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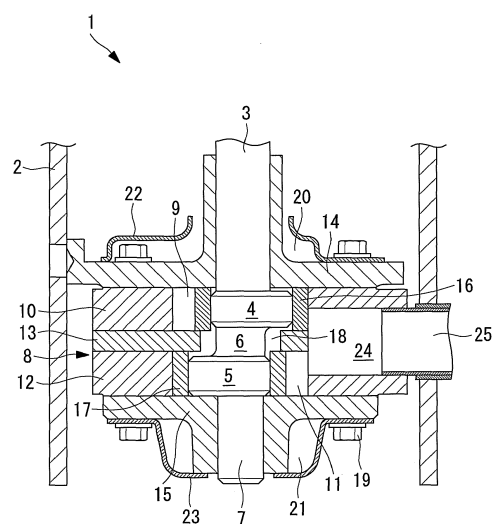
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(54) **ROTARY COMPRESSOR AND METHOD FOR MANUFACTURING THE SAME**

(57) Provided is a rotary compressor which exhibits a high efficiency without an increase in a suction pressure loss due to reduction in a cylinder width and which can be easily assembled without the difficulty in assembly and manufacturing to ensure concentricity even if a suction port extending across a plurality of components is provided. Also provided is a method for manufacturing the rotary compressor.

In a rotary compressor 1, two upper and lower cylinder chambers 9, 11 are formed by an upper cylinder 10, a separator plate 13, a lower cylinder 12, an upper bearing 14, and a lower bearing 15, and a single suction port 24 communicating with the upper and lower cylinder chambers 9, 11 is provided to extend across three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12.

FIG. 1



- 1 : ROTARY COMPRESSOR
- 3 : DRIVE SHAFT
- 4 : UPPER ECCENTRIC SHAFT PORTION
- 5 : LOWER ECCENTRIC SHAFT PORTION
- 9 : UPPER CYLINDER CHAMBER
- 10 : UPPER CYLINDER
- 11 : LOWER CYLINDER CHAMBER
- 12 : LOWER CYLINDER
- 13 : SEPARATOR PLATE
- 14 : UPPER BEARING
- 15 : LOWER BEARING
- 16 : UPPER ROTOR
- 17 : LOWER ROTOR
- 24 : SUCTION PORT

Description

{Technical Field}

[0001] The present invention relates to a rotary compressor including one or more (two) cylinder chambers and a method for manufacturing such a rotary compressor.

{Background Art}

[0002] For example, the points for increasing the efficiency of a rotary compressor are as follows: (1) a leakage loss is reduced in such a manner that a cylinder width (a cylinder thickness) is reduced to shorten the axial seal length between a rotor outer peripheral surface and a cylinder inner peripheral surface; (2) a sliding loss in rotor rotation is reduced in such a manner that a journal portion diameter, an eccentric shaft portion diameter, and an outer rotor diameter are each reduced; and (3) in the case of a multi-cylinder rotary compressor including a plurality of cylinder chambers, the seal portion length between a separator plate end surface and a rotor end surface is increased to the maximum extent possible. However, in a current rotary compressor structure, there are the following limitations, and for this reason, it is difficult to make the design satisfying all of the above-described points.

[0003] A. When the cylinder width (the cylinder thickness) is reduced, limitations are imposed on the diameter of a suction port provided at a cylinder and the diameter of a suction pipe connected to the suction port. For this reason, a required port diameter and a required pipe diameter cannot be ensured, leading to a lower efficiency due to an increase in a suction pressure loss. In order to cope with such a point, it has been proposed that a suction port is in the shape elongated in a circumferential direction as described in PTL 1.

[0004] B. In the multi-cylinder rotary compressor, a separator plate needs to be provided between a plurality of cylinders, but there are limitations in ensuring the sealability of a separator plate through-hole into which an eccentric shaft portion is inserted. For this reason, the diameter of the through-hole cannot be increased. Moreover, there are also limitations in assembly and in increasing the amount of eccentricity of the eccentric shaft portion. Thus, it has been proposed that the diameter of a through-hole of a separator plate and the diameters of upper and lower eccentric shaft portions are set in a particular relationship as described in PTL 2 and that a drive shaft is divided into two portions between upper and lower eccentric shaft portions as described in PTLs 1 and 2.

[0005] Moreover, PTL 3 describes the configuration in which a plurality of cylinders and a separator plate are integrally formed and a drive shaft is divided into two portions between upper and lower eccentric shaft portions. With this configuration, e.g., a high-efficiency compressor with a reduced number of components has been proposed because a design can be made without the

limitations on the suction port diameter and the suction pipe diameter, the limitations on sealing of the separator plate, and the limitations on assembly of the rotary shaft.

5 {Citation List}

{Patent Literature}

[0006]

10

{PTL 1}

Japanese Unexamined Patent Application, Publication No. 2010-121481

{PTL 2}

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Japanese Domestic Re-publication of PCT International Publication No. WO 2013/057946

{PTL 3}

Japanese Unexamined Patent Application, Publication No. 2015-68211

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{Summary of Invention}

{Technical Problem}

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[0007] As described in PTL 1, since the suction port or the suction pipe connected to the suction port are formed in an elongated hole shape or an oval shape, the cylinder width can be reduced, and the flow path cross-sectional area of the suction port or the suction pipe can be ensured. Thus, an increase in the suction pressure loss can be suppressed. However, in order to process the suction port or the suction pipe into the elongated hole shape or the oval shape, not only additional work is required, but also there are obvious limitations in reducing the dimensions of the elongated or oval hole in a minor-axis direction while suppressing an increase in the suction pressure loss. For this reason, it is difficult to suppress, to a satisfactory level, efficiency and performance lowering due to an increase in the suction pressure loss.

