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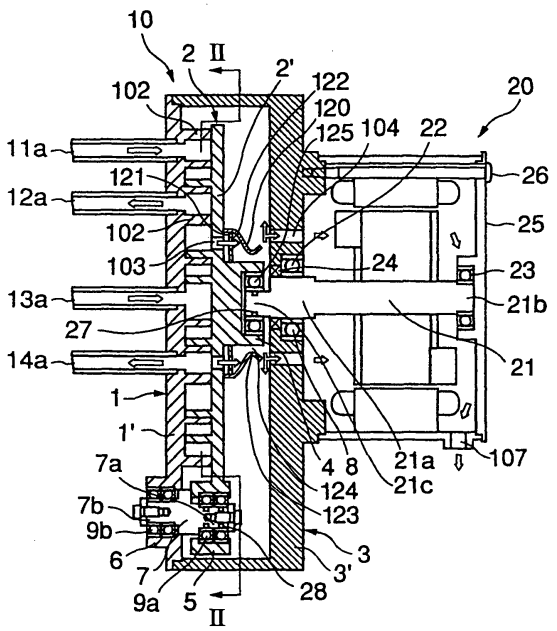
Remarks:
Amended claims in accordance with Rule 86 (2) EPC.

(54) Scroll fluid machine

(57) A scroll fluid machine comprises stationary and orbiting scrolls 1,2. The orbiting scroll 2 is revolved by a driving shaft 21 with respect to the stationary scroll 1 to crease an inner expanding region. Fluid from the inner expanding region flows to the rear side of an orbiting end plate 2' of the orbiting scroll 2. An expanding cover 120 is mounted to the orbiting end plate 2' to create a narrower space 124 between a boss 4 of the orbiting end plate 2' and an inward-projecting portion 123 of the expanding cover 120. Fluid from the expanding region flows through the narrower space 124 and is depressurized or cooled. The cooled fluid cools the boss 4.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a scroll fluid machine and especially to a scroll fluid machine that enables itself to be cooled effectively.

BACKGROUND ART

[0002] JP 2003-307188A filed by the same applicant discloses a scroll fluid machine comprising stationary and orbiting scrolls, the orbiting scroll being driven and revolved with respect to the stationary scroll to create outer compressing and inner expanding regions between stationary and orbiting scroll wraps of the stationary and orbiting scrolls. Fluid expanded and cooled in the expanding region between inner stationary and orbiting wraps flows through a discharge bore to the rear surface of an orbiting end plate. Fluid flows from the rear surface of the orbiting end plate via the outer circumference of a blocking plate to an electric motor. In the scroll fluid machine, the rear surface of the orbiting end plate is effectively cooled.

[0003] Meanwhile, a central bearing is provided between the orbiting end plate and an eccentric portion of a driving shaft in a boss of the orbiting end plate. The driving shaft is driven by the electric motor and the orbiting end plate is revolved by the eccentric portion of the driving shaft. Then, the compressing and expanding regions are created between the stationary and orbiting scrolls. The bearing is subjected to rotation of the driving shaft and heated thereby decreasing durability.

SUMMARY OF THE INVENTION

[0004] In view of the disadvantage, it is an object of the present invention to provide a scroll fluid machine in which a central bearing in a boss of an orbiting end plate is effectively cooled thereby increasing durability.

[0005] According to the present invention, there is provided a scroll fluid machine comprising a driving shaft having an eccentric portion; a stationary scroll having a stationary end plate from which an inner stationary wrap projects ; an orbiting scroll having an orbiting end plate from which an inner orbiting wrap projects, and a boss in which the eccentric portion is fitted via a central bearing; and an inner annular partition wall mounted to the stationary or orbiting end plate, said inner orbiting wrap being revolved by the eccentric portion of the driving shaft to engage with said inner stationary wrap inside the inner partition wall to form an expanding region, characterized in that an expanding cover that has an inward-projecting portion is mounted to the orbiting end plate to surround the boss to form a narrower space between the inward-projecting portion and the boss, fluid from the expanding region being passed through the narrower space and further depressurized or cooled.

BRIEF DESCRIPTION OF DRAWINGS

[0006]

Fig. 1 is a vertical sectional side view of an embodiment of a scroll fluid machine according to the present invention; and

Fig. 2 is a sectional view taken along the line II-II in Fig. 1.

