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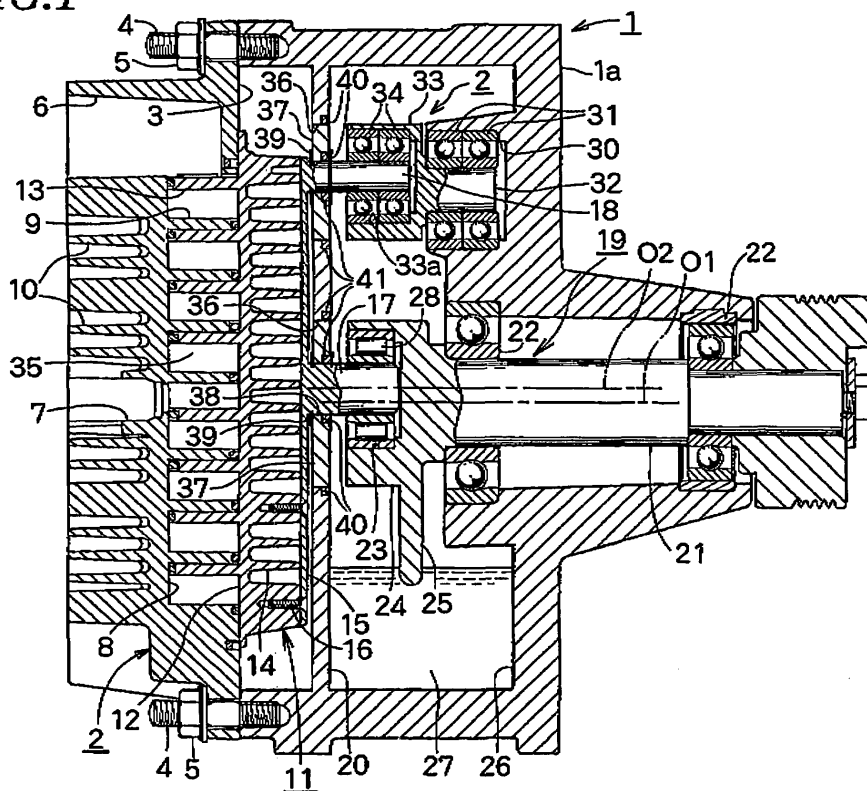
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20124 Milano (IT)**(54) **Scroll fluid machine**

(57) A housing (1) of a scroll fluid machine encloses an orbiting scroll (11) separated by a partition wall (20) from a driving part including a driving shaft (21). The partition wall (20) has a hole (36) through which a pivot (17)

at the end of the driving shaft (21) passes. A disc (37) is put in the hole (36). Between the pivot (17) and the disc (37) and between the disc (37) and the inner circumferential surface of the hole (36), a sealing member (41) is provided.

FIG.1**EP 1 811 179 A2**

Description

Technical Field of Invention

[0001] The present invention relates to a scroll fluid machine such as a compressor or a vacuum pump for compressing fluid such as air or refrigerant and especially to a scroll fluid machine in which bearings of an orbiting scroll drive part is lubricated by lubricating oil and sealing structure is provided.

Background Art

[0002] JP11-336676A discloses a scroll fluid machine in which bearing of driving part of an orbiting scroll are lubricated by taking up lubricating oil stored in a housing.

[0003] Such a scroll fluid machine achieves higher lubricating capability than a scroll fluid machine in which bearings of driving part is lubricated by grease to extend life of the bearing. However, lubricating oil is likely to go into a sealed chamber between an orbiting scroll and a fixed scroll. It is required to seal the parts from lubricating oil.

[0004] In the scroll fluid machine in JP11-336676A, a partition wall is provided between a driving part where lubricating oil is stored and an orbiting end plate in a housing. One of the orbiting end plate and the partition wall, a metal thrust plate which slidably contacts the other during revolving is merely provided, but no special sealing member is provided.

[0005] So owing to wear of contacting surface of the thrust plate and the end plate or partition wall, lubricating oil in the driving part enters the orbiting scroll side and thus is likely to go into the sealed chamber between the orbiting and fixed scrolls.

[0006] To prevent such problem, the inventors proposed a scroll fluid machine similar to the scroll fluid machine above and comprising a novel sealing structure as shown in Fig. 6.

