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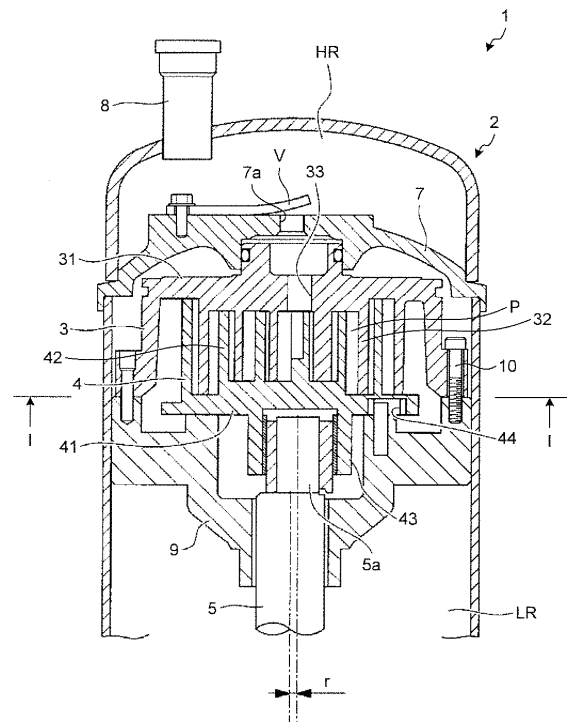
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(72) Inventors:

• **Sato, Hajime****Tokyo, 108-8215 (JP)**(54) **Scroll compressor**

(57) To improve the strength of a fixed scroll of a scroll compressor and suppress the compression performance, a scroll compressor includes a fixed scroll 3 in which a spiral wall 32 is provided on an inner face of an end plate 31, an external wall 34 is provided integrally with the end plate 31 so as to surround a periphery of the wall 32, and a pair of fluid channels 36 penetrating the external wall 34 is provided. A centerline S of the fluid channel 36 is arranged to be deviated from a center O of an involute base circle of the wall.

FIG.1

Description

Field

[0001] The present invention relates to a scroll compressor.

Background

[0002] A scroll compressor compresses fluid in a compression chamber by combining spiral walls of a fixed scroll and an orbiting scroll while shifting phases of the walls, and causing the orbiting scroll to revolve, and gradually decreasing the volume of a pair of compression chambers formed between the respective walls.

[0003] Conventionally, for example, in a scroll compressor described in Patent Literature 1, an external wall is formed integrally with a fixed scroll so as to surround the periphery of a wall of a fixed scroll. The scroll compressor includes a fluid channel for introducing fluid into the compression chamber, the fluid channel penetrating the external wall. The fluid channel is formed by being notched in the external wall, and is provided to form a pair corresponding to respective compression chambers, and face each other with a center of an involute base circle of the spiral wall being put therebetween. Furthermore, an opening of the fluid channel is directed towards the center of the base circle.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Patent Application Laid-open No. 2007-255191

Summary

Technical Problem

[0005] However, if a fluid channel is notched and formed in an external wall to face each other with a center of a base circle being put therebetween, and an opening thereof is directed towards the center of the base circle, there is a problem that the strength of the scroll compressor decreases because both of fluid channels and the center of the base circle are arranged linearly. For example, a fixed scroll may bend starting from a straight line connecting both of the fluid channels and the center of the base circle, due to a pressure difference between a pressure chamber provided outside of the fixed scroll and the compression chamber. In this case, the scroll can be damaged due to excessive contact between the ends of the walls of respective scrolls, or compression leakage may occur due to insufficient contact between the ends of the walls of the respective scrolls. when the compression leakage occurs, the compression performance of the scroll compressor deteriorates.

[0006] Furthermore, as in the scroll compressor described in Patent Literature 1, when the opening of the fluid channel is directed towards the center of the base circle, fluid reaches an intake of the compression chamber constituted by the fixed scroll and the orbiting scroll after being introduced to the center of the base circle, and the fluid channel bends, thereby causing a flow pressure loss. If the flow pressure loss is generated, the compression performance of the scroll compressor deteriorates.