DETAILED DESCRIPTION

[0007] Figs. 1 and 2 illustrate an embodiment of a scroll fluid machine according to the present invention, comprising a scroll portion 10 and an electric motor 20. A stationary end plate 1' of a stationary scroll 1 has an inner annular partition wall 101; an outer annular partition wall 102; an outer stationary wrap 1 a between the inner and outer partition walls 101 and 102; and an inner stationary wrap 1b inside the inner partition wall 101. An orbiting end plate 2' of an orbiting scroll 2 has an outer orbiting wrap 2a that engages with the outer stationary wrap 1 a; and an inner orbiting wrap 2b that engages with the inner stationary wrap 1b. The orbiting scroll 2 is covered with a housing 3 fixed to the stationary scroll 1. An electric motor 20 is fixed to a wall 3' of the housing 3 by a bolt 26. Journals 21 a and 21 b of a driving shaft 21 of the electric motor 20 are rotatably supported by the housing 3 and a rear cover 25 of the electric motor 20 by bearings 8 and 23 respectively so that an axis of the driving shaft 21 may coincide with the center of the stationary scroll 1.

[0008] Three bosses 5 protrude near the outer periphery of the orbiting scroll 2 like an equilateral triangle, and a pin 7a at one end of an auxiliary crank 7 is rotatably supported in each of the bosses 5 via a bearing 9a. There are provided three bosses 6 on the stationary scroll 1 and a pin 7b at the other end of the stationary scroll 1 in each of the bosses 6 via a bearing 9b. The pins 7a, 7b are provided eccentrically by a certain amount. An eccentric portion 21 is formed at one end of the driving shaft 21 and supports a boss 4 at the center of the rear surface of the orbiting end plate 2' via a bearing 22. The eccentric portion 21 c has the same eccentricity as that of the pins 7a,7b of the auxiliary crank 7. Owing to such structure, when the driving shaft 21 is rotated, the orbiting scroll 2 is revolved around the axis of the driving shaft 21. The revolution mechanism may be a known means such as Oldham coupling. As shown in Fig. 2, with respect to a spiral direction of the scroll wrap, the inner scroll wraps are wound in a counterclockwise direction from the center, and the outer scroll wraps are wound in a clockwise direction from the annular wall.

[0009] Numeral 24 denotes a seal, and 27,28 denote elastic rings. When an inner ball of the bearing is loosened from the eccentric portion 21c so as to facilitate the eccentric portion 21c to insert into the bearing 8 of the orbiting scroll, the elastic rings 27,28 prevent fretting corrosion owing to rotation of the inner surface of the inner

ball of the bearing on the outer circumference of the pin portion 21c.

[0010] For example, when the elastic ring 27 made of hard rubber is fitted in a bore of the eccentric portion 21c, the elastic ring 27 prevents the inner ball from rotating on the eccentric portion 21c owing to friction after fitting of the inner ball while resistance is small during fitting of the inner ball. Similarly, the elastic ring 28 facilitates the pin portion 7a of the auxiliary crank 7 to insert into the bearing 9a of the orbiting scroll 2 and prevents the inner ball of the bearing 9a from sliding.

[0011] On the end plate 1' of the stationary scroll 1, there are a compressing portion inlet 11 inside the outer partition wall 102; a compressing portion outlet 12 outside the inner partition wall 101; an expanding portion outlet 14 inside the inner partition wall 101; and an expanding portion inlet 13 at the center. Pipes 11a, 12a, 14a, 13a are connected to the holes 11,12,14,13 respectively. When the electric motor 20 is rotated in a counterclockwise direction seen from the right in Fig. 1, the orbiting scroll 2 is revolved in the counterclockwise direction around the center of the stationary scroll 1 as shown in Fig. 2 while the orbiting scroll 2 is prevented from rotation around its own axis. Thus, a compressing region is created between the inner and outer partition walls 101 and 102, and an expanding region is created inside the inner partition wall 101.

[0012] Fluid is sucked through the inlet 11, compressed in the compressing region by engagement of the outer scroll wraps 1 a and 2a between the inner and outer partition walls 101 and 102 and discharged through the outlet 12. Fluid is sucked through the inlet 13, expanded in the expanding region by engagement of the inner scroll wraps 1b and 2b inside the inner partition wall 101 and discharged through the outlet 13.

[0013] The orbiting scroll end plate 2' has an expanded fluid discharge bore 103 communicating with the expanding region, The fluid expanded in the expanding region is discharged not only through the outlet 14 of the stationary scroll end plate 1' but also through the discharge bore 103 of the orbiting scroll end plate 2'.

[0014] An expanding cover 120 is mounted to the orbiting end plate 2' and has a support plate 121 between the boss 4 of the orbiting end plate 2' and the expanding cover 120. The support plate 121 has an annular bore 122, and the expanding cover 120 has an inward-projecting portion 123. The fluid from the discharge bore 103 passes through the annular bore 122 of the support plate 121 and through a narrower space 124 between the inward-projecting portion 123 and the boss 4. In the narrower space 124, the fluid becomes faster and is depressurized, so that the fluid is further cooled.

