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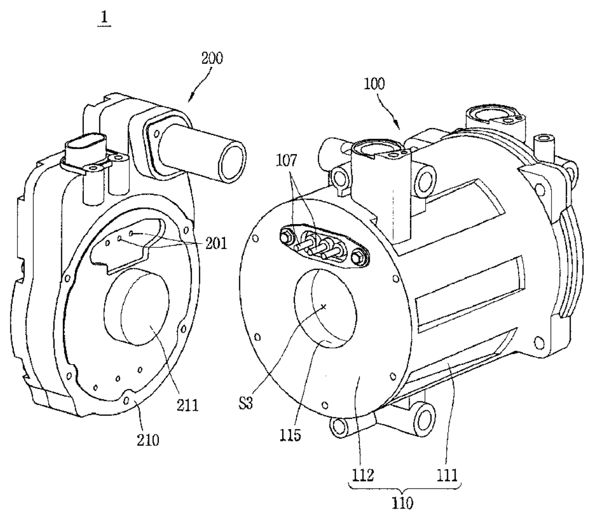
(54) MOTOR OPERATED COMPRESSOR

(57) A motor operated compressor according to the present disclosure may include a first scroll; a second scroll that forms a pair of two compression chambers between the first scroll and the second scroll while being engaged with the first scroll to perform an orbiting movement; a frame fixed in a radial direction at an opposite side of the first scroll with the second scroll interposed therebetween a frame fixed in a radial direction; and a balance weight fixedly coupled to the rotation shaft, wherein the rotation shaft or the balance weight is supported on the frame in an axial direction.

FIG. 1



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Description

[0001] The present disclosure relates to a compressor, and more particularly, to a motor operated compressor mainly applied to vehicles including electric vehicles.

[0002] In general, compressors for performing the role of compressing refrigerant in automotive air-conditioning systems have been developed in various forms, and in recent years, the development of motor operated compressors electrically driven using a motor have been actively carried out according to the electricization trend of auto parts.

[0003] A scroll compression method suitable for a high compression ratio operation is mainly applied to motor operated compressors. Such a scroll type motor operated compressor is provided with an electric motor unit formed with a rotary motor inside a closed casing, and provided with a compression unit composed of a fixed scroll and an orbiting scroll on one side of the electric motor unit, and the electric motor unit and the compression unit are connected by a rotation shaft to transmit a rotational force of the electric motor unit to the compression unit. The rotational force transmitted to the compression unit causes the orbiting scroll to perform an orbiting movement with respect to the fixed scroll to form a pair of two compression chambers composed of a suction chamber, an intermediate pressure chamber, and a discharge chamber so that refrigerant is sucked into both the compression chambers, respectively, and compressed and discharged simultaneously.

[0004] In addition, an inverter type compressor capable of varying the operation speed of a motor, including a constant speed motor, has been developed as a motor operated compressor. In the inverter type motor operated compressor, an inverter is mounted on an outer circumferential surface or one side surface of a casing, and the inverter is electrically connected to a motor provided inside the casing using a terminal passing through the casing.

[0005] On the other hand, a scroll type compressor applied to an automotive air-conditioning system is mainly installed in a transverse type in the engine room structure of a vehicle. Accordingly, as an electric motor unit and a compression unit are arranged in a transverse direction and connected by a rotation shaft, a main frame and a subframe for supporting the rotation shaft are respectively provided on both lateral sides around the electric motor unit.

[0006] However, in the foregoing motor operated compressor in the related art, there is a problem in that an axial length of the compressor increases as the electric motor unit is located on one side of the compression unit, and the main frame and the subframe are located on both axial sides of the electric motor unit.

[0007] Furthermore, in a motor operated compressor in the related art, the inverter is provided on a side where the subframe is provided in the case of a low-pressure type, but low-temperature refrigerant sucked into an inner space of the casing may not be sufficiently in contact with a surface to which the inverter is coupled, due to the subframe. As a result, the refrigerant may be unable to effectively cool the inverter, thereby reducing compressor efficiency due to inverter overheating.

[0008] In addition, in a motor operated compressor in the related art, oil is separated from the refrigerant discharged from the compression chamber to the discharge space, and supplied to the compression chamber or the bearing surface through the oil supply passage provided in the scroll or frame, but there is a problem that a friction loss occurs since oil is not quickly supplied during compressor start-up due to difficulty in forming the oil supply passage in the scroll or frame and an increase of the oil supply passage.

[0009] Moreover, in a motor operated compressor in the related art, the rotation shaft is supported by using ball bearings, but as cost and operation noise due to ball bearings are increased and a tilting of the orbiting scroll is increased due to a gap between the compression unit and the bearings, there is a problem that refrigerant leakage in the compression unit is increased.

[0010] An object of the present disclosure is to provide a motor operated compressor in which a rotation shaft is supported on one axial side of an electric motor unit, thereby reducing an axial length of the compressor.

[0011] Another object of the present disclosure is to provide a motor operated compressor in which a distance between an intake inlet and an inverter for guiding suction refrigerant into an inner space of a casing is decreased, thereby allowing the suction refrigerant to effectively cool the inverter.

[0012] Still another object of the present disclosure is to provide an motor operated compressor capable of easily forming an oil supply passage for guiding oil to a sliding portion as well as rapidly supplying oil.

[0013] Yet still another object of the present disclosure is to provide a motor operated compressor capable of reducing cost due to the bearings supporting the rotation shaft, reducing operating noise, and reducing a gap between the compression unit and the bearings to reduce refrigerant leakage in the compression chamber.

[0014] In order to achieve the objectives of the present disclosure, there is provided a scroll compressor in which a plurality of scrolls are supported and provided by a frame, a rotation shaft for transmitting a rotational force of a drive motor is coupled to one of the plurality of scrolls, a weight balance is coupled to the rotation shaft, and the rotation shaft or the balance weight is supported by the frame in an axial direction.

[0015] Here, part of the casing may be formed to be recessed in an axial direction toward the drive motor.

[0016] Furthermore, a plurality of bearings supported in a radial direction on an opposite side of the drive motor with respect to the frame may be spaced apart by a predetermined distance in an axial direction at one end of the rotation shaft.

[0017] In addition, in order to achieve the objectives of the present disclosure, there is provided a motor operated compressor, including a first scroll; a second scroll that forms a pair of two compression chambers between the first scroll and the second scroll while being engaged with the first scroll to perform an orbiting movement; a frame fixed in a radial direction at an opposite side of the first scroll with the second scroll interposed therebetween; and a rotation shaft eccentrically coupled to the second scroll through the frame in which a first bearing protrusion portion protrudes in a radial direction to be supported in an axial direction on the frame.

[0018] Here, the first bearing protrusion portion may be provided between the second scroll and the frame.

[0019] Furthermore, a shaft hole may be formed to be supported in a radial direction in the frame to allow the rotation shaft to pass therethrough, and a second bearing protruding portion may be protruded in an axial direction toward the first bearing protrusion portion at one end of the shaft hole to correspond to the first bearing protrusion portion in an axial direction.

[0020] Furthermore, a balance weight may be coupled to the rotation shaft, and the first bearing protrusion portion may be supported by the second bearing protrusion portion inside the balance weight.

[0021] Furthermore, an outer diameter of the first bearing protrusion portion may be greater than or equal to that of the second bearing protrusion portion.

[0022] In addition, in order to achieve the objectives of the present disclosure, there is provided a motor operated compressor, including a first scroll; a second scroll that forms a pair of two compression chambers between the first scroll and the second scroll while being engaged with the first scroll to perform an orbiting movement; a frame fixed in a radial direction at an opposite side of the first scroll with the second scroll interposed therebetween a frame fixed in a radial direction; and a balance weight fixedly coupled to the rotation shaft, wherein the rotation shaft or the balance weight is supported on the frame in an axial direction.

[0023] Here, a first bearing protrusion portion extended in a radial direction may be formed on the rotation shaft, and a second bearing protrusion portion may be protruded toward the first bearing protrusion portion to support the first bearing protrusion portion in an axial direction.

[0024] Furthermore, a fixed portion fixed to the rotation shaft is formed in an annular shape on the balance weight, and a second bearing protrusion portion may be protruded toward the fixed portion to support the fixed portion in an axial direction.

[0025] Furthermore, a support portion may be formed on the rotation shaft such that the fixed portion is coupled to the rotation shaft to support the balance weight in an axial direction.

[0026] Here, a first end portion of the rotation shaft may be rotatably coupled to the first scroll through the frame and the second scroll.

[0027] Furthermore, the first end portion of the rotation shaft is supported on the frame and the first scroll, respectively, in an axial direction to form a fixed end, and a second end portion of the rotation shaft, which is opposite to the first end portion with respect to the frame, may form a free end.

[0028] Furthermore, the rotation shaft is formed with an oil supply groove extended in an axial direction from an end of the first end portion to a predetermined length, and a plurality of oil supply holes may be formed at intervals along the axial direction in the middle of the oil supply groove to face the first scroll, the second scroll, and the frame.

[0029] Furthermore, a pressure-reducing member for reducing the pressure of oil may be inserted into the oil supply groove.

[0030] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0031] In the drawings:

FIG. 1 is a perspective view in which a compressor module and an inverter module are disassembled in a motor operated compressor according to an embodiment of the present disclosure;

FIG. 2 is an internal cross-sectional view in which the compressor module and the inverter module are assembled in the motor operated compressor according to FIG. 1;

FIGS. 3 and 4 are views for explaining a relationship between an intake portion and an inverter receiving portion, in which FIG. 3 is a cross-sectional view taken along line "IV-IV" in FIG. 2, and FIG . 4 is an enlarged cross-sectional view of the vicinity of a drive motor;

FIGS. 5 and 6 are views showing a rotation axis, in which FIG. 5 is a cross-sectional view showing a supporting state of the rotation shaft, and FIG. 6 is a cross-sectional view taken along line "V-V" in FIG. 5;

FIG. 7 is an enlarged cross-sectional view showing a compression mechanism unit in the motor operated compressor according to FIG. 2;

FIG. 8 is a plan view showing a state in which a fixed wrap and an orbiting wrap are engaged with each other in a compression mechanism unit according to the present embodiment;

FIG. 9 is a cross-sectional view showing an axial support structure according to the present embodiment;

FIG. 10 is an enlarged cross-sectional view showing portion "A" in FIG. 9;

FIG. 11 is a cross-sectional view taken along line "VI-VI" in FIG. 10;

FIG. 12 is a cross-sectional view showing another embodiment of the axial support structure according to the present embodiment; and

FIG. 13 is a cross-sectional view showing another embodiment of a support structure of the rotation shaft in a motor operated compressor according to the present disclosure.

[0032] Hereinafter, a motor operated compressor according to the present disclosure will be described in detail with reference to an embodiment illustrated in the accompanying drawings.

[0033] FIG. 1 is a perspective view in which a compressor module and an inverter module are disassembled in a motor operated compressor according to an embodiment of the present disclosure, and FIG. 2 is an internal cross-sectional view in which the compressor module and the inverter module are assembled in the motor operated compressor according to FIG. 1.

[0034] As illustrated in these drawings, a low-pressure motor operated scroll compressor (hereinafter, abbreviated as a motor operated compressor) 1 according to the present embodiment includes a compressor module 100 configured to suck, compress and discharge refrigerant and an inverter module 200 detachably coupled to one side of the compressor module 100 to control a rotational speed of a drive motor 103 which will be described later.

[0035] The compressor module 100 is provided with a first sealing terminal 107, and the inverter module 200 is provided with a second sealing terminal 201. The first sealing terminal 107 is exposed to the outside of the compressor module 100 and the second sealing terminal is exposed to the outside of the inverter module 200 to allow the first sealing terminal 107 and the second sealing terminal 201 to be detachable from each other.

