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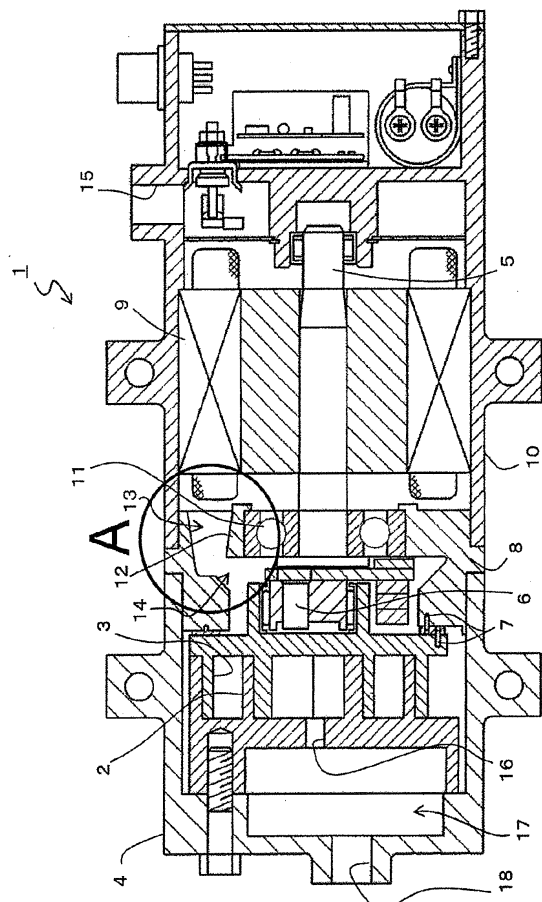
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(54) **SCROLL FLUID MACHINE**

(57) A scroll-type fluid machine is configured so that the scroll-type fluid machine has compact, lightweight, and long life characteristics obtained by mounting, without increasing the diameter of the barrel, a bearing having a higher load capacity and so that a degradation in the performance due to a pressure loss during a high flow-rate operation is minimized by providing the gas flow path in the center plate with a sufficient cross-sectional area. A scroll-type fluid machine is provided with: a first housing which contains a scroll mechanism; a second housing which contains an electric motor; and a center plate which is disposed between both the housings, which contains a motion conversion mechanism for converting rotational motion to orbiting motion, which has mounted thereto a rotation prevention mechanism for preventing the rotation of a movable scroll, and which holds the bearing for supporting the main shaft. At least a part of the fluid path, which connects the insides of the first and second housings through the portion at which the center plate is disposed, is configured to connect an axial recess and a radial recess which are formed in the center plate, the axial recess facing the inside of the second housing and extending in the axial direction, the radial recess being located closer to the first housing than the bearing and extending in the radial direction.

FIG. 1



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DescriptionTechnical Field of the Invention

[0001] The present invention relates to a scroll-type fluid machine, such as a scroll-type electric compressor for air-conditioning and a scroll-type expander which is loaded with an electric generator used for recovering exhaust heat from vehicles and boilers.

Background Art of the Invention

[0002] Known is an electric compressor of which electric motor and scroll-type compression mechanism are placed in the same axis. Such a compressor comprises a housing to house a pair of scroll bodies, another housing to house an electric motor and a center plate provided with mechanism component parts which convert a rotation into a swing, as disclosed in patent document 1 and 2. In such a compressor, after refrigerant is sucked from a suction port provided on a housing to house the electric motor, it passes through a void of the electric motor, and then through a void of a bearing held by the center plate or a void of an outer periphery of a cylindrical section which holds the bearing, so as to be taken into the scroll bodies and discharged from a discharge port of a housing to house the pair of scroll bodies.

[0003] On the other hand, in the expander which is loaded with the electric generator, the suction port and the discharge port are reversed so that refrigerant flows in a direction opposite to the above-described case of compressor. In other words, after refrigerant is sucked from a suction port provided on a housing to house a pair of scroll bodies and is taken into the scroll bodies, it passes through a void of a bearing held by the center plate or a void of an outer periphery of a cylindrical section which holds the bearing, and then through a void of the electric generator, so as to be discharged from a discharge port of a housing to house the electric generator.

