(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2004 (23.12.2004)

PCT

(10) International Publication Number
WO 2004/111454 A1

(51) International Patent Classification[7]: F04C 2/107

(21) International Application Number: PCT/KR2003/001177

(22) International Filing Date: 16 June 2003 (16.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant (*for all designated States except US*): **LG ELECTRONICS INC.** [KR/KR]; 20, Yoido-Dong, Youngdungpo-Gu, Seoul 150-010 (KR).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **PARK, Joon-Hong** [KR/KR]; 1597-6 5/2, Banyeo 3-Dong, Haeundae-Gu, Busan 612-816 (KR). **LEE, Geun-Hyoung** [KR/KR]; 741-16 10/2, Gwangan 4-Dong, Suyeong-Gu, Busan 613-809 (KR). **AHN, Jae-Woo** [KR/KR]; 315, Uijeon-Ri, Jinyeong-Eup, Kimhae, Gyeongsangnam-Do 621-801 (KR).

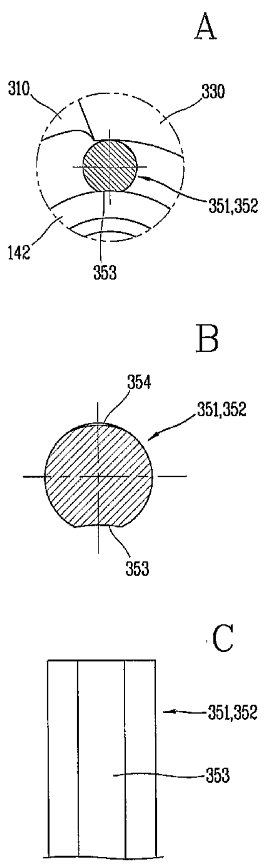
(74) Agent: **PARK, Jang-Won**; Jewoo Bldg. 5th Floor, 200, Nonhyun-Dong, Gangnam-Gu, Seoul 135-010 (KR).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,

[Continued on next page]

(54) Title: COMPRESSOR



(57) Abstract: A compressor includes a cylinder assembly (301) having an internal compression space, a suction path (301) and a discharge path connected to the compression space; a rotational shaft (140) inserted into the cylinder assembly in a lengthy direction; a partition plate (150) for partitioning the compression space into a first and a second compression spaces (341,342) and rotating by being combined with the rotational shaft (140); a first and a second vanes (341,342) contacted to each surface of the partition plate (150) so as to divide the first and second compression spaces (341,342) into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft (140) according to rotation of the partition plate (150), wherein a surface contacting portion having a circular section and a curvature same with an outer diameter of the rotational shaft (140) is formed at least one of the first and second vanes (341,342).

WO 2004/111454 A1

SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

COMPRESSOR

TECHNICAL FIELD

The present invention relates to a compressor.

BACKGROUND ART

Generally, a compressor is for compressing a fluid. According to operation types, etc, the compressor can be divided into a linear compressor, a scroll compressor, a piston compressor and a rotary compressor, etc.

In modifications of the rotary compressor, there are a method for compressing a fluid with a piston eccentrically combined with a rotational shaft so as to rotate in a compression chamber; and a method for compressing a fluid with a partition plate combined with a rotational shaft so as to divide a cylindrical compression space into upper and lower spaces. In particular, the rotary compressor using the second method has been disclosed in WO 01/81765 A1 and has been called a 'Z' compressor according to a shape of the partition plate.

In the meantime, EER (energy efficiency ratio) indicates performance of a compressor, performance and life span of the compressor can be varied according to a structure thereof.

Because compressors have different structures according to operation types, a compressor is required to have an appropriate structure in consideration of performance and life span thereof.

TECHNICAL GIST OF THE PRESENT INVENTION

In order to solve the above-described problems, it is an object of the present invention to provide a compressor having a structure capable of improving performance and life span thereof.

It is another object of the present invention to provide a compressor having a simple structure capable of showing improved performance by reducing leakage of a fluid between a compression region and a suction region in a compression space.

It is still another object of the present invention to provide a compressor having a structure capable of preventing abrasion of a contact maintaining unit for making a vane contact to a partition plate.

It is still another object of the present invention to provide a compressor having a structure capable of reducing leakage of a fluid between a compression region and a suction region in a compression space and at the same time, facilitating fabrication.

It is still another object of the present invention to provide a compressor having a structure capable of preventing compression loss generated by expansion of a compressed fluid remained on a lower portion of a vane.

It is still another object of the present invention to provide a compressor having a structure capable of improving compression efficiency by installing a compression unit and a motor unit horizontally or slantingly.

It is still another object of the present invention to provide a compressor having a structure capable of improving compression efficiency by installing a discharge pipe between a compression unit and a motor unit of a casing having a sealed space.

In order to achieve the above-mentioned objects, a compressor in accordance with the present invention includes a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate; and a contact maintaining unit for making the first and second vanes maintain a state contacted to each surface of the partition plate while performing a reciprocating motion in the lengthy direction of the rotational shaft with the first and second vanes.

In addition, a compressor in accordance with the present invention includes a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate; and at least one abrasion preventing unit interposed between the top end of the first vane and the first contact maintaining unit and/or between the top end of the second vane and the second contact maintaining unitin order to prevent abrasion of the end of the contact maintaining unit.

In addition, a compressor in accordance with the present invention includes a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate, wherein a surface contacting portion having a circular section and a curvature same with an outer diameter of the rotational shaft is formed at least one of the first and second vanes.

In addition, a compressor in accordance with the present invention includes a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate, wherein an inner diameter of a vane insertion hole formed at the cylinder assembly for receiving the first and second vanes respectively and making the first and second vanes perform a reciprocating motion in a certain region is greater than a distance from the outer circumference of the rotational shaft at which the first or second vane is contacted to an inner diameter of the cylinder assembly.

In addition, a compressor in accordance with the present invention includes a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate, wherein a vane insertion hole formed at the cylinder assembly for receiving the first and second vanes respectively and making them perform a reciprocating motion in a certain region is communicated with the discharge path by a connection path.

In addition, a compressor in accordance with the present invention includes a compression unit having a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; and a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft, a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate; a motor unit combined with the rotational shaft in order to generate a rotational force; and a casing having a sealed space in which the compression unit and the motor unit are disposed and having a discharge pipe combined between the compression unit and the motor unit in order to discharge a fluid compressed in the compressionunit.

In addition, a compressor in accordance with the present invention includes a compression unit having a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly, a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft, and a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate; a motor unit combined with the rotational shaft in order to generate a rotational force; and a casing having a sealed space in which the compression unit and the motor unit are disposed so as to be perpendicular to the gravity direction.

In addition, a compressor in accordance with the present invention includes a compression unit having a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space; a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly; a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft; and a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate; a motor unit combined with the rotational shaft in order to generate a rotational force; and a casing having a sealed space in which the compression unit is installed below the motorunit in the gravity direction.

BRIEF DESCRIPTION OF DRAWINGS

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.

In the drawings:

Figure 1 is a longitudinal-sectional view illustrating a compressor in accordance with a first embodiment of the present invention;

Figure 2 is an enlarged-sectional view illustrating a compressionunit of the compressor in Figure 1;

Figure 3 is a perspective view illustrating a rotational shaft and a partition plate of the compression unit in Figure 1;

Figure 4A is a sectional view illustrating an example of a vane of the compressor in Figure 1;

Figure 4B is a sectional view illustrating a modified example of the vane of the compressor in Figure 1;

Figure 4C is a conceptual view illustrating a dead volume of the vane in Figure 4A;

Figure 5A is a partial-enlarged view illustrating a vane having a surface contact portion of the compressor in Figure 1;

Figure 5B is a sectional view illustrating a section of the vane in Figure 5A;

Figure 5C is a side view illustrating the vane in Figure 5A;

Figure 6 is a sectional view illustrating a modified example of a vane insertion hole of the compressor in Figure 1;

Figure 7A is a sectional view illustrating an embodiment of a vane of the compressor in Figure 1;

Figure 7B is a perspective view illustrating the vane in Figure 7A;

Figure 8 is a bottom view illustrating part of a covering unit having an internal connection path of the compressor in Figure 1;

Figure 9A is a side view illustrating a first embodiment of a contact maintaining unit of the compressor in Figure 1;

Figure 9B is a plane view illustrating the contact maintaining unit in Figure 9A;

Figure 10A is a side view illustrating a second embodiment of a contact maintaining unit of the compressor in Figure 1;

Figure 10B is a plane view illustrating the contact maintaining unit in Figure 10A;

Figure 11A is a side view illustrating a third embodiment of a contact maintaining unit of the compressor in Figure 1;

Figure 11B is a longitudinal-sectional view illustrating a vane in Figure 11A;

Figure 11C is a side view illustrating the vane in Figure 11A;

Figures 12A and 12B are sectional views illustrating a fourth embodiment of a contact maintaining unit of the compressor in Figure 1;

Figure 13A is a plane view illustrating part of a guide unit installed at a muffler of the compressor in Figure 1;

Figure 13B is a longitudinal-sectional view illustrating the guide unit in Figure 13A;

Figure 14A is a side view illustrating a guide unit having a restraining member of the compressor in Figure 1;

Figure 14B is a side view illustrating the restraining member in Figure 14A;

Figure 15A is a partial-perspective view illustrating a fifth embodiment of a contact maintaining unit of the compressor in Figure 1;

Figure 15B is a plane view illustrating the top surface of the vane in Figure 15A;

Figure 16 is a sectional view illustrating a compressor in accordance with a second embodiment of the present invention;

Figure 17 is a conceptual view illustrating a pressure separate member of the compressor in Figure 16;

Figure 18 is a plane view illustrating the pressure separate member in Figure 17 used as a muffler;

Figure 19 is a conceptual view illustrating an oil supply pipe of the compressor in Figure 17; and

Figure 20 is a sectional view illustrating a compressor in accordance with a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the preferred embodiments of the present invention will be described with reference to accompanying drawings.

As depicted in Figure 1, a compressor in accordance with a first embodiment of the present invention includes a cylinder assembly 301 having an internal compression space, a suction path 310 and a discharge path (not shown) connected to the compression space; a rotational shaft 140 inserted into the cylinder assembly 310 in a lengthy direction of the cylinder assembly 310; a partition plate 150 for partitioning the compression space into a first and a second compression spaces 341, 342 and rotating by being combined with the rotational shaft 140; a compressionunit 300 having a first and a second vanes 351, 352 contacted to each surface of the partition plate 150 so as to divide the first and second compression spaces 341, 342 into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft 150 according to rotation of the partition plate 150; and a motor unit 200 for rotating the rotational shaft 140.