[0036] Meanwhile, the inverter module 200 is provided to be in contact with a portion of the compressor casing 101 that forms the suction space (S1). Accordingly, heat generated in an inverter device 220 of the inverter module 200 and the like may be quickly dissipated by cool refrigerant sucked into the suction space (S1).

[0037] In addition, the inverter module 200 includes an inverter housing 210 having a predetermined internal volume. At least one inverter device 220 for controlling a rotational speed of the drive motor 103 as well as the second sealing terminal 201 described above are accommodated inside the inverter housing 210 .

[0038] The compressor module 100 includes a drive motor 103, which is an electric motor, and a compression mechanism unit 105 for compressing refrigerant using a rotational force of the drive motor 103 within the compressor casing 101.

[0039] The compressor casing 101 is provided with an intake port 111a to which a suction pipe is connected and an exhaust port 121a to which a discharge pipe is connected, and a suction space (S1) and a discharge space (S2) are communicated with the suction port 111a and the discharge port 121a, respectively. The drive motor 103 is installed in the suction space (S1), and the compressor of the present embodiment forms a low pressure compressor.

[0040] Furthermore, the compressor casing 101 includes a main housing 110 in which the drive motor 103 is installed and a rear housing 120 coupled to an open rear end of the main housing 110. An inner space of the main housing 110 forms the suction space (S1) together with one side of the compression mechanism unit 105, and an inner space of the rear housing 120 forms the discharge space (S2) together with the other side of the compression mechanism unit 105.

[0041] The exhaust port 121a described above is formed at one side of the rear housing body 121 on one side of the discharge space (S2), and an oil separator (not shown) for separating oil from refrigerant being discharged is provided inside the exhaust port 121a and around the exhaust port 121a. Furthermore, an oil separation portion (S21) for separating oil from refrigerant discharged from the compression chamber is formed in an upper half of the discharge space (S2), and an oil storage portion (S22) for storing oil separated from the discharge space (S2) is formed in a lower half portion thereof. The oil storage portion (S22) is communicated with the compression mechanism unit 105 through an oil supply passage (F0). The oil supply passage (Fo) communicates the oil storage portion with the oil supply groove. The oil supply structure will be further described later.

[0042] The main housing 110 may be formed with a cylindrical portion 111 formed in a cylindrical shape, and a front end of the cylindrical portion 111 may be integrally extended to form a closed sealing portion 112, and a rear end of the cylindrical portion 111 forms an opening portion 113. The inverter module 200 is coupled to an outer surface of the sealing portion 112, and the compression mechanism unit 105 is coupled to the opening portion 113 to seal the suction space (S1).

[0043] Here, the main housing 110 may have a front inner diameter and a rear inner diameter equal to each other, but in consideration of the drawing of a mold core when manufacturing the mold of the main housing 110, the rear inner diameter that is an open side may be preferably formed to be larger than the front inner diameter that is a closed side.

[0044] Furthermore, the sealing portion 112 of the main housing 110 is formed with an inverter receiving portion 115 protruded in a direction toward the opening portion 113 at a central portion of the inner side surface thereof to form an inverter receiving space (S3). The inverter receiving portion 115 is a space in which an inverter heat dissipation protrusion portion 211 of the inverter housing 210 is accommodated, and may be formed to be recessed at a height (or a depth) that can overlap with the intake port 111a in a radial direction. Accordingly, a contact area between cool refrigerant sucked into the suction space (S1) through the intake port 111a by the inverter receiving portion 115 and the sealing portion 112 is enlarged to enhance a heat dissipation effect for the inverter device. It will be described again while describing the drive motor and the rotation shaft.

[0045] On the other hand, a drive motor 103 constituting an electric motor unit is pressed and coupled to the main housing 110. The drive motor 103 includes a stator 131 fixed inside the main housing 110 and a rotor 132 positioned inside the stator 131 and rotated by an interaction between the stator 131 and the rotor 132.

[0046] The stator 131 is shrink-fitted and fixed to an inner circumferential surface of the main housing 110. An outer circumferential surface of the stator 131 is formed in a D-cut shape to form a refrigerant passage between the inner circumferential surface of the compressor casing (hereinafter, abbreviated as a casing) 110 and the outer circumferential surface of the stator 131. Accordingly, refrigerant sucked through the inlet port 111a may be guided to the compression chamber (V) through the suction groove 154 of the first scroll 150 which will be described later.

[0047] The stator 131 is laminated by a plurality of thin annular steel plates to form a stator laminate 131a, and the stator laminate 131a is wound with a coil 135. FIGS. 3 and 4 are views for explaining a relationship between an intake portion and an inverter receiving portion, in which FIG. 3 is a cross-sectional view taken along line "IV-IV" in FIG. 2, and FIG . 4 is an enlarged cross-sectional view of the vicinity of a drive motor.

[0048] As illustrated in FIGS. 3 and 4, the coil 135 is formed in an annular shape when viewed from the rear side, and an axial length (L1) of the coil is formed to be larger than an axial length (L2) of the stator laminate, and a front end of the coil 135 facing the sealing portion 112 of the main housing 110 is further protruded than a front end of the stator laminate 131a. Accordingly, the inverter receiving portion 115 of the main housing 110 may be formed up to a height overlapping with the intake port 111a in a radial direction as well as overlapping with the coil 135 in a radial direction as described above. Due to this, as the rotation shaft 133 which will be described later is supported on the compression mechanism unit in a cantilever manner, it is not necessary to provide an additional subframe or bearing in the sealing portion 112 of the main housing 110, and the inverter receiving portion may be protruded up to a height at which the inverter receiving portion overlaps with the coil using a space from which the subframe or bearing is excluded.

[0049] For the rotor 132, a plurality of thin annular steel plates are laminated in a similar manner to the stator 131 to form a rotator laminate 132a, and the rotation shaft 133 is press-fitted and coupled to an inner circumferential surface of the rotor laminate 132a. A length of the rotor laminate is formed to be shorter than that of the stator laminate or at least shorter than that of the coil.

[0050] The rotation shaft 133 is coupled to the center of the rotor 132 such that a rear end facing the compression mechanism unit 105 is supported by the frame 140 and the fixed scroll 150, which will be described later, in a cantilever manner.

[0051] For example, as shown in FIGS. 2 and 4, a front end (second end portion) 133b of the rotation shaft 133 is formed to be shorter or equal to a front end of the rotor 132, and a rear end (first end portion) thereof may be rotatably coupled to the fixed scroll 150 through the frame 140 and the orbiting scroll 160.

[0052] Here, the front end 133b of the rotation shaft 133 may be formed to be larger than the front end of the rotor 132, but the front end of the rotation shaft 133 may form a free end that is not supported by separate bearings, and thus may not be necessarily formed to be larger than the rotor 132. Even when formed to be larger than the rotor, it may be preferably formed to be shorter than the front end of the coil 135. FIGS. 5 and 6 are views showing a rotation axis, in which FIG. 5 is a cross-sectional view showing a supporting state of the rotation shaft, and FIG. 6 is a cross-sectional view taken along line "V-V" in FIG. 5 .

[0053] As shown in FIG. 5, since the first end portion 133a of the rotation shaft 133 is supported on the frame 140 and the fixed scroll 150 in an axial direction as described above as well as a rotational force must be transmitted to the orbiting scroll 160, a second bearing portion 133c2, an eccentric portion 133c3 and a first bearing portion 133c1 are formed in the order in a direction from the first end portion 133a toward the second end portion 133b.

[0054] The first bearing portion 133c1, the second bearing portion 133c2, and the eccentric portion 133c3 are formed to correspond to a first bushing bearing 171 provided on the frame 140, a second bushing bearing 172 provided on the fixed scroll 150, a third bush bearing 173 provided on the orbiting scroll 160, respectively. Accordingly, the first bearing portion 133c1 and the second bearing portion 133c2 are formed on the coaxial center lines CL1, CL2, and the eccentric portion 133c3 is eccentrically formed on another axial center line CL3 with respect to the first bearing portion 133c1 and the second bearing portion 133c2.

[0055] Furthermore, the oil supply passage (Fo) for guiding oil stored in the oil storage portion (S22) to the bearing portions 133c1, 133c2 and the eccentric portion 133c3 is formed on the rotation shaft 133. The oil supply passage (Fo) includes an oil supply groove 133e formed by a predetermined depth in a direction from the first end portion 133a of the rotation shaft 133 toward the second end portion 133b and a plurality of oil supply holes 133f1, 133f2, 133f3 penetrating in a radial direction from the oil supply groove 133e toward the bearing portions 133c1, 133c2 and the eccentric portion 133c3, respectively. The oil supply holes include the first oil supply hole 133f1 corresponding to the first bearing portion 133c1, the second oil supply hole 133f2 corresponding to the second bearing portion 133c2, and the third oil supply hole 133f3 corresponding to the eccentric portion 133c3, and the respective oil supply holes may be formed within an axial range of the respective bearing portions and eccentric portion corresponding to those oil supply holes.

[0056] On the other hand, a pressure-reducing portion may be formed in the oil supply groove 133e. In other words, an inlet of the oil supply passage (Fo) is communicated with the discharge space (precisely, the oil storage portion (S2)) which is a high pressure portion, but an outlet of the oil supply passage (Fo) is communicated with the suction space (S1) which is a low pressure portion. Accordingly, oil may excessively flow out from the oil storage portion (S22) of the discharge space (S2) to the suction space (S1) or refrigerant discharged to the discharge space (S2) or oil in the back pressure space (S4) may be leaked to the suction space (S1) through the oil supply passage (precisely, between the first bearing portion and the first bush bearing). In consideration of this, a pressure-reducing member 133g such as a pressure-reducing rod is inserted into the oil supply groove 133e to decrease an inner diameter of the oil supply groove 133e, thereby decreasing the pressure to an intermediate pressure while the oil supply groove 133e passes through a pressure-reducing section.

[0057] In addition, the rotation shaft 133 may be pushed in a direction toward the suction space (S1) by a pressure difference between the discharge space (S2) and the suction space (S1). Accordingly, when the rotation shaft 133 is supported by ball bearings, the rotation shaft 133 is axially supported by the ball bearings, but when the rotation shaft 133 is supported by bush bearings, thrust bearings for axially supporting the rotation shaft 133 must be provided separately. It will be described in detail later while describing an axial bearing portion of the rotation shaft.

[0058] Meanwhile, in the scroll compressor according to the present embodiment, a compression mechanism unit is formed to constitute a compression chamber while the orbiting scroll coupled to the rotation shaft is supported by the frame to perform an orbiting movement with respect to the fixed scroll. FIG. 7 is an enlarged cross-sectional view showing a compression mechanism unit in the motor operated compressor according to FIG. 2.

[0059] As illustrated in FIGS. 2 and 7, the compression mechanism unit 105 includes a frame 140, a fixed scroll (hereinafter, referred to as a first scroll) 150 supported by the frame 140, and an orbiting scroll (hereinafter, referred to as a second scroll) 160 disposed between the frame 140 and the first scroll 150 to perform an orbiting movement.

[0060] The frame 140 is coupled to a front opening end 113 of the main housing 110, and the first scroll 150 is fixedly supported on a rear side of the frame 140, and the second scroll 160 is orbitably supported by the rear side of the frame to perform an orbiting movement between the first scroll 150 and the frame 140. Furthermore, the second scroll 160 is eccentrically coupled to the rotation shaft 133 coupled to the rotor 132 of the drive motor 103 to form a pair of compression chambers (V) formed of a suction chamber, an intermediate pressure chamber, and a discharge chamber along with the first scroll 150 while performing an orbiting movement with respect to the first scroll 150.

[0061] The frame 140 is formed with a frame end plate portion 141 in a circular plate shape, and formed with a frame sidewall portion 142 protruded from a rear side of the frame end plate portion 141 and coupled to to a sidewall portion 152 of the first scroll 150 which will be described later.

