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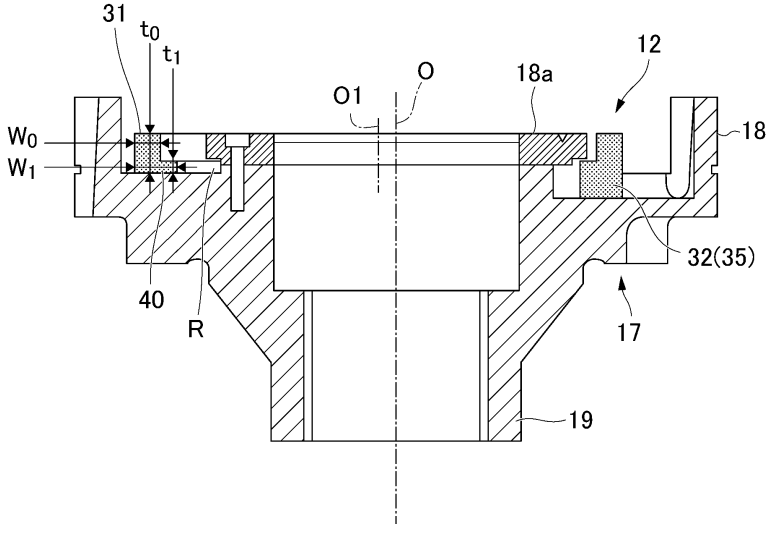
(54) **OLDHAM'S RING AND SCROLL COMPRESSOR**

(57) An Oldham's ring (12) includes: a main body portion (31) having an annular shape and is disposed to surround an axis (O); a plurality of keys (32) protruding from the main body portion (31), fitted into groove portions (38, 39) formed in an orbiting scroll (10) and a housing (3), and configured to linearly-reciprocatingly slide with respect to inner surfaces of the groove portions (38, 39); and flange portions (40) formed on the main body portion (31) so as to protrude radially inward from an inner circumferential surface of the main body portion (31). The flange portions (40) is allowed to overlap with a thrust plate (18a) of a bearing (17) that is another facing member in a direction of the axis (O).

FIG. 5



EP 3 660 312 A1

Description

Technical Field

[0001] The present invention relates to an Oldham's ring and a scroll compressor.

[0002] Priority is claimed on Japanese Patent Application No. 2017-150056, filed August 02, 2017, the content of which is incorporated herein by reference.

Background Art

[0003] Conventionally, a scroll compressor that is used in an air conditioner or a refrigerator and compresses a fluid (a refrigerant) is known. In such a scroll compressor, a volume of a compression chamber formed between a fixed scroll and an orbiting scroll is reduced by turning the orbiting scroll relative to the fixed scroll to revolve around the fixed scroll, and thus the fluid is compressed.

[0004] As shown in Patent Document 1, an Oldham's ring is interposed between a frame and an orbiting scroll to cause revolution of the orbiting scroll while preventing rotation of the orbiting scroll in a scroll compressor. Keys are provided on the Oldham's ring, and the Oldham's ring is linearly reciprocated relative to the orbiting scroll and a housing while the keys and grooves formed in the orbiting scroll slide.

Citation List

Patent Document

[0005] Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2016-079923

Summary of Invention

Technical Problem

[0006] Here, the Oldham's ring is a member that receives a high mechanical load when the scroll compressor is in operation. For this reason, an equivalent strength is required for the Oldham's ring. As a measure for enhancing strength (flexural rigidity) of the Oldham's ring while avoiding interference with another adjacent member, increasing dimensions (thickness and width) of the entire Oldham's ring can be considered. However, in the case where the dimensions of the Oldham's ring are increased, dimensions of the scroll compressor are also increased. Thus, an Oldham's ring whose strength can be secured while dimensions are suppressed is required.

[0007] The present invention was solve these problems, and is directed to providing an Oldham's ring having a small size and a higher strength and a scroll compressor having the same.

Solution to Problem

[0008] According to a first aspect of the present invention, an Oldham's ring is installed on a scroll compressor including an orbiting scroll and a fixed scroll, wherein the orbiting scroll is fixed on a main shaft rotatably supported by a housing, a compression chamber in which a refrigerant is compressed are formed between the orbiting scroll and the fixed scroll facing the orbiting scroll, and the orbiting scroll is supported by the Oldham's ring to revolve around an axis of the main shaft without rotation. The Oldham's ring includes: a main body portion having an annular shape and is disposed to surround the axis; a plurality of keys protruding from the main body portion, fitted into groove portions formed in the orbiting scroll and the housing, and configured to reciprocatingly slide on inner surfaces of the groove portions to allow the main body portion to linearly reciprocate; and flange portions formed on the main body portion so as to protrude radially inward from an inner circumferential surface of the main body portion in a direction in which the main body portion slides in a reciprocating way, wherein the flange portions are allowed to overlap with another facing member when the flange portions are viewed in a direction of the axis.

[0009] According to the constitution, the flange portions are formed on the main body portion of the Oldham's ring. Thus, without increasing dimensions of the entire Oldham's ring, strength of the main body portion can be enhanced. Furthermore, since the flange portions are allowed to overlap with the other facing member when the flange portions is viewed in the direction of the axis, interference between the other facing member and the Oldham's ring when the main body portion reciprocates can be avoided.

[0010] According to a second aspect of the present invention, in the Oldham's ring, the flange portions may have plate shapes that spread in a direction perpendicular to the axis.

[0011] According to the constitution, the plate-like flange portions are provided at the main body portion of the Oldham's ring. Thus, without increasing dimensions of the entire Oldham's ring, strength of the main body portion can be enhanced. Furthermore, since the flange portions have simple plate shapes, design and production can be easily performed.

