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(19) **United States**(12) **Patent Application Publication**
TSUKAMOTO et al.(10) **Pub. No.: US 2025/0109748 A1**(43) **Pub. Date: Apr. 3, 2025**(54) **HERMETIC COMPRESSOR AND
REFRIGERATION CYCLE APPARATUS**(52) **U.S. Cl.**CPC *F04C 29/12* (2013.01); *F04C 23/008*
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Hiroki NAGASAWA, Tokyo (JP)(21) Appl. No.: **18/833,270**(22) PCT Filed: **Mar. 28, 2022**(86) PCT No.: **PCT/JP2022/015029**

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(57)

ABSTRACT

A hermetic compressor includes a compression mechanism in a hermetic container. The compression mechanism is driven by an electric motor through a rotation shaft, and includes a cylinder including a cylinder chamber having a cylindrical shape. The cylinder has a cylinder suction hole extending in a radial direction of the cylinder and allowing fluid to be sucked into the cylinder chamber. In an outer circumferential surface of the cylinder, a cylindrical groove is formed in such a manner as to surround the cylinder suction hole. Between the cylinder suction hole and the cylindrical groove, a cylinder tubular portion is provided. To an outer circumferential surface of the cylinder tubular portion, a suction pipe or a connecting pipe provided at one end of the suction pipe is connected, the suction pipe being a pipe through which the fluid is guided from outside of the hermetic container to the cylinder chamber.