[0062] Furthermore, a frame thrust surface 143 on which the second scroll is placed and supported in an axial direction is formed on an inner side of the frame sidewall portion 142, and a back pressure space (S4) in which part of refrigerant discharged from the compression chamber (V) is filled along with oil to support a back surface of the second scroll 160 is formed at the center of the frame thrust surface 143. Accordingly, a pressure of the back pressure space (S4) forms an intermediate pressure between the pressure of the suction space (S1) and a final pressure (i.e., discharge pressure) of the compression chamber (V).

[0063] The back pressure space (S4) may communicate with at least one oil supply hole. Furthermore, a frame shaft hole 145 through which the rotation shaft 133 passes is formed at the center of the back pressure space (S4), and the first bearing 171 is provided on an inner circumferential surface of the frame shaft hole 145.

[0064] The first bearing 171 may be formed with bush bearings as shown in FIG. 5, but may also be formed with ball bearings according to circumstances. However, the bush bearing is advantageous in terms of cost since it is less expensive than the ball bearing as well as advantageous due to ease of assembly and reduced weight and noise.

[0065] The back pressure space (S4) may be sealed by a first sealing member 181 provided on a thrust surface between the frame 140 and the second scroll 160 and a second sealing member 182 provided between an inner circumferential surface of the frame 140 and an outer circumferential surface of the rotation shaft 133.

[0066] The first sealing member 181 may be formed in an annular shape having a rectangular shaped cross section or a V-shaped cross sectional, and may be inserted into a first sealing groove (no reference numeral) provided on the thrust surface 143 of the frame 140. In this case, the first sealing member 181 may seal between that and the second scroll 160 while being pushed up and floated by a force due to a pressure of the back pressure space (S4).

[0067] The second sealing member 182 may be formed in an annular shape having a U-shaped cross section, and inserted into an annular second sealing groove (no reference numeral) provided around the frame shaft hole 145. In this case, the second sealing member 182 may be open by a force due to a pressure of the back pressure space (S4) to seal the back pressure space (S4) while being in close contact with an outer circumferential surface of the rotation shaft 133. However, the second sealing member 182 may be excluded in some cases. The pressure of the back pressure space (S4) is suppressed from being stagnated as the back pressure space (S4) is communicated through a fine passage formed in the suction space (S1) and an inner circumferential surface of the first bearing 171 when the second sealing member is excluded, and thus oil may efficiently flow into each bearing hole.

[0068] Meanwhile, the first scroll 150 may be fixedly coupled to the frame 140 or may be press-fitted into the casing 110 to be fixed.

[0069] For the first scroll 150, a fixed scroll end plate portion (hereinafter, referred to as a first end plate portion) 151 may be formed in a substantially disk shape, and a fixed scroll sidewall portion (hereinafter, referred to as a first sidewall portion) 152 coupled to a sidewall portion 142 of the frame 140 may be formed at an edge of the first end plate portion 151. A fixed wrap (hereinafter, referred to as a first wrap) 153 engaged with an orbiting wrap (hereinafter, referred to as a second wrap) 162 which will be described later to form a compression chamber (V) is formed on a front side of the first end plate portion 151. The first wrap 153 will be described later with the second wrap 162.

[0070] A suction passage 154 is formed at one side of the first side wall portion 152 to allow the suction space (S1) and the suction chamber (no reference numeral) to communicate with each other, and a discharge port 155 communicated with the discharge chamber to discharge the compressed refrigerant into the discharge space (S3) is formed at a central portion of the first end plate portion 151. Only one discharge port 155 may be formed to communicate with both a first compression chamber (V1) and a second compression chamber (V2) which will be described later, and a first discharge port 155a and a second discharge port 155b may be formed to communicate independently the first compression chamber (V1) and the second compression chamber (V2).

[0071] The bearing receiving portion 156 may be protruded toward an inner wall side of the rear housing 120 on a rear side of the first end plate portion 151. The bearing receiving portion 156 may be brought into close contact with or spaced apart by a predetermined distance from the inner wall side of the rear housing 120. However, when the second bearing portion 133c2 of the rotation shaft 133 can be stably supported only by a thickness of the first end plate portion 151, the bearing receiving portion may not be formed.

[0072] However, when the bearing receiving portion 156 is formed, an oil supply pipe 157 protruded toward a bottom surface of the discharge space (S2) may be connected to the lowest point of the bearing receiving portion. Accordingly, an inner space 156a of the bearing receiving portion 156 is connected to the oil storage portion (S22) of the discharge space (S2), and thus oil filled in the oil storage portion (S22) may flow into the inner space 156a of the bearing receiving portion 156 by a pressure difference.

[0073] Furthermore, a second bearing hole 158 is formed such that the second bearing portion 133c2 of the rotating shaft 133 is rotatably inserted into the center of the bearing receiving portion 156 so as to be radially supported at the center of the first end plate portion 151, and the second bearing 172 is inserted into and coupled to the second bearing hole 158. The second bearing 172 may be formed with bush bearings as shown in FIG. 5, but may also be formed with ball bearings, in some cases, similarly to the first bearing 171.

[0074] Meanwhile, the second scroll 160 is provided between the frame 140 and the first scroll 150, and eccentrically coupled to the rotation shaft 133 in an orbital manner.

[0075] For the second scroll 160, an orbiting scroll end plate portion (hereinafter, referred to as a second end plate portion) 161 is formed in a substantially disc shape, and a second wrap 162 engaged with the first wrap 153 to form a compression chamber is formed on a rear side of the second end plate portion 161.

[0076] The second wrap 162 may be formed in an involute shape together with the first wrap 153, but may be formed in various other shapes. FIG. 8 is a plan view showing a state in which a fixed wrap and an orbiting wrap are engaged with each other in a compression mechanism unit according to the present embodiment.

[0077] As illustrated in FIGS. 2 and 8, the second wrap 162 may have a shape in which a plurality of arcs having different diameters and origin points are connected to each other, and an outermost curve may be formed in a substantially elliptical shape having a major axis and a minor axis. The first wrap 153 may be formed in the same manner.

[0078] A rotation axis coupling portion 163 which forms an inner end portion of the second wrap 162 and to which an eccentric portion 133c3 of the rotation shaft 133 which will be described later is rotatably inserted and coupled may be formed in an axially penetrating manner at a central portion of the second end plate portion 161. An outer circumferential portion of the rotation shaft coupling portion 163 is connected to the second wrap 162 to form the compression chamber (V) together with the first wrap 153 during the compression process.

[0079] In addition, the rotation shaft coupling portion 163 may be formed to have a height that overlaps with the second wraps 162 on the same plane, and disposed at a height where the eccentric portion 133c2 of the rotation of the rotation axis 133 overlaps with the second wraps 162 on the same plane. Through this, the repulsive force and the compressive force of the refrigerant are canceled each other while being applied to the same plane with respect to the second end plate portion, thereby preventing an inclination of the second scroll 160 due to an action of the compressive force and the repulsive force.

[0080] In addition, the rotation shaft coupling portion 163 is formed with a concave portion 163a to be engaged with the protrusion portion 153a of the first wrap 153 which will be described later at an outer circumferential portion opposite to an inner end portion of the first wrap 153, and one side of the concave portion 163a is formed with an increase portion 163b configured to increase a thickness from an inner circumferential portion to an outer circumferential portion of the rotation shaft coupling portion 163 on the upstream side along a direction of forming the compression chamber (V). It may increase a compression passage of the first compression chamber (V1) immediately before discharge, thereby increasing a compression ratio of the first compression chamber (V1) to be close to that of the second compression chamber (V2) as a result. The first compression chamber (V1) is a compression chamber formed between an inner surface of the first wrap 153 and an outer surface of the second wrap 162, which will be described later, separately from the second compression chamber V2.

[0081] The other side of the concave portion 163a is formed with an arc compression surface 163c having an arc shape. A diameter of the arc compression surface 163c is determined by a thickness of an inner end portion of the first wrap 153 (i.e., a thickness of the discharge end) and an orbiting radius of the second wrap 162, and thus the diameter of the arc compression surface 163c increases when increasing the thickness of the inner end portion of the first wrap 153. As a result, the thickness of the second wrap around the arc compression surface 163c may also increase to secure durability, and a compression path may be lengthened to increase a compression ratio of the second compression chamber (V2) accordingly.

[0082] Furthermore, a protrusion portion 153a protruded toward an outer circumferential portion of the rotation shaft coupling portion 163 may be formed adjacent to an inner end portion (suction end or start end) of the first wrap 153 corresponding to the rotation shaft coupling portion 163, and a contact portion 153b protruded from the protrusion portion and engaged with the concave portion 163a may be formed on the protrusion portion 153a. In other words, the inner end portion of the first wrap 153 may be formed to have a larger thickness than the other portions. Therefore, a wrap strength of the inner end portion that receives the greatest compressive force on the first wrap 153 is improved to improve durability.

[0083] On the other hand, the compression chamber (V) may be formed between the first end plate portion 151 and the first wrap 153, and between the second wrap 162 and the second end plate portion 161, and a suction chamber, an intermediate pressure chamber, and a discharge chamber may be consecutively formed according to an advancing direction of the wrap.

[0084] As shown in FIG. 8, the compression chamber (V) includes a first compression chamber (V1) formed between an inner surface of the first wrap 153 and an outer surface of the second wrap 162, and a second compression chamber (V2) formed between an outer surface of the first wrap 153 and an inner surface of the second wrap 162. In other words, the first compression chamber (V1) includes a compression chamber formed between two contact points (P11, P12) formed by the inner surface of the first wrap 153 and the outer surface of the second wrap 162 being in contact with each other, and the second compression chamber (V2) includes a compression chamber formed between two contact points (P21, P22) formed by the outer surface of the first wrap 153 and the inner surface of the second wrap 162 being in contact with each other.

[0085] Here, when an angle having a large value between angles formed by two lines connecting the center of the eccentric portion, that is, the center (O) of the rotation shaft coupling portion, and the two contact points (P11, P12) is α, the first compression chamber (V1) immediately before discharge has $\alpha < 360°$ immediately before at least the start of discharge, and a distance (l) between normal vectors at the two contact points (P11, P12) also has a value larger than zero.

[0086] Due to this, the first compression chamber immediately before discharge may have a smaller volume than the case where the first compression chamber has the fixed wrap and the orbiting wrap made of an involute curve, and thus it may be possible to improve both a compression ratio of the first compression chamber (V1) and a compression ratio of the second compression chamber (V2) without increasing a size of the first wrap 153 and the second wrap 162.

[0087] On the other hand, a rotation prevention mechanism for preventing a rotational movement of the second scroll 160 is provided between the frame 140 and the second scroll 160. An oldham ring or pin-ring structure may be applicable to the rotation prevention mechanism. The present embodiment will be described around an example to which the pin-ring structure is applied.

[0088] For a rotation prevention portion 190 according to the present embodiment, a rotation prevention groove 191 may be formed on either one of a rear side of the frame 140 and a front side of the end plate portion 161 of the second scroll 160, and a rotation prevention pin 192 rotatably inserted into the rotation prevention groove may be formed on a member facing the rotation prevention groove 191. FIGS. 2 and 7 show examples in which the rotation prevention grooves 191 and the rotation prevention pin 192 are coupled to the frame 140 and the second scroll 160, respectively.

[0089] The rotation prevention grooves 191 are formed at regular intervals along a circumferential direction on an outer side of the back pressure space (S4) on the thrust surface 143 of the frame 140. An inner diameter of the rotation prevention groove 191 is formed to be larger than the rotation prevention pin 192 to allow the rotation prevention pin 192 to perform an orbiting movement.

