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(54) COMPRESSOR

(57) In order to provide a compressor wherein the rigidity of a bearing can be increased and transmission of heat to a cylinder main body can be reduced, this compressor is equipped with a cylinder main body of a rotary compression mechanism, an upper bearing (22) provided on one surface side of the cylinder main body and supporting a drive shaft, and a muffler plate (42) disposed on one surface side of the upper bearing (22). The upper bearing (22) includes: a partition rib (46) formed rising from one surface of the upper bearing (22) and extending along the radial direction of the upper bearing (22); a refrigerant circulation section (38) surrounded by the partition rib (46) and the muffler plate (42), to which refrigerant discharged from the cylinder main body circulates, and a heat-blocking section (39) surrounded by the partition rib (46) and the muffler plate (42) and separated from the refrigerant circulation section (38) by the partition rib (46) and the muffler plate (42) to prevent refrigerant from circulating thereto.

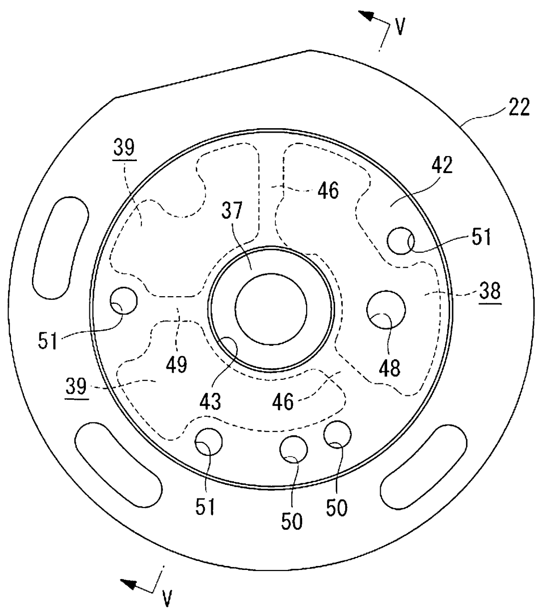

FIG. 3

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Description

Technical Field

[0001] The present invention relates to a compressor that is applied to an air conditioner and the like, and that compresses refrigerant and discharges the compressed refrigerant.

Background Art

[0002] A compression portion of a compressor used in an air conditioner and the like is driven by an electromagnetic motor. The electromagnetic motor is constituted of a rotor and a stator, and the rotor and the compression portion are connected to each other via a drive shaft (a shaft). The rotor of the motor rotates, which rotates the compression portion.

[0003] The compression portion includes a rotary compression mechanism that includes a cylinder main body, and an upper bearing and a lower bearing that each support a rotating shaft. Refrigerant taken into a cylinder chamber formed in the cylinder main body is compressed by the rotation of a roller in the cylinder chamber, and then discharged into a muffler (a discharge chamber) via discharge ports and discharge valves. After that, the refrigerant discharged to the muffler is delivered toward the motor in a sealed container (a housing) of the compressor.

[0004] The muffler is, as described in Patent Document 1 below, almost in a bowl shape, for example, and installed on the upper bearing so as to cover the discharge valves. Patent Document 1 discloses the configuration in which a rib is integrally formed with the upper bearing serving as a frame, which increases the rigidity of the frame.

Citation List

Patent Document

[0005] Patent Document 1: Japanese Patent Publication No. 3301837

Summary of Invention

Technical Problems

[0006] In the above-described rotary compression mechanism, the refrigerant discharged into the muffler is compressed in the cylinder chamber and thus has a high temperature, which heats structural bodies such as the muffler and the upper bearing while the compressor is in operation. As a result, the refrigerant taken into the cylinder chamber, which has a relatively low temperature, is heated by the upper bearing and the like. Therefore, the rotary compression mechanism takes in and compresses refrigerant having an increased temperature, which deteriorates efficiency.

[0007] Unlike Patent Document 1, an upper bearing having no rib formed thereon has low rigidity, which causes resonance at an eigenvalue (about 1 kHz) in a low frequency region of the upper bearing, for example. As a result, the bearing and the drive shaft (the shaft) suffer from elastic deformation and thus noise increases.

[0008] In light of the foregoing, an object of the present invention is to provide a compressor capable of increasing the rigidity of a bearing and suppressing transmission of heat to a cylinder main body.

Solution to Problems

[0009] A compressor of the present invention employs the following solutions to solve the problems described above.

[0010] The compressor according to the present invention includes a cylinder main body of a rotary compression mechanism, a bearing provided on one surface side of the cylinder main body and supporting a drive shaft, and a plate portion disposed on one surface side of the bearing. The bearing includes a wall portion formed rising from the one surface of the bearing and extending along the radial direction of the bearing, a refrigerant circulation section surrounded by the wall portion and the plate portion, the refrigerant circulation section allowing refrigerant discharged from the cylinder main body to circulate thereto, and a heat-blocking section surrounded by the wall portion and the plate portion and separated from the refrigerant circulation section by the wall portion and the plate portion to prevent the refrigerant from circulating thereto.

[0011] According to this configuration, the heat-blocking section to which the refrigerant does not circulate is formed separated from the refrigerant circulation section to which the refrigerant circulates. The heat-blocking section is separated from the refrigerant circulation section by the wall portion formed along the radial direction of the bearing and the plate portion disposed on one surface side of the bearing. As a result, the heat-blocking section serves as a heat-blocking space to which heat of the refrigerant is hardly transmitted. Therefore, temperature rise of the cylinder main body is suppressed, which can reduce temperature rise of the refrigerant flowing on the intake side of the cylinder main body. The refrigerant circulation section receives the refrigerant discharged from the cylinder main body, and thus provides silencing effect.

[0012] In addition, the wall portion is formed rising from one surface of the bearing and extending along the radial direction of the bearing, which increases the rigidity of the bearing.

[0013] In order to separate the refrigerant circulation section and the heat-blocking section from each other, two wall portions, for example, are provided extending in different two directions from the center of the bearing. The angle between the two wall portions or the angle between the wall portion and a first rib is preferably less than 180 degrees. Therefore, the rigidity of the bearing can be further increased.

[0014] In the above-described invention, the bearing may further include the first rib that is formed rising from the one surface of the bearing and extending along the radial direction of the bearing in the heat-blocking section.

[0015] According to this configuration, not only the wall portion but also the first rib is formed, on one surface of the bearing, extending along the radial direction of the bearing. Therefore, the rigidity of the bearing can be increased.

[0016] In the above-described invention, another configuration may be employed in which the number of the cylinder main body provided is at least two, and the bearing further includes a second rib that is formed rising from the one surface of the bearing and extending along the radial direction of the bearing in the refrigerant circulation section, the refrigerant circulation section is divided into at least two separated spaces by the second rib, and one of the separated spaces allows refrigerant to be discharged thereto from one of the cylinder main bodies and the other separated space allows refrigerant to be discharged thereto from the other cylinder main body.

[0017] According to this configuration, the refrigerant circulation section to which the refrigerant circulates is divided into two separate spaces by the second rib. One of the separated spaces allows the refrigerant to be discharged thereto from one of the cylinder main bodies. The other separated space allows the refrigerant to be discharged thereto from the other cylinder main body. Therefore, the refrigerant discharged from one of the cylinder main bodies and the refrigerant discharged from the other cylinder main body both circulate in the respective separated spaces of the refrigerant circulation section and are silenced.

[0018] In the above-described invention, another configuration may be employed in which the at least two separated spaces allow refrigerant to circulate therein, from one to another, and the plate portion has only one discharge port formed thereon, the discharge port causing refrigerant to be discharged therethrough from the separated spaces.

[0019] According to this configuration, the refrigerant discharged from the one of the cylinder main bodies and the refrigerant discharged from the other cylinder main body join each other in the separated spaces of the refrigerant circulation section. The joined refrigerant is discharged from the separated spaces via the discharge port formed on the plate portion. Therefore, providing the one of the cylinder main bodies and the other cylinder main body eliminates the need to provide an additional part for joining the refrigerant outside of the compression mechanism.

[0020] In the above-described invention, another configuration may be employed in which the second rib has a notch portion formed thereon to allow the refrigerant to circulate in the at least two separated spaces, from one to another, the notch portion being formed by partially cutting the bearing in the radial direction.

[0021] According to this configuration, the refrigerant circulates via the notch portion of the second rib, that is, the refrigerant circulates between the at least two separated spaces without lowering the height of the second rib other than the notch portion. Therefore, the rigidity of the bearing can be increased in comparison with the configuration in which the height of the second rib is uniformly lowered along the radial direction of the bearing to circulate the refrigerant in the separated spaces, from one to another.

[0022] In the above-described invention, another configuration may be employed in which the plate portion has a groove portion formed thereon to allow the refrigerant to circulate in the at least two separated spaces, from one to another, the groove portion being formed at a position corresponding to the second rib.

[0023] According to this configuration, the refrigerant circulates via the groove portion formed on the plate portion, that is, the refrigerant circulates between the at least two separated spaces without lowering the height of the second rib. Therefore, the rigidity can be increased in comparison with the configuration in which, to circulate the refrigerant in the separated spaces from one to another, the height of the second rib is uniformly lowered along the radial direction of the bearing or the notch portion is partially formed on the second rib.

