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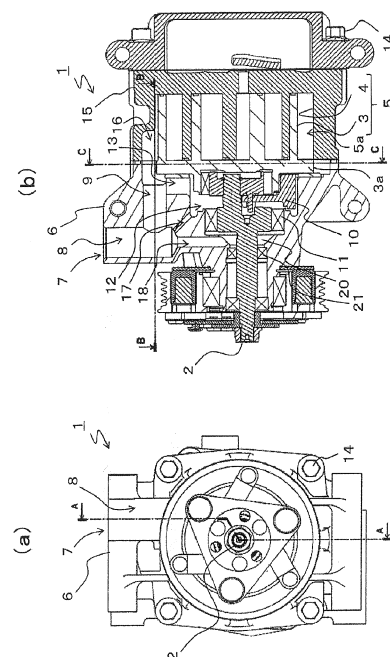
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(54) **SCROLL COMPRESSOR**

(57) A housing which forms one portion of a compressor case and which supports a bearing for a main shaft has formed therein: an opening through which gas to be compressed is sucked; a suction space extending in a cylindrical-shape from the opening toward the inside of the compressor; a first gas passageway extending from the suction space in the direction of the axis of the main shaft; and a second gas passageway for connecting the first gas passageway and the space in which the bearing for the main shaft is disposed. A shell which forms the other portion of the compressor case and which is fastened to the housing has formed therein a third gas passageway for connecting the first gas passageway and the internal space of a compression mechanism. The scroll compressor is characterized in that the first gas passageway and the third gas passageway are connected to each other in a region located further on the outer side of the main shaft in the rotation radius direction than the movable region of the bottom plate of a movable scroll. As a result of the configuration, in the scroll-type compressor, the sliding portions of the bearing, a lip seal, a thrust plate, etc. can be lubricated while the degree of superheat of suction gas is suppressed.

FIG. 1



DescriptionTechnical Field of the Invention

[0001] The present invention relates to a scroll-type compressor having a front housing with multipath gas passageways through which the gas to be compressed is sucked.

Background Art of the Invention

[0002] There have been various suggested gas passageway structures through which refrigerant gas or the like to be compressed is sucked into a scroll-type compressor so that lubricating oil contained in the gas to be compressed achieves the lubrication in the compressor.

[0003] Patent document 1 discloses a scroll-type compressor provided with a main suction hole and auxiliary suction hole in a front housing. Patent document 2 discloses a scroll compressor of which passageway for a lubricant mist and a working medium flowing from a suction hole comprises two circuits (first circuit and second circuit).

[0004] Patent document 3 discloses a scroll compressor provided with a plurality of suction passageways so that lubricating oil in the refrigerant passes by a sliding contact portion such as main shaft bearing through the suction passageways.

Prior art documents

Patent documents

[0005]

Patent document 1: JP-3227075-B

Patent document 2: JP-9-32745-A

Patent document 3: JP-4106088-B

Summary of the InventionProblems to be solved by the Invention

[0006] A scroll-type compressor should be designed to prevent an excessive superheat degree of the suction gas in case that the pressure loss in the gas passageway from the suction port of the housing to the compression chamber sectioned with scroll walls to determine the suction displacement or the heat received from the sliding contact portion might increase the superheat degree of the suction gas. However, any conventional scroll-type compressors don't have a structure capable of satisfying both the prevention of excessive superheat of the suction gas and the lubrication of bearing, lip seal and thrust plate.

[0007] Accordingly, it could be helpful to provide a scroll-type compressor capable of achieving both the prevention of excessive superheat of the suction gas and

the lubrication of bearing, lip seal, thrust plate and the like.

Means for solving the Problems

[0008] To achieve the above-described object, a scroll-type compressor according to the present invention is a scroll-type compressor comprising: a housing which forms one portion of a compressor case and which supports a bearing for a main shaft having an opening through which a gas to be compressed is sucked, a suction space extending with a cylindrical-shape from the opening into the compressor, a first gas passageway extending from the suction space along a rotation axis of the main shaft, and a second gas passageway communicating with the first gas passageway and a space in which the bearing is disposed; and a shell which forms the other portion of the compressor case and which is fastened to the housing having a third gas passageway communicating with the first gas passageway and an internal space of a compression mechanism, characterized in that the first gas passageway and the third gas passageway communicate with each other at an outer side than a region where a bottom plate of a movable scroll can move with respect to a direction of a turning radius of the main shaft.

[0009] Such a scroll-type compressor makes it possible that the above-described suction space and the first to third gas passageways control the superheat degree of the suction gas appropriately and lubricate the bearing for the main shaft and the sliding contact portion around the compression mechanism effectively. Particularly because the first gas passageway and the third gas passageway communicate with each other at the outer side than the movable region of the bottom plate of the movable scroll, the bottom plate does not block the portion at which the passageways communicate with each other even when the main shaft rotates to swing the movable scroll, so that the suction gas flows in the gas passageways properly.

[0010] In the scroll-type compressor, it is preferable that the housing has a lubricating oil passageway which is independent from the first gas passageway and communicates with the suction space and the space in which the bearing is disposed. With such a lubricating oil passageway, the lubricating oil contained in the refrigeration gas or the like to be compressed which has been sucked from the opening on the housing could be delivered directly to the bearing for the main shaft from the suction space without going through the first gas passageway.

