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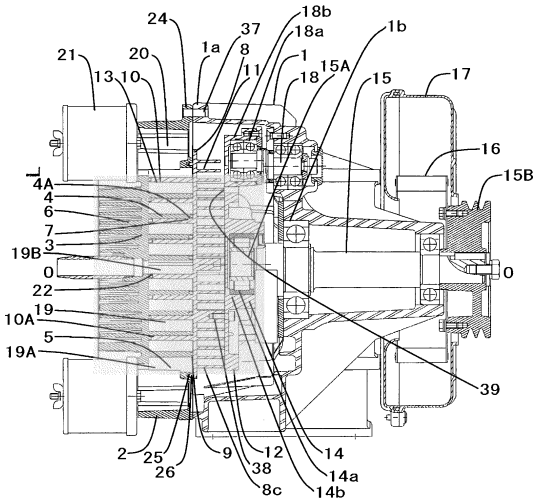
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(54) SCROLL FLUID MACHINE

(57) It is an object of the present invention to realize reliability improvement and a long life of a rotation preventing mechanism by preventing heat from being directly transferred from an orbiting scroll to a rotation preventing mechanism. The present invention includes a fixed scroll, an orbiting scroll provided to be opposed to the fixed scroll and moved to orbit, a casing provided on an outer side of the orbiting scroll, a driving shaft for driving the orbiting scroll, a back face plate fastened to the orbiting scroll and connected to the driving shaft by a boss portion, and a rotation preventing mechanism provided between the casing and the boss plate for preventing a rotation of the orbiting scroll, in which the back face plate includes a rotation preventing mechanism side back face plate integrally provided with the rotation preventing mechanism and a driving shaft side back face plate integrally provided with the boss portion, and the rotation preventing mechanism side back face plate is not in contact with the orbiting scroll.

FIG. 1



EP 3 109 475 A1

Description

Technical Field

[0001] The present invention relates to a scroll type fluid machine.

Background Art

[0002] Patent Literature 1 discloses "a cooling structure in a scroll fluid machine characterized in that at least a back face of a boss portion for an auxiliary crank and a center portion corresponding to a boss portion for the rotating shaft are brought into contact with a cooling fin tip portion on the orbiting scroll side and are integrated with the orbiting scroll".

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent No. 4130285

Summary of Invention

Technical Problem

[0004] In the scroll type fluid machine disclosed in Patent Literature 1, the fin tip end of the orbiting scroll back face and the boss back face of the bearing housing member of the auxiliary crank are in contact with each other, and a temperature of a scroll lap is transferred from a contact portion to cause a temperature rise of the auxiliary crank bearing to pose a problem of reducing life of a bearing or grease.

[0005] In view of the problem described above, it is an object of the present invention to provide a scroll type fluid machine realizing reliability improvement and a long life of a rotation preventing mechanism by preventing heat from directly transferring from the orbiting scroll to the rotation preventing mechanism.

Solution to Problem

[0006] In order to solve the problem, the present invention provides a scroll type fluid machine including a fixed scroll, an orbiting scroll provided to be opposed to the fixed scroll and moved to orbit, a casing provided on an outer side of the orbiting scroll, a driving shaft for driving the orbiting scroll, a back face plate fastened to the orbiting scroll and connected to the driving shaft by a boss portion, and a rotation preventing mechanism provided between the casing and the back face plate for preventing a rotation of the orbiting scroll, in which the back face plate includes a rotation preventing mechanism side back face plate integrally provided with the rotation preventing mechanism and a driving shaft side back face plate provided integrally with the boss portion, and the rotation preventing mechanism side back face plate is not in contact with the orbiting scroll.

Advantageous Effects of Invention

[0007] According to the present invention, a scroll type fluid machine realizing the reliability improvement and the long life of a rotation preventing mechanism can be provided.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a sectional view of a scroll type fluid machine according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a perspective view of an orbiting scroll according to the embodiment of the present invention.

[Fig. 3] Fig. 3 is a perspective view of a back face plate according to the embodiment of the present invention.

[Fig. 4] Fig. 4 is a perspective view of the orbiting scroll and a back face plate according to the embodiment of the present invention.

Description of Embodiments

[0009] A detailed description will be given in accordance with attached drawings by taking an example of a scroll type air compressor as a scroll type fluid machine according to the embodiment of the present invention as follows.