[0015] The orbiting end plate 2' is driven by the eccentric portion 21c of the driving shaft 21, so that a central bearing 125 between the boss 4 and the eccentric portion 21c is heated during rotation of the eccentric portion 21c. The cooling fluid which flows through the narrower space 124 near the boss 4 effectively cools the central bearing 125, thereby increasing durability of the bearing 125.

EXPLANATION OF INDUSTRIAL APPLICABILITY OF INVENTION

[0016] A scroll fluid machine according to the present invention is utilized to feed air into a fuel cell and discharge it or as an air-expanding cooler.

Claims

1. A scroll fluid machine comprising:

a driving shaft 21 having an eccentric portion 21c;
a stationary scroll 1 having a stationary end plate 1' from which an inner stationary wrap 1b projects ;
an orbiting scroll 2 having an orbiting end plate 2' from which an inner orbiting wrap 2b projects, and a boss 4 in which the eccentric portion 21c is fitted; and
an inner annular partition wall 101 mounted to the stationary or orbiting end plate 1',2', said inner orbiting wrap 2b being revolved by the eccentric portion 21c of the driving shaft 21 to engage with said inner stationary wrap 1a inside the inner partition wall 101 to form an expanding region, **characterized in that**:

an expanding cover 120 that has an inward-projecting portion 123 is mounted to the orbiting end plate 2' to surround the boss 4 to form a narrower space 124 between the inward-projecting portion 123 and the boss 4, fluid from the expanding region being passed through the narrower space 124 and further depressurized or cooled.

2. A scroll fluid machine as claimed in claim 1 wherein an annular support plate 121. is mounted around the boss 4 to support the expanding cover 120, the support plate 121 having an annular bore 122 through which fluid from the expanding region passes to the narrower space 124.

Amended claims in accordance with Rule 86(2) EPC.

1. A scroll fluid machine comprising:

a driving shaft 21 having an eccentric portion 21 c;
a stationary scroll 1 having a stationary end plate 1' from which an inner stationary wrap 1b and an outer stationary wrap 1a project;
an orbiting scroll 2 having an orbiting end plate

2' from which an inner orbiting wrap 2b and an outer orbiting wrap 2a project, and a boss 4 in which the eccentric portion 21c is fitted; and

an inner annular partition wall 101 mounted to the stationary or orbiting end plate 1',2', said orbiting scroll 2 being revolved by the eccentric portion 21 c of the driving shaft 21 to allow the inner orbiting wrap 2b to engage with said inner stationary wrap 1b inside the inner partition wall 101 to form an expanding region and to allow the outer orbiting wrap 2a to engage with the outer stationary wrap 1 a outside the inner partition wall 101, **characterized in that**:

an expanding cover 120 that has an inward-projecting portion 123 is mounted to the orbiting end plate 2' to surround the boss 4 to form a narrower space 124 between the inward-projecting portion 123 and the boss 4, fluid from the expanding region being passed through the narrower space 124 and further depressurized or cooled.

2. A scroll fluid machine as claimed in claim 1 wherein an annular support plate 121 is mounted around the boss 4 to support the expanding cover 120, the support plate 121 having an annular bore 122 through which fluid from the expanding region passes to the narrower space 124.

