 that supports the rotary shaft (crankshaft) 7, and a fixed-scroll member 32 and an orbiting scroll member 33 that have spiral wraps 32B and 33B erected on end plates 32A and 33A, respectively, and that form a pair of compression chambers 34 by engaging the spiral wraps 32B and 33B with each other and mounting them on the bearing member 31.

[0035] The scroll compressor 3 is configured by also including an orbiting boss 33C that joins the orbiting scroll member 33 to an eccentric pin 7B of the rotary shaft 7 via a drive bush 13 so as to cause the orbiting scroll member 33 to revolve in an orbit, a self-rotation preventing mechanism 35 that is provided between the orbiting scroll member 33 and the bearing member 31 and allows the orbiting scroll member 33 to revolve in an orbit while preventing it from self-rotating, a discharge reed valve 36 (see Fig. 2) that is provided on a rear surface of the fixed-scroll member 32 and that opens and closes a discharge port 32C, a discharge cover 38 that is fixedly disposed at the rear surface of the fixed-scroll member 32 so as to surround the discharge reed valve 36, forming an oil separation chamber 37, a discharge pipe 39 that is connected to a central section of the discharge cover 38 and discharges compressed high-temperature high-pressure gas outward, and an oil separation mechanism 40 that is disposed inside the oil separation chamber 37 and separates oil from the compressed gas.

[0036] The aforementioned scroll compressor 3 is configured to take the intermediate-pressure refrigerant gas discharged to the sealed housing 10 after being compressed by the low-stage rotary compressor 2 into the compression chambers 34, perform a compressing operation by revolving the orbiting scroll member 33 in an orbit so as to compress this intermediate-pressure refrigerant gas to an even higher pressure state, and then discharge the refrigerant gas into the oil separation chamber 37 in the discharge cover 38 through the discharge reed valve 36. After oil in this high-temperature high-pressure refrigerant gas is removed by the oil separation mechanism 40 in the oil separation chamber 37, the gas is delivered outside the multistage compressor 1, i.e., a refrigeration-cycle side, through the discharge pipe 39.

[0037] Furthermore, a known positive-displacement oil pump 14 is fitted between the lowermost end of the rotary shaft (crankshaft) 7 and the lower bearing 23 of the low-stage rotary compressor 2. This positive-displacement oil pump 14 is configured to pump up lubricating oil 15 that fills the bottom of the sealed housing 10 so as to forcedly supply the lubricating oil 15 to desired sections to be lubricated, such as the bearings in the rotary compressor 2 and the scroll compressor 3, through an oil hole 16 provided in the rotary shaft 7.

[0038] The configuration of the oil separation mechanism 40 will be described below in detail.

As shown in Figs. 2 to 5, the oil separation mechanism 40 includes the oil separation chamber 37 with a cylindrical shape formed by the inner peripheral surface of the discharge cover 38, and a cylindrical partition member 42 fixedly disposed, within the oil separation chamber 37, on the rear surface of the fixed-scroll member 32 together with the discharge cover 38 via a gasket 41. The partition member 42 is formed as a separate component from the fixed-scroll member 32 and has a flange 42A at a lower section thereof, and is tightly fixed to the rear surface of the fixed-scroll member 32 together with the discharge cover 38 via the flange 42A.

[0039] As shown in Figs. 2 and 3, the partition member 42 is disposed eccentrically to the cylindrical oil separation chamber 37, formed by the inner peripheral surface of the discharge cover 38, in the disposed direction of the discharge reed valve 36, and partitions the interior of the oil separation chamber 37 into an inner-peripheral-side gas discharge chamber 43 surrounding the discharge reed valve 36 and an outer-peripheral-side oil storage chamber 44. By disposing the partition member 42 in such an eccentric manner, the oil storage chamber 44 is given a shape with a small radial width in the disposed direction of the discharge reed valve 36 and a large radial width at the opposite side; in consequence, the oil storage chamber 44 can have a larger capacity as compared with a case where the partition member 42 is provided concentrically with the discharge cover 38 so as to surround the discharge reed valve 36.