[0007] The present invention has been achieved to solve the above problems, and an object of the present invention is to provide a scroll compressor that can improve the strength of a fixed scroll thereof and can suppress deterioration of the compression performance thereof. Solution to Problem

[0008] According to an aspect of the present invention, a scroll compressor includes a fixed scroll in which a spiral wall is provided on an inner face of an end plate, an external wall is provided integrally with the end plate so as to surround a periphery of the wall, and a pair of fluid channels penetrating the external wall is provided. The fluid channel is arranged such that a centerline thereof deviates from a center of an involute base circle of the wall.

[0009] The centerline of the fluid channel is a normal passing through a center of a straight line connecting the closest (narrowest) parts of both opposing side wall faces of the fluid channels. According to the scroll compressor of the present invention, because the centerline of the fluid channel is arranged to be deviated from the center of the involute base circle of the wall, the direction of the opening of the fluid channel is formed to be deviated from the center of the base circle. That is, the direction of the fluid channel (the flow direction of the fluid) is not arranged linearly with the center of the base circle being put therebetween. Therefore, the external wall in which the fluid channel is not formed provides additional strength, thereby avoiding a situation in which the fixed scroll bends. Consequently, any damage or compression leakage does not occur. As a result, the strength of the fixed scroll can be improved, and deterioration of the compression performance of the scroll compressor can be suppressed.

[0010] Advantageously, in the scroll compressor, an opening of the fluid channel is arranged towards an intake of a compression chamber constituted by the wall.

[0011] According to this scroll compressor, the fluid channel is formed with the direction thereof (the flow direction of the fluid) being directed towards the intake of the compression chamber. Therefore, the fluid flows towards the intake of the compression chamber, along with the direction of the fluid channel, thereby reducing a flow pressure loss. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0012] Advantageously, in the scroll compressor, opposing side wall faces of the fluid channel are provided

parallel to each other.

[0013] According to this scroll compressor, the fluid flows smoothly towards the fluid channel and the flow pressure loss can be reduced. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0014] Advantageously, in the scroll compressor, respective centerlines of the respective fluid channels are provided parallel to each other.

[0015] According to this scroll compressor, the direction of the opening of each fluid channel is formed to be deviated from each other and the direction of the fluid channel (the flow direction of the fluid) is not arranged linearly with the center of the base circle being put therebetween. Therefore, the external wall in which the fluid channel is not formed provides additional strength, thereby avoiding a situation in which the fixed scroll bends. Consequently, any damage or compression leakage does not occur. As a result, the strength of the fixed scroll can be improved, and deterioration of the compression performance of the scroll compressor can be suppressed.

[0016] Advantageously, in the scroll compressor, the centerlines of the fluid channels are provided parallel to a tangent to an external end of the wall.

[0017] According to this scroll compressor, the direction (the flow direction of the fluid) of the fluid channel is formed linearly towards the intake of the compression chamber. Therefore, the fluid flows linearly towards the intake of the compression chamber along with the direction of the fluid channel, and the flow pressure loss can be reduced most effectively. As a result, deterioration of the compression performance of the scroll compressor can be most suppressed.

[0018] Advantageously, in the scroll compressor, a gap between opposing side wall faces of the fluid channels is formed to become wider towards inside of the external wall.

[0019] According to this scroll compressor, the resistance of the fluid immediately after passing through the fluid channel is reduced, thereby reducing the flow pressure loss. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0020] Advantageously, in the scroll compressor, an opening width of the fluid channel is formed larger than an opening width of the intake of the compression chamber, constituted by the walls.

[0021] According to this scroll compressor, because the fluid is reliably introduced into the intake, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0022] Advantageously, in the scroll compressor, carbon dioxide is used as fluid to be compressed.

[0023] Use of carbon dioxide to a fluorocarbon refrigerant is preferable because it has less negative influence on the environment. Furthermore, because carbon dioxide provides a pressure about three times as high as that

of a fluorocarbon refrigerant, it is required to improve the strength of a fixed scroll, and thus carbon dioxide is preferable for the scroll compressor according to the present invention.

Advantageous Effects of Invention

[0024] According to the present invention, the strength of the fixed scroll of the scroll compressor can be improved and deterioration of the compression performance thereof can be suppressed.