[0012] According to a third aspect of the present invention, in the Oldham's ring, the flange portions may have inclined surfaces that spread in an inclined direction with respect to the axis.

[0013] According to the constitution, in comparison with the case where the flange portions have plate shapes, thicknesses of the flange portions can be secured. Thus, without increasing dimensions of the entire Oldham's ring, strength of the main body portion can be further enhanced.

[0014] According to a fourth aspect of the present invention, in the Oldham's ring, the other facing member may be a bearing, and a counterbored portion in which

the flange portions are housed may be formed in the bearing.

[0015] According to the constitution, strength of the Oldham's ring can be enhanced while interference between the Oldham's ring and the bearing is avoided.

[0016] According to a fifth aspect of the present invention, a scroll compressor includes: a main shaft configured to rotate about an axis; a housing configured to support the main shaft to be rotatable relative to the main shaft; an orbiting scroll provided on the main shaft; a fixed scroll configured to face the orbiting scroll and to form a compression chamber compressing a refrigerant between the orbiting scroll and the fixed scroll; and the Oldham's ring described in any one of first to fourth aspects configured to support the orbiting scroll.

[0017] According to the constitution, the scroll compressor with the Oldham's ring having a small size and higher strength can be provided.

Advantageous Effects of Invention

[0018] According to the present invention, an Oldham's ring having a small size and a higher strength and a scroll compressor having the same can be provided.

Brief Description of Drawings

[0019]

Fig. 1 is a sectional view illustrating a scroll compressor according to an embodiment of the present invention.

Fig. 2 is a perspective view of an Oldham's ring according to an embodiment of the present invention.

Fig. 3A is a perspective view illustrating a sliding state of the Oldham's ring of the scroll compressor according to the embodiment of the present invention, and illustrating a sliding state against an orbiting scroll.

Fig. 3B is a perspective view illustrating a sliding state of the Oldham's ring of the scroll compressor according to the embodiment of the present invention, and illustrating a sliding state against a housing.

Fig. 4 is an enlarged sectional view of main portions of the Oldham's ring according to the embodiment of the present invention.

Fig. 5 is a sectional view along line A-A of Fig. 4.

Fig. 6 is an enlarged sectional view of main portions illustrating a modification of the Oldham's ring according to the embodiment of the present invention.

Description of Embodiments

[0020] Hereinafter, a scroll compressor 1 according to an embodiment of the present invention will be described.

[0021] As illustrated in Fig. 1, the scroll compressor 1 includes a main shaft 2 that rotates about an axis O, a housing 3 that supports the main shaft 2 to be rotatable relative to the main shaft 2, an orbiting scroll 10 and a fixed scroll 11 that are provided in the housing 3, and an Oldham's ring 12 that supports the orbiting scroll 10.

[0022] The main shaft 2 has a columnar shape whose center is the axis O, and rotates about the axis O. Further, an eccentric bushing 14 having a tubular shape whose center is a central axis O1 eccentric from the axis O is fixed to an upper end of the main shaft 2.

[0023] The housing 3 has a housing main body 16 that has a tubular shape in which a space S is formed, and a bearing 17 that is fixed to an inner surface of the housing main body 16 in the space S. The housing 3 supports the main shaft 2 via the bearing 17, and the main shaft 2 is housed in the space S.

[0024] The bearing 17 has a bearing main body portion 18 that surrounds the main shaft 2 from the outside in a radial direction and supports the main shaft 2 to be rotatable relative to the housing 3, and an annular protrusion portion 19 that extends toward an upper side, which becomes one side in a direction of the axis O, along an inner surface of the housing main body 16 from an outer position of the bearing main body portion 18 in a radial direction and has an annular shape fixed to the inner surface of the housing main body 16. An eccentric bushing 14 is disposed inside the annular protrusion portion 19. Furthermore, as illustrated in Fig. 4 or 5, a disk-like thrust plate 18a whose center is the axis O is mounted on an upper surface of the bearing main body portion 18.

[0025] Furthermore, an introduction port 4 and a discharge port 5, which allow communication between the space S and an exterior of the housing 3 and to which a refrigerant F can flow, are formed in the housing 3.

[0026] The orbiting scroll 10 is mounted on the main shaft 2 via the eccentric bushing 14 from above. The orbiting scroll 10 is made rotatable about the central axis O1 of the eccentric bushing 14 relative to the eccentric bushing 14.

[0027] Further, although detailed illustration is omitted, the orbiting scroll 10 has an end plate 21 that has a disk shape, a lap wall 22 that has a spiral shape when viewed in an extending direction of the central axis O1, is provided integrally with the end plate 21, and extends from the end plate 21 to an upper side that is one side of the central axis O1, and a tubular portion 23 that extends downward from the end plate 21 and is mounted on the eccentric bushing 14 on the same axis as the central axis O1 to cover the eccentric bushing 14 from outside. The main shaft 2 is rotated, and thereby the orbiting scroll 10 moves around the axis O of the main shaft 2.

[0028] Although detailed illustration is omitted, the fixed scroll 11 has an end plate 27 that is integrally formed at the annular protrusion portion 19 of the bearing 17, and has a disk shape like the orbiting scroll 10, and a lap wall 28 that has a spiral shape when viewed in an extending direction of the central axis O1, is provided integrally with the end plate 27, and extends from the end plate 27 to a lower side that is one side of the central axis O1 toward the end plate 21 of the orbiting scroll 10.

[0029] The end plate 27 of the fixed scroll 11 and the end plate 21 of the orbiting scroll 10 are disposed vertically apart from each other in an extending direction of the central axis O1, and the lap wall 28 of the fixed scroll 11 and the lap wall 22 of the orbiting scroll 10 are be engaged with each other, and face each other in a radial direction of the central axis O1. A compression chamber C is formed between the lap walls 22 and 28.

