



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
15.07.2015 Bulletin 2015/29

(51) Int Cl.:
F04C 29/06 ^(2006.01) **F04C 18/356** ^(2006.01)
F04C 29/12 ^(2006.01)

(21) Application number: **13846059.7**

(86) International application number:
PCT/JP2013/005026

(22) Date of filing: **26.08.2013**

(87) International publication number:
WO 2014/057602 (17.04.2014 Gazette 2014/16)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **11.10.2012 JP 2012226183**

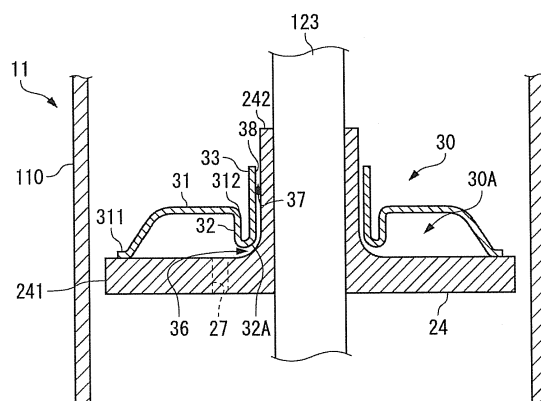
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(54) **COMPRESSOR**

(57) To provide a compressor which can produce a high noise reduction effect by sufficiently reducing pressure pulsations of a refrigerant discharged from a muffler outlet. A rotary compressor 1 includes: a compression mechanism 20 which compresses a refrigerant with rotation of a shaft 123; and a muffler 30 which is provided around the shaft 123 opposite to the compression mechanism 20 and receives the refrigerant discharged from

the compression mechanism 20. A muffler outlet 38 for discharging the refrigerant inside the muffler 30 opens annularly along an outer periphery of the shaft 123. A constriction 36, at which a passage of the refrigerant flowing toward the muffler outlet 38 is narrowed in the length direction of the shaft 123, is formed around the shaft 123 inside the muffler 30.

FIG. 2



Description

Technical Field

[0001] The present invention relates to a compressor.

Background Art

[0002] A rotary compressor used in a refrigeration cycle includes a cylinder into which a refrigerant is suctioned through a suction pipe, and a piston rotor which is rotated eccentrically inside the cylinder (e.g., Patent Literature 1). The piston rotor is fixed on an eccentric shaft part of a shaft, and bearings which rotatably support the shaft are disposed on each side of the cylinder in the axial direction. A compression chamber is formed by these bearings closing the inside of the cylinder.

[0003] A refrigerant suctioned into the compression chamber is compressed with rotation of the piston rotor, and is cyclically discharged from a discharge port formed in the bearing. In order to receive the refrigerant ejected from the discharge port and reduce the pressure pulsations, a muffler is provided so as to cover the bearing. The muffler has a shape bulged in the direction away from the bearing, and circular muffler outlets penetrating through the bulged wall are formed in it.

[0004] Even though the muffler reduces pressure pulsations of a refrigerant by causing the refrigerant to impinge on its inner surface, it is a challenge to reduce pressure pulsations in higher-power compressors of recent years. If a refrigerant with large pressure pulsations is discharged from the muffler outlet, large noise is generated on the outside of the muffler. Therefore, it is desirable to minimize the pressure pulsations of the refrigerant discharged from the muffler outlet.

[0005] Here, pressure pulsations are linked to the intrinsic resonance property which is determined by the shape of the internal space of the muffler. In Patent Literature 1, two outlets of the muffler are disposed in the vicinity of a node of a first-order resonance mode inside the muffler in order to reduce noise, and the muffler is given an asymmetric shape in planar view to displace these outlets from the positions of antinodes of a second-order resonance mode.

Citation List

Patent Literature

[0006] Patent Literature 1: Japanese Patent No. 4911147

Summary of Invention

Technical Problem

[0007] In Patent Literature 1, although the positions of the antinodes of the first-order resonance mode and the

second-order resonance mode are avoided in disposing the outlets of the muffler, actually, the muffler outlets are not completely removed from the positions of the antinodes of the second-order resonance mode, so that a refrigerant at the positions of the antinodes having large pressure fluctuations is discharged from the muffler outlets. Moreover, given third- and higher-order resonance modes, the positions of the muffler outlets of Patent Literature 1 always fall within the vicinity of the antinodes of at least one of the resonance modes.

[0008] The problem described above also exists in other types of compressors such as scroll compressors.

[0009] On the basis of the above problem, the present invention aims to provide a compressor which can produce a high noise reduction effect by sufficiently reducing pressure pulsations of a refrigerant discharged from a muffler outlet.

Solution to Problem

[0010] As described above, elaborating the shape in planar view of the muffler alone as in Patent Literature 1 ends up the muffler outlets lying in the vicinity of the antinodes of at least one of the resonance modes.

[0011] Having been made in view of this, a compressor of the present invention includes: a compression mechanism which compresses a refrigerant with rotation of a shaft; and a muffler which is provided around the shaft opposite to the compression mechanism and receives the refrigerant discharged from the compression mechanism.

[0012] In the present invention, a muffler outlet for discharging the refrigerant inside the muffler opens annularly along an outer periphery of the shaft, and a constriction, at which a passage of the refrigerant flowing toward the muffler outlet is narrowed in the length direction of the shaft, is formed around the shaft inside the muffler.

[0013] The constriction in the present invention can be formed by disposing an encircling part, which encircles the outer periphery of the shaft, inside the muffler. The constriction faces one end of the encircling part in the length direction.

