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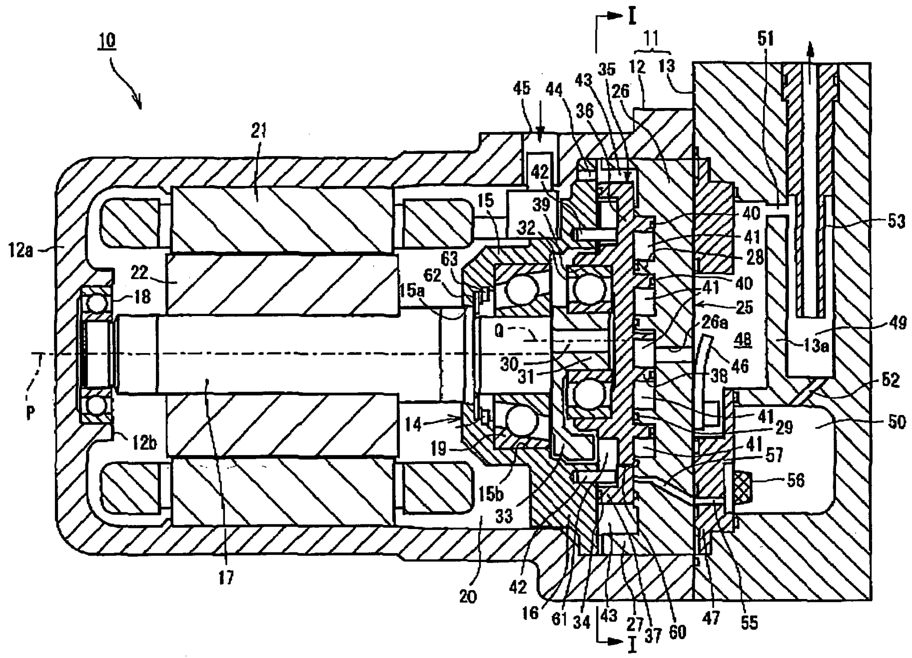
(54) Horizontally-mounted scroll compressor

(57) A horizontally-mounted scroll compressor includes a first annular seal member (34,90,101,102,103,105) which is provided between a movable base plate and a slide-contact body (14,74) for sealing between a back-pressure region (61,82a) and a suction-pressure region (20,43,75,86). The first seal member has a plurality of first groove portions (34a-d) which connect the back-pressure region to the suction-pressure region. The shortest distance along a circumference of the first seal member between any two of the first groove portions which are the remotest from each other is set at not less than one-third of a circumferential length of the first seal member.

FIG. 1



EP 1 818 541 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a horizontally-mounted scroll compressor in which a crankshaft of an orbital scroll member extends horizontally, for example, a horizontally-mounted scroll compressor for compressing refrigerant for use in the refrigerant circuit of an air conditioning system.

[0002] Conventional horizontally-mounted scroll compressors include a fixed scroll member having a fixed base plate which is fixed in the housing thereof and a fixed scroll wall which extends from the front surface of the fixed base plate, and a movable scroll member having a movable base plate and a movable scroll wall which extends from the front surface of the movable base plate. The fixed and movable scroll walls are engaged with each other thereby to define compression chambers therebetween. In such scroll compressor, the fixed base plate has a front wall which is in slide contact with the front surface of the movable scroll member. A shaft support is provided so as to slide relative to the back surface of the movable scroll member, and a back-pressure region is defined on the back side of the movable scroll member. The compression chambers are moved radially inwardly while being reduced in volume by the orbital motion of the movable scroll member, thereby the scroll compressor compressing a compressible fluid.

[0003] In such scroll compressor, the movable scroll member receives a force (or a positive-pressure force) which results from the pressure in the compression chambers and is applied thereto in the thrust direction. As the pressure in the compression chambers rises, the positive-pressure force is increased. Thus, large load acts on the sliding portions of the movable scroll member, and the reliability of the scroll compressor may be damaged.

[0004] Japanese Patent Application Publication No. 2005-180345 discloses a scroll compressor in which an introduction passage is provided for connecting a discharge-pressure region to a back-pressure region. The introduction passage passes through the sliding portion between the movable scroll member and the front wall of the fixed base plate. The clearance at the sliding portion is varied in response to the position of the movable scroll member in the direction in which the movable scroll member moves toward or away from the front wall of the fixed base plate. Thus, the cross-sectional area of the clearance where gas passes is changed to adjust the pressure in the back-pressure region.

[0005] For example, when the pressure in the compression chambers falls, and the positive-pressure force applied to the movable scroll member becomes lower than a back-pressure force which results from the pressure in the back-pressure chamber and acts in the thrust direction. Thereby, the movable scroll member is moved toward the front wall of the fixed base plate. Thus, the clearance at the sliding portion between the movable scroll member and the front wall of the fixed scroll member becomes minimum, thereby preventing the refrigerant gas from being introduced from the discharge-pressure region to the back-pressure region. As a result, the pressure in the back-pressure chamber tends to fall.

[0006] On the other hand, when the pressure in the compression chambers rises and the positive-pressure force applied to the movable scroll member exceeds the back-pressure force, the movable scroll member is moved away from the front wall of the fixed scroll member. Thus, the clearance between the movable scroll member and the front wall of the fixed scroll member becomes maximum, thereby promoting the refrigerant gas to be introduced from the discharge-pressure region to the back-pressure region therethrough. As a result, the pressure in the back-pressure region tends to rise.

[0007] As to another conventional art, Japanese Patent Application Publication No. 8-121366 discloses a vertical-mounted scroll compressor in which a seal member is provided dividing the back-pressure region in the housing into two spaces. The seal member has a groove for supplying lubricating oil to the sliding portion between the fixed and movable scroll members. The quantity of the lubricating oil supplied to the sliding portion is adjusted by changing the number, the width and the depth of the groove.

[0008] In the horizontally-mounted scroll compressor of Japanese Patent Application Publication No. 2005-180345, the atmosphere in the back-pressure region and the suction-pressure region may be changed into liquid state or mist state or remain in gas state. In other words, the atmosphere in the back-pressure region and the suction-pressure region may be unevenin the vertical direction. Generally, the atmosphere in the upper area of the back-pressure region and the suction-pressure region tends to be in gas state, and the lower area of the regions tends to be liquid state or mist state. When the atmosphere in the back-pressure region and the suction-pressure region is uneven, the back pressure in the back-pressure region may not respond to the discharge pressure as intended, and becomes excessive or insufficient. When the back pressure in the back-pressure region is excessive, frictional force at the sliding portion is increased and hence power loss of the compressor is increased. When the back pressure in the back-pressure region is insufficient, the refrigerant tends to leak from the compression chambers, causing poor compression. Thus, the performance of the compressor deteriorates.

[0009] A passage may be provided between the back-pressure region and the suction-pressure region for controlling the back pressure. When the passage is located only at the lower area or adjacent to the lower area of the above regions, however, the passage may be clogged with liquid such as lubricating oil, refrigerant liquid or the like. Thus, frictional force at the sliding portion may be increased, and poor compression is caused. Therefore, when the atmosphere in the back-pressure region and the suction-pressure region is uneven, an intended back pressure may not be set in the conventional horizontally-mounted scroll compressor.

[0010] The scroll compressor of Japanese Patent Application Publication No. 8-121366 includes the seal member with the groove. However, the scroll compressor is of vertical-mounted type and does not cause such a problem concerning the atmosphere in the back-pressure region and the suction-pressure region as in the horizontally-mounted scroll compressor. In addition, the groove of the seal member does not connect the back-pressure region to the suction-pressure region, and Japanese Patent Application Publication No. 8-121366 does not disclose the idea of controlling the back pressure in the back-pressure region by using the groove of the seal member.

[0011] The present invention is directed to a horizontally-mounted scroll compressor which provides an intended back pressure in a back-pressure region when the atmosphere in each of a back-pressure region and a suction-pressure region is uneven.

SUMMARY OF THE INVENTION

[0012] In accordance with an aspect of the present invention, a horizontally-mounted scroll compressor which includes a housing, a fixed scroll member, a movable scroll member, a compression chamber, a slide-contact body, and a back-pressure region. The housing has a discharge-pressure region and a suction-pressure region. The fixed scroll member has a fixed base plate which is fixed in the housing and a fixed scroll wall which extends from a front surface of the fixed base plate. The movable scroll member has a movable base plate and a movable scroll wall which extends from a front surface of the movable base plate. The fixed and movable scroll walls are engaged with each other. The compression chamber is formed between the fixed and the movable scroll members. The compression chamber is moved radially inwardly while being reduced in volume by orbital motion of the movable scroll member thereby to compress a compressible fluid. The slide-contact body is provided so as to be in slide contact with a back surface of the movable base plate. The back-pressure region is defined in the housing on a back side of the movable base plate and connected to the discharge-pressure region through an introduction passage. A first annular seal member is provided between the movable base plate and the slide-contact body for sealing between the back-pressure region and the suction-pressure region. The first seal member has a plurality of first groove portions which connect the back-pressure region to the suction-pressure region. The shortest distance along a circumference of the first seal member between any two of the first groove portions which are the remotest from each other is set at not less than one-third of a circumferential length of the first seal member.