[0011] In such a scroll-type compressor, it is preferable that a porous filling material is filled in a neighborhood of a portion which the suction space and the lubricating oil passageway communicate with each other. The porous filling material may be made of a porous material such as sponge and sintered metal, and alternatively made of a fiber material such as steel wool and porous filter. With such a porous filling material filled in the communicating portion between the suction space and the lubricating oil

passageway, the lubricating oil contained in the suction gas could be trapped to be efficiently delivered to the lubricating oil passageway, so that the bearing is improved further in the lubricity.

[0012] In the scroll-type compressor, it is preferable that the housing and the shell are fastened with a plurality of fastening means while the first gas passageway and the third gas passageway communicate with each other in a region between the fastening means which are adjacent to each other. With such fastening means such as bolts fastening the housing and the shell, the gas passageways could be configured to communicate with each other in the region between the adjacent bolts or the like, so that the compressor case is made compact.

[0013] In the scroll-type compressor, it is preferable that the suction space extends inward along the turning radius of the main shaft. With such a suction space extending toward the inside along the turning radius of the main shaft, more preferably configured to extend perpendicular to the main shaft, the suction gas containing the lubricating oil could be easily led close to the sliding contact portion such as bearing required to be highly lubricated.

[0014] Such a scroll-type compressor is suitable to a scroll-type compressor of which fixed scroll is formed integrally with the shell. With a scroll-type compressor provided with a fixed scroll integral with the shell to which the present invention has been applied, the superheat degree of the suction gas could be controlled appropriately without an additional peripheral port provided.

[0015] In the scroll-type compressor, it is preferable that a fin structure is formed inside the first gas passageway. With such a fin structure, the lubricating oil contained in the suction gas flowing in the first gas passageway could be trapped effectively. The lubricating oil trapped with the fin structure is delivered through the second gas passageway into the space in which the bearing is disposed so that the neighborhood of the bearing is improved in lubricity, and is delivered through the third gas passageway to the compression mechanism side so that the neighborhood of the compression mechanism is improved in lubricity.

[0016] In the scroll-type compressor, it is preferable that the first gas passageway is formed on a side surface of the suction space. With such a first gas passageway formed on the side of the suction space, the gas to be compressed flowing in the suction space could configure a flow bending at a right angle when flows into the first gas passageway. The lubricating oil in the gas to be compressed is subject to an inertial force at the bending portion of the gas flow, and therefore a part of the lubricating oil accumulates in the suction space without flowing into the first gas passageway. Thus with such a simple separation mechanism, the lubricating oil in the gas to be compressed could be trapped selectively.

[0017] In the scroll-type compressor, it is preferable that the suction space extends to a level lower than the first gas passageway in a vertical direction. With such

configured suction space, the lubricating oil trapped with the above-described simple separation mechanism could be stored at the bottom of the suction space, so that the trapped lubricating oil is efficiently supplied to each sliding contact portion if the suction space is provided with the lubricating oil passageway or the like at the bottom.

Effect according to the Invention

[0018] The scroll-type compressor according to the present invention makes it possible that the suction gas flow is kept in a good flow condition while the superheat degree of the suction gas is controlled appropriately, so that the bearing for the main shaft and the sliding contact portions around the compression mechanism are lubricated effectively.

Brief explanation of the drawings

[0019]

[Fig. 1] Fig. 1 shows a scroll-type compressor according to the first embodiment of the present invention, where (a) is a front view and (b) is a longitudinal section view of section A-A in (a).

[Fig. 2] Fig. 2 shows the scroll-type compressor shown in Fig. 1, where (a) is a longitudinal section view showing section B-B in Fig. 1(b) and (b) is a cross section view showing section C-C in Fig. 1 (b).

[Fig. 3] Fig. 3 shows a scroll-type compressor according to the second embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b).

[Fig. 4] Fig. 4 shows a scroll-type compressor according to the third embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b).

[Fig. 5] Fig. 5 shows a scroll-type compressor according to the fourth embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b).

[Fig. 6] Fig. 6 is a longitudinal section view corresponding to Fig. 1(b), showing a scroll-type compressor according to the fifth embodiment of the present invention.

Embodiments for carrying out the Invention

[0020] Hereinafter, desirable embodiments of the present invention will be explained with reference to figures.

[0021] Fig. 1 shows a scroll-type compressor according to the first embodiment of the present invention, where (a) is a front view and (b) is a longitudinal section

view of section A-A in (a). When compressor 1 is in operation, main shaft 2 rotates to swing movable scroll 3, so that the gas is compressed by compression mechanism 5 comprising movable scroll 3 and fixed scroll 4. Refrigerant gas to be compressed is sucked from opening 7 on a side surface of front housing 6 into suction space 8. Suction space 8 is shaped like a cylinder extending toward the inside (or downward in Fig. 1) along the turning radius of main shaft 2 from opening 7. Suction space 8 communicates on the side surface with first gas passageway 9 extending along the rotation axis of main shaft 2. Diverging from first gas passageway 9, second gas passageway 13 extends toward bearing 11 for main shaft 2 opening on container space 12 where counterweight 10 is placed.