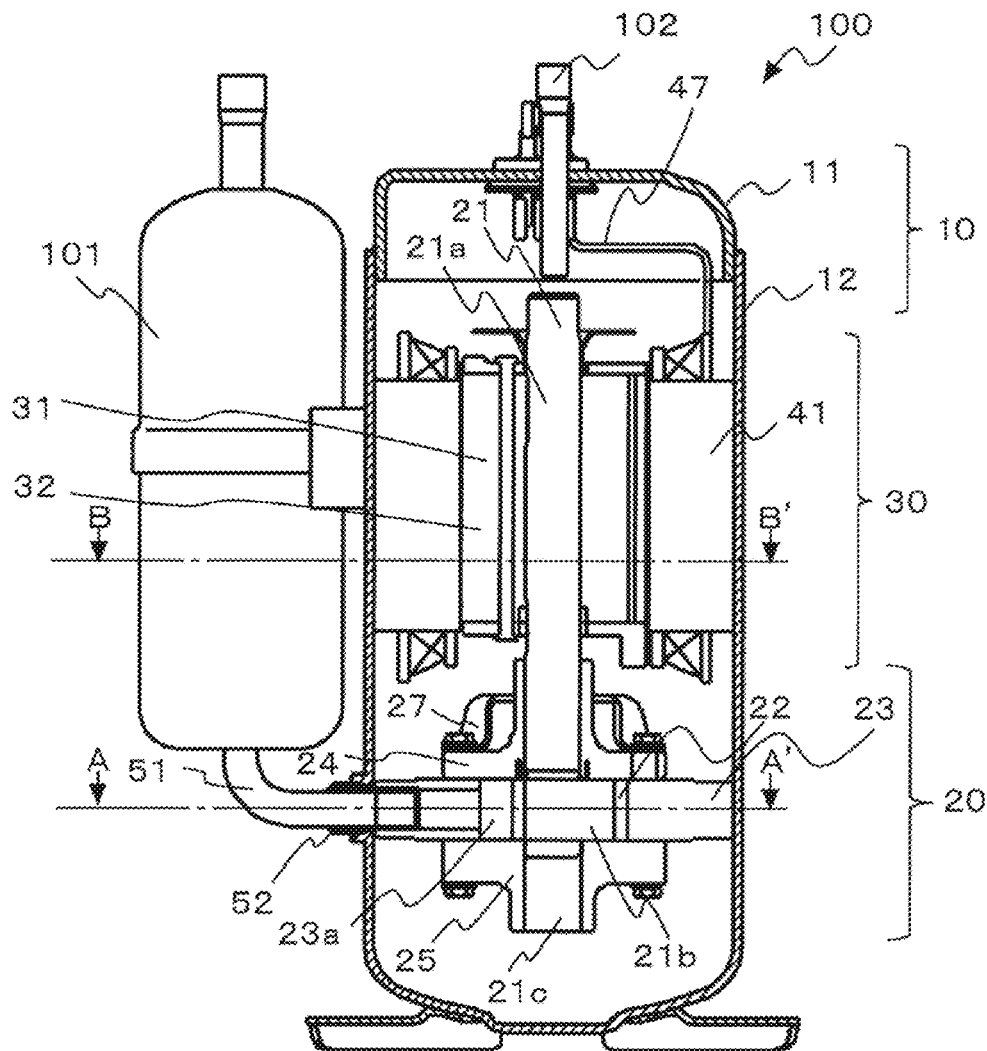


FIG. 1

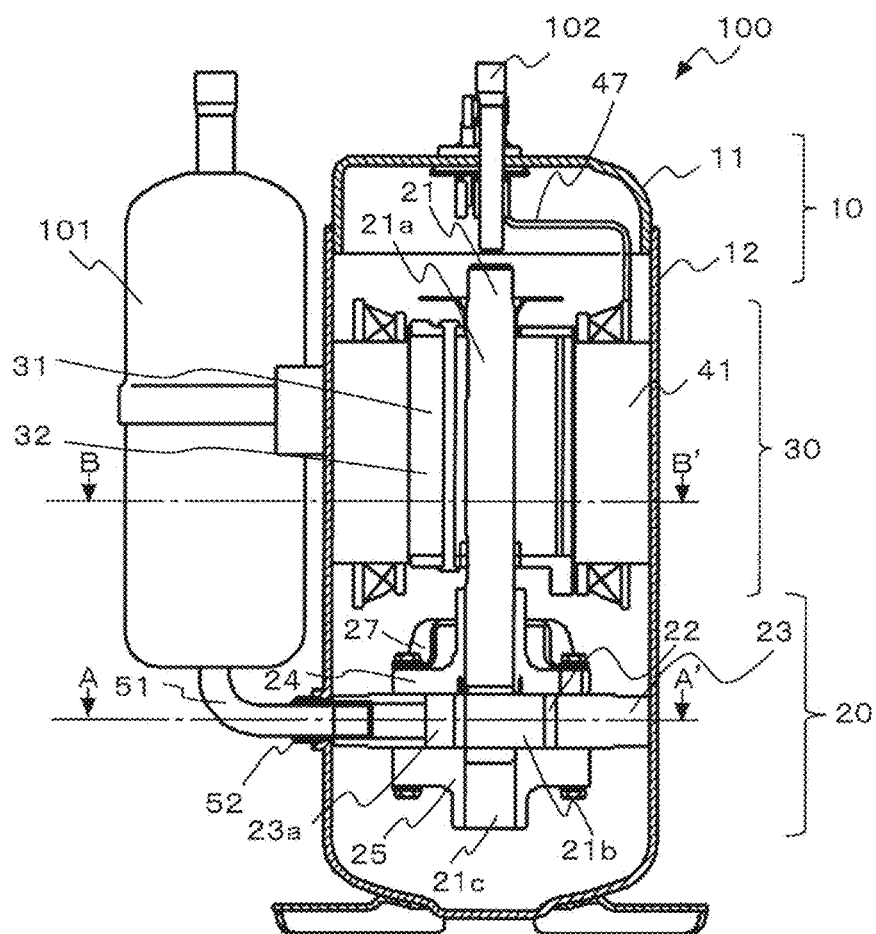


FIG. 2

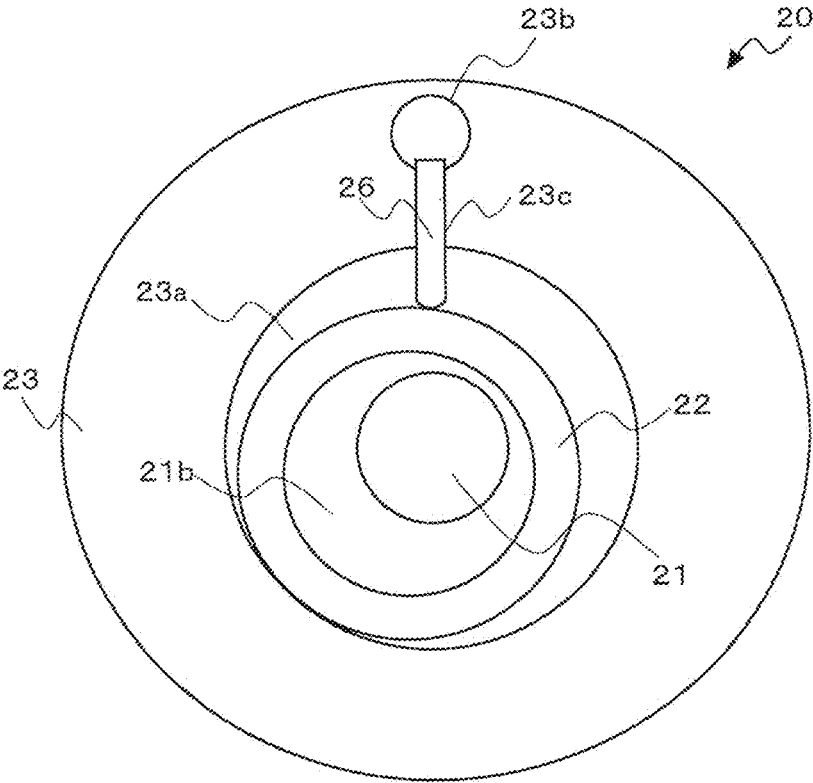


FIG. 3

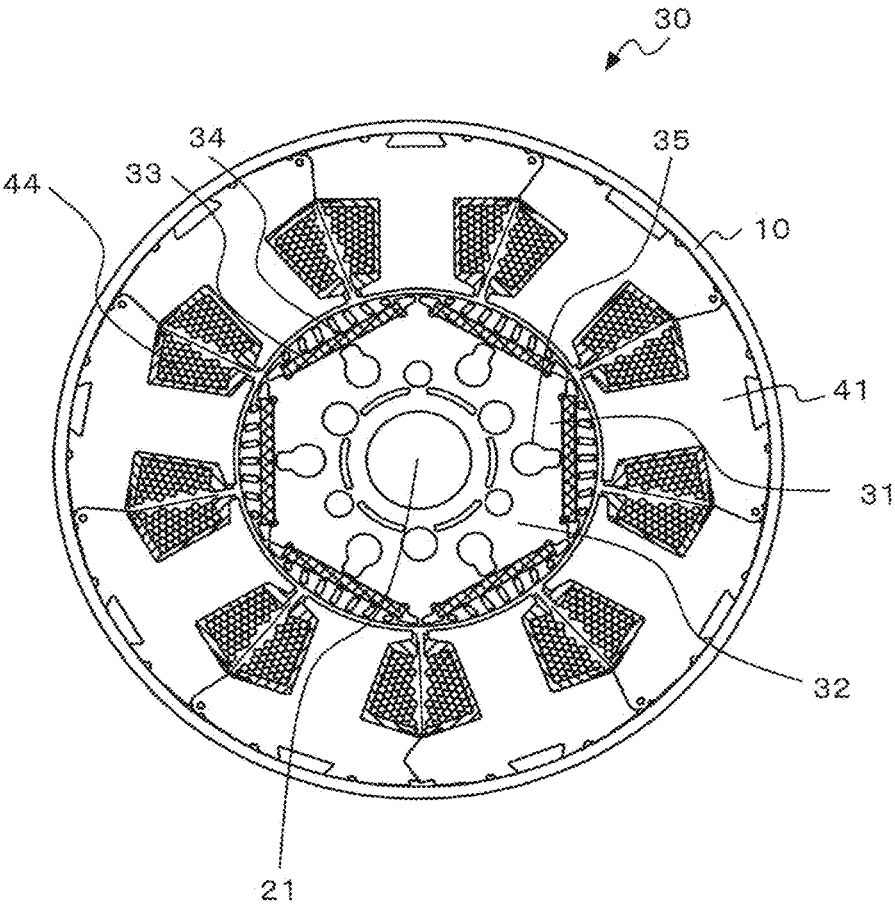


FIG. 4

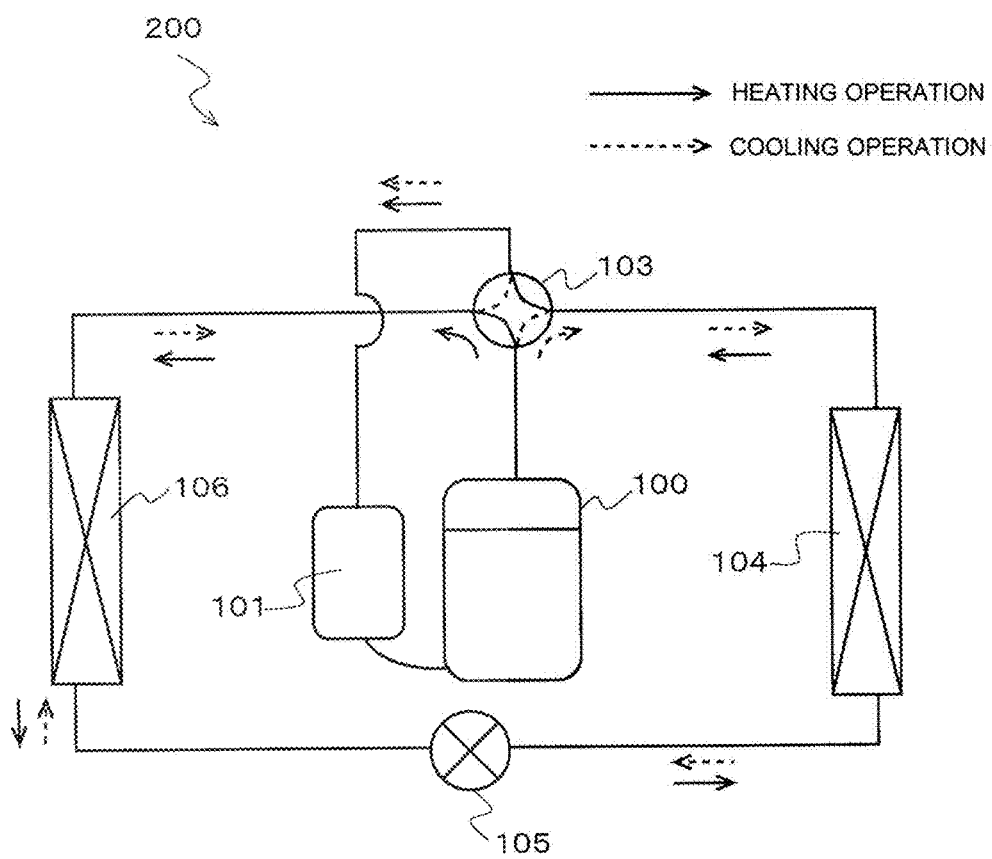


FIG. 5

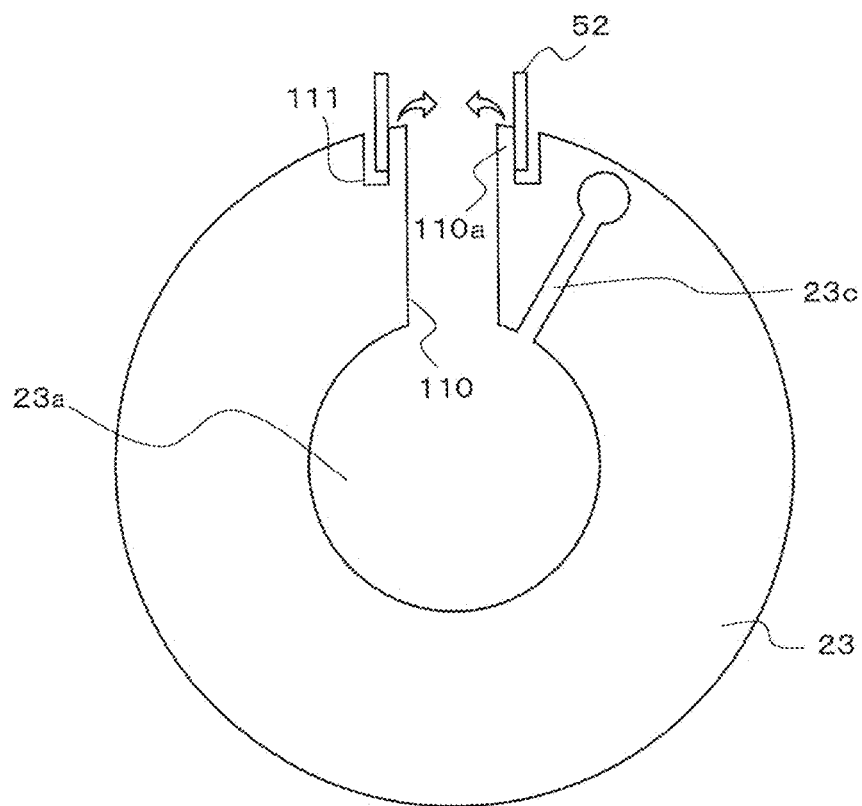


FIG. 6

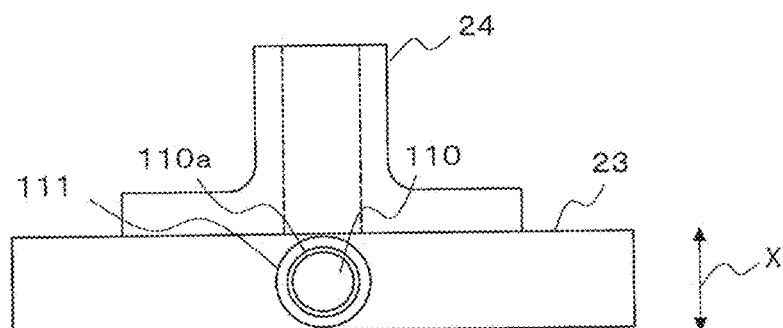


FIG. 7

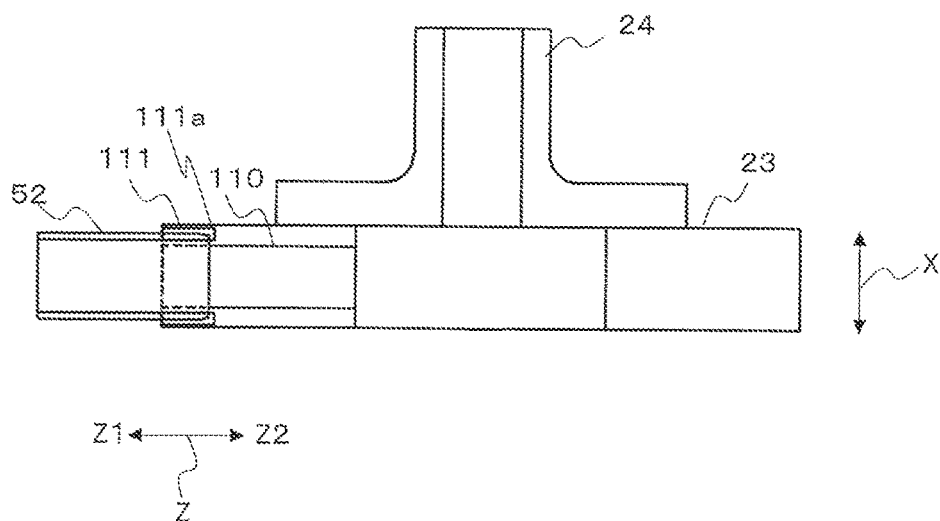


FIG. 8

Related Art

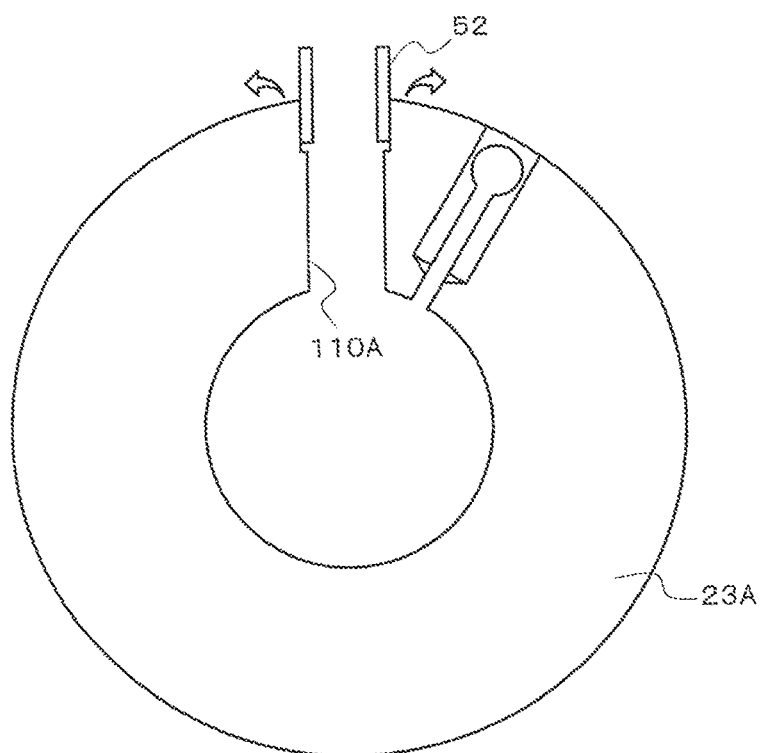


FIG. 9

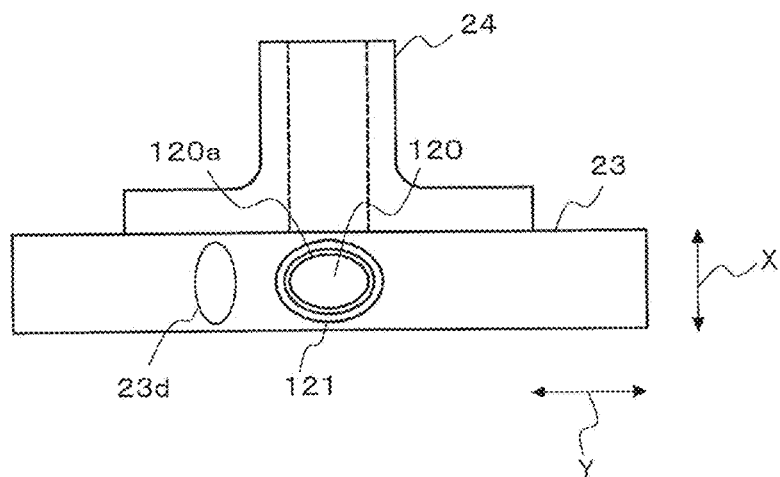


FIG. 10

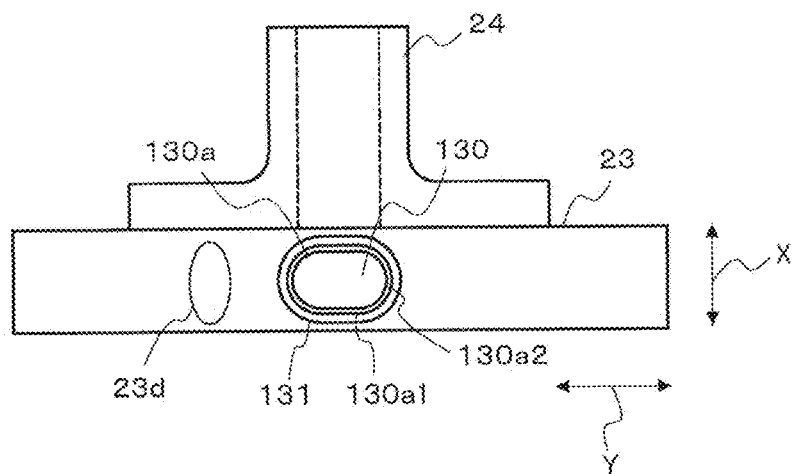


FIG. 11

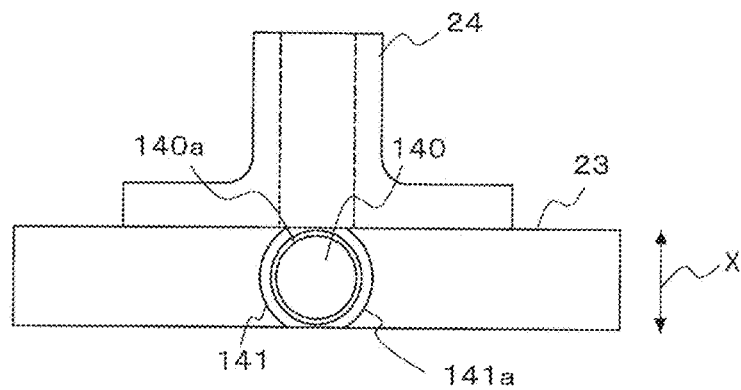


FIG. 12

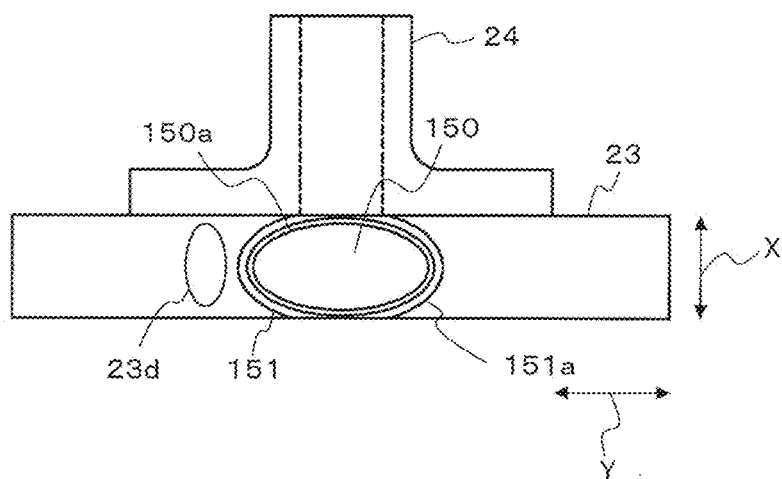


FIG. 13

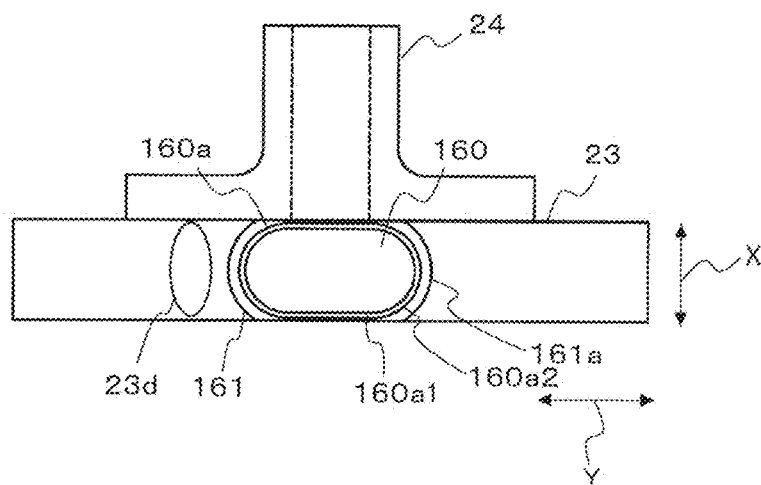
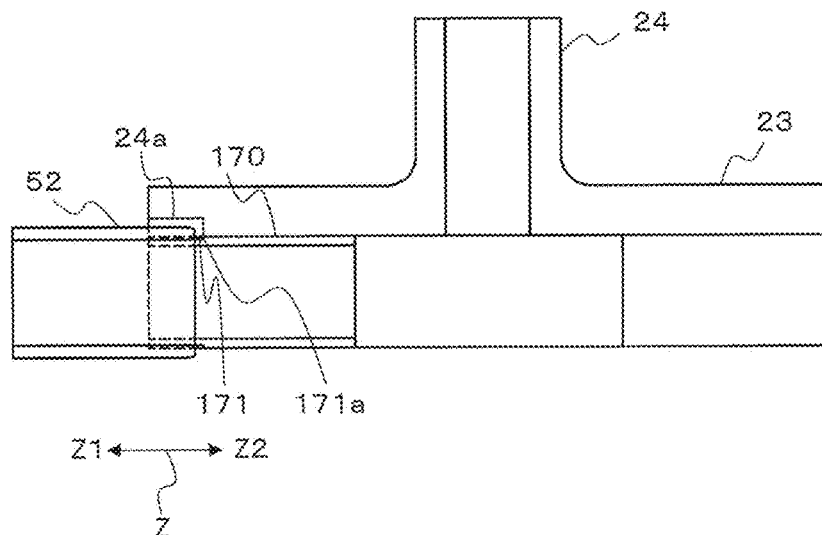


FIG. 14



HERMETIC COMPRESSOR AND REFRIGERATION CYCLE APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a U.S. national stage application of PCT/JP2022/015029 filed on Mar. 28, 2022, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a hermetic compressor including a compression mechanism and to a refrigeration cycle apparatus.

BACKGROUND

[0003] In general, in a known hermetic compressor, a compression mechanism and an electric motor that drives the compression mechanism are accommodated in a hermetic container, and the compression mechanism has a cylinder having a suction hole into which a suction pipe is press-fitted (see, for example, Patent Literature 1).

Patent Literature

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2004-270575

[0005] However, in a hermetic compressor disclosed in Patent Literature 1, an inner circumferential surface of a suction hole of a cylinder is connected to an outer circumferential surface of a suction pipe. Therefore, when the suction pipe is press-fitted into the suction hole of the cylinder, the suction hole is expanded, thus causing the cylinder to be distorted in a circumferential direction as a whole.