[0013] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. 1 is a longitudinal cross-sectional view of a horizontally-mounted scroll compressor of a first preferred embodiment according to the present invention;

FIG. 2 is a partially enlarged cross-sectional view of the horizontally-mounted scroll compressor of the first preferred embodiment;

FIG. 3 is a perspective view of a seal member of the first preferred embodiment;

FIG. 4 is a cross-sectional view taken along the line I - I in FIG. 1;

FIG. 5A is a partially enlarged cross-sectional view of the horizantally-maunted scroll compressor of the first preferred embodiment when a gap exists between a movable base plate and a shaft support;

FIG. 5B is a partially enlarged cross-sectional view of the horizontally-mounted scroll compressor of the first preferred embodiment when a gap exists between the movable base plate and a fixed base plate;

FIG. 6 is a partially enlarged cross-sectional view of a horizontally-mounted scroll compressor of a second preferred embodiment according to the present invention;

FIG. 7A is a front view of an annular seal member of an alternative embodiment according to the present invention;

FIG. 7B is a front view of an annular seal member of an alternative embodiment according to the present invention;

FIG. 7C is a front view of an annular seal member of an alternative embodiment according to the present invention; and

FIG. 8 is a perspective view of a groove portion of an annular seal member of an alternative embodiment according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The following will describe a horizontally-mounted scroll compressor of a first preferred embodiment according to the present invention. The horizontally-mounted scroll compressor is used in the refrigerant circuit of a vehicle air conditioning system and hereinafter referred to merely as compressor. Carbon dioxide is used as a compressible fluid in the refrigerant circuit. FIG. 1 is a longitudinal cross-sectional view of the compressor of the first preferred embodiment. FIG. 2 is a partially enlarged cross-sectional view of the compressor. FIG. 3 is a perspective view of an annular seal member. FIG. 4 is a cross-sectional view taken along the line I - I in FIG. 1.

[0016] Referring to FIG. 1, a compressor 10 has a housing 11 including a first housing component 12 and a second housing component 13 which is fixed to the first housing component 12. The first housing component 12 has a cylindrical shape which has a bottom 12a on the left side in FIG. 1. The second housing component 13 is cover-shaped and has a partition 13a which defines a plurality of spaces therein. The opening end of the first housing component 12 is covered with the second housing component 13.

[0017] The first housing component 12 has an annular rib 12b which extends from the center of the inner surface of the bottom 12a. The first housing component 12 accommodates a shaft support 14 adjacently to the opening endof the first housing component 12. The shaft support 14 includes a cylindrical portion 15 and a flange portion 16. The cylindrical portion 15 has a hole 15a and a bearing-receiving portion 15b. The flange portion 16 extends radially from the right end of the cylindrical portion 15 adjacent to the opening of the first housing component 12. The outer periphery of the flange portion 16 is press-fitted to the inner wall of the first housing component 12. Thus, the inner space of the first housing component 12 is divided into two spaces by the shaft support 14.

[0018] The first housing component 12 accommodates a rotary shaft 17. The rotary shaft 17 is rotatably supported at one end thereof by a bearing 18 which is disposed in the rib 12b, and at the other end thereof by a bearing 19 which is disposed in the bearing-receiving portion 15b of the shaft support 14. The inner space of the first housing component 12 adjacent to the bottom 12a provides a motor chamber 20 in which a stator 21 is fixed to the inner surface of the first housing component 12. A rotor 22 is disposed inside the stator 21 and fixed to the rotary shaft 17 in the motor chamber 20. The stator 21 and the rotor 22 form an electric motor of the compressor 10, and electric power is supplied to the stator 21 to rotate the rotor 22 and the rotary shaft 17 integrally.

[0019] A fixed scroll member 25 is accommodated and fixed in the first housing component 12 adjacent to the opening of the first housing component 12 so that it is located closer to the opening of the first housing component 12 than the shaft support 14. A movable scroll member 35 is disposed between the fixed scroll member 25 and the shaft support 14. The fixed scroll member 25 has a disc-shaped fixed base plate 26, an outer peripheral wall 27 and a fixed scroll wall 28. The outer peripheral wall 27 extends from the outer periphery of a front surface (or a left surface in FIG. 1) of the fixed base plate 26. The fixed scroll wall 28 extends from the radially inner portion of the front surface of the fixed base plate 26 inside the outer peripheral wall 27. In this invention, the surface of the fixed base plate 26 which faces the movable scroll member 35 is the front surface of the fixed base plate 26 or the fixed scroll member 25. A seal member 29 is provided on the distal end of the fixed scroll wall 28, and the outer peripheral wall 27 is joined at its distal end to the outer periphery of the flange portion 16 of the shaft support 14.

[0020] A crankshaft 30 is provided on the end of the rotary shaft 17 adjacent to the opening of the first housing component 12 and has an eccentric axis Q which is offset from the axis P of the rotary shaft 17. A bushing 31 is fitted on the crankshaft 30. An inner ring of a bearing 32 is attached to the bushing 31. The movable scroll member 35 is supported on an outer ring of the bearing 32. A balancer 33 is provided on the bushing 31 for alleviating imbalance of the rotary shaft 17 due to the offset arrangement of the movable scroll member 35.

[0021] The movable scroll member 35 has a disc-shaped movable base plate 36, an annular outer peripheral wall 37, a movable scroll wall 38, and a bearing-receiving portion 39 or a boss for receiving therein the bearing 32. The annular outer peripheral wall 37 extends from the outer periphery of a back surface (or a left surface in FIG. 1) of the movable base plate 36. The movable scroll wall 38 extends from a front surface (or a right surface in FIG 1) of the movable base plate 36 and is located radially inward of the outer peripheral wall 37. In this invention, the surface of the movable base plate 36 which faces the fixed scroll member 25 is the front surface of the movable base plate 36 or the movable scroll member 35. A seal member 40 is provided on the distal end of the movable scroll wall 38. The outer peripheral wall 37 is in slide contact at the distal end thereof with the flange portion 16 of the shaft support 14. The shaft support 14 corresponds to a slide-contact body of the invention which is in slide contact with the back surface of the movable scroll member 35. An annular seal member 34 as a first seal member is provided on the distal end of the outer peripheral wall 37 of the movable scroll member 35. The seal member 34 will be described later.

[0022] The movable scroll wall 38 of the movable scroll member 35 and the fixed scroll wall 28 of the fixed scroll member 25 are engaged with each other. The movable scroll wall 38 is in slide contact at the distal end thereof with the fixed base plate 26. The fixed scroll wall 28 is in slide contact at the distal end thereof with the movable base plate 36. Thus, the fixed scroll member 25 and the movable scroll member 35 cooperate to define therebetween compression chambers 41 by the base plates 26 and 36 and the scroll walls 28 and 38. A plurality of pins 42 as a self-rotation blocking means for the movable scroll member 35 are provided between the back surface of the movable base plate 36 and the flange portion 16 of the shaft support 14.

[0023] The outer peripheral wall 27 of the fixed scroll member 25, the outer peripheral wall 37 of the movable scroll member 35 and the flange portion 16 of the shaft support 14 cooperate to define a suction chamber 43 as a suction-pressure region. The flange portion 16 of the shaft support 14 has a suction passage 44 which connects the motor chamber 20 to the suction chamber 43. The first housing component 12 has an inlet 45 which is in communication with the motor chamber 20 and is connected to the lower pressure side of an external refrigerant circuit. Thus, low-pressure refrigerant gas is introduced from the external refrigerant circuit into the suction chamber 43 through the inlet 45, the motor chamber 20 and the suction passage 44 during operation of the compressor 10. In the first preferred embodiment, the motor chamber 20 and the suction chamber 43 also correspond to the suction-pressure region of the invention.

[0024] A discharge chamber 48, an oil-separation chamber 49 and an oil-collection chamber 50 are defined in the second housing component 13 of the housing 11. The fixed scroll member 25 has at the center thereof a discharge hole 26a. A reed type valve 46 is provided on the fixed base plate 26 adjacent to the opening of the discharge hole 26a which faces the discharge chamber 48. In the first preferred embodiment, a partition member 47 is disposed between the second housing component 13 and the fixed scroll member 25 and defines the discharge chamber 48 and the oil-collection chamber 50 together with the partition 13a. The discharge chamber 48, the oil-separation chamber 49 and the oil-collection chamber 50 are divided by the partition 13a. The partition 13a has a passage 51 which connects the discharge chamber 48 to the oil-separation chamber 49 and a passage 52 which connects the oil-separation chamber 49 to the oil-collection chamber 50.

[0025] An oil separator 53 is provided in the oil-separation chamber 49 for collecting lubricating oil which is contained in the refrigerant gas having a discharge pressure. The oil separator 53 is connected to the high-pressure side of the external refrigerant circuit. The lubricating oil which is collected by the oil separator 53 is introduced into the oil-collection chamber 50 through the passage 52. During the operation of the compressor 10, the high-pressure compressed refrigerant gas is delivered to the external refrigerant circuit through the discharge hole 26a, the discharge chamber 48, the oil-separation chamber 49 and the oil separator 53. The discharge chamber 48, the oil-separation chamber 49 and the oil-collection chamber 50 correspond to the discharge-pressure region of the invention.

[0026] The following will describe the adjustment of the back pressure acting on the movable scroll member 35. As shown in FIG. 2, the partition member 47 has a hole 55 extending therethrough from the oil-collection chamber 50 to the outer periphery of the back surface of the fixed base plate 26. The opening of the hole 55 adjacent to the oil-collection chamber 50 is covered with a filter 56 which serves to remove foreign substances from the lubricating oil flowing from the oil-collection chamber 50 into the hole 55. The fixed base plate 26 has at the outer periphery thereof a hole 57 which is in communication with the hole 55 and extends from the back surface to the front surface of the fixed base plate 26. The fixed base plate 26 has a front wall 26b radially inward of the outer peripheral wall 27. The hole 57 has an opening on the front wall 26b.