Advantageous Effects of Invention

[0024] According to the present invention, the rigidity of the bearing can be increased by the wall portion and transmission of heat to the cylinder main body can be reduced. Therefore, temperature rise of the cylinder main body is suppressed, which can reduce temperature rise of refrigerant flowing on the intake side of the cylinder main body.

Brief Description of Drawings

[0025]

FIG. 1 is a vertical cross-sectional view of a compressor according to a first embodiment of the present invention.

FIG. 2 is a horizontal cross-sectional view of a cylinder main body of the compressor according to the first embodiment of the present invention.

FIG. 3 is a plan view of an upper bearing and a muffler plate of the compressor according to the first embodiment of the present invention.

FIG. 4 is a plan view of the upper bearing of the compressor according to the first embodiment of the present invention.

FIG. 5 is a vertical cross-sectional view taken along line V-V in FIG. 3.

FIG. 6 is a vertical cross-sectional view taken along line VI-VI in FIG. 4.

FIG. 7 is an outline vertical cross-sectional view of the upper bearing and the muffler plate of the compressor according to the first embodiment of the present invention.

FIG. 8 is a plan view of an upper bearing and a muffler plate of a compressor according to a second embodiment of the present invention.

FIG. 9 is a plan view of the upper bearing of the compressor according to the second embodiment of the present invention.

FIG. 10 is an outline vertical cross-sectional view of the upper bearing and the muffler plate of the compressor according to the second embodiment of the present invention.

FIG. 11 is an outline vertical cross-sectional view of an upper bearing and a muffler plate of a compressor according to a first modification of the second embodiment of the present invention.

FIG. 12 is an outline vertical cross-sectional view of an upper bearing and a muffler plate of a compressor according to a second modification of the second embodiment of the present invention.

FIG. 13 is an outline vertical cross-sectional view of an upper bearing and a muffler plate of a compressor according to a third modification of the second embodiment of the present invention.

FIG. 14 is a plan view of an upper bearing and a muffler plate of a compressor according to a fourth modification of the second embodiment of the present invention.

Description of Embodiments

First Embodiment

[0026] A compressor 1 according to a first embodiment of the present invention will be described below with reference to the drawings. As illustrated in FIG. 1, the multi-cylinder rotary compressor 1 according to the present embodiment is provided with a cylindrical sealed container 2 whose upper and lower portions are respectively sealed by an upper cover 3 and a lower cover 4. A motor 5 is installed in the upper part of the interior of the sealed container 2, and a rotary compression mechanism 6 driven by the motor 5 is installed in the lower part of the sealed container 2.

[0027] A mounting leg 7 is provided on the outer circumference of the lower portion of the sealed container 2. Further, a discharge piping 8 that penetrates through the upper cover 3 is provided in the upper portion of the sealed container 2. The discharge piping 8 discharges a high-pressure refrigerant gas compressed by the multi-cylinder rotary compressor 1 toward a refrigeration cycle. Furthermore, an accumulator 9 is installed on an outer circumferential portion of the sealed container 2. The accumulator 9 separates a liquid portion, such as oil and liquid refrigerant, contained in a low-pressure refrigerant gas returned from the refrigerating cycle side, and causes only a gas portion to be taken in by the compression mechanism 6 via intake piping 10 and 11.

[0028] The motor 5 is provided with a stator 12 and a rotor 13. The stator 12 is fixedly installed on the inner circumferential surface of the sealed container 2 by press fitting and the like. The rotor 13 is connected to and integrally provided with a drive shaft 14. This configuration allows a rotational driving force of the rotor 13 to be transmitted to the compression mechanism 6 via the drive shaft 14. Further, in the lower part of the drive shaft 14, a first eccentric pin 15 and a second eccentric pin 16 are provided respectively corresponding to a first roller 24 and a second roller 25 of the rotary compression mechanism 6 described below.

[0029] In the present embodiment, the rotary compression mechanism 6 is of a two-cylinder type, and a first cylinder chamber 17 and a second cylinder chamber 18 are respectively formed in first and second compression mechanisms 6A and 6B of the compression mechanism 6. The compression mechanism 6 is further provided with a first cylinder main body 19, a second cylinder main body 20, a partition plate (a separator plate) 21, an upper bearing 22, a lower bearing 23, and the like.

[0030] The first cylinder main body 19 and the second cylinder main body 20 are fixedly installed inside the sealed container 2 respectively corresponding to the first eccentric pin 15 and the second eccentric pin 16 of the drive shaft 14. The partition plate 21 is interposed between the first cylinder main body 19 and the second cylinder main body 20, defining the first cylinder chamber 17 and the second cylinder chamber 18. The upper bearing 22 is provided on the upper surface of the first cylinder main body 19, defining the first cylinder chamber 17 and supporting the drive shaft 14. The lower bearing 23 is provided on the lower surface of the second cylinder main body 20, defining the second cylinder chamber 18 and supporting the drive shaft 14.

[0031] The first and second compression mechanisms 6A and 6B are respectively provided with the first roller 24 and the second roller 25 and with blades 28 and 29.

[0032] The first roller 24 and the second roller 25 are respectively rotatably fitted with the first eccentric pin 15 and the second eccentric pin 16, and rotate inside the first cylinder chamber 17 and the second cylinder chamber 18. The first eccentric pin 15 and the second eccentric pin 16 are connected to the drive shaft 14 and rotate together with the drive shaft 14. The center of gravity of the second roller 25 fitted with the second eccentric pin 16 is positioned, with respect to an axis of the drive shaft 14, remote from the center of gravity of the first roller 24 fitted with the first eccentric pin 15.

[0033] As illustrated in FIG. 2, the blades 28 and 29 are slidably fitted into blade grooves 26 and 27 provided in the first cylinder main body 19 and the second cylinder main body 20, and partition the interior of each of the first cylinder chamber 17 and the second cylinder chamber

18 into an intake chamber side and a discharge chamber side.

[0034] The low-pressure refrigerant gas is taken into the first cylinder chamber 17 and the second cylinder chamber 18 of the first and second compression mechanisms 6A and 6B, from the intake piping 10 and 11 via intake ports 30 and 31.

[0035] The refrigerant gas taken into the first cylinder chamber 17 is compressed by the rotation of the first roller 24, and then discharged into a later-described refrigerant circulation section 38 of the upper bearing 22 via discharge ports and discharge valves (not illustrated). After that, the refrigerant gas is discharged into a muffler 32. The muffler 32 is almost in a bowl shape, for example, and installed on the upper bearing 22 so as to cover the discharge ports and the discharge valves (not illustrated). The refrigerant gas taken into the second cylinder chamber 18 is compressed by the rotation of the second roller 25, and then discharged into the muffler 32 via discharge ports and discharge valves. The refrigerant gas discharged into the muffler 32 is discharged into the sealed container 2, and then delivered to the refrigeration cycle via the discharge piping 8.

[0036] The first cylinder main body 19, the second cylinder main body 20, the partition plate 21, the upper bearing 22, and the lower bearing 23, which constitute the compression mechanism 6, are integrally tightened and fixed by bolts. Further, a bottom portion of the interior of the sealed container 2 is filled with refrigeration oil 34, such as PAG oil or POE oil. The refrigeration oil 34 can be supplied to lubrication parts inside the compression mechanism 6 via oil supply holes and the like provided in the drive shaft 14. An appropriate amount of an extreme-pressure agent suitable for each type of oil is added to the refrigeration oil 34. Note that, because an oil supply mechanism for the compression mechanism 6 has a typical configuration, a detailed description thereof is omitted herein.

[0037] A first balance weight 35 is provided on the upper surface of the rotor 13, which is one side of the drive shaft 14 in the axial direction thereof and is a surface located remote from the compression mechanism 6. Further, the center of gravity of the first balance weight 35 is positioned, with respect to the axis of the drive shaft 14, remote from the center of gravity of the first roller 24. A second balance weight 36 is provided on the lower surface of the rotor 13, which is the other side of the drive shaft 14 in the axial direction thereof and is a surface located adjacent to the compression mechanism 6. Further, the center of gravity of the second balance weight 36 is positioned, with respect to the axis of the drive shaft 14, remote from the center of gravity of the second roller 25.

[0038] As a result of the first balance weight 35 and the second balance weight 36 being provided on the upper surface and the lower surface of the rotor 13, a centrifugal force that acts on the first balance weight 35 and the second balance weight 36 can be balanced against a centrifugal force that is generated by the rotation of the first roller 24 and the second roller 25 and acts on the first roller 24 and the second roller 25.

[0039] The rotor 13 is formed of a plurality of steel plates insulated from each other and stacked on top of each other in the axial direction of the drive shaft 14. The steel plate is an example of a magnetic metal plate, and may be another magnetic metal plate. The steel plates stacked on top of each other suppress generation of an eddy current. The steel plates are arranged such that the outer surface of the rotor 13 is on the same plane. Therefore, a gap (also referred to as an air gap) formed between the stator 12 and the rotor 13 is constant in the circumferential direction. The size of the air gap ranges, for example, from a hundred and several ten μm to several hundred μm in a manner that depends on the size of the motor 5 and the like.