SUMMARY

[0006] The present disclosure is applied to solve the above problem, and relates to a hermetic compressor and a refrigeration cycle apparatus that can reduce the likelihood that a cylinder will be distorted in a circumferential direction as a whole.

[0007] A hermetic compressor according to one embodiment of the present disclosure includes a compression mechanism in a hermetic container. The compression mechanism is driven by an electric motor through a rotation shaft, and includes a cylinder including a cylinder chamber having a cylindrical shape. The cylinder has a cylinder suction hole that extends in a radial direction of the cylinder and that allows fluid to be sucked into the cylinder chamber. In an outer circumferential surface of the cylinder, a cylindrical groove is formed in such a manner as to surround the cylinder suction hole. Between the cylinder suction hole and the cylindrical groove, a cylinder tubular portion is provided. To an outer circumferential surface of the cylinder tubular portion, a suction pipe or a connecting pipe provided at one end of the suction pipe is connected, the suction pipe being a pipe through which the fluid is guided from outside of the hermetic container to the cylinder chamber.

[0008] A refrigeration cycle apparatus according to another embodiment of the present disclosure includes: the above hermetic compressor; an outdoor-side heat exchanger; a pressure reducing device; and an indoor-side heat exchanger.

[0009] In the hermetic compressor according to each of the embodiments of the present disclosure, in the outer circumferential surface of the cylinder, the cylindrical groove is formed in such a manner as to surround the cylinder suction hole. The cylinder tubular portion is provided between the cylinder suction hole and the cylindrical groove. The suction pipe or the connecting pipe is connected to the outer circumferential surface of the cylinder tubular portion. It is therefore possible to reduce occurrence of distortion of the cylinder in the circumferential direction as a whole, since the cylinder suction hole is not expanded when the suction pipe or the connecting pipe is connected to the cylinder tubular portion.

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIG. 1 is a vertical sectional schematic view of a hermetic compressor according to Embodiment 1.

[0011] FIG. 2 is a cross-sectional schematic view of a compression mechanism as the hermetic compressor as illustrated in FIG. 1 is viewed in a direction indicated by arrows A and A'; that is, a cross-sectional schematic view of the compression mechanism that is taken along line A-A'.

[0012] FIG. 3 is a cross-sectional schematic view of an electric motor 30 as the hermetic compressor 100 as illustrated in FIG. 1 is viewed in a direction indicated by arrows B and B', that is, a cross-section schematic view of the electric motor that is taken along line B-B'.

[0013] FIG. 4 is a schematic configuration diagram of a refrigeration cycle apparatus including the hermetic compressor according to Embodiment 1.

[0014] FIG. 5 is a cross-sectional schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of the hermetic compressor according to Embodiment 1.

[0015] FIG. 6 is a schematic diagram illustrating the cylinder suction hole and surroundings thereof in the cylinder of the hermetic compressor according to Embodiment 1 as viewed from the front.

[0016] FIG. 7 is a vertical sectional schematic diagram illustrating the cylinder suction hole and surroundings thereof in the cylinder of the hermetic compressor according to Embodiment 1 when viewed side-on.

[0017] FIG. 8 is a cross-sectional schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of an existing hermetic compressor.

[0018] FIG. 9 is a schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 2 as viewed from the front.

[0019] FIG. 10 is a schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 3 as viewed from the front.

[0020] FIG. 11 is a schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 4 as viewed from the front.

[0021] FIG. 12 is a schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 5 as viewed from the front.

[0022] FIG. 13 is a schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 6 as viewed from the front.

[0023] FIG. 14 is a vertical sectional schematic diagram illustrating a cylinder suction hole and surroundings thereof in a cylinder of a hermetic compressor according to Embodiment 7 as viewed side-on.

DETAILED DESCRIPTION

[0024] Hereinafter, embodiments of the present disclosure will be described with reference to the drawings. It should be noted that in the present disclosure, the following descriptions concerning the embodiments are not limiting. In addition, relationships in size between the components in the drawings may differ from actual ones.

Embodiment 1

[0025] FIG. 1 is a sectional view of a hermetic compressor 100 according to Embodiment 1. FIG. 2 is a cross-sectional schematic view of a compression mechanism 20 as the hermetic compressor 100 as illustrated in FIG. 1 is viewed in a direction indicated by arrows A and A'; that is, a cross-sectional schematic view of the compression mechanism 20 that is taken along line A-A'. The overall configuration of the hermetic compressor 100 according to Embodiment 1 will be described below with reference to FIGS. 1 and 2. As the hermetic compressor 100, for example, a single-cylinder rotary compressor having a single cylinder 23 as illustrated in FIG. 1, that is, a single rotary compressor, is used. It should be noted that the hermetic compressor 100 is not limited to the single rotary compressor, and may be a rotary compressor having a plurality of cylinders 23, for example, a twin rotary compressor having two cylinders 23.

[0026] As illustrated in FIG. 1, the hermetic compressor 100 includes a compression mechanism 20 and an electric motor 30 in a hermetic container 10. The compression mechanism 20 compresses refrigerant gas, and the electric motor 30 drives the compression mechanism 20. The hermetic container 10 is made up of an upper container 11 and a lower container 12. The compression mechanism 20 is located in a lower portion of the hermetic container 10, and the electric motor 30 is located in an upper portion of the hermetic container 10. The compression mechanism 20 and the electric motor 30 are connected by a rotation shaft 21. The rotation shaft 21 transmits rotational motion of the electric motor 30 to the compression mechanism 20. In the compression mechanism 20, refrigerant gas is compressed by the transmitted rotational force, and the compressed refrigerant gas is discharged into the hermetic container 10. The interior of the hermetic container 10 is filled with the compressed refrigerant gas, that is, high-temperature and high-pressure refrigerant gas. In the lower portion of the hermetic container 10, that is, at the bottom portion thereof, refrigerating machine oil is stored as oil for lubricating the compression mechanism 20. At a lower portion of the rotation shaft 21, an oil pump (not illustrated) is provided. The oil pump pumps up the refrigerating machine oil stored in the bottom portion of the hermetic container 10 as the rotation shaft 21 rotates, and supplies the refrigerating machine oil to sliding parts of the compression mechanism 20, thereby ensuring a mechanical lubricating action of the compression mechanism 20.

[0027] The rotation shaft 21 includes a main shaft portion 21a, an eccentric shaft portion 21b, and a sub-shaft portion 21c. The main shaft portion 21a, the eccentric shaft portion 21b, and the sub-shaft portion 21c are formed in this order from the upper side in the axial direction. The electric motor 30 is fixed to the main shaft portion 21a by shrink fit or press fit. A cylindrical rolling piston 22 is slidably fitted to the eccentric shaft portion 21b.

[0028] The compression mechanism 20 includes a cylinder 23, the rolling piston 22, an upper bearing 24, a lower bearing 25, and a vane 26 (see FIG. 2). In the cylinder 23, a cylindrical space, that is, a cylinder chamber 23a, is provided such that its opposite ends in the axial direction are opened. It is allowable that the cylinder chamber 23a does not have an exactly cylindrical space. The cylinder chamber 23a may have a substantially cylindrical space. As illustrated in FIG. 2, the cylinder chamber 23a accommodates the eccentric shaft portion 21b of the rotation shaft 21, the rolling piston 22, and the vane 26. The eccentric shaft portion 21b is eccentrically moved in the cylinder chamber 23a. The rolling piston 22 is fitted to the eccentric shaft portion 21b. The vane 26 partitions a space formed by an inner circumferential surface of the cylinder chamber 23a and an outer circumferential surface of the rolling piston 22.

[0029] In the cylinder 23, a vane groove 23c formed to extend in a radial direction of the cylinder 23 extends through the cylinder 23 in the axial direction. One of ends of the vane groove 23c in the radial direction is opened in the cylinder chamber 23a and the other end is opened in a back pressure chamber 23b. In the vane groove 23c, the vane 26 is accommodated. The vane 26 is moved back and forth in the radial direction in the vane groove 23c. The vane 26 has a flat shape, that is, a substantially cuboid shape such that its thickness in the circumferential direction is smaller than its length in the radial direction and its length in the axial direction. In part of the vane groove 23c that is located in the back pressure chamber 23b, a vane spring (not illustrated) is provided. Normally, high-pressure refrigerant gas in the hermetic container 10 flows into the back pressure chamber 23b, and a differential pressure between a refrigerant-gas pressure in the back pressure chamber 23b and a refrigerant-gas pressure in the cylinder chamber 23a produces a force to move the vane 26 in the radial direction toward the center of the cylinder chamber 23a. The vane 26 is moved in the radial direction toward the center of the cylinder chamber 23a by both the force produced due to the differential pressure between the back pressure chamber 23b and the cylinder chamber 23a and a pressing force of the vane spring in the radial direction. The force to move the vane 26 in the radial direction brings one end of the vane 26 that adjoins the cylinder chamber 23a into contact with a cylindrical outer circumferential surface of the rolling piston 22. It is therefore possible to partition the space defined by the inner circumferential surface of the cylinder 23 and the outer circumferential surface of the rolling piston 22 into a suction-side space and a compression-side space. Even when refrigerant gas in the hermetic container 10 is not sufficient to press the vane 26 against the outer circumferential surface of the rolling piston 22, that is, a differential pressure between a refrigerant-gas pressure in the back pressure chamber 23b and a refrigerant-gas pressure in the cylinder chamber 23a is not sufficient to press the vane 26 against the outer circumferential surface of the rolling piston 22, it is still possible to press one end of the vane 26 against the outer

circumferential surface of the rolling piston 22 with the force of the vane spring. With this configuration, one end of the vane 26 can necessarily be in contact with the outer circumferential surface of the rolling piston 22.