[0040] A separator plate 45 is fixedly disposed on an upper surface of the partition member 42 by using several screws. The separator plate 45 is concentric with the inner peripheral surface of the discharge cover 38 and is attached so as to uniformly cover an upper surface of the oil storage chamber 44 while maintaining a uniform gap of about 1 mm to 2 mm therearound. The separator plate 45 is provided with an outlet 46 for blowing out compressed gas from the gas discharge chamber 43 towards the oil storage chamber 44. This outlet 46 is formed by press molding a section of the separator plate 45 into an upward-protruding arch shape and then opening one end thereof in a semicircular shape.

[0041] The outlet 46 is provided at a position corresponding to an outer peripheral area of a maximum eccentric section of the partition member 42 disposed eccentrically in the disposed direction of the discharge reed valve 36, that is, an upper-left area of the oil storage chamber 44 shown in Fig. 4, and is open at a predetermined angle in a tangential direction towards the inner peripheral surface of the discharge cover 38. By opening the outlet 46 in this manner, the compressed gas can be blown out in the form of an orbiting flow from an outermost peripheral area within the oil storage chamber 44 towards the inner peripheral surface of the discharge cover 38.

[0042] Supposing that the disposed position of the aforementioned outlet 46 is 0 degrees, an oil ejection port 47 for ejecting the oil separated by the oil separation mechanism 40 from the oil storage chamber 44 to a low-pressure area within the sealed housing 10 is disposed at a position at which an angle θ relative to the orbiting direction of the compressed gas blown out from the outlet 46 is from 180 to 360 degrees. This oil ejection port 47 is formed in an inner wall of the discharge cover 38 so as to face the inner peripheral surface thereof, and is in communication with the oil storage chamber 44 and is provided at a position on the outer side of the outer periphery thereof. A strainer 48 is fitted in the oil ejection port 47.

[0043] The aforementioned oil ejection port 47 extends through the flange 42A of the partition member 42 and is in communication with a fine groove 49 (see Fig. 5) provided in the sealing gasket 41 interposed between mating surfaces of the rear surface of the fixed-scroll member 32 and the partition member 42. The gasket 41 is formed by coating a surface of an iron plate with an elastic material, and the fine groove 49 formed by cutting this gasket 41 in the thickness direction thereof is provided around substantially the entire circumference along a cylindrical segment of the partition member 42 and then meanders therefrom several times in an area opposite to the direction of eccentricity of the partition member 42. This fine groove 49 constitutes a decompression mechanism 50 that decompresses high-pressure oil to a low-pressure state before returning it to the low-pressure area within the sealed housing 10.

[0044] The other end of the fine groove 49 is in communication with an oil drop hole 51 provided in an outer peripheral area of the end plate 32A of the fixed-scroll member 32, and in an oil drop hole 52 provided in the bearing member 31, this oil drop hole 51 is configured to merge with an oil drainage hole 53, provided in the bearing member 31 for draining lubricating oil after being used for bearing lubrication, within the bearing member 31 and then allows the oil to flow down near the inner peripheral surface of the center housing 10A through an oil drainage pipe 54 fitted to the bearing bracket 11.

[0045] With the above-described configuration, this embodiment provides the following advantages. Low-temperature low-pressure refrigerant gas taken into the cylinder chamber 20 of the low-stage rotary compressor 2 through the intake pipe 25 is compressed to intermediate pressure by the rotation of the rotor 24 and is subsequently discharged into the discharge chambers 26 and 27. After merging inside the discharge chamber 26, this intermediate-pressure refrigerant gas is discharged into a space below the electric motor 4 and then flows therefrom to a space above the electric motor 4 by passing through the gas channel hole 6A or the like provided in the rotor 6 of the electric motor 4.

[0046] The intermediate-pressure refrigerant gas flowing into the space above the electric motor 4 travels through a gas channel (not shown) formed on the outer periphery or the like of the bearing member 31 constituting the high-stage scroll compressor 3 and is guided to an intake (not shown) provided in the fixed-scroll member 32 so as to be taken into the compression chambers 34. After being compressed in two stages to a high-temperature high-pressure state by a compressing operation performed by revolving the orbiting scroll member 33 in an orbit, the intermediate-pressure refrigerant gas is discharged from the discharge port 32C into the discharge cover 38 via the discharge reed valve 36.