[0090] Furthermore, the rotation prevention groove 191 may be formed directly on the thrust surface 143 of the frame 140, but after forming an annular groove (not shown) on the frame thrust surface 143, a plurality of rotation preventing grooves 191 may be formed at regular intervals inside the annular groove.

[0091] The rotation prevention pins 192 and the rotation prevention grooves 191 are formed to correspond one to the other such that the rotation prevention pins

192 can be inserted into the plurality of rotation prevention grooves 191, respectively. Accordingly, the plurality of rotation prevention pins 192 are inserted into the rotation prevention grooves 191, respectively, to guide an orbiting movement while restricting a rotational movement of the second scroll 160.

[0092] Here, an outer circumferential surface of the rotation prevention pin 192 continuously makes sliding contact with an inner circumferential surface of the rotation prevention groove 191, and thus the rotation prevention groove 191 and the rotation prevention pin 192 are preferably formed of a wear-resistant material such as a spring steel. However, since the second scroll 160 and the frame 140 formed with the rotation prevention groove 191 and the rotation prevention pin 192 are formed of a light and soft material such as an aluminum material in consideration of the weight of the compressor, the prevention groove 191 and the rotation prevention pin 192 may be deteriorated in wear resistance.

[0093] As a result, the rotation prevention pin 192 is made of a material having a high wear resistance and a high rigidity such as a spring steel and fixedly coupled to the second scroll 160, whereas a lubricating ring made of the same or similar material as the rotation prevention pin 192 may be inserted into the rotation prevention groove 191 to form a rotation prevention mechanism having a pin-ring structure.

[0094] Here, the lubricating rings may be individually formed and assembled, but a plurality of lubricating rings may be bound and integrally formed with an annular plate. It also applies to the rotation prevention ring as well. In other words, a plurality of rotation prevention rings may also be formed integrally with one annular plate and collectively coupled to the second scroll.

[0095] Reference numerals 159a, 159b on the drawing denote bypass holes.

[0096] The foregoing scroll compressor according to the present embodiment operates as follows.

[0097] In other words, when power is applied to the drive motor 103, the rotation shaft 133 transmits a rotational force to the second scroll 160 while rotating together with the rotor 132.

[0098] Then, the second scroll 160 performs an orbiting movement by the rotation prevention mechanism to reduce the volume while the compression chamber (V) continuously moves toward the center side.

[0099] Then, as shown in an arrow of FIG. 2, refrigerant flows into the suction space (S1) through the intake port 111a, and the refrigerant that has flowed into the suction space (S1) flows through a passage formed on an outer circumferential surface of the stator 131 and an inner circumferential surface of the main housing 110 or a gap between the stator 131 and the rotor 132 and is sucked into the compression chamber (V) through the suction passage 154.

[0100] At this time, part of the refrigerant sucked into the suction space (S1) through the intake port 111a first comes into contact with the sealing portion 112, which is a front side of the main housing 110, prior to passing through the drive motor 103. Accordingly, the sealing portion 112 is cooled by exchanging heat with cold suction refrigerant, thereby dissipating the heat of the inverter module 200 attached to an outer side surface of the main housing 110.

[0101] In particular, when the inverter receiving portion 115 provided in the sealing portion 112 is protruded in a direction toward the drive motor 130 as in the present embodiment, as described above, the cold refrigerant sucked into the suction space (S1) may be easily brought into contact with the inverter receiving portion 115 to enhance the heat dissipation effect of the sealing portion 112, thereby reducing the temperature of the inverter housing 210 to more quickly dissipate the heat of the inverter device 220 accommodated inside the inverter housing 210.

[0102] On the other hand, refrigerant sucked into the compression chamber (V) through the suction space (S1) is compressed by the first scroll 150 and the second scroll 160 and discharged into the discharge space (S2) through the discharge port 155, and the refrigerant discharged to the discharge space (S2) is separated from the discharge space (S2), and the refrigerant is discharged to the refrigeration cycle through the discharge port 121a while oil is accumulated in the oil storage portion (S22).

[0103] Then, the oil collected in the oil storage portion (S22) flows into the oil supply groove 133e of the rotation shaft 133 through the oil supply pipe 157 according to a pressure difference between the discharge space (S2) and the suction space (S1), and the oil is supplied to the second oil supply hole 133f2, the third oil supply hole 133f3, and the first oil supply hole 133f1 while moving in a direction from the first end portion 133a of the rotation shaft 133 toward the second end portion 133b along the oil supply groove 133e. At this time, as the pressure reducing member 133g is inserted into the oil supply groove 133e, the pressure of the oil moving to the oil supply groove 133e is reduced to an intermediate pressure.

[0104] Then, the oil supplied to the second oil supply hole 133f2 and the third oil supply hole 133f3 lubricates the second bearing 172 and the third bearing 173 while moving to the compression chamber (V) and the back pressure space (S4) according to the pressure difference, and the oil supplied to the first oil supply hole 133f1 lubricates the first bearing 171 while moving to an outer circumferential surface of the first bearing portion 133c1 according to the pressure difference.

[0105] At this time, when the back pressure space (S4) communicates with the suction space (S1), the discharge space (S2), the back pressure space (S4) and the suction space (S1) are communicated with each other by the oil supply groove 133e of the rotation shaft 133 and the oil supply holes 133f1, 133f2, 133f3, and accordingly, oil may lubricate each bearing surface while not being stagnated in the oil storage portion (S22), the oil supply passage (Fo) and the back pressure space (S4) but moving between the discharge space (S2), the back pressure space (S4), and the suction space (S1) by a pressure difference.

[0106] In this manner, as the bearing portion supporting the rotation shaft in a radial direction is provided only on one side of the drive motor with respect to the drive motor, it may be possible to reduce an axial length of the compressor as a whole.

[0107] In addition, as the rotation shaft is not protruded from the drive motor or the protruded length becomes short, the inverter receiving portion may be disposed close to the drive motor to enhance a contact possibility between refrigerant sucked into the suction space of the casing and the inverter receiving portion, thereby effectively cooling the inverter.

[0108] In addition, as the oil supply passage is formed through the rotation shaft, a length of the oil supply passage may be reduced to quickly supply oil during compressor start-up, thereby reducing friction loss.

[0109] In addition, as the rotation shaft is supported in a radial direction using bush bearings, it may be possible to reduce the cost due to the bearings, reduce operating noise, and reduce a gap between the compression unit and the bearings, thereby reducing refrigerant leakage in the compression chamber.

[0110] In addition, as the rotation shaft is coupled through the orbiting scroll, a differential pressure between a back pressure of the back pressure space and an axial gas force in the compression chamber may be reduced, and accordingly, it may be possible to enable an high-speed operation and suppress refrigerant leakage while the behavior of the orbiting scroll is stabilized.

[0111] Meanwhile, in the motor operated compressor according to the present embodiment, as described above, an inner space of the compressor casing is divided into a suction space and a discharge space, and both ends of the rotation axis are located in the suction space and the discharge space, respectively. Accordingly, the rotating shaft may be pushed into the suction space by a pressure of the discharge space. In the related art, as the rotation shaft is supported by ball bearings, the bearing portion is provided such that the ball bearings support the rotation shaft in an axial direction as well as a radial direction or support the rotation shaft in an axial direction in a subframe or the like that supports a suction side end portion of the rotation shaft. However, in a structure in which the rotation shaft is supported by bush bearings and the subframe is removed as in the present embodiment, a separate axial support structure for supporting an axial direction of the rotation shaft is required. FIG. 9 is a cross-sectional view showing an axial support structure according to the present embodiment, and FIG. 10 is an enlarged cross-sectional view showing portion "A" in FIG. 9, and FIG. 11 is a cross-sectional view taken along line "VI-VI" in FIG. 10.

[0112] As illustrated in FIGS. 9 and 10, the present embodiment may form a first bearing protrusion portion 136 on the rotation shaft 133 to be supported in an axial direction on a second bearing protrusion portion 146 of the frame 140, which will be described later.

[0113] The first bearing protrusion portion 136 of the rotation shaft 133 is extended in a radial direction from an outer circumferential surface of the rotation shaft 133 and formed in an annular flange shape, and the second bearing protrusion portion 146 of the frame 140 is protruded in an axial direction by a predetermined height from an end portion of the shaft hole 145 or a circumference of the shaft hole 145 of the frame forming the back pressure space (S4), and extended toward the first bearing protrusion portion 136 of the rotation shaft 133.

[0114] A bearing surface 136a is formed in a direction toward the drive motor 103 on the first bearing protrusion portion 136 of the rotation shaft 133, and a bearing surface 146a is formed in a direction toward the compression mechanism unit 105 on the second bearing protrusion portion 146 of the frame 140. Accordingly, the bearing surface 136a of the first bearing protrusion portion 136a is supported in an axial direction on the bearing surface 146a of the second bearing protrusion portion 146 to suppress the rotation shaft 133 from being pushed in a direction toward the suction space (S1) by the pressure of the discharge space (S2).

[0115] A diameter (D1) of the first bearing protrusion portion 136 is formed to be smaller than or equal to an inner diameter of an eccentric mass portion 137b extended from the fixed portion 137a of the balance weight 137, and a diameter (D2) of the second bearing protrusion portion 146 is formed to be smaller than or equal to the diameter (D1) of the first bearing protrusion portion 136. An outer diameter of the second bearing protrusion portion 146 is formed to be smaller than an inner diameter of the eccentric mass portion 137b of the balance weight 137, and thus when the balance weight 137 rotates together with the rotation shaft 133, it may be possible to prevent the eccentric mass portion 137b of the balance weight 137 from colliding with the second bearing protrusion portion 146 in advance.

[0116] Meanwhile, in the above-described embodiment, the first bearing protrusion portion may be formed on the rotation shaft to be supported in an axial direction on the second bearing protrusion portion of the frame, but the first bearing protrusion portion may be formed on the balance weight coupled to the rotation shaft. FIG. 12 is a cross-sectional view showing another embodiment of the axial support structure according to the present embodiment.

[0117] As illustrated in FIG. 12, the fixed portion 137a inserted and fixed to the rotation shaft 133 is formed in an annular shape on the balance weight 137, and the eccentric mass portion 137b having a semicircular cross section or an circular-arc cross section is formed on one side of the fixed portion 137a. The eccentric mass portion 137b is formed so as to protrude in a direction toward the drive motor 103. The eccentric mass portion 137b is protruded in an axial direction from part of an edge of the fixed portion 137a, and spaced from the rotation shaft

133.

[0118] A precision-machined bearing surface 137c is formed on part of the front surface of the fixed portion 137a, that is, inside the eccentric mass portion 137b. The fixed portion 137a serves as a type of first bearing protrusion portion described previously in the embodiment of FIG. 10. Accordingly, the bearing surface 137c of the fixed portion 137a may correspond to the bearing surface 146a of the second bearing protrusion portion 146 provided in the frame 140, thereby suppressing the rotation shaft 133 from being pushed in a direction from the discharge space (S2) toward the suction space (S1).

[0119] Furthermore, a support portion 133h may be formed on an outer circumferential surface of the rotation shaft 133 to press-fit and tightly fix the fixed portion 137a of the balance weight 137. The support portion 133h may be formed as a stepped surface or may be formed as an annular protrusion as shown in the drawing. Accordingly, even when the balance weight 137 forms an axial bearing portion together with the frame, the balance weight 137 may be suppressed from being pushed in an axial direction.

[0120] On the other hand, in the above-described embodiments, the third bearing portion of the rotation shaft is rotatably coupled to the first scroll and is supported in a radial direction, but the third bearing portion of the rotation shaft may also be rotatably inserted into the bearing receiving portion provided in the rear housing and supported in a radial direction. FIG. 13 is a cross-sectional view showing another embodiment of a support structure of the rotation shaft in a motor operated compressor according to the present disclosure.