[0014] The term "around the shaft" in the present invention also refers to around a member such as a bearing which is disposed around the shaft.

[0015] According to the present invention, since the muffler outlet is disposed along the outer periphery of the shaft, the muffler outlet lies in the vicinity of a node, at which pressure pulsations are minimum, in any resonance mode.

[0016] Moreover, it is possible to reduce the pressure pulsations of the refrigerant through the effect of the constriction and cause the refrigerant to pass through the vicinity of a node around the shaft so as to be discharged from the muffler outlet with the pressure pulsations kept low.

[0017] As a result, since the pressure pulsations of the refrigerant discharged from the muffler outlet are as small

as at the positions of the nodes of the resonance modes, a high effect of reducing the noise outside the muffler can be obtained.

[0018] Furthermore, in this embodiment, since the refrigerant inside the muffler can be discharged from the vicinity of the node of any resonance mode, it is not necessary to give the muffler an asymmetric shape based on a specific mode. Thus, the design flexibility of the muffler can be improved.

[0019] In the compressor of the present invention, it is preferable that the encircling part is provided in a main body of the muffler and protrudes to the inside of the muffler; that a passage is formed along the shaft between the encircling part and the shaft; and that the constriction communicates with the muffler outlet through the passage.

[0020] In this way, the flow of the refrigerant is straightened along the shaft through the passage from the constriction to the muffler outlet, which may contribute to noise reduction.

[0021] The encircling part in the present invention can also be configured, for example, by deep drawing so as to be integrally continuous with the main body of the muffler and constricted toward the inside of the muffler.

[0022] Alternatively, the encircling part may be formed as a cylinder separate from the main body of the muffler. In this way, the muffler can be produced by simply fixing the encircling part on the muffler main body, which allows for ease of processing. Moreover, since the dimensional accuracy of the clearance between the encircling part and the shaft is higher compared with the case where the encircling part is formed by deep drawing, it is easy to stabilize the quality.

[0023] Furthermore, since the constriction can be easily narrowed by extending the axial length of the encircling part, pressure pulsations can be reduced more sufficiently.

Advantageous Effects of Invention

[0024] According to the compressor of the present invention, it is possible to obtain a high noise reduction effect by sufficiently reducing pressure pulsations of a refrigerant discharged from a muffler outlet.

Brief Description of Drawings

[0025]

[FIG. 1] FIG. 1 is a longitudinal cross-sectional view of a rotary compressor according to a first embodiment of the present invention.

[FIG. 2] FIG. 2 is a cross-sectional view of a muffler of the compressor of FIG. 1.

[FIG. 3A] FIG. 3A is a schematic plan view of the muffler showing a first-order resonance mode.

[FIG. 3B] FIG. 3B is a schematic plan view of the muffler showing a second-order resonance mode.

[FIG. 3C] FIG. 3C is a schematic plan view for illustrating the positions of bolts for fixing the muffler.

[FIG. 4] FIG. 4 is a cross-sectional view of a muffler according to a second embodiment of the present invention.

[FIG. 5A] FIG. 5A is a cross-sectional view of a muffler according to a modified example of the present invention.

[FIG. 5B] FIG. 5B is a cross-sectional view of a muffler according to another modified example of the present invention.

Description of Embodiments

[0026] In the following, the present invention will be described in detail on the basis of embodiments shown in the accompanying drawings.

(First Embodiment)

[0027] As shown in FIG. 1, a rotary compressor 1, which is used for an air conditioner, a refrigerator, etc., includes a substantially circular cylindrical case 11, a motor 12 housed in the case 11, and a compression mechanism 20 driven by the motor 12 inside the case 11, and is connected with a refrigerant circuit (not shown).

[0028] The case 11 has a cylindrical shell 110, an upper lid 111 provided at the upper end of the shell 110, and a bottom lid 112 provided at the lower end of the shell 110. The motor 12 and the compression mechanism 20 are hermetically sealed inside the case 11.

[0029] The shell 110 is provided with a suction pipe 15 for suctioning a refrigerant into the compression mechanism 20. The suctioned refrigerant is compressed by the compression mechanism 20 and released to the inside of the case 11 and fills it. The high-pressure refrigerant is discharged to the refrigerant circuit through a discharge pipe 17 provided through the upper lid 111.

[0030] The motor 12 includes a stator 121 fixed on the inner peripheral surface of the case 11, and a rotor 122 disposed on the inside of the stator 121 and rotated upon application of current to the stator 121. A longitudinal groove 121A, through which the refrigerant discharged from the compression mechanism 20 passes to the upper side, is formed in an outer peripheral part of the stator 121.

[0031] The rotary drive force of the motor 12 is output to a shaft 123 fixed on the rotor 122. The shaft 123 is disposed along the vertical direction and extends further to the lower side than the rotor 122.

[0032] The compression mechanism 20 includes: an eccentric shaft part 21 which is eccentric relative to the axial center of the shaft 123; a piston rotor 22 which is fitted on the outer periphery of the eccentric shaft part 21; a cylinder 23 on the inside of which the piston rotor 22 is disposed; and a first bearing 24 and a second bearing 25 which rotatably support the shaft 123. This compression mechanism 20 compresses the refrigerant by

gradually reducing the volume of a compression chamber 20P, which is formed inside the cylinder 23, with rotation of the piston rotor 22.

[0033] The eccentric shaft part 21 is formed integrally with the shaft 123 between the first bearing 24 and the second bearing 25, and is turned around the axis of the shaft 123.