[0007] In the scroll fluid machine, in a housing (e) having a driving part (b) for an orbiting scroll (a) and a storage portion (d) for lubricating oil (c) at the bottom, the driving part (b) and the orbiting scroll (a) are divided by a partition wall (f) to allow the orbiting scroll (a) to revolve. An annular sealing member (g) having a rectangular cross-section and called wiper seal is provided between the partition wall (f) and the orbiting scroll (a) above an oil level of the storage portion (d) to surround a plurality of self-rotation-preventing devices of the orbiting scroll (a). The sealing member (g) slidably contacts the inner side surface of the support plate (i) of the orbiting scroll (a) to prevent the lubricating oil (c) taken up by the counter weight (k) of the driving shaft (j) from going into the orbiting scroll (a).

[0008] However, such a sealing structure does not completely prevent lubricating oil from going into the orbiting scroll. Because the support plate is eccentrically revolved with the orbiting scroll, surface contact of the support plate with the sealing member allows lubricating

oil on the support plate to be taken up to the circumferential end of the orbiting scroll gradually.

Technical Problem and Its Solution

[0009] In view of the disadvantage, it is an object of the invention to provide a scroll fluid machine for preventing lubricating oil from going into an orbiting scroll through a partition wall.

[0010] According to the present invention, there is provided a scroll fluid machine comprising:

a housing;

a partition wall dividing the housing into first and second sections;

a driving shaft having an eccentric axial portion at one end in the second section of the housing;

a pivot provided in the eccentric axial portion of the driving shaft to extend through a hole of the partition wall from the second section to the first section;

a fixed scroll fixed to the housing and provided in the first section of the housing;

an orbiting scroll facing and engaging with the fixed scroll in the first section, the orbiting scroll being mounted to the pivot to rotate by the driving shaft; and

a self-rotation preventing device for preventing the orbiting scroll from rotating on its own axis in the first section, characterized in that;

said hole of the partition wall is greater in diameter than the pivot to be concentric with the driving shaft, said scroll fluid machine further comprising a disc having an external diameter almost equal to an internal diameter of the hole to rotate in the hole, the disc having an eccentric hole through which the pivot extends to rotate therein, a first sealing member being provided in the disc between the pivot and the disc, a second sealing member being provided in the partition wall between the disc and the partition wall.

Brief Description of Drawings

[0011]

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

Fig. 2 is an enlarged view of a main part in Fig. 1 ;

Fig. 3 is a sectional rear view taken along the line III-III in Fig. 2;

Fig. 4 is a vertical sectional view of a main part of a variation of a sealing member;

Fig. 5 is a vertical sectional view of a main part of another variation of a sealing member; and

Fig. 6 is a central vertical sectional side view of a known scroll fluid machine.

Embodiments of Invention

[0012] At the front end of a tubular housing 1 which opens in a front or left surface in Fig. 1, a rear plate 3 of a fixed scroll 2 is fixed with a bolt 4 and a nut 5.

[0013] The fixed scroll 2 comprises a circular fixed end plate 8 which has an inlet 6 at the outer circumference and an outlet 7 at the center. A spiral fixed wrap 9 is mounted on the rear surface of the fixed end plate 8, and a plurality of cooling fins 10 are horizontally mounted on the front surface thereof.

[0014] An-orbiting wrap 13 which engages with the fixed wrap 9 is mounted on a circular orbiting end plate 12 of an orbiting scroll 11 disposed behind the fixed scroll 2 and a plurality of cooling fins 14 are horizontally mounted on the rear surface thereof.

[0015] The front surface of the outer circumference of the orbiting end plate 12 contacts the rear surface of the rear plate 3 of the fixed scroll 2.

[0016] On the rear surface of the orbiting scroll 11, a circular support plate 15 is fixed with a plurality of countersunk screws 16 to put the cooling fins 14 therebetween. At the center of the rear surface of the support plate 15, a pivot 17 projects rearwards. On the outer circumference of the rear surface, there are three self rotation-preventing pivots 18 of self-rotation-preventing devices 29 later described.

[0017] The housing 1 is divided into the orbiting scroll 11 and a rear driving part 19 by a partition wall 20 close to the support plate 15. The pivot 17 and the self rotation-preventing pivots 18 pass through the partition wall 20 to project in the driving part 19.

[0018] Along the center of the housing 1, a driving shaft 21 driven by a motor (not shown) is rotatably mounted via a pair of ball bearings 22,22.

[0019] The driving shaft 21 has an eccentric axial portion 24 which has an eccentric hole which opens at the front end. The center O2 of the eccentric hole 23 is disposed away from the center O1 of the driving shaft O1.