[0010] A description will be given of the embodiment of the present invention by using Figs. 1, 2, 3, and 4.

[0011] Fig. 1 shows the sectional view of the scroll type compressor according to the present embodiment. A casing 1 of the scroll type air compressor is formed in a cylindrical shape, provided on an outer side of an orbiting scroll 8, and rotatably supports a driving shaft 15 at inside thereof.

[0012] A fixed scroll 2 provided on an opening side of the casing 1 is substantially configured by an end plate 3 formed substantially in a circular plate shape centering on an axial line O-O, a lap portion 4 in a scroll shape erected in an axial direction at a tooth bottom face which become a surface of the end plate 3, an outer peripheral wall portion 5 in a cylindrical shape provided on an outer diameter side of the end plate 3 by surrounding the lap portion 4, and plural cooling fins 6 projected from a back face of the end plate 3 as shown in Fig. 1.

[0013] Here, the lap portion 4 is wound in a scroll shape of, for example, around three windings from an inner diameter side to an outer diameter side when, for example, the innermost diameter end is made to be a winding start end and the outermost diameter end is made to be a

winding finish end. Further, the tooth tip face of the lap portion 4 is separated from the tooth bottom face of the end plate 9 of the orbiting scroll 8 which becomes a counterpart by a constant axial direction dimension.

[0014] Further, the tooth tip face of the lap portion 4 is provided with a seal groove 4A along a winding direction of the lap portion 4, and a tip seal 7 as a seal member which is brought into abrasive contact with the end plate 9 of the orbiting scroll 8 is provided in the seal groove 4A. Further, the outer peripheral wall portion 5 is opened to an end face of the fixed scroll 2 by substantially configuring a circular shape. Further, the outer peripheral wall portion 5 is arranged on an outer side in a diameter direction of the lap portion 10 to avoid an interference with the lap portion 10 of the orbiting scroll 8.

[0015] The orbiting scroll 8 provided to be able to orbit in the casing 1 is substantially configured by an end plate 9 substantially in a circular plate shape arranged opposedly to the end plate 3 of the fixed scroll 2, the lap portion 10 in a scroll shape erected from the tooth bottom face which becomes a surface of the end plate 9, and plural cooling fins 11 projected from a back face of the end plate 9. A back face plate 12 connected to a driving shaft 15 is provided on a tip end side of the cooling fin 11.

[0016] Here, the lap portion 10 configures a scroll shape of, for example, around 3 windings substantially similar to the lap portion 4 of the fixed scroll 2. Further, a tooth tip face of the lap portion 10 is separated by a constant axial direction dimension from a tooth bottom face of the end plate 3 of the fixed scroll 2 which becomes a counterpart. Further, the tooth tip face of the lap portion 10 is provided with a seal groove 10A along a winding direction of the lap portion 10, and a tip seal 13 as a seal member which is brought into abrasive contact with the end plate 3 of the fixed scroll 2 is provided in the seal groove 10A.

[0017] Further, a boss portion 14 in a cylindrical shape connected to a crank portion 15A of the driving shaft 15 is integrally formed with a center side of the back face plate 12 via an orbiting bearing 14a and a bearing housing 14b. At this occasion, a pulley 15B is provided to be disposed at an outer portion of the casing 1 on one end side of the driving shaft 15, the pulley 15B is connected to an output side of an electric motor as, for example, the driving source via a belt (both not illustrated) or the like. Thereby, the driving shaft 15 is rotationally driven by the electric motor or the like and moves to orbit the orbiting scroll 8 relative to the fixed scroll 2.

[0018] Further, the pulley 15B is attached with a cooling fan 16 by using a bolt or the like, and the cooling fan 16 generates cooling wind in a fan casing 17. Thereby, the cooling fan 16 sends cooling wind to an inner portion of the casing 1 and back face sides of the respective scrolls 2 and 8 along a duct or the like in the fan casing 17, and cools the casing 1, the fixed scroll 2, the orbiting scroll 8 and the like.

[0019] Further, the auxiliary cranks 18 as, for example, three rotation preventing mechanisms (only one is illustrated) for preventing rotation of the orbiting scroll 8 are provided between the back face plate 12 and the casing 1. The auxiliary cranks 18 are arranged in auxiliary crank boss portions 18b respectively formed at the casing 1 and the back face plate 12 via auxiliary crank bearings.