[0040] The following describes the upper bearing 22 according to the present embodiment with reference to FIGS. 3 to 6.

[0041] The upper bearing 22 has a disc shape and includes, in the center thereof, a cylindrical portion 37 through which the drive shaft 14 penetrates. The bottom surface of the upper bearing 22 is provided in contact with the upper surface of the first cylinder main body 19. The outer circumferential surface of the upper bearing 22 is fixed to the sealed container 2.

[0042] The refrigerant circulation section 38 and a heat-blocking section 39 are formed on the upper surface of the upper bearing 22 adjacent to the motor 5.

[0043] The refrigerant circulation section 38 is a space surrounded by a recessed portion 40 and a muffler plate 42. The recessed portion 40 is formed on the upper surface side of the upper bearing 22 in a shape depressed toward the bottom surface thereof. The muffler plate 42 is installed on the upper surface of the upper bearing 22.

[0044] The heat-blocking section 39 is a space surrounded by a recessed portion 41 and the muffler plate 42. The recessed portion 41 is formed on the upper surface side of the upper bearing 22 in a shape depressed toward the bottom surface thereof. The recessed portion 41 is formed on a different portion from the recessed portion 40 included in the refrigerant circulation section 38.

[0045] The muffler plate 42 has a disc shape and includes, in the center thereof, a through hole 43 through which a cylindrical portion 37 of the upper bearing 22 penetrates.

[0046] The recessed portions 40 and 41 formed on the upper surface side of the upper bearing 22, are surrounded by an outer peripheral wall 44, a center wall 45, and partition ribs 46. The outer peripheral wall 44 is almost parallel to the outer circumferential surface of the upper bearing 22 and has a circular arc shape. The center wall 45 is almost parallel to the outer circumferential surface of the cylindrical portion 37 and has a circular arc shape.

[0047] The partition ribs 46 are formed extending in two different directions from the center side of the upper bearing 22 along the radial direction thereof. The partition ribs 46 are provided between the outer peripheral wall 44 and the center wall 45. The partition ribs 46 are provided in a projecting manner with respect to the flat plate surface of the upper bearing 22. This configuration allows the upper bearing 22 to have the ribs formed on one surface side thereof along the radial direction, thereby increasing the rigidity of the upper bearing 22 in comparison with the configuration in which the upper bearing 22 has no ribs.

[0048] In the refrigerant circulation section 38, a discharge port 47 is formed on the upper bearing 22. The discharge port 47 has a discharge valve (not illustrated) installed therein. The refrigerant discharged from the first cylinder chamber 17 is supplied to the refrigerant circulation section 38 via the discharge port 47. The refrigerant is stored once inside of the refrigerant circulation section 38, and then discharged from the refrigerant circulation section 38 toward the motor 5 in the sealed container 2 via a discharge port 48 formed on the muffler plate 42.

[0049] The heat-blocking section 39 is separated from the refrigerant circulation section 38 by the partition ribs 46, therefore, the refrigerant discharged from the first cylinder chamber 17 or the second cylinder chamber 18 is not supplied to the heat-blocking section 39, unlike the refrigerant circulation section 38. In addition, no refrigerant is introduced from the refrigerant circulation section 38 into the heat-blocking section 39.

[0050] In the heat-blocking section 39, a rib (a first rib) 49 is provided extending along the radial direction of the upper bearing 22. Therefore, on the upper surface of the upper bearing 22, at least three rib-like portions including the two partition ribs 46 projecting and extending along the radial direction are formed in the circumferential direction. This configuration reinforces the upper surface of the upper bearing 22 by not only the partition ribs 46 but also the rib 49 in the heat-blocking section 39, thereby increasing the rigidity of the upper bearing 22. As a result, a bending mode hardly appears in a low frequency region, which makes resonance less likely to occur than the configuration in which two rib-like portions are provided.

[0051] The rib 49 may have a height so as to extend from the bottom portion of the recessed portion 41 to the bottom surface of the muffler plate 42. Alternatively, the rib 49 may have a height so as not to come into contact with the bottom surface of the muffler plate 42. Larger height of the rib 49 can increase the rigidity of the upper bearing 22.

[0052] The angle between the rib 49 and each of the adjacent partition ribs 46, or the angle between the partition ribs 46 adjacent to each other is preferably less than 180 degrees. In this configuration, a bending mode hardly appears in a low frequency region, which makes resonance less likely to occur than the configuration in which the angle is 180 degrees.

[0053] On the upper bearing 22, through holes 50 are formed on places other than the refrigerant circulation section 38 and the heat-blocking section 39. Into the through holes 50, the refrigerant flows from the second cylinder chamber 18. The refrigerant passed through the through holes 50 is discharged into the muffler 32.

[0054] On the upper bearing 22, a plurality of bolt holes 51 are formed. The bolt holes 51 have bolts penetrating therethrough, the bolts passing through the muffler plate 42, the first cylinder main body 19 and the second cylinder main body 20, the partition plate 21, the upper bearing 22 and the lower bearing 23. All these members are tightened together by the bolts.

[0055] According to the present embodiment, as illustrated in FIG. 7, in the upper bearing 22, the heat-blocking section 39 in which the refrigerant does not circulate is formed separated from the refrigerant circulation section 38 in which the refrigerant circulates. The heat-blocking section 39 is separated from the refrigerant circulation section 38 by the partition ribs 46 formed along the radial direction of the upper bearing 22, the muffler plate 42 installed on the upper surface side of the upper bearing 22, and the like. In the heat-blocking section 39, air or refrigerant oil is present having lower temperatures than the refrigerant discharged from the first cylinder chamber 17. This configuration allows the heat-blocking section 39 to serve as a heat-blocking space to which the heat of the refrigerant is hardly transmitted. FIG. 7 is an outline vertical cross-sectional view of the upper bearing and the muffler plate of the compressor according to the present embodiment.

[0056] The heat-blocking section 39 can therefore suppress the temperature rises of the first and second compression mechanisms 6A and 6B caused by the refrigerant discharged from the first cylinder chamber 17 or the refrigerant on the motor 5 side. Furthermore, the heat-blocking section 39 can reduce the temperature rise of the refrigerant taken into the first cylinder chamber 17 or the second cylinder chamber 18. The refrigerant circulation section 38 temporarily stores therein the refrigerant discharged from the first cylinder chamber 17, which reduces the noise generated when discharging the refrigerant and thus provides silencing effect.

Second Embodiment

[0057] The following describes a compressor according to a second embodiment of the present invention with reference to FIGS. 8 to 10. Because the structural members are the same as those of the first embodiment, a detailed description thereof will be omitted.

[0058] In the above-described first embodiment, the configuration in which no rib is formed in the refrigerant circulation section 38 has been described. But the present invention is not limited to this configuration. In the present embodiment, a rib (a second rib) 52 is formed in the refrigerant circulation section 38.

[0059] Specifically, the rib 52 is formed in the refrigerant circulation section 38 along the radial direction of the upper bearing 22. Therefore, on the upper surface of the upper bearing 22, rib-like portions projecting and extending along the radial direction of the upper bearing 22 including not only the partition ribs 46 and the rib 49 in the heat-blocking section 39, but also the rib 52 in the refrigerant circulation section 38 are formed. Therefore, on the upper surface of the upper bearing 22, at least four rib-like portions projecting and extending along the radial direction are formed in the circumferential direction. This configuration increases the rigidity of the upper bearing 22. As a result, a bending mode hardly appears at a low frequency, which makes resonance less likely to occur than the configuration in which two or three rib-like portions are provided.

[0060] The rib 52 formed in the refrigerant circulation section 38 has a height so as not to come into contact with the muffler plate 42. This configuration allows the refrigerant to circulate through the refrigerant circulation section 38, although the rib 52 is formed therein.

[0061] The refrigerant circulation section 38 is divided into a first separated space 38A and a second separated space 38B with the rib 52 interposed therebetween.

[0062] On the upper bearing 22, a discharge port 53 is formed in the first separated space 38A and a discharge port 54 is formed in the second separated space 38B in the refrigerant circulation section 38. The discharge port 53 formed in the first separated space 38A has a discharge valve (not illustrated) installed therein. Via the discharge port 53, the refrigerant discharged from the first cylinder chamber 17 is supplied to the first separated space 38A. Via the discharge port 54, the refrigerant discharged from the second cylinder chamber 18 is supplied to the second separated space 38B.

[0063] The muffler plate 42 has a discharge port 55 formed on the first separated space 38A side thereof.

[0064] The refrigerant is stored once in the first separated space 38A and second separated space 38B of the refrigerant circulation section 38. The refrigerant stored in the second separated space 38B flows into the first separated space 38A, and then joins the refrigerant stored therein. Subsequently, the joined refrigerant is discharged from the first separated space 38A toward the motor 5 in the sealed container 2 via the discharge port 55 formed on the first separated space 38A side of the muffler plate 42.