[0022] Front housing 6 and shell 15 integral with fixed scroll 4 are fastened with bolts 14 as fastening means. On the contacting surface between front housing 6 and shell 15, first gas passageway 9 and third gas passageway 16 communicate with each other at an outer side (or an upper side in the Fig.) than a movable region where bottom plate 3a of movable scroll 3 can move, with respect to a direction of the turning radius of main shaft 2. Third gas passageway 16 extends at the inside of shell 15 along the rotation axis of main shaft 2 (or toward the right in the Fig.) so that first gas passageway 9 communicates with internal space 5a of compression mechanism 5. Because first gas passageway 9 and third gas passageway 16 communicate with each other at an outer side than the movable region of bottom plate 3a in the direction of the turning radius of main shaft 2, such a communication is maintained even when compressor 1 is in operation.

[0023] On the bottom of suction space 8, lubricating oil passageway 17 extending to container space 12 without going through first gas passageway 9 as well as lubricating oil passageway 18 extending to lip seal lubrication space 20 without going through first gas passageway 9 are provided. Such configured suction space 8 functions as a simple oil separator for separating lubricating oil from suction gas to be compressed. Namely, the refrigerant component in the gas to be compressed tends to flow into first gas passageway 9 communicating with the side of suction space 8 while the lubricating oil component in the gas to be compressed tends to flow into lubricating oil passageway 17 communicating with the bottom of suction space 8. Therefore, the lubricating oil can be preferentially delivered toward bearing 11 for main shaft 2 required to be highly lubricated.

[0024] Fig. 2 shows compressor 1 shown in Fig. 1, where (a) is a longitudinal section view showing section B-B in Fig. 1(b) and (b) is a cross section view showing section C-C in Fig. 1(b). In Fig. 2, first gas passageway 9 extends with approximately uniform cross section toward shell 15 along the rotation axis of main shaft 2, so as to have almost the same cross-section shape as third gas passageway 16 near shell 15.

[0025] Fig. 3 shows scroll-type compressor 31 accord-

ing to the second embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b). Front housing 32 of compressor 31 is provided with first gas passageway 33 of which cross-section has been enlarged along the rotation axis of main shaft 2 to have a greater curvature and which extends toward shell 35 with almost the same cross-section shape as third gas passageway 34.

[0026] Fig. 4 shows scroll-type compressor 41 according to the third embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b). Front housing 42 of compressor 41 is provided with first gas passageway 43 of which cross-section has been enlarged along the rotation axis of main shaft 2 by a constant ratio and which extends toward shell 45 with almost the same cross-section shape as third gas passageway 44. Further, inside first gas passageway 43, fins 46 having greater surface area extend along the rotation axis of main shaft 2. Such a structure makes it possible that the lubricating oil in the gas flowing inside first gas passageway 43 is trapped by fins 46 and is led by the gravity to a portion by which the movable scroll is supported as being brought into sliding contact.

[0027] Fig. 5 shows scroll-type compressor 51 according to the fourth embodiment of the present invention, where (a) is a longitudinal section view corresponding to Fig. 2(a) and (b) is a cross section view corresponding to Fig. 2(b). Front housing 52 of compressor 51 is provided with first gas passageway 53 of which cross-section has been enlarged along the rotation axis of main shaft 2 by a constant ratio and which extends toward shell 55 with almost the same cross-section shape as third gas passageway 54. Further, a part of first gas passageway 53 is formed as fins 56 extending along the rotation axis of main shaft 2. Such a structure makes it possible that the lubricating oil in the gas flowing inside first gas passageway 53 is trapped by fins 56 and is led through second gas passageway 57 to bearings and the portion by which the movable scroll is supported as being brought into sliding contact.

[0028] Fig. 6 is a longitudinal section view corresponding to Fig. 1(b), showing scroll-type compressor 61 according to the fifth embodiment of the present invention. The bottom of suction space 63 of front housing 62 is filled with porous filling material 64 comprising porous particles or fibers. The filled porous filling material 64 can trap the lubricating oil component in the gas to be compressed efficiently, so that the lubricating oil is easily led to lubricating oil passageway 65, 66. The other configuration is the same as Fig. 1(b) with its detailed explanation omitted.

Industrial Applications of the Invention

[0029] The structure of the scroll-type compressor according to the present invention is applicable to every

scroll-type compressor required to have a high lubricity on a sliding portion.

Explanation of symbols

[0030]

1, 31, 41, 51, 61: compressor
 2: main shaft
 3: movable scroll
 3a: bottom plate
 4: fixed scroll
 5: compression mechanism
 5a: internal space
 6, 32, 42, 52, 62: front housing
 7: opening
 8, 63: suction space
 9, 33, 43, 53: first gas passageway
 10: counterweight
 11: bearing
 12: container space
 13, 36, 47, 57: second gas passageway
 14: bolt
 15, 35, 45, 55: shell
 16, 34, 44, 54: third gas passageway
 17, 18, 65, 66: lubricating oil passageway
 20: lip seal lubrication space
 21: lip seal
 46, 56: fin
 64: porous filling material

Claims

1. A scroll-type compressor comprising:

a housing which forms one portion of a compressor case and which supports a bearing for a main shaft having an opening through which a gas to be compressed is sucked, a suction space extending with a cylindrical-shape from the opening into the compressor, a first gas passageway extending from the suction space along a rotation axis of the main shaft, and a second gas passageway communicating with the first gas passageway and a space in which the bearing is disposed; and

a shell which forms the other portion of the compressor case and which is fastened to the housing having a third gas passageway communicating with the first gas passageway and an internal space of a compression mechanism, **characterized in that**

the first gas passageway and the third gas passageway communicate with each other at an outer side than a region where a bottom plate of a movable scroll can move with respect to a direction of a turning radius of the main shaft.