[0020] Plural compression chambers 19 provided between the fixed scroll 2 and the orbiting scroll 8 are successively formed from an outer side in a diameter direction over to an inner side in the diameter direction to be disposed between the lap portions 4 and 10, and maintained in airtight by the tip seals 7 and 13. Further, when the orbiting scroll 8 is moved to orbit in a forward direction, the respective compression chambers 19 are continuously reduced therebetween while moving from outer sides in a diameter direction to inner sides in the diameter direction of the lap portions 4 and 10.

[0021] Thereby, outside air is sucked from a suction port 20 to be described later to a compression chamber 19A disposed on an outer side in a diameter direction in the respective compression chambers 19. The air is compressed to be compressed air before it reaches a compression chamber 19B disposed on an inner side in a diameter direction. Further, the compressed air is delivered from a delivery port 22 and stored at an outside storing tank (not illustrated).

[0022] The suction port 20 provided on the outer diameter side of the fixed scroll 2 is opened from an outer diameter side over to the outer peripheral wall portion 5 of the end plate 3, and communicates with the compression chamber 19A disposed on an outer side in a diameter direction. Further, the suction port 20 is disposed on an outer side in a diameter direction of the lap portion 10 of the orbiting scroll 8 in the end plate 3 of the fixed scroll 2, is opened to a range where the tip seal 13 is not brought into abrasive contact (nonabrasive area) . Further, the suction port 20 sucks, for example, air at the atmospheric pressure into the compression chamber 19A disposed on an outer side in a diameter direction through a suction filter 21.

[0023] Further, the suction port 20 may be configured to suck compressed air. In this case, the suction port 20 may be configured to connect the suction port 20 to a piping supplied with compressed air by removing the suction filter 21.

[0024] The delivery port 22 provided on an inner side (center side) in a diameter direction of the end plate 3 of the fixed scroll 2 communicates with the compression chamber 19B disposed on the inner side in the diameter direction and delivers compressed air in the compression chamber 19B to outside.

[0025] A flange 24 disposed on an outer side in a diameter direction of the lap portion 4 of the fixed scroll 2 fixes the fixed scroll 2 to the casing 1 by a flange 1a of the casing 1. Positioning of the fixed scroll 2 and the casing 1 is carried out by inserting a positioning member by a positioning hole 37.

[0026] A face seal groove 25 provided at an end face of the fixed scroll 2 opposed to the end plate 9 of the

orbiting scroll 8 is disposed on an outer side in a diameter direction of the outer peripheral wall portion 5 and formed in a shape of a circular ring surrounding the outer peripheral wall portion 5. Further, a face seal 26 in the circular ring shape is attached into the face seal groove 25. Further, the face seal 26 seals an interval between an end face of the fixed scroll 2 and the end plate 9 of the orbiting scroll 8 in airtight and prevents air sucked into the outer peripheral wall portion from therebetween from leaking.

[0027] The scroll type air compressor according to the present embodiment is configured as described above, and next, a description will be given of an operation of the scroll type air compressor.

[0028] First, when the driving shaft 15 is driven to rotate by a drive source of an electric motor or the like (not illustrated), the orbiting scroll 8 carries out an orbiting movement centering on an axial direction O-O of the driving shaft 15 in a state of preventing rotation by the rotation preventing mechanism, and the compression chamber 19 partitioned between the lap portion 4 of the fixed scroll 2 and the lap portion 10 of the orbiting scroll 2 is continuously reduced. Thereby, air sucked from the suction port 20 of the fixed scroll 2 can be delivered from the delivery port 22 of the fixed scroll 2 to an outside tank (not illustrated) as compressed air while being compressed successively by the respective compression chambers 19.

[0029] A description will be given of a cooling structure of the scroll type air compressor according to the present invention. Cooling wind generated by the cooling fan 16 flows to an inner portion of the casing 1 and the back face sides of the respective scrolls 2 and 8 along a duct or the like in the fan casing 17, and cools the casing 1, the fixed scroll 2, the orbiting scroll 8 and the like.

[0030] A description will be given of a detailed configuration of the orbiting scroll 8 and the back face plate 12 according to the present embodiment in reference to Figs. 2 through 4.