[0065] The discharge port 55, which is formed only one on the muffler plate 42, may be formed on the side of the second separated space 38B rather than the side of the first separated space 38A. In this configuration, the refrigerant flows from the first separated space 38A to the second separated space 38B.

[0066] According to the present embodiment, the refrigerant discharged from the first cylinder chamber 17 and the refrigerant discharged from the second cylinder chamber 18 join in the refrigerant circulation section 38, which eliminates the need to provide an additional part for joining the refrigerant outside of the upper bearing 22.

[0067] According to the present embodiment, the refrigerant from the second cylinder chamber 18 is introduced to the second separated space 38B. This configuration increases the number of steps of the muffler, unlike the first embodiment in which the refrigerant passes through the through holes 50 on the upper bearing 22 as is and discharged to the outside. Therefore, the compressor according to the present embodiment has an increased silencing effect.

[0068] Furthermore, according to the present embodiment, as illustrated in FIG. 10, in the upper bearing 22, the heat-blocking section 39 in which the refrigerant does not circulate is formed separated from the refrigerant circulation section 38 in which the refrigerant circulates. The heat-blocking section 39 is separated from the refrigerant circulation section 38 by the partition ribs 46 formed along the radial direction of the upper bearing 22, the muffler plate 42 installed on the upper surface side of the upper bearing 22, and the like. In the heat-blocking section 39, air or refrigerant oil is present having lower temperatures than the refrigerant discharged from the first cylinder chamber 17 or the second cylinder chamber 18. This configuration allows the heat-blocking section 39 to serve as a heat-blocking space to which the heat of the refrigerant is hardly transmitted.

[0069] The heat-blocking section 39 can therefore suppress the temperature rises of the first and second compression mechanisms 6A and 6B caused by the refrigerant discharged from the first cylinder chamber 17 or the second cylinder chamber 18, and the refrigerant on the motor 5 side. Furthermore, the heat-blocking section 39 can reduce the temperature rise of the refrigerant taken into the first cylinder chamber 17 or the second cylinder chamber 18.

[0070] In the above-described example, the configuration is employed in which the refrigerant discharged from the second cylinder chamber 18 is supplied to the second separated space 38B. But the present invention is not limited to this example. For example, another configuration may be employed in which the refrigerant discharged from the second cylinder chamber 18 is not supplied to the refrigerant circulation section 38; the upper bearing 22, as illustrated in FIG. 11, has a discharge port 56 formed only at the second separated space 38B; via the discharge port 56, the refrigerant discharged from the first cylinder chamber 17 is supplied to the second separated space 38B.

[0071] The muffler plate 42 has a discharge port 57 formed on the first separated space 38A side thereof.

[0072] This configuration causes the refrigerant to be stored once in the second separated space 38B of the refrigerant circulation section 38 and then flow to the first separated space 38A. Subsequently, the refrigerant is discharged from the first separated space 38A toward the motor 5 in the sealed container 2 via the discharge port 57 formed on the first separated space 38A side of the muffler plate 42.

[0073] The refrigerant from the second cylinder chamber 18 is, in the same manner as the first embodiment, not stored in the refrigerant circulation section 38 and passes through the through holes (not illustrated) on the upper bearing 22 as is, and discharged to the motor 5 side in the sealed container 2.

[0074] In the above-described embodiment, the configuration is employed in which the rib 52 is provided along the radial direction of the upper bearing 22 and has a height so as not to come into contact with the muffler plate 42. But the present invention is not limited to this configuration. For example, another configuration may be employed in which the rib 52, as illustrated in FIG. 12, has a notch portion 58 formed thereon, the notch portion 58 being formed by cutting a part of the rib 52 in the radial direction and the remaining part of the rib 52 having a height so as to come into contact with the muffler plate 42. In this configuration, the refrigerant circulates between the first separated space 38A and the second separated space 38B via the notch portion 58 formed on the rib 52.

[0075] According to this modification, the rigidity of the upper bearing 22 can be increased in comparison with the configuration in which the height of the rib 52 is uniformly lowered along the radial direction of the upper bearing 22. In addition, the muffler plate 42 and the rib 52 come into contact with each other, which hardly causes deformation in the muffler plate 42 formed in a planar shape, allowing a flow path area to be constantly ensured for a long time and also increasing the reliability. Furthermore, this configuration can readily reduce the area through which the refrigerant circulates between the first separated space 38A and the second separated space 38B, thereby increasing silencing effect.

[0076] In addition, in the above-described embodiment, the configuration in which the height of the rib 52 is lowered or the notch portion 58 is partially formed on the rib 52 to circulate the refrigerant has been described. But the present invention is not limited to this configuration. For example, another configuration, as illustrated in FIG. 13, may be employed in which on a surface on the refrigerant circulation section 38 side of the muffler plate 42, a groove portion 59 is formed at the position corresponding to the rib 52. The groove portion 59 and the rib 52 are separated from each other, which allows the refrigerant to circulate between the groove portion 59 and the rib 52.

[0077] According to this modification, the refrigerant circulates between the first separated space 38A and the second separated space 38B via the groove portion 59 formed on the muffler plate 42, which eliminates the need to lower the height of the rib 52. Therefore, the rigidity of the upper bearing 22 can be increased in comparison with the configuration in which the height of the rib 52 is uniformly lowered along the radial direction of the upper bearing 22 or the notch portion 58 is partially formed on the rib 52.

[0078] In addition, the groove portion 59 formed on the muffler plate 42 may be formed by bending an area corresponding to the groove portion 59 of the muffler plate 42 that is formed of a thin plate. In this configuration, the rigidity of the muffler plate 42 can be increased in comparison with the configuration in which the muffler plate 42 does not have the groove portion 59. In addition, the muffler plate 42 and the upper bearing 22 are tightened together by bolts, which can also increase rigidity of the combination of the muffler plate 42 and the upper bearing 22.

[0079] The groove portion formed on the muffler plate 42 may be formed with a method other than bending. For example, the groove portion may be formed in a concave shape by digging into the muffler plate 42 having a plate shape at the area corresponding to the groove portion.

[0080] Furthermore, in the above-described embodiment, the configuration in which with the first separated space 38A and the second separated space 38B provided in the refrigerant circulation section 38, the refrigerant circulates between the first separated space 38A and the second separated space 38B has been described. But the present invention is not limited to this configuration. The rib 52 may be provided in contact with the muffler plate 42 throughout the radial direction of the upper bearing 22. That is, the first separated space 38A and the second separated space 38B may be separated from each other by the rib 52.

[0081] In this configuration, the upper bearing 22, as illustrated in FIG. 9, has the discharge ports 53 and 54 formed in the first separated space 38A and the second separated space 38B, respectively, of the refrigerant circulation section 38. The discharge port 53, which is formed in the first separated space 38A, has a discharge valve installed therein.

[0082] In addition, the muffler plate 42, as illustrated in FIG. 14, has discharge ports 60 and 61 formed on the first separated space 38A side and the second separated space 38B side, respectively.

[0083] Via the discharge port 53, the refrigerant discharged from the first cylinder chamber 17 is supplied to the first separated space 38A of the refrigerant circulation section 38 and stored once therein. The refrigerant is then discharged from the first separated space 38A toward the motor 5 in the sealed container 2 via the discharge port 60 formed on the first separated space 38A side of the muffler plate 42. In addition, via the discharge port 54, the refrigerant discharged from the second cylinder chamber 18 is supplied to the second separated space 38B of the refrigerant circulation section 38 and stored once therein. The refrigerant is then discharged from the second separated space 38B toward the motor 5 in the sealed container 2 via the discharge port 61 formed on the second separated space 38B side of the muffler plate 42.

[0084] On this occasion, the refrigerant does not circulate between the first separated space 38A and the second separated space 38B. Also in this configuration, the refrigerant is stored in the first separated space 38A and the second separated space 38B, thereby providing silencing effect.

[0085] Note that although in the above-described embodiment, the configuration in which the muffler 32 is installed has been described, the present invention is not limited to this configuration, and a configuration in which the muffler 32 is not installed can be employed. In addition, in the above-described embodiment, the configuration in which the multi-cylinder rotary compressor has a plurality of compression mechanisms has been described. But a configuration in which the multi-cylinder rotary compressor has a single compression mechanism may be employed.