Brief Description of Drawings

[0025]

FIG. 1 is a schematic cross-sectional view of a scroll compressor according to an embodiment of the present embodiment.

FIG. 2 is a cross-sectional view along a line I-I in FIG. 1.

FIG. 3 is a cross-sectional view along the line I-I in FIG. 1 and depicts another embodiment.

FIG. 4 is a cross-sectional view along the line I-I in FIG. 1 and depicts another embodiment.

FIG. 5 is a cross-sectional view along the line I-I in FIG. 1 and depicts another embodiment.

Description of Embodiments

[0026] Embodiments of the present invention will be explained below in detail with reference to the accompanying drawings. The present invention is not limited to the embodiments. In addition, constituent elements in the following embodiments include those that can be easily assumed by persons skilled in the art or that are substantially equivalent.

[0027] FIG. 1 is a schematic cross-sectional view of a scroll compressor according to an embodiment of the present invention. As shown in FIG. 1, a scroll compressor 1 includes a housing 2, a fixed scroll 3, an orbiting scroll 4, and a rotating shaft 5.

[0028] As shown in FIG. 1, the housing 2 is a sealed container having the fixed scroll 3, the orbiting scroll 4 or the like arranged therein. A discharger cover 7, a suction pipe (not shown), a discharge pipe 8, and a frame 9 are provided in the housing 2. The discharger cover 7 separates the inside of the housing 2 into a high-pressure chamber HR and a low-pressure chamber LR. The suction pipe guides fluid from outside into the low-pressure chamber LR. The discharge pipe 8 guides fluid from the high-pressure chamber HR to outside. The frame 9 supports the fixed scroll 3 and the orbiting scroll 4.

[0029] As shown in FIG. 1, the rotating shaft 5 transmits a rotating and driving force of a motor (not shown) provided in a lower part inside the housing 2 to the orbiting scroll 4. The rotating shaft 5 is rotatably supported substantially vertically in the housing 2. An eccentric pin 5a

that drives the orbiting scroll 4 to revolve is provided at an upper end of the rotating shaft 5. The eccentric pin 5a is a columnar portion extending upward from an end face of the rotating shaft 5 at a position decentered from the center of rotation of the rotating shaft 5 in the end face thereof by a revolution radius r of the orbiting scroll 4.

[0030] As shown in FIG. 1, the fixed scroll 3 and the orbiting scroll 4 compress fluid having flown into the low-pressure chamber LR of the housing 2, and discharge the fluid to the high-pressure chamber HR. The fixed scroll 3 is fixed to the frame 9 in the housing 2, and a spiral fixed-side wall 32 is formed on an inner face (the lower face in FIG. 1) of a fixed-side end plate 31. A discharge hole 33 is formed in the middle of the fixed-side end plate 31. The discharge hole 33 communicates with an opening 7a provided in the discharger cover 7, and is opened or closed together with the opening 7a by a discharge reed valve V provided in the discharge cover 7.

[0031] The orbiting scroll 4 includes a spiral movable-side wall 42 formed on an inner face (the upper face in FIG. 1) of a movable-side end plate 41 facing the inner face of the fixed-side end plate 31. By combining the movable-side wall 42 of the orbiting scroll 4 with the fixed-side wall 32 of the fixed scroll 3 with the phases thereof being displaced by 180 degrees, a compression chamber P partitioned by the respective end plates 31 and 41 and the respective walls 32 and 42 is formed. Further, the orbiting scroll 4 includes a boss 43 formed on an external face (the lower face in FIG. 1) of the movable-side end plate 41, into which the eccentric pin 5a provided at the upper end of the rotating shaft 5 is inserted. Furthermore, the orbiting scroll 4 is revolved, while rotation thereof is blocked by an annular rotation blocking member 44 arranged between the frame 9 fixed to the housing 2 and the orbiting scroll 4 at the underneath thereof.

[0032] The fixed scroll 3 in the scroll compressor 1 having the above configuration is explained below in detail with reference to the drawings. FIGS. 2 to 5 are cross-sectional views along a line I-I in FIG. 1.