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[0008] PTLs 1 to 3 have proposed that the drive shaft is divided into two portions between the eccentric shaft portions to relax the limitations on assembly and to ensure the seal length between the separator plate and a rotor, and that the single suction port communicating with each cylinder chamber is provided for the integrated structure of the upper and lower cylinders and the separator plate to suppress an increase in the suction pressure loss, for example. However, it is difficult to integrally join the two divided portions of the drive shaft together to ensure the concentricity of these portions, and to manufacture the integrated structure of the upper and lower cylinders and the separator plate. In the case of forming upper and lower cylinders and a separator plate as separate components, it is difficult to process part of a suction port in each component and assemble these components together to form a single suction port with concentricity thereof.

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[0009] The present invention has been made in view

of the above-described situation, and is intended to provide a rotary compressor which exhibits a high efficiency without an increase in a suction pressure loss due to reduction in a cylinder width (a cylinder thickness) and which can be easily assembled without the difficulty in assembly and manufacturing to ensure concentricity even if a suction port extending across a plurality of components is provided. The present invention is also intended to provide the method for manufacturing the rotary compressor.

{Solution to Problem}

[0010] In order to solve the above-described problems, the rotary compressor and the method for manufacturing such a rotary compressor according to the present invention employ the following solution.

[0011] A first aspect of the present invention provides a rotary compressor including a drive shaft configured such that eccentric shaft portions are, at two upper and lower points, provided with a predetermined spacing in an axial direction, upper and lower cylinders each forming a corresponding one of upper and lower cylinder chambers corresponding respectively to the eccentric shaft portions, a separator plate provided between the upper and lower cylinders to closely contact the upper and lower cylinders, upper and lower bearings each provided to closely contact a corresponding one of the upper surface of the upper cylinder or the lower surface of the lower cylinder, and upper and lower rotors each fitted onto a corresponding one of the eccentric shaft portions and each configured to rotate in a corresponding one of the upper and lower cylinder chambers. A single suction port communicating with the upper and lower cylinder chambers is provided to extend across three components including the upper cylinder, the separator plate, and the lower cylinder.

[0012] According to the configuration of the present aspect, the two upper and lower cylinder chambers are formed by the upper cylinder, the separator plate, the lower cylinder, the upper bearing, and the lower bearing. Since the single suction port communicating with the upper and lower cylinder chambers is provided to extend across the three components including the upper cylinder, the separator plate, and the lower cylinder, the rotary compressor can be assembled in the manner similar to that of a typical two-cylinder rotary compressor including two upper and lower cylinder chambers divided by a separator plate. Even if the cylinder widths (the cylinder thicknesses) of the upper and lower cylinders respectively forming the upper and lower cylinder chambers are sufficiently reduced, no limitations are imposed on a suction port diameter and a suction pipe diameter, and the single suction port having such a large diameter that a suction pressure loss does not increase can be provided to extend across the three components including the upper cylinder, the separator plate, and the lower cylinder to communicate with the upper and lower cylinder cham-

bers. Thus, the two-cylinder rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability without the need for configuring the drive shaft as a divided structure and integrally configuring the upper and lower cylinders. Note that even in the case where the single suction port is provided to extend across the three components including the upper cylinder, the separator plate, and the lower cylinder as described above, the method for performing drilling with these components being temporarily assembled together is used. Thus, the concentricity of the suction port after assembly can be easily ensured, and the difficulty in providing the single suction port for the three separate components can be overcome.

[0013] In the above-described rotary compressor, the single suction port may be provided to extend across five components including the upper and lower bearings in addition to the three components including the upper cylinder, the separator plate, and the lower cylinder.

[0014] According to the configuration of the present aspect, the single suction port is provided to extend across the five components including the upper and lower bearings in addition to the three components including the upper cylinder, the separator plate, and the lower cylinder. Since the single suction port is provided to extend across the upper and lower bearings each disposed to closely contact a corresponding one of the upper surface of the upper cylinder or the lower surface of the lower cylinder, the larger-diameter suction port communicating with the upper and lower cylinder chambers can be provided. Thus, the two-cylinder rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability. Note that even in the case where the single suction port is provided to extend across the above-described five components, the method for performing drilling with these components being temporarily assembled together is used.

Thus, the concentricity of the suction port after assembly can be easily ensured, and the difficulty in providing the single suction port for the five separate components can be overcome.

[0015] A rotary compressor includes a drive shaft configured such that an eccentric shaft portion is provided at a predetermined position in an axial direction, a cylinder forming a single cylinder chamber corresponding to the eccentric shaft portion, upper and lower bearings each provided to closely contact a corresponding one of upper and lower surfaces of the cylinder, and a rotor fitted onto the eccentric shaft portion and configured to rotate in the cylinder chamber. A single suction port communicating with the single cylinder chamber is provided to extend across three components including the upper bearing, the cylinder, and the lower bearing.

[0016] According to the configuration of the present

aspect, the single cylinder chamber is formed by the cylinder, the upper bearing, and the lower bearing, and the single suction port communicating with the single cylinder chamber is provided to extend across the three components including the upper bearing, the cylinder, and the lower bearing. Thus, the rotary compressor can be assembled in the manner similar to that of a typical single-cylinder rotary compressor including a single cylinder chamber. Even if the width (the thickness) of the cylinder forming the single cylinder chamber is sufficiently reduced, no limitations are imposed on the suction port diameter and the suction pipe diameter, and the single suction port having such a large diameter that the suction pressure loss does not increase can be provided to extend across the three components including the upper bearing, the cylinder, and the lower bearing to communicate with the single cylinder chamber. Thus, the single-cylinder rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability. Note that even in the case where the single suction port is provided to extend across the three components including the cylinder, the upper bearing, and the lower bearing as described above, the method for performing drilling with these components being temporarily assembled together is used. Thus, the concentricity of the suction port after assembly can be easily ensured, and the difficulty in providing the single suction port for the three separate components can be overcome.

[0017] A second aspect of the present invention provides a method for manufacturing any of the above-described rotary compressors including the step of temporarily assembling the three or five components forming the plurality of cylinder chambers or the three components forming the single cylinder chamber, the step of drilling the single suction port across the plurality of components in the temporarily-assembled state, the step of disassembling the plurality of components into each component after drilling of the suction port, and the step of assembling, in a given order, the rotary compressor including the plurality of components.

