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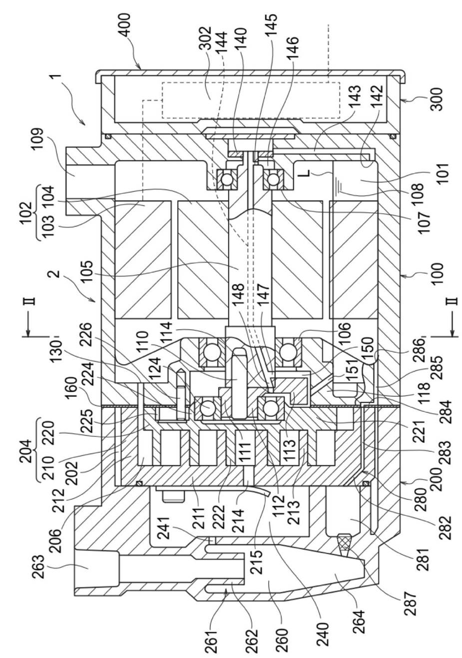
(54) **ELECTRIC COMPRESSOR**

(57) An electric compressor (1) comprises: a housing (2) having a suction port (109) and a discharge port (263) of a working medium; a drive shaft (105); a motor (10 2) for rotating the drive shaft; and a scroll compression mechanism (204) having an orbiting scroll (220) attached to one end of the drive shaft and driven by t he drive shaft, and a fixed scroll (210). An oil pump (140) attached to the othe r end of the drive shaft and driven by the drive shaft supplies oil sucked from an oil storage space (108) at the lower part of a motor chamber (101) to a porti on to be lubricated via an oil supply passage (144) provided inside the drive sh aft (105). Oil contained in the working medium compressed by the scroll compress ion mechanism (204) is separated by an oil separator (261) and returned to the o il storage space (108) via an oil return passage (280).

[FIG. 1]



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Description

[Technical Field]

[0001] The present invention relates to an electric compressor.

[Background Art]

[0002] Patent Document 1 describes a conventional horizontal scroll compressor. In this compressor, oil is drawn from an oil reservoir inside a shell by an oil pump provided at the end of a rotary shaft on the opposite side from a scroll co mpression mechanism, and supplied to bearing sliding parts, etc. The oil that ha s lubricated the bearing sliding parts, etc. is returned to the oil reservoir. I n the compressor of Patent Document 1, an oil flow path and an oil reservoir are provided at the bottom of the shell, while a refrigerant gas flow path is provi ded at the upper end part of the shell. Namely, by substantially separating the flow path of the liquid oil from the flow path of the refrigerant gas, the oil i s prevented from being drawn into the compression chamber of the scroll compress ion mechanism together with the refrigerant gas. Patent Document 1 indicates tha t almost no oil flows into the compression chamber.

[0003] However, if almost no oil flows into the compression chamber as described above, there is concern that the sliding parts or rolling parts of the fixed se roll and orbiting scroll may be damaged due to insufficient lubrication.

[0004] Furthermore, if almost no oil flows into the compression chamber as descr ibed above, it is not possible to ensure airtightness of the compression chamber due to oil, and there is concern that the compression efficiency of the compres sor may decrease.

[0005] To eliminate these concerns, it is conceivable to adopt a configuration t hat allows a sufficient amount of oil to be supplied to the compression chamber, and a configuration that supplies the amount of oil necessary for lubrication t o the compression chamber together with the refrigerant gas, for example. For ex ample, it is conceivable to provide a refrigerant gas intake port of the compres sion chamber also in the lower region of the shell. When a sufficient amount of oil is supplied to the compression chamber, the oil is discharged from the compr ession chamber together with the compressed refrigerant gas and flows out into t he refrigeration cycle outside the compressor. The oil that has flowed out into the refrigeration cycle circulates through the refrigeration cycle and then flow s back into the compressor again from the suction port of the compressor.

[0006] When the refrigeration cycle is operating at low load, the oil that has f lowed out from the compressor does not easily return to the compressor, and thus the amount of oil in the oil reservoir of the shell is reduced, which has the r isk that lubrication may occur within the compressor. In refrigeration cycles us ed in bus air conditioners, refrigerated vehicles, etc., the compressor is often disposed below the vehicle around the engine, and a heat exchanger is often dis posed above the vehicle such as on the roof or the like; therefore the total len gth of piping of the refrigeration cycle is long. In this case, it becomes even more difficult for the oil that has flowed out from the compressor to return to the compressor, making the above-mentioned problems more likely to occur.

[0007] It should be noted that, in the device of Patent Document 1, even if a su fficient amount of oil were supplied to the compression chamber, the same proble ms as those described above would still occur.

[0008] The horizontal scroll compressor disclosed in Patent Document 2 has an oi 1 separator installed in the shell (housing) of the compressor, and minimizes th e amount of oil contained in the working medium that flows out from the compress or to the refrigeration cycle. In the compressor of Patent Document 2, the oil s eparated from the working medium at the oil separator is returned to the space n ear the orbiting scroll in the motor chamber via a through-hole formed inside th e wall of the fixed scroll. This returned oil is used to lubricate the scroll co mpression mechanism, the motor unit, and the sliding parts around it. According to the configuration of Patent Document 2, the problem of oil that has flowed ou t from the compressor into the refrigeration cycle piping not returning sufficie ntly does not occur. Here, "working medium" refers to the medium that circulat es within the refrigeration cycle including the compressor, and includes a refri gerant and oil.