[0034] The piston rotor 22 is rotated inside the cylinder 23 as the eccentric shaft part 21 turns.

[0035] The cylinder 23 has a circular cylindrical inner peripheral surface which comes into sliding contact with the outer peripheral surface of the piston rotor 22. The axial center of the inner peripheral surface of the cylinder 23 coincides with the axial center of the shaft 123. The inside of the cylinder 23 is closed by the first bearing 24 and the second bearing 25.

[0036] The cylinder 23 is provided with a blade (not shown) which partitions the inside of the cylinder 23 into a suction side and a discharge side, and a spring (not shown) which presses down the blade. A suction port 26 penetrating through the side wall of the cylinder 23 is formed in the vicinity of the blade. The suction port 26 is connected with the suction pipe 15.

[0037] This cylinder 23 is fixed on the inner wall of the case 11, and the first bearing 24 and the second bearing 25 are fixed on the upper and lower end surfaces, respectively, of the cylinder 23.

[0038] The first bearing 24 lying on the upper side of the cylinder 23 has a disc-like fixed part 241 to be fixed on the cylinder 23 and a sliding part 242 which rises up from a central part of the fixed part 241 and slides with the outer periphery of the shaft 123.

[0039] The fixed part 241 has a discharge port 27 (indicated by the broken line), which opens to the inside of the cylinder 23, formed in it so as to penetrate in the thickness direction. As the piston rotor 22 rotates and the compression chamber 20P reaches its minimum volume, the refrigerant inside the compression chamber 20P is discharged through the discharge port 27 which is formed near the inner peripheral surface of the cylinder 23. The discharge port 27 is provided with a reed valve (not shown) which opens when the refrigerant pressure inside the compression chamber 20P reaches a predetermined value.

[0040] A muffler 30 is provided around the sliding part 242 opposite to the upper surface of the fixed part 241. The muffler 30 reduces the pressure pulsations of the refrigerant and discharges the refrigerant from its muffler outlet 38 into the case 11.

[0041] The rotary compressor 1 of this embodiment features the structure of the muffler 30 shown in FIG. 2. The muffler 30 forms a discharge chamber 30A, between the muffler 30 and the upper surface of the fixed part 241, for the refrigerant discharged from the discharge port 27.

[0042] The muffler 30, which is formed in a substantially annular shape in planar view, includes a muffler main body 31 which receives the refrigerant ejected from the discharge port 27, an encircling part 32 encircling the

outer periphery of the sliding part 242, and a flow straightening part 33 forming the muffler outlet 38. The muffler 30 has the muffler main body 31, the encircling part 32, and the flow straightening part 33 integrally formed by deep drawing.

[0043] An outer peripheral edge part 311 of the muffler main body 31 is fixed with bolts (not shown) on the fixed part 241. While the muffler main body 31 of this embodiment is formed in a dome-like shape, the shape is arbitrary.

[0044] The encircling part 32 is continuous with an inner peripheral edge part 312 of the muffler main body 31 so as to be constricted toward the inside of the muffler 30.

[0045] The encircling part 32 is formed so as to be bent downward from the inner peripheral edge part 312 of the muffler main body 31, further bent to turn upward in the vicinity of the upper surface of the fixed part 241, and then be continuous with the circular cylindrical flow straightening part 33 lying on the upper side of the muffler main body 31. A leading end 32A of the encircling part 32 has a curved surface. The clearance in the height direction left between this leading end 32A and the upper surface of the fixed part 241 corresponds to a constriction 36 through which the refrigerant passes. The constriction 36 is formed along the entire periphery of the sliding part 242.

[0046] The shaft 123 and the sliding part 242 are inserted into the encircling part 32 and the flow straightening part 33. The inner diameters of these encircling part 32 and flow straightening part 33 are set to be larger than the outer diameter of the sliding part 242. Thus, a passage 37 through which the refrigerant flows is formed between the sliding part 242 and the encircling part 32 and the flow straightening part 33 along the shaft 123. The terminal end of this passage 37 is the muffler outlet 38 which opens annularly along the outer periphery of the sliding part 242. The constriction 36 communicates with the muffler outlet 38 through the passage 37.

[0047] As the piston rotor 22 rotates, the rotary compressor 1 of this embodiment compresses a low-pressure refrigerant gas, which is suctioned through the suction pipe 15 from an accumulator (gas-liquid separator) (not shown) connected with the refrigerant circuit into the compression chamber 20P, and discharges the compressed refrigerant from the discharge port 27 into the muffler 30. The refrigerant discharged from the muffler outlet 38 into the case 11 flows through the longitudinal groove 121A of the stator 121 to the upper space of the case 11 and is discharged to the external refrigerant circuit through the discharge pipe 17.

[0048] Here, the refrigerant inside the muffler 30 resonates while repeatedly expanding and contracting according to the intrinsic resonance property of the muffler 30. There are a first-order resonance mode shown in FIG. 3A and a second-order resonance mode shown in FIG. 3B, as well as third- and higher-order resonance modes. If the muffler outlet 38 is formed in the vicinity of a node N, at which pressure fluctuations are small, in

each resonance mode, it is possible to avoid discharging a refrigerant with large pressure fluctuations to the outside of the muffler 30, so that noise can be reduced.

[0049] If the muffler outlet is to be formed so as to penetrate through the muffler main body 31 from the upper surface, as shown in FIG. 3A, muffler outlets 98 (indicated by the two-dot chain line), for example, are provided beside the node N. However, the positions of the muffler outlets 98 fall within the vicinity of antinodes AN of the second-order resonance mode shown in FIG. 3B. Even if the muffler 30 is given an asymmetric shape in planar view to displace the positions of the muffler outlets 98 from the positions of the antinodes AN of the second-order resonance mode, the muffler outlets 98 always fall within at least the vicinity of the antinodes AN of the superimposed higher-order resonance modes.