The motor unit 200 and the compression unit 300 are deposed in the casing 100, as depicted in Figure 1, the compression unit is installed at the lower portion, and the motor unit 200 is installed at the upper portion.

In particular, in the casing 100, a suction pipe 311 for sucking a fluid into the compression space connects the compression unit 300 to the outside, the fluid compressed in the compressor unit 300 is discharged into a sealed space S of the casing 100, and the fluid is discharged through a discharge pipe 130 installed at the upper portion. The suction pipe 311 is connected to an evaporator or an accumulator, etc.

As depicted in Figure 1, the casing 100 includes an upper cap 121, a lower cap 122 and a casing main body 110 for forming the sealed space S by being combined with the upper and lower caps 121, 122.

And, oil is filled in the lower portion of the casing 100 in order to smooth the operation of the motor unit 200 and the compression unit 300, and the oil is transmitted to each unit of the motor unit 200 and the compression unit 300 by an oil supplier (not shown) formed at the rotational shaft 140.

In the first embodiment of the compressor depicted in Figure 1, the discharge pipe 130 is installed at the upper portion. However, in a second embodiment of a compressor depicted in Figure 17, the discharge pipe 130 is installed between the motor unit 200 and the compression unit 300 at the casing 100.

By installing the discharge pipe between the motor unit 200 and the compression unit 300 at the casing 100, because the fluid does not pass the motor unit 200, it is possible to reduce influence of heat generated in the operation of the motor unit 200 on a temperature of the compressed fluid, and accordingly performance of the compressor can be improved.

As depicted in Figure 1, the motor unit 200 includes a stator 210 fixed at the internal wall of the casing main body 110; and a rotor 220 rotatably inserted into the stator 210 and receiving the rotational shaft 140 at the center.

Herein, regardless of construction thereof any device capable of providing a rotational force to the rotational shaft can be used as the motor unit 200.

As described above, it is preferable for the rotational shaft 140 to be owned by both the motor unit 200 and the compression unit 300 simultaneously. As depicted in Figure 2, in the rotational shaft 140, an oil path 141 is formed in the lengthy direction, and an oil supplier (not shown) is installed at the lower end.

The cylinder assembly 301 includes a cylinder main body 330 installed at the lower portion of the motor unit 200, having the same rotational shaft 140 with the motor unit 200, having the suction path 310 connected to the suction pipe 311 at the side and having the internal compression space; and a pair of covering units 320 for sealing the compression space by covering the top and bottom portions of the cylinder main body 330 and having a bearing 323 for rotatably supporting the rotational shaft 140 at the center.

As depicted in Figures 1 and 2, the covering units 320 are respectively combined with the top and bottom surfaces of the cylinder main body 330 by fastening members such as bolts, etc. and include a base plate 321 forming part of the outer wall of the first and second compression spaces 341, 342 and a journal portion 322 for rotationally supporting the rotational shaft 140 and supporting rotational moment generated in the compression process.

The partition plate 150 is inserted into the compression space of the cylinder main body 330 so as to form the first and second compression spaces 341, 342 at the upper and lower portions thereof and is combined with the rotational shaft 140. In particular, it is preferable for the partition plate 150 to be fabricated as one body with the rotational shaft 140.

And, as depicted in Figure 3, the top and bottom surfaces of the partition plate 150 are formed as curved surfaces having symmetric structures. It has a convex surface around the top dead center 151 as the most outer wall of the compression space of the cylinder main body 330, it has a concave surface around the bottom dead center 152 as the most inner portion of the compression space, and a region 153 from the top dead center 151 to the bottom dead center 152 or from the bottom dead center 152 to the top dead center 151 is formed to have a certain curvature.

In particular, as depicted in Figures 1 and 2, it is preferable for the rotational shaft 140 to have a pair of hub units 142 for supporting the covering unit 320 and the bearing 323; and rotating while contacting with the first and second vanes 351, 352.

In order to divide the first and second compression spaces 341, 342 into the suction region and the compression region respectively and prevent the fluid in the compression region from flowing into the suction region, the first and second vanes 351, 352 should be maintained contacted with the top or bottom surface of the partition plate 150, the outer circumference 142a of the rotational shaft 140 (or hub unit 142) and the inner circumference 331 of the cylinder main body 330.

In order to reciprocate the first and second vanes 351, 352 within a certain region in the lengthy direction of the rotational shaft 140 according to the rotation of the partition plate 150, the first and second vanes 351, 352 are respectively inserted into vane insertion holes 361, 362 formed though the base plates 321 of the covering units 320.

As depicted in Figures 4A and 4B, a section of the first and second vanes 351, 352 can be formed as a circular shape or a polygonal shape, in particular, a quadrangle shape.

Herein, as depicted in Figure 4A, when a section of the vane 351, 352 is circular, it is easy to fabricate the vane 351, 352 and the vane insertion hole 361, 362. However, as depicted in Figure 4C, because of circular shape's characteristics, dead volume (V_d) that is not used in compression exist.

In addition, the vane 351, 352 has to maintain the contacted state with the rotational shaft 140 (or the hub unit 142), when a section of the vane 351, 352 is circular, because of linear contact state, the highly compressed fluid may leak from the compression region to the suction region. In order to prevent the above problem, it is preferable for the vane 341, 342 contacting the rotational shaft 351 (or hub unit 142) to have a surface contact portion 353 having a curvature same with that of an outer diameter of the rotational shaft 351 (or hub unit 142), as shown in Figures 5A ~ 5C. It is preferable to form the surface contact portion only at a region contacted to the rotational shaft 351 (or hub unit 142).

In addition, since the same problem can occur at a contacted portion of the vane 351, 352 with an inner diameter of the cylinder main body 330, by forming the vane 351, 352 with a second surface contact portion 354 having a curvature same with the inner diameter of the cylinder main body 330, it is possible to prevent leakage of the fluid.

In addition, as depicted in Figures 1 and 2, when a section of the vane 351, 352 is circular, an outer diameter (C) of the vane insertion hole 361, 362 has to be corresponded to a distance (D) from an outer diameter of the rotational shaft 140 (or the hub unit 142) to an inner diameter of the cylinder main body 330, however, errors occur in fabrication and operation processes, and fluid leakage may occur due to the errors.

In more detail, as depicted in Figure 6, in a distance (D) from the outer diameter of the rotational shaft 140 (or the hub unit 142) to the inner diameter of the cylinder main body 330, when an error range about a distance A from the center of the rotational shaft 140 to the center of the distance D is ±0.05μm, a leakage path can be widen as 20μm, and accordingly it may cause performance lowering.

In order to prevent that phenomenon, as depicted in Figure 6, after maintaining an error range about a distance A from the center of the rotational shaft 140 to the center of the distance (D) as ±0.05μm, it is preferable to maintain a difference of the distance D from the outer diameter of the rotational shaft 140 (or the hub unit 142) to the inner diameter of the cylinder main body 330 so as to be lower a certain range such as 0.020mm.

In that case, by increasing tolerance error in fabrication process of the vane insertion hole 361, 462, it is possible to reduce a fabrication cost and prevent increase of a leakage path occurred due to fabrication error or operation, and accordingly compression performance can be improved.

In the meantime, when a section of the vane 351, 352 shown in Figure 4B is quadrangular, there is a merit not having a dead volume in the compression space, however, it is difficult to fabricate the vane insertion hole 361, 362 in which the vane 351, 352 is inserted.

Accordingly, in the vane insertion hole 361, 362 fabrication aspects, it is preferable for the vane 351, 352 to have a circular section, in consideration of that, as depicted in Figures 7A and 7B, the vane 351, 352 has an upper circular portion 351a and has a lower polygonal portion 351b, in particular, a quadrangular portion, herein the lower polygonal portion 351b is maintained so as to contact with the partition plate(the outer circumference 142a of the rotational shaft 140 (or hub unit 142) and the inner circumference 331 of the cylinder main body 330).

In the vane 351, 352 having the circular portion 351a and the polygonal portion 351b, by fabricating the vane insertion hole 361 as a circular shape, it is easy to process, at the same time, by forming a portion contacted with the rotational shaft 140 (or the hub unit 142) and the inner circumference of the cylinder main body 330 as a quadrangular shape, dead volume can be decreased.

In the meantime, as depicted in Figure 4C, in the vane 351, 352, a portion contacted to the partition plate 150 is curved-formed, according to a contact state thereof, dead volume V_d that is not used in compression is formed, when the vane 351, 352 proceeds into the suction region after passing the discharge region and the compressed fluid in the dead volume V_d is re-expanded, compression loss occurs. In the present invention, in order to solve the problem, as depicted in Figure 8, by forming a connection path 364 between the vane insertion hole 361 and the discharge hole 313, the compressed fluid existing in the dead volume V_d can be discharged. In particular, it is preferable to form the connection path 364 at the inner wall of the base plate 321 of the covering unit 320.

In the meantime, in order to make the first and second vanes 351, 352 contacted with the partition plate 150, the first and second vanes 351, 352 should be restrainedtoward the partition plate 150, and accordingly a contact maintaining unit 370 for making the first and second vanes 351, 352 respectively contacted to the top and/or bottom surface of the partition plate 150 is installed in the compressor in accordance with the present invention.

As depicted in Figure 1 and 2, in the contact maintaining unit 370, in order to apply an elastic force to the first and second vanes 351, 352 while moving according to the movement of the first and second vanes 351, 352, one end is fixed to the top surface of the first vane 351, and the other end is fixed to the top surface of the second vane 352.

In more detail, as depicted in Figures 1 and 2, the contact maintaining unit 370 is an elastic member such as a wire spring or a plate spring, etc., each end is respectively fixed to the upper portion of the first and second vanes 351, 352, as depicted in Figures 9A and 9B, it includes a pair of fixing portions 371 respectively fixed and-combined with the ends of the first and second vanes 351, 352; and a connecting portion 372 connecting the fixing portions 371.

As depicted in Figure 9B, the fixing portion 371 is inserted into an insertion groove 171 formed at each end of the first and second vanes 351, 352.

As depicted in Figures 9A and 9B, in combining the fixing portion 371 with the first and second vanes 351, 352, the fixing portion 371 can be curvedly formed in order to prevent the contact maintaining portion 370 from being separated from the first and second vanes 351, 352.

In addition, as depicted in Figures 10A and 10B, the fixing portion 371 can be inserted from the insertion groove 171 formed at the first and second vanes 351, 352 to the insertion hole 175 formed in the lengthy direction of the vanes 351, 352 so as to be fixed to the vanes 351, 352.