[0121] As illustrated in FIG. 13, a bearing protrusion 1122 is formed on an inner circumferential surface of a rear housing 1120 in a direction toward the first scroll 1150, and a bearing groove 1122a is formed at the center of the bearing protrusion portion 1122 such that a first end portion 1133a of the rotation shaft 1122 passing through the frame 1140, the second scroll 1160 and the first scroll 1150 is rotatably coupled thereto.

[0122] A second bearing 1172 made of bush bearings may be inserted and coupled to an inner circumferential surface of the bearing groove 1122a to support the second bearing portion 1133c2 of the rotation shaft 1133 in a radial direction.

[0123] Furthermore, a sealing member 1123 is provided between an end surface of the bearing groove 1122a and a rear surface of the first scroll 1150, thereby blocking refrigerant in the discharge space (S2) from flowing into the compression chamber (V) or an inner space of the bearing groove 1122a.

[0124] The basic configuration and operation effects of the motor operated compressor according to the present embodiment as described above are the same as those of the above-described embodiment. However, as the second bearing 1172 supporting the second bearing portion 1133c2 of the rotation shaft 1133 is installed in the casing 1110 other than the first scroll 1150, thereby facilitating the machining of the first scroll 1150 to be machined with a relatively high accuracy as well as suppressing the thermal deformation of the first scroll 1150 due to friction with the rotation shaft 1133, thereby improving the reliability of the compressor.

[0125] Furthermore, although not shown in the drawing, even in the case of the present embodiment, a double-sided scroll may be applicable to the second scroll. Even in this case, the basic configuration described above may also be applicable in the same manner.

[0126] In the motor operated compressor according to the present disclosure, as the bearing portion supporting the rotation shaft in a radial direction is provided only at one side of the drive motor, it may be possible to reduce an axial length of the entire compressor as compared with the bearing portion formed at both ends of the rotation shaft.

[0127] In addition, as only one end portion of the rotation shaft is supported in a radial direction and the other end thereof forms a free end in a radial direction, it may be possible to minimize a length of the rotation shaft protruded from the drive motor. Accordingly, the inverter receiving portion may be arranged close to the drive motor to a contact possibility between the inverter receiving portion and suction refrigerant, thereby effectively cooling the inverter.

[0128] In addition, as the oil supply passage is formed in the rotation shaft, a length of the oil supply passage for supplying oil to each bearing may be reduced, thereby reducing friction loss while the oil is quickly supplied to each bearing during compressor start-up.

[0129] In addition, as the rotation shaft or the balance weight coupled to the rotation shaft is supported on the frame and the rotation shaft is supported in an axial direction, bush bearings with a relatively low price, low operating noise and better assemblability compared to ball bearings may be applied to support a radial direction of the rotation shaft. Accordingly, a gap between the compression unit and the bearings may be reduced to reduce refrigerant leakage in the compression chamber.

Claims

1. A motor operated compressor, comprising:

a first scroll (150);
a second scroll (160) that forms a pair of two compression chambers between the first scroll (150) and the second scroll (160) while being engaged with the first scroll (150) to perform an orbiting movement;
a frame (140) fixed in a radial direction and disposed on an opposite side of the first scroll (150) with the second scroll (160) interposed between the frame (140) and the first scroll (150);
a rotation shaft (133) disposed to pass through the frame (140) and eccentrically coupled to the

second scroll (160);
a balance weight (137) fixedly coupled to the rotation shaft (133); and
a first bearing protrusion portion (136) protruding in a radial direction from the rotation shaft (133) or from the balance weight (137), and supported by the frame (140) in an axial direction.

2. The motor operated compressor of claim 1, wherein the first bearing protrusion portion (136) is formed between the second scroll (160) and the frame (140).

3. The motor operated compressor of claim 1 or 2, further comprising a shaft hole (145) formed in the frame (140), and
wherein the rotation shaft (133) is disposed to pass through the shaft hole (145), and supported in a radial direction by a circumference of the shaft hole (145), and
the compressor further comprises a second bearing protrusion portion (146) protruding in an axial direction from the circumference of the shaft hole (145) toward the first bearing protrusion portion (136) to face the first bearing protrusion portion (136).

4. The motor operated compressor of claim 3, wherein an outer diameter of the first bearing protrusion portion (136) is equal to or greater than that of the second bearing protrusion portion (146).

5. The motor operated compressor of claim 3 or 4, wherein the second bearing protrusion portion (146), the first bearing protrusion portion (136), and the balance weight (137) are sequentially disposed in an axial direction.

6. The motor operated compressor of any one of claims 1 to 5, wherein the balance weight (137) comprises:

a fixed portion (137a) configured to surround the rotation shaft (133)and fixed to the rotation shaft (133); and
an eccentric mass portion (137b) having a circular-arc cross section and having a portion protruding in an axial direction from an edge of the fixed portion (137a) to be spaced apart from the rotation shaft (133).

7. The motor operated compressor of claim 6, the first bearing protrusion portion (136) is supported by the second bearing protrusion portion (146) in a region surrounded by the eccentric mass portion (137b).

8. The motor operated compressor of claim 6, wherein in case where the first bearing protrusion portion (136) protrudes in a radial direction from the balance weight (137), and
the compressor further comprises a support portion (133h) protruding from an outer circumferential surface of the rotation shaft (133) and engaged with the fixed portion (137a) so as to prevent an axial movement of the balance weight (137).

9. The motor operated compressor of any one of claims 1 to 8, wherein the rotation shaft (133) is disposed to further pass through the second scroll (160), and a first end portion (133a) of the rotation shaft (133) is rotatably coupled to the first scroll (150),
wherein the first end portion (133a) of the rotation shaft (133) is supported by the frame (140) and the first scroll (150) to form a support end, and a second end portion (133b) of the rotation shaft (133), which is disposed opposite to the first end portion (133a) with respect to the frame (140), forms a free end.

10. The motor operated compressor of claim 9, wherein the rotation shaft (133) further comprises an oil supply groove (133e) formed from an end of the first end portion (133a) to a predetermined length in the axial direction,
a plurality of oil supply holes (133f1, 133f2, 133f2) spaced from each other in the axial direction and facing at least two out of the first scroll (150), the second scroll (160) and the frame (140), and
a pressure-reducing member (133g) configured to decrease an inner diameter of the oil supply groove (133e) so as to reduce the pressure of oil is inserted into the oil supply groove (133e).

11. The motor operated compressor of claim 9, wherein the rotation shaft (133) further comprises an oil supply groove (133e) formed from an end of the first end portion (133a) to a predetermined length in the axial direction,
a plurality of oil supply holes (133f1, 133f2, 133f2) spaced from each other in the axial direction and facing at least two out of the first scroll (150), the second scroll (160), and the frame (140),
wherein the motor operated compressor further comprises a rear housing (120) formed to cover the first scroll (150),
a discharge space (S2) formed between the first scroll (150) and the rear housing (120) to accommodate refrigerant and oil discharged from the compression chamber, and
an oil supply passage (Fo) formed in the first scroll (150) and configured to communicate the oil storage portion (S22) with the oil supply groove (133e) to supply oil filled in the oil storage portion (S22) of the discharge space (S2) to the oil supply groove (133e) by a pressure difference.

12. The motor operated compressor of claim 10 or 11, further comprising a back pressure space (S4) formed between the second scroll (160) and the frame (140), wherein the back pressure space (S4) communicates with at least one oil supply hole (133f1, 133f2, 133f3) to receive oil through the oil supply groove (133e) and the oil supply hole (133f1, 133f2, 133f3).

13. The motor operated compressor of claim 1 or 2, wherein a shaft hole (145) is formed in the frame (140),a first bearing (171) formed to surround the rotation shaft (133) is provided on an inner circumferential surface of the shaft hole (145),
a first bearing portion (133c1) of the rotation shaft (133) is disposed to pass through the shaft hole (145), and supported by the first bearing (171) in a radial direction,
wherein the rotation shaft (133) is provided with a second bearing portion (133c2) at a first end thereof, and
the first scroll (150) is provided with a bearing receiving portion (156) formed to accommodate the second bearing portion (133c2), and
a second bearing (172) formed to surround the second bearing portion (133c2) is provided between an inner circumferential surface of the bearing receiving portion (156) and an outer circumferential surface of the second bearing portion (133c2).

14. The motor operated compressor of claim 12, wherein the rotation shaft (133) is provided with a cylindrically shaped eccentric portion (133c3) inserted into a rotation shaft coupling portion of the second scroll (160), and
an axial center of the eccentric portion (133c3) is offset from an axial center of the rotation shaft (133) such that the rotation shaft (133) is coupled to the second scroll (160) at an eccentric position, and
a third bearing (173) formed to surround the eccentric portion (133c3) is provided between an inner circumferential surface of the rotation shaft coupling portion (163) and an outer circumferential surface of the eccentric portion (133c3).

15. The motor operated compressor of claim 14, wherein the first bearing (171), the second bearing (172), and the third bearing (173) are configured with bush bearings.