[0027] The opening of the hole 57 in the front wall 26b faces the outer periphery of the front surface of the movable base plate 36 of the movable scroll member 35. The outer periphery of the front surface of the movable base plate 36 is in slide contact with the front wall 26b located on the outer periphery of the fixed base plate 26. A slight gap (clearance) is formed between the movable base plate 36 and the front wall 26b of the fixed base plate 26 and allows the movable scroll member 35 to slightly move in the direction of the axis P. As shown in FIG. 2, tip seals 58 and 59 are provided on the front wall 26b of the fixed base plate 26 for sealing between the hole 57 and the suction chamber 43 and between the hole 57 and the compression chamber 41, respectively.

[0028] The movable base plate 36 has a hole 60 which is extended through the movable base plate 36 at the outer periphery of the front surface which faces the front wall 26b. The hole 60 communicates the above gap (clearance) with the back surface of the movable base plate 36. One opening of the hole 60 is located at the front surface of the movable base plate 36, facing the front wall 26b of the fixed base plate 26. The other opening of the hole 60 opened on the back surface of the movable base plate 36 is located radially inward of the outer peripheral wall 37. A space surrounded by the outer peripheral wall 37 of the movable base plate 36 forms a back-pressure chamber 61 as a back-pressure region. The back-pressure chamber 61 is defined by the back surface of the movable base plate 36 and the inner wall surface of the shaft support 14. A shaft-seal member 62 is disposed in the shaft support 14 for sealing between the back-pressure chamber 61 and the motor chamber 20 and held by a retaining ring 63 which is fitted in the inner wall surface of the shaft support 14.

[0029] As described above, an introduction passage includes the hole 55, the hole 57, the slight gap (clearance) between the front wall 26b of the fixed base plate 26 and the movable base plate 36, and the hole 60 to connect the oil-collection chamber 50 to the back-pressure chamber 61. The introduction passage is used for adjusting the back pressure by the discharge pressure.

[0030] The foregoing has described that the distal end of the outer peripheral wall 37 of the movable scroll member 35 is in slide contact with the flange portion 16 of the shaft support 14, and the seal member 34 is provided thereon. The seal member 34 is installed in a groove 37a which is formed in the distal end of the outer peripheral wall 37. The seal member 34 is made of rubber and has four groove portions 34a through 34d as first groove portions which are spaced at regular intervals along the circumference of the seal member 34, that is, at intervals each corresponding to one-fourth of the circumferential length of the seal member 34 as shown in FIG. 3. Preferably, the groove portions are provided under the following conditions. The number of the groove portions is two or more. Among the groove portions, two groove portions, whose direct distance therebetween is the longest, are selected, and the shortest distance along the circumference of the seal member 34 between the selected two groove portions (e.g. the groove portion 34c is the remotest from the groove portion 34a, and the groove portion 34d is the remotest from the groove portion 34b.) is set at not less than one-third of the circumferential length of the seal member 34. The longest distance along the circumference of the seal member 34 therebetween is set at not more than two-thirds of the circumferential length of the seal member 34. Each of the groove portions 34a through 34d is a narrow groove formed in the end surface of the seal member 34 and extending in the radial direction of the seal member 34 for connecting the back-pressure chamber 61 to the suction chamber 43. Each depth of the groove portions 34a through 34d corresponds to the width of the gap between the front wall 26b of the fixed base plate 26 and the movable base plate 36. Each width of the groove portions 34a through 34d is set so that the groove portions 34a through 34d function as a throttle between the back-pressure chamber 61 and the suction chamber 43.

[0031] When the seal member 34 thus formed is installed in the movable scroll member 35, any of the groove portions 34a through 34d faces the upper area of the back-pressure chamber 61 and the suction chamber 43, and any groove portion other than the groove portion faces the lower area thereof. That is, there exist at least one groove which connects the upper areas of the back-pressure chamber 61 and the suction chamber 43, and at least one groove which connects the lower areas of the back-pressure chamber 61 and the suction chamber 43. When the atmosphere in the back-pressure chamber 61 and the suction chamber 43 is uneven, the back pressure is adjusted through the groove portions 34a, 34b and 34d, since the groove portions 34a is located on the upper side where clogging hardly occurs, and the groove portions 34b and 34d are located in the intermediate region as shown in FIG. 4. Thus, the back pressure in the back-pressure chamber 61 can be set as intended. When the movable scroll member 35 orbits in slide contact with the shaft support 14, the seal member 34 may be moved in the groove 37a circumferentially. Despite such movement of the seal member 34, there exist at least one of the groove portions 34a through 34d which connects the upper areas of the back-pressure chamber 61 and the suction chamber 43, and at least one of the groove portions 34a through 34d which connects the lower areas of the back-pressure chamber 61 and the suction chamber 43.

[0032] In the first preferred embodiment, the upper areas of the back-pressure chamber 61 and the suction chamber 43 indicate areas corresponding to one-fourth of the vertical length of the compressor 10 from the top of the compressor 10 which is mounted horizontally. The lower areas of the back-pressure chamber 61 and the suction chamber 43 indicate areas corresponding to one-fourth of the vertical length of the compressor 10. The refrigerant is in gas state in the upper areas of the back-pressure chamber 61 and the suction chamber 43 where the groove portions 34a through 34d of the seal member 34 are hardly clogged with liquid. The refrigerant tends to be in mist state or liquid state in the lower areas of the back-pressure chamber 61 and the suction chamber 43. In addition, the lubricating oil tends to be accumulated therein. Thus, the groove portions 34a through 34d of the seal member 34 in the lower area tends to be clogged with liquid such as the refrigerant liquid and the lubricating oil.

[0033] The following will describe the operation of the compressor 10. When the electric motor of the compressor 10 is supplied with electric power, the rotor 22 is rotated with the rotary shaft 17. As the rotary shaft 17 is rotated, the movable scroll member 35 orbits while blocking its self rotation, thus drawing the refrigerant into the compression chambers 41 and compressing it therein. In the suction process, the low-pressure refrigerant is introduced from the external refrigerant circuit into the suction chamber 43 through the inlet 45, the motor chamber 20 and the suction passage 44. In the compression process, the refrigerant is compressed in the compression chamber 41 by volume reduction of the compression chamber 41. The compressed refrigerant pushes open the check valve 46 and is discharged to the external refrigerant circuit through the discharge hole 26a, the discharge chamber 48, the oil-separation chamber 49 and the oil separator 53. The lubricating oil contained in the refrigerant gas is separated in the oil separator 53 and collected in the oil-collection chamber 50.

[0034] The oil-collection chamber 50 is a part of the discharge-pressure region, and the refrigerant in the oil-collection chamber 50 is introduced into the back-pressure chamber 61 through the introduction passage 55, 57, 60. The pressure (or back pressure) in the back-pressure chamber 61 depends on the balance between an amount of the refrigerant introduced from the oil-collection chamber 50 into the back-pressure chamber 61 through the introduction passage and an amount of the refrigerant flowing out of the back-pressure chamber 61 through the groove portions 34a through 34d.

[0035] The movable scroll member 35 receives an urging force (or a back-pressure force) which results from the back pressure in the back-pressure chamber 61 and is applied thereto in the thrust direction (or in the direction of the axis P) to urge the movable scroll member 35 toward the fixed scroll member 25. The movable scroll member 35 also receives an urging force (or a compression force) which results from the refrigerant pressure in the compression chambers 41 and is applied thereto in the thrust direction to urge the movable scroll member 35 toward the shaft support 14. The back-pressure force and the compression force acts in opposite directions. Thus, the position of the movable scroll member 35 relative to the fixed scroll member 25 in the axial direction depends on the balance between the back-pressure force and the compression force (or a positive-pressure force).

[0036] When the pressure in the compression chamber 41 falls and the compression force becomes lower than the back-pressure force, the movable base plate 36 of the movable scroll member 35 is moved away from the shaft support 14 by the back-pressure force. Thereby, the gap between the front wall 26b of the fixed base plate 26 and the movable scroll member 35 becomes minimum or the gap does not exist. As shown in FIG. 5A, when the gap between the front wall 26b and the movable base plate 36 is minimized, the introduction passage is closed to prevent the refrigerant gas from passing therethrough. Thus, the refrigerant gas having the discharge pressure is not introduced into the back-pressure chamber 61 from the oil-collection chamber 50 . By moving the movable base plate 36 away from the shaft support 14, however, a second gap is formed between the outer peripheral wall 37 of the movable base plate 36 and the shaft support 14. This second gap is formed by minimizing the gap between the fixed base plate 26 and the movable base plate 36 before the movable base plate 36 is moved away from the shaft support 14.

[0037] The seal member 34 is provided between the outer peripheral wall 37 of the movable base plate 36 and the shaft support 14. Thus, the groove portions 34a through 34d connects the back-pressure chamber 61 to the suction chamber 43 even when there is no gap between the outer peripheral wall 37 of the movable base plate 36 and the shaft support 14. Since the pressure in the suction chamber 43 is lower than that in the back-pressure chamber 61, the refrigerant gas in the back-pressure chamber 61 flows out to the suction chamber 43 therethrough while being throttled by the groove portions 34a through 34d. Thus, the back pressure falls and the back-pressure force urging the movable scroll member 35 toward the fixed scroll member 25 is decreased. At this time, the atmosphere may be uneven between the upper and lower areas of the back-pressure chamber 61 and the suction chamber 43, for example, the atmosphere is in gas state in the upper area but is changed into liquid state in the lower area. In this case, even if any of the groove portions 34a through 34d which is located in the lower area may not function as a throttle due to liquid clogging, any other of the groove portions 34a through 34d which is located in the upper area functions as a throttle for adjusting the back pressure in the back-pressure chamber 61.