In the meantime, as depicted in Figures 11A~11C, from the center of the rotational shaft 140 in the radial direction, the insertion groove 171 can be slantingly formed toward the cylinder assembly 301. By forming the insertion groove 171 slantingly, when the vane 351, 352 is caught in the vane insertion hole 361, and the contact maintaining unit 370 is deformed along a slant surface 175 of the insertion groove 171, it is possible to prevent the contact maintaining unit 370 from being separated from the separation groove 171.

In the meantime, in order not to disturb the rotor of the motor unit, as depicted in Figure 12A, the connecting portion 372 of the contact maintaining unit 370 is curvedly formed, or as depicted in Figure 12B, by forming a straight portion 372b parallel with the rotational shaft 140 and a pair of slant portions 372a for connecting the straight portion 372b with the fixing portion 371, it is possible to prevent interference between the contact maintaining unit 370 and the stator 210 of the motor unit 200.

And, as depicted in Figure 2, the connecting portion 372 of the contact maintaining unit 370 is inserted into a guide portion 333 formed around the outer circumference of the cylinder main body 330 of the cylinder assembly 301 in the rotational shaft direction.

And, the guide portion 333 may be additionally formed around the outer circumference of the cylinder main body 330 of the cylinder assembly 301, however, in that case an additional process is required.

Accordingly, it is preferable that the guide portion 333 is formed to perform the same functions of an oil path formed at the cylinder assembly 301 or a thorough hole for making a fluid flow up/down of the cylinder assembly 330.

In addition, the guide portion 333 may be formed at the cylinder assembly 301, however, as depicted in Figures 13A and 13B, when a muffler 160 is combined with the cylinder assembly 301, in fabrication of the muffler 160 by a press processing, etc. by forming the guide portion 333 together instead at the cylinder assembly 301, the guide portion 333 can be easily formed.

In the meantime, while the contact maintaining unit 370 reciprocates , shaking of the contact maintaining unit 370 may occur. In particular, because of a force of the compressed fluid in the compression space applied on the contact maintaining unit 370, a rotational force for rotating the vanes 351, 352 may occur, and accordingly fluid leakage may occur. Herein, when a section of the vane 351, 352 is circular, since the vane insertion hole 361 has the circular shape, there is a need to prevent the rotation.

Accordingly, as depicted in Figures 14A and 14B, in the guide portion 333, in order to prevent the shaking of the contact maintaining unit 370, it is preferable to form a pair of restraining members 377 with the connecting portion 372 of the contact maintaining unit 370 therebetween so as to move toward only the rotational shaft. A plate spring can be used as the restraining member 377.

In the meantime, as depicted in Figure 15A, the contact maintaining unit 370 does not move in the reciprocating motion of the first and second vanes 351, 352 and provide the elastic force to the first and second vanes 351, 352 toward the partition plate 150.

In more detail, in the contact maintaining unit 370, because the end is contacted to the top surface of the vane 351, 352, abrasion may occur due to friction. In order to prevent the problem, an abrasion preventing unit 380 can be interposed between the contact maintaining unit 370 and the vane 351, 352 in order to prevent abrasion of the end of the contact maintaining unit 370.

As depicted in Figure 15A, the abrasion preventing unit 380 includes a supporting plate 381 for supporting the end of the contact maintaining unit 370 by a surface contact; and an axial member 383 combined with the supporting plate 381 and rotatably inserted into the top portion of the vane 351, 352 so as to rotate the supporting plate 381 in order to make the supporting plate 381 and the end of the contact maintaining unit 370 maintain the surface contact according to the reciprocating motion of the vane 351, 352.

Herein, torsion spring 379, etc. fixed to the cylinder assembly 301 is used as the contact maintaining unit 370.

And, as depicted in Figure 15B, the axial member 383 is inserted into the top portion of the vane 351, 352, and a groove 384 having a '+' shape is formed so as not to disturb the rotation of the supporting plate 381.

In Figure 15B, reference numeral 374 is a fixed arm in which the coil spring is inserted, 373 is a fixing member for fixing the fixed arm to the covering unit 320.

The operation of the compressor in accordance with the first embodiment of the present invention will be described in detail.

First, when power is supplied from the outside to the motor unit 200, it is rotated by the mutual operation of the rotor 210 and the stator 220, the rotational shaft 140 fixed to the rotor 220 is rotated according to the rotation of the rotor 220. And, according to the rotation of the rotational shaft 140, the compression unit 100 mutually owning the rotational shaft 140 is operated together.

In more detail, the partition plate 150 combined with the rotational shaft 140 is rotated, according to the rotation of the partition plate 150, the fluid is sucked and compressed continuously in the first and second compression spaces 341, 342 through the suction path 310, the compressed fluid flows into the discharge pipe 130 through the discharge path (not shown) and is transmitted to the connection part such as an evaporator.

Herein, when the compressor is a sealed type, the fluid compressed in the compression unit 300 is discharged into the sealed space S of the casing 100 and flows into the discharge pipe 100 connected to the casing 100.

Hereinafter, a compressor in accordance with a second embodiment of the present invention will be described in detail.

Parts and operation same with or similar to those of the compressor in accordance with the first embodiment will be abridged for simplicity convenience. In addition, parts same or similar with those of the first embodiment will have the same reference numerals.

The motor unit 200 and the compression unit 300 can be respectively deposed in the upper and lower regions of the casing 100, however, in the second embodiment, as depicted in Figure 16, the motor unit 200 and the compression unit 300 are deposed in the casing 100 so called "horizontally", i.e. perpendicular with the gravity direction.

And, when the motor unit 200 and the compression unit 300 are deposed in the casing 100 horizontally, there is an oil supply problem. In order to solve it, as depicted in Figure 17, a pressure separate member 610 can be additionally formed between the compression unit 300 and the motor unit 200 in order to divide the sealed space (S) of the casing 100 into a high pressure region and a low pressure region.

In the pressure separate member 610, in order to make the oil flow from the high pressure region to the lower pressure region by the pressure difference, an oil hole 611 is formed. In Figure 17, a thick arrow shows an oil flow direction by the pressure difference.

In particular, as depicted in Figure 18, it is preferable for the pressure separate member 610 to be installed as one body with the muffler 160 combined with the cylinder assembly 301.

In addition, for oil supply to the oil path 141 formed at the rotational shaft 140, as depicted in Figure 19, the end of the rotational shaft 140 placed at the opposite of the motor unit 200 is rotatably combined with an oil supply pipe 620 in which one end of the oil supply pipe 620 is put in the oil.

In particular, in order to form a space for containing the oil around the end of the rotational shaft 140, the oil supply pipe 620 can be connected to a cap member 630 combined with the cylinder assembly 301.

And, as depicted in Figure 1, alike the first embodiment, the discharge pipe 130 connected to the casing 100 can be installed at the top cap of the casing 100. However, as depicted in Figure 16 or 17, in order to reduce influence of heat generated on a temperature of the compressed fluid in the operation of the motor unit 200, it is preferable to install the discharge pipe 130 between the motor unit 200 and the compression unit 300 at the casing 100.

Hereinafter, a compressor in accordance with a third embodiment of the present invention will be described in detail.

Parts and operation same with or similar to those of the compressor in accordance with the first embodiment will be abridged for simplicity convenience. In addition, parts same or similar with those of the first embodiment will have the same reference numerals.

As depicted in Figure 20, in the compressor in accordance with the third embodiment of the present invention, the compression unit 300 is installed below the motor unit 200 in the gravity direction.

The compression unit 300 is disposed in the casing 100 so as to be below the motor unit 200. In particular, the rotational shaft 140 combined with the motor unit 200 is installed so as to be slant toward the vertical direction of the casing 100 (or the gravity direction).

In order to install the rotational shaft 140 combined with the motor unit 200 slant toward the vertical direction of the casing 100, as depicted in Figure 20, the casing 100 is installed at an installation unit 710 having height H1 of a portion at which the motor unit 200 is installed lower than height (H2) of a portion at which the motor unit 200 is installed.

In the meantime, following table 1 shows test results of compressors in accordance with the present invention in comparison with the conventional art.

Table 1

Type	Upright Type	Upright Type	Horizontal Type
Discharge Pipe Position	Conventional Art	Example 1	Example 2
Cooling Capacity (Bty/hr)	9,407	9,762	10,200
Input (Watt)	1,119	1,144	1,155
EER	8.40	8.54	8.85
Discharge Temperature (°C)	93.76	93.81	89.5

In Table 1, a compressor of Example 1 has an upright structure (in which the motor unit and the compression unit are arranged in parallel with the gravity direction), the discharge pipe is arranged between the motor unit and the compression unit at the casing 100. A compressor of Example 2 has a horizontal structure (in which the motor unit and the compression unit are arranged perpendicular to the gravity direction), the discharge pipe is arranged between the motor unit and the compression unit at the casing 100.

As shown in Table 1, by arranging the discharge pipe between the motor unit and the compression unit at the casing 100, cooling capacity can be improved in comparison with the conventional art, in particular, energy efficiency ratio (EER) can be remarkably improved from 8.40 to 8.54.

In addition, by changing the position of the discharge pipe and using the horizontal structure, cooling capacity can be improved in comparison with the conventional art, in particular, energy efficiency ratio can be improved from 8.40 to 8.54.

INDUSTRIAL APPLICABILITY

In the present invention, by reducing fluid leakage occurred between the compression region and the suction region of the compression space with a simple structure, performance of a compressor can be improved.

In addition, by having a structure capable of preventing abrasion of the contact maintaining unit for maintaining the contact state of the vane and the partition plate, it is possible to prevent breakage and increase life span.

By providing a compressor having a vane structure capable of reducing fluid leakage occurred between the compression region and the suction region of the compression space and being simply fabricated, performance of the compressor can be improved.

By preventing compression loss occurred by re-expansion of the compressed fluid existing in the lower portion of the vane, performance of a compressor can be improved.

By installing the compression unit and the motor unit horizontally or vertically, compression efficiency can be improved.

By installing the discharge pipe between the compression unit and the motor unit of the casing having the sealed space, compression efficiency can be improved.

CLAIMS

1. A compressor comprising:

a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space;

a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly;

a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft;

a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate,

wherein a surface contacting portion having a curvature same with an outer diameter of the rotational shaft is formed at least one of the first and second vanes.

2. The compressor of claim 1, wherein the surface contacting portion is formed only at a region contacted to the rotational shaft.