[0018] According to the configuration of the present aspect, the single suction port is drilled to extend across the plurality of components in the state in which the three or five components forming the plurality of cylinder chambers or the three components forming the single cylinder chamber are temporarily assembled together. Subsequently, the temporarily-assembled components are disassembled into each component after processing of the suction port, and then, the rotary compressor including these components is assembled in the given order. Thus, even if the width (the thickness) of the cylinder forming each cylinder chamber is sufficiently reduced, no limitations are imposed on the suction port diameter, and the single suction port having such a large diameter that the suction pressure loss does not increase can be provided to extend across the plurality of components to commu-

nicate with each cylinder chamber. Thus, the rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability. Even in the case where the single suction port is provided to extend across the plurality of components, the rotary compressor is assembled as follows: after the plurality of components forming each cylinder chamber have been temporarily assembled together, the single suction port is drilled in the temporarily-assembled state, the assembled components are disassembled into each component, and then, the rotary compressor including these components is assembled in the given order. Thus, the concentricity of the suction port after assembly can be easily ensured, and the difficulty in providing the single suction port for the separate components can be overcome.

{Advantageous Effects of Invention}

[0019] According to the rotary compressor of the present invention, the rotary compressor can be assembled in the manner similar to that of the typical two-cylinder rotary compressor including the two upper and lower cylinder chambers divided by the separator plate. Even if the cylinder widths (the cylinder thicknesses) of the upper and lower cylinders respectively forming the upper and lower cylinder chambers are sufficiently reduced, no limitations are imposed on the suction port diameter and the suction pipe diameter. The single suction port having such a large diameter that the suction pressure loss does not increase can be provided to extend across the three components including the upper cylinder, the separator plate, and the lower cylinder to communicate with the upper and lower cylinder chambers. Thus, the two-cylinder rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability without the need for configuring the drive shaft as a divided structure and integrally forming the upper and lower cylinders.

[0020] Moreover, according to the rotary compressor of the present invention, the rotary compressor can be assembled in a manner similar to that of the typical single-cylinder rotary compressor including the single cylinder chamber. Even if the width (the thickness) of the cylinder forming the single cylinder chamber is sufficiently reduced, no limitations are imposed on the suction port diameter and the suction pipe diameter. The single suction port having such a large diameter that the suction pressure loss does not increase can be provided to extend across the three components including the upper bearing, the cylinder, and the lower bearing to communicate with the single cylinder chamber. Thus, the single-cylinder rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability.

[0021] Further, according to the rotary compressor manufacturing method of the present invention, even if the width (the thickness) of the cylinder forming each cylinder chamber is sufficiently reduced, no limitations are imposed on the suction port diameter. The single suction port having such a large diameter that the suction pressure loss does not increase can be provided to extend across the plurality of components to communicate with each cylinder chamber. Thus, the rotary compressor can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability.

[0022] Even in the case where the single suction port is provided to extend across the plurality of components, the rotary compressor is assembled as follows: after the plurality of components forming each cylinder chamber have been temporarily assembled together, the single suction port is drilled in the temporarily-assembled state, the assembled components are disassembled into each component, and then, the rotary compressor including these components is assembled in the given order. Thus, the concentricity of the suction port after assembly can be easily ensured, and the difficulty in providing the single suction port for the separate components can be overcome.

{Brief Description of Drawings}

[0023]

{Fig. 1}

FIG. 1 is a longitudinal sectional view of a main portion of a rotary compressor of a first embodiment of the present invention;

{Fig. 2}

FIG. 2 is a schematic perspective view of a suction port structure of the rotary compressor;

{Fig. 3}

FIG. 3 is an exploded perspective view of FIG. 2;

{Fig. 4}

FIG. 4 is a schematic perspective view of a suction port structure of a rotary compressor of a second embodiment of the present invention;

{Fig. 5}

FIG. 5 is an exploded perspective view of FIG. 4;

{Fig. 6}

FIG. 6 is a schematic perspective view of a suction port structure of a rotary compressor of a third embodiment of the present invention; and

{Fig. 7}

FIG. 7 is an exploded perspective view of FIG. 6.

{Description of Embodiments}

[0024] Embodiments of the present invention will be described below with reference to drawings.

[First Embodiment]

[0025] A first embodiment of the present invention will be described below with reference to FIGS. 1 to 3.

[0026] FIG. 1 is a longitudinal sectional view of a rotary compressor of the first embodiment of the present invention, FIG. 2 is a schematic perspective view of a suction port structure of such a rotary compressor, and FIG. 3 is an exploded perspective view of FIG. 2.

[0027] The rotary compressor 1 of the present embodiment is a rotary compressor when the present invention is applied to a multi-cylinder rotary compressor, and a two-cylinder closed rotary compressor 1 including two cylinders will be described herein as an example.

[0028] The rotary compressor 1 includes a cylindrical closed housing 2, and is configured such that a rotary compression mechanism 8 driven via a drive shaft (a crank shaft) 3 by a not-shown electric motor provided on an upper side in the closed housing 2 is placed on a lower side in the closed housing 2. The drive shaft (the crank shaft) 3 is, at an upper portion thereof, coupled to a rotor of the electric motor such that the electric motor rotatably drives the drive shaft 3. At a lower portion of the drive shaft 3, an upper eccentric shaft portion (a crank portion) 4 and a lower eccentric shaft portion (a crank portion) 5 are provided respectively at two upper and lower points to shift from each other by a phase of 180° with a predetermined spacing between these portions. The drive shaft 3 is provided with an intermediate shaft portion 6 provided between the upper and lower eccentric shaft portions 4, 5, and is also provided with a bearing support 7 extending downward from a lower portion of the lower eccentric shaft portion 5.