[0047] In the two-stage compressing process mentioned above, a portion of the lubricating oil 15 supplied by the oil pump 14 for lubricating the low-stage rotary compressor 2 is merged with the refrigerant gas and is discharged into the sealed housing 10 together with the intermediate-pressure refrigerant gas. Furthermore, a portion of the lubricating oil 15, flowing down to the bottom of the sealed housing 10 after being supplied to the high-stage scroll compressor 3 through the oil hole 16 to lubricate the scroll compressor 3, merges with the intermediate-pressure refrigerant gas. The intermediate-pressure refrigerant gas merged with the lubricating oil 15 is taken in and compressed by the scroll compressor 3 while still containing the oil, and becomes high-temperature high-pressure gas which is subsequently discharged from the discharge port 32C together with the oil.

[0048] The compressed high-temperature high-pressure gas containing the oil is first discharged into the gas discharge chamber 43 and is then blown out therefrom towards the oil storage chamber 44 through the outlet 46, provided in the separator plate 45, at a predetermined angle in the tangential direction from the outermost peripheral area of the oil storage chamber 44 towards the inner peripheral surface of the discharge cover 38. Therefore, the compressed gas is given an orbiting flow, and the oil contained in the compressed gas is separated therefrom by a centrifugal force produced by the orbiting flow so as to drop down to the bottom of the oil storage chamber 44. The compressed gas separated from the oil is discharged towards the refrigeration-cycle side through the discharge pipe 39 connected to the central section of the discharge cover 38. Consequently, the oil circulation ratio (OCR) of the lubricating oil 15 circulating to the refrigeration-cycle side can be reduced, thereby improving the system efficiency, as well as preventing a shortage of lubricating oil in the compressor 1.

[0049] On the other hand, the oil separated in the oil storage chamber 44 drops further down from the periphery of the separator plate 45 so as to accumulate at the bottom of the oil storage chamber 44. The effect of the orbiting flow of the compressed gas causes this oil to move in an orbit in the same direction; but because the partition member 42 is eccentrically disposed within the oil storage chamber 44, the oil tends to gather in the vicinity of the opening area of the oil ejection port 47 due to a pressure drop in the narrow area in the direction of eccentricity. Thus, the oil ejection port 47 can be constantly maintained in a liquid-sealed state by the oil, and after decompressing the high-pressure oil to low pressure with the decompression mechanism 50 constituted of the fine groove 49 provided in the gasket 41, the oil can be ejected to the low-pressure area within the sealed housing 10 via the oil drop holes 51 and 52 and the oil drainage pipe 54 so as to flow down therefrom to the bottom of the sealed housing 10.

[0050] As mentioned above, with this embodiment, since the cylindrical partition member 42 that partitions the interior of the oil separation chamber 37 into the gas discharge chamber 43 and the oil storage chamber 44 is disposed eccentrically in the disposed direction of the discharge reed valve 36, the capacity of the oil storage chamber 44 can be sufficiently increased even if the discharge reed valve 36 is made sufficiently long. In consequence, in addition to allowing for smooth operation of the discharge reed valve 36, a sufficient capacity of the oil storage chamber 44 can be ensured, and the oil separation function of the oil separation mechanism 40 can be enhanced.

[0051] Moreover, since the outlet 46 for blowing out compressed gas from the gas discharge chamber 43 to the oil storage chamber 44 is provided at a position in the separator plate 45 that corresponds to the outer peripheral area of the maximum eccentric section of the partition member 42, the compressed gas can be blown out at a predetermined angle in the tangential direction towards the inner peripheral surface of the discharge cover 38, without using a gas outlet pipe, at a position closer to the inner peripheral wall surface of the discharge cover 38 corresponding to the maximum diameter of the oil storage chamber 44. Therefore, the configuration of the oil separation mechanism 40 can be simplified and the oil can be centrifugally separated efficiently by utilizing the centrifugal force to the utmost, thereby enhancing the oil separation efficiency.

[0052] Furthermore, since the separator plate 45 is concentric with the inner peripheral surface of the oil storage chamber 44 and is attached so as to uniformly cover the upper surface of the oil storage chamber 44 while maintaining a uniform gap of about 1 mm to 2 mm therearound, the surrounding narrow gap can be reliably ensured and can compensate for an installation error, if any, in the separator plate 45 and allow the separated oil to fall into the oil storage chamber 44, in addition to minimizing lifting of the separated oil within the oil storage chamber 44 caused by the compressed gas, thereby enhancing the oil separation efficiency. It is preferable that the gap surrounding the separator plate 45 be made as narrow as possible from the viewpoint of suppressing lifting of the oil caused by the compressed gas.