[0009] However, the temperature of the working medium discharged from the scroll compression mechanism during operation is high. Therefore, the temperature of t he oil that has returned via the above path is also high. If high-temperature, 1 ow-viscosity oil is supplied to the bearing sliding parts, etc., there is the ri sk that poor lubrication may occur. Furthermore, if high-temperature oil is supp lied to the scroll compression mechanism, a sufficient amount of the working med ium cannot be supplied to the scroll compression mechanism, and there the risk t hat compression efficiency may decrease.

[Summary of the Invention]

[0010] An object of the present invention is to provide an electric compressor t hat can reliably and appropriately lubricate parts to be lubricated.

[0011] One embodiment of the present invention provides an electric compressor c omprising: a housing having a suction port and a discharge port for a working me dium; a drive shaft rotatably supported in a motor chamber in the housing; a mot or accommodated in the motor chamber in the housing and rotating the drive shaft ; a scroll compression mechanism including a fixed scroll fixed to the housing, and an orbiting scroll attached to one end of the drive shaft and driven by the drive shaft; an oil pump attached to the other end of the drive shaft, driven by the drive shaft, and supplying oil drawn from an oil storage space provided at the bottom of the motor chamber to parts to be lubricated of the scroll compress ion mechanism via an oil supply passage provided inside the drive shaft; and an oil separator provided inside the housing and separating oil contained in the wo rking medium compressed by the scroll compression mechanism from the working med ium, wherein an oil return passage is provided inside the housing for returning the oil separated by the oil separator to the oil storage space of the motor cha mber.

[0012] According to the above embodiment, it is possible to reliably and appropr iately lubricate the parts to be lubricated.

[Brief Description of the Drawings]

[0013]

FIG. 1 is an axial cross-sectional view that schematically illustrates a configu ration of an electric compressor according to an embodiment of the present inven tion.

FIG. 2 is a front view of a wall (partition wall) of a motor chamber on a scroll compression mechanism side as seen from a motor side (corresponding to the view taken along the arrow II-II in FIG. 1).

[0014] FIG. 3 is a perspective view of a balance weight.

[Embodiments of the Invention]

[0015] An embodiment of the present invention will be described below with refer ence to the accompanying drawings.

[0016] As shown in FIG. 1, the electric compressor 1 comprises a housing 2. In t he illustrated embodiment, the housing 2 is mainly formed of a central motor blo ck 100, a compression/discharge block 200 on the left side of the motor block 10 0, an electrical block 300 on the right side of the motor block 100, and a lid b lock 400 that closes the right open end of the electrical block 300. Each of the blocks 100, 200, 300, and 400 is a die-cast product made of an aluminum alloy, for example.

[0017] Adjacent blocks are butted together via a sealing member (not shown) as n eeded, and are firmly fastened together with screws (not shown). Note that it go es without saying that appropriate sealing members are provided as needed not on ly between adjacent blocks but also between adjacent member that require sealing , and that the surface pressure required for sealing is ensured between the cont acting surfaces of the members by means of fastening with screws, for example. I t should be noted that such seals are not necessarily shown, and many of the fas tening means are also not shown.

[0018] A motor chamber (motor accommodation space) 101 in which a motor 102 is a ccommodated is formed inside the motor block 100. The motor 102 has a stator 103 and a rotor 104. The rotor 104 has a plurality of permanent magnets (details no t shown) embedded therein and is fixed to a drive shaft (rotating shaft) 105.

[0019] The drive shaft 105 is supported by a housing 2 (the motor block 100 in t he illustrated example) via bearings (rolling bearings) 106 and 107 so as to be rotatable about a rotation axis extending in the horizontal direction. The stato r 103 is supplied with power from an inverter drive circuit 302 provided inside the electrical block 300, which causes the rotor 104 to rotate.

[0020] The bottom of the motor chamber 101 serves as an oil storage space 108 in which lubricating oil is stored.

[0021] The top of the housing 2 (top of the motor block 100 in the illustrated e xample) is provided with an intake port 109 for taking in a working medium to be compressed by the electric compressor 1 into the housing 2. The suction port 10 9 is the top inside the motor chamber 101 and opens into a space closer to the e lectrical block 300 than the motor 102.

[0022] The working medium drawn in by compressor contains a very small amount of mist-like oil in addition to the refrigerant.

[0023] The compression/discharge block 200 is provided with a scroll chamber (sc roll accommodation space) 202, a discharge chamber 240, and an oil separation ch amber 260.

[0024] The inside of the scroll chamber 202 is provided with a scroll compressio n mechanism 204. The scroll compression mechanism 204 has a fixed scroll 210 fix ed to the housing 2 (the compression discharge block 200 in the illustrated exam ple) and an orbiting scroll 220 disposed at one end of the drive shaft 105 and d riven by the motor 102.

[0025] The fixed scroll 210 has an end plate 211, a cylindrical outer wall 212 e xtending from the outer peripheral edge of the end plate 211 toward the orbiting scroll 220, and a spiral wall 213 extending from the end plate 211 toward the o rbiting scroll 220 on the radially inner side of the outer peripheral wall 212.