[0029] The rotary compression mechanism 8 includes an upper cylinder 10 forming an upper cylinder chamber 9 corresponding to the upper eccentric shaft portion 4, a lower cylinder 12 forming a lower cylinder chamber 11 corresponding to the lower eccentric shaft portion 5, a separator plate 13 dividing between the upper cylinder 10 and the lower cylinder 12, an upper bearing 14 provided on the upper surface of the upper cylinder 10, and a lower bearing 15 provided on the lower surface of the lower cylinder 12. An upper rotor 16 rotatably fitted onto the upper eccentric shaft portion 4 is rotatable in the upper cylinder chamber 9, and a lower rotor 17 rotatably fitted onto the lower eccentric shaft portion 5 is rotatable in the lower cylinder chamber 11. Note that the separator plate 13 is provided with a through-hole 18 through which the drive shaft 3 passes.

[0030] The upper cylinder chamber 9 forms a closed space formed in such a manner that the upper and lower sides of the upper cylinder 10 are closed by the upper bearing 14 and the separator plate 13. The lower cylinder chamber 11 forms a closed space formed in such a manner that the upper and lower sides of the lower cylinder 12 are closed by the lower bearing 15 and the separator plate 13. As well known, each of the upper and lower cylinder chambers 9, 11 is fitted into a vane groove pro-

vided at a corresponding one of the upper and lower cylinders 10, 12 to slide in a radial direction. Each of the upper and lower cylinder chambers 9, 11 is divided into a suction side and a discharge side by a vane pressed, at a tip end portion thereof, against the outer peripheral surface of a corresponding one of the upper and lower rotors 16, 17 by a vane presser spring.

[0031] The upper bearing 14 and the lower bearing 15 rotatably support the drive shaft 3 at the portion above the upper eccentric shaft portion 4 and the bearing support 7 extending downward from the lower portion of the lower eccentric shaft portion 5. In the present embodiment, the upper bearing 14 is, by, e.g., plug welding, fixed to the inner peripheral surface of the closed housing 2 at plural points. The upper cylinder 10, the lower cylinder 12, the separator plate 13, the lower bearing 15, etc. are integrally fastened and fixed to the upper bearing 14 with a plurality of bolts/nuts 19. Thus, the rotary compression mechanism 8 is fixed and placed in the closed housing 2.

[0032] In the present embodiment, the upper bearing 14 is fixed and placed in the closed housing 2, and other components are integrally fastened and fixed to the upper bearing 14. In this manner, the rotary compression mechanism 8 is fixed and placed in the closed housing 2. One or both of the upper cylinder 10 and the lower cylinder 12 may be fixed and placed in the closed housing 2, and other components may be fixed to the upper cylinder 10 and/or the lower cylinder 12. In this manner, the rotary compression mechanism 8 may be fixed and placed in the closed housing 2.

[0033] A cover 22, 23 forming a discharge chamber 20, 21 into which high-pressure gas compressed in a corresponding one of the upper and lower cylinders 10, 12 is discharged is fastened and fixed to the outer surface of a corresponding one of the upper and lower bearings 14, 15 with the bolts/nuts 19. The high-pressure gas discharged into the discharge chamber 20, 21 is discharged into the closed housing 2, and then, is discharged to the outside of the compressor from the upper side of the closed housing 2.

[0034] The rotary compression mechanism 8 configured as described above is not basically different from a compression mechanism of a well-known two-cylinder rotary compressor. The compression mechanism of the typical two-cylinder rotary compressor generally has the following configuration: a suction port for an upper cylinder chamber 9 provided at an upper cylinder 10 and a suction port for a lower cylinder chamber 11 provided at a lower cylinder 12 are separately provided at the upper cylinder 10 and the lower cylinder 12, and two suction pipes branched at an accumulator are separately connected to the suction ports. In the present embodiment, a refrigerant gas suction system for the two upper and lower cylinder chambers 9, 11 is configured as follows.

[0035] As described above, the two upper and lower cylinder chambers 9, 11 are formed in such a manner that the upper bearing 14, the upper cylinder 10, the separator plate 13, the lower cylinder 12, and the lower bear-

ing 15 are fastened and fixed together in a close contact state, and a single suction port 24 extending across three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12 is provided to communicate with the upper cylinder chamber 9 and the lower cylinder chamber 11. A suction pipe 25 is connected to the suction port 24 so that refrigerant gas having passed through an accumulator can be simultaneously sucked into the above-described three components.

[0036] Since the single suction port 24 is, as described above, drilled to extend across the three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12, the suction port 24 having a flow path cross-sectional area with a sufficiently-large diameter can be drilled without limitations due to the cylinder widths (the cylinder thicknesses) of the upper and lower cylinders 10, 12, as clearly seen from FIGS. 2 and 3. That is, even if the thicknesses of the upper and lower cylinders 10, 12 are reduced to increase the efficiency of the rotary compressor 1, the large-diameter suction port 24 can be provided to reduce or prevent a suction pressure loss at the suction port 24 and the suction pipe 25 without reducing the diameter of the suction port and expanding the suction port into, e.g., a special elongated hole.

[0037] In the case where the single suction port 24 is, as described above, provided to extend across the three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12, part of the suction port 24 is separately provided at each component. After each component has been separately processed, these components are integrally joined together to form the single suction port 24. In this case, it is difficult to ensure the concentricity of the suction port 24. However, such concentricity can be easily ensured in the following manner: after the above-described three components have been temporarily assembled together as illustrated in FIG. 2, the single suction port 24 is drilled by mechanical processing in such an assembled state, the assembly of the components is disassembled into each component, and then, the rotary compressor 1 including these three components is assembled in a given order.

[0038] According to the present embodiment described above, the following features and advantageous effects are provided.

[0039] In the rotary compressor 1 described above, low-pressure refrigerant gas sucked into the upper cylinder chamber 9 and the lower cylinder chamber 11 from the suction pipe 25 through the suction port 24 is compressed in such a manner that the drive shaft 3 is rotatably driven to eccentrically rotate the upper rotor 16 and the lower rotor 17 on the inner peripheral surfaces of the upper cylinder chamber 9 and the lower cylinder chamber 11. Then, the gas compressed to a set pressure is discharged into the upper and lower discharge chambers 20, 21 through a not-shown discharge valve and a not-shown discharge port, and then, is discharged into the closed housing 2. Thereafter, such gas is sent from an

upper portion of the closed housing 2 to the outside of the compressor (a refrigeration cycle).