[0053] Supposing that the disposed position of the outlet 46 is 0 degrees, the oil ejection port 47 for ejecting the oil separated in the oil storage chamber 44 to the low-pressure area within the sealed housing 10 is disposed at a position at which an angle θ relative to the orbiting direction of the compressed gas blown out from the outlet 46 is from 180 to 360 degrees. Therefore, the disposed position of the oil ejection port 47 can be set at a position where the oil separated in the oil storage chamber 44 tends to gather the most due to the effect of a pressure drop caused by the eccentric disposition of the partition member 42. Thus, the oil ejection port 47 can be constantly liquid-sealed by the separated oil, and a compression loss caused by the compressed gas blowing out from the oil ejection port 47 towards the low-pressure side can be suppressed. In addition, since the oil ejection port 47 is in communication with the oil storage chamber 44 and is provided on the outer side of the outer periphery thereof, the oil can be guided to the oil ejection port 47 even as the oil moves in an orbit with the orbiting flow of the compressed gas within the oil storage chamber 44, whereby the oil ejection port 47 can be liquid-sealed by the oil. In consequence, blow-by of the compressed gas from the oil ejection port 47 can be reliably prevented.

[0054] Furthermore, since the fixed-scroll member 32 and the partition member 42 are formed as separate components and the decompression mechanism 50 that decompresses the oil ejected to the low-pressure area within the sealed housing 10 from the oil ejection port 47 is formed by providing the fine groove 49 in the sealing gasket 41 interposed between the mating surfaces of the fixed-scroll member 32 and the partition member 42, it eliminates the need to provide a dedicated component as the decompression mechanism 50 and also the need to ensure an extra space for installing the decompression mechanism 50, thereby allowing for compactness, as well as achieving a simplified configuration and cost reduction. Moreover, since the rear-surface configuration of the fixed-scroll member 32 can be simplified, machining of the fixed-scroll member 32, which requires high machining accuracy, can be facilitated. In addition, since the fine groove 49 is provided around substantially the entire circumference along the cylindrical segment of the partition member 42, a sealing effect can be expected from the oil flowing through the fine groove 49 in addition to the sealing effect by the gasket 41. In consequence, the sealability by the gasket 41 between the partition member 42 and the fixed-scroll member 32 can be further enhanced.

[0055] The present invention is not limited to the invention according to the above embodiment, and suitable modifications are permissible so long as they do not depart from the gist of the invention. For example, although the scroll compressor 3 according to the above embodiment is also applicable to refrigeration-cycle compressors that use any kind of refrigerant (working gas), other than R410A refrigerant or CO2 refrigerant, the scroll compressor 3 is suitable for use with CO2 refrigerant, which is particularly a high-pressure refrigerant. Specifically, because CO2 refrigerant has high pressure and high density and oil separation is thus difficult, the scroll compressor 3 according to the present invention with a high centrifugal separation effect for oil is effective since higher oil separation performance is required. Furthermore, although it may be necessary to increase the sealing effect due to an increase in pressure difference, the scroll compressor 3 according to the present invention is effective for a high-pressure refrigerant in view of the fact that a sealing effect can be expected from the oil flowing through the fine groove 49 constituting the decompression mechanism 50, in addition to the gasket 41.

[0056] Furthermore, although the partition member 42 is formed as a separate component from the fixed-scroll member 32 in the above embodiment, the present invention is not limited to this, and the partition member 42 may alternatively be integrally molded to the rear surface of the end plate 32A of the fixed-scroll member 32. In that case, however, regarding the decompression mechanism 50 for decompressing the separated oil and ejecting the oil to the low-pressure area within the sealed housing 10, a configuration in which, for example, a decompression mechanism 50 is provided by inserting a pin having a spiral groove on the outer periphery thereof into an oil ejection hole provided in the end plate 32A of the fixed-scroll member 32 may be employed.