[0038] When the pressure in the compression chambers 41 rises and the compression force exceeds the back-pressure force, the movable base plate 36 of the movable scroll member 35 is moved away from the fixed base plate 26 by the compression force. Thus, as shown in FIG. 5B, the outer peripheral wall 37 of the movable base plate 36 is brought into contact with the shaft support 14, thereby preventing the refrigerant gas from flowing through between the outer peripheral wall 37 of the movable base plate 36 and the shaft support 14.

[0039] A gap is formed between the front surface of the movable scroll member 35 and the front wall 26b of the fixed scroll member 25. The space or the gap as a part of the introduction passage is formed between the front surfaces of both scroll members 25 and 35 and defined by the tip seals 58 and 59. The refrigerant gas having the discharge pressure is introduced from the oil-collection chamber 50 into the back-pressure chamber 61 through the introduction passage. Thus, the back pressure in the back-pressure chamber 61 rises and the back-pressure force urging the movable scroll member 35 toward the fixed scroll member 25 is increased. The increased back-pressure force reduces the contact pressure between the outer peripheral wall 37 of the movable base plate 36 and the shaft support 14, and hence the frictional force of the movable base plate 36 relative to the shaft support 14 on the back side is reduced. As a result, power loss of the compressor 10 is reduced and the performance of the compressor 10 is improved.

[0040] The increased back-pressure force establishes the stabler and closer contact between the movable scroll member 35 and the fixed scroll member 25 to prevent the refrigerant gas from leaking out of the compression chambers 41. Thus, compression efficiency of the compressor 10 is improved, which contributes to improving the performance of the compressor 10.

[0041] As described above, the movable scroll member 35 changes the size of the gap between the front surface of the movable base plate 36 and the shaft support 14 so that the back-pressure force based on the back pressure in the back-pressure chamber 61 corresponds appropriately to the compression force based on the pressure in the compression chambers 41, thereby adjusting the back pressure in the back-pressure chamber 61. Thus, the sliding resistance due to the orbital motion of the movable scroll member 35 can be reduced, and the sealing performance of the compression chambers 41 can be increased to improve the compression efficiency of the compressor 10.

[0042] The compressor 10 of the preferred embodiment offers the following advantageous effects.

(1) The seal member 34 serves to seal between the back-pressure chamber 61 and the suction chamber 43 while the groove portion 34a through 34d of the seal member 34 connects the back-pressure cham-

ber 61 to the suction chamber 43. The groove portions 34a through 34d function as a throttle, and the refrigerant gas in the back-pressure chamber 61 flows therethrough into the suction chamber 43 in which the pressure is lower than that in the back-pressure region. Thus, the back pressure in the back-pressure chamber 61 is adjusted in response to the discharge pressure. Since a plurality of the groove portions 34a through 34d are formed in the seal member 34, any of the groove portions 34a through 34d appropriately functions as a throttle even when the atmosphere in the back-pressure chamber 61 and the suction chamber 43 is uneven. For example, when the atmosphere in the back-pressure chamber 61 and the suction chamber 43 is in gas state in the upper area and is in liquid state in the lower area, any of the groove portions 34a through 34d which is located in the lower area may be clogged with liquid. Even in this case, any other of the groove portions 34a through 34d which is located in the upper area in which gas exists functions as a throttle. Thus, the back pressure in the back-pressure chamber 61 is appropriately adjusted.

(2) The lubricating oil which is separated by the oil separator 53 is stored in the discharge-pressure region. Thus, the atmosphere in the back-pressure chamber 61 and the suction chamber tends to be uneven. In this situation, it is more advantageous when the back pressure in the back-pressure chamber 61 is set as intended.

(3) The back pressure in the back-pressure chamber 61 can be adjusted merely by using simply the seal member 34 having the groove portions 34a through 34d. In addition, the seal member 34 has simple structure and is easily manufactured.

[0043] The following will describe a compressor of a second preferred embodiment according to the present invention with reference to FIG. 6. The compressor of the second preferred embodiment is a horizontally-mounted scroll compressor similar to that of the first preferred embodiment. In the compressor of the second preferred embodiment, the back-pressure chamber is defined only by the movable scroll member and the shaft support. FIG. 6 is a partially enlarged cross-sectional view of the compressor of the second preferred embodiment.

[0044] The basic structure of the compressor 70 of the second preferred embodiment is the same as that of the first preferred embodiment, and, therefore, the description of the structure of the compressor 70 common to the compressor 10 is not given. Referring to FIG. 6, a cylindrical first housing component 72 with a bottom (not shown) is joined to a cover-like second housing component 73. A space in the first housing component 72 is divided by a shaft support 74, and a divided space in the first housing component 72 on the bottom side is a motor chamber 75.

[0045] A fixed scroll member 76 is accommodated and fixed in the first housing component 72 adjacently to the opening end thereof. The fixed scroll member 76 includes a fixed base plate 77, a fixed scroll wall 78 extending from the front surface (or a left surface in FIG 6) of the fixed base plate 77, and an outer peripheral wall 79 extending from the outer periphery of the front surface of the fixed base plate 77. A discharge chamber 80 as a discharge-pressure region is defined in the second housing component 73 on the back side (or a right side in FIG 6) of the fixed base plate 77. A movable scroll member 81 is disposed between the fixed scroll member 76 and the shaft support 74. The shaft support 74 corresponds to a slide-contact body of the invention which is in slide contact with the back surface of the movable scroll member 81.

[0046] The movable scroll member 81 is supported by a crankshaft (not shown) of a rotary shaft (not shown) so that it can be orbited. The movable scroll member 81 includes a movable base plate 82 and a movable scroll wall 83 extending from the front surface (or a right surface in FIG. 6) of the movable base plate 82. The movable scroll member 81 and the fixed scroll member 76 are engaged with each other thereby to define compression chambers 85 therebetween. A suction chamber 86 as a suction-pressure region is defined between the outer peripheral wall 79 of the fixed base plate 77 and the outer peripheral surface of the movable base plate 82. The suction chamber 86 is connected to the external refrigerant circuit through an inlet 96 which extends through the outer peripheral wall 79 and the first housing component 72.

[0047] The distal end of the movable scroll wall 83 is in slide contact with the front surface of the fixed base plate 77, and a tip seal 87 is provided on the distal end of the movable scroll wall 83. Similarly, the distal end of the fixed scroll wall 78 is in slide contact with the front surface of the movable base plate 82, and a tip seal 88 is provided on the distal end of the fixed scroll wall 78.

[0048] The outer periphery of the front surface of the movable base plate 82, which is located radially outward of the compression chamber 85, is in slide contact with a front wall 77a which is formed in the front surface of the fixed base plate 77. The front wall 77a of the fixed base plate 77 has a recess 77b in which two tip seals 89 are provided at the radially inner and outer peripheries thereof, respectively.

[0049] The outer periphery of the back surface of the movable base plate 82, which is located radially inward of the suction chamber 86, is in slide contact with the shaft support 74. The movable base plate 82 has at the outer periphery of the back surface thereof an annular recess 82a which provides a back-pressure chamber. The back surface of the movable base plate 82 and the shaft support 74 are in slide contact with each other on the radially inner and outer sides of the recess 82a or the back-pressure chamber, and an annular seal member 90 as a first seal member is provided on the back surface of the movable base plate 82 on the radially outer side of the recess 82a.

[0050] The seal member 90 has a plurality of groove portions 90a (or narrow grooves) as first groove portions for connecting the recess 82a to the suction chamber 86. An annular seal member 91 as a second seal member is provided on the shaft support 74 on the radially inner side of the recess 82a. The seal member 91 has a plurality of groove portions 91 a (or narrow grooves) as second groove portions for connecting the recess 82a to the motor chamber 75. Both seal members 90 and 91 have the same structure as seal member 34 of the first preferred embodiment except the size of diameter.

[0051] The fixed base plate 77 has a hole 92 for connecting the discharge chamber 80 to the recess 77b. The opening of the hole 92 on the discharge chamber 80 side is covered with a filter 94. The movable base plate 82 of the movable scroll member 81 has a hole 95 for connecting the recess 77b of the fixed base plate 77 to the recess 82a of the movable base plate 82. That is, an introduction passage which includes the hole 92 and the recess 77b of the fixed base plate 77 and the hole 95 of the movable base plate 82, is provided for connecting the discharge chamber 80 to the recess 82a.

[0052] In operation of the compressor 70 of the second preferred embodiment, the movable scroll member 81 orbits while blocking its self rotation, thus drawing the refrigerant gas into the compression chambers 41and compressing it therein. The movable scroll member 81 receives an urging force (or a back-pressure force) which results from the back pressure in the back-pressure chamber or the recess 82a and is applied thereto in the thrust direction to urge the movable scroll member 81 toward the fixed scroll member 76. The movable scroll member 81 also receives an urging force (or a compression force) which result from the pressure of the refrigerant gas in the compression chambers 85, and is applied to thereto in the thrust direction to urge the movable scroll member 81 toward the shaft support 74.