[0030] The refrigerant F is introduced into the compression chamber C through the introduction port 4 of the housing 3. A shape of the compression chamber C changes as the orbiting scroll 10 revolves around the axis O, and thereby the introduced refrigerant F is compressed, and is then discharged from the discharge port 5 to the exterior of the housing 3.

[0031] Next, the Oldham's ring 12 will be described.

[0032] As illustrated in Fig. 2, the Oldham's ring 12 is disposed below the end plate 21 of the orbiting scroll 10. The Oldham's ring 12 is supported from below by the annular protrusion portion 19, and curbs rotation of the orbiting scroll 10.

[0033] To be more specific, the Oldham's ring 12 includes a main body portion 31 that has a toric shape disposed to surround the axis O and the central axis O1, and a plurality of keys 32 that protrude from front and back surfaces of the main body portion 31.

[0034] Here, the front surface of the main body portion 31 is an upper surface that is a surface directed upward, and the back surface is a lower surface that is a surface directed downward. The keys may protrude outward from an outer circumferential surface of the main body portion 31 in a radial direction.

[0035] The main body portion 31 is provided to be interposed between the end plate 21 of the orbiting scroll 10 and the annular protrusion portion 19.

[0036] As the keys 32, two types of keys 32 that are first keys 33 that protrude upward from the front surface of the main body portion 31 and second keys 35 that protrude downward from the back surface of the main body portion 31 are provided. Inner circumferential surfaces of the first keys 33 and an inner circumferential surface of the main body portion 31 are flush with each other.

[0037] A pair of the first keys 33 are integrally formed on the main body portion 31 at positions 180 degrees from each other in a circumferential direction of the main body portion 31. Here, as illustrated in Fig. 3A, first groove portions 38 that are recessed upward are formed in a lower surface of the end plate 21 of the orbiting scroll 10 which faces the Oldham's ring 12. The first keys 33 are fitted into the first groove portions 38. That is, a pair of the first groove portions 38 are formed at positions corresponding to the positions at which the first keys 33 are formed.

[0038] The first keys 33 linearly reciprocate relative to the first groove portions 38 in an extending direction of a line segment L1 (see Fig. 2) that links the pair of first keys 33. That is, the first keys 33 have first sliding surfaces 33a, as surfaces that face one side of the main body portion 31 in a circumferential direction, which linearly reciprocate in contact with inner surfaces 38a of the first groove portions 38.

[0039] Like the first keys 33, a pair of the second keys 35 are integrally formed on the main body portion 31 at positions 180 degrees from each other in a circumferential direction of the main body portion 31. The second keys 35 are provided at positions 90 degrees from the first keys 33 in a circumferential direction. Here, as illustrated in Fig. 3B, second groove portions 39 that are recessed downward are formed in an upper surface of the annular protrusion portion 19 which faces the Oldham's ring 12. The second keys 35 are fitted into the second groove portions 39. That is, a pair of the second groove portions 39 are formed at positions corresponding to the positions at which the second keys 35 are formed.

[0040] The second keys 35 linearly reciprocate relative to the second groove portions 39 in an extending direction of a line segment L2 (see Fig. 2) that links the pair of second keys 35. That is, the second keys 35 has second sliding surfaces 35a, as surfaces that face one side of the main body portion 31 in a circumferential direction, which linearly reciprocate in contact with inner surfaces 39a of the second groove portions 39. Here, a sliding direction D2 of the second key 35 is a direction perpendicular to a sliding direction D1 of the first key 33. The main body portion 31 reciprocates in the sliding direction D2.

[0041] As illustrated in Fig. 4 or 5, flange portions 40 are formed on the inner circumferential surface of the main body portion 31 (i.e., a surface that faces an inner side in a radial direction of the axis O). The flange portions 40 protrude inward from the inner circumferential surface of the main body portion 31 in a radial direction. The flange portions 40 have plate shapes that spread in a plane perpendicular to the axis O. Edges on inner circumferential sides of the flange portions 40 have circular arc shapes whose centers are the axis O. Inner circumferential surfaces of the flange portions 40 are flush with inner circumferential surfaces of the second keys 35.

[0042] As illustrated in Fig. 5, when a dimension of the main body portion 31 in the direction of the axis O is defined as t0, and a dimension of the flange portion 40 in the direction of the axis O is defined as t1, a relationship of Math (1) shown below is established.

$$t1/t0 \leq 0.5 \cdots\cdots\cdots (1)$$

[0043] Furthermore, when a dimension from the inner circumferential surface to an outer circumferential surface of the main body portion 31 is defined as w0, and a dimension from the inner circumferential surface of the flange portion 40 to the outer circumferential surface of the main body portion 31 is defined as w1, a relationship of Math (2) shown below is established.

$$w1/w0 \leq 1.5 \cdots\cdots\cdots (2)$$

[0044] Of surfaces of each flange portion 40 which face both sides in the direction of the axis O, a surface facing a lower side is flush with a lower surface of the main body portion 31 which is located on a lower side of the main body portion 31. That is, the flange portions 40 are eccentrically formed on the lower side of the main body portion 31. The flange portions 40 are not provided at the circumferential positions at which the first keys 33 are provided in a circumferential direction of the main body portion 31 (in a circumferential direction of the axis O). In other words, the flange portions 40 are provided only in regions that include the positions corresponding to the second keys 35 within the inner circumferential surface of the main body portion 31. In the present embodiment, a pair of flange portions 40 are formed in regions including the circumferential positions at which the second keys 35 are provided and regions excluding the circumferential positions at which the first keys 33 are provided to continuously extend in a circumferential direction.