[0020] A counter weight 25 projects from the outer circumferential surface of the eccentric axial portion 24 in a direction opposite to the eccentric hole 23. The counter weight 25 also acts as a taking-up bar for a lubricating oil 27 stored in a storage 26 at the bottom of the housing 1 to allow the lubricating oil 27 to be taken up every one rotation of the driving shaft 21.

[0021] In the eccentric hole 23, the pivot 17 of the orbiting scroll 11 concentric therewith is rotatably engaged via a ball bearing 28. The center O2 of the pivot 17 de-

viates from the center O1 of the driving shaft 21.

[0022] A self-rotation-preventing device 29 prevents the orbiting scroll 21 from rotating on its own axis, and comprises a support shaft 32 pivotally supported in a recess 30 of a rear wall 1a of the housing 1 in parallel with the driving shaft 21, an eccentric axial portion 33 at the front end of the support shaft 32; and the pivot 18 supported in an eccentric hole 33a of the eccentric axial portion 33 via two ball bearings 34,34.

[0023] Rotation of the driving shaft 21 allows the orbiting scroll 11 to eccentrically revolve by the pivot 17 in the eccentric hole 23 and the self-rotation-preventing devices 29 thereby gradually reducing a volume of a sealed chamber 35 between the fixed wrap 9 and the orbiting wrap 13 towards the center to compress a fluid from the inlet 6 to the outlet 7 from which the fluid is discharged.

[0024] As shown in Figs. 2 and 3, in the partition wall 20, the pivot 17 goes through a hole 36 coaxially with the driving shaft 21. In the hole 36, a disc 37 rotatably fits to have the same thickness as that of the partition wall.

[0025] The pivot 17 rotatably fits in the eccentric hole 38 having an internal diameter equal to an external diameter of the pivot 17. Snap rings 39,39 around the pivot 17 limit axial movement of the disc 37 to prevent the disc 37 from coming off the hole 36.

[0026] On the rear end of the hole 36 of the partition wall 20 and on the rear end of the eccentric hole 38 of the disc 37, annular stepped portions 40,40 are formed and engages with oil-resistant sealing members 41,41 such as rubber having a rectangular cross-section in the disc 37 and the pivot 17 respectively in a liquid-tight manner.

[0027] The hole 36 and the disc 37 are concentric with the driving shaft 21 and the pivot 17 rotatably goes through the eccentric hole 38. Thus, rotation of the driving shaft 21 enables the pivot 17 to rotate around the center O1 without problem thereby causing the disc 37 to rotate around the center O1 in the hole 36.

[0028] The inner circumferential surfaces of the sealing members 41 slidably contact the outer circumferential surfaces of the disc 37 and the pivot 17 thereby keeping sealing capability to the hole 36 and the eccentric hole 38.

[0029] Similar sealing structure is provided on the peripheral end of the partition wall 20 through which the self-rotation preventing pivot 18 passes. Each member of the sealing structure of the self-rotation preventing pivot 18 is smaller because the diameter of the self-rotation preventing pivot 18 is smaller than that of the pivot 17, but the sealing structure is almost the same as the sealing structure of the pivot 17. Thus, the same numerals are allotted and its description will be omitted.

[0030] As described above, in the partition wall 20 dividing the driving part 19 from the orbiting scroll 11 in the housing 1, the hole 36 through which the pivot 17 and the self rotation-preventing pivot 18 with a play is concentric with the driving shaft 21 and the support shaft 32. The inner circumferential surface of the sealing member 41 slidably contacts the outer circumferential surface of

the disc 37 in the hole 36 and the outer circumferential surfaces of the pivot 17 and the self-rotation-preventing shaft 18 which rotatably fit in the eccentric hole 38 of the disc 37 to keep sealing capability. Thus, the lubricating oil 27 taken up by the counter weight 25 to lubricate the bearings 22,28,31,34 in the driving part 19 does not go into the orbiting scroll 11 in front of the partition wall 20.

[0031] The present invention is not limited to the foregoing embodiment.

[0032] In the foregoing embodiment, the outer larger-diameter sealing member 41 engages on the stepped annular groove 40 of the partition wall 20. But a stepped annular groove may be provided on the outer circumference of the disc 37 and a sealing member 41 may engage on the stepped annular groove to allow the outer circumferential surface to slidably contact the inner surface of the hole 36 of the partition wall 20.