[0053] When the pressure in the compression chambers 85 falls and the compression force becomes lower than the back-pressure force, the movable base plate 82 of the movable scroll member 81 is moved away from the shaft support 74 by the back-pressure force. Thereby, the gap between the fixed base plate 77 and the movable base plate 82 becomes minimum or does not exist. When the gap between the fixed base plate 77 and the movable base plate 82 does not exist, the introduction passage is closed to prevent the refrigerant gas from passing therethrough. Thus, the refrigerant gas having the discharge pressure is not introduced into the recess 82a from the discharge chamber 80. However, a gap exists between the movable base plate 82 and the shaft support 74 and has the same width as the gap between the fixed base plate 77 and the movable base plate 82 before the movable base plate 82 is moved away from the shaft support 74.

[0054] Since the seal member 90 is provided between the movable base plate 82 and the shaft support 74 on the radially outer side of the recess 82a, when the gap exists between the movable base plate 82 and the shaft support 74, only the groove portions 90a connect the recess 82a to the suction chamber 86. On the radially inner side of the recess 82a, the groove portions 91a of the seal member 91 connects the recess 82a to a space which is in communication with the motor chamber 75. Since the pressure in the suction chamber 86 and the motor chamber 75 is lower than that in the recess 82a, the refrigerant gas in the recess 82a is throttled by the groove portions 90a and 91a while flowing out to the suction chamber 86 and the motor chamber 75 therethrough. Thus, the back pressure falls and the back-pressure force urging the movable scroll member 81 toward the fixed scroll member 76 is decreased. At this time, when the atmosphere is in gas state in the upper area, and is in liquid state in the lower area, any of the groove portions 90a and 91a of the seal members 90 and 91 which is located in the lower area may not function as a throttle due to liquid clogging. However, any other of the groove portions 90a and 91 a which is located in the upper area function as a throttle for adjusting the back pressure in the recess 82a.

[0055] On the other hand, when the pressure in the compression chambers 85 rises and the compression force exceeds the back-pressure force, the movable base plate 82 of the movable scroll member 81 is moved away from the fixed base plate 77 by the compression force. Thus, the movable base plate 82 is brought into contact with the shaft support 74, thereby preventing the refrigerant gas from flowing through between the outer peripheral wall of the movable base plate 82 and the shaft support 74. However, a gap exists between the front surface of the movable scroll member 81 and the front surface of the fixed scroll member 76. At this time, the gap as a part of the introduction passage is formed in the recess 77b between the front surfaces of the both scroll members 76 and 81 and defined by the tip seals 89, and the refrigerant gas having the discharge pressure is introduced into the recess 82a through the introduction passage. Thus, the back pressure in the recess 82a rises and the back-pressure force urging the movable scroll member 81 toward the fixed scroll member 76 is increased.

[0056] The increased back-pressure force reduces the contact pressure between the outer peripheral wall of the movable base plate 82 and the shaft support 74 and hence the frictional force of the movable base plate 82 relative to the shaft support 74 on the back side is reduced. In addition, the increased back-pressure force establishes stable and close contact of the movable scroll member 81 with the fixed scroll member 76 to prevent the refrigerant gas from leaking out of the compression chambers 85.

[0057] The compressor 70 of the second preferred embodiment offers the same advantageous effects as mentioned in the paragraph (1) in the first preferred embodiment. In addition, since the recess 82a as a back-pressure region is formed between the seal members 90 and 91 having the groove portions 90a and 91a, the back pressure in the back-pressure chamber can be more reliably set as intended.

[0058] The following will describe alternative embodiments of the seal member. In the first preferred embodiment, the four groove portions 34a through 34d are spaced at regular intervals along the circumference of the seal member 40. In an alternative embodiment as shown in FIG. 7A, an annular seal member 101 has three groove portions (narrow grooves) 101 a through 101 c which are spaced at regular intervals along the circumference of the seal member 101. A distance along the circumference of the seal member 101 between any two of groove portions 101 a through 101 c which are adjacent to each other is one-third of the circumferential length of the seal member 101. According to the arrangement of the groove portions 101a through 101c, for example, when the groove portion 101a is located in the upper area, the groove portions 101b and 101c are located in the lower area. In this case, since the groove portion 101 a and the groove portions 101b and 101c are respectively located in the upper and lower areas, controlling the back pressure is less adversely affected by the uneven atmosphere in the back-pressure chamber and the suction chamber.

[0059] In another alternative embodiment as shown in FIG. 7B, an annular seal member 102 has five groove portions 102a through 102e. The groove portions 102a through 102e are spaced at irregular intervals along the circumference of the seal member 102.For example, the shortest distance along the circumference of the seal member 102 between the groove portion 102a and the groove portion 102d which is the remotest from the groove portion 102a, is set at not less than one-third of the circumferential length of the seal member 102. The groove portion 102e is located on the seal member 102 between the groove portions 102a and 102d, which corresponds to the longest distance between the groove portions 102a and 102d. Thus, according to the arrangement of the groove portions 102a through 102e, any of the groove portions 102a through 102e is located in the upper area of the back-pressure chamber and the suction chamber, and any other of them is located in the lower area thereof.

[0060] In still another alternative embodiment as shown in FIG. 7C, an annular seal member 103 has two groove portions 103a and 103b. Both of the shortest and longest distances along the circumference of the seal member 103 between the groove portions 103a and 103b are set at not less than one-third of the circumferential length of the seal member 103. Thus, when the groove portion 103a is located in the lower area of the back-pressure chamber and the suction chamber, the groove portion 103b is located in the upper area thereof. It is assumed that both groove portions 103a and 103b are located at the substantially same height, namely, at the substantially same height as the center of the compressor. In this case, the groove portions 103a and 103b are not located in the lower area. Thus, the groove portions 103a and 103b are hardly clogged with liquid and mist, with the result that controlling the back pressure is hardly adversely affected by the uneven atmosphere in the back-pressure chamber and the suction chamber.

[0061] As shown in FIGS. 7A through 7C, the shortest and longest distance along the circumference of the seal members 101 through 103 between any two of the groove portions 101a through 101c, 102a through 102e or 103a and 103b which are the remotest from each other, may be set at not less than one-third of the circumferential length of the seal member 101, 102 or 103. More preferably, the number of the groove portions may be three or more, and the shortest distance along the circumference of the seal member between any two of the groove portions which are the remotest from each other, may be set at not less than one-third of the circumferential length of the seal member, and the rest of the groove portions may be located between the two of the groove portions on the part of the circumference of the seal member which corresponds to the longest distance along the circumference of the seal member therebetween.

[0062] The following will describe an alternative embodiment of the groove portion of the annular seal member. In the first preferred embodiment, each of the groove portion 34a through 34d includes only a single narrow groove in the seal member 34. In an alternative embodiment as shown in FIG. 8, a seal member 105 has a groove portion 105c including a set of three narrow grooves 105a which extend radially or substantially parallely, and are spaced at certain intervals. Contact surfaces 105b which are in contact with the shaft support are formed between the narrow grooves 105a. Thus, the rigidity of the seal member 105 adjacent to the narrow grooves 105a is maintained to prevent the groove portion 105c from being deformed. In addition, since the groove portion 105c is formed by the narrow grooves 105a, the width of the groove portion 105c can be changed freely while the rigidity of the seal member 105 adjacent to the narrow grooves 105a is maintained. The cross section of the narrow grooves of the groove portion is not limited to a square shape but may be a circular shape, a triangular shape and the like as long as they function as a groove.

[0063] The present invention is not limited to the first and second preferred embodiments described above and the alternative embodiments described above but may be modified as exemplified below.

[0064] In the first and second preferred embodiments, the annular seal member has the four groove portions which are spaced at regular intervals along the circumference of the annular seal member. However, the annular seal members as shown in FIGS. 7A through 7C may be used instead.

[0065] In the second preferred embodiment, the annular seal member is provided on the radially inner side of the recess formed on the front wall of the fixed base plate. However, a tip seal which does not have any groove portion may be provided in place of this annular seal member. In this case, only the other annular seal member which has the groove portions and is provided on the radially outer side of the recess is used for adjusting the back pressure by connecting the back-pressure chamber to the suction chamber. Alternatively, the two seal members which are provided on the radially inner and outer sides of the recess may have different structure. For example, the number of the groove portions and the number of the narrow grooves of each groove portion may be different between the two seal members.

[0066] In the first preferred embodiment, the shaft-seal member is provided for sealing between the back-pressure chamber and the motor chamber which is a part of the suction-pressure region. However, the shaft-seal member may not be provided and the motor chamber may be a part of the back-pressure region. In this case, the inlet is not connected to the motor chamber, and the suction passage needs to be provided so as to connect the inlet to the suction chamber.

[0067] In the first preferred embodiment, the oil separator is provided for collecting the lubricating oil in the refrigerant gas, and the collected lubricating oil is introduced into the back-pressure chamber through the introduction passage and flows through the groove portions of the annular seal member. However, another passage may be provided independently of the introduction passage for the lubricating oil to pass therethrough. Thus, the groove portions of the seal member can be less clogged with liquid.

[0068] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein but may be modified within the scope of the appended claims.