[0026] The orbiting scroll 220 has an end plate 221 and a spiral wall 222 that s tands from the end plate 221 toward the fixed scroll 210.

[0027] One end side of an eccentric pin 110 is press-fitted into a position offs et from the center of rotation of the drive shaft 105. A balance weight 111 is a ttached to the eccentric pin 110. The balance weight 111 has a cylindrical journ al part 112 and a weight part 113. The other end side of the eccentric pin 110 d escribed above is fitted into a hole provided in the journal part 112. Therefore , in conjunction with the rotation of the drive shaft 105, the balance weight 11 1 performs an eccentric rotational motion around the center of rotation of the d rive shaft 105, and reduces vibrations that occur in conjunction with the orbiti ng motion of the orbiting scroll 220.

[0028] The outer peripheral surface of the journal part 112 is fitted into the i nner race of a bearing (rolling bearing) 124. The outer race of the bearing 124 is fitted into a cylindrical bearing receiver 224 that rises from the end plate 221 of the orbiting scroll 220 toward the drive shaft 105.

[0029] The end plate 221 of the orbiting scroll 220 is provided with a plurality of (e.g., eight) cylindrical recesses so as to surround the bearing receiver 22 4, and a cylindrical ring 225 made of a bearing material is press-fitted into ea ch recess. A plurality of (e.g., eight) pins 226 are press-fitted into a wall (p artition wall) 118 of the motor block 100 adjacent to the scroll compression mec hanism 204. Each ring 225 accommodates one pin 226. The outer diameter of the pi n 226 is smaller than the inner diameter of the ring 225.

[0030] Due to the presence of the bearing 124 and the cooperative action of the ring 225 and the anti-rotation pin 226, the orbiting scroll 220 can only revolve (orbital motion) and cannot rotate on its own axis. Such a so-called "pin and ring" type anti-rotation mechanism is well known as an anti-rotation mechanism in a scroll compression mechanism, and therefore detailed illustration and descr iption thereof will be omitted. It should be noted that, instead of the pin and ring type rotation prevention mechanism described above, a rotation prevention m echanism using an Oldham ring may be used.

[0031] The wall of the housing 2 (in the illustrated example, the wall of the mo tor block 100, or namely, the partition wall 118) that partitions the motor cham ber 101 and the scroll chamber 202 has a plurality of (e.g., six) through-holes 130 (hereinafter referred to as "working medium supply holes 130") formed ther ein (see FIG. 2).

[0032] The plurality of (e.g., six) working medium supply holes 130 are provided at positions slightly inside the cylindrical outer peripheral wall 212 of the f ixed scroll 210 and are spaced at equal intervals in the circumferential directi on. The working medium supply holes 130 are provided such that the working mediu m is introduced into the outermost peripheral portion of the compression chamber 206 formed between the spiral wall 213 of the fixed scroll 210 and the spiral w all 222 of the orbiting scroll 220.

[0033] The working medium supply holes 130 are provided at positions higher than an oil level L (see L in FIG. 2) in the motor chamber 101 during normal operati on of the electric compressor 1, such that the oil in the oil storage space 108 at the bottom of the motor chamber 101 (especially the high-temperature oil in t he oil storage space 108 near the scroll compression mechanism 204) does not flo w directly into the scroll compression mechanism 204. In other words, the workin g medium supply holes 130 are not provided at positions lower than the oil level L.

[0034] The working medium introduced into the motor chamber 101 through the suct ion port 109 passes through the gap between the outer wall of the motor block 10 0 and the stator 103, the gap within the stator 103, the gap between the stator 103 and the rotor 104, etc., to flow through the motor chamber 101 toward the co mpression/discharge block 200, and flows into the scroll compression mechanism 2 04 through the working medium supply holes 130.

[0035] In other words, the motor chamber 101 is provided in a low-pressure regio n where a working medium with a relatively low pressure and low temperature draw n in from the suction port 109 flows, and the motor chamber is provided in a spa ce on the upstream side of the scroll compression mechanism 204.

[0036] During normal operation of the electric compressor 1, oil in the oil stor age space 108 at the bottom of the motor chamber 101 is stirred up in conjunctio n with rotation of the rotor 104, and the oil becomes mist and floats inside the motor chamber 101. This oil mist is carried along with the flow of the working medium and flows into the scroll compression mechanism 204, and seals and lubric ates the contact portion between the fixed scroll 210 and the orbiting scroll 22 0 that move relative to each other.

[0037] During normal operation of the electric compressor 1, the working medium introduced into the outermost peripheral portion of the compression chamber 206 is compressed while moving toward the center side of the scroll in conjunction w ith orbiting of the orbiting scroll 220. The compressed working medium flows int o the discharge chamber 240 through one or more discharge holes 214 (one in the illustrated example) provided in the approximate center of the end plate 211 of the fixed scroll 210. A check valve 215 made of an elastic metal plate is attach ed to the end plate 211. The check valve 215 opens the discharge hole 214 only w hen the pressure in the compression chamber 206 at the position corresponding to the discharge hole 214 is high, and closes the discharge hole 214 when the pres sure is low.

[0038] The working medium that has flowed into the discharge chamber 240 flows o ut into the oil separation chamber 260 through a through-hole 241 formed in the wall of the housing 2 (in the illustrated example, the wall of the compression d ischarge block 200) that partitions the discharge chamber 240 and the oil separa tion chamber 260.