[0045] Here, as illustrated in Fig. 5, a counterbored portion R, which is recessed inward in the radial direction of the axis O, is formed at a connection portion between the bearing main body portion 18 and the thrust plate 18a in the bearing 17. The counterbored portion R is formed across both the bearing main body portion 18 and the thrust plate 18a.

[0046] A dimension of the counterbored portion R in the direction of the axis O is set to be approximately the same as or slightly larger than the dimension (t1 mentioned above) of the flange portion 40 in the direction of the axis O. Thus, while the Oldham's ring 12 slides, the flange portions 40 are allowed to enter (be housed in) the counterbored portion R without interfering with the bearing main body portion 18 and the thrust plate 18a. That is, the flange portions 40 overlap the bearing 17 that is another facing member when the flange portions 40 are viewed in the direction of the axis O.

[0047] In the Oldham's ring 12, the flange portions 40 are formed on the main body portion 31. Thus, without increasing dimensions of the entire Oldham's ring 12, strength of the main body portion 31 can be enhanced. Furthermore, since the flange portions 40 are configured to be allowed to overlap with another facing member (the bearing 17) when the flange portions 40 are viewed in the direction of the axis O, interference between the other member and the Oldham's ring 12 can be avoided. Furthermore, according to the constitution, since the flange portions 40 have simple plate shapes, design and production can be easily performed compared to a case where another shape is adopted.

[0048] An embodiment of the present invention has been described with reference to Figs. 1 to 5. The constitution is one example, and various alternations or modifications can be performed on this constitution. For example, in the embodiment, an example of the bearing 17 has been described as an example of the other member facing the Oldham's ring 12. However, the Oldham's ring 12 does not necessarily face the bearing 17 in the direction of the axis O, and may be disposed to face a member other than the bearing 17. The other member facing the Oldham's ring 12 may be a member formed integrally with the housing main body 16, and may be a member separated from the housing main body 16 and mounted on the housing main body 16.

[0049] Furthermore, in the embodiment, the constitution in which the flange portions 40 are provided only on at least a part of the inner circumferential surface of the main body portion 31 has been described as an example. However, the constitution of the flange portions 40 is not limited thereto, and the flange portions 40 may be provided throughout the inner circumferential surface of the main body portion 31. That is, the flange portions 40 may be at least provided to protrude from the main body portion 31 in the extending direction of the line segment L2 which is the direction in which the Oldham's ring 12 slides in a reciprocating way.

[0050] In addition, as the shapes of the flange portions 40, a constitution other than that in the embodiment can be adopted. For example, as illustrated in Fig. 6, of both surfaces of the flange portions 40, a surface directed upward is inclined, and may thereby form an inclined surface 40a. In a sectional view including the axis O, the inclined surface 40a spreads in an inclined direction with respect to the axis O. To be specific, the inclined surface 40a spreads from bottom to top as it is goes from inside to outside in the radial direction of the axis O.

[0051] Further, the counterbored portion R having a shape corresponding to the inclined surface 40a is formed at the thrust plate 18a. An outer circumferential surface of the counterbored portion R is approximately parallel to the inclined surface 40a, and spreads in an inclined direction with respect to the axis O in the sectional view including the axis O. According to the constitution, in comparison with the case where the flange portions 40 have the plate shapes, a thickness of the flange portions 40 (a dimension in the direction of the axis O) can be secured. Thus, the strength of the Oldham's ring 12 can be further enhanced.

Industrial Applicability

[0052] The Oldham's ring and the scroll compressor can be made small with high strength.

Reference Signs List

[0053]

1: Scroll compressor
2: Main shaft
3: Housing
4: Introduction port

5:	Discharge port
10:	Orbiting scroll
11:	Fixed scroll
12:	Oldham's ring
14:	Eccentric bushing
16:	Housing main body
17:	Bearing
18:	Bearing main body portion
18a:	Thrust plate
19:	Annular protrusion portion
21:	End plate
22:	Lap wall
23:	Tubular portion
27:	End plate
28:	Lap wall
31:	Main body portion
32:	Key
33:	First key
33a:	First sliding surface
35:	Second key
35a:	Second sliding surface
38:	First groove portion
38a:	Inner surface
39:	Second groove portion
39a:	Inner surface
40:	Flange portion
40a:	Inclined surface
O:	Axis
O1:	Central axis
R:	Counterbored portion
F:	Refrigerant
S:	Space
C:	Compression chamber
L1, L2:	Line segment

Claims

1. An Oldham's ring installed on a scroll compressor including an orbiting scroll and a fixed scroll, wherein the orbiting scroll is fixed on a main shaft rotatably supported by a housing, a compression chamber in which a refrigerant is compressed are formed between the orbiting scroll and the fixed scroll facing the orbiting scroll, and the orbiting scroll is supported by the Oldham's ring to revolve around an axis of the main shaft without rotation, the Oldham's ring comprising:

a main body portion having an annular shape and is disposed to surround the axis;
a plurality of keys protruding from the main body portion, fitted into groove portions formed in the orbiting scroll and the housing, and configured to reciprocatingly slide with respect to inner surfaces of the groove portions to allow the main body portion to linearly reciprocate; and
flange portions formed on the main body portion so as to protrude radially inward from an inner circumferential surface of the main body portion in a direction in which the main body portion slides in a reciprocating way,
wherein the flange portions is allowed to overlap with another facing member when the flange portions are viewed in a direction of the axis.

2. The Oldham's ring according to claim 1, wherein the flange portions have plate shapes that spread in a direction perpendicular to the axis.