Claims

1. A scroll compressor in which an oil separation chamber is formed by providing a discharge cover on a rear surface of a fixed-scroll member provided with a discharge port, and an oil separation mechanism is provided within the oil separation chamber,
wherein the oil separation mechanism includes a cylindrical partition member that partitions an interior of the oil separation chamber into an inner-peripheral-side gas discharge chamber and an outer-peripheral-side oil storage chamber, and a separator plate that closes an upper surface of the partition member, and
wherein the partition member is disposed eccentrically in a disposed direction of a discharge reed valve provided on the discharge port.

2. The scroll compressor according to Claim 1, wherein the separator plate is provided with an outlet through which compressed gas blows out from the gas discharge chamber towards the oil separation chamber, and wherein the outlet is provided at a position corresponding to an outer peripheral area of a maximum eccentric section of the eccentrically-disposed partition member.

3. The scroll compressor according to Claim 2, wherein the outlet is open at a predetermined angle towards an inner peripheral wall surface of the discharge cover.

4. The scroll compressor according to Claim 2 or 3, wherein when the position of the outlet is defined as 0 degrees and an angle relative to an orbiting direction of the compressed gas blown out from the outlet is denoted by θ, an oil ejection port that ejects oil from the oil storage chamber to a low-pressure area is disposed at a position corresponding to an angle θ of 180 to 360 degrees.

5. The scroll compressor according to Claim 4, wherein the oil ejection port is in communication with the oil storage chamber and is provided on an outer side of an outer periphery thereof.

6. The scroll compressor according to any one of Claims 1 to 5, wherein the separator plate is concentric with an inner peripheral wall surface of the discharge cover and is provided so as to cover an upper surface of the oil storage chamber.

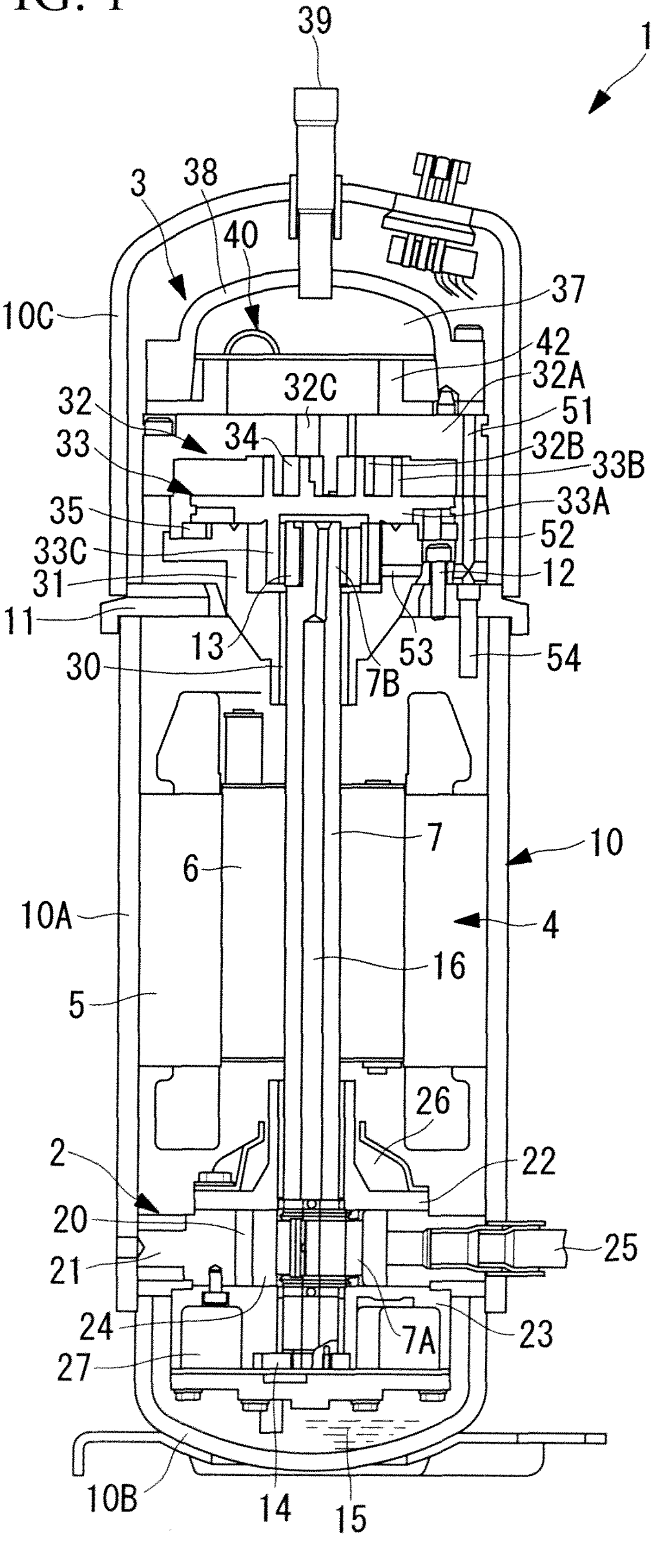
7. The scroll compressor according to Claim 6, wherein a gap of 1 mm to 2 mm is formed between the separator plate and the inner peripheral wall surface of the discharge cover.