Claims

1. A horizontally-mounted scroll compressor (10, 70) including:

    a housing (11) having a discharge-pressure region (48, 49, 50, 80) and a suction-pressure region (20, 43, 75, 86);
    a fixed scroll member (25, 76) having a fixed base plate (26, 77) which is fixed in the housing (11) and a fixed scroll wall (28, 78) which extends from a front surface of the fixed base plate (26, 77);
    a movable scroll member (35, 81) having a movable base plate (36, 82) and a movable scroll wall (38, 83) which extends from a front surface of the movable base plate (36, 82), the fixed and movable scroll walls (28, 78, 38, 83) being engaged with each other;
    a compression chamber (41, 85) formed between the fixed and movable scroll members (25, 76, 35, 81), the compression chamber (41, 85) being moved radially inwardly while being reduced in volume by orbital motion of the movable scroll member (35, 81) to compress a compressible fluid;
    a slide-contact body (14, 74) being provided so as to be in slide contact with a back surface of the movable base plate (36, 82); and
    a back-pressure region (61, 82a) being defined on a back side of the movable base plate (36, 82) and connected to the discharge-pressure region (48, 49, 50, 80) through an introduction passage (55, 57, 60, 77b, 92, 95),
    characterized in that;
    a first annular seal member (34, 90, 101, 102, 103, 105) is provided between the movable base plate (36, 82) and the slide-contact body (14, 74) for sealing between the back-pressure region (61, 82a) and the suction-pressure region (20, 43, 75, 86),
    in that the first seal member (34, 90, 101, 102, 103, 105) has a plurality of first groove portions (34a, 34b, 34c, 34d, 90a, 101a, 101b, 101c, 102a, 102b, 102c, 102d, 102e, 103a, 103b, 105c) which connect the back-pressure region (61, 82a) to the suction-pressure region (20, 43, 75, 86), and
    in that the shortest distance along a circumference of the first seal member (34, 90, 101, 102, 103, 105) between any two of the first groove portions (34a, 34b, 34c, 34d, 90a, 101a, 101b, 101c, 102a, 102b, 102c, 102d, 102e, 103a, 103b, 105c) which are the remotest from each other is set at not less than one-third of a circumferential length of the first seal member (34, 90, 101, 102, 103, 105).

2. The horizontally-mounted scroll (10, 70) compressor according to claim 1, wherein the longest distance along the circumference of the first seal member (34, 90, 101, 102, 103, 105) between any two of the first groove portions (34a, 34b, 34c, 34d, 90a, 101a, 101b, 101c, 102a, 102b, 102c, 102d, 102e, 103a, 103b, 105c) which are the remotest from each other is set at not more than two-thirds of the circumferential length of the first seal member (34, 90, 101, 102, 103, 105).

3. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 and 2, wherein the first groove portions (34a, 34b, 34c, 34d, 90a, 101a, 101 b, 101c, 102a, 102b, 102c, 102d, 102e, 103a, 103b, 105c) are spaced at regular intervals along the circumference of the first seal member (34, 90,

101, 102, 103, 105).

4. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 3, wherein each of the first groove portions (34a, 34b, 34c, 34d, 90a, 101a, 101b, 101c, 102a, 102b, 102c, 102d, 102e, 103a, 103b, 105c) includes a plurality of spaced grooves (105a).

5. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 4, wherein a second annular seal member (91) is provided between the movable base plate (36, 82) and the slide-contact body (14, 74) and has a diameter smaller than that of the first seal member (34, 90, 101, 102, 103, 105), the second seal member (91) has a plurality of second groove portions (91 a) which connects the back-pressure region (61, 82a) to the suction-pressure region (20, 43, 75, 86).

6. The horizontally-mounted scroll compressor (10, 70) according to claim 5, wherein the shortest distance along a circumference of the second seal member (91) between any two of the second groove portions (91a) which are the remotest from each other, is set at not less than one-third of a circumferential length of the second seal member (91).

7. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 5 and 6, wherein the longest distance along the circumference of the second seal member (91) between any two of the second groove portions (91a) which are the remotest from each other, is set at not more than two-thirds of a circumferential length of the second seal member (91).

8. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 5 through 7, wherein the second groove portions (91a) are spaced at regular intervals along the circumference of the first seal member (91).

9. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 5 through 8, wherein each of the second groove portions (91 a) includes a plurality of spaced grooves.

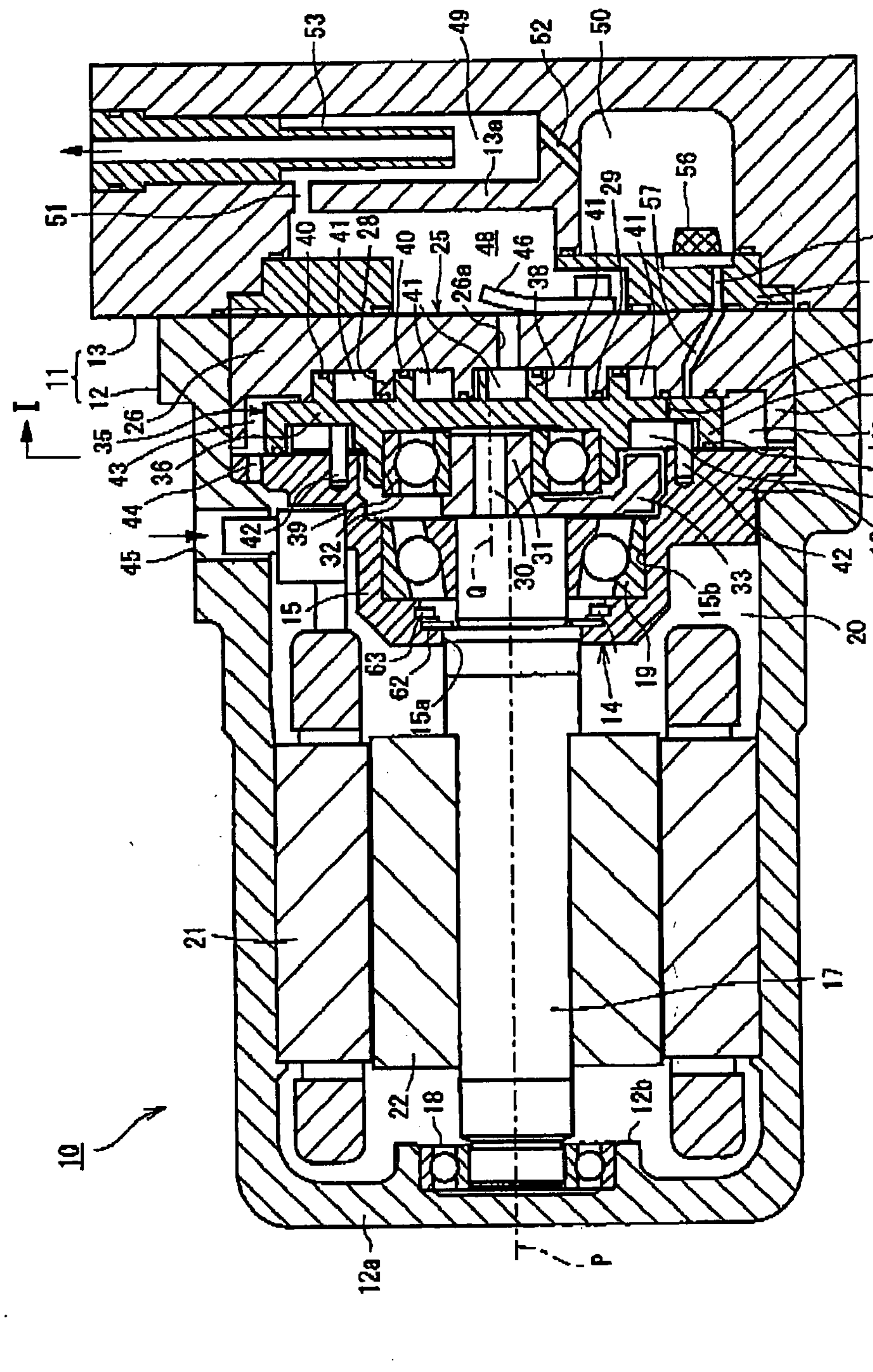
10. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 9, wherein an oil separator (53) is provided in the discharge-pressure region (48, 49, 50, 80), the introduction passage (55, 57, 60, 77b, 92, 95) allowing oil which is collected by the oil separator (53) to pass therethrough.

11. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 10, wherein the back-pressure region (61, 82a) is a recess (82a) which is formed in the back surface of the movable base plate (36, 82).

12. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 11, wherein the introduction passage (55, 57, 60, 77b, 92, 95) includes a hole (57, 92) which extends through the fixed base plate (26, 77), a gap which is formed between the fixed base plate (26, 77) and the movable base plate (36, 82), and a hole (60, 95) which extends through the movable base plate (36, 82).

13. The horizontally-mounted scroll compressor (10, 70) according to any one of claims 1 through 12, wherein the slide-contact body (14, 74) is a shaft support (14, 74) which is accommodated in the housing (11) and rotatably supports a rotary shaft (17).