FIG. 1

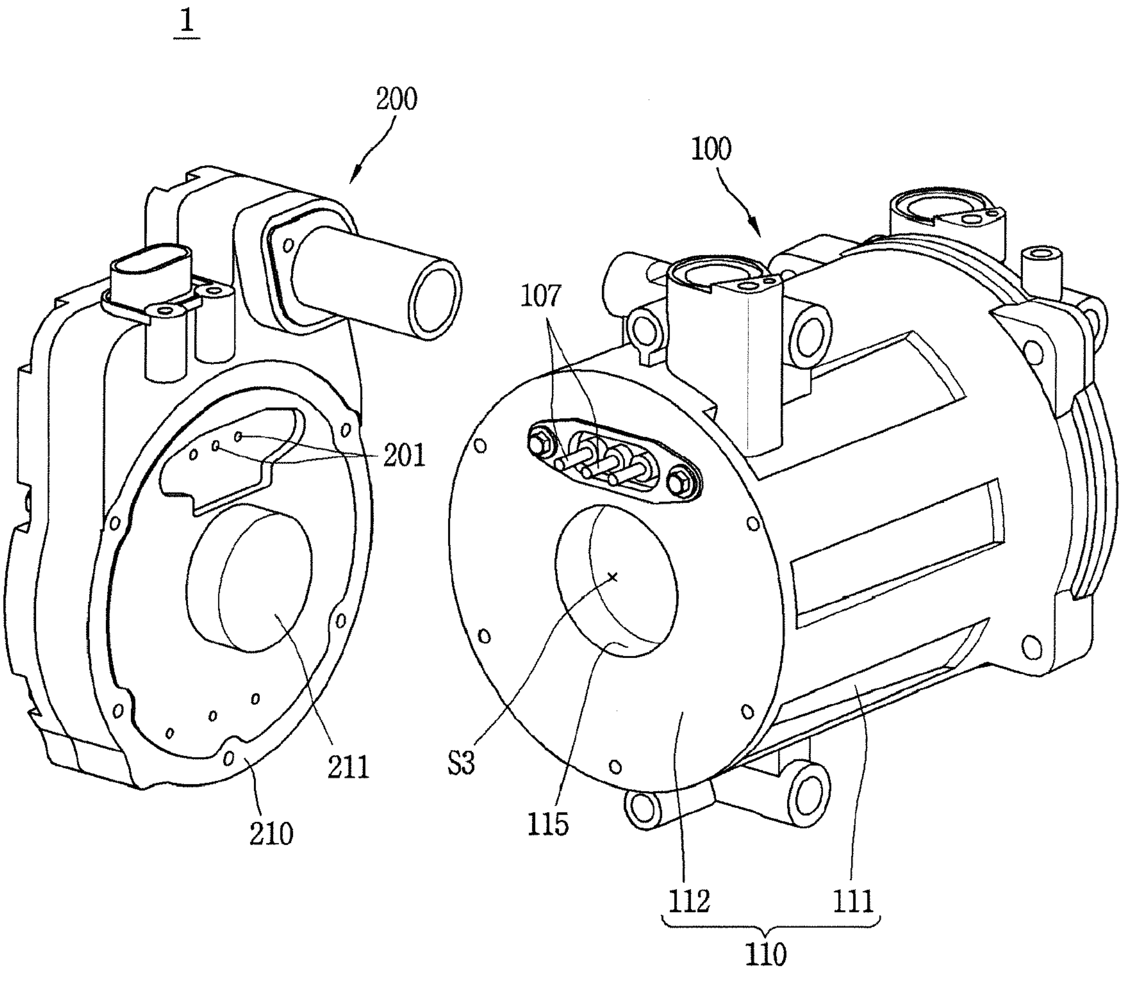


FIG. 2

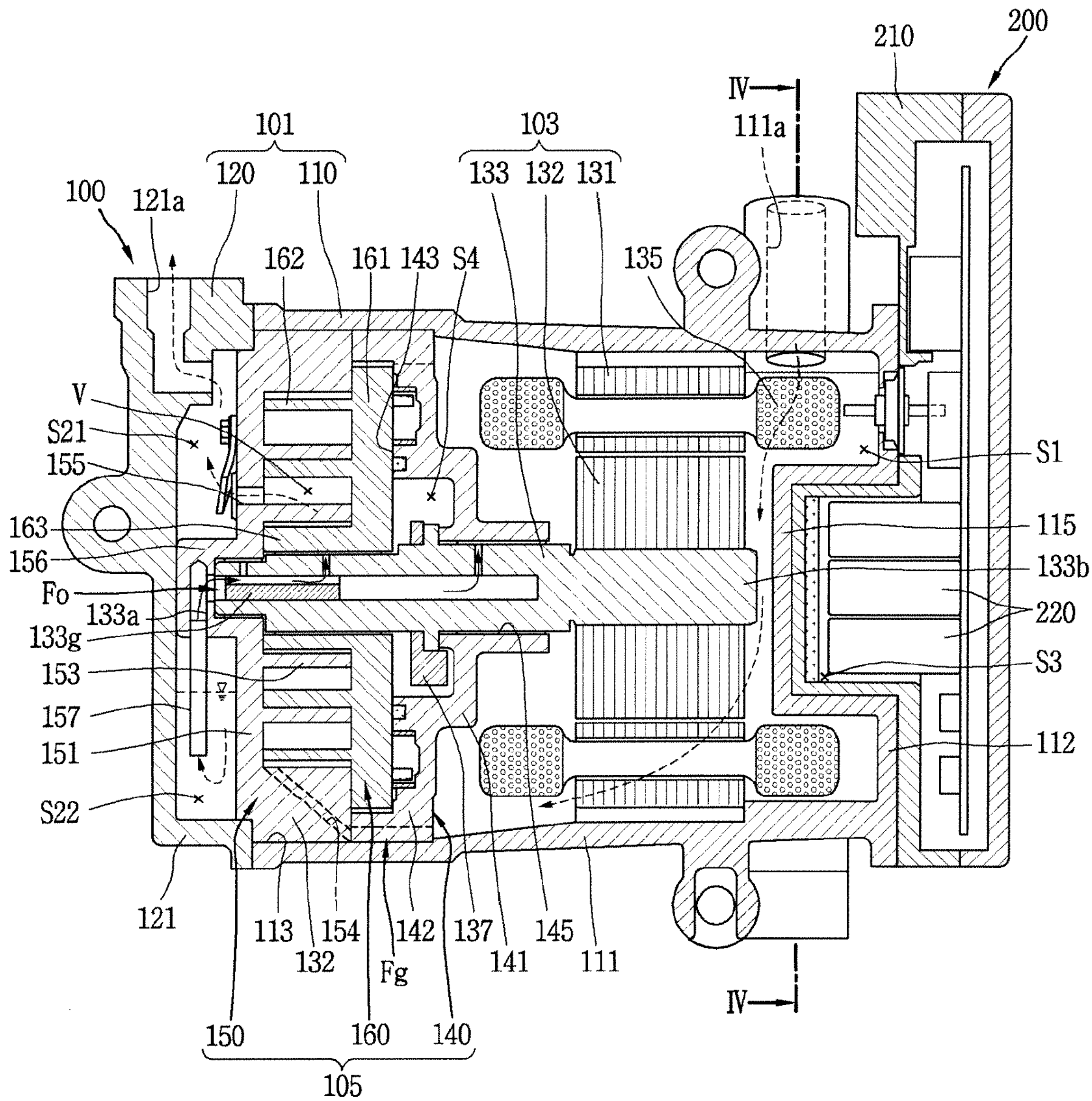

200
210
IV
111a
101
103
100
121a
120
110
133
132
131
162
161
143
S4
135
V
S21
155
S1
163
115
156
133b
Fo
133a
220
133g
153
S3
157
112
151
S22
121
113
132
154
142
137
141
145
111
Fg
150
160
140
105
IV