8. The scroll compressor according to any one of Claims 4 to 7, wherein the partition member is formed as a separate component from the fixed-scroll member, and wherein a decompression mechanism that decompresses the oil ejected from the oil ejection port to the low-pressure area is provided between mating surfaces of the partition member and the fixed-scroll member.

9. The scroll compressor according to Claim 8, wherein the decompression mechanism is constituted of a fine groove provided in a gasket that is interposed between the partition member and the fixed-scroll member and that forms a seal between the two members.

10. The scroll compressor according to Claim 9, wherein the fine groove is provided around substantially the entire circumference along a cylindrical segment of the partition member.

FIG. 1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33C
31
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7B
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14
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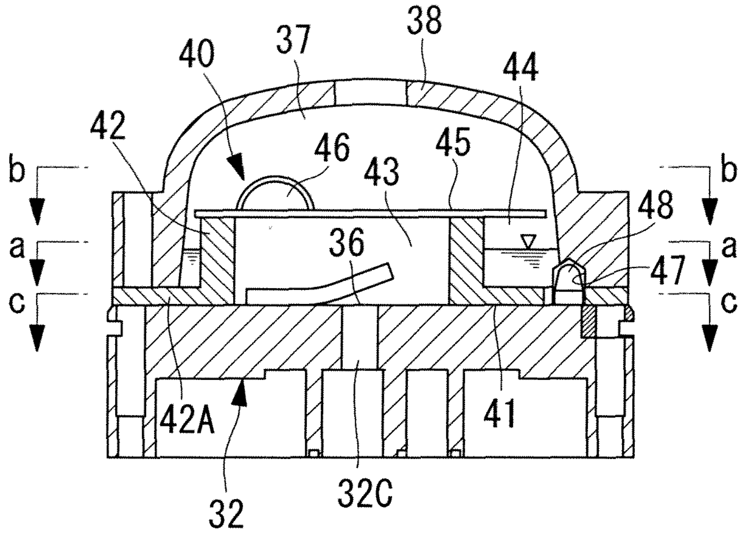
FIG. 2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41
32
32C

FIG. 3

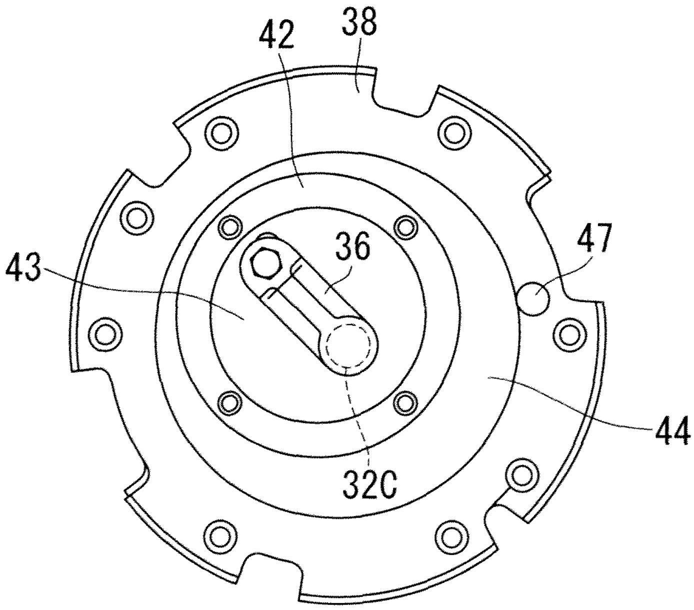
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FIG. 4