Prior art documents

Patent documents

[0004]

Patent document 1: JP2008-232057-A

Patent document 2: JP2008-303819-A

Summary of the InventionProblems to be solved by the Invention

[0005] In the process of research and development aiming to reliability improvement and reduction in size and weight of scroll-type fluid machines, a main shaft bearing was required to have a great load capacity without scaling up a body diameter of a compressor. How-

ever, it is difficult to form a void as a main gas flow path because the outer diameter of a cylindrical section holding the bearing becomes almost equal to the inner diameter of a coupling section of a movable scroll body when the outer diameter of the bearing is enlarged in order to increase the load capacity of the bearing without changing the inner diameter which may affect on another component part. Furthermore, it is difficult that performance deterioration from pressure loss during high flow-rate operation is prevented only by the void of the bearing.

[0006] Accordingly, an object of the present invention is to provide a scroll-type fluid machine which can achieve a long life and a reduction in size and weight while a bearing with greater load capacity is incorporated without enlarging the body diameter and which can prevent the performance deterioration from pressure loss during high flow-rate operation by ensuring the section area of the gas flow path of the center plate.

Means for solving the Problems

[0007] To achieve the above-described object, a scroll-type fluid machine according to the present invention is a scroll-type fluid machine comprising a first housing which houses a scroll mechanism made of a fixed scroll and a movable scroll, a second housing which houses an electric motor to rotate a main shaft, and a center plate, which is interposed between the housings, which has a motion conversion mechanism to convert a rotation motion of the main shaft to a swing motion of the movable scroll, which is provided with a rotation preventing mechanism for the movable scroll, and which holds a bearing to hold the main shaft, and a fluid path which communicates an inside of the second housing and an inside of the first housing through an installation part of the center plate, characterized in that at least a part of the fluid path is formed by connecting an axial recessed portion and a radial recessed portion, which are formed in the center plate, the axial recessed portion facing the inside of the second housing and extending in an axial direction, the radial recessed portion being located closer to the first housing than the bearing and extending in a radial direction.

[0008] In the scroll-type fluid machine, at least a part of the fluid path, which connects the inside of the first housing and the inside of the second housing through the center plate, is formed by connecting the axial recessed portion and the radial recessed portion which are formed in the center plate, so as to sufficiently ensure the section area of the gas flow path and to prevent the performance from deteriorating by pressure loss during a high flow-rate operation. Further, the fluid path is formed by connecting the axial recessed portion extending axially along the main shaft and the radial recessed portion extending radially, so that the gas flow path can be formed by a simple processing.

[0009] In the scroll-type fluid machine of the present invention, it is preferable that a plurality of the axial re-

cessed portions are formed along a circumferential direction. Such axial recessed portions make it easy to ensure the section area of the fluid path even if a bearing with relatively high load capacity is incorporated.

[0010] Furthermore, it is preferable that a part of an inner surface of the axial recessed portion is formed to be a surface extending in a shape tapered toward the inside of the second housing. The axial recessed portion is formed in such a shape, so that the strength of the center plate is maintained and the processing is simplified.

[0011] In the scroll-type fluid machine of the present invention, it is preferable that the radial recessed portion is formed to be a ring-shaped recess extending in a circumferential direction. The radial recessed portion is formed in such a shape, so that the processing is simplified.

[0012] It is preferable that a part of an inner surface of the radial recessed portion is formed to be a surface extending in a shape tapered toward the inside of the second housing from the inside of the first housing. The radial recessed portion is formed in such a shape, so that the strength of the center plate is maintained and the processing is simplified.

[0013] In the scroll-type fluid machine of the present invention, it is preferable that the axial recessed portion is provided at a time of producing a material for the center plate. The axial recessed portion is provided at the same time of producing the material for the center plate, so that the production process of the center plate can be simplified. Further, it is preferable that the material for the center plate is produced by casting and the axial recessed portion is formed with a die. Furthermore, it is possible that the radial recessed portion is formed with a core mold. Such a production process is employed, so that the center plate can be produced further efficiently.

[0014] In addition, it is possible that the radial recessed portion is formed by machining. The machining can be easily performed especially in a case where the radial recessed portion is formed into a ring-shaped recess extending in a circumferential direction.