[0033] As shown in FIGS. 2 to 5, the fixed scroll 3 includes an external wall 34 formed integrally with the end plate 31 to surround the periphery of the spiral wall 32. The fixed scroll 3 according to the present embodiment includes a depressed portion 35 constituting the compression chamber P in a central part of the inner face of the end plate 31, and the wall 32 is formed in the depressed portion 35. The wall 42 of the orbiting scroll 4 is inserted into the depressed portion 35. The external wall 34 is formed to include a stepped portion around the depressed portion 35. Bolts 10 (see FIG. 1) for fixing the fixed scroll 3 to the frame 9 penetrate the external wall 34. A pair of fluid channels 36 penetrating the external wall 34 is formed in the external wall 34.

[0034] The fluid channel 36 is formed by being notched from outside of the external wall 34 to the depressed portion 35, so as to introduce fluid into the compression chamber P. A centerline S of the fluid channel 36 is arranged to be deviated from a center O of an involute base

circle.

[0035] The centerline S of the fluid channel 36 is a normal passing through a center of a straight line A connecting the closest (narrowest) parts of both of the opposing side wall faces 36a of the fluid channel 36. FIG. 2 depicts an embodiment in which both of the side wall faces 36a of the fluid channel 36 are formed parallel to each other. FIG. 3 depicts an embodiment in which both of the side wall faces 36a of the fluid channel 36 are not parallel to each other, and at least one of the side wall faces 36a is inclined so that an opening width is enlarged towards the inside (towards the compression chamber P). FIG. 4 depicts an embodiment in which both of the side wall faces 36a of the fluid channel 36 are not parallel to each other, and at least one of the side wall faces 36a is curved so that the opening width is enlarged towards the inside (towards the compression chamber P). In any case shown in FIGS. 3 to 5, the centerline S is arranged to be deviated from the center O of the involute base circle of the wall 32. The centerline S corresponds to a flow direction of fluid passing through the fluid channel 36. Because the centerline S of the fluid channel 36 is arranged to be deviated from the center O of the involute base circle of the wall 32, the direction of the opening of the fluid channel 36 is formed to be deviated from the center O of the base circle.

[0036] That is, the direction of the fluid channel 36 (the flow direction of fluid) is not arranged linearly with the center O of the base circle being put therebetween. Therefore, the external wall 34 where the fluid channel 36 is not formed and the stepped portion around the depressed portion 35 provide additional strength, thereby avoiding a situation in which the fixed scroll 3 bends. Consequently, excessive contact between the ends of the walls 32 and 42 of the respective scrolls 3 and 4 or insufficient contact therebetween does not occur, and thus any damage of the scrolls 3 and 4 or compression leakage does not occur. As a result, according to the scroll compressor 1 of the present embodiment, the strength of the fixed scroll 3 can be improved, and deterioration of the compression performance of the scroll compressor can be suppressed.

[0037] As shown in FIGS. 2 to 5, the fluid channel 36 is arranged with the opening being directed towards an intake of the compression chamber P constituted by the walls 32 and 42. Specifically, the fluid channel 36 is formed so that the side wall faces 36a extend towards the intake of the compression chamber P. The intake of the compression chamber P is formed inside of external ends of the walls 32 and 42. That is, the fluid channel 36 is formed with the direction thereof (the flow direction of fluid) being directed towards the intake of the compression chamber P. Therefore, the fluid flows towards the intake of the compression chamber P along with the direction of the fluid channel 36, thereby decreasing the flow pressure loss. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0038] As shown in FIGS. 2 and 5, in the fluid channel 36, the opposing side wall faces 36a are provided parallel to each other. Therefore, fluid flows smoothly towards the fluid channel 36, thereby decreasing the flow pressure loss. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0039] As shown in FIGS. 2 to 5, respective centerlines S of the fluid channels 36 are provided parallel to each other. That is, because the directions of the openings of the respective fluid channels 36 are formed to be deviated from each other, the direction of the fluid channel 36 (the flow direction of fluid) is not arranged linearly with the center O of the base circle being put therebetween. Therefore, the external wall 34 where the fluid channel 36 is not formed and the stepped portion around the depressed portion 35 provide additional strength, thereby avoiding a situation in which the fixed scroll 3 bends. Consequently, excessive contact between the ends of the walls 32 and 42 of the respective scrolls 3 and 4 or insufficient contact therebetween does not occur, and thus any damage of the scrolls 3 and 4 or compression leakage does not occur. As a result, according to the scroll compressor 1 of the present embodiment, the strength of the fixed scroll 3 can be improved, and deterioration of the compression performance of the scroll compressor can be suppressed.