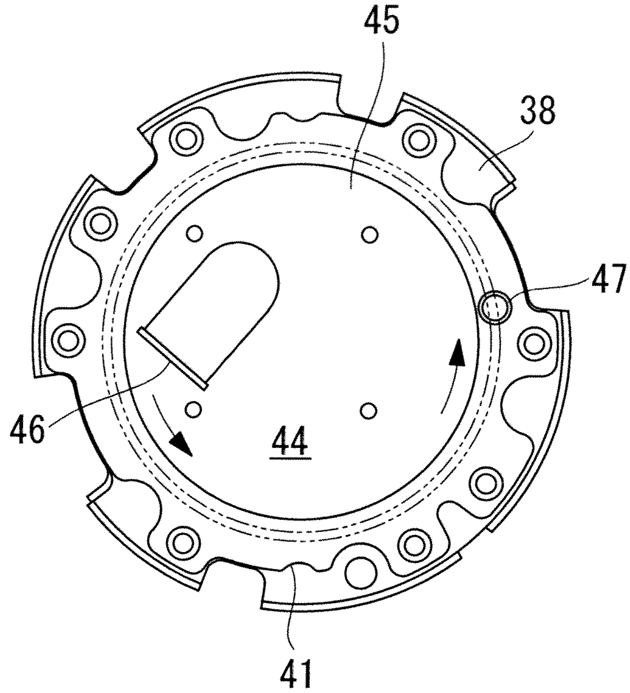
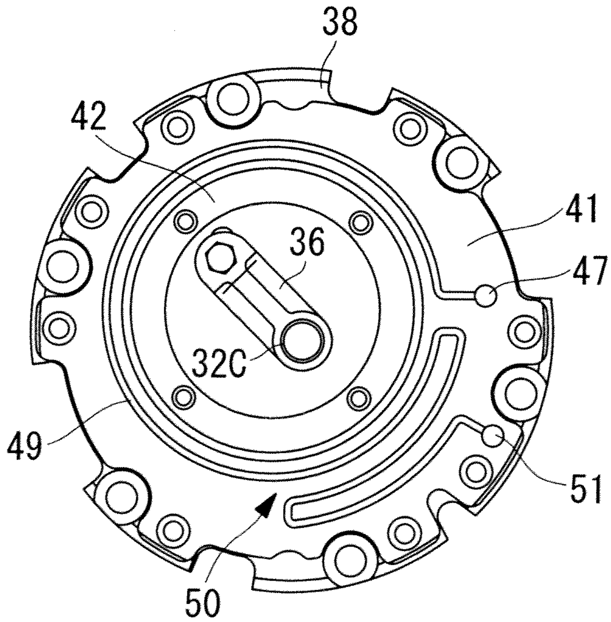


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/050101

A. CLASSIFICATION OF SUBJECT MATTER
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)
F04C18/02, F04C29/02, F04B39/04

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 7-189940 A (Matsushita Electric Industrial Co., Ltd.), 28 July, 1995 (28.07.95), Par. No. [0011]; Figs. 1 to 2 (Family: none)	1-3,6-7 4-5,8-10
Y	JP 2006-336599 A (Matsushita Electric Industrial Co., Ltd.), 14 December, 2006 (14.12.06), Figs. 1 to 6 (Family: none)	1-3,6-7
Y	JP 9-170581 A (Daikin Industries, Ltd.), 30 June, 1997 (30.06.97), Par. Nos. [0039] to [0043]; Fig. 8 (Family: none)	6-7

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

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March, 2009 (16.03.09)	24 March, 2009 (24.03.09)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/050101

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 8-151990 A (Daikin Industries, Ltd.), 11 June, 1996 (11.06.96), Fig. 1 (Family: none)	4
A	JP 61-226587 A (Toshiba Corp.), 08 October, 1986 (08.10.86), Page 4, lower right column, line 20 to page 5, upper left column, line 3; Fig. 1 (Family: none)	5
A	JP 2006-83867 A (Denso Corp., Toyota Industries Corp.), 30 March, 2006 (30.03.06), Par. No. [0018]; Fig. 2 (Family: none)	9

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