2. The scroll-type compressor according to claim 1, wherein the housing has a lubricating oil passageway which is independent from the first gas passageway and communicates with the suction space and the space in which the bearing is disposed.

3. The scroll-type compressor according to claim 2, wherein a porous filling material is filled in a neighborhood of a portion which the suction space and the lubricating oil passageway communicate with each other.

4. The scroll-type compressor according to any of claims 1 to 3, wherein the housing and the shell are fastened with a plurality of fastening means so that the first gas passageway and the third gas passageway communicate with each other in a region between the fastening means which are adjacent to each other.

5. The scroll-type compressor according to any of claims 1 to 4, wherein the suction space extends inward along the turning radius of the main shaft.

6. The scroll-type compressor according to any of claims 1 to 5, wherein the bearing is disposed as opening on a container space where a counterweight is placed.

7. The scroll-type compressor according to any of claims 1 to 6, wherein a fixed scroll is formed integrally with the shell.

8. The scroll-type compressor according to any of claims 1 to 7, wherein a fin structure is formed inside the first gas passageway.

9. The scroll-type compressor according to any of claims 1 to 8, wherein the first gas passageway is formed on a side surface of the suction space.

10. The scroll-type compressor according to claim 9, wherein the suction space extends to a level lower than the first gas passageway in a vertical direction.