[0033] In Fig. 4, a sealing member 41 is disposed in the middle of the disc 37. An annular groove 42 having a rectangular cross-section is formed in the middle of a hole 36 and a disc 37 of a partition wall 20 and a sealing member 41 engages in the groove 42.

[0034] On the contrary, in Fig. 5, an annular groove 43 having a rectangular cross-section is formed on the outer circumferential surface of a disc 37 and a pivot 17, and a sealing member 41 engages in the groove 43.

[0035] The sealing member 31 may comprise an O-ring having a circular or elliptical cross-section.

[0036] In the foregoing embodiment, to make a sealing area by the sealing member 41 at minimum by reducing an external diameter of the disc 37, and an internal diameter of the hole 36 and the eccentric hole 38, the pivot 17 and self-rotation-preventing pivot 18 comprise relatively-small-diameter solid shafts which fit in the eccentric holes 23,33a of the eccentric axial portions 24,33. But, as shown in Fig. 6 as prior art, the present invention may apply to a scroll fluid machine in which the pivot 17 and self-rotation-preventing pivot 18 comprise larger-diameter tubular ones.

[0037] In this case, a larger hole is formed in the partition wall 20 and a larger disc which has an eccentric hole in which a tubular pivot fits engages in the hole. A sealing member may be applied to the hole.

[0038] In the foregoing embodiments, the present invention is applied a scroll fluid machine in which the lubricating oil 27 stored in the storage portion 26 is taken up by the counter weight 25 or a taking-up bar to allow bearings of the orbiting scroll 11 and self-rotation-preventing device 29 to be lubricated, but may be applied to a scroll fluid machine in which bearing of driving part is lubricated with lubricating oil fed with an oil pump.

Claims

1. A scroll fluid machine comprising:

a housing (1);

a partition wall (20) dividing the housing into first and second sections;

a driving shaft (21) having an eccentric axial portion at one end in the second section of the housing;

a pivot (17) provided in the eccentric axial portion (24) of the driving shaft to extend through a hole (36) of the partition wall (20) from the second section to the first section;

a fixed scroll (2) fixed to the housing (1) and provided in the first section of the housing (1); an orbiting scroll (11) facing and engaging with the fixed scroll (2) in the first section, the orbiting scroll (11) being mounted to the pivot (17) to rotate by the driving shaft (21); and

a self-rotation preventing device (29) for preventing the orbiting scroll (11) from rotating on its own axis in the first section, **characterized in that;**

said hole (36) of the partition wall (20) is greater in diameter than the pivot (17) to be concentric with the driving shaft (21), said scroll fluid machine further comprising a disc (37) having an external diameter almost equal to an internal diameter of the hole (36) to rotate in the hole (36), the disc (37) having an eccentric hole (38) through which the pivot (17) extends to rotate therein, a first sealing member (41) being provided in the disc (37) between the pivot (17) and the disc (37), a second sealing member (41) being provided in the partition wall (20) between the disc (37) and the partition wall (20).

2. A scroll fluid machine as defined in claim 1 wherein the self-rotation preventing device (29) comprises a pivot (18) projecting from the orbiting scroll (11); and a support shaft (32) having an eccentric axial portion (33) rotatably supporting the pivot (18), the partition wall (20) having a hole (36) through which the pivot (18) passes, the hole (36) having a disc (37), a third sealing member (41) being provided in the disc (37) between the pivot (18) and the disc (37), a fourth sealing member (41) being provided in the partition wall (20) between the disc (37) and the partition wall (20).
3. A scroll fluid machine as defined in claim 2 wherein the partition wall (20) and discs (37,37) have stepped annular grooves (40,40) in which the sealing members (41,41) are put.
4. A scroll fluid machine as defined in claim 2 wherein the pivots (17,18) comprises solid shafts which can rotate in eccentric holes (23,38).
5. A scroll fluid machine as defined in claim 2 wherein snap rings (39,39) are provided around the pivots (17,18) to limit axial movement of the discs (37,37).