[0050] Therefore, in this embodiment, not only the muffler outlet 38 is disposed along the outer periphery of the sliding part 242, but also the encircling part 32 is disposed inside the muffler 30 to form the constriction 36 facing the leading end 32A of the encircling part 32.

[0051] Here, since the muffler outlet 38 is disposed along the outer periphery of the sliding part 242, the muffler outlet 38 lies in the vicinity of the node N in any resonance mode.

[0052] Moreover, it is possible to reduce the pressure pulsations of the refrigerant through the effect of the constriction 36 formed by the encircling part 32 and cause the refrigerant to pass through the vicinity of the node N around the shaft 123 so as to be discharged from the muffler outlet 38 with the pressure pulsations kept low.

[0053] Therefore, since the pressure pulsations of the refrigerant discharged from the muffler outlet 38 are as small as at the positions of the nodes N of the resonance modes, a high effect of reducing the noise outside the muffler 30 can be obtained.

[0054] Furthermore, the flow of the refrigerant is straightened along the shaft 123 by the passage 37 from the constriction 36 to the muffler outlet 38, which also contributes to noise reduction.

[0055] Since the direction of the constriction 36 (height direction) and the direction of constriction of the muffler outlet 38 (planar direction) intersect with each other, plane wave components traveling in the horizontal direction are constricted in the constriction 36 and then turned toward the muffler outlet 38 while the refrigerant pressure is propagating from the inlet (discharge port 27) of the muffler 30 toward the muffler outlet 38, which contributes to further reduction of pressure pulsations.

[0056] Moreover, in this embodiment, since the refrigerant inside the muffler 30 can be discharged from the vicinity of the node N of any resonance mode, it is not necessary to give the muffler 30 an asymmetric shape based on a specific mode. Since the muffler 30 of this embodiment may have an arbitrary shape as long as it has the encircling part 32, the design flexibility of the muffler 30 can be improved.

[0057] There is also no restriction on the positions of

the bolts fixing the muffler 30. For example, as shown in FIG. 3C, if the muffler main body 31 is formed in a shape constricted toward the planar center at a plurality of positions on the circumference in order to form a plurality of bolt holes 39 into which the bolts are inserted, the resonance property of the muffler 30 is changed, but the positions of the bolt holes 39 can be set at arbitrary positions without the need for taking into account the positions of nodes and antinodes.

(Second Embodiment)

[0058] Next, a second embodiment of the present invention will be described with reference to FIG. 4.

[0059] The following description will be focused on differences from the first embodiment.

[0060] A muffler 40 in the second embodiment includes a muffler main body 41 and an encircling part 42, which are separate parts.

[0061] The muffler main body 41 is formed by deep drawing almost in the same manner as the muffler main body 31 of the first embodiment, and has an opening 41A, into which the encircling part 42 is inserted, formed at the center. The encircling part 42 is fixed by interference-fitting, shrink-fitting, etc. on the inner peripheral surface of the opening 41A of the muffler main body 41.

[0062] The encircling part 42 is formed by extrusion etc. into a circular cylinder having an inner diameter larger than the outer diameter of the sliding part 242. A lower end 42A side of the encircling part 42 corresponds to the above-described encircling part 32, and an upper end 42B side of the encircling part 42 corresponds to the above-described flow straightening part 33.

[0063] The passage 37 is formed between the inner peripheral surface of the encircling part 42 and the outer peripheral surface of the sliding part 242.

[0064] The constriction 36 is formed between the lower end 42A of the encircling part 42 and the upper surface of the fixed part 241.

[0065] Since the muffler main body 41 of this embodiment has no folded part, it is easy to deep-draw. Since the muffler 40 can be produced simply by fixing the encircling part 42 on the muffler main body 41, the ease of processing can be improved.

[0066] Moreover, since the dimensional accuracy of the clearance between the encircling part 42 and the sliding part 242 is higher than in the case where the encircling part 32 is formed by deep drawing, it is easy to stabilize the quality.

[0067] Furthermore, in this embodiment, since the opening of the constriction 36 can be easily reduced by extending the encircling part 42 in the axial direction, the pressure pulsations of the refrigerant can be reduced more sufficiently.

[0068] The member to be used and the processing method of the muffler can be appropriately selected in consideration of the ease of processing. For example, it is also possible to form a side surface part 411 of the

muffler main body 41 with a circular cylindrical member and weld a plate member, which corresponds to an upper surface 412 of the muffler main body 41, on the upper end surface of the circular cylindrical member.

[0069] Next, modified examples of the present invention will be shown.

[0070] As shown in FIG. 5A, it is also possible to provide an encircling part 52 which rises up from the fixed part 241. There is no passage formed between the encircling part 52 and the sliding part 242. On the other hand, a passage 57 is formed between the inner peripheral part of the muffler main body 41 and the outer peripheral surface of the shaft 123, and the terminal end of the passage 57 is the muffler outlet 38 which opens annularly along the outer periphery of the sliding part 242.

[0071] A leading end 52A of the encircling part 52 extends close to the passage 57, and forms a constriction 56 between the leading end 52A and the muffler main body 41. The constriction 56 is formed along the entire circumference around the sliding part 242.