Reference Signs List

[0086]

1 Compressor
2 Sealed container
5 Motor
6 Compression mechanism
6A First compression mechanism
6B Second compression mechanism
8 Discharge piping
9 Accumulator
10, 11 Intake piping
12 Stator
13 Rotor
14 Drive shaft
17 First cylinder chamber
18 Second cylinder chamber
19 First cylinder main body (Cylinder main body, One cylinder main body)
20 Second cylinder main body (Cylinder main body, Other cylinder main body)
21 Partition plate
22 Upper bearing (Bearing)
23 Lower bearing
30, 31 Intake port
32 Muffler
37 Cylindrical portion
38 Refrigerant circulation section
38A First separated space (Separated space, One separated space)
38B Second separated space (Separated space, Other separated space)
39 Heat-blocking section
40, 41 Recessed portion
42 Muffler plate (Plate portion)
43, 50 Through hole
44 Outer peripheral wall
45 Center wall
46 Partition rib (Wall portion)
47, 48 Discharge port
49 Rib (First rib)
51 Bolt hole
52 Rib (Second rib)
53, 54, 55, 56, 57 Discharge port
58 Notch portion
59 Groove portion
60, 61 Discharge port

Claims

1. A compressor comprising:

a cylinder main body of a rotary compression mechanism;
a bearing provided on one surface side of the cylinder main body and supporting a drive shaft; and
a plate portion disposed on one surface side of the bearing, wherein
the bearing includes:

a wall portion formed rising from the one surface of the bearing and extending along a radial direction of the bearing;
a refrigerant circulation section surrounded by the wall portion and the plate portion, the refrigerant circulation section allowing refrigerant discharged from the cylinder main body to circulate thereto; and
a heat-blocking section surrounded by the wall portion and the plate portion, and separated from the refrigerant circulation section by the wall portion and the plate portion to prevent the refrigerant from circulating thereto.

2. The compressor according to claim 1, wherein the bearing further includes a first rib that is formed rising from the one surface of the bearing and extending along the radial direction of the bearing in the heat-blocking section.

3. The compressor according to claim 1 or 2, wherein:

the number of the cylinder main body provided is at least two;
the bearing further includes a second rib that is formed rising from the one surface of the bearing and extending along the radial direction of the bearing in the refrigerant circulation section;
the refrigerant circulation section is divided into at least two separated spaces by the second rib; and
one of the separated spaces allows refrigerant to be discharged thereto from one of the cylinder main bodies and the other separated space allows refrigerant to be discharged thereto from the other cylinder main body.

4. The compressor according to claim 3, wherein:

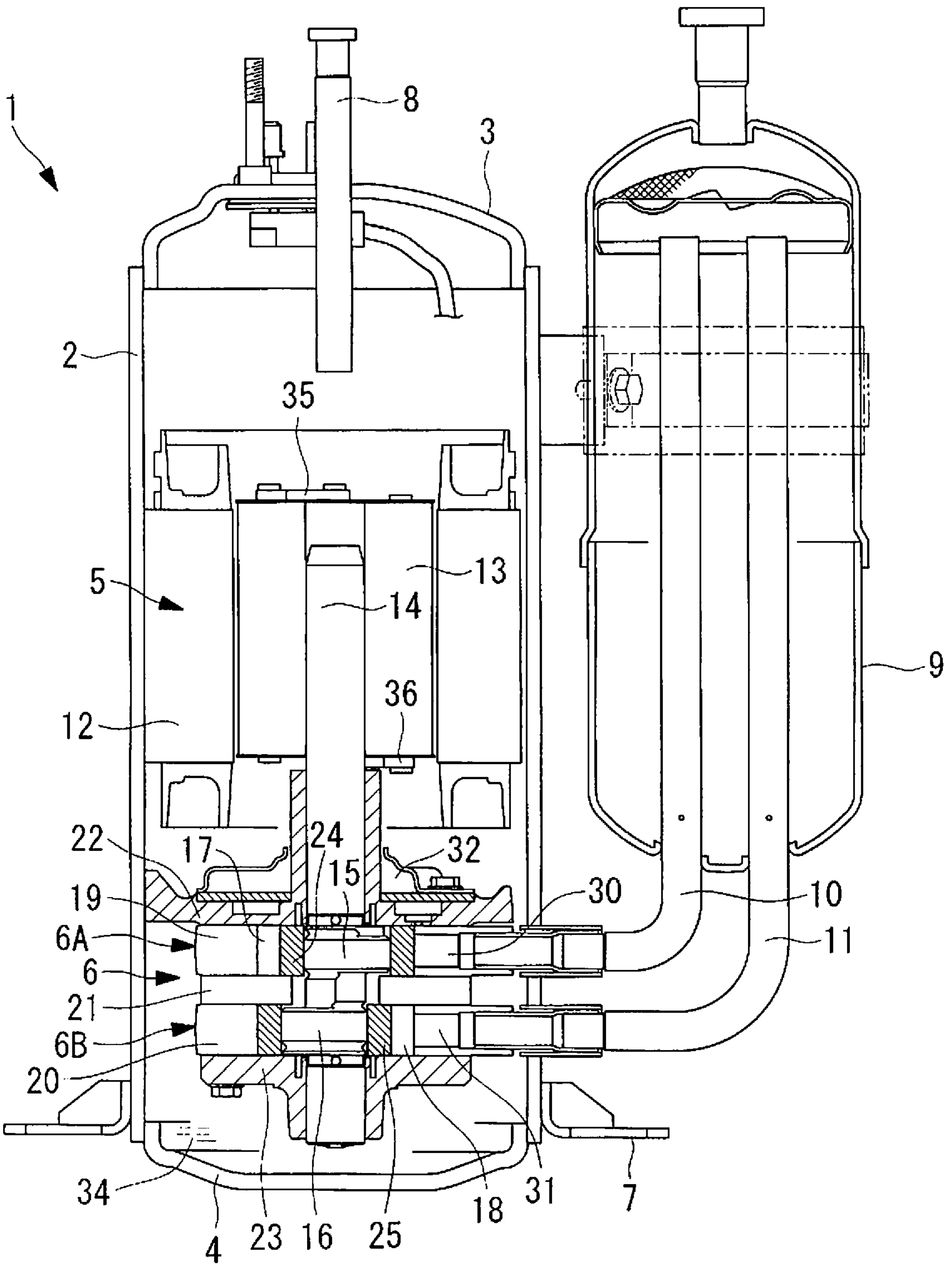
the at least two separated spaces allow refrigerant to circulate therein, from one to another;

and

the plate portion has only one discharge port formed thereon, the discharge port causing refrigerant to be discharged therethrough from the separated spaces.

5. The compressor according to claim 3 or 4, wherein the second rib has a notch portion formed thereon to allow the refrigerant to circulate in the at least two separated spaces, from one to another, the notch portion being formed by partially cutting the bearing in the radial direction.

6. The compressor according to claim 3 or 4, wherein the plate portion has a groove portion formed thereon to allow the refrigerant to circulate in the at least two separated spaces, from one to another, the groove portion being formed at a position corresponding to the second rib.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6A
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6B
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FIG. 1