[0030] As illustrated in FIG. 1, the upper bearing 24 is formed in a substantially inverse T-shape as viewed side-on, and is fitted to the main shaft portion 21a of the rotation shaft 21 to support the main shaft portion 21a such that the main shaft portion 21a is rotatable. The upper bearing 24 is in contact with the cylinder 23 and closes an upper-side opening of the cylinder chamber 23a in the axial direction. The lower bearing 25 is formed in a substantially T-shape as viewed side-on, and is fitted to the sub-shaft portion 21c of the rotation shaft 21 to support the sub-shaft portion 21c such that the sub-shaft portion 21c is rotatable. The lower bearing 25 is in contact with the cylinder 23 and closes a lower-side opening of the cylinder chamber 23a in the axial direction. In the cylinder 23, a suction port (not illustrated) is provided that allows refrigerant gas corresponding to low-pressure fluid to be sucked into the cylinder chamber 23a from the outside of the hermetic container 10. The upper bearing 24 has a discharge port (not illustrated) that allows compressed refrigerant gas to be discharged to the outside of the cylinder chamber 23a.

[0031] At the discharge port of the upper bearing 24, a discharge valve (not illustrated) is provided. The discharge valve controls the timing at which high-temperature and high-pressure refrigerant gas is discharged from the cylinder 23 through the discharge port. That is, the discharge valve is kept closed until refrigerant gas compressed in the cylinder chamber 23a of the cylinder 23 reaches a predetermined pressure. When the refrigerant gas reaches the predetermined pressure or higher, the discharge valve is opened and as a result, the high-temperature and high-pressure refrigerant gas is discharged from the cylinder chamber 23a to the outside of the cylinder chamber 23a. The discharge valve also prevents backflow of the refrigerant gas after the refrigerant gas is discharged.

[0032] In the cylinder chamber 23a, operations to suck, compress, and discharge refrigerant gas are repeated, and as a result, the refrigerant gas is intermittently discharged from the discharge port, thus causing noise such as pulsation noise. In order to reduce this noise, a discharge muffler 27 is attached to an outer side of the upper bearing 24, that is, part of the upper bearing 24 that is closer to the electric motor 30 than other part of the upper bearing 24, such that the discharge muffler 27 covers the upper bearing 24. The discharge muffler 27 has a discharge hole (not illustrated) through which a space defined by the discharge muffler 27 and the upper bearing 24 communicates with the interior of the hermetic container 10. Refrigerant gas discharged from the cylinder 23 through the discharge port is once discharged to the space defined by the discharge muffler 27 and the upper bearing 24, and is thereafter discharged from the discharge hole into the hermetic container 10.

[0033] Beside the hermetic container 10, a suction muffler 101 is provided to reduce the likelihood that liquid refrigerant will be directly sucked into the cylinder chamber 23a of the cylinder 23. In general, from an external refrigerant circuit to which the hermetic compressor 100 is connected, low-pressure refrigerant gas and liquid refrigerant are mixedly sent to the hermetic compressor 100. If the liquid refrigerant flows into the cylinder 23 and is compressed in the compression mechanism 20, a failure occurs in the

compression mechanism 20. Thus, in the suction muffler 101, the refrigerant gas and the liquid refrigerant are separated from each other, and only the refrigerant gas is sent to the cylinder chamber 23a. The suction muffler 101 is connected to the suction port of the cylinder 23 by a suction pipe 51 and a connecting pipe 52 provided at one end of the suction pipe 51. Low-pressure refrigerant gas sent from the suction muffler 101 is sucked into the cylinder chamber 23a through the suction pipe 51 and the connecting pipe 52. That is, the suction pipe 51 and the connecting pipe 52 guide the low-pressure refrigerant gas from the outside of the hermetic container 10 to the cylinder chamber 23a.

[0034] The compression mechanism 20 has the above configuration, and the eccentric shaft portion 21b of the rotation shaft 21 is rotated in the cylinder chamber 23a of the cylinder 23 by the rotational motion of the rotation shaft 21. An operating chamber is defined by the inner circumferential surface of the cylinder chamber 23a, the outer circumferential surface of the rolling piston 22 fitted to the eccentric shaft portion 21b, and the vane 26, and the volume of the operating chamber increases or decreases as the rotation shaft 21 rotates. First, the operating chamber communicates with the suction port, and low-pressure refrigerant gas is then sucked into this operating chamber. Next, the operating chamber is blocked so as not to communicate with the suction port, and as the volume of the operating chamber decreases, refrigerant gas in the operating chamber is compressed. Eventually, the operating chamber communicates with the discharge port, and after the refrigerant gas in the operating chamber reaches a predetermined pressure, the discharge valve provided at the discharge port is opened, whereby the refrigerant gas compressed to a high-pressure and high-temperature state is discharged to the outside of the operating chamber, that is, the high-pressure and high-temperature refrigerant gas is discharged to the outside of the cylinder chamber 23a. The high-pressure and high-temperature refrigerant gas discharged from the cylinder chamber 23a into the hermetic container 10 through the discharge muffler 27 passes through the electric motor 30, then flows up in the hermetic container 10, and is discharged to the outside of the hermetic container 10 from a discharge pipe 102 provided at the top of the hermetic container 10. A refrigerant circuit in which refrigerant flows is formed outside the hermetic container 10. The discharged refrigerant circulates in the refrigerant circuit and flows back to the suction muffler 101.

[0035] FIG. 3 is a cross-sectional schematic view of the electric motor 30 as the hermetic compressor 100 as illustrated in FIG. 1 is viewed in a direction indicated by arrows B and B', that is, a cross-section schematic view of the electric motor 30 that is taken along line B-B'. Next, the electric motor 30 that transmits a rotational force to the compression mechanism 20 will be described with reference to FIG. 3. The electric motor 30 includes a substantially cylindrical stator 41 fixed to the inner circumferential surface of the hermetic container 10 and a substantially columnar rotor 31 located inward of the stator 41.

[0036] The rotor 31 includes a rotor iron core 32 formed by laminating iron core sheets obtained by stamping out a thin electromagnetic steel sheet. The rotor 31 is a rotor using permanent magnets as in, for example, a brushless DC motor or a rotor using secondary windings as in an induction motor. For example, in the case where the electric motor 30 is a brushless DC motor as illustrated in FIG. 3, magnet

insertion holes **33** are provided in the axial direction of the rotor iron core **32**. In the magnet insertion holes **33**, permanent magnets **34** such as ferrite magnets or rare-earth magnets are inserted. The permanent magnets **34** produces magnetic poles on the rotor **31**. With an action of magnetic fluxes produced by the magnetic poles on the rotor **31** and magnetic fluxes produced by stator windings **44** on the stator **41**, the rotor **31** is rotated.

[0037] In an induction motor (not illustrated), secondary windings are provided at the rotor iron core **32**, instead of the permanent magnets. The stator windings **44** at the stator **41** induce the magnetic fluxes to rotor-side secondary windings provided on a rotor side to produce a rotational force that causes the rotor **31** to rotate.

[0038] In the center of the rotor iron core **32**, a shaft hole (not illustrated) is provided through which the rotation shaft **21** extends. The main shaft portion **21a** of the rotation shaft **21** is fastened to the rotor iron core **32** by, for example, shrink fit, whereby rotational motion of the rotor **31** is transmitted to the rotation shaft **21**. Around the shaft hole, air holes **35** are provided. High-pressure and high-temperature refrigerant compressed by the compression mechanism **20** located below the electric motor **30** passes through the air holes **35**. It should be noted that the refrigerant compressed by the compression mechanism **20** also passes through an air gap between the rotor **31** and the stator **41** and gaps between the stator windings **44**, in addition to the air holes **35**.

[0039] FIG. 4 is a schematic configuration diagram of a refrigeration cycle apparatus **200** including the hermetic compressor **100**. Next, the refrigeration cycle apparatus **200** including the hermetic compressor **100** will be described with reference to FIG. 4. The refrigeration cycle apparatus **200** is, for example, an air-conditioning apparatus. The refrigeration cycle apparatus **200** includes the hermetic compressor **100** including the suction muffler **101** connected to the suction side of the hermetic compressor **100**, a flow switching valve **103** connected to the discharge side of the hermetic compressor **100**, an outdoor-side heat exchanger **104**, a pressure reducing device **105**, and an indoor-side heat exchanger **106**, and these components are sequentially connected by pipes, whereby a refrigerant circuit is formed in which refrigerant circulates. In general, an R407C refrigerant, an R410A refrigerant, an R32 refrigerant, or other kind of refrigerant is used as the refrigerant that circulates in the refrigerant circuit. Also, in general, in the refrigeration cycle apparatus **200**, the indoor-side heat exchanger **106** is mounted in a device provided indoors, while the hermetic compressor **100**, the flow switching valve **103**, the outdoor-side heat exchanger **104**, and the pressure reducing device **105** are mounted in a device located outdoors.

[0040] The flow switching valve **103** is, for example, a four-way valve, and configured to switch the flow direction of the refrigerant between plural flow directions to switch the operation between a cooling operation and a heating operation. It should be noted that, in place of the four-way valve, for example, a combination of two-way valves or a combination of three-way valves may be used as the flow switching valve **103**. The pressure reducing device **105** is configured to reduce the pressure of refrigerant to expand the refrigerant. The pressure reducing device **105** is, for example, an electronic expansion valve whose opening degree can be adjusted. The pressure reducing device **105** is adjusted in opening degree to control the pressure of refrigerant that flows into the indoor-side heat exchanger **106** in

the cooling operation and to control the pressure of refrigerant that flows into the outdoor-side heat exchanger **104** in the heating operation. The outdoor-side heat exchanger **104** serves as an evaporator or a condenser, and causes heat exchange to be performed between air and the refrigerant to evaporate and gasify the refrigerant or condense and liquefy the refrigerant. The outdoor-side heat exchanger **104** serves as an evaporator in the heating operation, and serves as a condenser in the cooling operation. The indoor-side heat exchanger **106** serves as an evaporator or a condenser, and causes heat exchange to be performed between air and the refrigerant to evaporate and gasify the refrigerant or condense and liquefy the refrigerant. The indoor-side heat exchanger **106** serves as a condenser in the heating operation, and serves as an evaporator in the cooling operation.