[0072] Also in such configuration as above, it is possible to sufficiently reduce the pressure pulsations of the refrigerant through the effect of the constriction 56, and since the encircling part 52 is not continuous with the muffler main body 41, the ease of processing of the muffler can be improved.

[0073] As shown in FIG. 5B, it is also possible to form an encircling part 53 which protrudes downward from an inner peripheral part of the muffler main body 41. There is the passage 37 formed between the encircling part 53 and the sliding part 242. The muffler main body 41 and the encircling part 53 are integrally formed by deep drawing. Since this muffler has no part which is bent to be turned up (in a hairpin shape), it is easy to deep-draw.

[0074] Also in such configuration, it is possible to sufficiently reduce the pressure pulsations of the refrigerant through the effect of the constriction 36 formed by the encircling part 53 between the encircling part 53 and the upper surface of the fixed part 241.

[0075] As shown in FIG. 5B, the passage 37 may be formed so as not to extend upward beyond the muffler main body 41. The same applies to the above-described embodiments and the passages 37, 57 of the other modified examples.

[0076] It is possible to make a selection of the configurations exemplified above or appropriately change one configuration into another within the scope of the present invention.

[0077] The position of the constriction in the present invention is not limited to the vicinity of the upper surface of the fixed part 241 or the vicinity of the inner peripheral part of the muffler main body 41, but the constriction may be formed at an intermediate position in the height of the muffler. In that case, for example, an encircling part rising up from the fixed part 241, and an encircling part fixed on the muffler main body 41 and extending downward should be formed, and a constriction should be formed between the ends of these encircling parts.

[0078] Increasing the diameter of the portion of the sliding part 242 lying inside the muffler, instead of providing the encircling part 52 shown in FIG. 5A, has an equivalent effect.

[0079] While the above-described muffler is provided around the sliding part 242 of the first bearing 24 which encircles the shaft 123, depending on the structure of the compressor, there may be no bearing at the position where the muffler is provided. In that case, the encircling part directly encircles the shaft 123 without the sliding part 242 interposed between them.

[0080] It is also possible to partition the inner space of the muffler into a plurality of sections, and to configure such that the pressure pulsations of the refrigerant discharged from the compression mechanism 20 are gradually reduced as the refrigerant passes through each section. If the frequency of the pressure pulsations is lowered in this way, it is possible to avoid the refrigerant which expands and contracts in an audible frequency band or in a frequency band, in which resonance with peripheral members is likely, being discharged from the muffler, so that the noise suppression effect can be increased.

[0081] The present invention is also applicable to a twin rotary compressor which includes two sets of cylinders and piston rotors. In addition, the present invention is applicable to various types of compressors including a scroll compressor which has one scroll making revolving motion relative to the other scroll.

Reference Signs List

[0082]

1	Rotary compressor
11	Case
12	Motor
15	Suction pipe
17	Discharge pipe
20	Compression mechanism
22	Piston rotor
23	Cylinder
24	First bearing
25	Second bearing
26	Suction port
27	Discharge port
30, 40	Muffler
30A	Discharge chamber
31	Muffler main body
32, 42, 52, 53	Encircling part
33	Flow straightening part
36, 56	Constriction
37, 57	Passage
38	Muffler outlet
39	Bolt hole
41	Muffler main body
121	Stator
121A	Longitudinal groove
122	Rotor

123 Shaft
 241 Fixed part
 242 Sliding part
 AN Antinode
 N Node

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Claims

1. A compressor comprising:

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a compression mechanism which compresses a refrigerant with rotation of a shaft; and a muffler which is provided around the shaft opposite to the compression mechanism and receives the refrigerant discharged from the compression mechanism, wherein a muffler outlet for discharging the refrigerant inside the muffler opens annularly along an outer periphery of the shaft, and a constriction, at which a passage of the refrigerant flowing toward the muffler outlet is narrowed in the length direction of the shaft, is formed around the shaft inside the muffler.

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2. The compressor according to claim 1, wherein the constriction is formed so as to face one end in the length direction of an encircling part which encircles the outer periphery of the shaft inside the muffler.

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3. The compressor according to claim 2, wherein the encircling part is provided in a main body of the muffler and protrudes to the inside of the muffler, a passage is formed along the shaft between the encircling part and the shaft, and the constriction communicates with the muffler outlet through the passage.

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4. The compressor according to claim 3, wherein the encircling part is integrally continuous with the main body of the muffler and is constricted toward the inside of the muffler.

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5. The compressor according to claim 3, wherein the encircling part is a cylinder separate from the main body of the muffler.

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Amended claims under Art. 19.1 PCT

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1. (amended)

A compressor comprising:

a compression mechanism which compresses a refrigerant with rotation of a shaft; and a muffler which is provided around the shaft opposite to the compression mechanism and receives the refrigerant discharged from the com-

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pression mechanism, wherein a muffler outlet for discharging the refrigerant inside the muffler opens annularly along an outer periphery of the shaft, a constriction, at which a passage of the refrigerant flowing toward the muffler outlet is narrowed in the length direction of the shaft, is formed around the shaft inside the muffler, and an encircling part, which is provided in a main body of the muffler and encircles the outer periphery of the shaft inside the muffler, is bent downward from an inner peripheral edge part of the main body of the muffler and further bent to turn upward from one end of the encircling part in the length direction.

2. (amended)

The compressor according to claim 1, wherein the constriction is formed so as to face the end of the encircling part.

3. (amended)

The compressor according to claim 1 or 2, wherein the encircling part protrudes to the inside of the muffler, a passage is formed along the shaft between the encircling part and the shaft, and the constriction communicates with the muffler outlet through the passage.