[0040] As shown in FIG. 5, the centerlines S of the fluid channels 36 are provided parallel to a tangent T to the external ends of the walls 32 and 42. That is, the fluid channel 36 is formed linearly with the direction thereof (the flow direction of fluid) being directed towards the intake of the compression chamber P. Therefore, because the fluid flows towards the intake of the compression chamber P along with the direction of the fluid channel 36, the flow pressure loss can be reduced most effectively. As a result, deterioration of the compression performance of the scroll compressor can be most suppressed.

[0041] As shown in FIGS. 3 and 4, the fluid channel 36 is formed such that a gap between the opposing side wall faces 36a becomes wider towards the inside of the external wall 34 (towards the compression chamber P). Consequently, the resistance of fluid immediately after passing through the fluid channel 36 is reduced, thereby reducing the flow pressure loss. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed.

[0042] As shown in FIGS. 2 to 5, an opening width A of the fluid channel 36 is formed larger than an opening width B of the intake of the compression chamber P, which is constituted by the walls 32 and 42. Consequently, fluid can be reliably introduced into the intake. As a result, deterioration of the compression performance of the scroll compressor can be further suppressed. The opening width A of the fluid channel 36 is the closest (narrowest) part of both opposing side wall faces 36a of the fluid channel 36, and corresponds to a length of the

straight line A connecting both of the side wall faces 36a.

[0043] The scroll compressor 1 according to the present embodiment is suitable for using carbon dioxide as its fluid (refrigerant). Carbon dioxide is preferable for the fluorocarbon refrigerant because it causes less negative influence on the environment. Furthermore, because carbon dioxide provides a pressure about three times as high as that of the fluorocarbon refrigerant, it is required to improve the strength of the fixed scroll, and thus carbon dioxide is preferable for the scroll compressor 1 according to the present embodiment.

Industrial Applicability

[0044] As described above, the scroll compressor according to the present invention is suitable for improving the strength of the fixed scroll thereof and suppressing the compression performance thereof. Reference Signs List

[0045]

- | | |
|-----|------------------------------------|
| 1 | scroll compressor |
| 3 | fixed scroll |
| 31 | fixed-side end plate (end plate) |
| 32 | fixed-side wall (wall) |
| 33 | discharge hole |
| 34 | external wall |
| 35 | depressed portion |
| 36 | fluid channel |
| 36a | side wall face |
| 4 | orbiting scroll |
| 41 | movable-side end plate (end plate) |
| 42 | movable-side wall (wall) |
| A | opening width of fluid channel |
| B | opening width of intake |
| O | center of base circle |
| P | compression chamber |
| S | centerline |
| T | tangent to external ends of walls |

Claims

1. A scroll compressor (1) comprising a fixed scroll (3) in which a spiral wall (32) is provided on an inner face of an end plate (31), an external wall (34) is provided integrally with the end plate (31) so as to surround a periphery of the wall, and a pair of fluid channels (36) penetrating the external wall (34) is provided, wherein the fluid channel (36) is arranged such that a centerlines (S) thereof deviates from a center of an involute base circle of the wall. 5 10
2. The scroll compressor (1) according to claim 1, wherein an opening of the fluid channel (36) is arranged towards an intake of a compression chamber (P) constituted by the wall. 15
3. The scroll compressor (1) according to claim 1 or 2, wherein opposing side wall faces (36a) of the fluid channel (36) are provided parallel to each other. 20
4. The scroll compressor (1) according to any one of claims 1 to 3, wherein respective centerlines (S) of the respective fluid channels (36) are provided parallel to each other. 25
5. The scroll compressor (1) according to any one of claims 1 to 4, wherein the centerlines (S) of the fluid channels (36) are provided parallel to a tangent to an external end of the wall. 30
6. The scroll compressor (1) according to any one of claims 1, 2, 4, and 5, wherein a gap between opposing side wall faces (36a) of the fluid channels (36) is formed to become wider towards inside of the external wall (34). 35
7. The scroll compressor (1) according to any one of claims 1 to 6, wherein an opening width of the fluid channel (36) is formed larger than an opening width of the intake of the compression chamber (P) constituted by the walls. 40
8. The scroll compressor (1) according to any one of claims 1 to 7, wherein carbon dioxide is used as fluid to be compressed. 45