FIG. 3

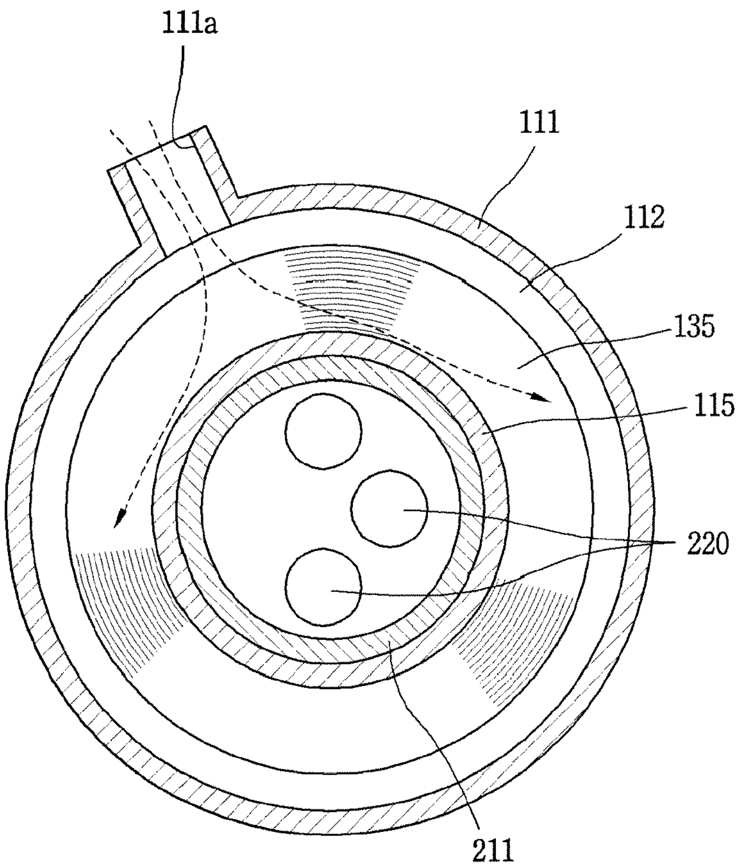


FIG. 4

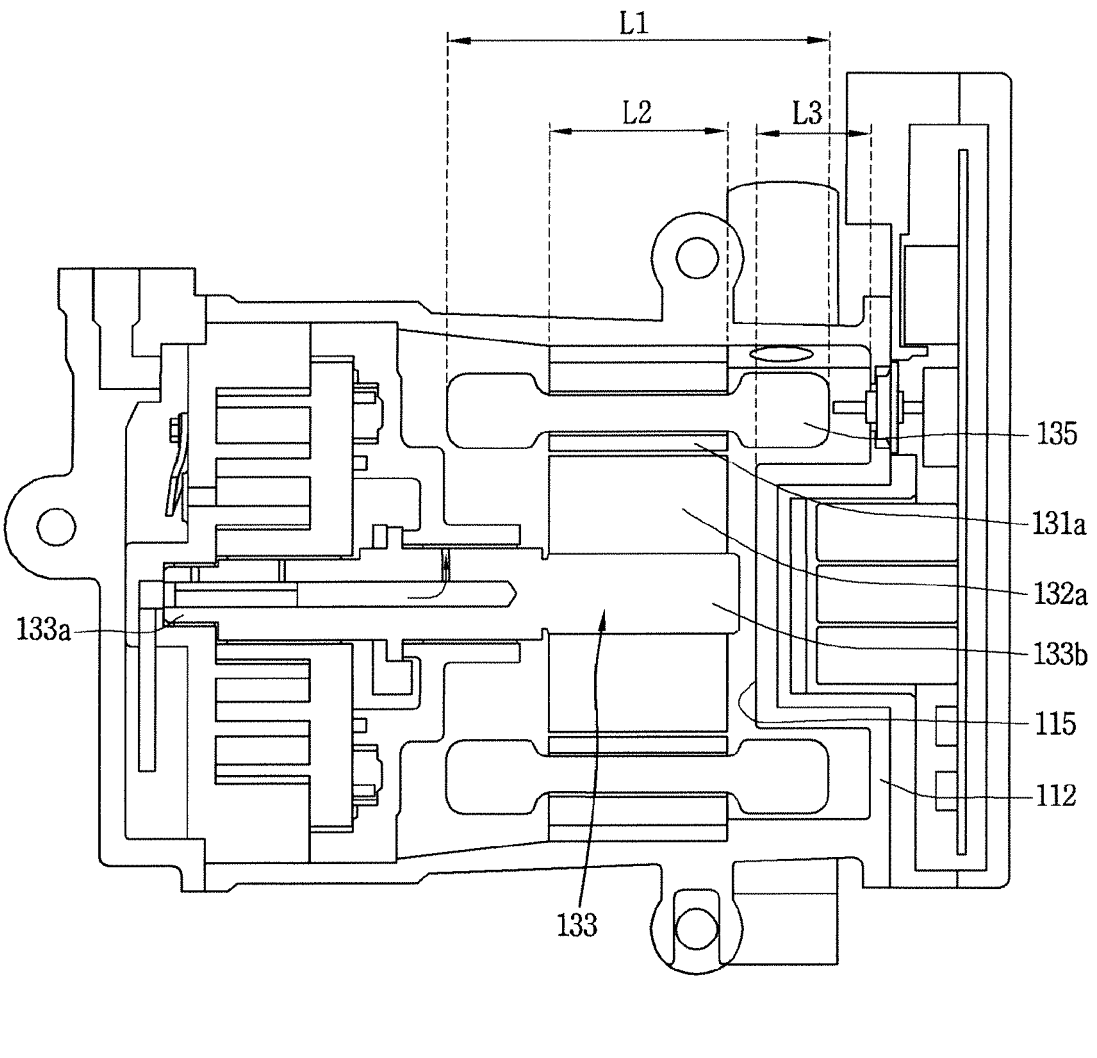


FIG. 5

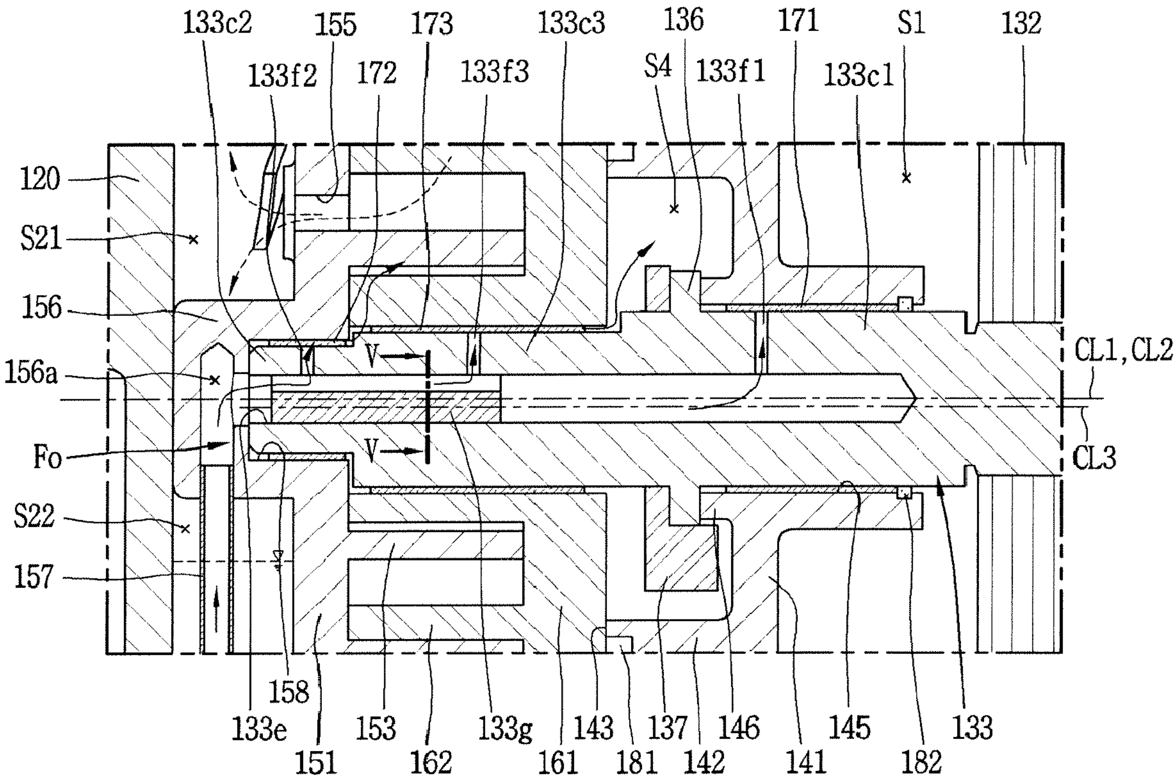

133c2
155
173
133c3
136
171
S1
132
133f2
172
133f3
S4
133f1
133c1
120
S21
156
156a
Fo
S22
157
CL1,CL2
CL3
V
V
158
133e
151
153
162
133g
161
143
181
137
142
146
141
145
182
133

FIG. 6

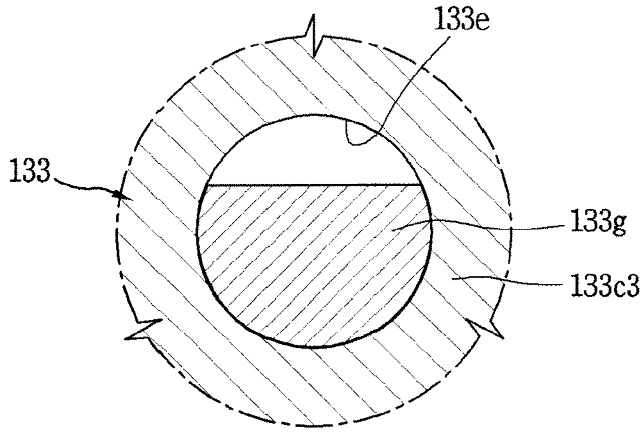
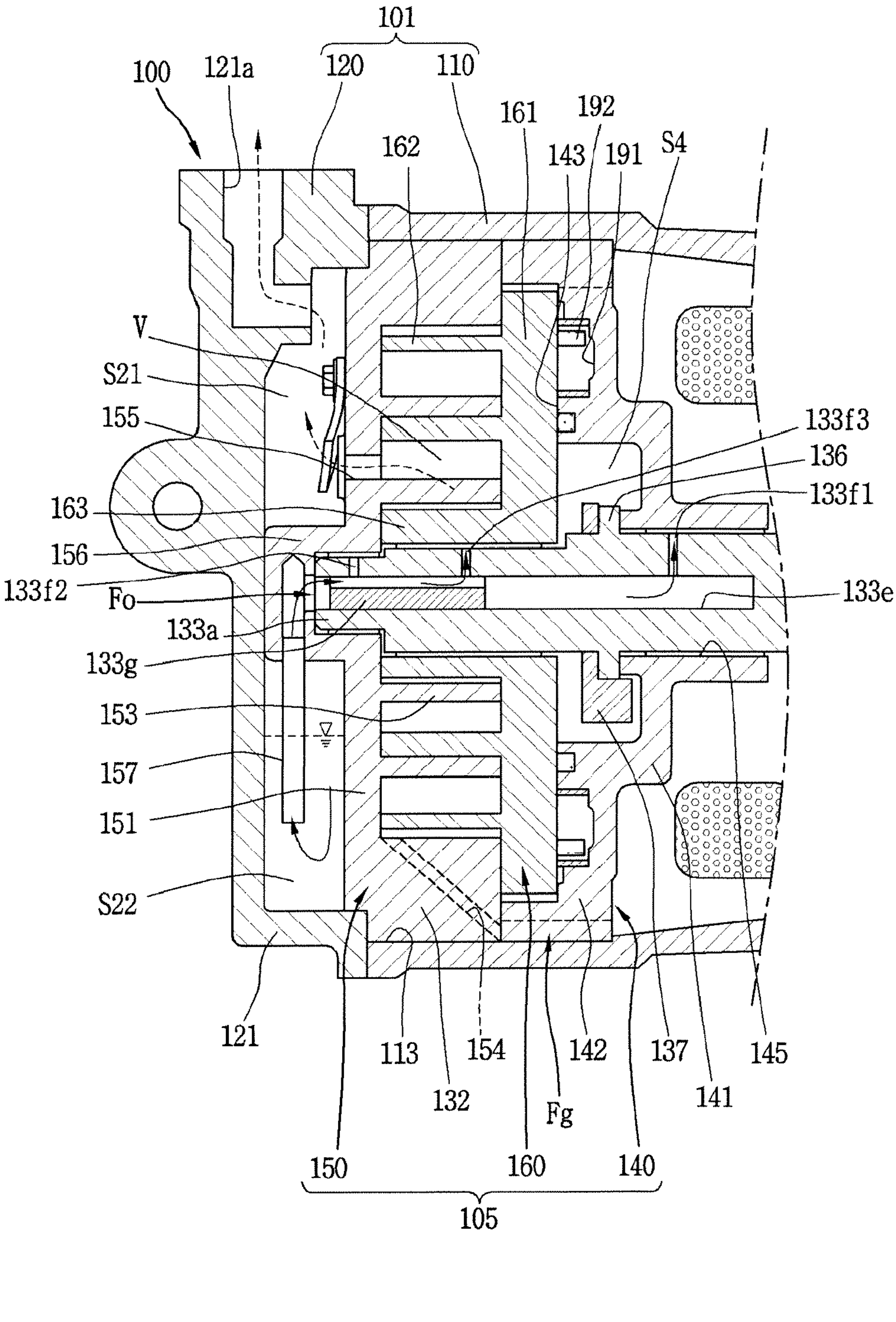

133e
133
133g
133c3

FIG. 7


101
100
121a
120
110
161
192
162
143
191
S4
V
S21
155
133f3
136
133f1
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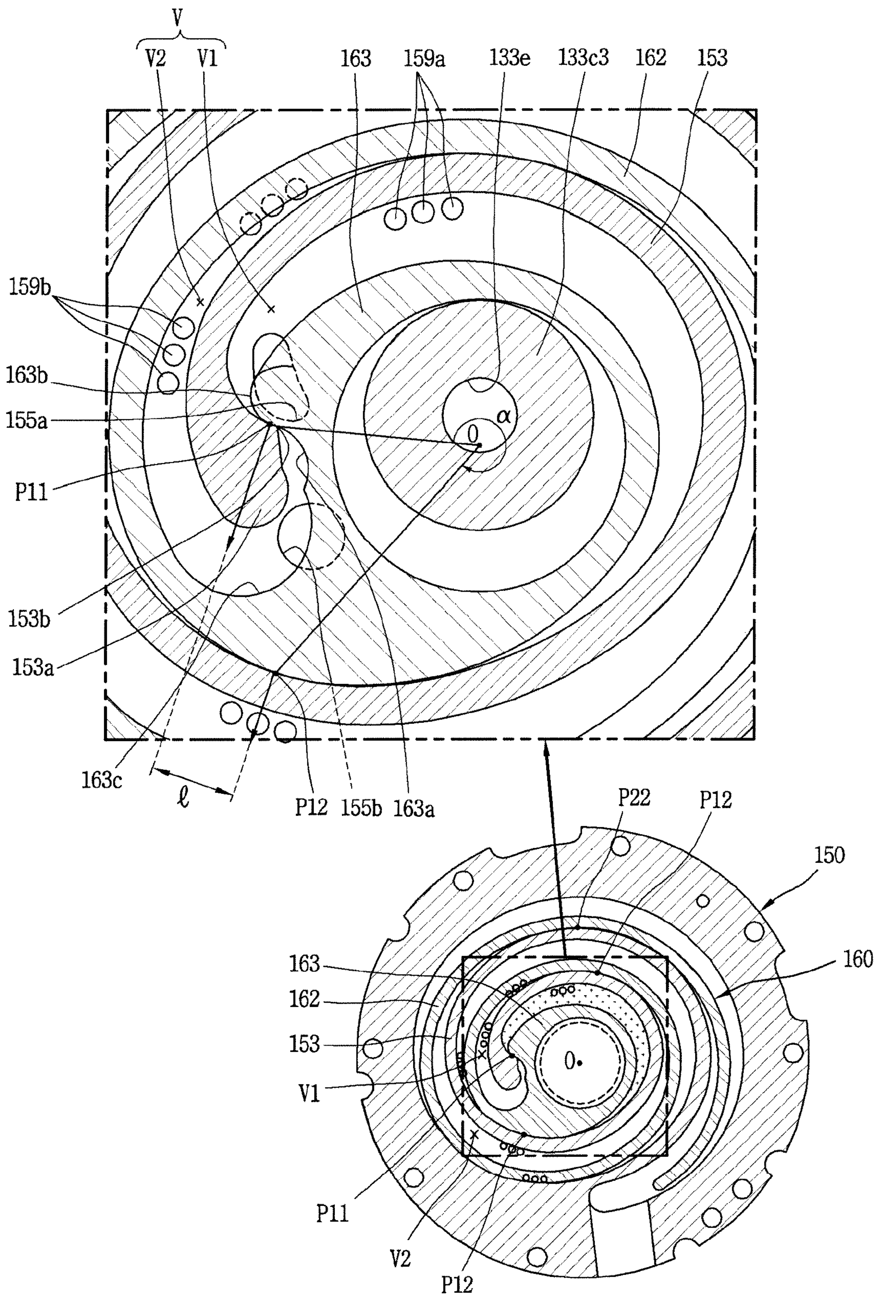
156
133f2
Fo
133e
133a
133g
153
157
151
S22
121
113
154
142
137
145
132
141
Fg
150
160
140
105