4. (amended)

The compressor according to claim 3, wherein the encircling part is integrally continuous with the main body of the muffler and is constricted toward the inside of the muffler.

5. (amended)

The compressor according to claim 3, wherein the encircling part is a cylinder separate from the main body of the muffler.

FIG. 1

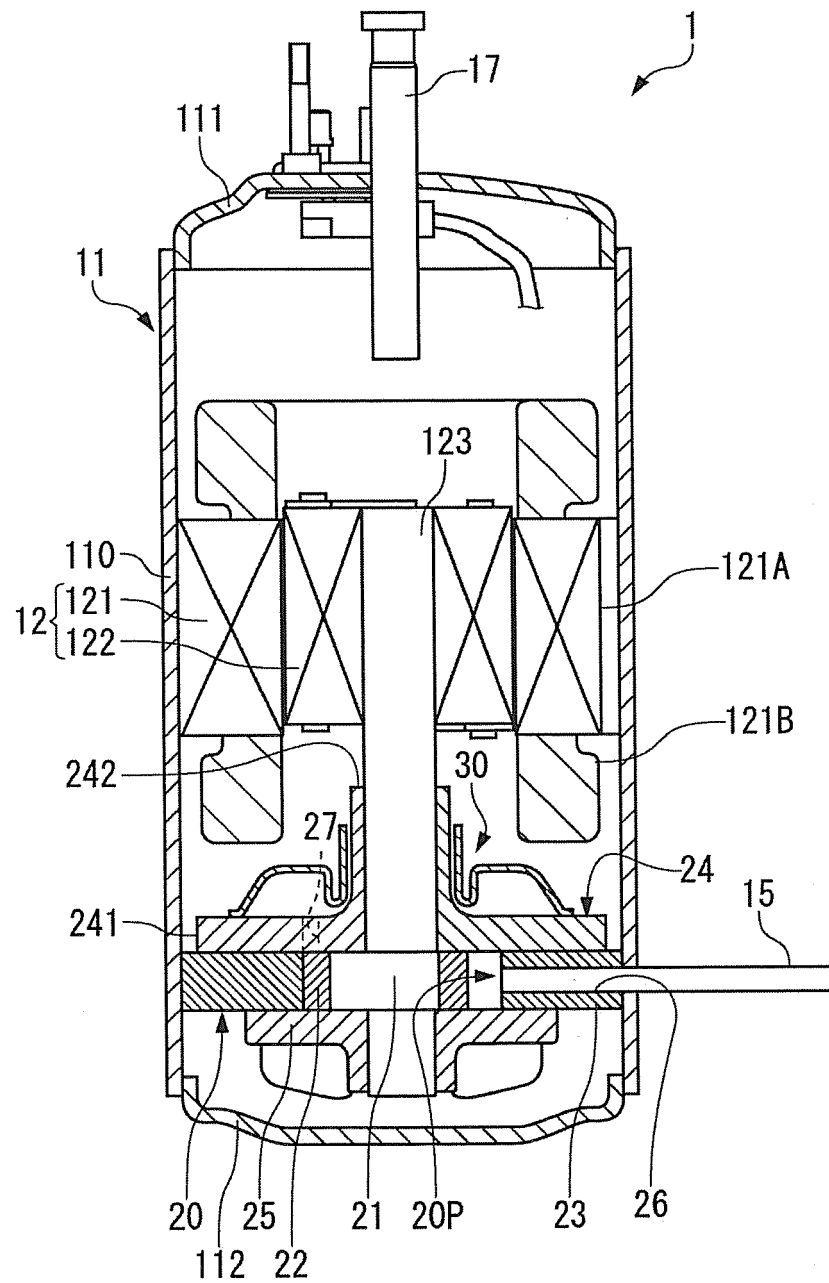
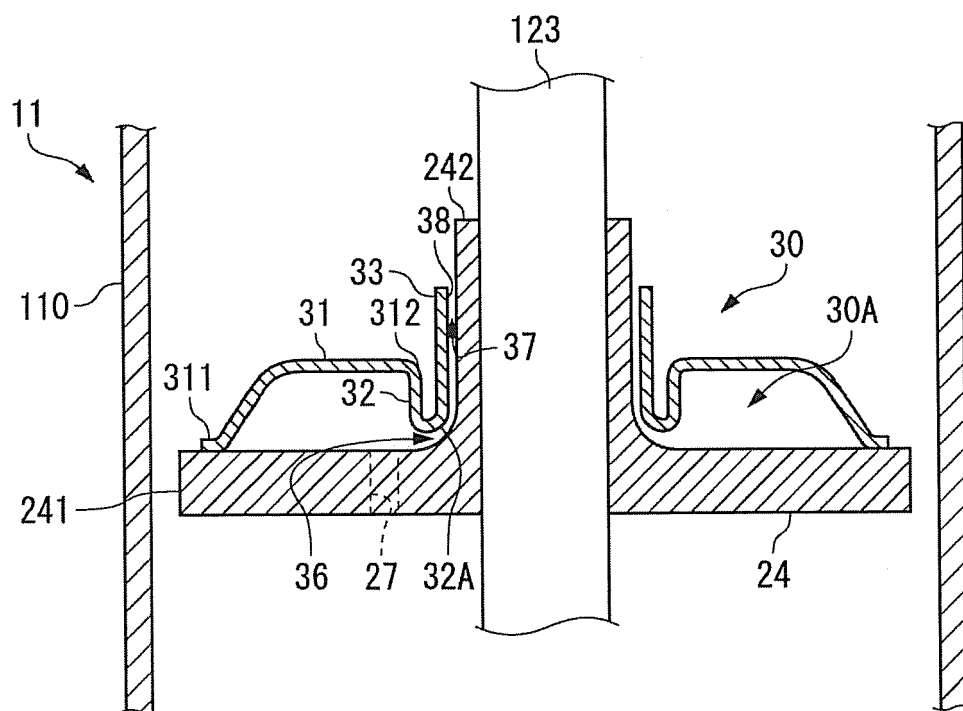