3. The compressor of claim 1 or 2, wherein a second surface contacting portion having a curvature same with an inner diameter of the cylinder assembly is formed at least one of the first and second vanes.

4. The compressor of claim 1, wherein at least one of the first and second vanes consists of a circular portion having a circular section; and a polygonal portion having a polygonal section connected to the circular portion so as to form the surface contacting portion by being contacted with the partition plate.

5. The compressor of claim 4, wherein a section of the polygonal portion is quadrangular.

6. The compressor of claim 1 or 2, wherein an inner diameter of a vane insertion hole formed at the cylinder assembly to receive the first and second vanes respectively and make them perform a reciprocating motion in a certain region is greater than a distance from the outer circumference of the rotational shaft at which the first or second vane is contacted to an inner diameter of the cylinder assembly.

7. The compressor of claim 1 or 4, wherein the vane insertion hole formed at the cylinder assembly to receive the first and second vanes respectively and make them perform a reciprocating motion in a certain region is connected to the discharge path by a connection path.

8. A compressor comprising:

a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space;

a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly;

a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft;

a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate,

wherein an inner diameter of a vane insertion hole formed at the cylinder assembly to receive the first and second vanes respectively and make them perform a reciprocating motion in a certain region is greater than a distance from the outer circumference of the rotational shaft at which the first or second vane is contacted to an inner diameter of the cylinder assembly.

9. The compressor of claim 8, wherein difference between an inner diameter of the vane insertion hole and a distance from the outer circumference of the rotational shaft at which the first or second vane is contacted to an inner diameter of the cylinder assembly is less than 0.02mm.

10. The compressor of claim 8 or 9, wherein the vane insertion hole is communicated with the discharge path by a connection path.

11. A compressor comprising:

a cylinder assembly having an internal compression space, a suction path and a discharge path connected to the compression space;

a rotational shaft inserted into the cylinder assembly in a lengthy direction of the cylinder assembly;

a partition plate for partitioning the compression space into a first and a second compression spaces and rotating by being combined with the rotational shaft;

a first and a second vanes contacted to each surface of the partition plate so as to divide the first and second compression spaces into a compression region and a suction region respectively in order to perform a reciprocating motion within a certain region in the lengthy direction of the rotational shaft according to rotation of the partition plate,

wherein a vane insertion hole formed at the cylinder assembly to receive the first and second vanes respectively and make them perform a reciprocating motion in a certain region is communicated with the discharge path by a connection path.

12. The compressor of claim 11, wherein the connection path is formed at an inner wall of the cylinder assembly.

FIG. 1

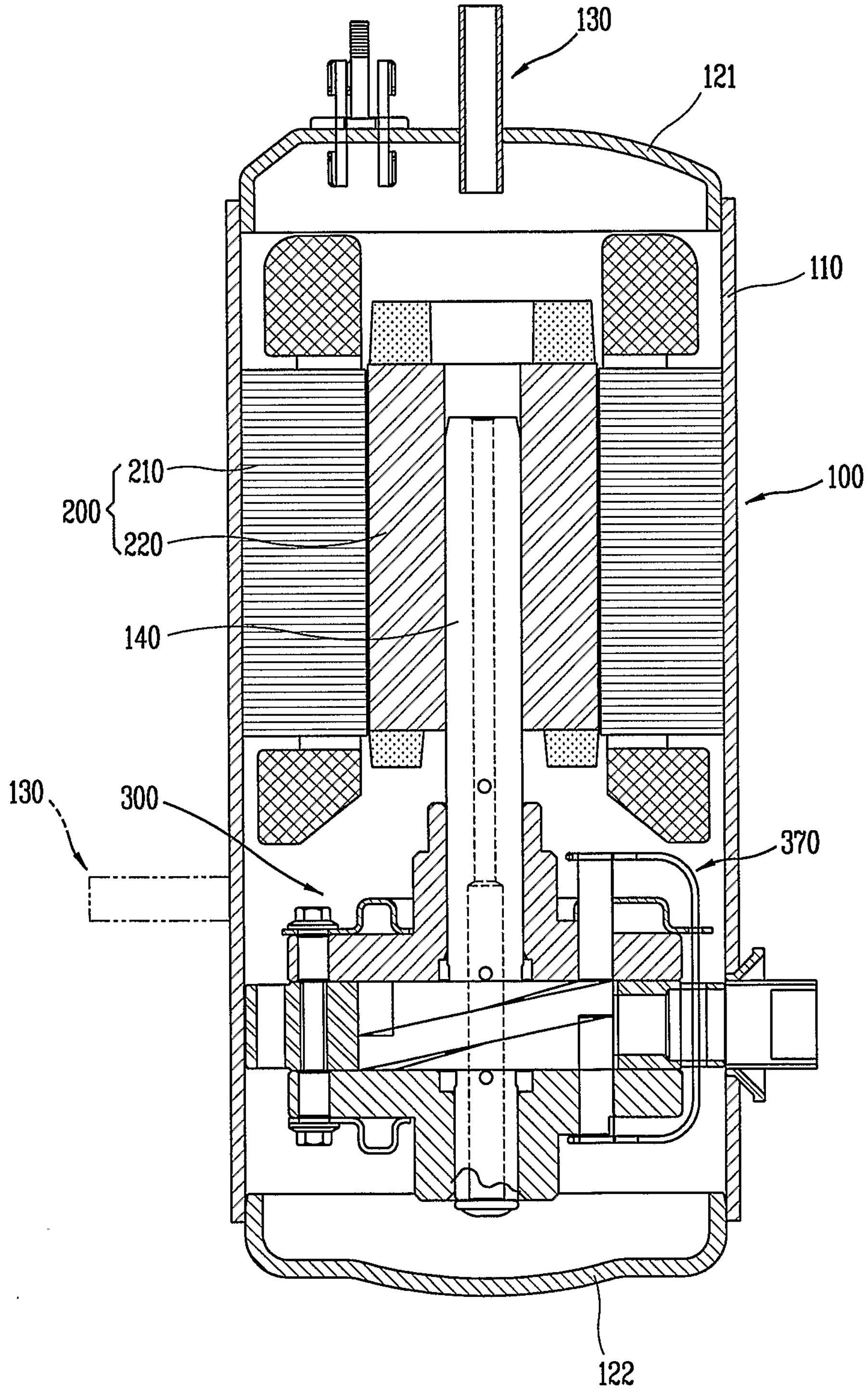


FIG. 2

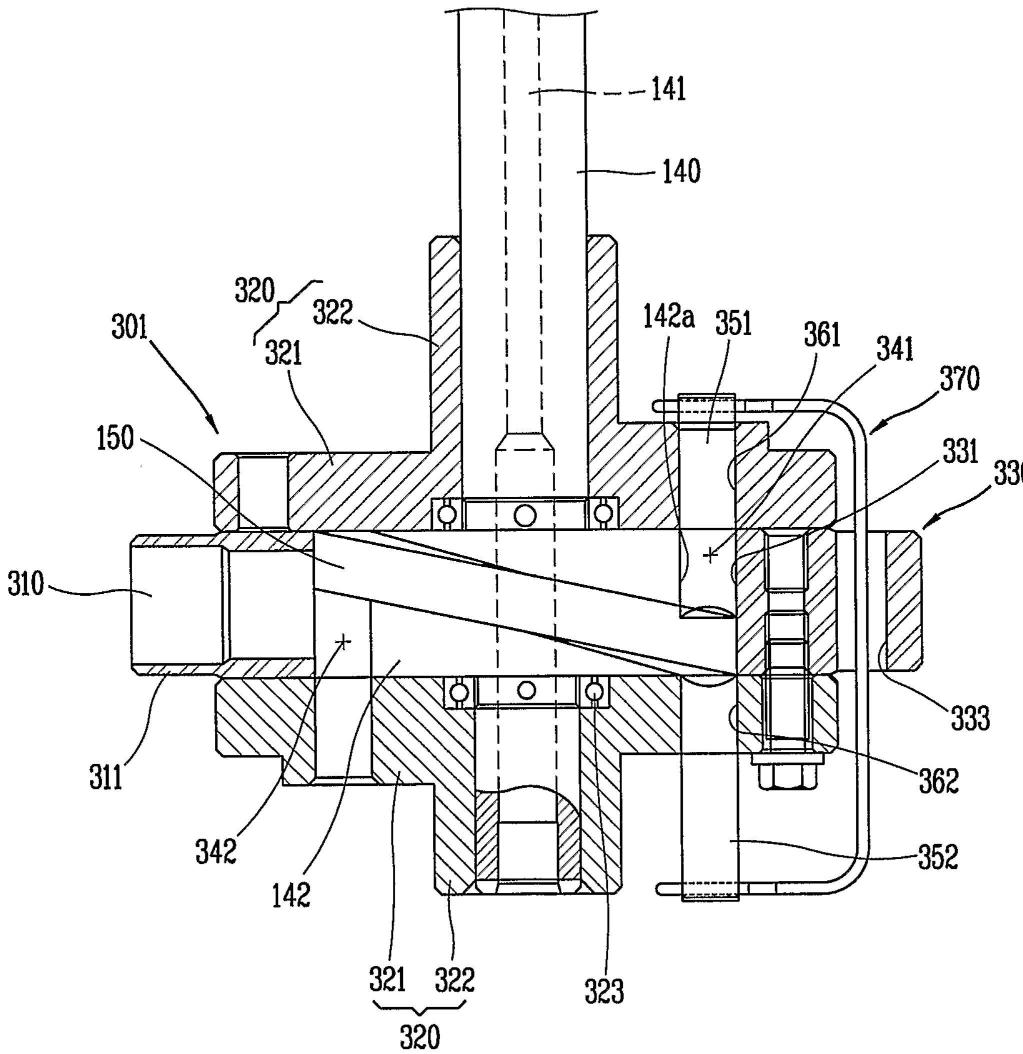

141
140
320
322
301
321
142a
351
361
341
370
331
330
150
310
333
311
362
342
142
352
321
322
323
321
322
320