[0041] In the heating operation, the flow switching valve **103** is connected to the indoor-side heat exchanger **106** as indicated by solid lines in FIG. 4. High-temperature and high-pressure refrigerant obtained by compression by the hermetic compressor **100** flows to the indoor-side heat exchanger **106** and condenses and liquefies. Thereafter, the refrigerant that has liquefied is reduced in pressure by the pressure reducing device **105** to change into low-temperature and low-pressure two-phase refrigerant, and the low-temperature low-pressure two-phase refrigerant then flows to the outdoor-side heat exchanger **104** and evaporates and gasifies. The refrigerant that has gasified passes through the flow switching valve **103** and flows back to the hermetic compressor **100**. That is, the refrigerant circulates as indicated by solid arrows in FIG. 4. Because of this circulation of the refrigerant, at the outdoor-side heat exchanger **104** serving as an evaporator, the refrigerant sent to the outdoor-side heat exchanger **104** exchanges heat with outside air to receive heat from the outside air. The refrigerant that has received heat is sent to the indoor-side heat exchanger **106** serving as a condenser, and at the indoor-side heat exchanger **106**, exchanges heat with indoor air to heat the indoor air.

[0042] In the cooling operation, the flow switching valve **103** is connected to the outdoor-side heat exchanger **104** as indicated by dashed lines in FIG. 4. High-temperature and high-pressure refrigerant obtained through compression by the hermetic compressor **100** flows to the outdoor-side heat exchanger **104** and condenses and liquefies. Thereafter, the refrigerant that has liquefied is reduced in pressure by the pressure reducing device **105** to change into low-temperature and low-pressure two-phase refrigerant, and the low-temperature and low-pressure two-phase refrigerant then flows to the indoor-side heat exchanger **106** and evaporates and gasifies. The refrigerant that has gasified passes through the flow switching valve **103** and flows back to the hermetic compressor **100**. That is, when the operation is changed from the heating operation to the cooling operation, the indoor-side heat exchanger **106** serving as a condenser changes to serve as an evaporator, and the outdoor-side heat exchanger **104** serving as an evaporator changes to serve as a condenser. Thus, the refrigerant circulates as indicated by dashed arrows in FIG. 4. Because of the circulation of the refrigerant, at the indoor-side heat exchanger **106** serving as an evaporator, the refrigerant exchanges heat with indoor air to receive heat from the indoor air, that is, cool the indoor air. The refrigerant that has received heat is sent to the outdoor-side heat exchanger **104** serving as a condenser to exchange heat with outside air and transfer heat to the outside air.

[0043] FIG. 5 is a cross-sectional schematic diagram illustrating a cylinder suction hole 110 and surroundings thereof in the cylinder 23 of the hermetic compressor 100 according to Embodiment 1. FIG. 6 is a schematic diagram illustrating the cylinder suction hole 110 and the surroundings thereof in the cylinder 23 of the hermetic compressor 100 according to Embodiment 1 as viewed from the front. FIG. 7 is a vertical sectional schematic view illustrating the cylinder suction hole 110 and the surroundings in the cylinder 23 of the hermetic compressor 100 according to Embodiment 1 as viewed side-on. Next, the shape of a suction passage in the hermetic compressor 100 will be described with reference to FIGS. 5 to 7. In the cylinder 23, the cylinder suction hole 110 is formed. The cylinder suction hole 110 extends through the cylinder 23 from an outer circumferential surface of the cylinder 23 to an inner circumferential surface thereof, that is, extends through the cylinder 23 in the radial direction of the cylinder 23, but does not extend through the cylinder 23 in the thickness direction of the cylinder 23. In the outer circumferential surface of the cylinder 23, a cylindrical groove 111 that has a circular shape as viewed from the front is provided in such a manner as to surround the cylinder suction hole 110. Between the cylindrical groove 111 and the cylinder suction hole 110, a cylinder tubular portion 110a is provided. The connecting pipe 52 is connected to an outer circumferential surface of the cylinder tubular portion 110a by press-fitting, screws, welding, or an adhesive, for example. Therefore, a bonding face between the cylinder tubular portion 110a and the connecting pipe 52 is that between the outer circumferential surface of the cylinder tubular portion 110a and an inner circumferential surface of the connecting pipe 52. The connecting pipe 52 is not directly bonded to the inner circumferential surface of the cylinder suction hole 110. It should be noted that the cylinder tubular portion 110a has a circular shape as viewed from the front. However, it is not indispensable that the cylinder tubular portion 110a has an exactly circular shape. That is, the cylinder tubular portion 110a may have a substantially circular shape.

[0044] FIG. 8 is a cross-sectional schematic diagram illustrating a cylinder suction hole 110A and surroundings thereof in a cylinder 23A of an existing hermetic compressor. In an existing connecting-pipe connection configuration as illustrated in FIG. 8 in which an inner circumferential surface of the cylinder suction hole 110A of the cylinder 23A and an outer circumferential surface of the connecting pipe 52 are bonded together, there is a risk that the entire cylinder 23A will be deformed due to a load that is applied outwardly in the circumferential direction (in directions indicated by arrows in FIG. 8) in such a manner to release the load, thereby causing an inner side of the cylinder 23A to be deformed such that an inside diameter thereof change, and also causing a vane groove (not illustrated) to be deformed.

[0045] By contrast, in a connecting-pipe connection configuration according to Embodiment 1 as illustrated in FIG. 5, a load is applied to the cylinder 23 inwardly in the circumferential direction (directions indicated by arrows in FIG. 5) at the time of connecting the connecting pipe 52. Thus, the cylinder tubular portion 110a has lower stiffness with reference to the overall stiffness of the cylinder 23, and the cylinder tubular portion 110a is thus selectively (locally) distorted, thereby reducing the amount of distortion of the inner side of the cylinder 23 that changes the inner diameter thereof and the amount of distortion of the vane groove 23c.

It is therefore possible to reduce the risk that the rolling piston 22 will be locked due to the distortion of the inner side of the cylinder 23 and the risk that the vane 26 will be locked due to the distortion of the vane groove 23c. It should be noted that as illustrated in FIGS. 6 and 7, the cylindrical groove 111 does not extend through the cylinder 23 in the thickness direction of the cylinder 23 (direction indicated by arrow X).

[0046] In other words, in the existing connecting-pipe connection configuration as illustrated in FIG. 8, when the connecting pipe 52 is press-fitted into the cylinder suction hole 110A of the cylinder 23A, such a force as to press and expand the cylinder 23 the cylinder suction hole 110A of the cylinder 23 is applied, thereby increasing the possibility of distortion of the entire cylinder 23 and the possibility of deformation of the inner side of the cylinder 23 and deformation of the vane groove 23c. By contrast, in the connecting-pipe connection configuration in Embodiment 1 as illustrated in FIG. 5, the inner circumferential surface of the connecting pipe 52 is press-fitted into the outer circumferential surface of the cylinder tubular portion 110a that is a thin-walled cylinder having a small thickness and provided on the outer circumferential surface of the cylinder 23. Thus, the cylinder 23 is not distorted as a whole, and that is, only the cylinder tubular portion 110a is easily deformed, whereby it is possible to reduce deformation of the inner side of the cylinder 23 that results in change in the inside diameter thereof and the deformation of the vane groove 23c.

[0047] The hermetic compressor 100 according to Embodiment 1 includes the compression mechanism 20 in the hermetic container 10, and the compression mechanism 20 is driven by the electric motor 30 through the rotation shaft 21. The compression mechanism 20 includes the cylinder 23 that includes the cylinder chamber 23a having a cylindrical shape and that has the cylinder suction hole 110 which extends in the radial direction and through which fluid is sucked into the cylinder chamber 23a. In the outer circumferential surface of the cylinder 23, the cylindrical groove 111 is formed in such a manner as to surround the cylinder suction hole 110. The cylinder tubular portion 110a is provided between the cylinder suction hole 110 and the cylindrical groove 111. The suction pipe 51 through which the fluid is guided from the outside of the hermetic container 10 to the cylinder chamber 23a, or the connecting pipe 52 provided at one end of the suction pipe 51, is connected to the outer circumferential surface of the cylinder tubular portion 110a.

[0048] The refrigeration cycle apparatus 200 according to Embodiment 1 includes the hermetic compressor 100, the outdoor-side heat exchanger 104, the pressure reducing device 105, and the indoor-side heat exchanger 106.

[0049] In the hermetic compressor 100 according to Embodiment 1, in the outer circumferential surface of the cylinder 23, the cylindrical groove 111 is formed in such a manner as to surround the cylinder suction hole 110. The cylinder tubular portion 110a is provided between the cylinder suction hole 110 and the cylindrical groove 111. The suction pipe 51 or the connecting pipe 52 is connected to the outer circumferential surface of the cylinder tubular portion 110a. Thus, the cylinder suction hole 110 is not expanded at the time of connecting the suction pipe 51 or the connecting pipe 52 to the cylinder tubular portion 110a. It is therefore

possible to reduce the likelihood that the cylinder **23** will be distorted in the circumferential direction as a whole.

Embodiment 2

[0050] Hereinafter, Embodiment 2 will be described. Regarding Embodiment 2, components that are the same as or equivalent to those in Embodiment 1 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiment 1 will be made.

[0051] FIG. 9 is a schematic diagram illustrating a cylinder suction hole **120** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 2 as viewed from the front. It should be noted that in Embodiment 1, as illustrated in FIG. 6, the cylinder **23** has the cylinder tubular portion **110a** having a circular shape as viewed from the front, and in contrast, in Embodiment 2, as illustrated in FIG. 9, the cylinder **23** has a cylinder tubular portion **120a** having an elliptical shape as viewed from the front. In the outer circumferential surface of the cylinder **23**, a cylindrical groove **121** having an elliptical shape is provided in such a manner as to surround the cylinder suction hole **120**. Between the cylindrical groove **121** and the cylinder suction hole **120**, the cylinder tubular portion **120a** described above is provided. The connecting pipe **52** is connected to an outer circumferential surface of the cylinder tubular portion **120a** by press-fitting, screws, welding, or an adhesive, for example.