FIG. 2



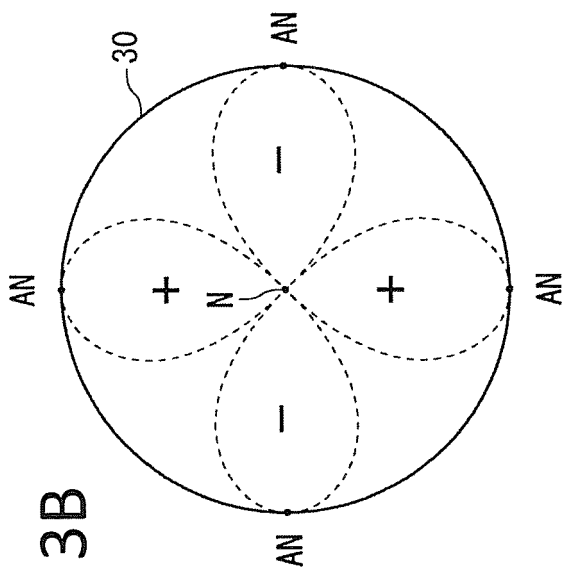


FIG. 3B

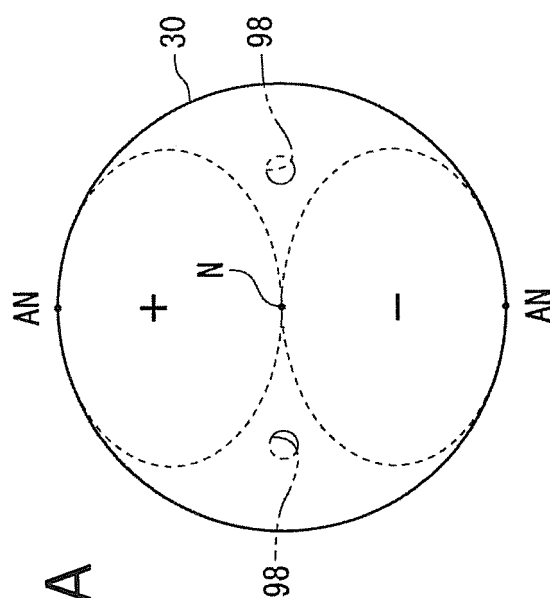


FIG. 3A

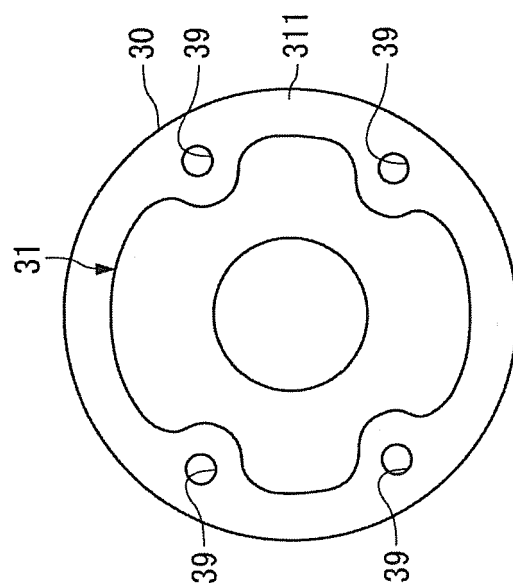


FIG. 3C

FIG. 4

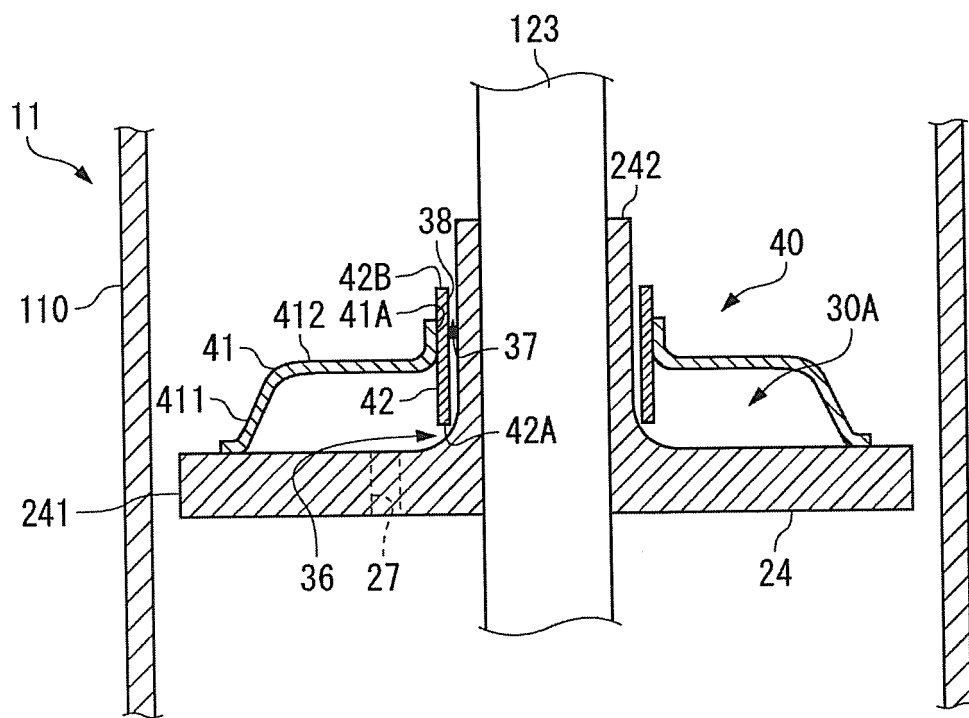


FIG. 5A

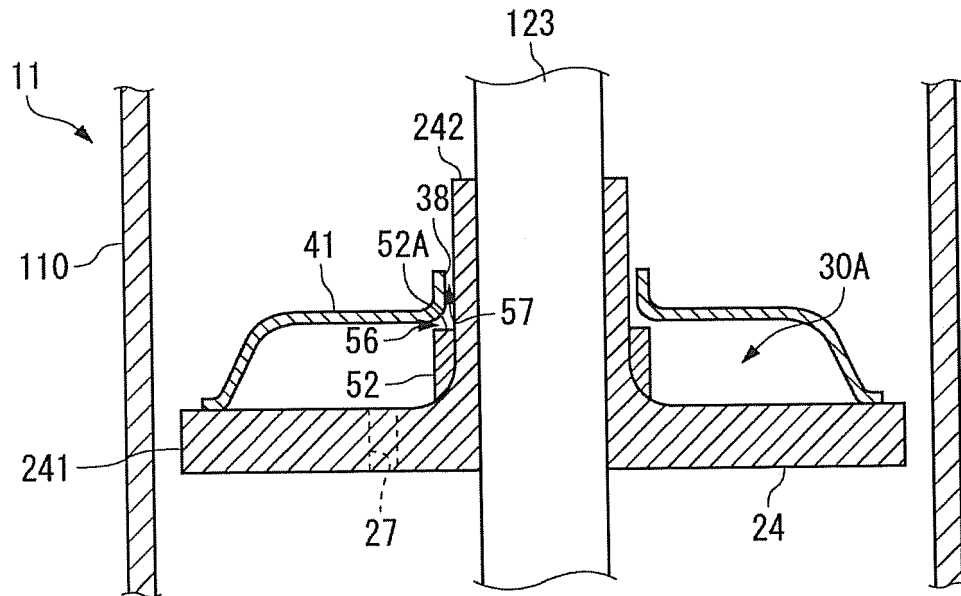
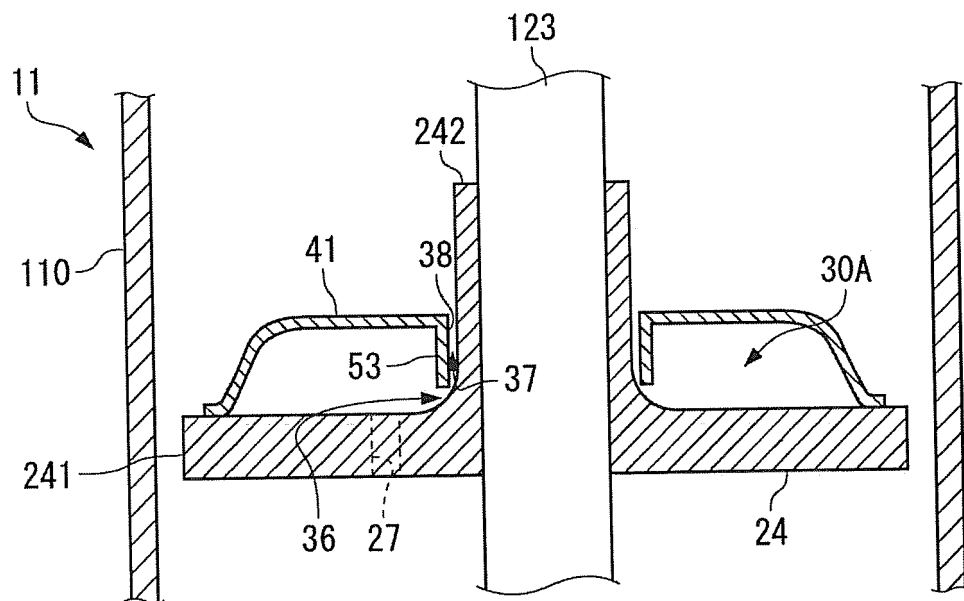


FIG. 5B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/005026

A. CLASSIFICATION OF SUBJECT MATTER

F04C29/06(2006.01)i, F04C18/356(2006.01)i, F04C29/12(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)

F04C29/06, F04C18/356, F04C29/12

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 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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	JP 4-91390 A (Daikin Industries, Ltd.), 24 March 1992 (24.03.1992), entire text; all drawings (Family: none)	1-5
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 135230/1981(Laid-open No. 40591/1983) (Tokyo Shibaura Electric Co., Ltd.), 17 March 1983 (17.03.1983), entire text; all drawings (Family: none)	1-5

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

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search
10 October, 2013 (10.10.13)Date of mailing of the international search report
22 October, 2013 (22.10.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/005026

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-18373 A (Toshiba Corp.), 26 January 1993 (26.01.1993), entire text; all drawings (Family: none)	1-5
A	JP 2005-189627 A (Daikin Industries, Ltd.), 14 July 2005 (14.07.2005), entire text; all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4911147 B [0006]