FIG. 3

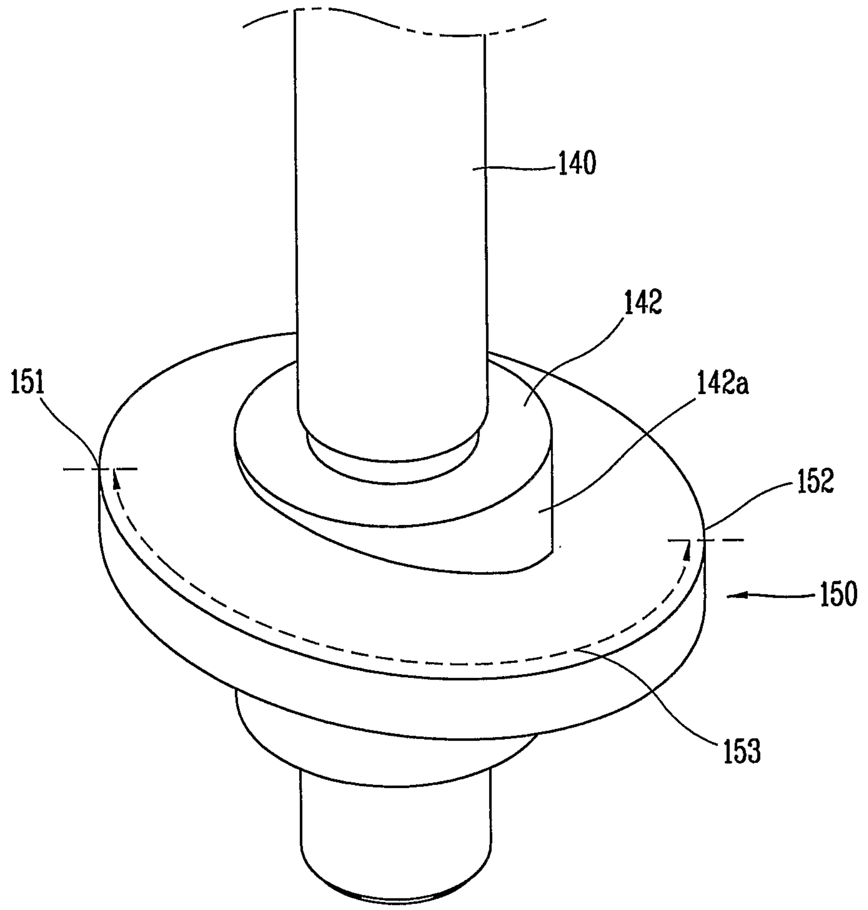


FIG. 4A

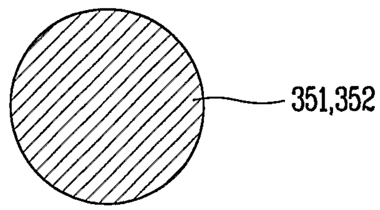


FIG. 4B

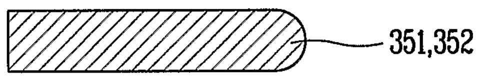


FIG. 4C

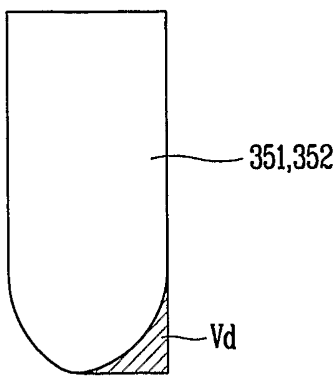


FIG. 5A

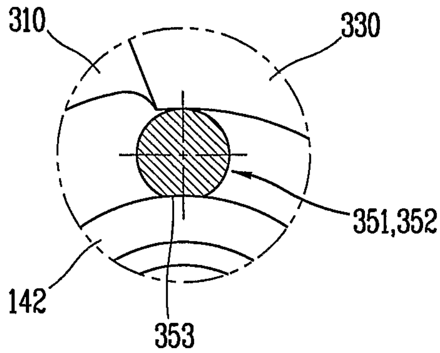


FIG. 5B

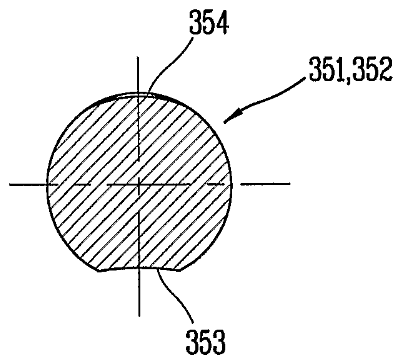


FIG. 5C

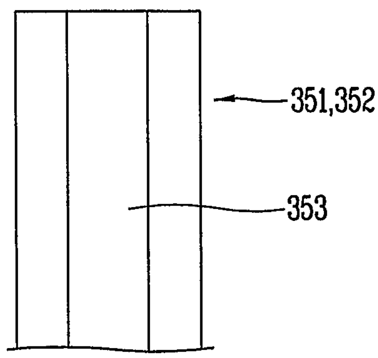


FIG. 6

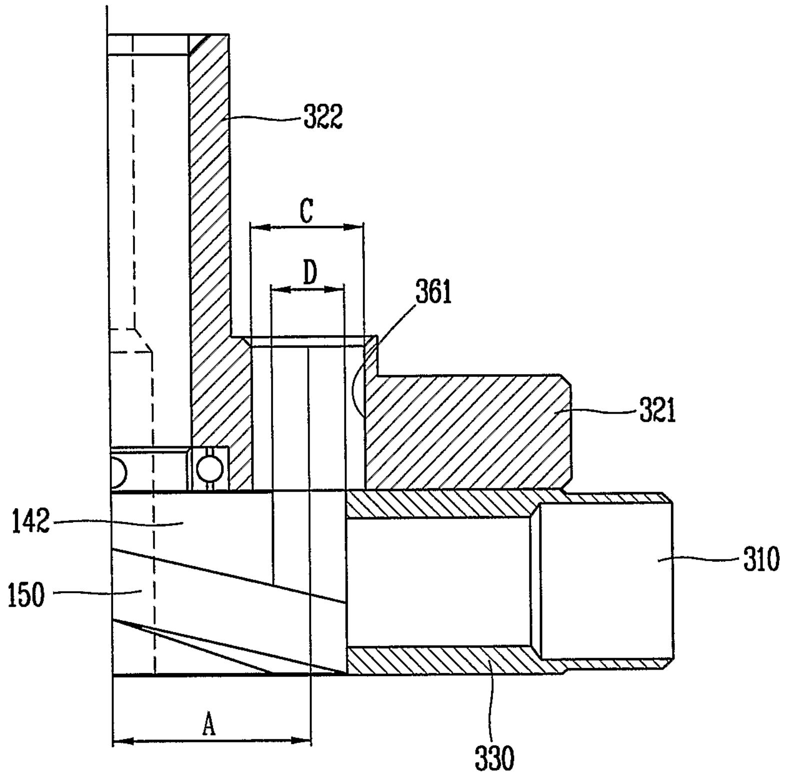


FIG. 7A

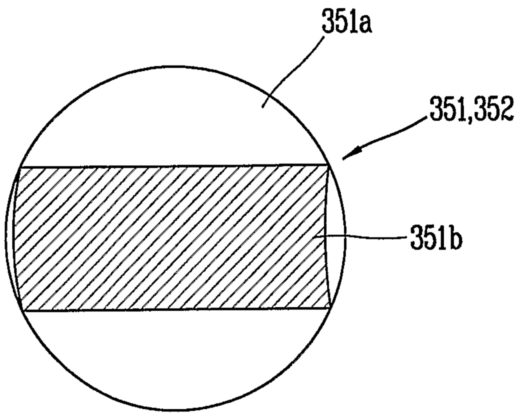


FIG. 7B

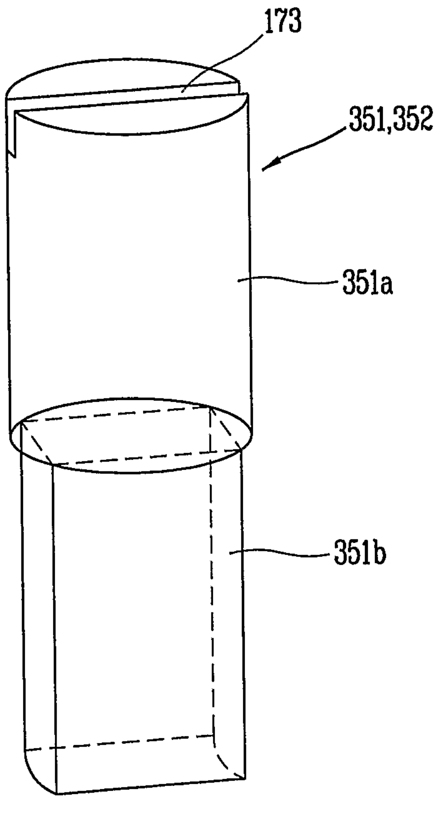


FIG. 8

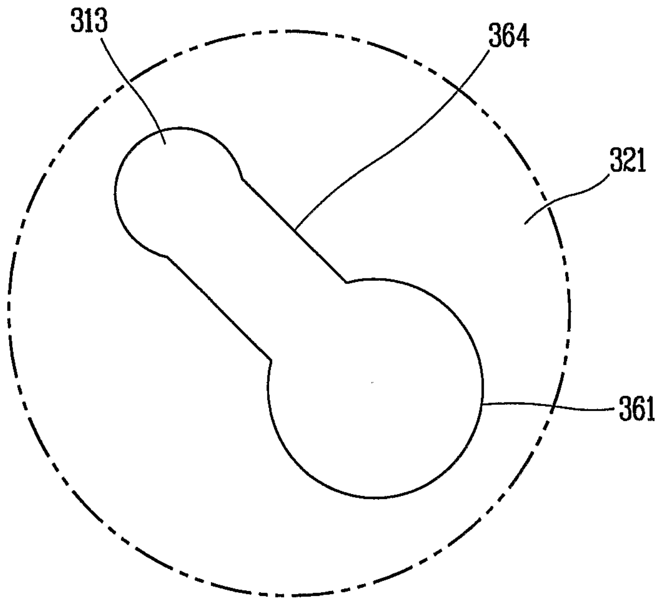


FIG. 9A

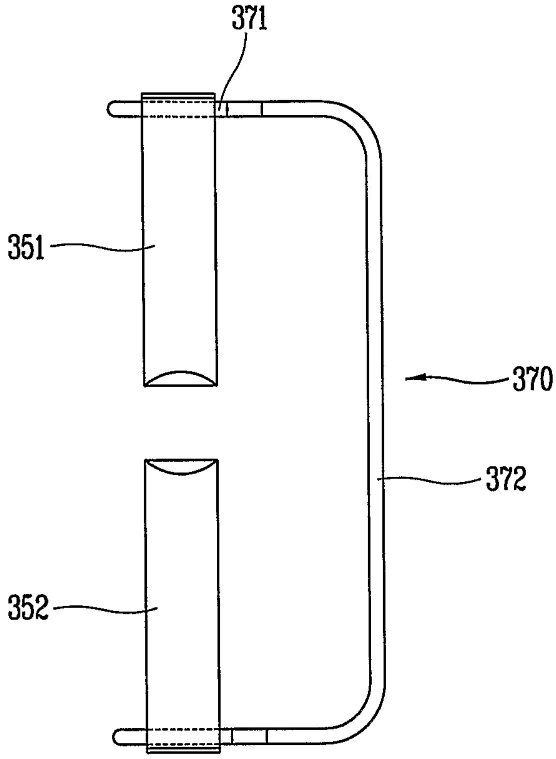


FIG. 9B

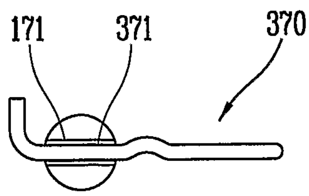


FIG. 10A

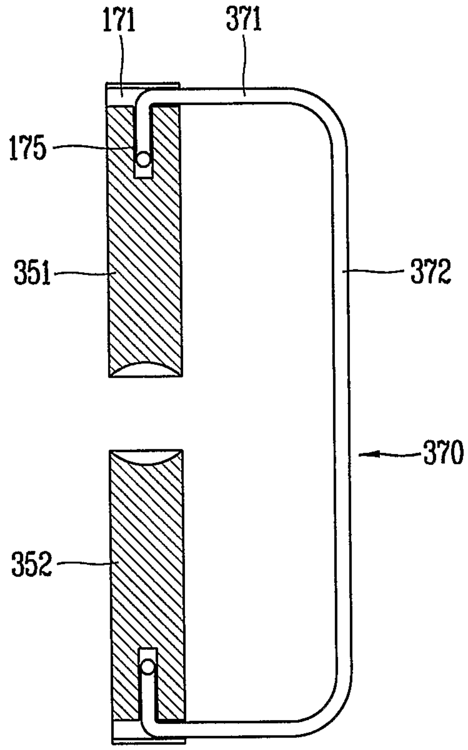


FIG. 10B

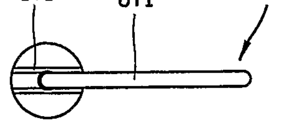


FIG. 11A

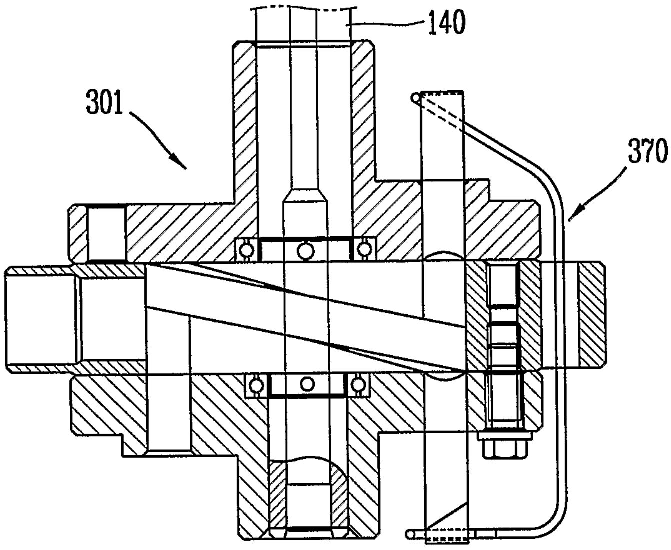