[0040] In such a multi-cylinder rotary compressor, a leakage loss can be reduced by reduction in the cylinder width (the cylinder thickness) as described above. However, due to such reduction in the cylinder width, there are limitations on a suction port diameter and a suction pipe diameter. Thus, the efficiency is lowered due to an increase in the suction pressure loss. In the present embodiment, the two upper and lower cylinder chambers 9, 11 are formed by the upper cylinder 10, the separator plate 13, the lower cylinder 12, the upper bearing 14, and the lower bearing 15. The single suction port 24 communicating with the upper cylinder chamber 9 and the lower cylinder chamber 11 is, as illustrated in FIGS. 2 and 3, provided to extend across the three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12.

[0041] Thus, the rotary compressor 1 can be assembled in the manner similar to that of the typical two-cylinder rotary compressor including the two upper and lower cylinder chambers 9, 10 divided by the separator plate 13. Even if the cylinder widths (the cylinder thicknesses) of the upper and lower cylinders 10, 12 respectively forming the upper and lower cylinder chambers 9, 11 are sufficiently reduced, no limitations are imposed on the diameter of the suction port 24 and the diameter of the suction pipe 25. The single suction port 24 having such a large diameter that the suction pressure loss does not increase can be provided to extend across the three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12 to communicate with the upper cylinder chamber 9 and the lower cylinder chamber 11.

[0042] Consequently, the two-cylinder rotary compressor 1 can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability without the need for configuring the drive shaft 3 as a divided structure and integrally configuring the upper and lower cylinders.

[0043] Even in the case where the single suction port 24 is provided to extend across the three components including the upper cylinder 10, the separator plate 13, and the lower cylinder 12 as described above, the following method is used: after the above-described three components have been temporarily assembled together as illustrated in FIG. 2, the suction port 24 is drilled by, e.g., mechanical processing in such an assembled state, the assembly of the components is disassembled into each component, and then, the rotary compressor including these three components is assembled in a given order. Thus, the concentricity of the suction port 24 after assembly can be easily ensured, and the difficulty in providing the single suction port 24 for the three separate components can be overcome.

[Second Embodiment]

[0044] Next, a second embodiment of the present invention will be described with reference to FIGS. 4 and 5.

[0045] The present embodiment is different from the first embodiment described above in that a suction port 34 is provided to extend across five components including an upper bearing 14 and a lower bearing 15. The present embodiment is similar to the first embodiment on the other points, and therefore, description thereof will not be repeated.

[0046] In the present embodiment, the single suction port 34 is provided to extend across the five components including the upper bearing 14 and the lower bearing 15 in addition to an upper cylinder 10, a separator plate 13, and a lower cylinder 12, as illustrated in FIGS. 4 and 5.

[0047] Since the single suction port 34 is provided to extend across the above-described five components, a rotary compressor 1 is assembled as follows: after the five components including the upper cylinder 10, the separator plate 13, the lower cylinder 12, the upper bearing 14, and the lower bearing 15 have been temporarily assembled as illustrated in FIG. 4, the suction port 34 is drilled by, e.g., mechanical processing in such an assembled state, the assembly of the components is disassembled into each component as illustrated in FIG. 5, and then, the rotary compressor 1 including the five components is assembled in a given order. As a result, the two-cylinder rotary compressor 1 can be manufactured, which includes the single larger-diameter suction port 34 communicating with the two upper and lower cylinder chambers 9, 11.

[0048] Thus, as in the first embodiment, the two-cylinder rotary compressor 1 can be also provided in the present embodiment, the rotary compressor 1 exhibiting a high efficiency without efficiency and performance lowering due to a suction pressure loss and being easily manufactured with favorable assemblability without the need for configuring a drive shaft 3 as a divided structure and integrally configuring the upper and lower cylinders. Moreover, the concentricity of the suction port 34 after assembly can be easily ensured, and the difficulty in providing the single suction port 34 for the five separate components can be overcome.

[Third Embodiment]

[0049] Next, a third embodiment of the present invention will be described with reference to FIGS. 6 and 7.

[0050] The present embodiment is different from the first and second embodiments described above in that a cylinder is applied to a single-cylinder rotary compressor 1. The present embodiment is similar to the first embodiment on other points, and description thereof will not be repeated.

[0051] The rotary compressor 1 of the present embodiment is a single-cylinder rotary compressor including a single cylinder. As illustrated in FIGS. 6 and 7, the single-

cylinder rotary compressor 1 includes the single cylinder 40 forming a cylinder chamber 41. The single cylinder 40 is disposed such that the upper and lower surfaces thereof closely contact respectively with upper and lower bearings 14, 15. Thus, the cylinder chamber 41 as a closed space is formed.

[0052] Note that in the case of the single-cylinder rotary compressor 1, a single eccentric shaft portion (e.g., only an upper eccentric shaft portion 4) is provided corresponding the single cylinder 40 at a drive shaft 3, and a single rotor (e.g., only a rotor 16) is fitted onto the eccentric shaft portion 4. Needless to say, a discharge chamber may be provided on any of upper and lower sides.

[0053] A single large-diameter suction port 44 extending across three components including an upper bearing 14, the cylinder 40, and a lower bearing 15 is provided to communicate with the single cylinder chamber 41 formed by the three components including the upper bearing 14, the cylinder 40, and the lower bearing 15.

[0054] As in the first and second embodiments, even in the case where the single suction port 44 is provided to extend across the three components including the upper bearing 14, the cylinder 40, and the lower bearing 15, drilling may be performed with these three components being temporarily assembled together as illustrated in FIG. 6, and then, the assembly of the components may be disassembled into each component. Subsequently, the rotary compressor 1 including these three components may be assembled in a given order.