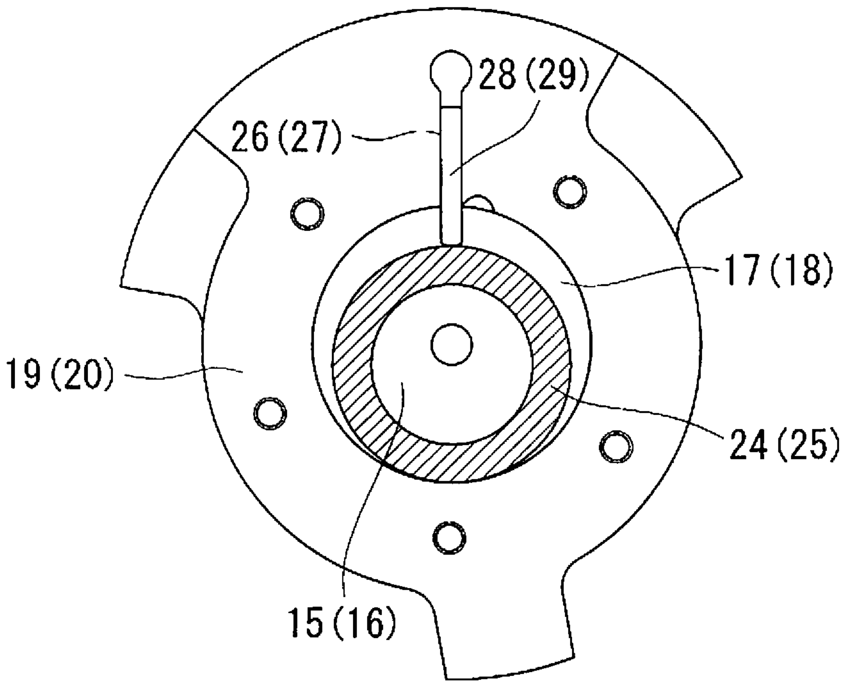

FIG. 2

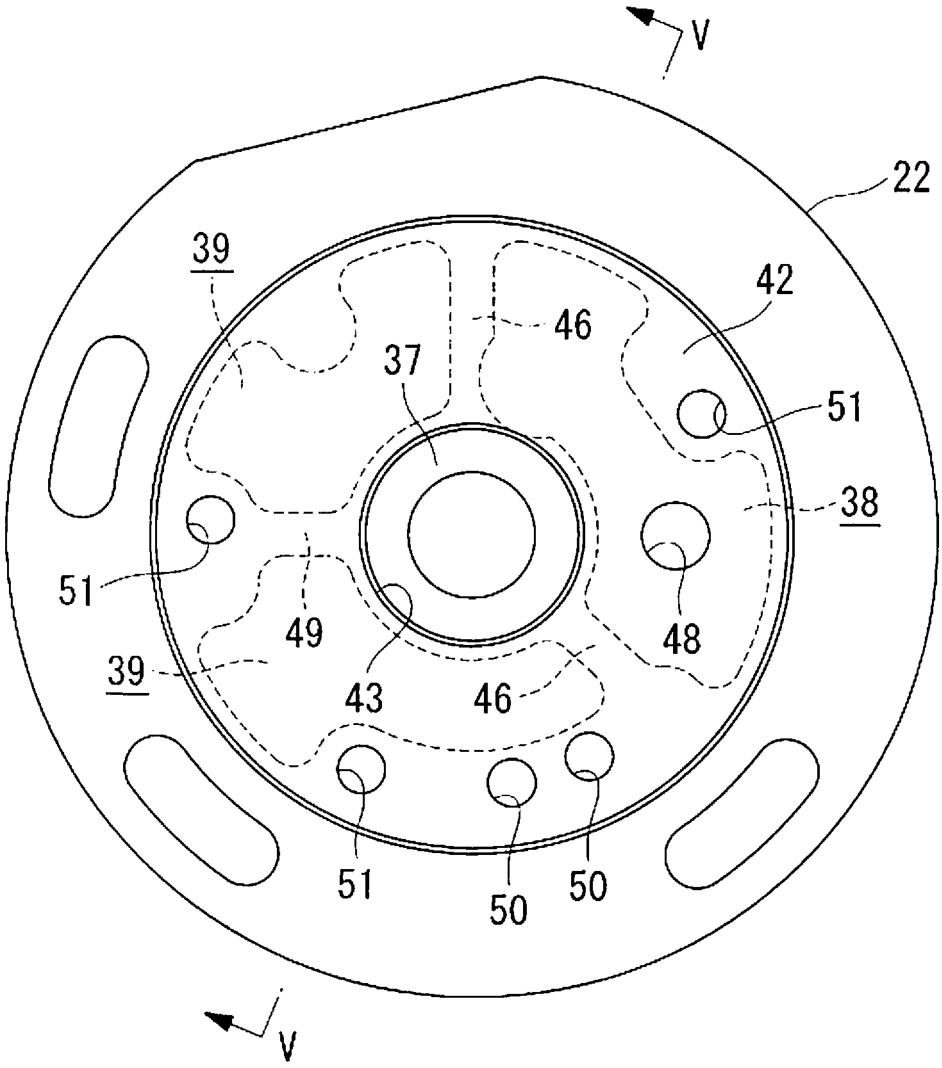

FIG. 3

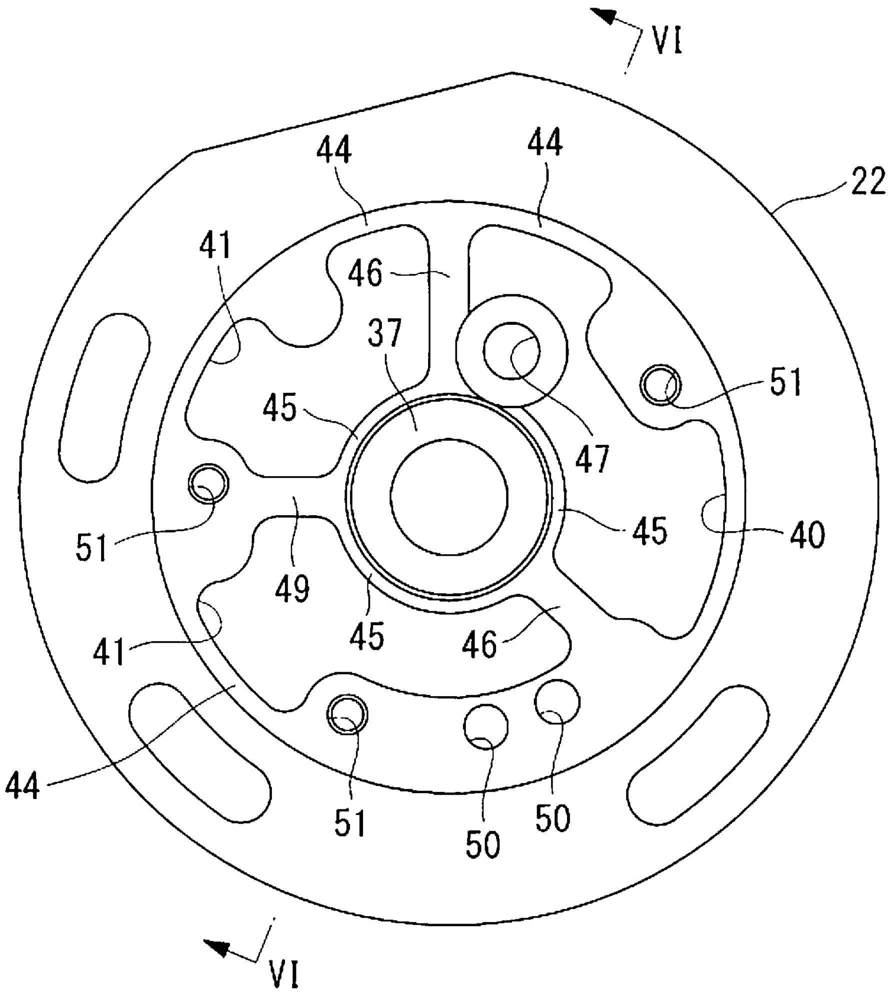
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FIG. 4

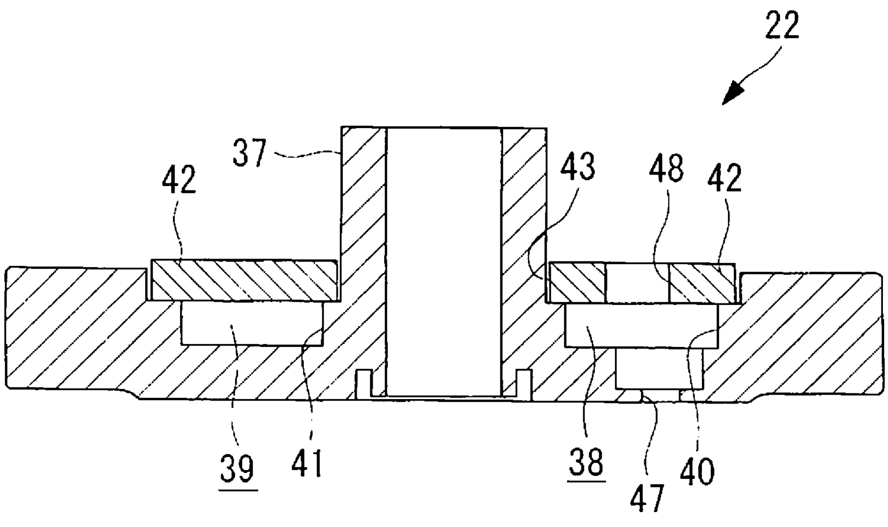
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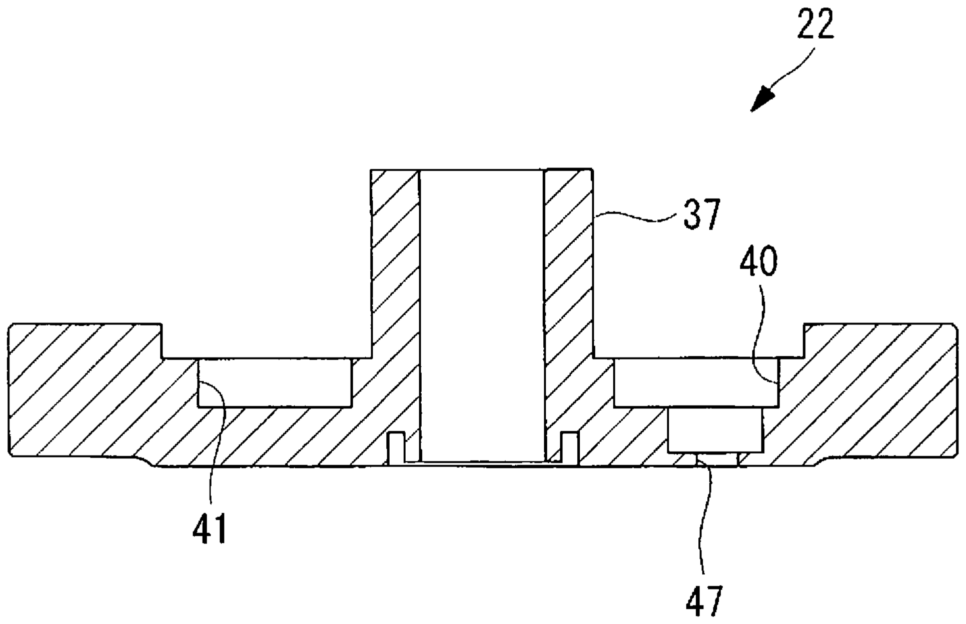
FIG. 5