FIG. 1

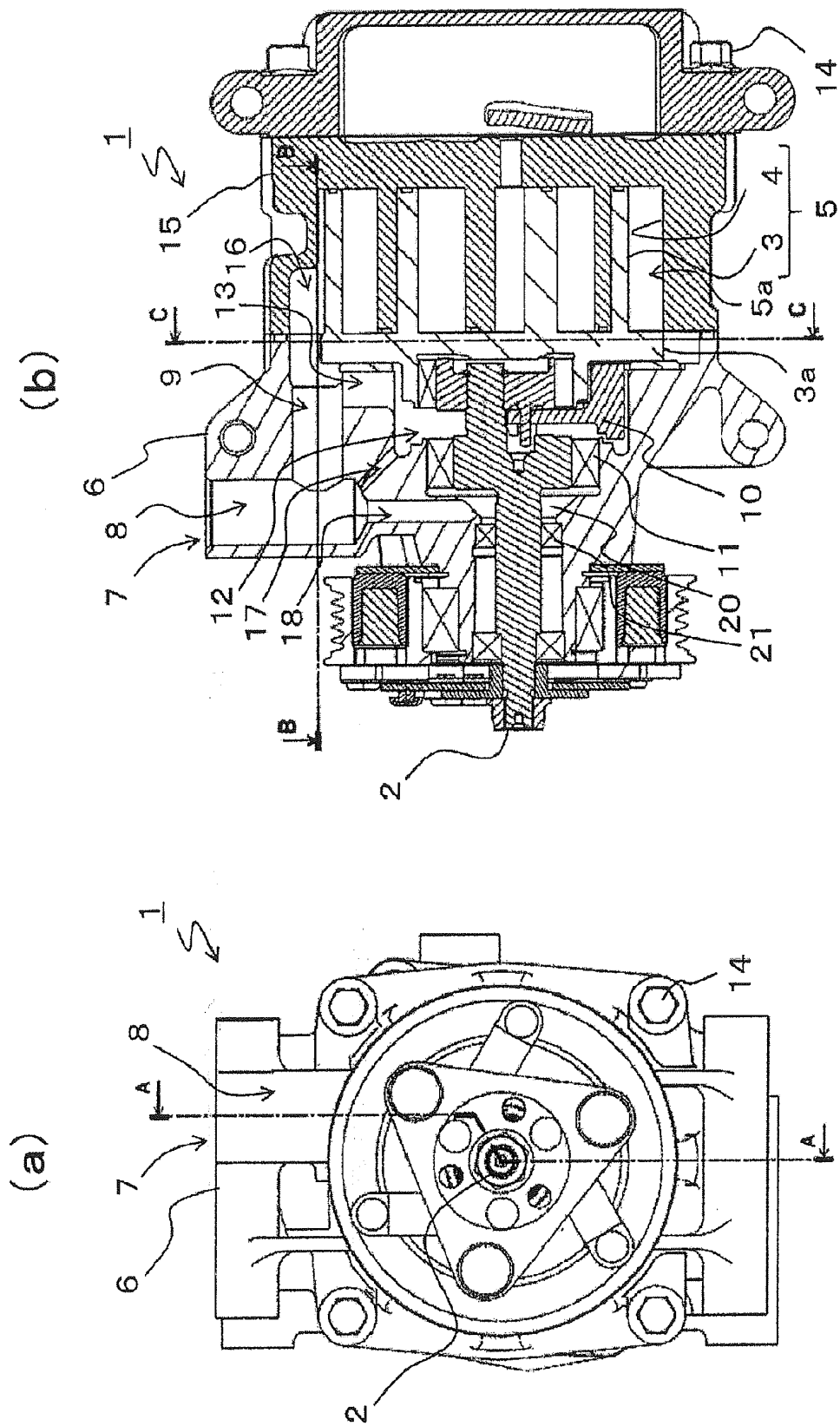


FIG. 2

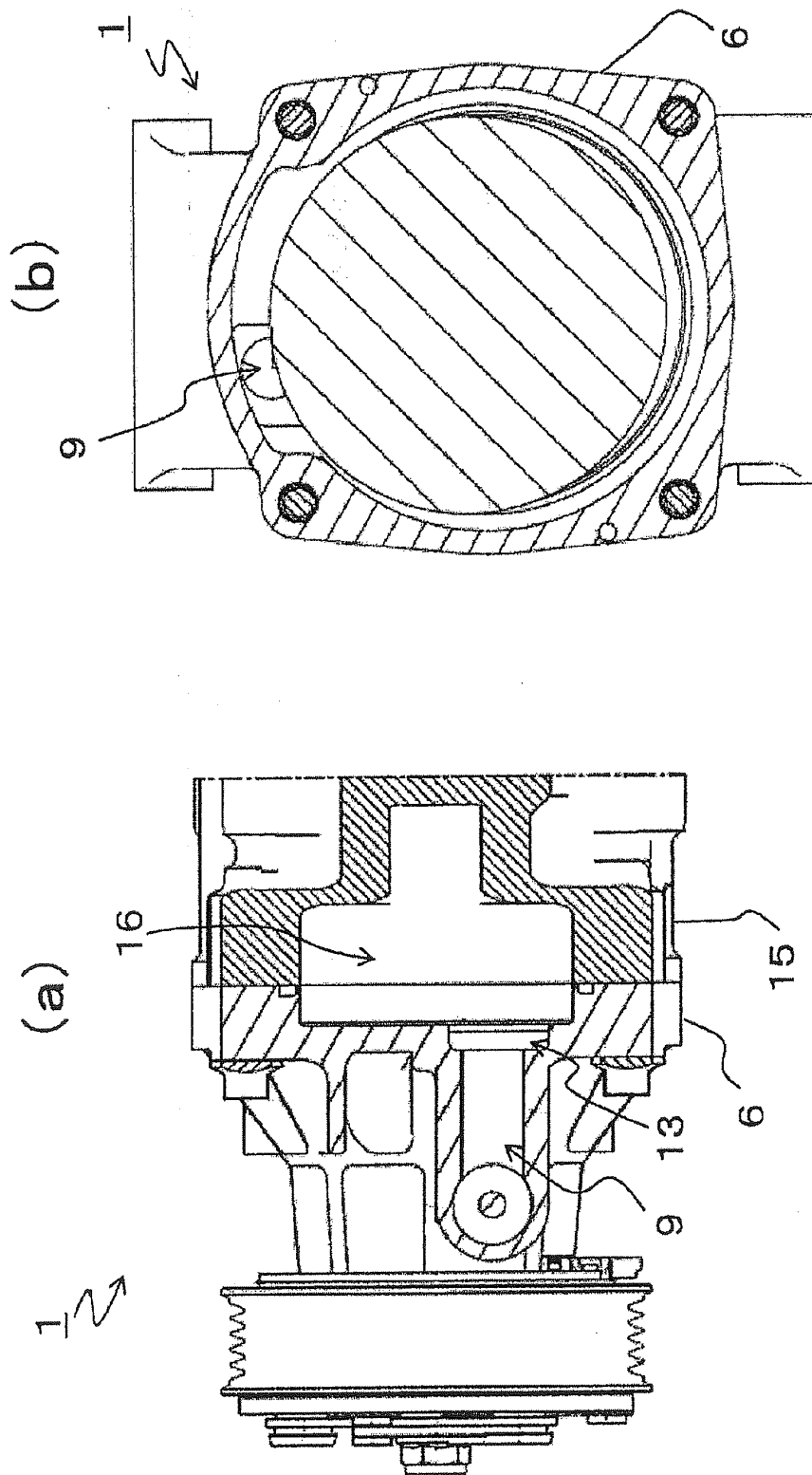


FIG. 3

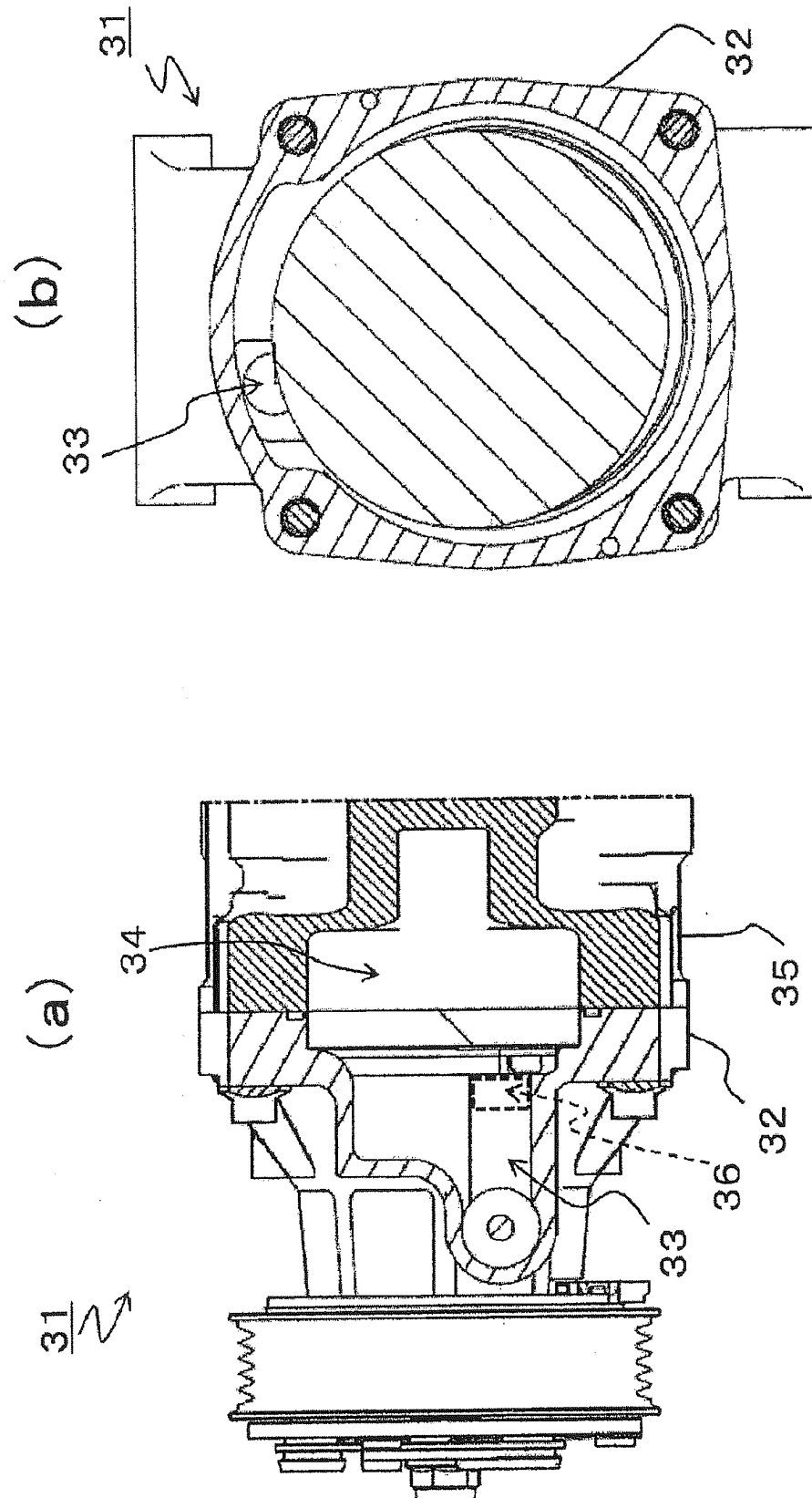


FIG. 4

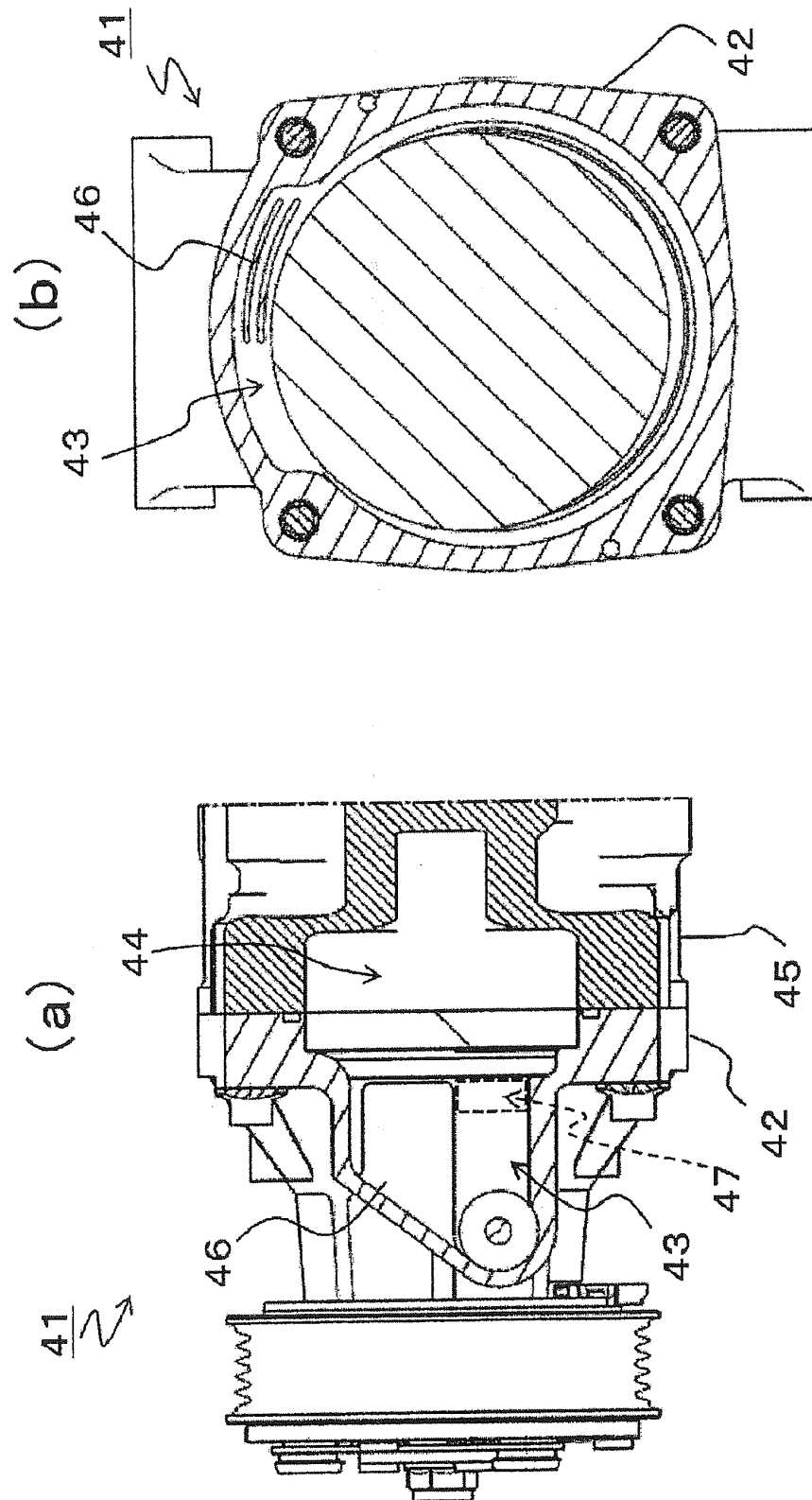


FIG. 5

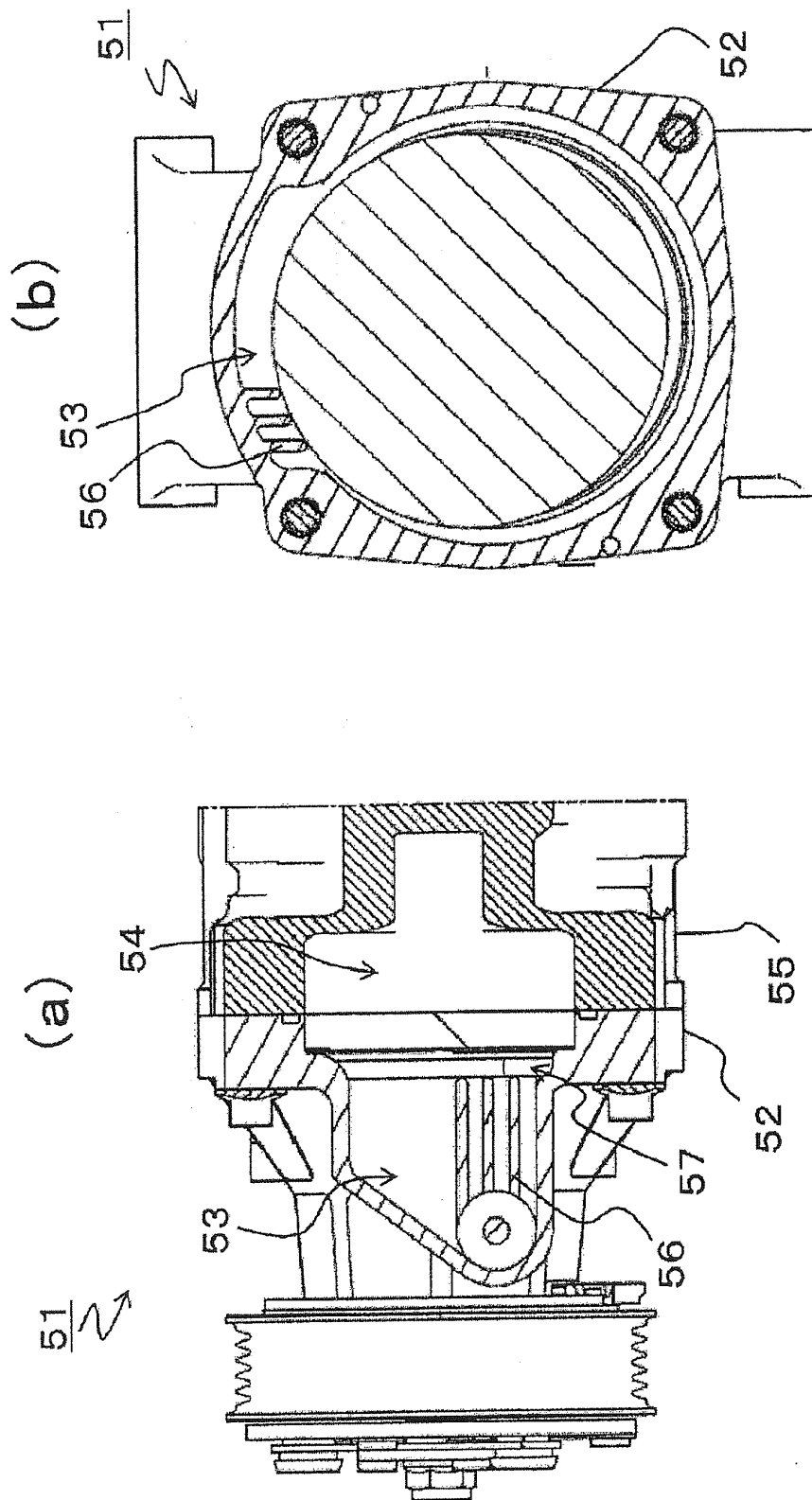
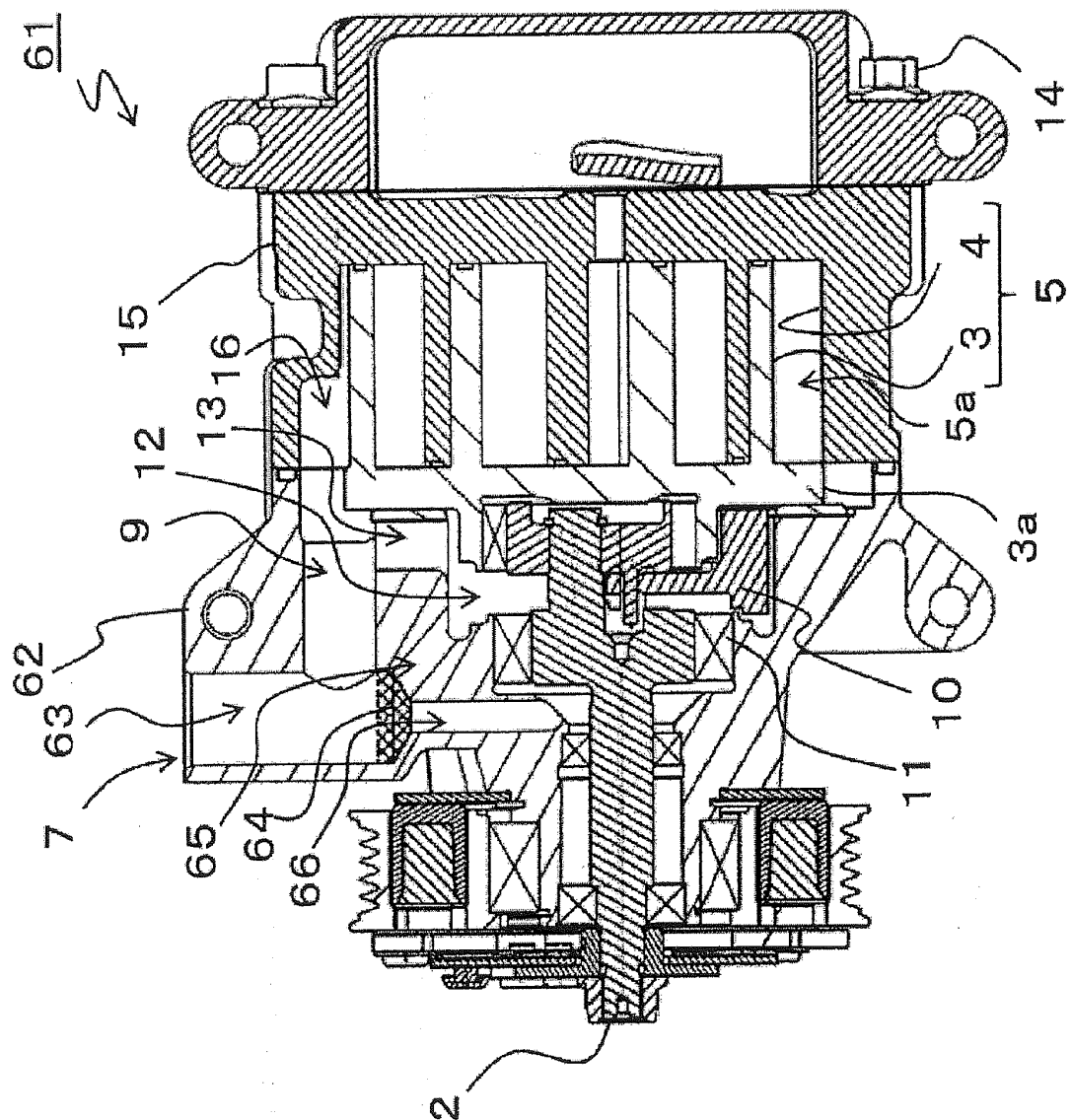


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/061634

A. CLASSIFICATION OF SUBJECT MATTER

F04C18/02 (2006.01) i, F04C29/02 (2006.01) i, F04C29/04 (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)

F04C18/02, F04C29/02, F04C29/04

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012

Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

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 A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 2241/1990 (Laid-open No. 92580/1991) (Toyoda Automatic Loom Works, Ltd.), 20 September 1991 (20.09.1991), entire text; all drawings (Family: none)	1, 2, 4-7, 9, 10 3, 8
Y A	JP 3227075 B2 (Denso Corp.), 12 November 2001 (12.11.2001), entire text; all drawings (Family: none)	1, 2, 4-7, 9, 10 3, 8

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search
08 August, 2012 (08.08.12)Date of mailing of the international search report
21 August, 2012 (21.08.12)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/061634

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-231356 A (Toyoda Automatic Loom Works, Ltd.), 07 September 1993 (07.09.1993), entire text; all drawings & US 5395223 A & DE 4305044 A1	1-10
A	JP 9-32745 A (Matsushita Electric Industrial Co., Ltd.), 04 February 1997 (04.02.1997), entire text; all drawings (Family: none)	1-10

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REFERENCES CITED IN THE DESCRIPTION

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- JP 3227075 B [0005]
- JP 9032745 A [0005]
- JP 4106088 B [0005]