[0031] Fig. 2 shows the back face of the orbiting scroll 8 according to the present embodiment. The orbiting scroll 8 is formed with the cooling fin 11 on the back face side of the end plate 9. Further, plural fastening portions 38 fastened to the back face plate 12 are provided at the back face of the scroll 8. Here, the cooling fin 11 and the fastening portion 38 may be integrally formed. Thereby, the flow of the cooling wind between the cooling fins 11 is not hampered by the fastening portion 38, and therefore, the orbiting scroll 8 and the back face plate 11 can be fastened without reducing cooling efficiency of the orbiting scroll 8 and the back face plate 12.

[0032] Further, the cooling fin may be provided to not only the orbiting scroll 8 but the back face plate 12. Thereby, a temperature rise of the back face plate can further be restrained.

[0033] Fig. 3 shows the back face plate 12 fastened to the orbiting scroll 8. The back face plate 12 is configured by a driving shaft side back face plate 12a integrally formed with the boss portion 14 connected to the driving shaft 15, and a rotation preventing mechanism side back face plate 12b integrally formed with the auxiliary crank bearing housing 18b accommodating the plural auxiliary cranks 18. There is constructed a structure in which a hollow portion 39 is provided between the driving shaft side back face plate 12a and the rotation preventing mechanism side back face plate 12b as well as the driving shaft side back face plate 12a and the rotation preventing mechanism side back face plate 12b are not connected in a diameter direction.

[0034] In the back face plate 12, the rotation preventing mechanism side back face plate 12b is connected to the driving shaft side back face plate 12a in a peripheral direction via a connecting portion 13. When the end plate 9 of the orbiting scroll 8 and the back face plate 12 are deformed by thermal expansion by a compressing operation, the thermal deformation can be absorbed by the hollow portion 39. Therefore, the thermal expansion of the driving shaft side back face plate 12a is not transferred to the rotation preventing mechanism side back face plate 12b, and a strain of the auxiliary crank bearing housing 18b can be restrained.

[0035] Here, the driving shaft side back face plate 12a may be formed by a material having rigidity lower than that of the rotation preventing mechanism side back face plate 12b. Thereby, more of deformation by the thermal expansion can be absorbed by the driving shaft side back face plate 12a, the strain of the auxiliary crank bearing housing 18b can be restrained more effectively, and the reliability and the life of the auxiliary crank can be improved further.

[0036] Fig. 4 shows the orbiting scroll 8 fastened with the back face plate 12. The present embodiment is configured such that the cooling fin 11 formed on the back face side of the orbiting scroll 8 is not in contact with the rotation preventing mechanism side back face plate 12b in a state where the orbiting scroll 8 and the back face plate 12 are fastened by the fastening portion 38. On the other hand, at a position opposed to the driving shaft side back face plate 12a, a dimension in an axial direction (longitudinal direction of the driving shaft 15) of the cooling fin 11 is formed to be larger than that at a position opposed to the rotation preventing mechanism back face plate 12b, and the cooling fin 11 is configured to be brought into contact with the driving shaft side back face plate 12a.

[0037] Thereby, direct heat transfer from the orbiting scroll 8 to the rotation preventing mechanism side back face plate 12b can be reduced, a temperature rise of the respective auxiliary crank bearings and the grease in the auxiliary crank bearings can be restrained effectively, and the reliability improvement and the long life can be realized.

[0038] On the other hand, the cooling fin 11 is configured to be brought into contact with the driving shaft side back face plate 12a, and therefore allowing the heat of the orbiting scroll 8 to escape effectively. Even when configured in this way, the driving side back face plate 12a

and the rotation preventing mechanism side back face plate 12b are not in contact in a diameter direction, and therefore, the heat transfer to the rotation preventing mechanism side back face plate 12b is not increased. Further, the heat transfer to the rotation preventing mechanism side back face plate 12b can be restrained further by preventing the contact with the cooling fin 11 at the connecting portion 13.

[0039] Further, at the hollow portion 39 between the driving shaft side back face plate 12a and the rotation preventing mechanism side back face plate 12b, the cooling wind flowing into a space formed between the orbiting scroll 8 and the back face plate 12 flows, and therefore, the temperature rise of the rotation preventing mechanism side back face plate 12b and the auxiliary crank 18 can be restrained while allowing the heat of the orbiting scroll 8 to escape effectively.