[0015] In the scroll-type fluid machine, it is possible that the center plate is formed integrally with either the first housing or the second housing. When the center plate is formed to be unified with the first housing or the second housing, the number of component parts can be reduced and the assembly process of the scroll-type fluid machine can be simplified.

[0016] The scroll-type fluid machine of the present invention can be constructed as a compressor or an expander. Namely, in the scroll-type fluid machine of the present invention, function as a compressor or an expander can be shown as depending on the rotational direction of the main shaft. Specifically when it is constructed as a compressor, it is preferable that a discharge valve is provided.

[0017] The scroll-type fluid machine according to the present invention is suitably used as a fluid machine load-

ed in a vehicle. Because fluid machines loaded in vehicles are strongly required to have a small size and a light weight, technical features of the scroll-type fluid machine of the present invention can be brought out effectively therein.

Effect according to the Invention

[0018] A scroll-type fluid machine according to the present invention makes it possible that the section area of the fluid path is sufficiently ensured by a simple processing and that the performance deterioration caused by a pressure loss during high flow-rate operation is efficiently prevented. As a result, it is not necessary for the body diameter to enlarge even when a bearing having higher load capacity is incorporated, so that a small-sized and light-weight fluid machine is achieved with a long life. In addition, the section area of the fluid path of the center plate is sufficiently ensured, so that the performance deterioration caused by a pressure loss in a high flow-rate operation is prevented.

Brief explanation of the drawings

[0019]

[Fig. 1] Fig. 1 is longitudinal section view of a scroll-type compressor according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a partial enlarged longitudinal section view where a neighborhood of part A of Fig. 1 has been enlarged.

Embodiments for carrying out the Invention

[0020] Hereinafter, desirable embodiments will be explained as referring to figures.

Fig. 1 is a longitudinal section view of a scroll-type compressor according to an embodiment of the present invention. Compressor 1 comprises first housing 4 to house fixed scroll 2 and movable scroll 3, crank mechanism 6 to convert the rotation of main shaft 5 to the swing of movable scroll 3, center plate 8 provided with rotation preventing mechanism 7 to prevent movable scroll 3 from rotating and second housing 10 to house electric motor 9, wherein electric motor 9 and compressor 1 are disposed in the same axis. Cylindrical bearing holding section 12 to hold bearing 11 of main shaft 5 is attached to a surface at electric motor 9 side of center plate 8. A plurality of radially formed ribs (not shown) are provided at the outer side from bearing holding section 12 in a radial direction. A plurality of radial recessed portions 13 extending axially along main shaft 5 are formed to have inner surfaces which extend as tapering toward the inside of second housing 10.

[0021] On the other hand, a surface of first housing 4 side of center plate 8 is provided with radial recessed portion 14 which extends in a direction perpendicular to

main shaft 5 and which is formed to be a ring-shaped recess extending over a whole circumference of center plate 8. The inner surface of radial recessed portion 14 is formed in a tapered shape extending in parallel with main shaft 5 from the inside of first housing 4 toward the inside of second housing 10 (electric motor 9 side).

[0022] Such formed radial recessed portion 14 and a plurality of axial recessed portions 13 communicate each other, so that a fluid path through which refrigerant gas to be compressed flows is formed. The refrigerant gas sucked from suction port 15 is delivered through a gap of electric motor 9 to a front side of center plate 8, and then, is taken into movable scroll 3 mainly via axial recessed portion 13 and radial recessed portion 14. After it is compressed by a compression mechanism made of movable scroll 3 and fixed scroll 2, it is discharged from discharge port 18 via discharge hole 16 and discharge chamber 17. The refrigeration circuit of compressor 1 is constructed to make such a path. Because refrigerant gas, which conventionally used to flow in a gap of bearing 11 or a gap at the outer periphery side of bearing holding section 12, comes to be able to flow inside a fluid path made of the radial recessed portion 14 and axial recessed portion 13 so as to ensure the section area of the refrigerant gas flow path, the pressure loss can be reduced in a high flow-rate operation.