[0055] As described above, in the single-cylinder rotary compressor 1, the single cylinder chamber 41 is formed by the single cylinder 40, the upper bearing 14, and the lower bearing 15, and the single suction port 44 communicating with the single cylinder chamber 41 is provided to extend across the three components including the upper bearing 14, the cylinder 40, and the lower bearing 15. Thus, such a rotary compressor 1 can be assembled in the manner similar to that of a typical single-cylinder rotary compressor 1 including a single cylinder chamber 41. Even if the width of the cylinder 40 forming the single cylinder chamber 41 is sufficiently reduced, no limitations are imposed on the diameter of the suction port 44 and the diameter of a suction pipe 25. The single suction port 44 having such a large diameter that a suction pressure loss does not increase can be provided to extend across the three components including the upper bearing 14, the cylinder 40, and the lower bearing 15 to communicate with the cylinder chamber 41.

[0056] With this configuration, as in the first and second embodiments, the single-cylinder rotary compressor 1 can be provided, which exhibits a high efficiency without efficiency and performance lowering due to the suction pressure loss and which is easily manufactured with favorable assemblability. Moreover, even in the case where the single suction port 44 is, as described above, provided to extend across the three components including the cylinder 40, the upper bearing 14, and the lower bearing 15, the method for performing drilling with these

components being temporarily assembled together is used. Thus, the concentricity of the suction port 44 after assembly can be easily ensured, and the difficulty in providing the single suction port 44 for the three separate components can be overcome.

[0057] Note that the present invention is not limited to the aspects of the above-described embodiments, and modifications can be optionally made without departing from the scope of the present invention. For example, the example where the upper bearing 14 is, using the plug welding, fixed and placed in the closed housing 2 has been described in the above-described embodiments, but other welding than the plug welding or swaging may be used to fix and place the upper bearing 14. Moreover, in the case of fastening and fixing other components to the fixed upper bearing 14 and the cylinders 10, 12, 40 in the closed housing 2, through-bolts are not necessarily used, and as necessary, each component may be separately fixed and placed with, e.g., bolts.

[0058] In each of the above-described embodiments, when the single suction port 24, 34, 44 is drilled with the plurality of components being temporarily assembled together, such processing may be performed in the state in which the components are appropriately and temporarily assembled together with, e.g., a clamping tool.

{Reference Signs List}

[0059]

1	rotary compressor
3	drive shaft
4	upper eccentric shaft portion
5	lower eccentric shaft portion
9	upper cylinder chamber
10	upper cylinder
11	lower cylinder chamber
12	lower cylinder
13	separator plate
14	upper bearing
15	lower bearing
16	upper rotor
17	lower rotor
24, 34, 44	suction port
40	cylinder
41	cylinder chamber

Claims

1. A rotary compressor (1) comprising:

a drive shaft (3) configured such that eccentric shaft portions (4,5) are, at two upper and lower points, provided with a predetermined spacing in an axial direction;
upper and lower cylinders (10,12) each forming a corresponding one of upper and lower cylinder

chambers (9,11) corresponding to the respective eccentric shaft portions (4,5);
 a separator plate (13) provided between the upper and lower cylinders (10,12) to closely contact the upper and lower cylinders (10,12);
 upper and lower bearings (14,15) each provided to closely contact a corresponding one of an upper surface of the upper cylinder (10) and a lower surface of the lower cylinder (12); and
 upper and lower rotors (16,17) each fitted onto a corresponding one of the eccentric shaft portions (4,5) and each configured to rotate in a corresponding one of the upper and lower cylinder chambers (9,11),
 wherein a single suction port (24) communicating with the upper and lower cylinder chambers (9,11) is provided to extend across three components including the upper cylinder (10), the separator plate (13), and the lower cylinder (12).

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2. The rotary compressor (1) according to claim 1, wherein
 the single suction port (24) is provided to extend across five components including the upper and lower bearings (14,15) in addition to the three components including the upper cylinder (10), the separator plate (13), and the lower cylinder (12).

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3. A rotary compressor (1) comprising:

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a drive shaft (3) configured such that an eccentric shaft portion (4) is provided at a predetermined position in an axial direction;
 a cylinder (10) forming a single cylinder chamber (9) corresponding to the eccentric shaft portion (4);
 upper and lower bearings (14,15) each provided to closely contact a corresponding one of upper and lower surfaces of the cylinder (10); and
 a rotor (16) fitted onto the eccentric shaft portion (4) and configured to rotate in the cylinder chamber (9),
 wherein a single suction port (24) communicating with the single cylinder chamber (9) is provided to extend across three components including the upper bearing (14), the cylinder (10), and the lower bearing (15).

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4. A method for manufacturing the rotary compressor (1) of any one of claims 1 to 3, comprising:

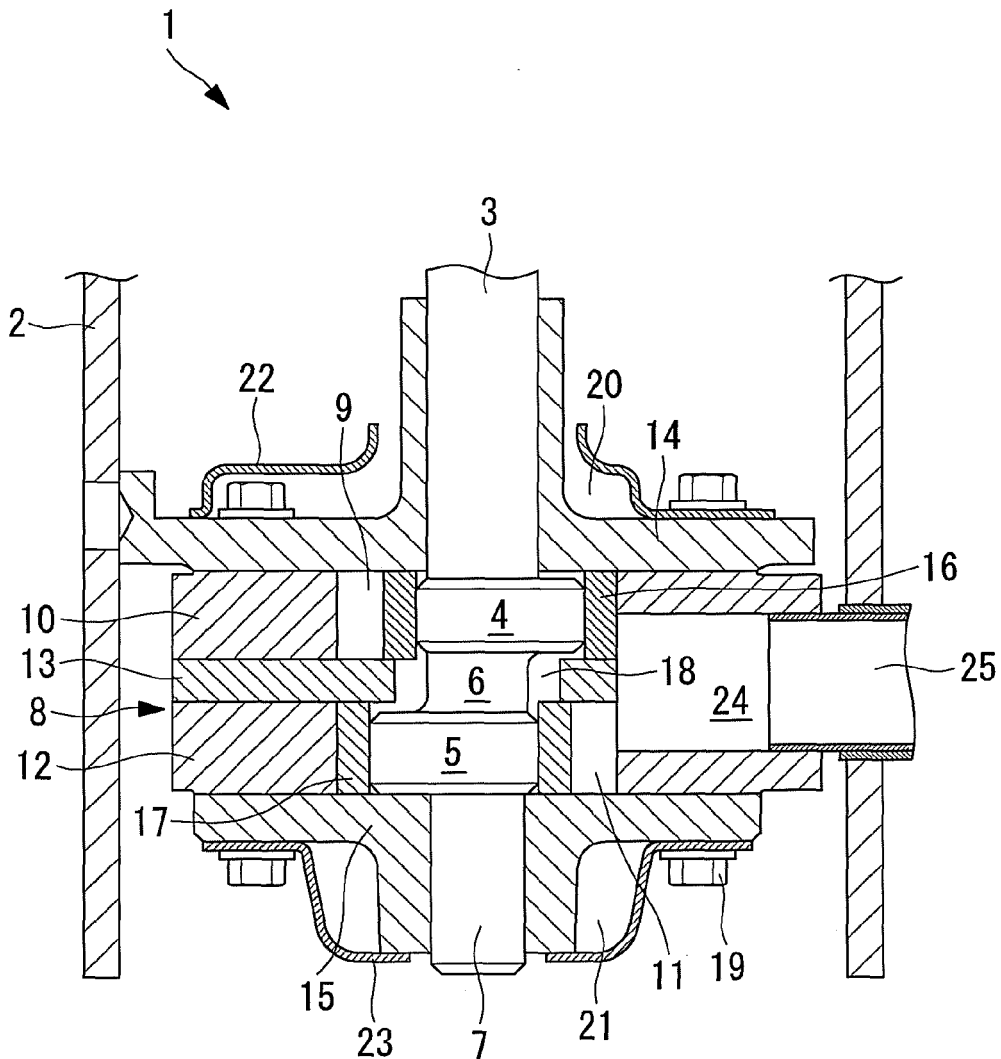
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a step of temporarily assembling the three or five components forming the plurality of cylinder chambers (9,11) or the three components forming the single cylinder chamber (9);
 a step of drilling the single suction port (24) across the plurality of components in a temporarily-assembled state;

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a step of disassembling the plurality of components into each component after drilling of the suction port (24); and
 a step of assembling, in a given order, the rotary compressor (1) including the plurality of components.

FIG. 1



- 1 ; ROTARY COMPRESSOR
- 3 ; DRIVE SHAFT
- 4 ; UPPER ECCENTRIC SHAFT PORTION
- 5 ; LOWER ECCENTRIC SHAFT PORTION
- 9 ; UPPER CYLINDER CHAMBER
- 10 ; UPPER CYLINDER
- 11 ; LOWER CYLINDER CHAMBER
- 12 ; LOWER CYLINDER
- 13 ; SEPARATOR PLATE
- 14 ; UPPER BEARING
- 15 ; LOWER BEARING
- 16 ; UPPER ROTOR
- 17 ; LOWER ROTOR
- 24 ; SUCTION PORT