[0052] The major axis of the elliptical shape of the cylinder tubular portion **120a** may extend in the circumferential direction (Y direction) or the thickness direction (X direction) of the cylinder **23**. In the case where the major axis of the elliptical shape of the cylinder tubular portion **120a** extends in the circumferential direction, expansion of the cylinder tubular portion **120a** in the thickness direction of the cylinder **23** is constrained, but the cylinder tubular portion **12a** can be expanded in the circumferential direction of the cylinder **23** and its opening area can thus be increased, as compared with the cylinder tubular portion **120a** has a circular shape. In contrast, in the case where the major axis of the elliptical shape of the cylinder tubular portion **120a** extends in the thickness direction, since the vane groove **23c** of the cylinder **23** is made to communicate with a spring hole **23d** provided in the same phase as the vane groove **23c**, expansion of the cylinder tubular portion **120a** in the circumferential direction of the cylinder **23** is constrained; in contrast, the cylinder tubular portion **120a** can be expanded in the thickness direction of the cylinder **23**, and its opening area can be increased as compared with the case where the cylinder tubular portion **120a** has a circular shape. In such a manner, it is possible to increase the effective diameter of the cylinder suction hole **120** by increasing the opening area of the cylinder tubular portion **120a**. It is therefore possible to reduce a pressure loss in a flow passage through which refrigerant flows. Accordingly, the volumetric efficiency can be increased, and the compressor performance can thus be improved.

[0053] In the hermetic compressor **100** according to Embodiment 2 as described above, the cylinder tubular portion **120a** is formed in the shape of an ellipse as viewed from the front.

[0054] In the hermetic compressor **100** according to Embodiment 2, it is possible to increase the opening area of the cylinder tubular portion **120a**, as compared with the case

where the cylinder tubular portion **120a** has a circular shape. As a result, it is possible to increase the effective diameter of the cylinder suction hole **120**, and thus to reduce the pressure loss in the flow passage through which refrigerant flows, and increase the volumetric efficiency increases. Accordingly, the compressor performance can be improved.

Embodiment 3

[0055] Hereinafter, Embodiment 3 will be described. Regarding Embodiment 3, components that are the same as or equivalent to those in Embodiment 1 or 2 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiments 1 and 2 will be made.

[0056] FIG. 10 is a schematic diagram illustrating a cylinder suction hole **130** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 3 as viewed from the front. It should be noted that in Embodiment 2, as illustrated in FIG. 9, the cylinder **23** has the cylinder tubular portion **120a** formed in the shape of an ellipse as viewed from the front. In contrast, in Embodiment 3, as illustrated in FIG. 10, the cylinder **23** has a cylinder tubular portion **130a** formed in the shape of a rectangle having rounded corners as viewed from the front. Specifically, the cylinder tubular portion **130a** is made up of a pair of opposite straight portions **130a1** and a pair of opposite arc-shaped portions **130a2**. In the outer circumferential surface of the cylinder **23**, a cylindrical groove **131** formed in the shape of a rectangle having rounded corners is provided in such a manner as to surround the cylinder suction hole **130**. Between the cylindrical groove **131** and the cylinder suction hole **130**, the cylinder tubular portion **130a** as described above is provided. The connecting pipe **52** is connected to an outer circumferential surface of the cylinder tubular portion **130a** by press-fitting, screws, welding, or an adhesive, for example.

[0057] The longitudinal direction of the cylinder tubular portion **130a** may be made to coincide with the circumferential direction (the Y direction) or the thickness direction (the X direction) of the cylinder **23**. In the case where the longitudinal direction of the cylinder tubular portion **130a** is the circumferential direction, expansion of the cylinder tubular portion **130a** in the thickness direction of the cylinder **23** is constrained, but the cylinder tubular portion **130a** can be expanded in the circumferential direction of the cylinder **23**, whereby the opening area of the cylinder tubular portion **130a** can be increased, as compared with the case where the cylinder tubular portion **130a** has a circular shape. In contrast, in the case where the longitudinal direction of the cylinder tubular portion **130a** is the thickness direction, when the vane groove **23c** of the cylinder **23** is made to communicate with the spring hole **23d** provided in the same phase as the vane groove **23c**, expansion of the cylinder tubular portion **130a** in the circumferential direction of the cylinder **23** is constrained, but the cylinder tubular portion **130a** can be expanded in the thickness direction of the cylinder **23**, whereby the opening area of the cylinder tubular portion **130a** can be increased, as compared with the case where the cylinder tubular portion **130a** has a circular shape. As described above, it is possible to increase the effective diameter of the cylinder suction hole **130** by increasing the opening area of the cylinder tubular portion **130a**. It is therefore possible to reduce the pressure loss in the flow passage through which refrigerant flows, and thus

increase the volumetric efficiency. Accordingly, the compressor performance can be improved.

[0058] In the hermetic compressor **100** according to Embodiment 3 as described above, the cylinder tubular portion **130a** is formed in the shape of a rectangle having rounded corners as viewed from the front.

[0059] In the hermetic compressor **100** according to Embodiment 3, it is possible to increase the opening area of the cylinder tubular portion **130a**, as compared with the case where the cylinder tubular portion **130a** has a circular shape. As a result, it is possible to increase the effective diameter of the cylinder suction hole **130**, and thus possible to reduce the pressure loss in the flow passage through which refrigerant flows, and increase the volumetric efficiency. Accordingly, it is possible to improve the compressor performance.

[0060] Embodiment 4

[0061] Hereinafter, Embodiment 4 will be described. Regarding Embodiment 4, components that are the same as or equivalent to those in any of Embodiments 1 to 3 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiments 1 to 3 will be made.

[0062] FIG. 11 is a schematic diagram illustrating a cylinder suction hole **140** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 4 as viewed from the front. It should be noted that in Embodiment 1, as illustrated in FIG. 6, the cylindrical groove **111** provided in the outer circumferential surface of the cylinder **23** and having a circular shape as viewed from the front does not extend through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction), and in contrast, in Embodiment 4, as illustrated in FIG. 11, a cylindrical groove **141** provided in the outer circumferential surface of the cylinder **23** and having a circular shape as viewed from the front extends through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction). To be more specific, the cylindrical groove **141** is formed in the outer circumferential surface of the cylinder **23**, and is made up of a pair of arc-shaped grooves **141a**. The arc-shaped grooves **141a** are opened in upper and lower surfaces of the cylinder **23**. Between the cylindrical groove **141** and the cylinder suction hole **140**, a cylinder tubular portion **140a** is provided. The connecting pipe **52** is connected to an outer circumferential surface of the cylinder tubular portion **140a** by press-fitting, screws, welding, or an adhesive, for example.

[0063] It should be noted that the connection surfaces between the cylinder tubular portion **140a** and the connecting pipe **52** are the outer circumferential surface of the cylinder tubular portion **140a** and the inner circumferential surface of the connecting pipe **52**. Thus, although the pair of arc-shaped grooves **141a** provided outward of the outer circumferential surface of the cylinder tubular portion **140a** are opened in the upper and lower surfaces of the cylinder **23**, the refrigerant does not leak from the cylinder suction hole **140** to the outside. With this configuration, it is possible to increase the effective diameter of the cylinder suction hole **140**, as compared with Embodiment 1. Accordingly, the compressor performance can be improved, as compared with Embodiment 1. Furthermore, the bonding face between the cylinder tubular portion **140a** and the connecting pipe **52** corresponds to the outer circumferential surface of the cylinder tubular portion **140a** and the inner circumferential surface of the connecting pipe **52**. Thus, the outer diameter

of the connecting pipe **52** is greater than the height of the cylinder **23**, but the outer circumferential surface of the connecting pipe **52** does not serve as a refrigerant sealing surface. To be more specific, although the inner circumferential surface of the connecting pipe **52** serves as a refrigerant sealing surface, refrigerant sealing is unnecessary on the outer circumferential surface of the connecting pipe **52**. For this reason, in a single cylinder rotary compressor that includes the cylinder **23** interposed between the upper bearing **24** and the lower bearing **25**, the upper bearing **24** and the lower bearing **25** do not share the refrigerant sealing surface between them.

[0064] In an existing method of carrying out refrigerant sealing on the outer circumferential surface of the connecting pipe, in order that the outer diameter of the connecting pipe be increased greater than or equal to the thickness of the cylinder, refrigerant sealing on the outer circumferential surface of the connecting pipe is necessary, and it is therefore necessary to perform recess processing on the upper bearing and the lower bearing in conformity with the outer circumferential surface of the connecting pipe. This is disadvantageous since it increases the material and machining costs. This is because it is necessary to increase the outer diameter of the upper bearing and the lower bearing as illustrated in FIG. 14 which will be described later, not FIG. 13 which will be described later, and it is also necessary to perform the above recess processing with high accuracy to prevent refrigerant leakage. In contrast, in the method of carrying out refrigerant sealing on the inner circumferential surface of the connecting pipe **52** according to Embodiment 4, the outer circumferential surface of the connecting pipe **52** does not serve as a refrigerant sealing surface. It is therefore unnecessary to perform the recess processing. Thus, it is possible to increase the outer diameter of the upper bearing **24** and the lower bearing **25** as illustrated in FIG. 13. Accordingly, the material and machining costs can be reduced.

[0065] In the hermetic compressor **100** according to Embodiment 4 as described above, the cylindrical groove **141** extends through the cylinder **23** in the thickness direction of the cylinder **23**.

[0066] In the hermetic compressor **100** according to Embodiment 4, it is possible to increase the effective diameter of the cylinder suction hole **140**, as compared with Embodiment 1. Accordingly, the compressor performance can be improved, as compared with Embodiment 1.

Embodiment 5

[0067] Embodiment 5 will be described. Regarding Embodiment 5, components that are the same as or equivalent to those in any of Embodiments 1 to 4 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiments 1 to 4 will be made.