[0023] Fig. 2 is a partial enlarged longitudinal section view where a neighborhood of part A of Fig. 1 has been enlarged. Desirable size and shape of axial recessed portion 13 and radial recessed portion 14 will be explained as referring to Fig. 2 as follows.

[0024] It is preferable that axial length a in an overlap region of axial recessed portion 13 and radial recessed portion 14 is 2-9 mm. The longer length a is, the more pressure loss is reduced. However excessively long length a would weaken the strength of center plate 9.

[0025] It is preferable that angle b, which is wedged between an end surface at movable scroll 3 side of center plate 9 and a tapered inner surface of radial recessed portion 14, is 20-60 degrees. Angle b within this range makes it easy to process radial recessed portion 14.

[0026] It is preferable that angle c (e) between the tapered inner surface of axial recessed portion 13 and the axial direction is 1-4 degrees. Angle c within this range makes it possible to improve fluidity of refrigerant gas which flows into axial recessed portion 13 from the inside of second housing 10 as well as to simplify processing radial recessed portion 14.

[0027] It is preferable that radial depth d of radial recessed portion 14 is 3-9mm. Depth d within this range makes it possible to improve fluidity of refrigerant gas which flows from axial recessed portion 13 via radial recessed portion 14 into the inside of first housing 4 as well as to simplify processing radial recessed portion 14.

Industrial Applications of the Invention

[0028] A scroll-type fluid machine according to the

present invention is suitably used as a compressor for vehicles, etc., which is required to have a small side and light weight.

5 Explanation of symbols

[0029]

1:	compressor
10 2:	fixed scroll
3:	movable scroll
4:	first housing
5:	main shaft
6:	crank mechanism
15 7:	rotation preventing mechanism
8:	center plate
9:	electric motor
10:	second housing
11:	bearing
20 12:	bearing holding section
13:	axial recessed portion
14:	radial recessed portion
15:	suction port
16:	discharge hole
25 17:	discharge chamber
18:	discharge port
a:	axial length in overlap region of axial recessed portion and radial recessed portion
b:	angle between end surface at movable scroll side and tapered inner surface of radial recessed portion
30 c, e:	angle between tapered inner surface of axial recessed portion and axial direction
d:	radial depth of radial recessed portion

Claims

1. A scroll-type fluid machine comprising:

- a first housing which houses a scroll mechanism made of a fixed scroll and a movable scroll;
 - a second housing which houses an electric motor to rotate a main shaft; and
 - a center plate, which is interposed between said housings, which has a motion conversion mechanism to convert a rotation motion of said main shaft to a swing motion of said movable scroll, which is provided with a rotation preventing mechanism for said movable scroll, and which holds a bearing to hold said main shaft, and a fluid path which communicates an inside of said second housing and an inside of said first housing through an installation part of said center plate, **characterized in that**
- at least a part of said fluid path is formed by connecting an axial recessed portion and a radial recessed portion, which are formed in said

- center plate, said axial recessed portion facing said inside of said second housing and extending in an axial direction, said radial recessed portion being located closer to said first housing than said bearing and extending in a radial direction. 5
2. The scroll-type fluid machine according to claim 1, wherein a plurality of said axial recessed portions are formed along a circumferential direction. 10
3. The scroll-type fluid machine according to claim 1 or 2, wherein a part of an inner surface of said axial recessed portion is formed to be a surface extending in a shape tapered toward said inside of said second housing. 15
4. The scroll-type fluid machine according to any of claims 1-3, wherein said radial recessed portion is formed to be a ring-shaped recess extending in a circumferential direction. 20
5. The scroll-type fluid machine according to any of claims 1-4, wherein a part of an inner surface of said radial recessed portion is formed to be a surface extending in a shape tapered toward said inside of said second housing from said inside of said first housing. 25
6. The scroll-type fluid machine according to any of claims 1-5, wherein said axial recessed portion is provided at a time of producing a material for said center plate. 30
7. The scroll-type fluid machine according to claim 6, wherein said material for said center plate is produced by casting and said axial recessed portion is formed with a die. 35
8. The scroll-type fluid machine according to any of claims 1-7, wherein said radial recessed portion is formed by machining. 40
9. The scroll-type fluid machine according to any of claims 1-8, wherein said center plate is formed integrally with either said first housing or said second housing. 45