[0039] The oil separation chamber 260 is provided with an oil separation structu re (oil separator) 261. In the illustrated embodiment, the oil separation struct ure 261 includes a cylindrical member 262. The working medium that has flowed in to the oil separation chamber 260 from the through-hole 241 flows at a high flow rate so as to swirl around the cylindrical member 262, and at this time, the mi st-like oil contained in the working medium is separated by centrifugal force.

[0040] The working medium from which the oil has been separated flows through th e inside of the cylindrical member 262 to the discharge port 263 that opens at t he top of the oil separation structure 261, and from there is discharged into a piping system (including a heat exchanger, etc. that constitutes the refrigerati on cycle) connected to the electric compressor 1.

[0041] The position where the oil separation structure 261 is provided is not li mited to the position shown in FIG.

1, and can be provided at any position in th e flow path of the working medium from the discharge hole 214 of the fixed scrol 1 210 to the discharge port 263 of the housing 2 (compression discharge block 20 0).

[0042] In other words, the oil separation structure 261 can be provided at any p osition on the downstream side of the scroll compression mechanism 204 in the hi gh-pressure region where a working medium with a relatively high pressure and hi gh temperature flows.

[0043] The oil separated from the working medium flows down along the inner wall surface of the oil separation chamber 260 and falls into an oil storage space 2 64 provided at the bottom of the oil separation chamber 260

[0044] The oil storage space 264 of the oil separation chamber 260 communicates with the oil storage space 108 of the motor chamber 101 via an oil return passag e 280.

[0045] Note that, in the illustrated embodiment, the oil return passage 280 is m ade up of the following elements.

(First element) A horizontal hole 281 drilled in the wall of the compression/dis charge block 200, extending horizontally from the oil storage space 264 toward t he end plate 211 of the fixed scroll 210

(Second element) A diagonal hole 282 drilled in the end plate 211 of the fixed s croll 210, extending diagonally

(Third element) A horizontal hole 283 drilled in the outer wall 212 of the fixed scroll 210, extending diagonally

(Fourth element) A vertical groove 284 extending vertically, formed in the end f ace of the wall of the motor block 100 on the fixed scroll 210 side

(Fifth element) A horizontal hole 285 drilled in the wall of the motor block 100 on the fixed scroll 210 side, extending horizontally, and terminating in an oil return hole 286 that opens into the oil storage space 108

[0046] The oil return passage 280 is provided with a pressure reducing mechanism using an orifice member (not shown) for narrowing the hole diameter (oil flow p ath area).

[0047] For example, an orifice member serving as a pressure reducing mechanism c an be provided in the horizontal hole 283, and by using an orifice member with a precisely machined inner diameter, the pressure of the oil flowing from the oil separation chamber 260 in the high-pressure region through the oil return passa ge 280 into the motor chamber 101 in the low-pressure region can be precisely li mited.

[0048] A filter 287 for removing foreign matter contained in the oil is provided on the upstream side of the orifice member, such as at the entrance of the hori zontal hole 281.

[0049] The oil is prevented from leaking from the oil return passage 280 between the oil storage space 264 of the oil separation chamber 260 and the oil storage space 108 of the motor chamber 101. Specifically, for example, appropriate seal ing is provided using a sealing member such as a sheet gasket or an O-ring as re quired. Such a sealing member may be provided, for example, between the end plat e 211 of the fixed scroll 210 and the wall of the compression/discharge block 20 0, and between the tip of the outer wall 212 of the fixed scroll 210 and the wal 1 of the motor block 100.

[0050] The route of the oil return passage 280 that communicates the oil storage space 264 of the oil separation chamber 260 and the oil storage space 108 of th e motor chamber 101 is not limited to the one shown in the drawings. For example , the oil return passage 280 does not have to penetrate the interior of the wall (end plate 211, outer wall 212) of the fixed scroll 210, but may instead penetr ate the wall of the compression discharge block 200 below the fixed scroll 210.

[0051] Next, lubrication of the parts around the drive shaft 105 will be describ ed.

[0052] An oil pump 140 driven by the drive shaft 105 is attached to the end of t he drive shaft 105 on the side opposite to the scroll compression mechanism 204. The oil pump 140 may be, for example, a trochoid oil pump, but is not limited t o this. The oil pump 140 is shown in a simplified form in FIG. 1.

[0053] An oil suction hole 142 is provided in the oil storage space 108 of the m otor chamber 101. The oil suction hole 142 is provided at a height position that is always lower than the oil level L in the oil storage space 108 during normal operation of the electric compressor 1.

[0054] Oil is drawn from the oil suction hole 142 through the oil suction passag e 143 into the oil pump 140. The oil suction passage 143 is, for example, a meta 1 pipe connected to the suction port of the oil pump 140. Alternatively, at leas t a portion of the oil suction passage 143 may be formed by a hole drilled in th e wall of the motor block 100.

[0055] The discharge port of the oil pump 140 communicates with an oil passage (oil supply passage) 144 drilled in the drive shaft 105. The oil passage 144 supp lies oil to parts that require lubrication between members that roll or slide in conjunction with rotation of the drive shaft 105.