FIG. 11B

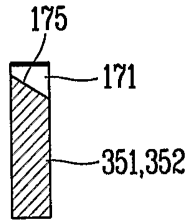


FIG. 11C

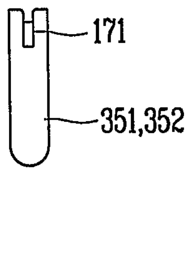


FIG. 12A

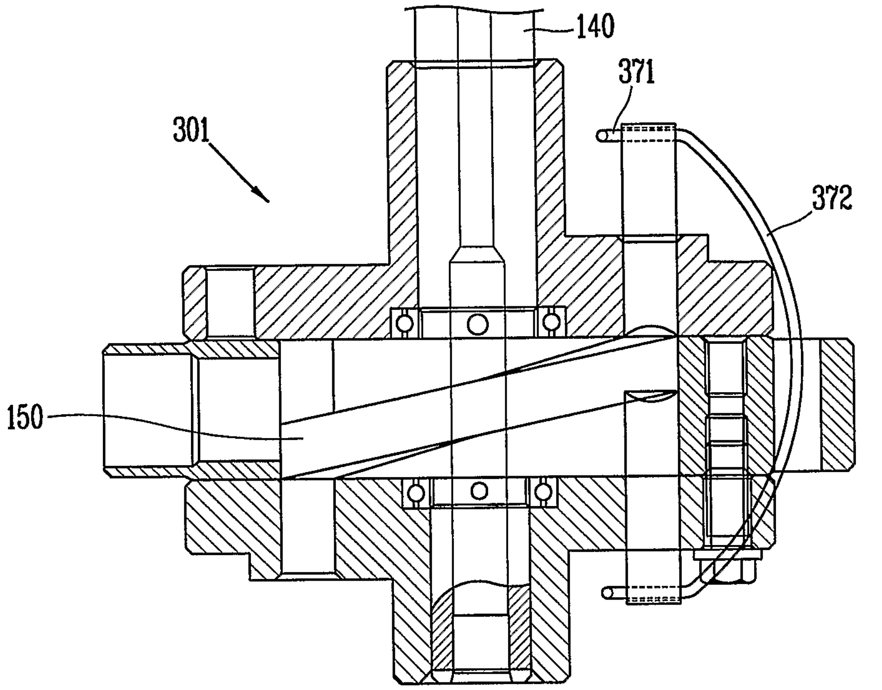


FIG. 12B

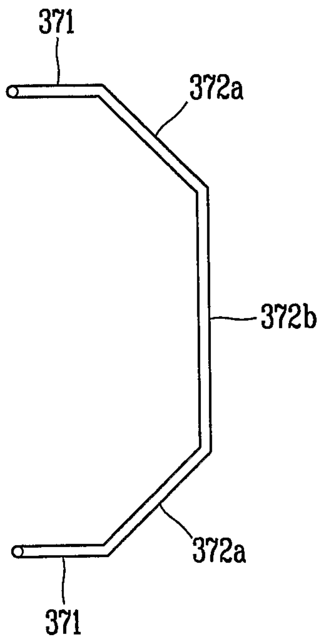


FIG. 13A

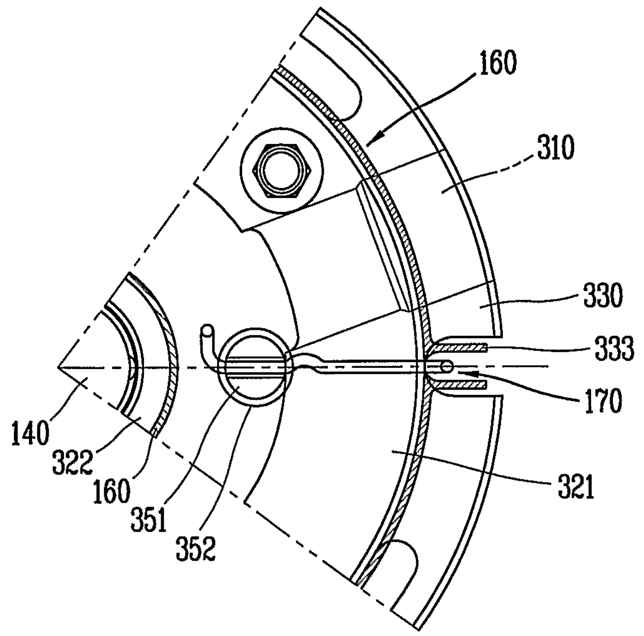


FIG. 13B

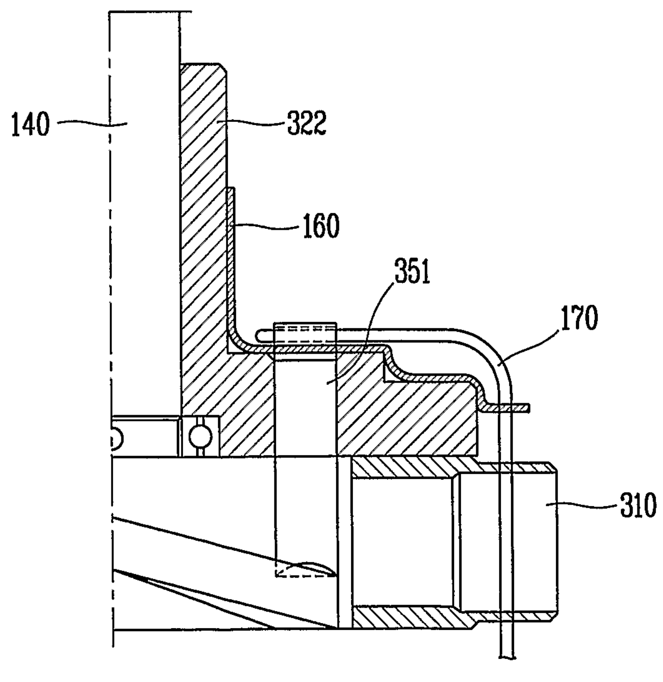


FIG. 14A

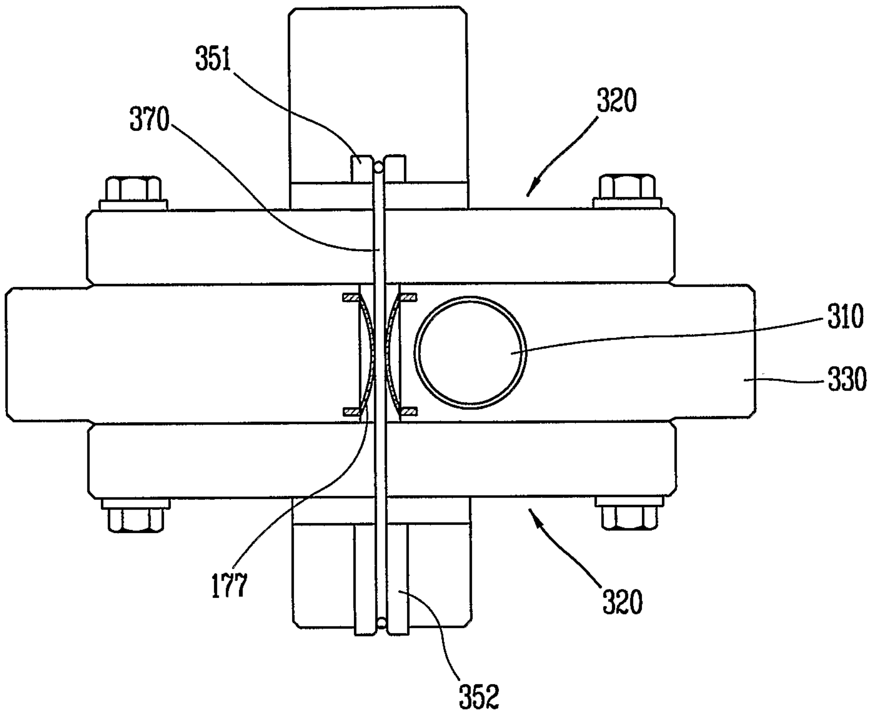


FIG. 14B

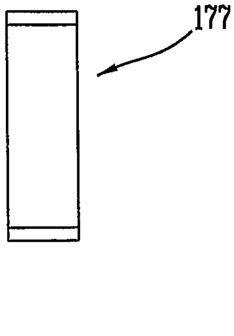


FIG. 15A

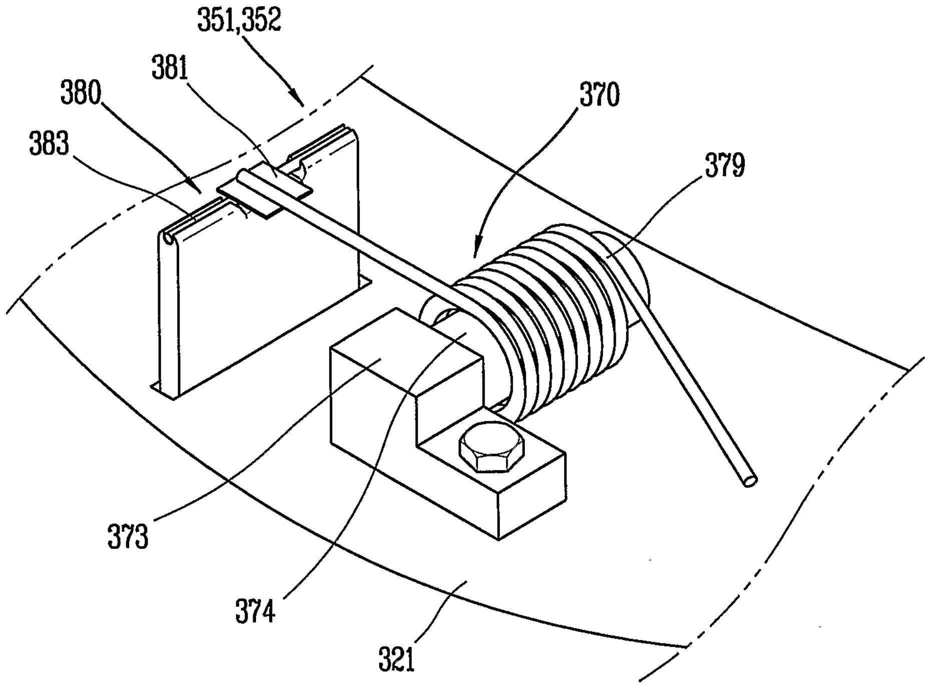


FIG. 15B

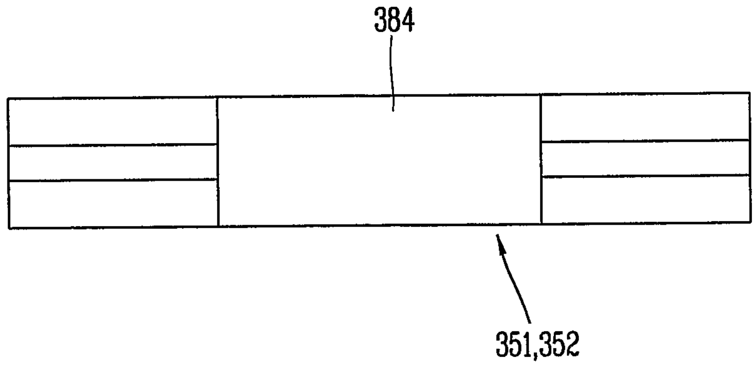


FIG. 16

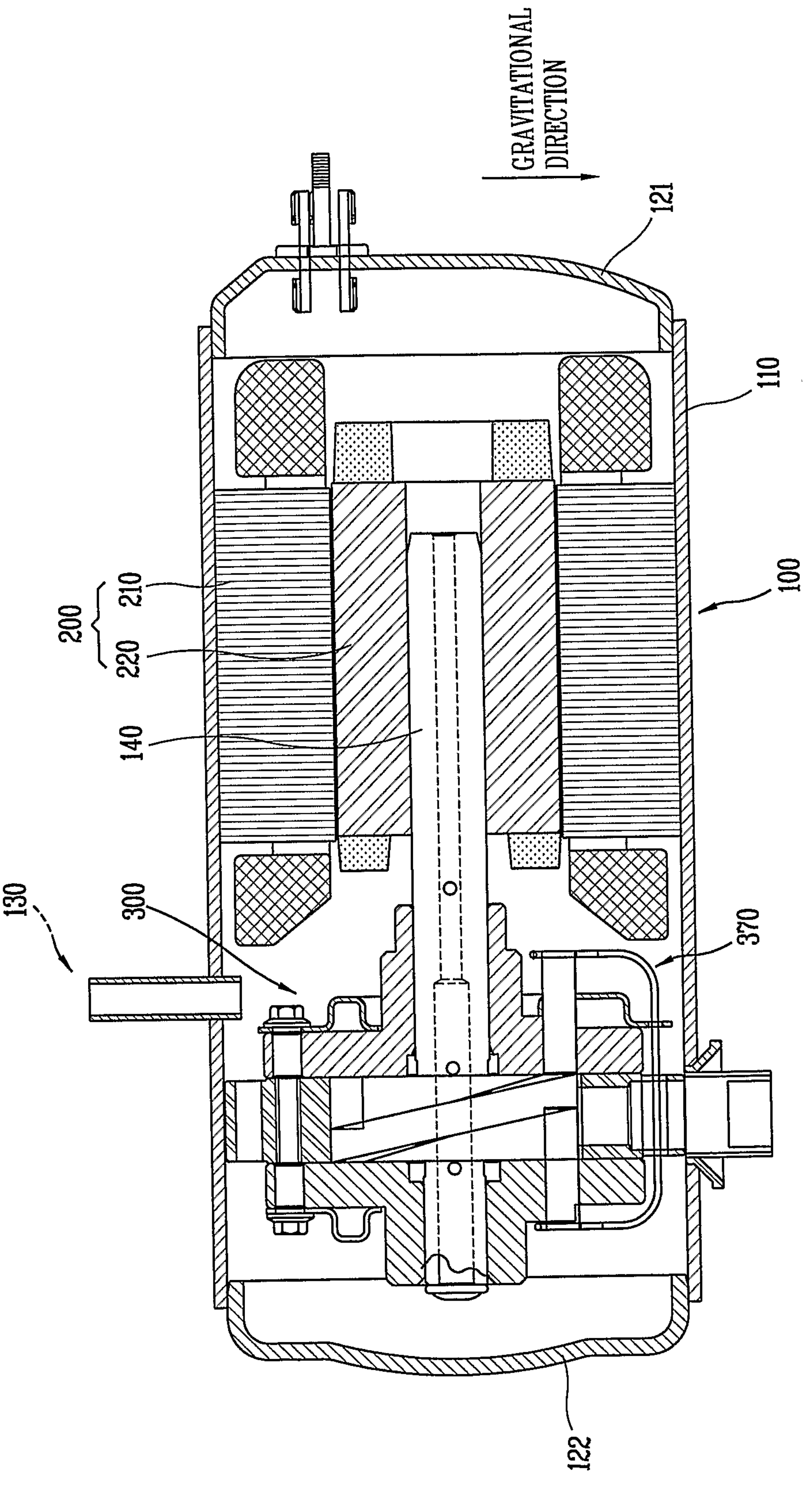

GRAVITATIONAL DIRECTION
121
110
100
200
210
220
140
130
300
370
122

FIG. 17

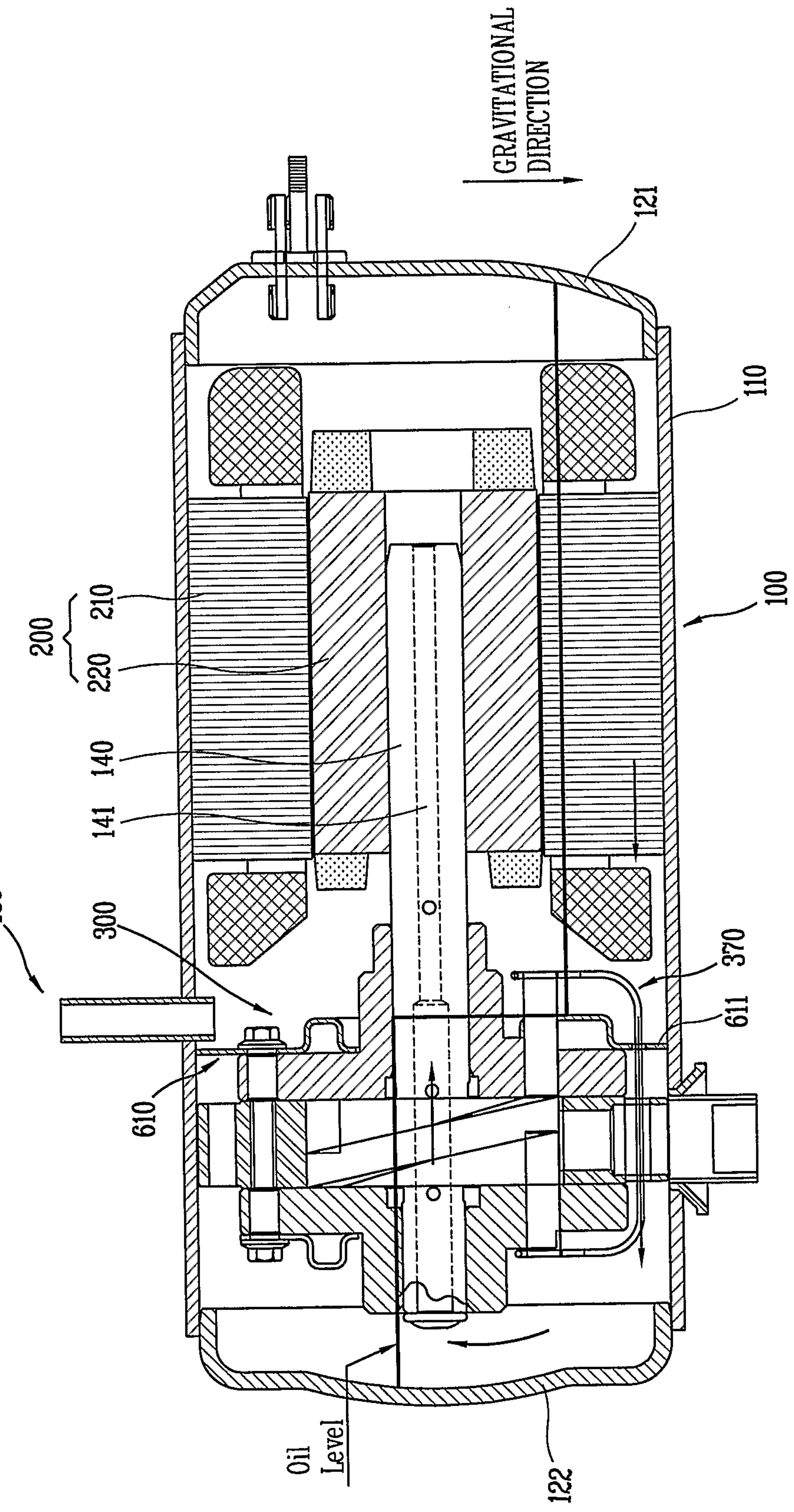

GRAVITATIONAL DIRECTION
121
110
100
200
210
220
140
141
130
300
370
611
610
Oil Level
122

FIG. 18

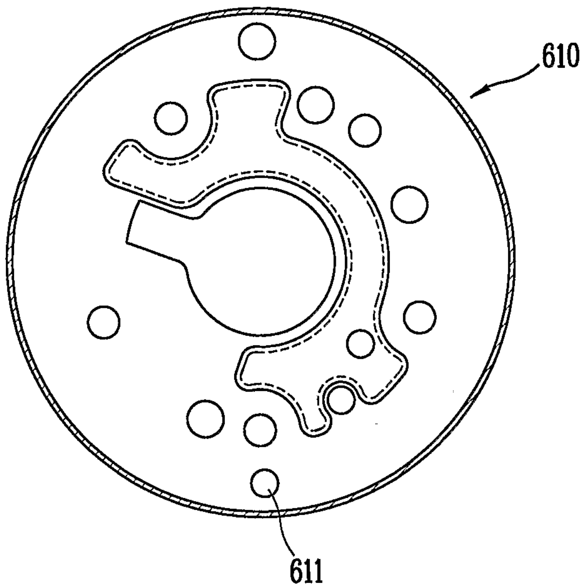