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FIG. 1

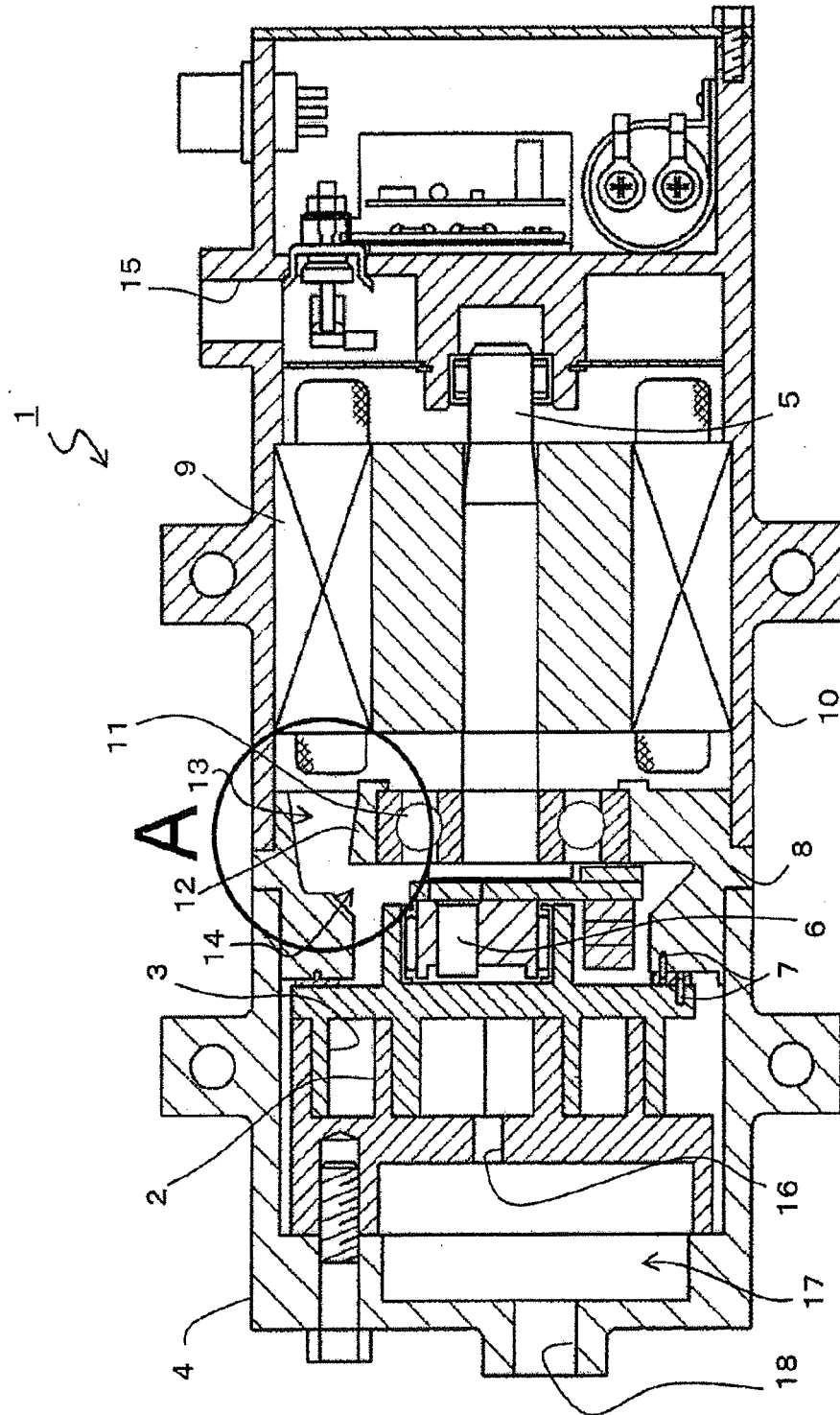
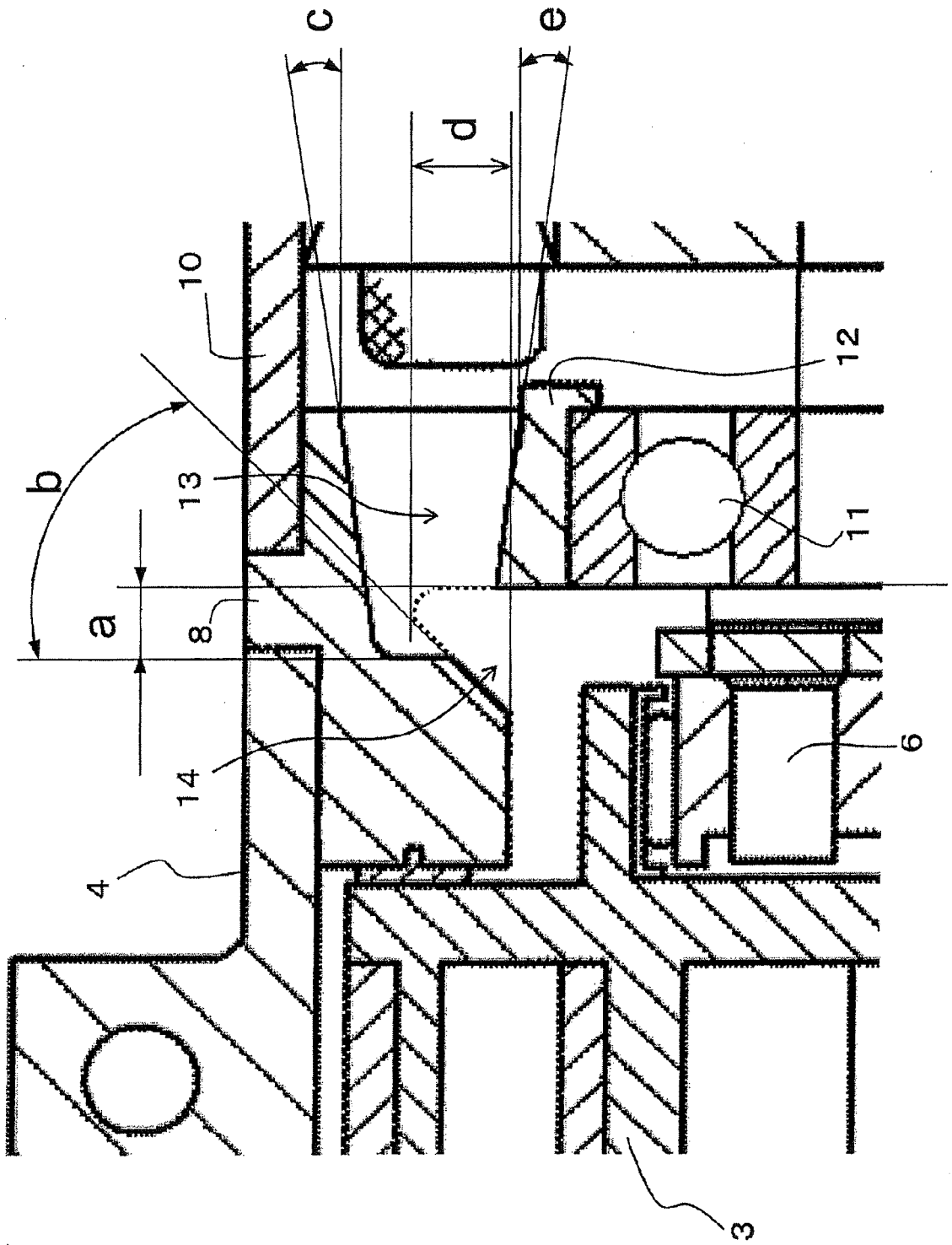