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FIG. 1

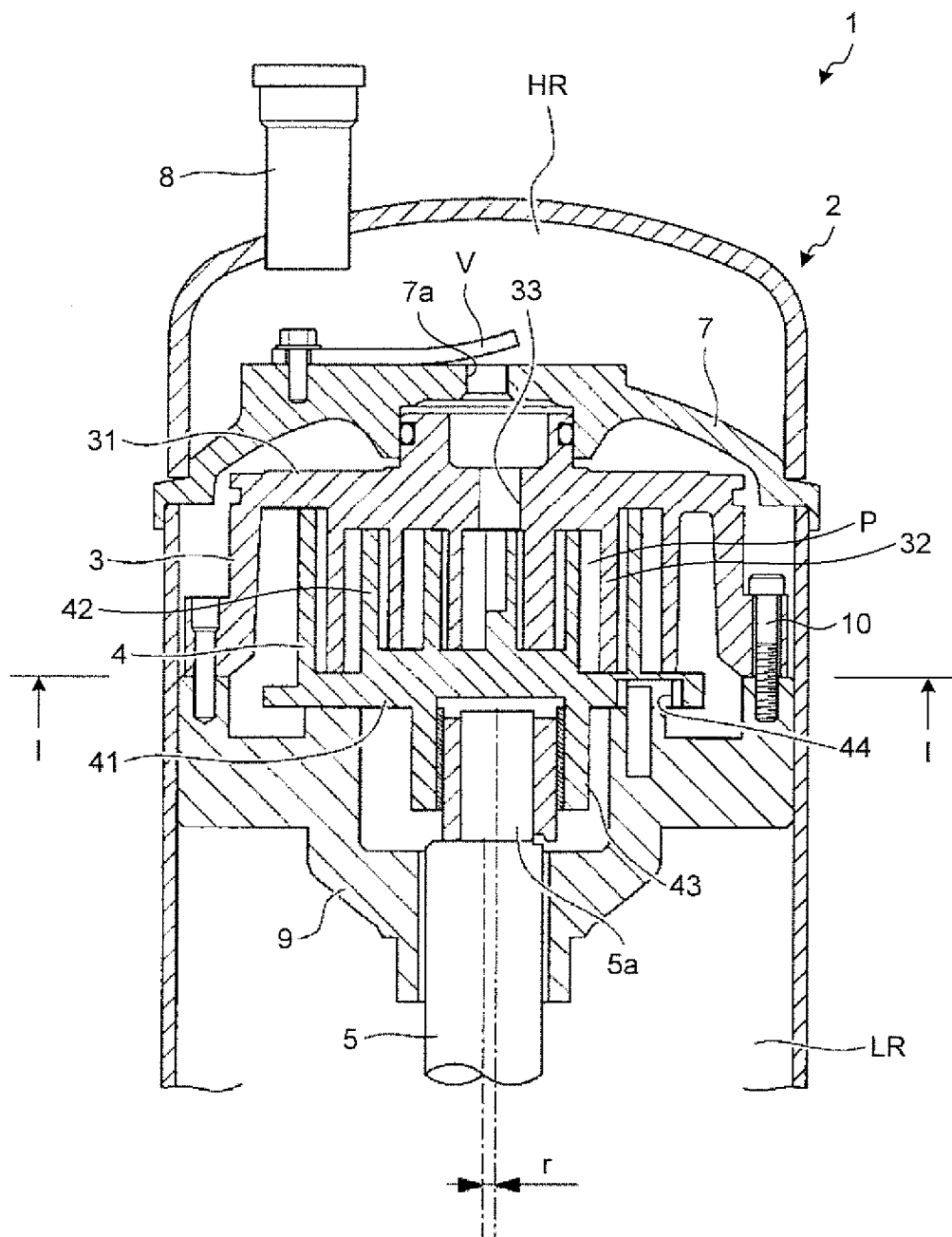


FIG.2

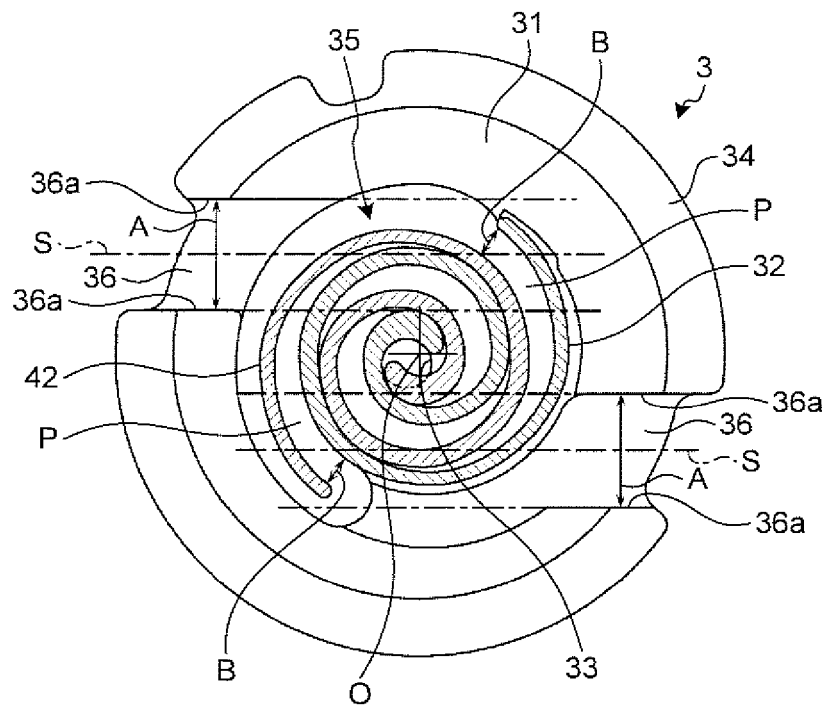


FIG.3

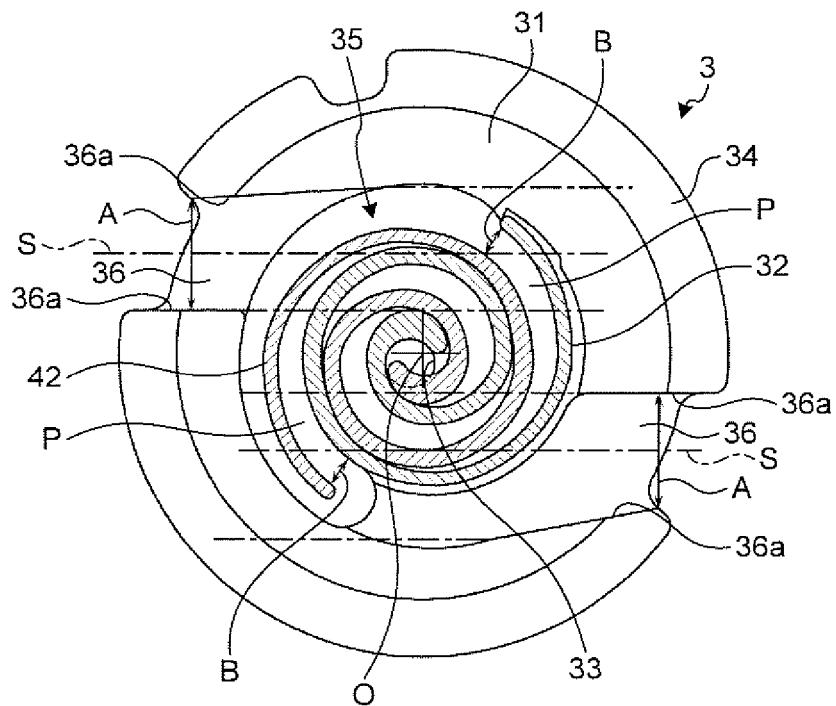


FIG.4