[0040] As described above, according to the present embodiment, the temperature rise of the rotation preventing mechanism side back face plate 12b and the auxiliary crank 18 can be restrained while allowing the heat of the orbiting scroll 8 to escape effectively. Further, temperature reduction of the auxiliary crank 18 can be carried out without adding parts, the cost can be reduced, and also a number of working steps (working time) can be reduced since mechanical working portions are reduced.

[0041] Although according to the present embodiment, the description has been given by taking up the example of the case of applying the present embodiment to the scroll type air compressor as the scroll type fluid machine, the present invention is not limited thereto, and the present invention may be applied to other scroll type fluid machine of a coolant compressor of compressing a coolant, a vacuum pump and the like. Further, the present invention may be applied to a system of a tank integrated type package compressor or a nitrogen gas generating apparatus having a scroll type fluid machine.

[0042] Any of the embodiments explained above only shows an example of embodying in carrying out the present invention, and a technical range of the present invention is not limitedly interpreted thereby. That is, the present invention can be carried out in various forms without being deviated from the technical thought or the major characteristic.

List of Reference Signs

[0043]

1	casing
1a	flange
2	fixed scroll
3, 9	end plates
4, 10	lap portions
5	outer peripheral wall portion
6, 11	cooling fins
7, 13	tip seals
8	orbiting scroll
12	back face plate
12a	driving shaft side back face plate
12b	rotation preventing mechanism side back face plate
13	connecting portion
14	boss portion
14a	orbiting bearing
14b	bearing housing
15	driving shaft
16	cooling fan
17	fan casing
18	auxiliary crank
18a	auxiliary crank bearing
18b	auxiliary crank boss portion
19	compression chamber
20	suction port
21	suction filter
22	delivery port
24	flange
25	face seal groove
26	face seal
37	positioning hole
38	fastening portion
39	hollow portion

Claims

1. A scroll type fluid machine comprising:

a fixed scroll;
an orbiting scroll provided to be opposed to the fixed scroll and moved to orbit;
a casing provided on an outer side of the orbiting scroll;
a driving shaft for driving the orbiting scroll;
a back face plate fastened to the orbiting scroll by a fastening portion and connected to the driving shaft by a boss portion; and
a rotation preventing mechanism provided between the casing and the back face plate for preventing a rotation of the orbiting scroll;
wherein the back face plate includes a rotation preventing mechanism side back face plate integrally provided with the rotation preventing mechanism and a driving shaft side back face plate provided integrally with the boss portion; and
wherein the rotation preventing mechanism side back face plate is not in contact with the orbiting scroll.

2. The scroll type fluid machine according to Claim 1, wherein the driving shaft side back face plate is brought into contact with a cooling fin formed at the orbiting scroll.

3. The scroll type fluid machine according to Claim 1,

wherein the driving shaft side back face plate is formed of a material having rigidity lower than rigidity of the rotation preventing mechanism side back face plate.

4. The scroll type fluid machine according to Claim 2, wherein a fastening portion for fastening the orbiting scroll and the back face plate is provided, and the fastening portion and the cooling fin are integrally formed.

5. The scroll type fluid machine according to Claim 1, wherein a hollow portion is included between the driving shaft side back face plate and the rotation preventing mechanism side back face plate.

6. The scroll type fluid machine according to Claim 1, wherein a cooling fin is provided at the back face plate.

7. A scroll type fluid machine comprising:

a fixed scroll;
an orbiting scroll provided to be opposed to the fixed scroll and moved to orbit;
a casing provided on an outer side of the orbiting scroll;
a driving shaft for driving the orbiting scroll;
a back face plate fastened to the orbiting scroll and connected to the driving shaft; and
a rotation preventing mechanism provided between the casing and the back face plate for preventing a rotation of the orbiting scroll;
wherein the back face plate includes a rotation preventing mechanism side back face plate provided integrally with the rotation preventing mechanism and a driving shaft side back face plate connected to the driving shaft; and
wherein a cooling wind passage is provided between the rotation preventing mechanism side back face plate and a cooling fin formed at the orbiting scroll.

8. The scroll type fluid machine according to Claim 7, wherein the driving shaft side back face plate is brought into contact with the cooling fin formed at the orbiting scroll.

9. The scroll type fluid machine according to Claim 7, wherein the driving shaft side back face plate is formed of a material having rigidity lower than rigidity of the rotation preventing mechanism side back face plate.