3. The Oldham's ring according to claim 1, wherein the flange portions have inclined surfaces that spread in an inclined direction with respect to the axis.

4. The Oldham's ring according to any one of claims 1 to 3, wherein the other facing member is a bearing, and a counterbored portion in which the flange portions are housed is formed in the bearing.

5. A scroll compressor comprising:

a main shaft configured to rotate about an axis;
a housing configured to support the main shaft to be rotatable relative to the main shaft;
an orbiting scroll formed on the main shaft;
a fixed scroll configured to face the orbiting scroll and to form a compression chamber compressing a refrigerant between the orbiting scroll and the fixed scroll; and
the Oldham's ring described in any one of claims 1 to 4 configured to support the orbiting scroll.

FIG. 1

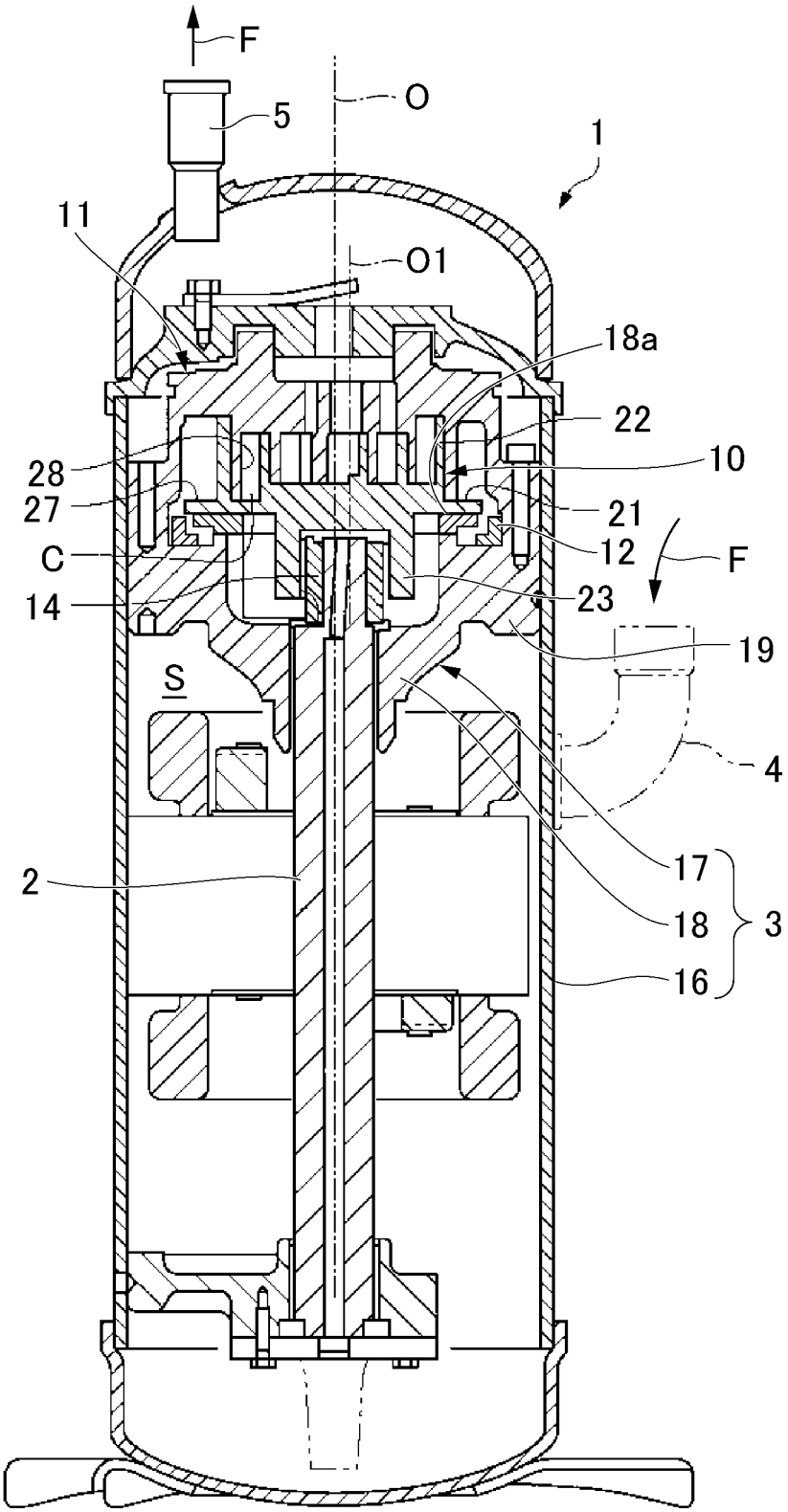


FIG. 2

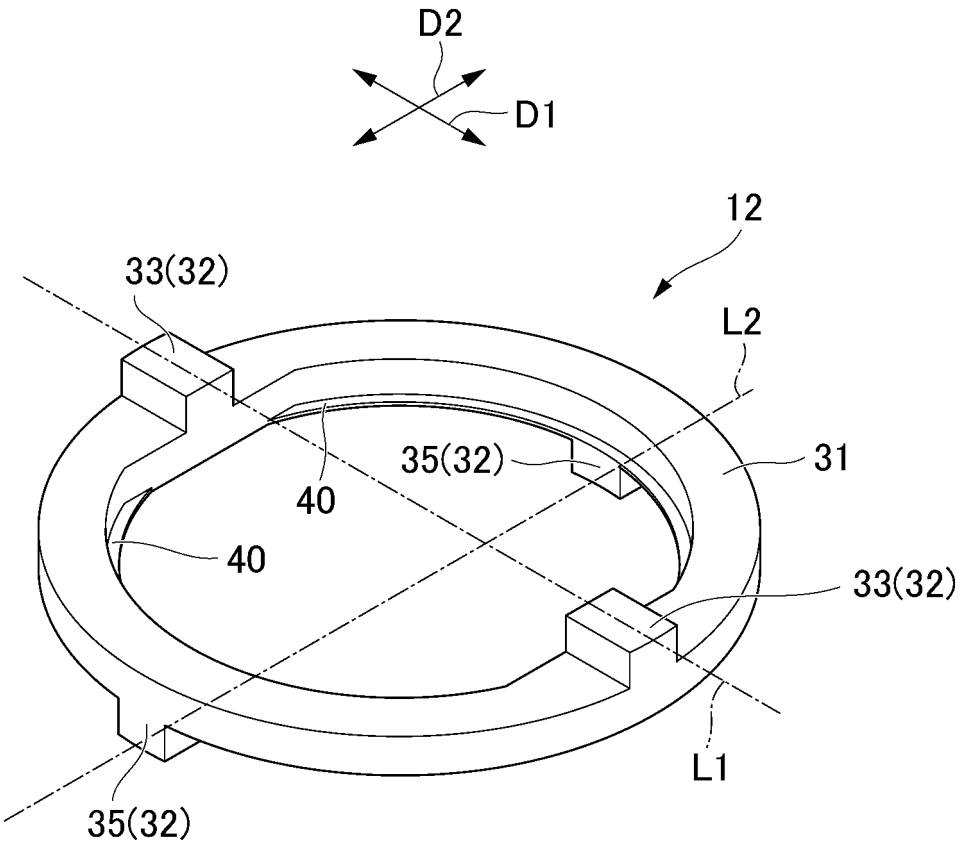


FIG. 3A