FIG. 2

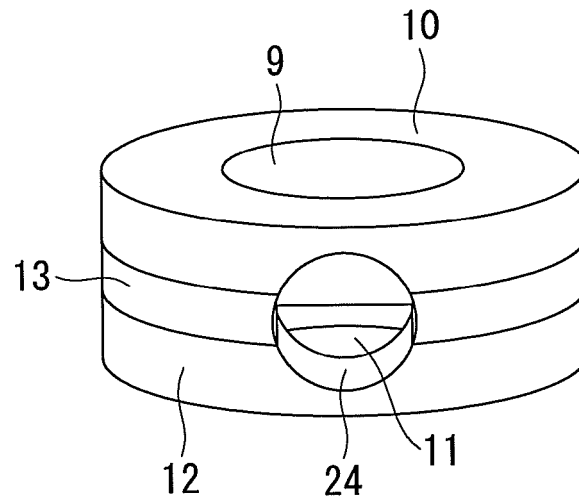


FIG. 3

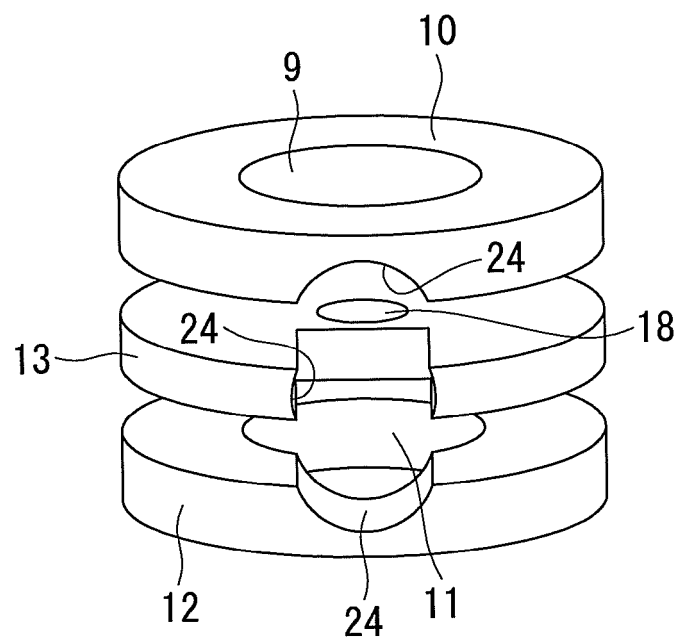


FIG. 4

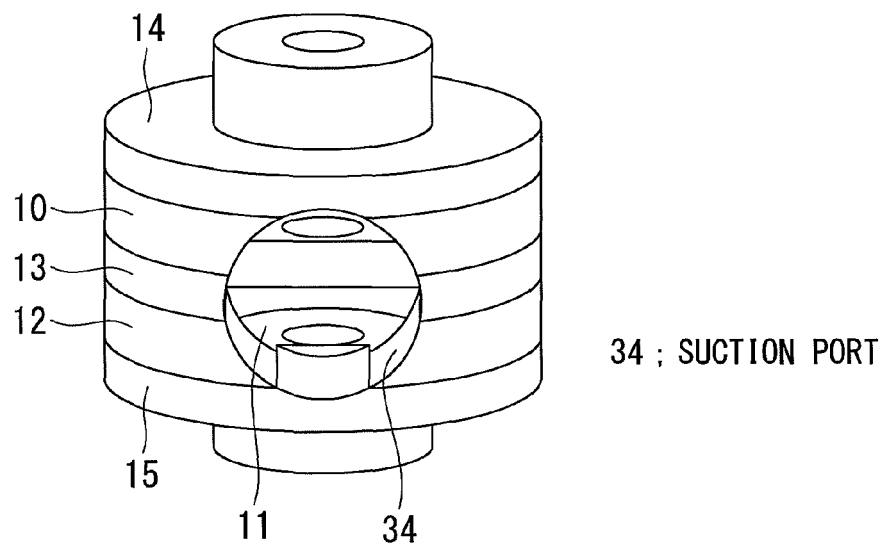


FIG. 5

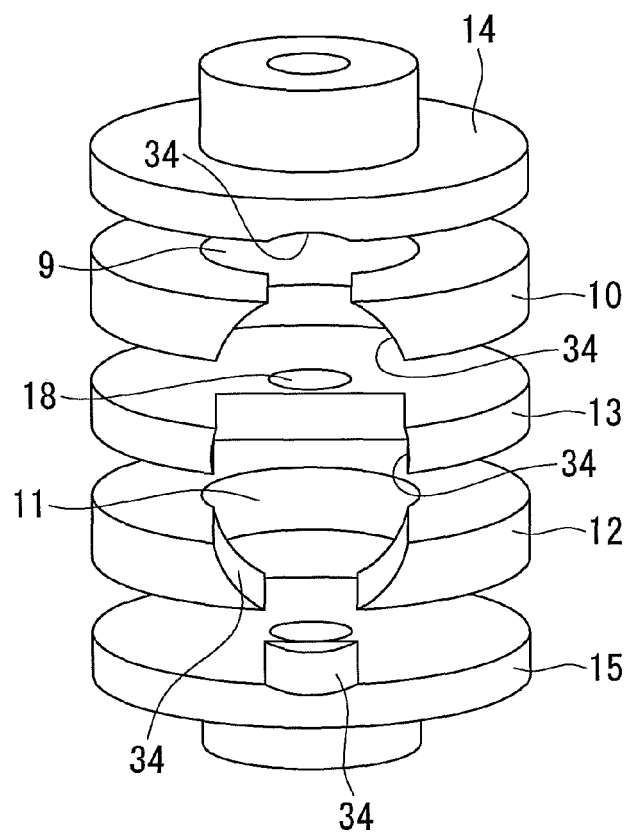


FIG. 6

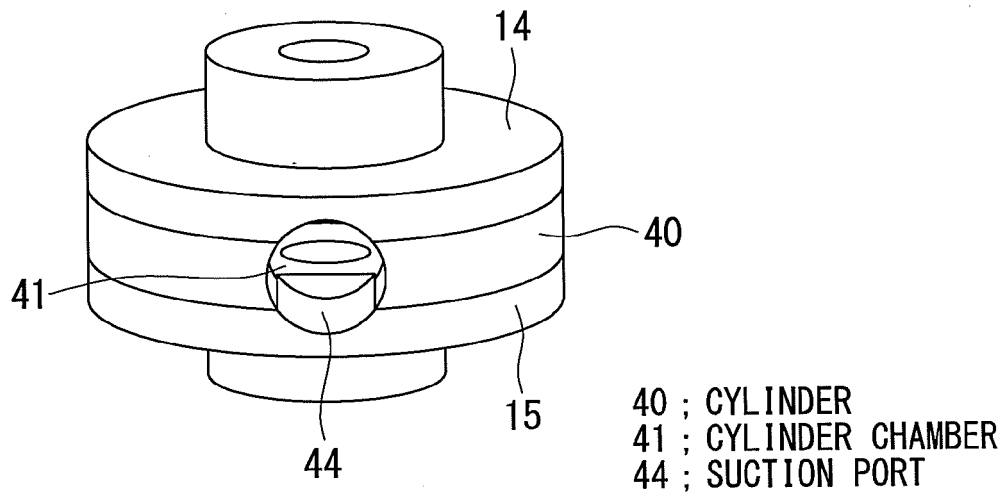
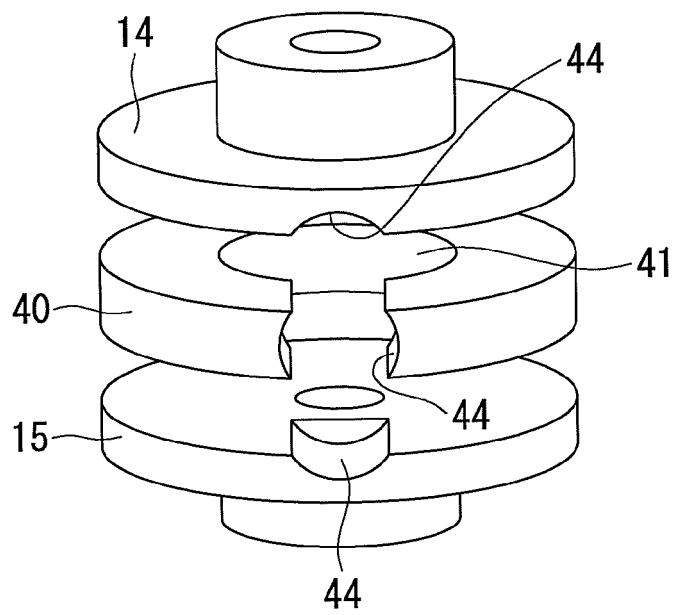


FIG. 7





EUROPEAN SEARCH REPORT

Application Number
EP 16 18 6345

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Place of search		Date of completion of the search	Examiner
Munich		13 December 2016	Durante, Andrea
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