10. The scroll type fluid machine according to Claim 8, wherein a fastening portion for fastening the orbiting scroll and the back face plate is provided and the fastening portion and the cooling fin are integrally formed.

11. The scroll type fluid machine according to Claim 7, wherein a hollow portion is included between the driving shaft side back face plate and the rotation preventing mechanism side back face plate.

12. The scroll type fluid machine according to Claim 7, wherein a cooling fin is provided to the back face plate.

FIG. 1

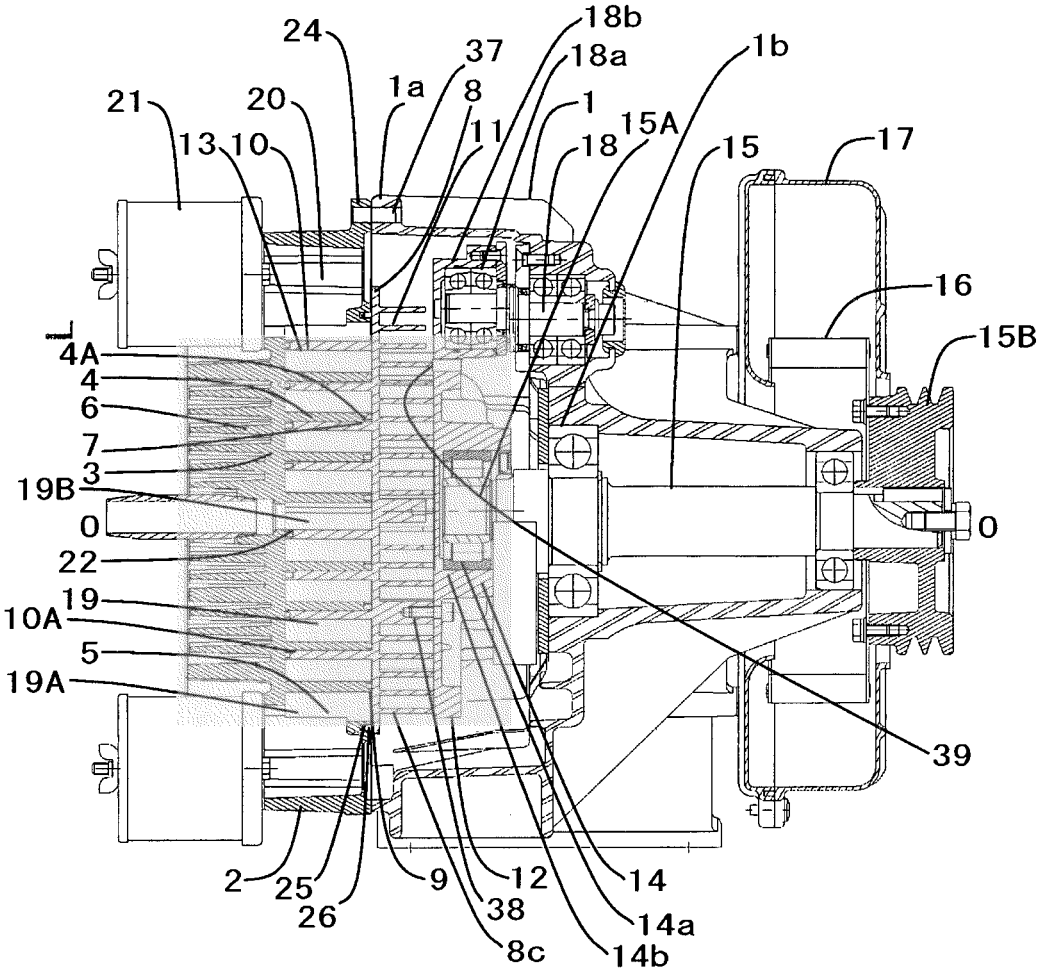

24
18b
37
18a
1b
21
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1a
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15A
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17
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15B
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3
19B
0
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14a
8c
14b