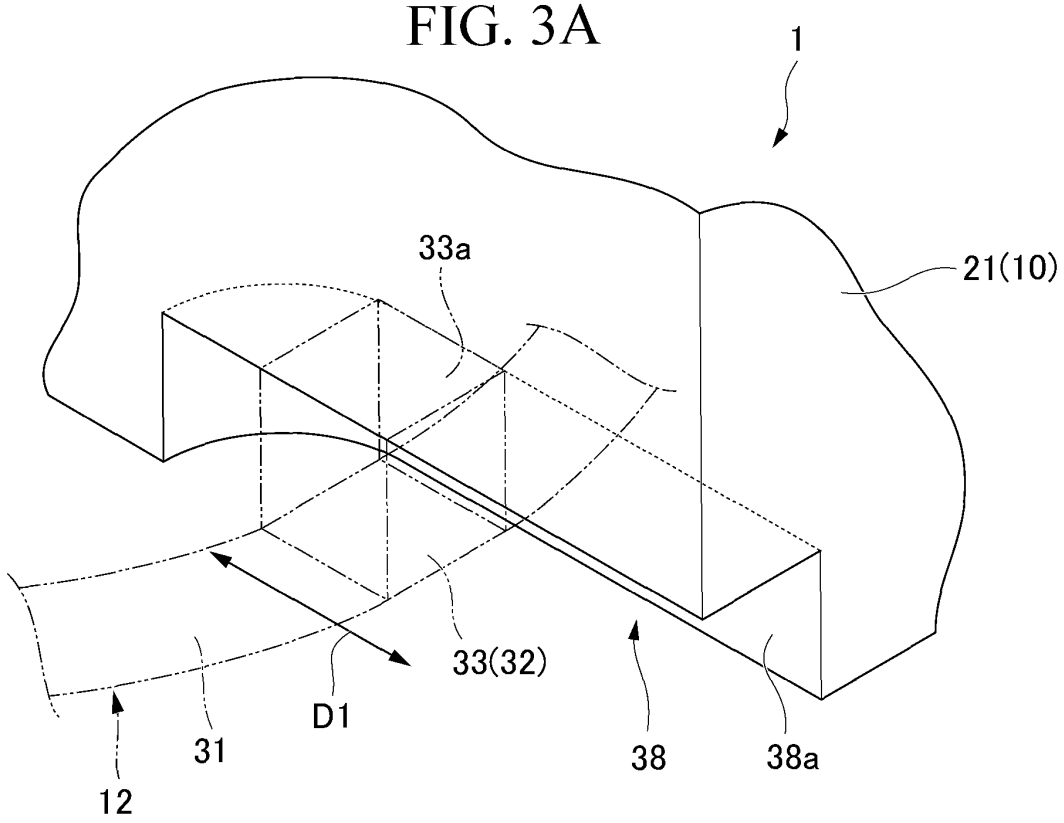


FIG. 3B

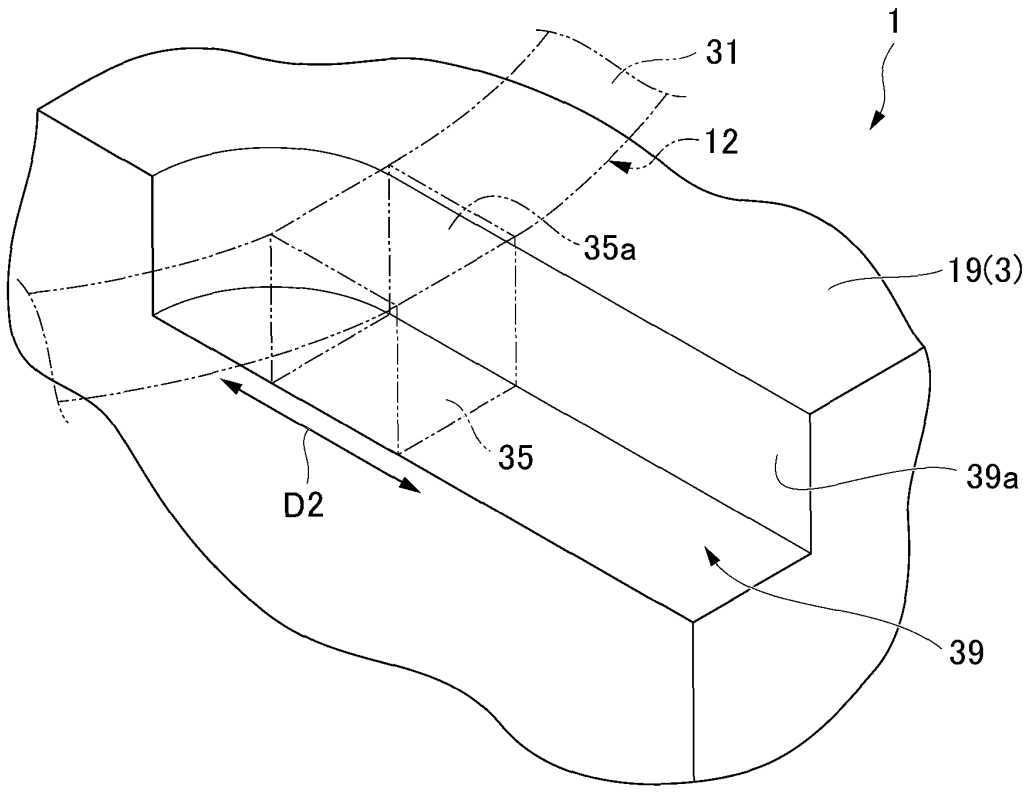


FIG. 4

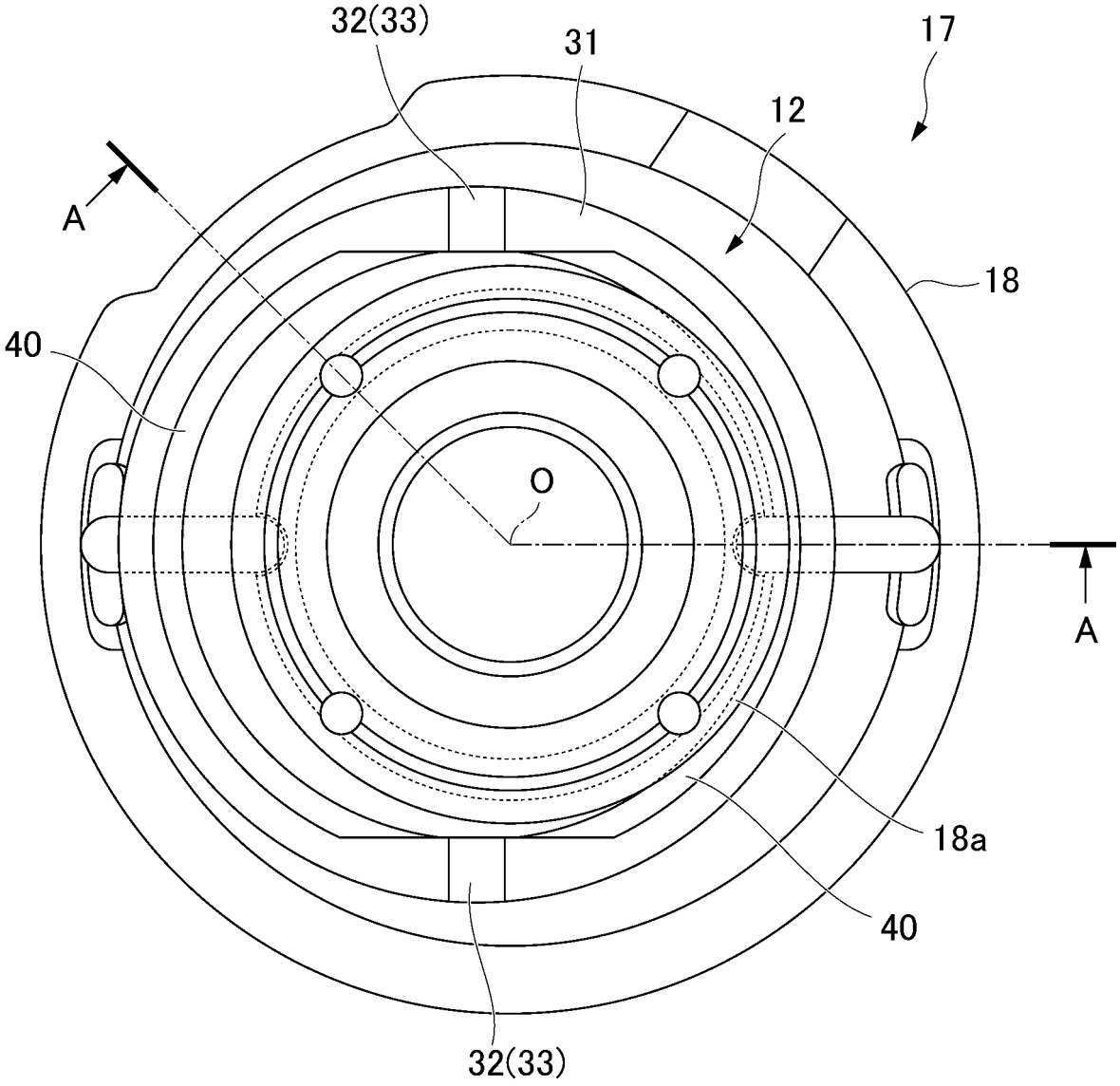


FIG. 5

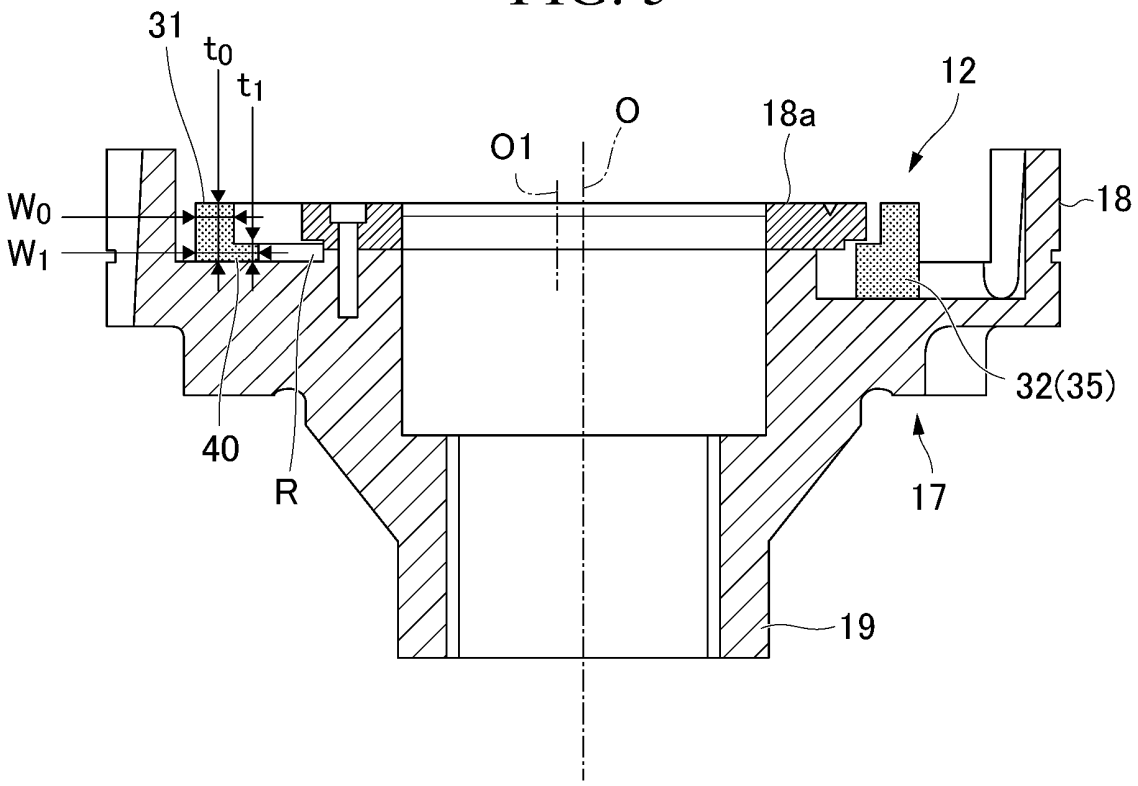
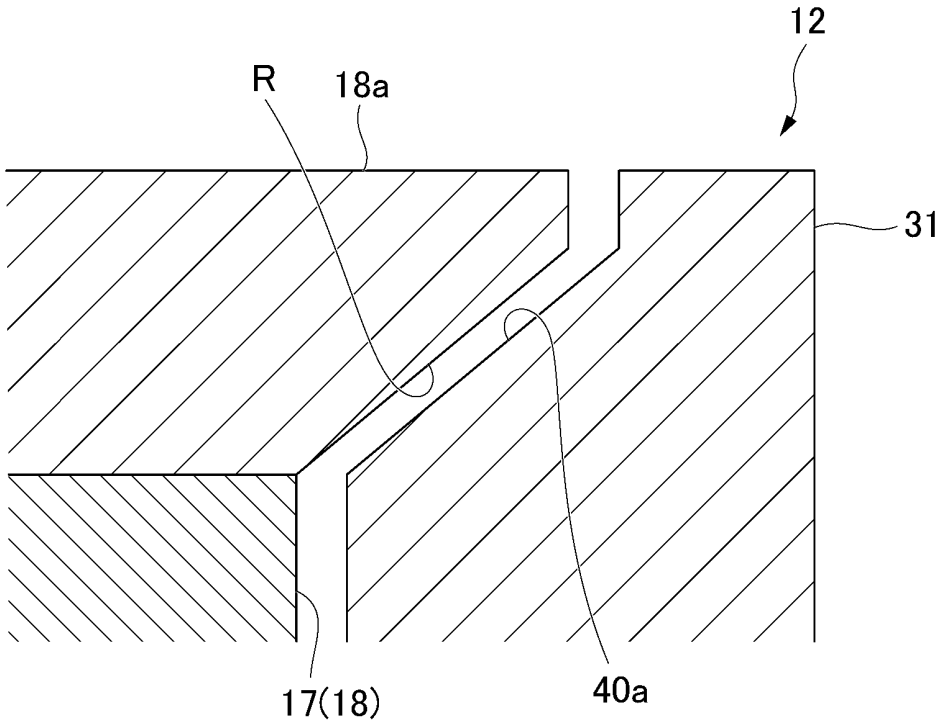


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/021216

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F04C18/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F04C18/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2017/115559 A1 (DAIKIN INDUSTRIES, LTD.) 06 July 2017, paragraphs [0001]-[0066], fig. 1-11 & JP 2017-120055 A	1-5
Y	JP 2016-3647 A (HITACHI APPLIANCES INC.) 12 January 2016, paragraphs [0015]-[0028], fig. 1 (Family: none)	1-5

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
13.08.2018	28.08.2018

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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Patent documents cited in the description

- JP 2017150056 A **[0002]**
- JP 2016079923 A **[0005]**