FIG. 8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V1
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163c
ℓ
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P22
P12
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153
V1
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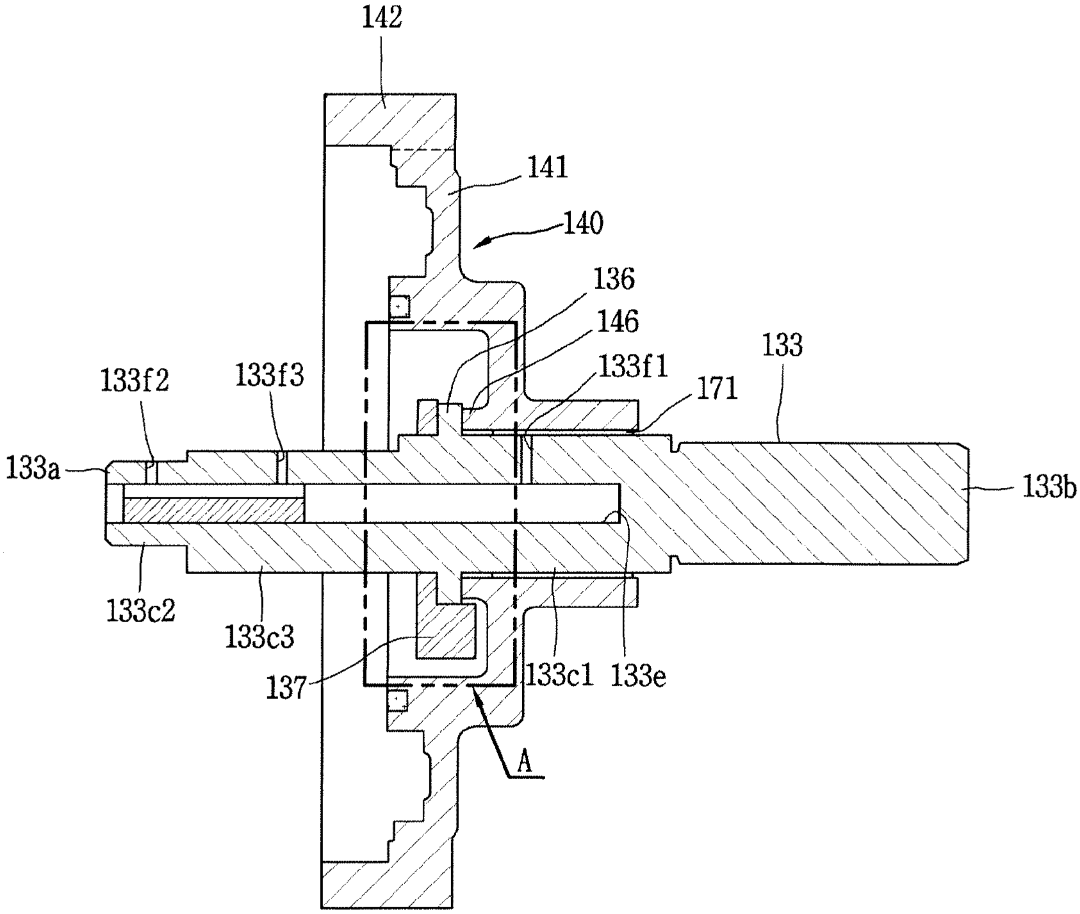
P11
V2
P12

FIG. 9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171
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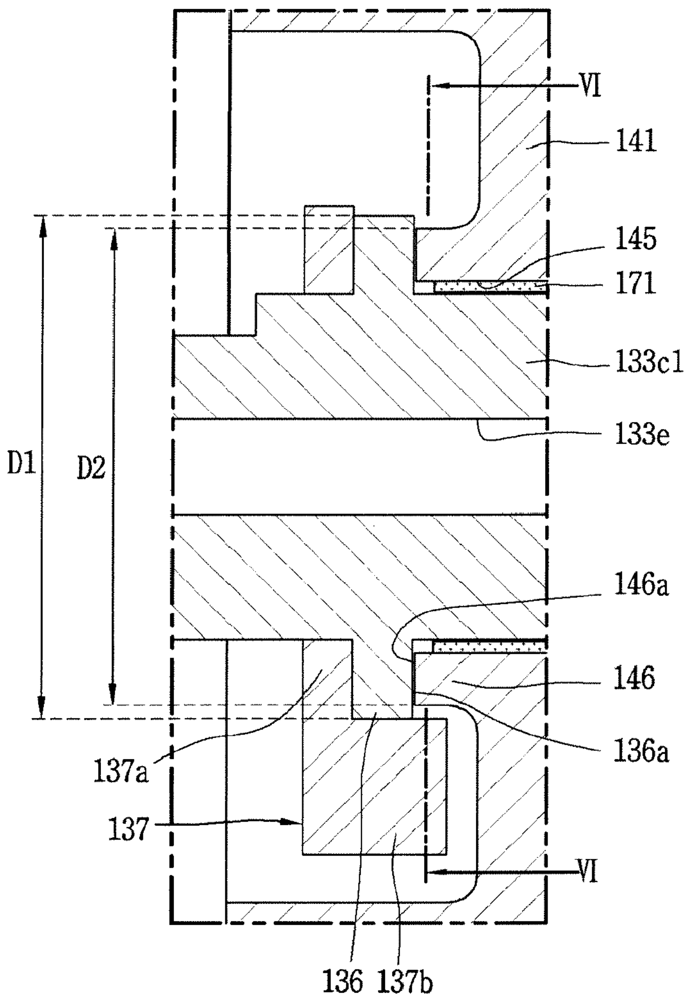
133c3
137
133c1
133e
A

FIG. 10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VI
136
137b

FIG. 11

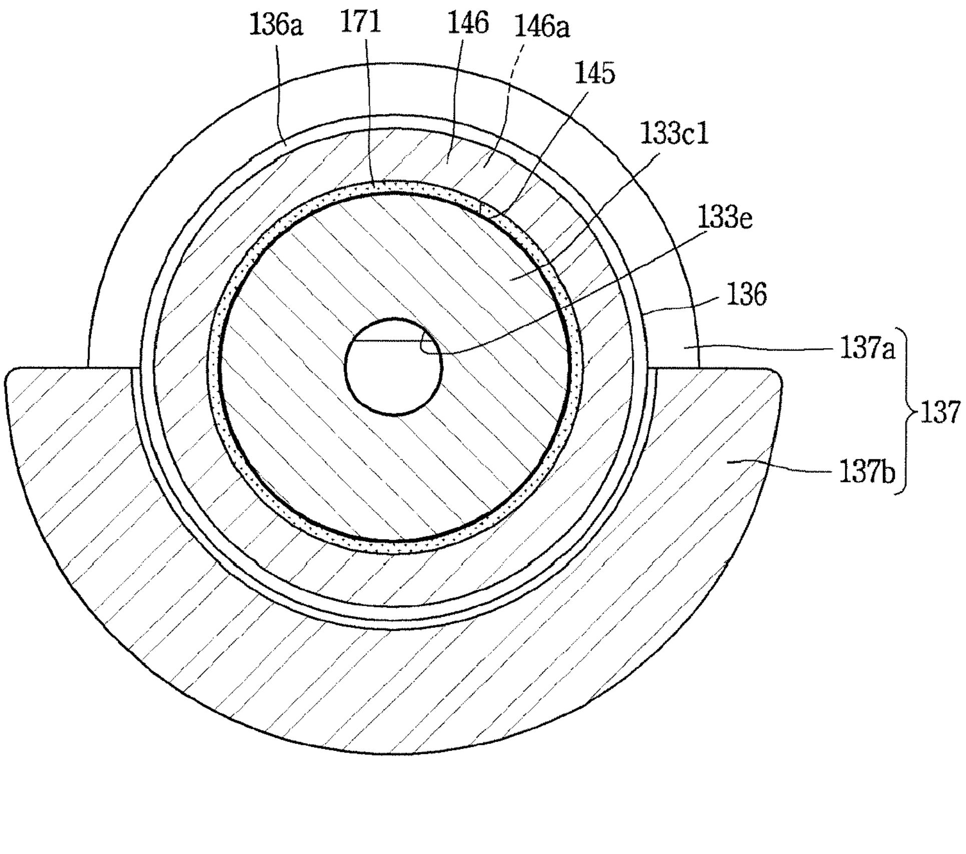


FIG. 12

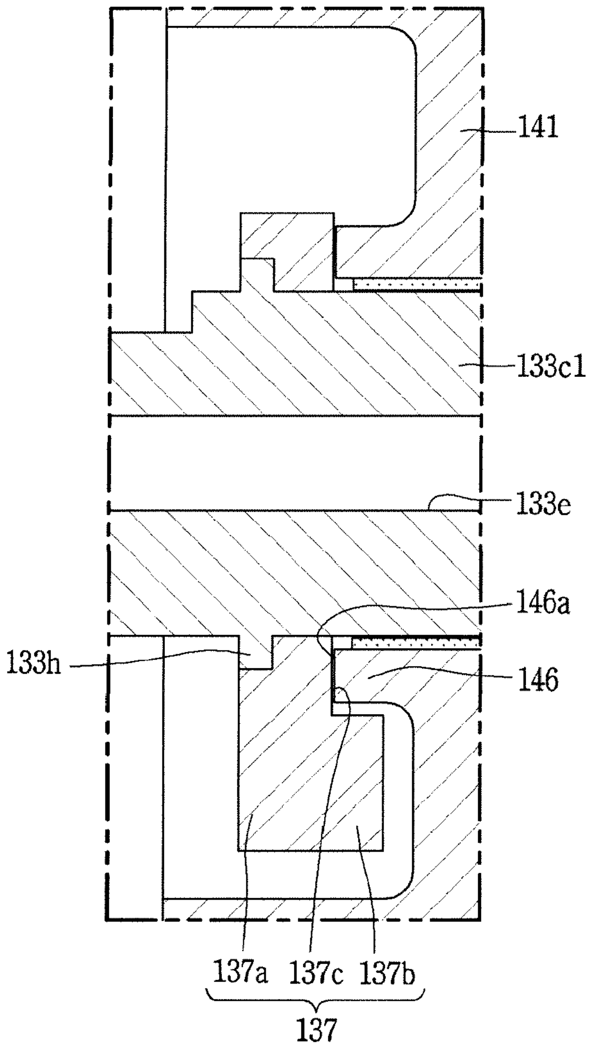
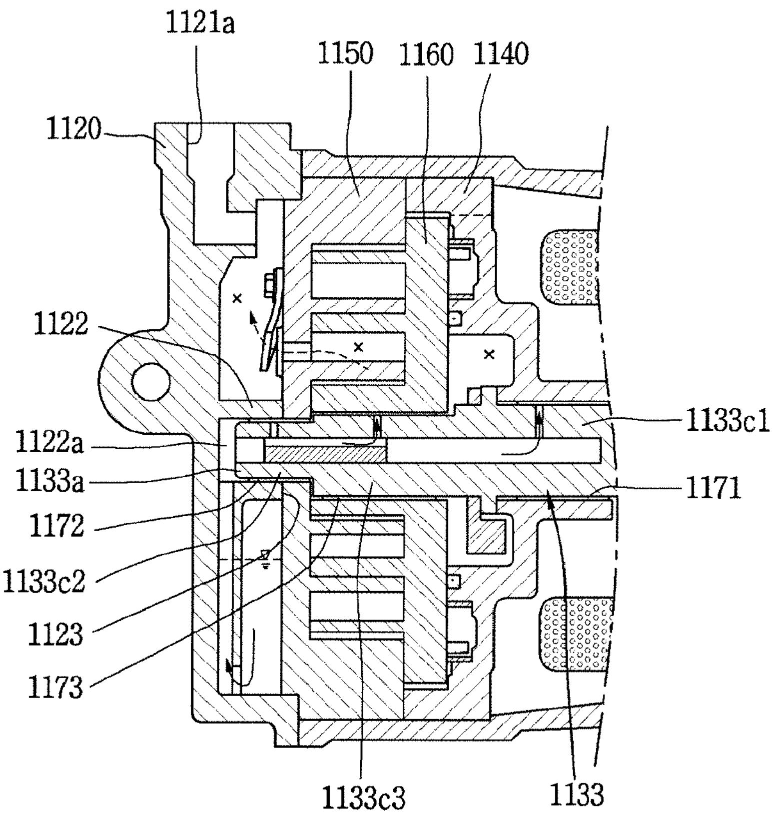


FIG. 13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1133c3
1133

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	15 March 2019	Durante, Andrea

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