FIG. 1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12a
12b
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13a
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26a
27
28
29
30
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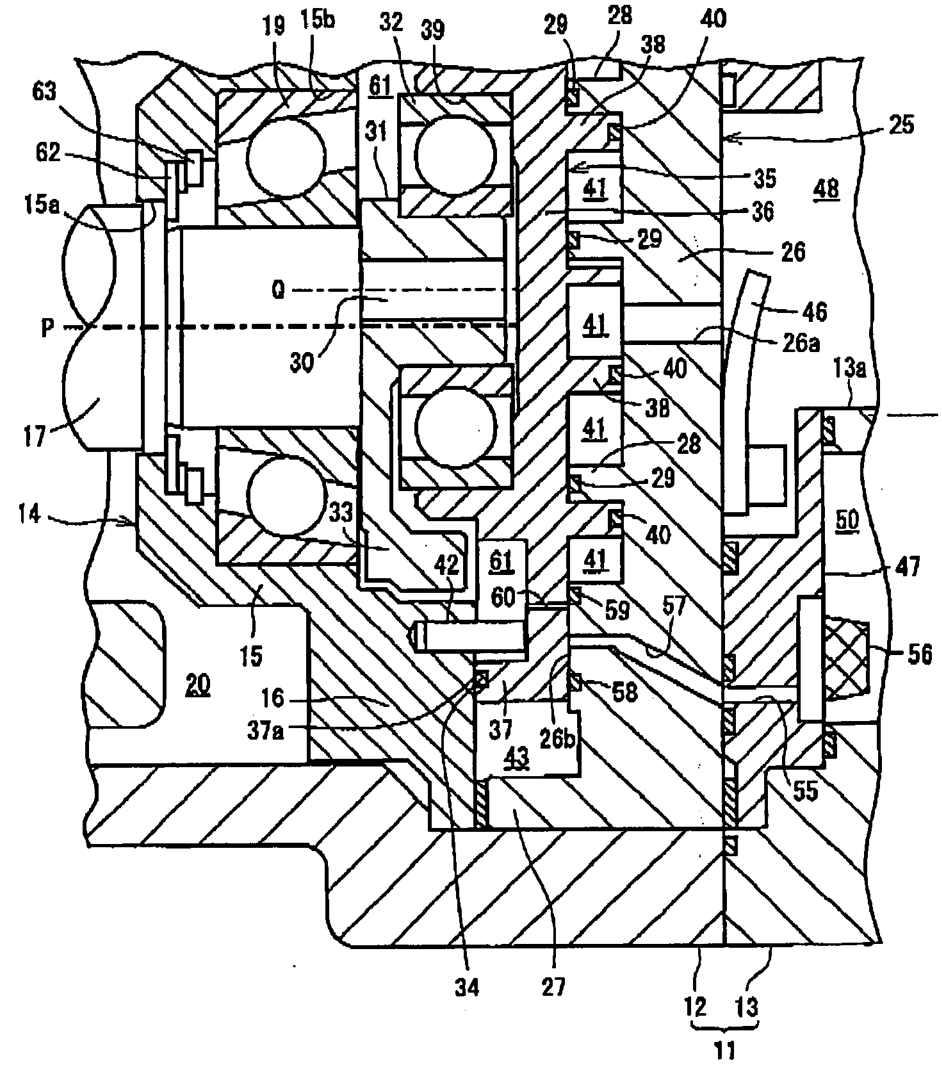
I
P
Q

FIG. 2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13a
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17
41
28
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33
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61
41
47
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34
27
12
13
11