FIG. 2

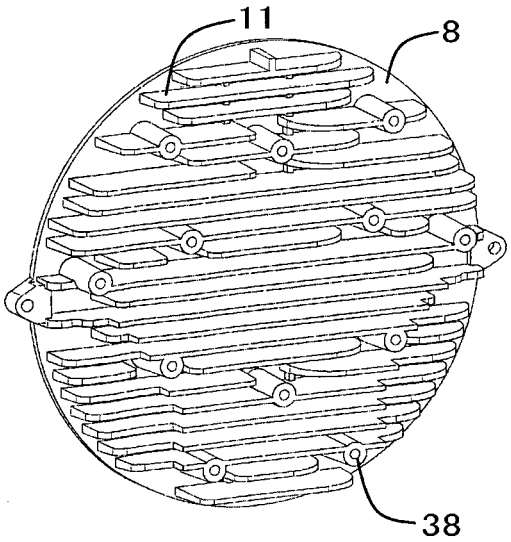

11
8
38

FIG. 3

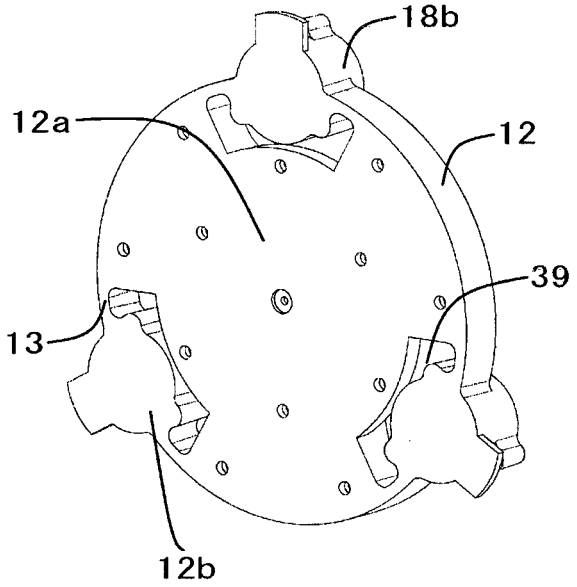
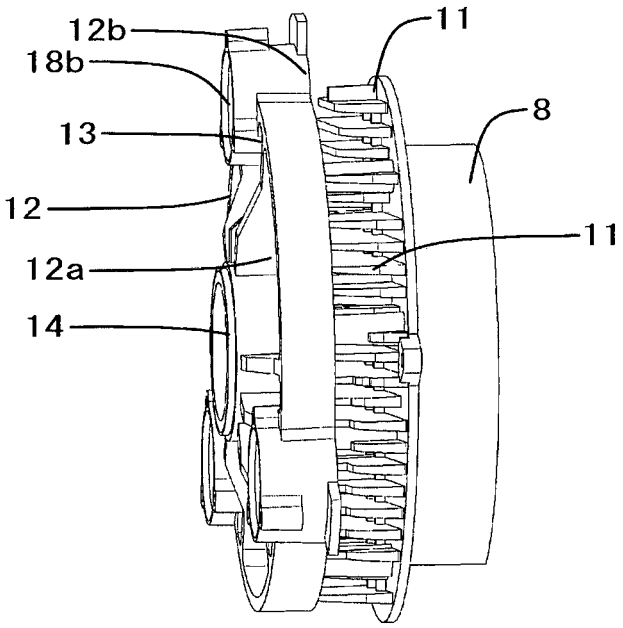


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/054101

A. CLASSIFICATION OF SUBJECT MATTER
F04C18/02(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, F04C29/04

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	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

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 2002-257066 A (Anest Iwata Corp.), 11 September 2002 (11.09.2002), entire text; all drawings (Family: none)	1-2,4,6-8, 10,12 5,11 3,9
X Y A	JP 9-144673 A (Tokico, Ltd.), 03 June 1997 (03.06.1997), entire text; all drawings (Family: none)	1-2,4,6-8, 10,12 5,11 3,9
Y	JP 2011-252448 A (Hitachi Industrial Equipment System Co., Ltd.), 15 December 2011 (15.12.2011), entire text; all drawings (Family: none)	5,11

☒ 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
16 April, 2014 (16.04.14)	28 April, 2014 (28.04.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/054101

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 2010-84592 A (Hitachi, Ltd.), 15 April 2010 (15.04.2010), entire text; all drawings (Family: none)	1-12
A	JP 2003-65271 A (Hokuetsu Industries Co., Ltd.), 05 March 2003 (05.03.2003), entire text; all drawings (Family: none)	1-12
A	JP 2003-65267 A (Hokuetsu Industries Co., Ltd.), 05 March 2003 (05.03.2003), entire text; all drawings (Family: none)	1-12

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4130285 B **[0003]**