FIG.1

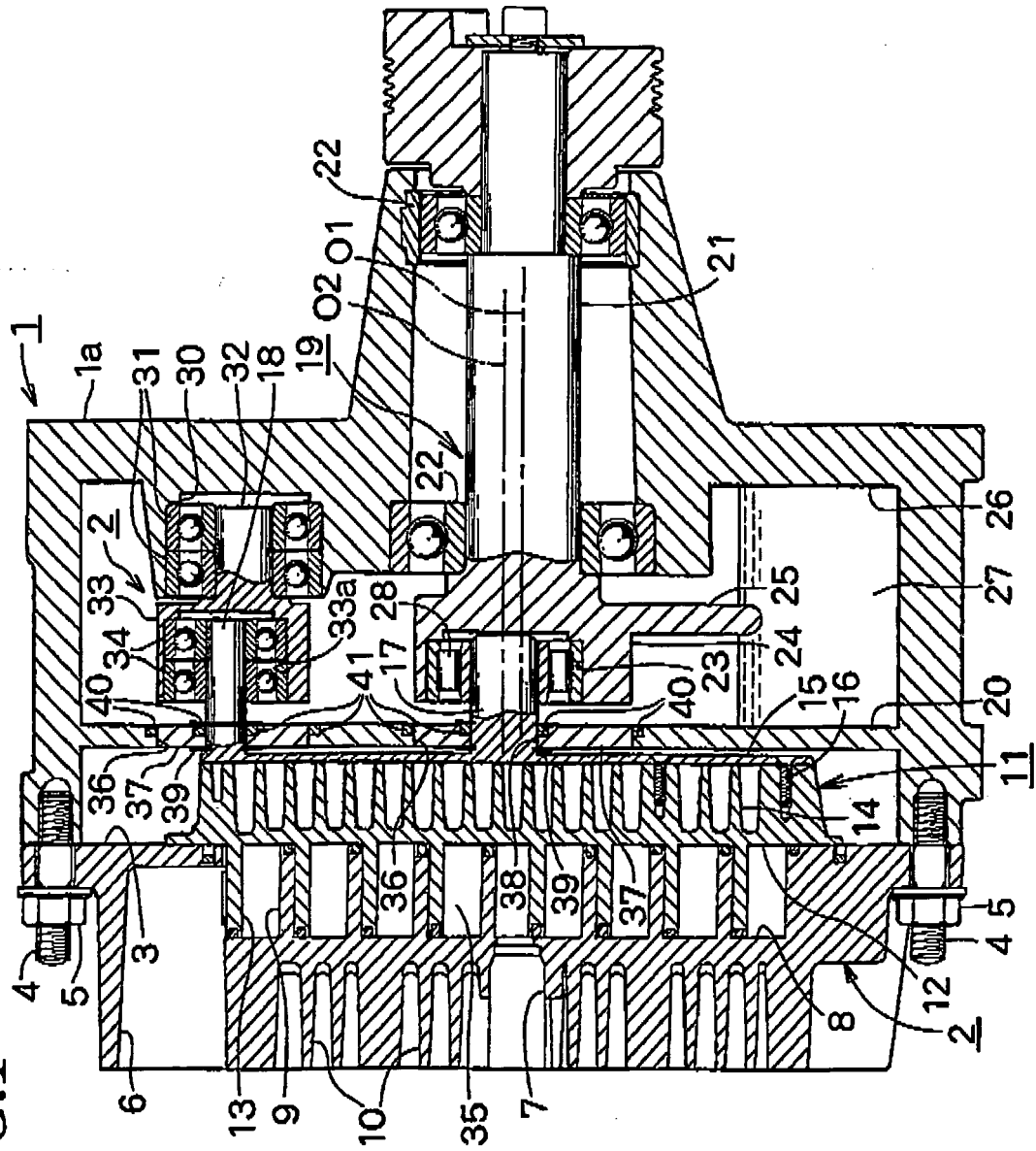


FIG.2

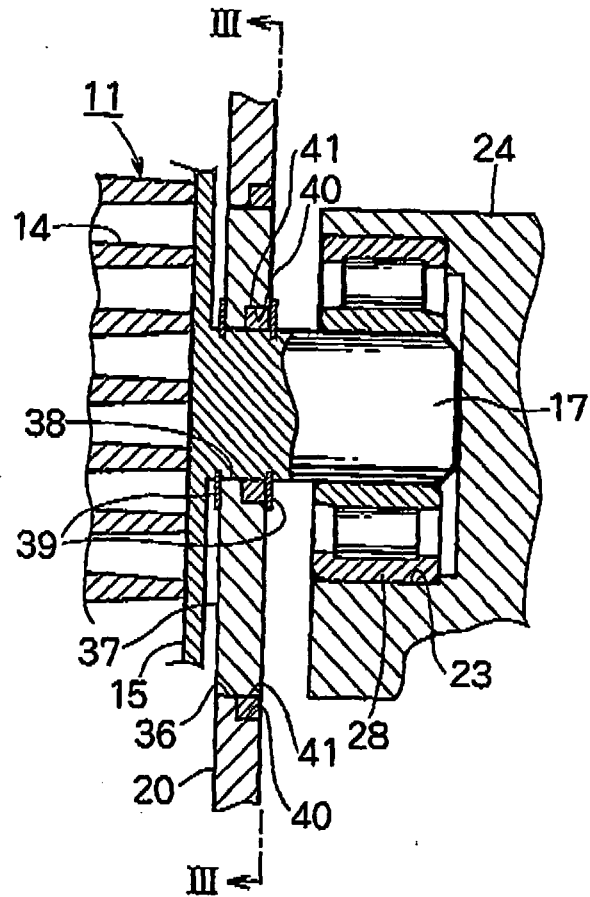


FIG.3