[0056] A first branch passage 145 branches off from the oil passage (main oil pa ssage) 144, and oil is supplied from this first branch passage 145 to a space 14 6 facing one end of the bearing 107. The oil flows through the bearing 107 to lu bricate the bearing 107, and then falls into the storage space 108 from the othe r end of the bearing 107.

[0057] Between the bearing 106 and the bearing 124, a cavity 150 is formed in th e wall of the motor block 100 on the scroll compression mechanism 204 side to al low rotational motion of the weight part 113 of the balance weight 111.

[0058] A second branch passage 147 branches off from the oil passage 144, and oi 1 is supplied from this second branch passage 147 to the space (part of the cavi ty 150) between the bearing 106 and the weight part 113 of the balance weight 11 1. A portion of this soil oil flows into the bearing 106 to lubricate the bearin g 106, and then falls into the oil storage space 108 from the end of the bearing 106 on the side opposite to the balance weight 111. The remainder of the oil su pplied from the second branch 147 flows to the bottom of the cavity 150.

[0059] The oil passage (main passage) 144 bends midway and then opens at the end face of the drive shaft 105. In other words, the oil passage 144 has an oil dis charge port 148 that opens at the end surface of the drive shaft 105.

[0060] The weight part 113 of the balance weight 111 is provided with a through-hole 114. The through-hole 114 extends from a first surface facing the end surfa ce of the drive shaft 105 having the oil discharge port 148 to a second surface on the opposite side thereof. The oil discharge port 148 is provided so as to fa ce the opening of the through-hole 114 (see also FIG. 3) in the first surface of the weight part 113. The through-hole 114 opens at the second surface so as to face the side of the bearing 124. Therefore, the oil discharged from the oil dis charge port 148 is efficiently supplied to the bearing 124. The oil that lubrica tes the bearing 124 falls to the bottom of the cavity 150.

[0061] The end face of the end plate 211 of the orbiting scroll 220 slides in co njunction with the orbiting motion of the orbiting scroll 220 against a thrust p late 160 made of a highly wear-resistant material sandwiched between the opposin g surfaces of the motor block 100 and the compression/discharge block 200. The o il that has fallen to the bottom of the cavity 150 wets the end face of the end plate 211 of the orbiting scroll 220 and also contributes to lubrication of the sliding surface between this end face and the thrust plate 160.

[0062] It should be noted that it is also possible for a portion of the oil that has wetted the end face of the end plate 211 of the orbiting scroll 220 to ente r between the fixed scroll 210 and the orbiting scroll 220 and contribute to lub rication therebetween. However, in the present embodiment, lubrication between t he fixed scroll 210 and the orbiting scroll 220 is mainly performed by mist-like oil contained in the working medium supplied from the working medium supply hol es 130.

[0063] The oil that has accumulated at the bottom of the cavity 150 passes throu gh an oil passage 151 that extends downward (diagonally downward in the illustra ted example) from the bottom of the cavity 150 and falls into the oil storage sp ace 108.

[0064] The working medium is adiabatically compressed within the compression cha mber 206 of the scroll compression mechanism 204, and thus the working medium is at a high temperature immediately after leaving the scroll compression mechanis m 204; therefore, the oil that is separated from the working medium and accumula ted in the oil separation chamber 260 is also at a high temperature. Accordingly , the oil flowing from the oil separation chamber 260 through the oil return pas sage 280 into the oil storage space 108 of the motor chamber 101 is also at a re latively high temperature.

[0065] In the present embodiment, the distance between the oil return hole 286 o f the oil return passage 280 and the oil suction hole 142 is sufficiently large such that the relatively high-temperature oil that has flowed from the oil separ ation chamber 260 through the oil return passage 280 into the oil storage space 108 of the motor chamber 101 is not immediately drawn into the oil pump 140 from the oil suction hole 142.

[0066] Specifically, the oil return hole 286 and the oil suction hole 142 are pr ovided near both ends of the motor chamber 101. In other words, the oil return h ole 286 and the oil suction hole 142 are positioned on opposite sides of the mot or 102 in the axial direction of the drive shaft 105.

[0067] By doing this, the temperature is made uniform by diffusing the oil withi n the oil storage space 108, and the oil having a temperature that has been redu ced by heat dissipation from the oil within the oil storage space 108 to the out side through the wall of the motor block 100 is then drawn into the oil pump 140 . This makes it possible to prevent oil that is not suitable for lubrication due to low viscosity at high temperature from being supplied to parts to be lubrica ted, such as bearings. Thus, it is possible to prevent problems such as wear and damage from occurring in the parts to be lubricated.

[0068] Furthermore, as described above, the working medium supply holes 130 are provided at positions higher than the oil level L (see L in FIG. 2) in the motor chamber 101, and thus the high-temperature oil that has flowed out from the oil return hole 286 into the motor chamber 101 does not immediately flow into the s croll compression mechanism 204. If high-temperature, low-viscosity oil is suppl ied to the scroll compression mechanism 204, there is a risk that the scroll com pression mechanism 204 may be damaged due to poor lubrication. Additionally, by supplying high-temperature oil to the scroll compression mechanism 204, the work ing medium drawn into the scroll compression mechanism 204 is heated, and there is a risk that compression efficiency may decrease. According to the present emb odiment, it is possible to prevent such a problem from occurring.