FIG. 3

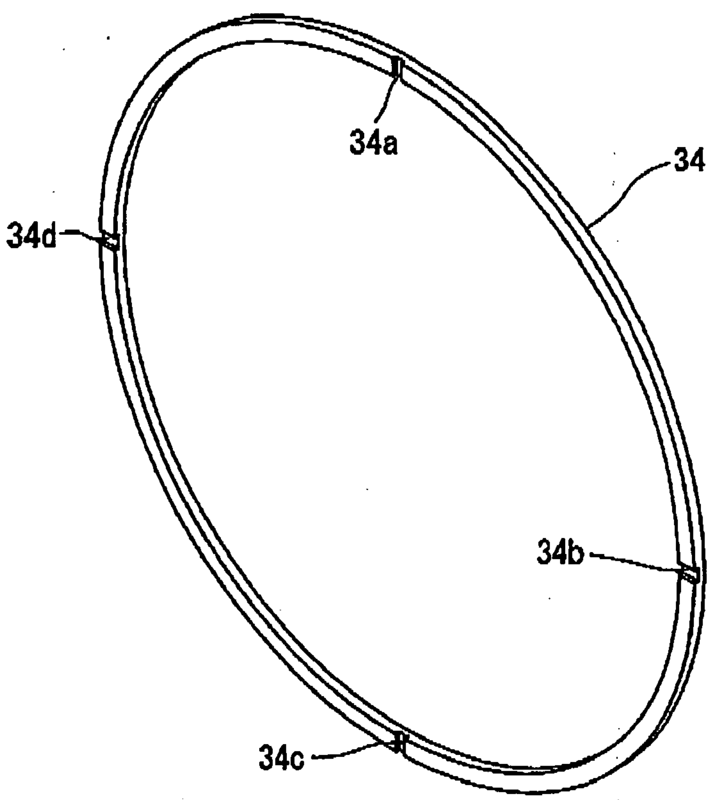


FIG. 4

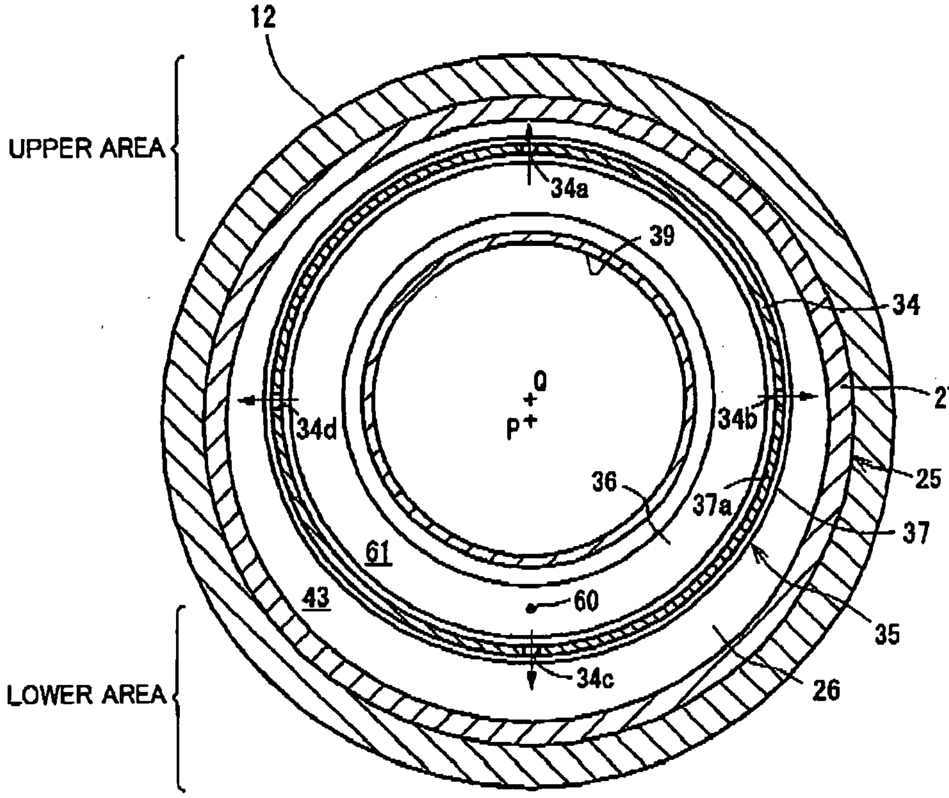

12
UPPER AREA
34a
39
34
Q
P
34d
34b
27
25
36
37a
37
61
43
60
35
34c
26
LOWER AREA

FIG. 5A

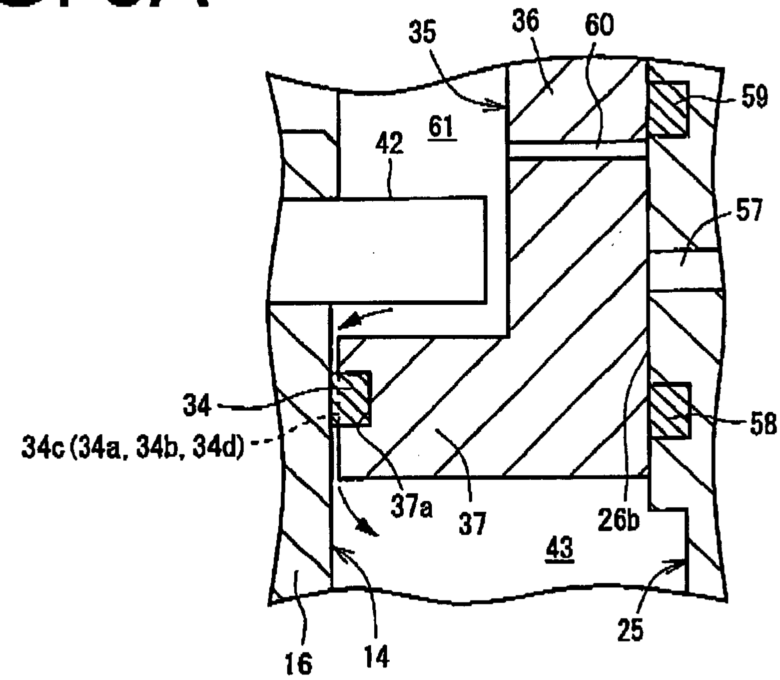

35
36
60
59
61
42
57
34
34c (34a, 34b, 34d)
58
37a
37
26b
43
25
16
14

FIG. 5B

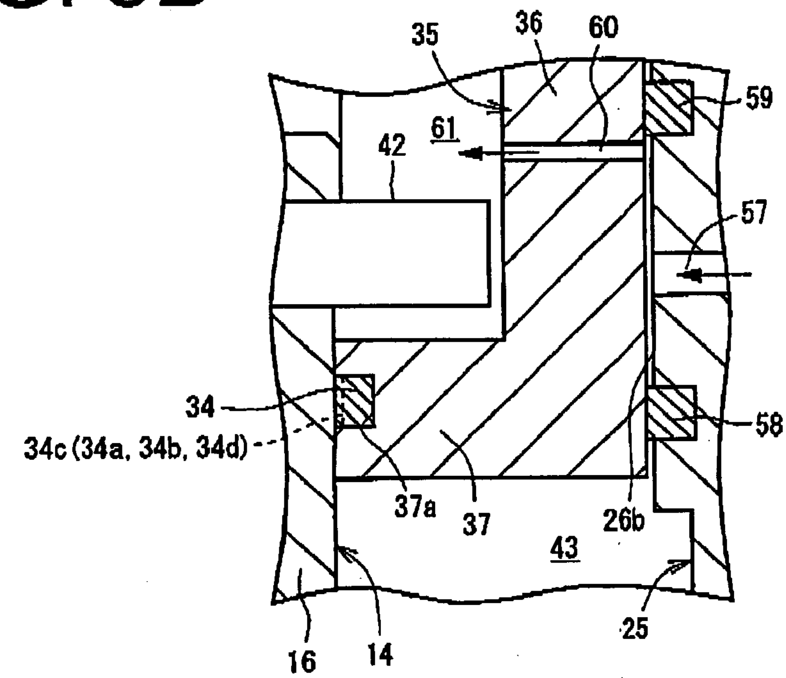
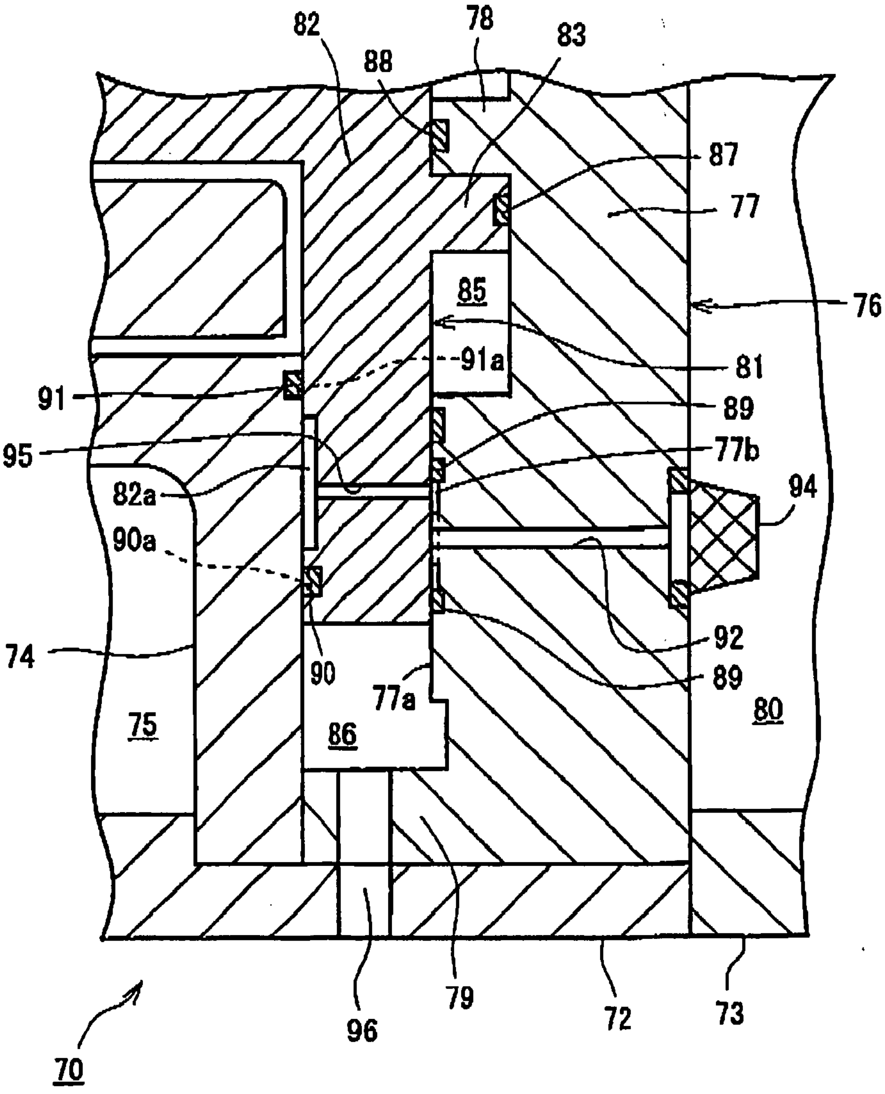

35
36
60
59
61
42
57
34
34c (34a, 34b, 34d)
58
37a
37
26b
43
25
16
14

FIG. 6


82
78
83
88
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85
76
91a
81
91
89
95
77b
94
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92
74
90
89
77a
80
75
86
96
79
72
73
70

FIG. 7A

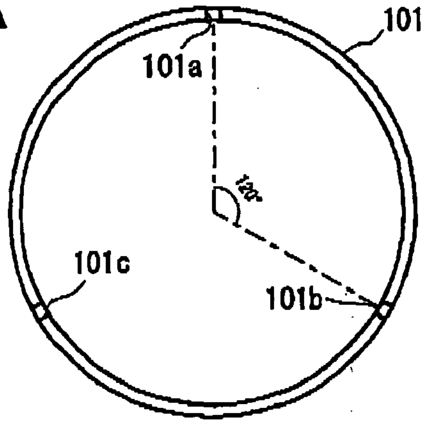


FIG. 7B

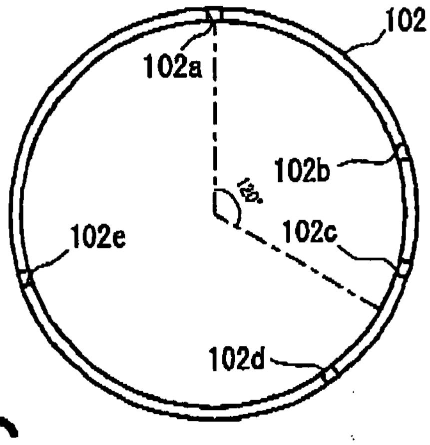


FIG. 7C

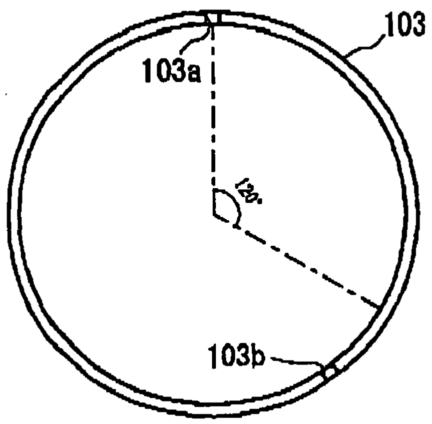
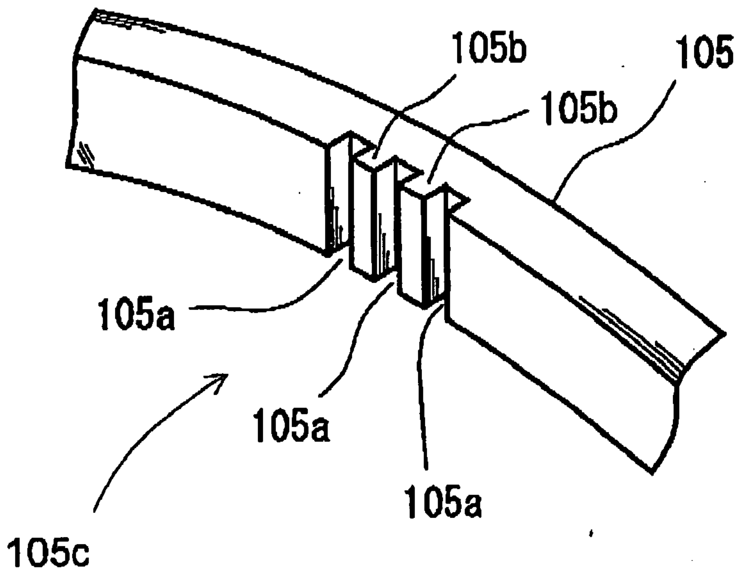


FIG. 8



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 2715

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	JP 10 159755 A (MATSUSHITA ELECTRIC IND CO LTD) 16 June 1998 (1998-06-16) * abstract; figures 1,2,4 * * paragraphs [0006] - [0008] *	1,2,5-7, 10-13 3,8	INV. F04C18/02
D,Y	JP 08 121366 A (HITACHI LTD) 14 May 1996 (1996-05-14) * abstract; figures 1,6 *	3,8	
A	JP 2000 136782 A (DENSO CORP; NIPPON SOKEN) 16 May 2000 (2000-05-16) * abstract; figures 1-8 *	5-13	
A	US 5 383 772 A (RICHARDSON JR HUBERT [US] ET AL) 24 January 1995 (1995-01-24) * figures 2,4 * * column 24, lines 49-63 *	1,5	

TECHNICAL FIELDS SEARCHED (IPC)

F04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 May 2007	Biloen, David

CATEGORY OF CITED DOCUMENTS

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8

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 00 2715

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23-05-2007

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