[0068] FIG. 12 is a schematic diagram illustrating a cylinder suction hole **150** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 5 as viewed from the front. It should be noted that in Embodiment 2, as illustrated in FIG. 9, the cylindrical groove **121** provided in the outer circumferential surface of the cylinder **23** and formed in the shape of an ellipse as viewed in front view does not extend through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction), and in contrast, in Embodiment 5, as illustrated in FIG.

12, a cylindrical groove **151** provided in the outer circumferential surface of the cylinder **23** and formed in the shape of an ellipse as viewed from the front extends through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction). That is, the cylindrical groove **151** is formed in the outer circumferential surface of the cylinder **23**, and is made up of a pair of arc-shaped grooves **151a**. The arc-shaped grooves **151a** are opened in the upper and lower surfaces of the cylinder **23**. Between the cylindrical groove **151** and the cylinder suction hole **150**, a cylinder tubular portion **150a** is provided. The connecting pipe **52** is connected to an outer circumferential surface of the cylinder tubular portion **150a** by press-fitting, screws, welding, or an adhesive, for example.

[0069] It should be noted that the bonding face between the cylinder tubular portion **150a** and the connecting pipe **52** corresponds to the outer circumferential surface of the cylinder tubular portion **150a** and the inner circumferential surface of the connecting pipe **52**. Thus, although the pair of arc-shaped grooves **151a** provided outward of the outer circumferential surface of the cylinder tubular portion **150a** are opened in the upper and lower surfaces of the cylinder **23**, refrigerant does not leak from the cylinder suction hole **150** to the outside. With this configuration, it is possible to increase the effective diameter of the cylinder suction hole **150**, as compared with Embodiment 2. Accordingly, the compressor performance can be improved, as compared with Embodiment 2.

[0070] In the hermetic compressor **100** according to Embodiment 5 as described above, the cylindrical groove **151** extends through the cylinder **23** in the thickness direction of the cylinder **23**.

[0071] In the hermetic compressor **100** according to Embodiment 5, it is possible to increase the effective diameter of the cylinder suction hole **150**, as compared with Embodiment 2. Accordingly, the compressor performance can be improved, as compared with Embodiment 2.

Embodiment 6

[0072] Embodiment 6 will be described. Regarding Embodiment 6, components that are the same as or equivalent to those in any of Embodiments 1 to 5 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiments 1 to 5 will be made.

[0073] FIG. 13 is a schematic diagram illustrating a cylinder suction hole **160** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 6 as viewed from the front. It should be noted that in Embodiment 4, as illustrated in FIG. 10, the cylindrical groove **131** provided in the outer circumferential surface of the cylinder **23** and formed in the shape of a rectangle having rounded corners as viewed from the front does not extend through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction), and in contrast, in Embodiment 6, as illustrated in FIG. 13, a cylindrical groove **161** provided in the outer circumferential surface of the cylinder **23** and formed in the shape of a rectangle having rounded corners as viewed from the front extend through the cylinder **23** in the thickness direction of the cylinder **23** (the X direction). That is, the cylindrical groove **161** is formed in the outer circumferential surface of the cylinder **23**, and made up of a pair of arc-shaped grooves **161a**. The arc-shaped grooves **161a** are opened in the upper and lower

surfaces of the cylinder **23**. Between the cylindrical groove **161** and the cylinder suction hole **160**, a cylinder tubular portion **160a** is provided, and the cylinder tubular portion **160a** is made up of a pair of opposite straight portions **160a1** and a pair of opposite arc-shaped portions **160a2**. The connecting pipe **52** is connected to an outer circumferential surface of the cylinder tubular portion **160a** by press-fitting, screws, welding, or an adhesive, for example.

[0074] It should be noted that the bonding face between the cylinder tubular portion **160a** and the connecting pipe **52** corresponds to the outer circumferential surface of the cylinder tubular portion **160a** and the inner circumferential surface of the connecting pipe **52**. Thus, although the pair of arc-shaped grooves **161a** provided outward of the outer circumferential surface of the cylinder tubular portion **160a** are opened in the upper and lower surfaces of the cylinder **23**, the refrigerant does not leak from the cylinder suction hole **160** to the outside. With this configuration, it is possible to increase the effective diameter of the cylinder suction hole **160**, as compared with Embodiment 3. Accordingly, the compressor performance can be improved, as compared with Embodiment 3.

[0075] In the hermetic compressor **100** according to Embodiment 6 as described above, the cylindrical groove **161** extends through the cylinder **23** in the thickness direction of the cylinder **23**.

[0076] In the hermetic compressor **100** according to Embodiment 6, it is possible to increase the effective diameter of the cylinder suction hole **160**, as compared with Embodiment 3. Accordingly, the compressor performance can be improved, as compared with Embodiment 3.

Embodiment 7

[0077] Embodiment 7 will be described. Regarding Embodiment 7, components that are the same as or equivalent to those in any of Embodiments 1 to 6 will be denoted by the same reference signs, and their descriptions will thus be omitted and only descriptions that are different from those regarding Embodiments 1 to 6 will be made.

[0078] FIG. 14 is a vertical sectional schematic diagram illustrating a cylinder suction hole **170** and surroundings thereof in the cylinder **23** of the hermetic compressor **100** according to Embodiment 7 as viewed side-on. In Embodiment 7, in the case where a cylindrical groove **171** extends through the cylinder **23** in the thickness direction of the cylinder **23**, for example, when an outer circumferential end portion (Z1-side end portion) of the upper bearing **24** is located closer to a radially outer side (Z1-side) than a radially inner end portion **171a** of the cylindrical groove **171** as illustrated in FIG. 14, a bearing recessed portion **24a** that is recessed toward a radially inner side (Z2-side) is provided at an outer circumferential end portion of the upper bearing **24**. With this configuration, it is possible to prevent interference between the upper bearing **24** and the connecting pipe **52**. It should be noted that the bearing recessed portion **24a** may have any shape as long as the bearing recessed portion **24a** can prevent interference between the upper bearing **24** and the connecting pipe **52**. It should be noted that even in the case where the cylindrical groove **171** extends through the cylinder **23** in the thickness direction of the cylinder **23**, for example, when the outer circumferential end portion of the upper bearing **24** (Z1-side end portion) is located closer to the radially inner side (Z2-side) than a radially inner end portion **111a** of the cylindrical groove **111**

as illustrated in FIG. 7, the upper bearing 24 does not interfere with the connecting pipe 52 even if the bearing recessed portion 24a is not provided.

[0079] The hermetic compressor 100 according to Embodiment 7 as described above includes a bearing that is in contact with the cylinder 23 and that supports the rotation shaft 21 such that the rotation shaft 21 is rotatable, and at the outer circumferential end portion of the bearing, the bearing recessed portion 24a is provided to prevent interference between the bearing and the suction pipe 51 or the connecting pipe 52.

[0080] The hermetic compressor 100 according to Embodiment 7 can prevent interference between the upper bearing 24 and the suction pipe 51 or the connecting pipe 52.

[0081] It should be noted that although regarding Embodiments 1 to 7, it is described above that the suction muffler 101 is connected to the suction port of the cylinder 23 by the suction pipe 51 and the connecting pipe 52 provided at one end of this suction pipe 51, this description is not limiting. The suction muffler 101 may be configured such that the connecting pipe 52 is not provided at one end of the suction pipe 51 and the suction pipe 51 is directly connected to the suction port of the cylinder 23 with no connecting pipe 52.

1. A hermetic compressor comprising a compression mechanism in a hermetic container, the compression mechanism being driven by an electric motor through a rotation shaft,

wherein

the compression mechanism includes a cylinder including a cylinder chamber having a cylindrical shape, the cylinder having a cylinder suction hole that extends in a radial direction of the cylinder and that allows fluid to be sucked into the cylinder chamber,

in an outer circumferential surface of the cylinder, a cylindrical groove is formed in such a manner as to surround the cylinder suction hole,

between the cylinder suction hole and the cylindrical groove, a cylinder tubular portion is provided, and

to an outer circumferential surface of the cylinder tubular portion, a connecting pipe provided at one end of a suction pipe is connected, the suction pipe being a pipe through which the fluid is guided from outside of the hermetic container to the cylinder chamber.

2. The hermetic compressor of claim 1, wherein the cylindrical groove extends through the cylinder in a thickness direction of the cylinder.

3. The hermetic compressor of claim 1, further comprising a bearing that is in contact with the cylinder and supports the rotation shaft such that the rotation shaft is rotatable,

wherein at an outer circumferential end portion of the bearing, a bearing recessed portion is provided to prevent interference between the bearing and the connecting pipe.

4. The hermetic compressor of claim 1, wherein the cylinder tubular portion has a circular shape as viewed from the front.

5. The hermetic compressor of claim 1, wherein the cylinder tubular portion is formed in the shape of an ellipse or a rectangle having rounded corners as viewed from the front.

6. A refrigeration cycle apparatus comprising: the hermetic compressor of claim 1; an outdoor-side heat exchanger; a pressure reducing device; and an indoor-side heat exchanger.

7. A hermetic compressor comprising a compression mechanism in a hermetic container, the compression mechanism being driven by an electric motor through a rotation shaft,

wherein

the compression mechanism includes a cylinder including a cylinder chamber having a cylindrical shape, the cylinder having a cylinder suction hole that extends in a radial direction of the cylinder and that allows fluid to be sucked into the cylinder chamber,

in an outer circumferential surface of the cylinder, a cylindrical groove is formed in such a manner as to surround the cylinder suction hole,

between the cylinder suction hole and the cylindrical groove, a cylinder tubular portion is provided, and

to an outer circumferential surface of the cylinder tubular portion, a suction pipe is connected, the suction pipe being a pipe through which the fluid is guided from outside of the hermetic container to the cylinder chamber.

8. The hermetic compressor of claim 7, further comprising a bearing that is in contact with the cylinder and supports the rotation shaft such that the rotation shaft is rotatable,

wherein at an outer circumferential end portion of the bearing, a bearing recessed portion is provided to prevent interference between the bearing and the suction pipe.

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