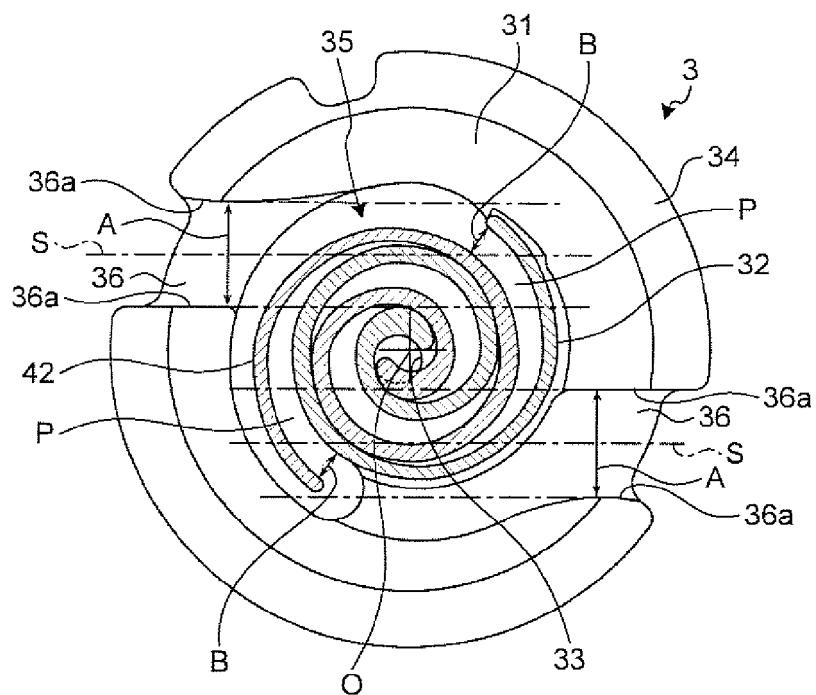
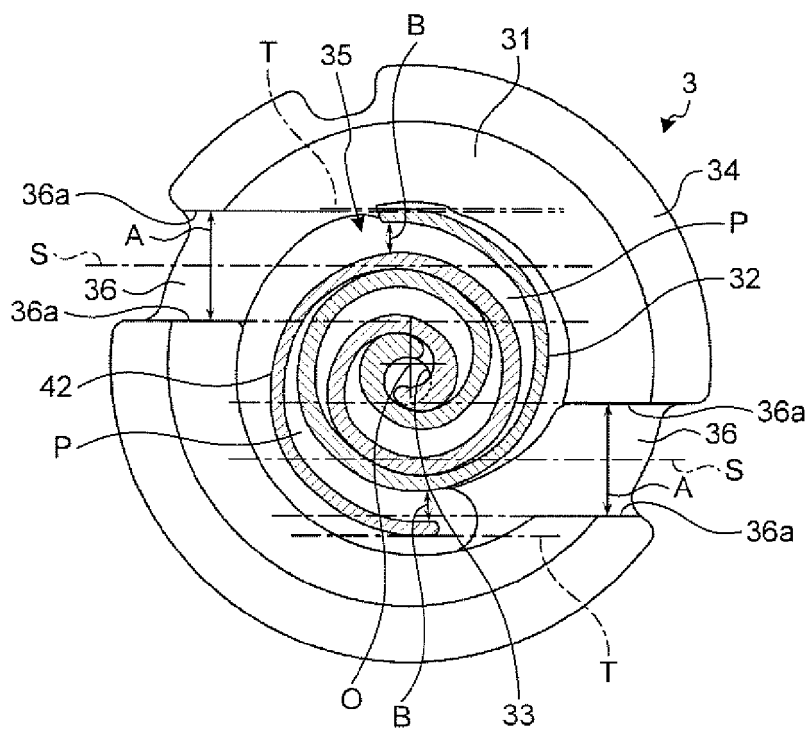


FIG.5





EUROPEAN SEARCH REPORT

Application Number
EP 11 18 4562

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 February 2012	Examiner Lange, Christian
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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The members are as contained in the European Patent Office EDP file on
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