[0069] In the present embodiment, before the working medium discharged from the scroll compression mechanism 204 flows out from the housing 2 through the discha rge port 263, the oil in the working medium is separated by the oil separation s tructure 261, and the separated oil is returned to the oil storage space 108 in the motor chamber 101. Due to this, the amount of oil that flows out into the re frigeration cycle connected to the electric compressor 1 is extremely small, and a sufficient amount of oil is always present in the oil storage space 108. Ther efore, there is no shortage of oil to lubricate the components inside the electr ic compressor 1.

[Key to Symbols]

[0070]

1	Electric compressor
2	Housing
101	Motor chamber
102	Motor
105	Drive shaft
106, 107	Bearing of drive shaft
108	Oil storage space
109	Suction port
111, 124, 225	Component attached to orbiting scroll
130	Working medium supply hole
140	Oil pump
142	Oil suction hole
144	Oil supply passage
204	Scroll compression mechanism
210	Fixed scroll
214	Discharge hole
220	Orbiting scroll
263	Discharge port
261	Oil separator (oil separation structure)
280	Oil return passage
286	Oil return hole

Claims

1. An electric compressor (1) comprising: a housing (2) having a suction port (109) and a discharge port (263) for a working medium;

a drive shaft (105) rotatably supported in a motor chamber (101) in the housing (2) ;
a motor (102) accommodated in the motor chamber (101) in the housing (2) and rot ating the drive shaft (105);
a scroll compression mechanism (204) including a fixed scroll (210) fixed to the housing (2), and an orbiting scroll (220) attached to one end of the drive shaf t (105) and driven by the drive shaft (105);
an oil pump (140) attached to the other end of the drive shaft (105), driven by the drive shaft (105), and supplying oil drawn from an oil storage space (108) p rovided at the bottom of the motor chamber (101) to parts to be lubricated (106, 107, 111, 124, 220, 225) of the scroll compression mechanism (204) via an oil s upply passage (144) provided inside the drive shaft (105); and
an oil separator (261) provided inside the housing (2) and separating oil from t he working medium compressed by the scroll compression mechanism (204), wherein an oil return passage (280) is provided inside the housing (2) for returning the oil separated by the oil separator (261) to the oil storage space (108) of the motor chamber (101).

2. The electric compressor according to claim 1, wherein the parts to be lubricated (106, 107, 111, 124, 220, 225) to which oil is supplied via the oil s upply passage (144) inside the drive shaft (105) do not include a sliding surfac e between the fixed scroll (210) and the orbiting scroll (220), and the sliding surface is lubricated by oil contained in the working medium drawn into the scro 11 compression mechanism (204).

3. The electric compressor according to claim 1, wherein the oil separate d at the oil separator (261) is returned to the oil storage space (108) in the m otor chamber (101) through the oil return passage (280) without passing through the parts to be lubricated.

4. The electric compressor according to claim 1, wherein the oil return p assage (280) terminates at an oil return hole (286) that opens into the motor ch amber (101),

the oil pump (140) draws oil from an oil suction hole (142) that opens into the oil storage space (108) in the motor chamber (101), and
the oil return hole (286) and the oil suction hole (142) are provided on opposit e sides of the motor (102).

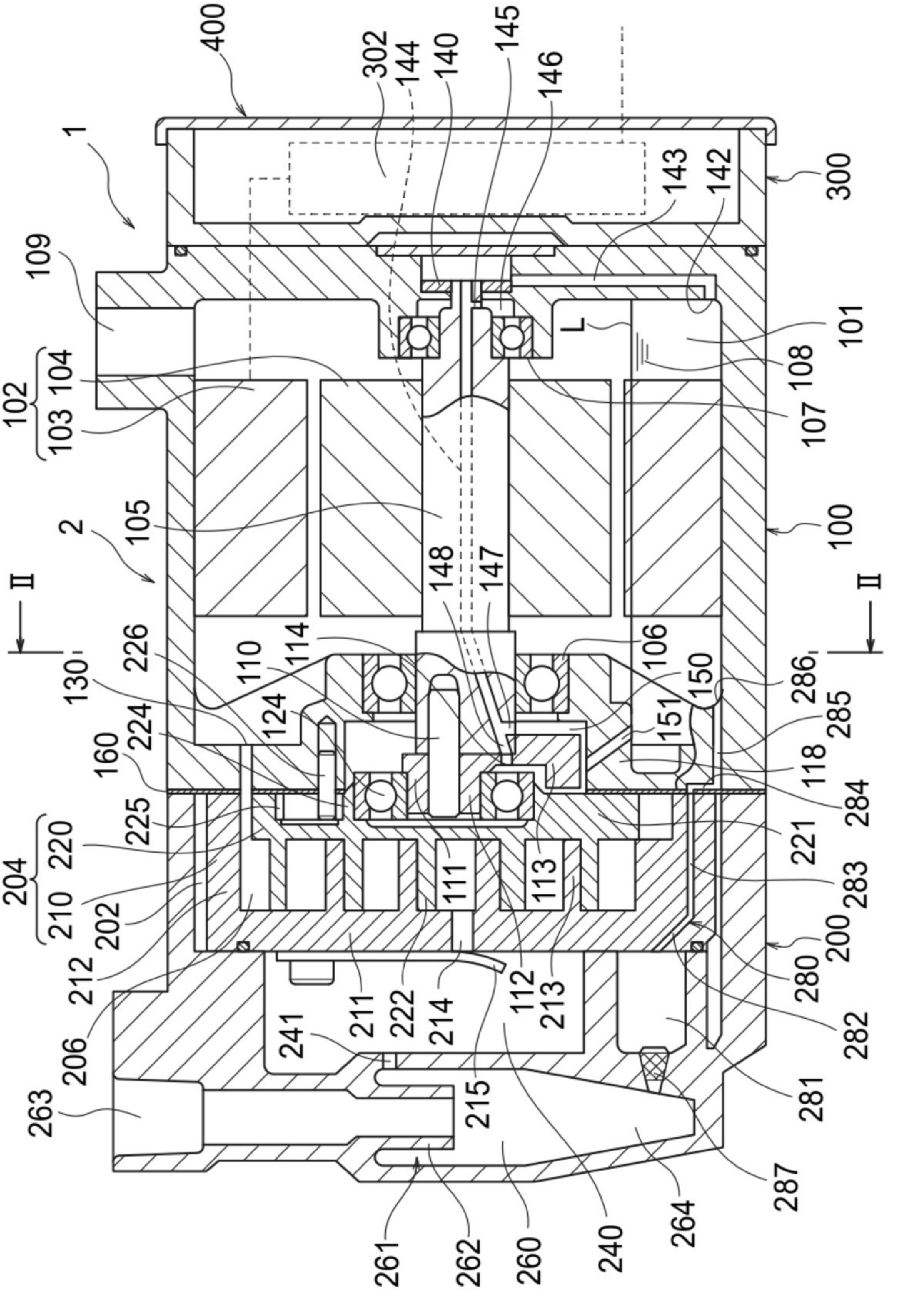
5. The electric compressor according to claim 1, wherein the housing (2) has a partition wall (118) that separates the motor chamber (101) from a space i n which the scroll compression mechanism (204) is disposed,