FIG. 19

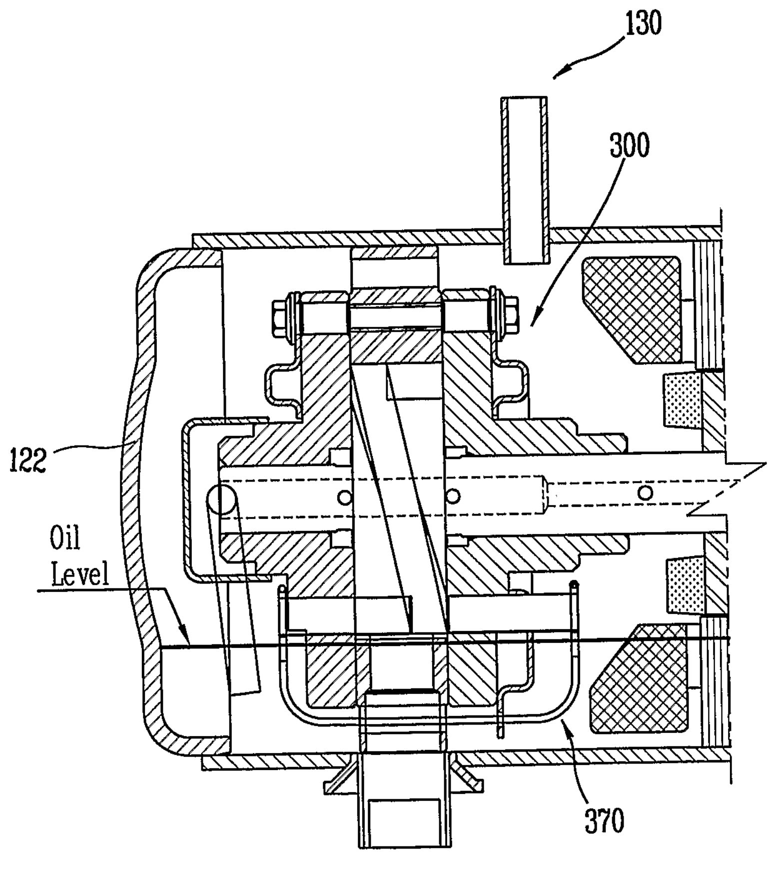
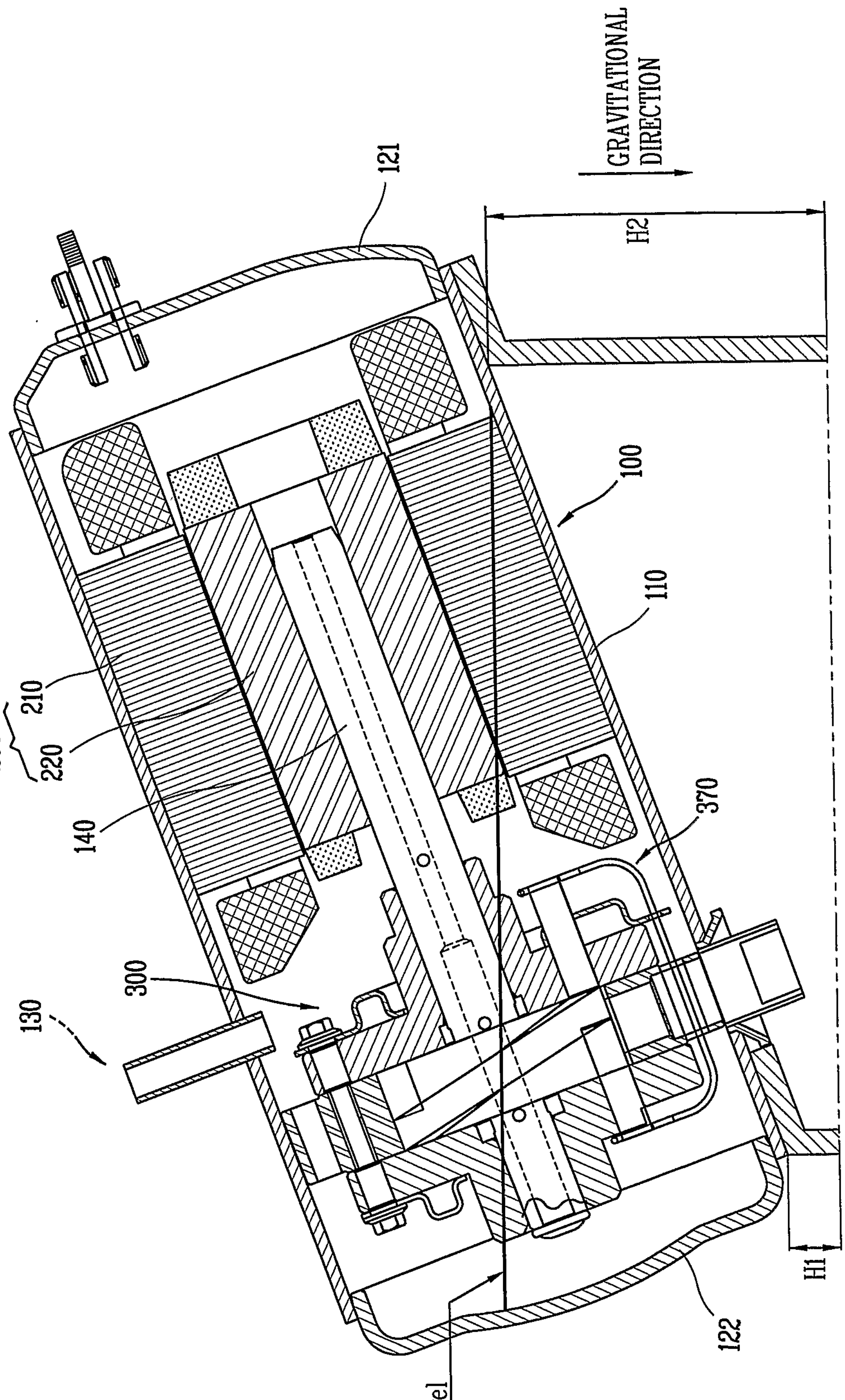


FIG. 20



GRAVITATIONAL DIRECTION
121
H2
100
110
200
210
220
140
370
300
130
H1
122
Oil Level

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 03/01177-0

CLASSIFICATION OF SUBJECT MATTER

IPC[7]: F04C 2/107

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)

IPC[7]: F04C 2/00, F04C 18/00, F01C 1/00

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

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

WPI, Epodoc, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 19708641 A1 (RUCHO G.) 3 September 1998 (03.09.1998) *the whole document.*	1-3,8,11
X	DE 2913608 A1 (WILLIMCZIK W.) 13 November 1980 (13.11.1980) *page 4.*	1-3,8,11
X	DE 2438871 A1 (KARPISEK L.) 26 February 1976 (26.02.1976) *pages 31-32.*	1-3,8,11
X	US 3838954 A (RAPONE N.) 1 October 1974 (01.10.1974) *column 4, lines 27-63.*	1-3,8,11

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

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 February 2004 (03.02.2004)	23 March 2004 (23.03.2004)
Name and mailing adress of the ISA/AT Austrian Patent Office Dresdner Straße 87, A-1200 Vienna Facsimile No. 1/53424/535	Authorized officer PETRIDES M. Telephone No. 1/53424/359

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR 03/01177-0

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
DE	A	19708641	1998-09-03			none	
DE	A	2438871	1976-02-26			none	
DE	A	2913608	1980-11-13	JP	A	56132404	1981-10-16
US	A	3838954	1974-10-01	IT	B	977547	1974-09-20
				IT	B	950532	1973-06-20
				DD	A	103302	1974-01-12
				FR	A	2176402	1973-10-26
				ZA	A	7301590	1973-11-28