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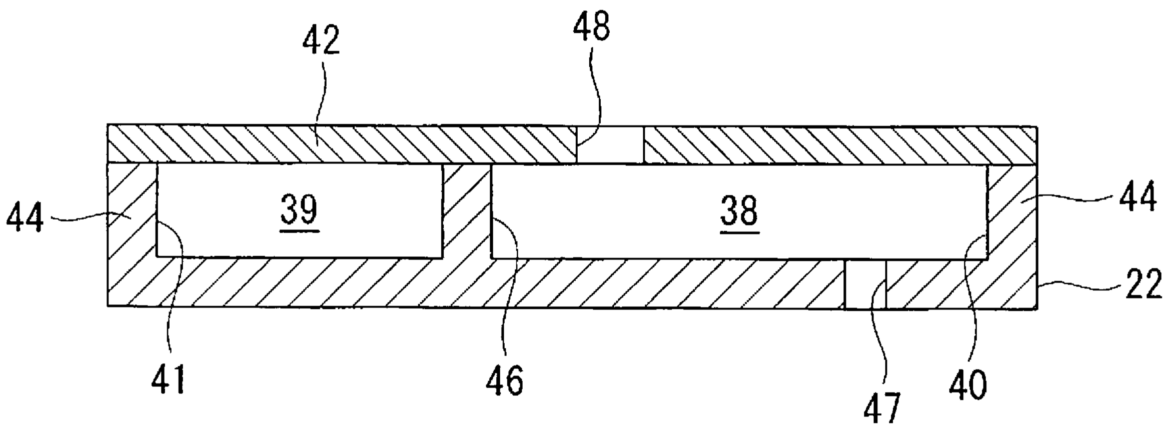

FIG. 7

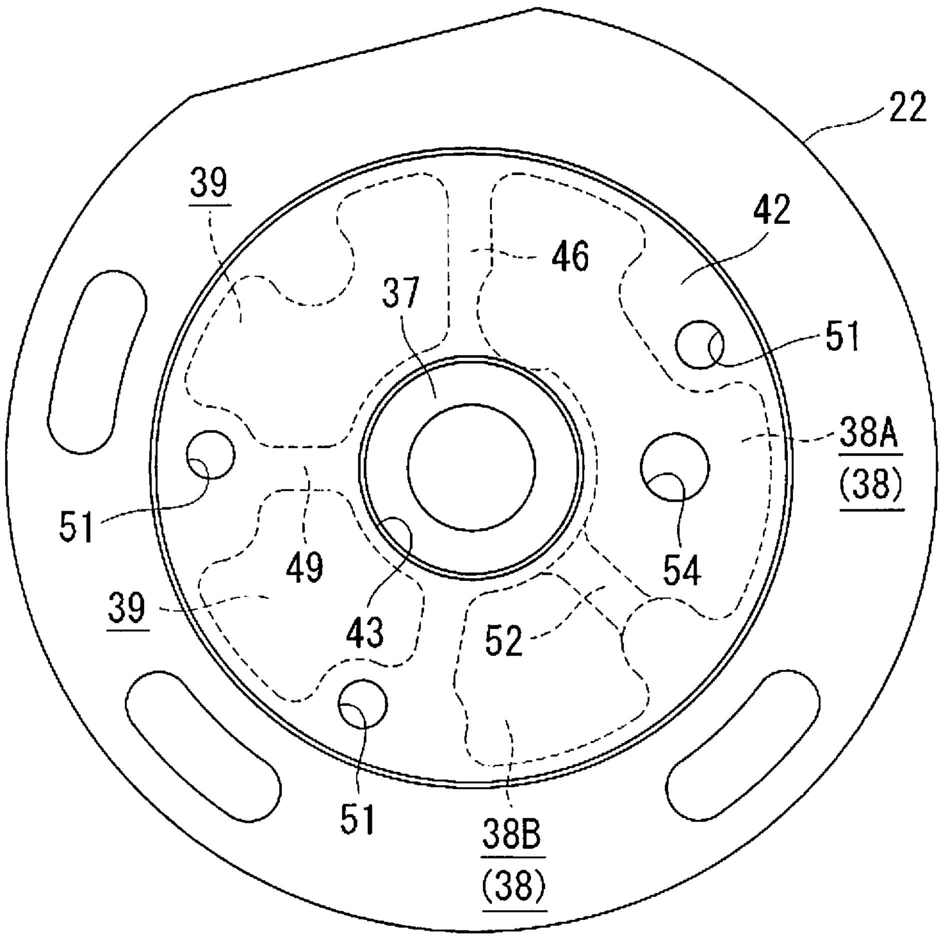

FIG. 8

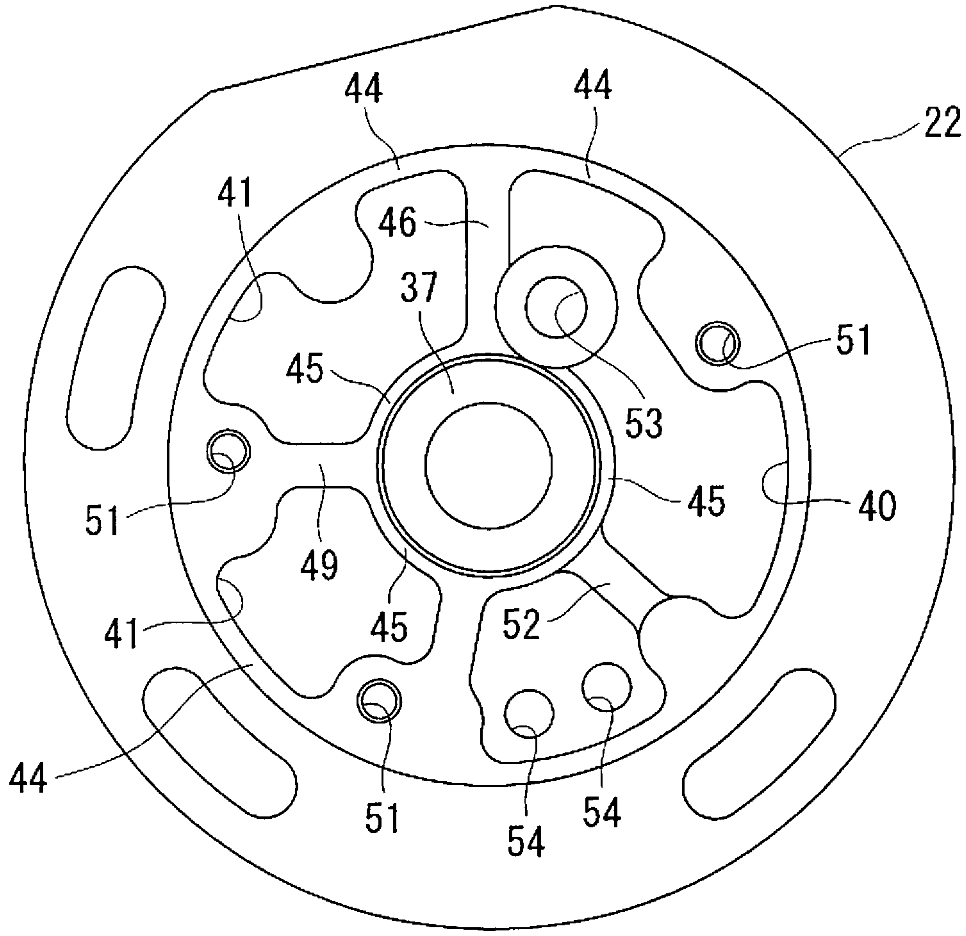
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FIG. 9

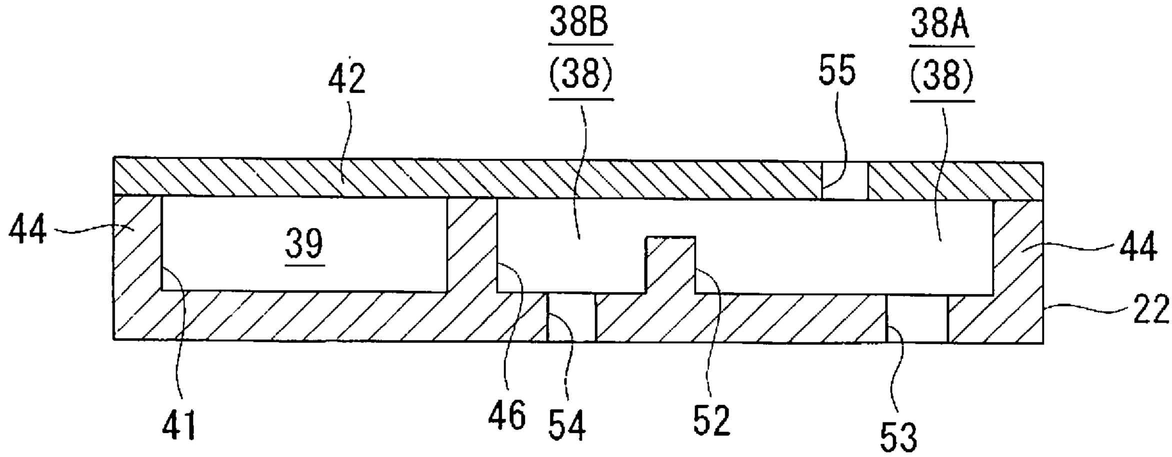
38B
(38)
38A
(38)
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FIG. 10