the partition wall (118) is provided with one or more working medium supply hole s (130) that allow the working medium that has flowed into the motor chamber (10 1) from the suction port (109) to pass toward the space in which the scroll comp ression mechanism (204) is disposed,
the oil return passage (280) terminates at an oil return hole (286) provided in the partition wall (118) that opens into the motor chamber (101), and
the working medium supply holes (130) are positioned above the oil return hole (286).

6. The electric compressor according to claim 5, wherein the working medi um supply hole (130) is provided at a position higher than a liquid level of oil in the oil storage space (108) of the motor chamber (101) during normal operati on of the electric compressor (1).

7. The electric compressor according to claim 1, wherein at least a porti on (282, 283) of the oil return passage (280) penetrates a wall that constitutes the fixed scroll (210).

[FIG. 1]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II
II
226
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285
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118
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284
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111
113
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202
212
211
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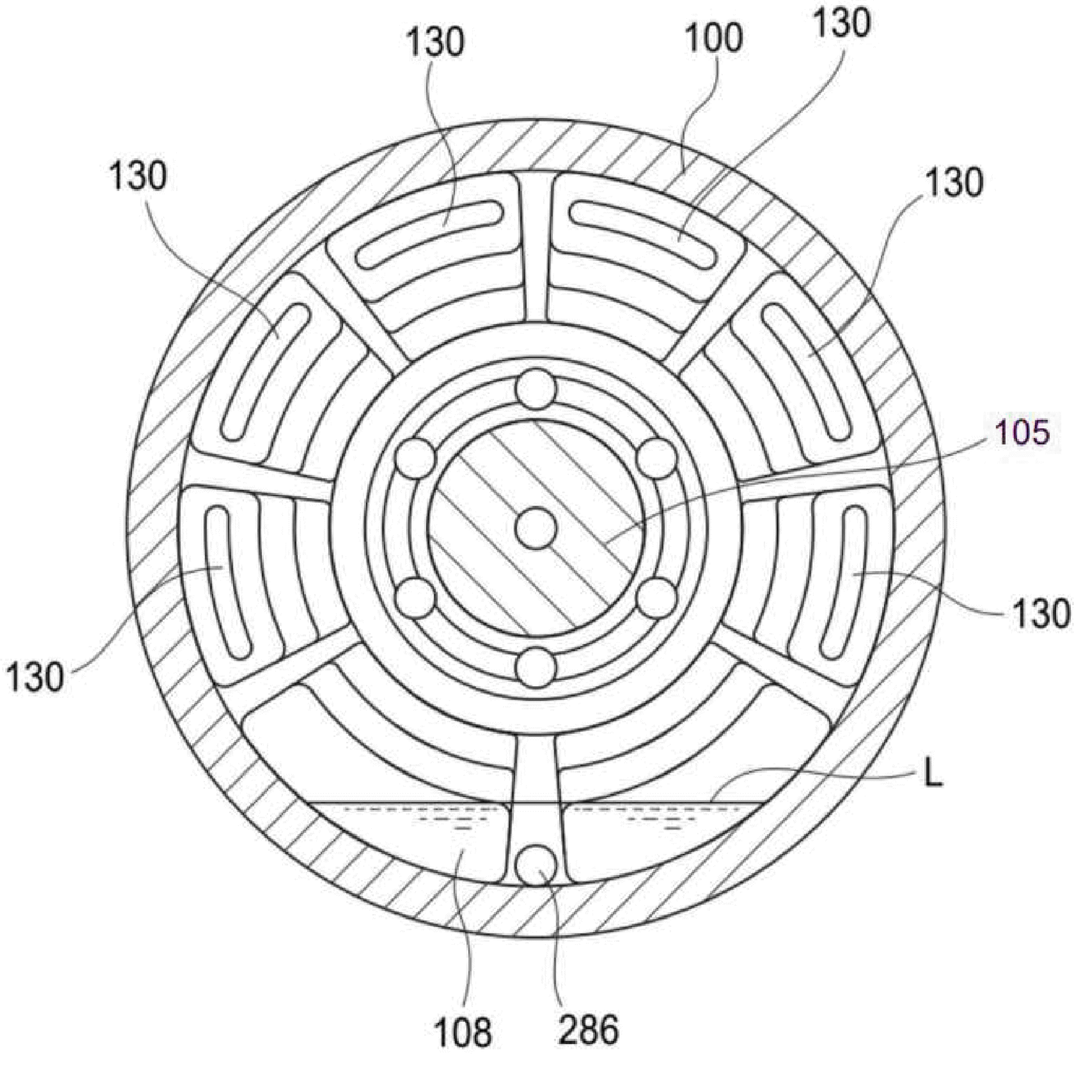
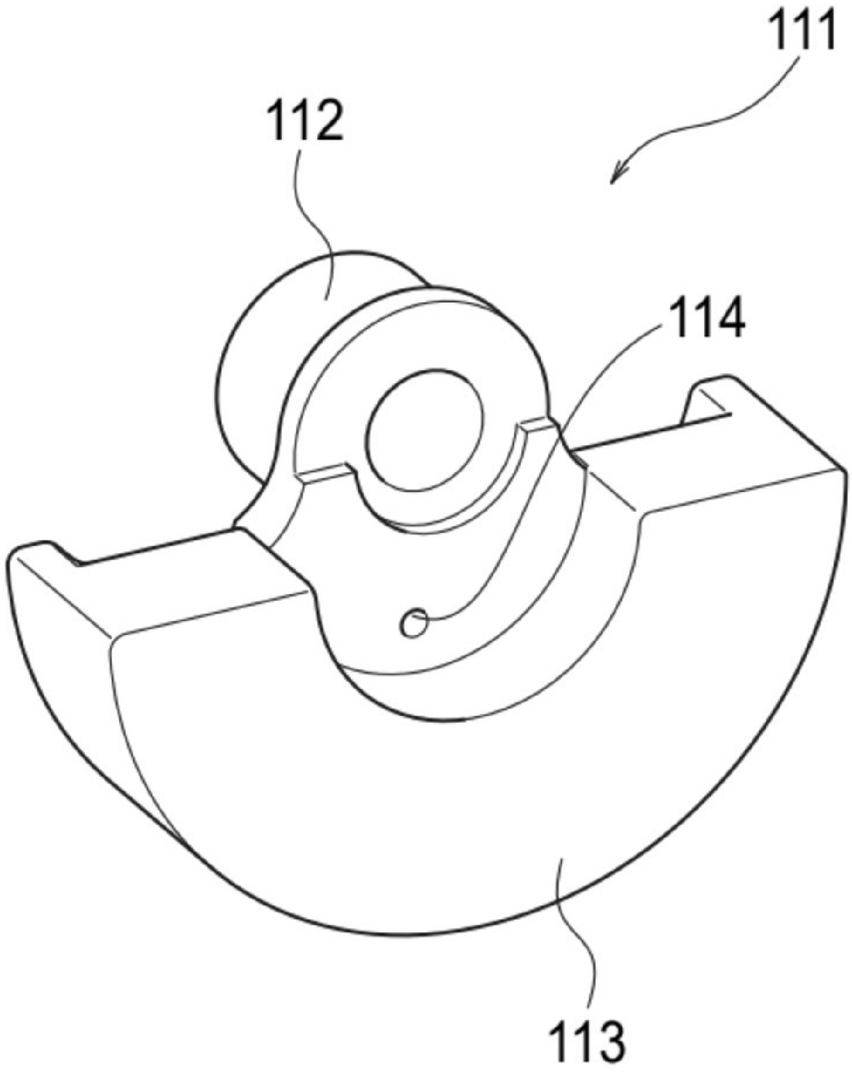
260

[FIG. 2]



[FIG. 3]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/030831

A. CLASSIFICATION OF SUBJECT MATTER

F04C 18/02(2006.01)i; ***F04C 29/02***(2006.01)i
FI: F04C18/02 311Y; F04C29/02 311H; F04C29/02 361A

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

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 1971-2024
Registered utility model specifications of Japan 1996-2024
Published registered utility model applications of Japan 1994-2024

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	JP 6-66275 A (DAIKIN INDUSTRIES, LTD.) 08 March 1994 (1994-03-08) paragraphs [0029], [0034], [0052]-[0053], fig. 11	1-7
Y	JP 9-32778 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 04 February 1997 (1997-02-04) paragraph [0023], fig. 1	1-7

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2024	**12 November 2024**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2024/030831

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 6-66275 A	08 March 1994	(Family: none)	
JP 9-32778 A	04 February 1997	JP 2000-170674 A	

Form PCT/ISA/210 (patent family annex) (July 2022)