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

A. CLASSIFICATION OF SUBJECT MATTER 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) F04C18/02		
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 1996-2010 Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010		
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.
X Y A	JP 08-105392 A (Mitsubishi Heavy Industries, Ltd.), 23 April 1996 (23.04.1996), paragraph [0007]; fig. 1 to 4 (Family: none)	1, 2 6-9 3-5
Y	JP 2002-070762 A (Toyota Industries Corp.), 08 March 2002 (08.03.2002), paragraphs [0008] to [0010]; fig. 1 & US 2002/0025268 A1 & DE 10140456 A1	6-9
A	JP 2003-239875 A (Sanden Corp.), 27 August 2003 (27.08.2003), paragraph [0012]; fig. 1 & US 2003/0156961 A1	1-9
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 15 December, 2010 (15.12.10)		Date of mailing of the international search report 28 December, 2010 (28.12.10)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/006250

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 2003-343458 A (Mitsubishi Heavy Industries, Ltd.), 03 December 2003 (03.12.2003), paragraph [0027]; fig. 1 (Family: none)	1-9

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Document 1 (JP 08-105392 A (Mitsubishi Heavy Industries, Ltd.), 23 April, 1996 (23.04.1996), [0007], fig. 1-4) discloses "a scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, (continued to extra sheet)

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

Continuation of Box No.III of continuation of first sheet (2)

further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein said axial recess is formed in plurality in the circumferential direction".

Thus, the invention of claims 1 and 2 is not admitted to involve any novelty to and any special technical feature over the invention disclosed in document 1.

Hence, it is admitted that the claims contain fourteen inventions (groups), as specified in the following.

Here, the inventions of claims 1 and 2 having no special technical feature are grouped into invention 1.

(Invention 1) Invention of claims 1 and 2 and invention of claims 3-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein the inner surface of said radial recess is partially formed in a counter-taper face from the inside of said first housing toward the inner side of said second housing". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

(Invention 2) Invention of claims 3-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein the inner surface of said axial recess is formed in a counter-taper face toward the inner side of said second housing".

(Invention 3) Invention of claims 4-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein said axial recess is formed into a recess extending annularly in the circumferential direction". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

(Invention 4) Invention of claims 5-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein the inner surface of said radial recess is partially formed in a counter-taper face from the inside of said first housing toward the inner side of said second housing".

(Invention 5) Invention of claims 6-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein said axial recess is formed at the time of manufacturing a forming stock of said center plate". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/006250

(Invention 6) Invention of claims 7-9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein the forming stock of said center plate is manufactured by a casting, and wherein said axial recess is formed by a mold".

(Invention 7) Invention of claims 8 and 9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein said radial recess is formed by a machining". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

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(Invention 8) Invention of claim 9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", and "wherein said center plate is formed integrally with either said first housing or said second housing".

(Invention 9) Invention of claim 4 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein said radial recess is formed into a recess extending annularly in the circumferential direction". (continued to next extra sheet)

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(Invention 10) Invention of claim 5 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein the inner surface of said radial recess is partially formed in a counter-taper face from the inside of said first housing toward the inner side of said second housing".

(Invention 11) Invention of claim 6 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein said axial recess is formed at the time of manufacturing a forming stock of said center plate". (continued to next extra sheet)

INTERNATIONAL SEARCH REPORT

International application No.

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(Invention 12) Invention of claim 7 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", "wherein the forming stock of said center plate is manufactured by a casting, and wherein said axial recess is formed by a mold".

(Invention 13) Invention of claim 8 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein said radial recess is formed by a machining".

(continued to next extra sheet)

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(Invention 14) Invention of claim 9 and having the following special technical features

"A scroll fluid mechanism comprising: a first housing storing a scroll mechanism having a fixed scroll and a movable scroll; a second housing storing an electric motor for driving a spindle rotationally; and a center plate interposed between the two housings, storing a motion converting mechanism for converting the rotating motions of said spindle into the swirling motions of said movable scroll, attaching a rotation preventing mechanism to said movable scroll, and holding the bearing of said spindle, further comprising a fluid passage for providing the communication between the inside of said second housing and the inside of said first housing through the setting section of said center plate, wherein at least a portion of said fluid passage is formed by providing the communication between an axial recess, which is formed in said center plate and extends in the axial direction while facing the inside of said second housing, and a radial recess, which is positioned closer to the side of said first housing than said bearing and which extends in the radial direction", "wherein said axial recess is formed in plurality in the circumferential direction", and "wherein said center plate is formed integrally with either said first housing or said second housing".

REFERENCES CITED IN THE DESCRIPTION

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