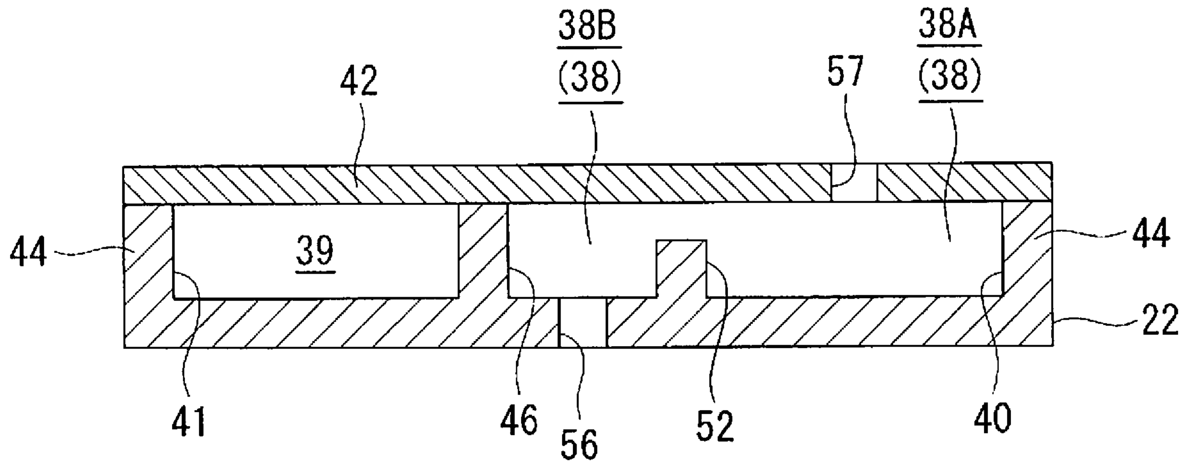

FIG. 11

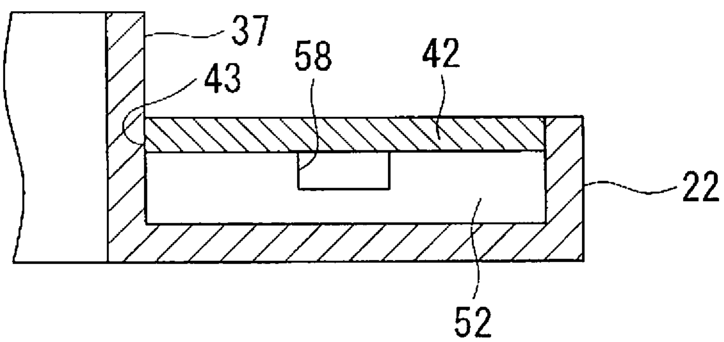

FIG. 12

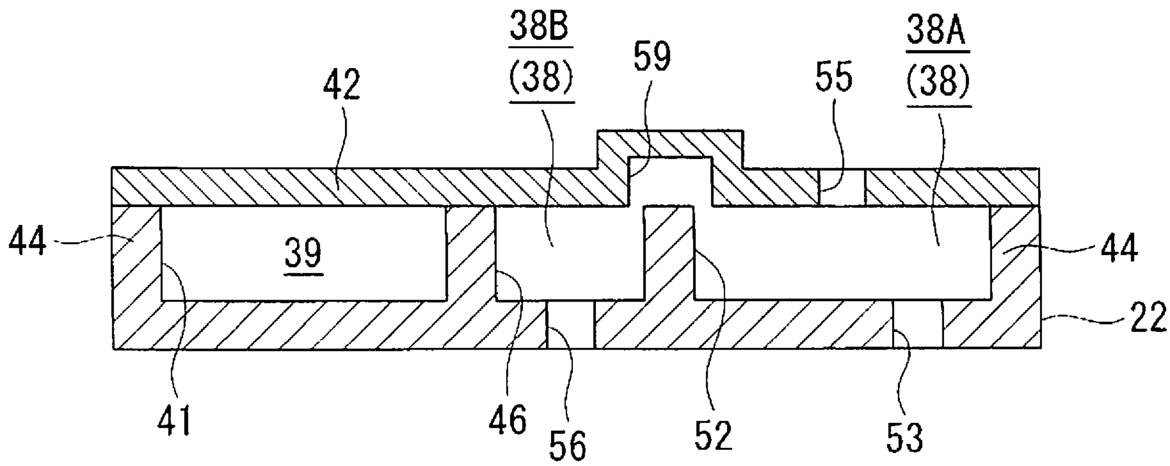

FIG. 13

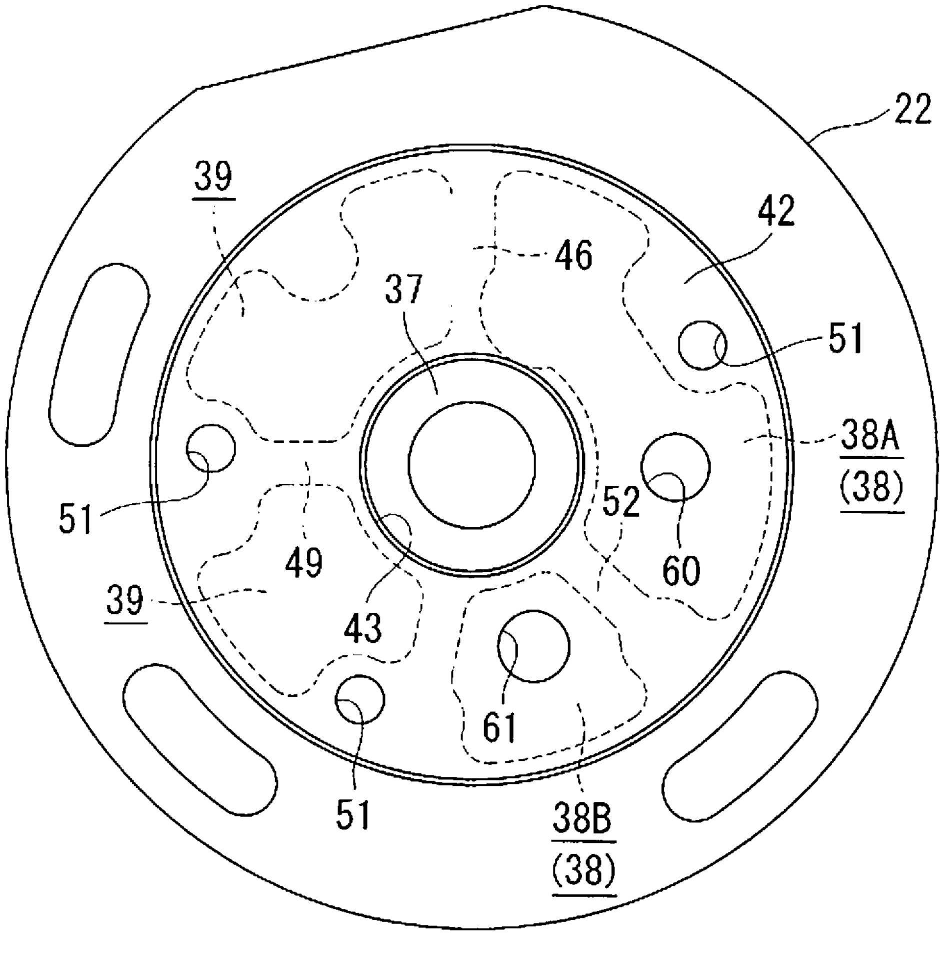

FIG. 14

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2015/086488

A. CLASSIFICATION OF SUBJECT MATTER
F04C18/356(2006.01)i, *F04C29/04*(2006.01)i, *F04C29/06*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04C18/356, F04C29/04, F04C29/06

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2016
Kokai Jitsuyo Shinan Koho	1971-2016	Toroku Jitsuyo Shinan Koho	1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2013-238132 A (Daikin Industries, Ltd.), 28 November 2013 (28.11.2013), paragraphs [0030] to [0071], [0084]; fig. 1 to 6 (Family: none)	1-2 3-6
P,X	WO 2015/190551 A1 (Daikin Industries, Ltd.), 17 December 2015 (17.12.2015), paragraphs [0023] to [0045], [0055]; fig. 1 to 5 & JP 2016-966 A	1
A	WO 2009/001680 A1 (Daikin Industries, Ltd.), 31 December 2008 (31.12.2008), entire text; all drawings & JP 2009-2298 A & CN 101688538 A	1-6

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 March 2016 (17.03.16)	05 April 2016 (05.04.16)

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

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2015/086488

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/073182 A1 (Panasonic Corp.), 23 May 2013 (23.05.2013), entire text; all drawings & US 2014/0322057 A1 & EP 2781757 A1 & CN 103946554 A	1-6
A	JP 2749940 B2 (Empresa Brasileira de Compressores S.A. -Embraco), 13 May 1998 (13.05.1998), entire text; all drawings & US 4979879 A & BR 8901185 A	3-6

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Patent documents cited in the description

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