FIG.1

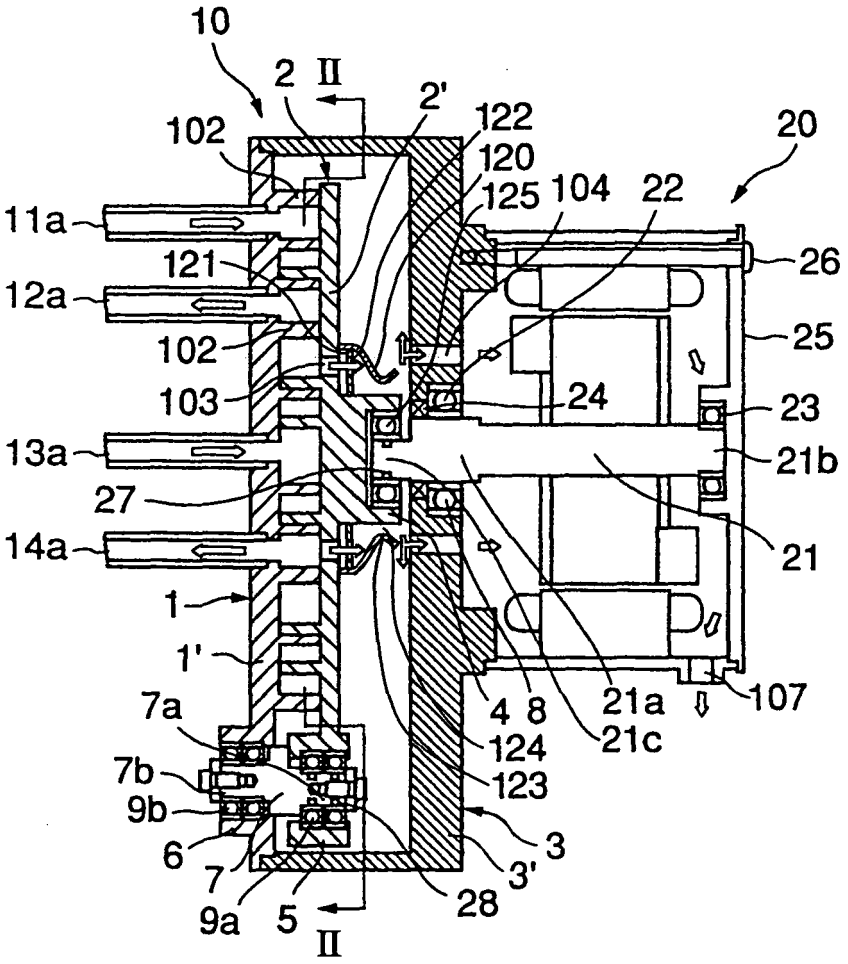
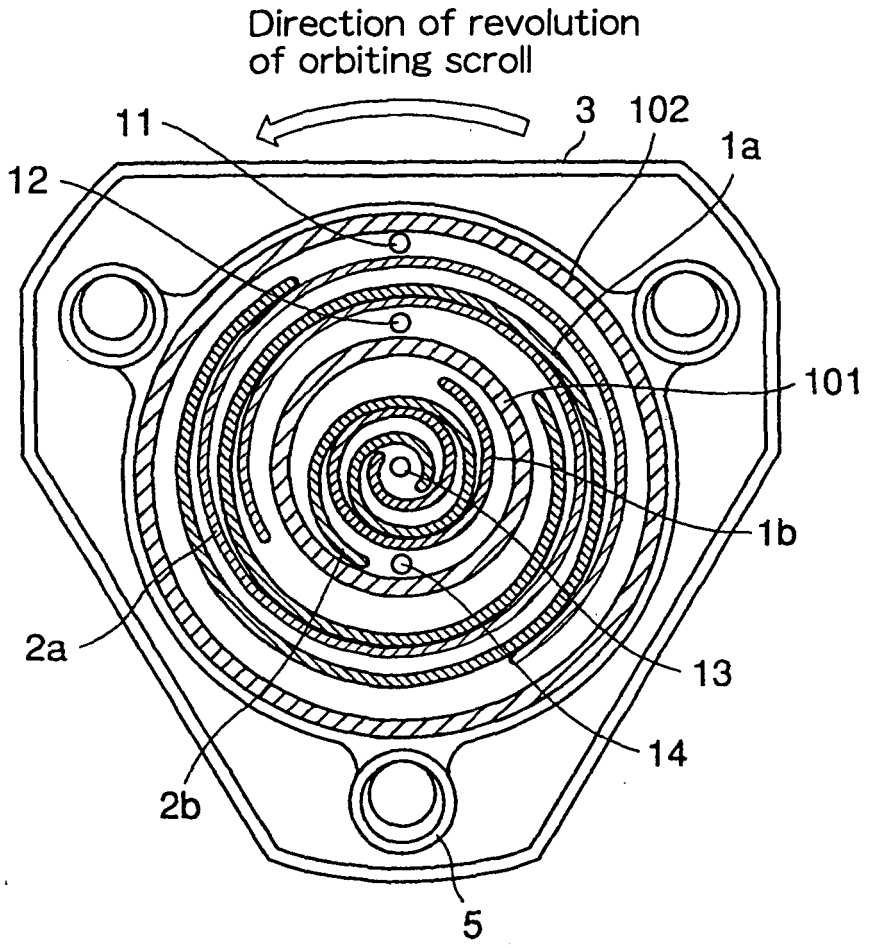

10
2
II
2'
102
122
120
125
104
22
20
11a
121
26
12a
102
25
103
24
23
13a
21b
27
21
14a
1
1'
7a
4
8
21a
107
21c
124
7b
123
9b
3
6
3'
7
28
9a
5
II

FIG.2


Direction of revolution
of orbiting scroll
11
3
102
1a
12
101
1b
2a
13
14
2b
5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 02 1089

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,A	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) -& JP 2003 343459 A (ANEST IWATA CORP), 3 December 2003 (2003-12-03) * abstract * -----	1	F01C1/02 F04C23/00 F01C11/00 F01C21/06
A	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) -& JP 2003 307188 A (ANEST IWATA CORP), 31 October 2003 (2003-10-31) * abstract * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F01C
F04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 January 2005	Lequeux, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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25-01-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2003343459 A	03-12-2003	NONE	
JP 2003307188 A	31-10-2003	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82