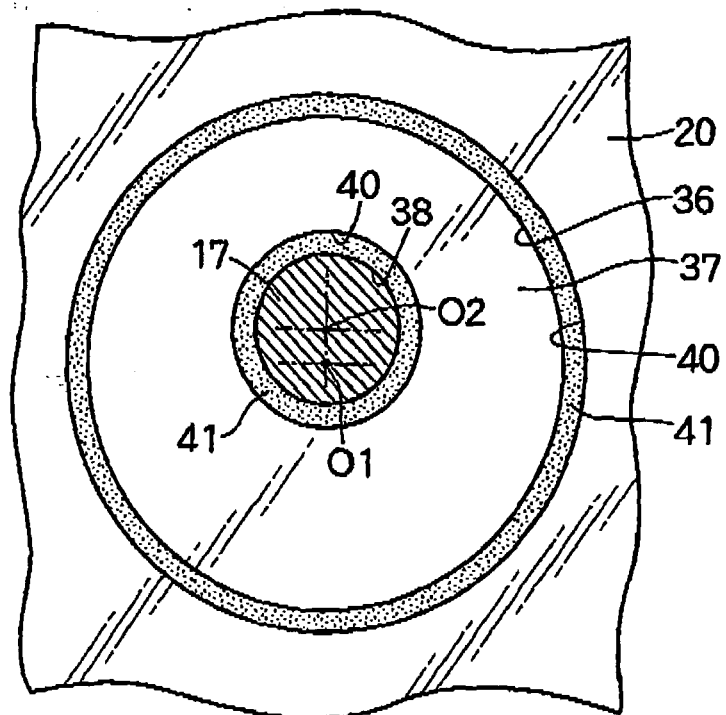


FIG.4

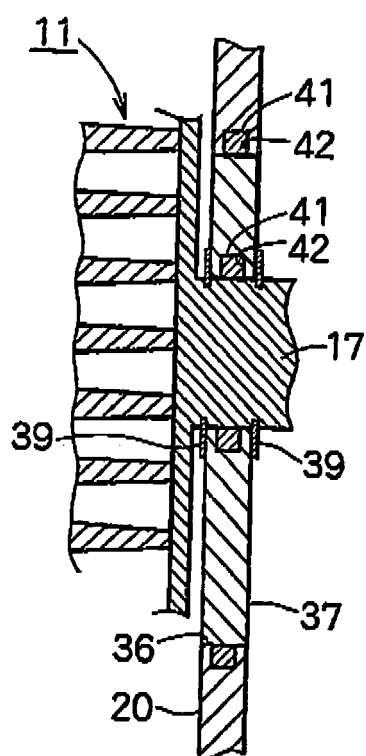
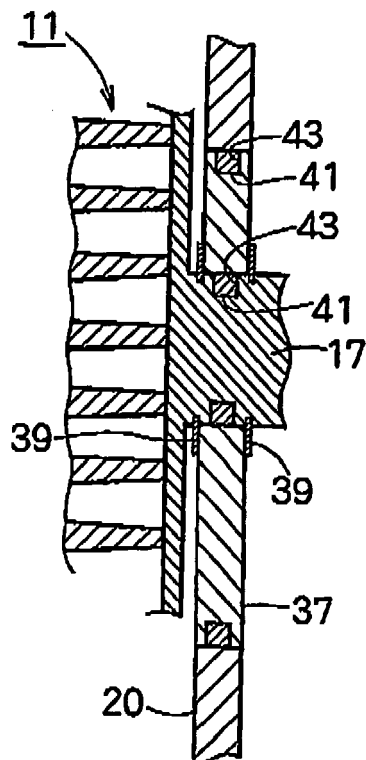
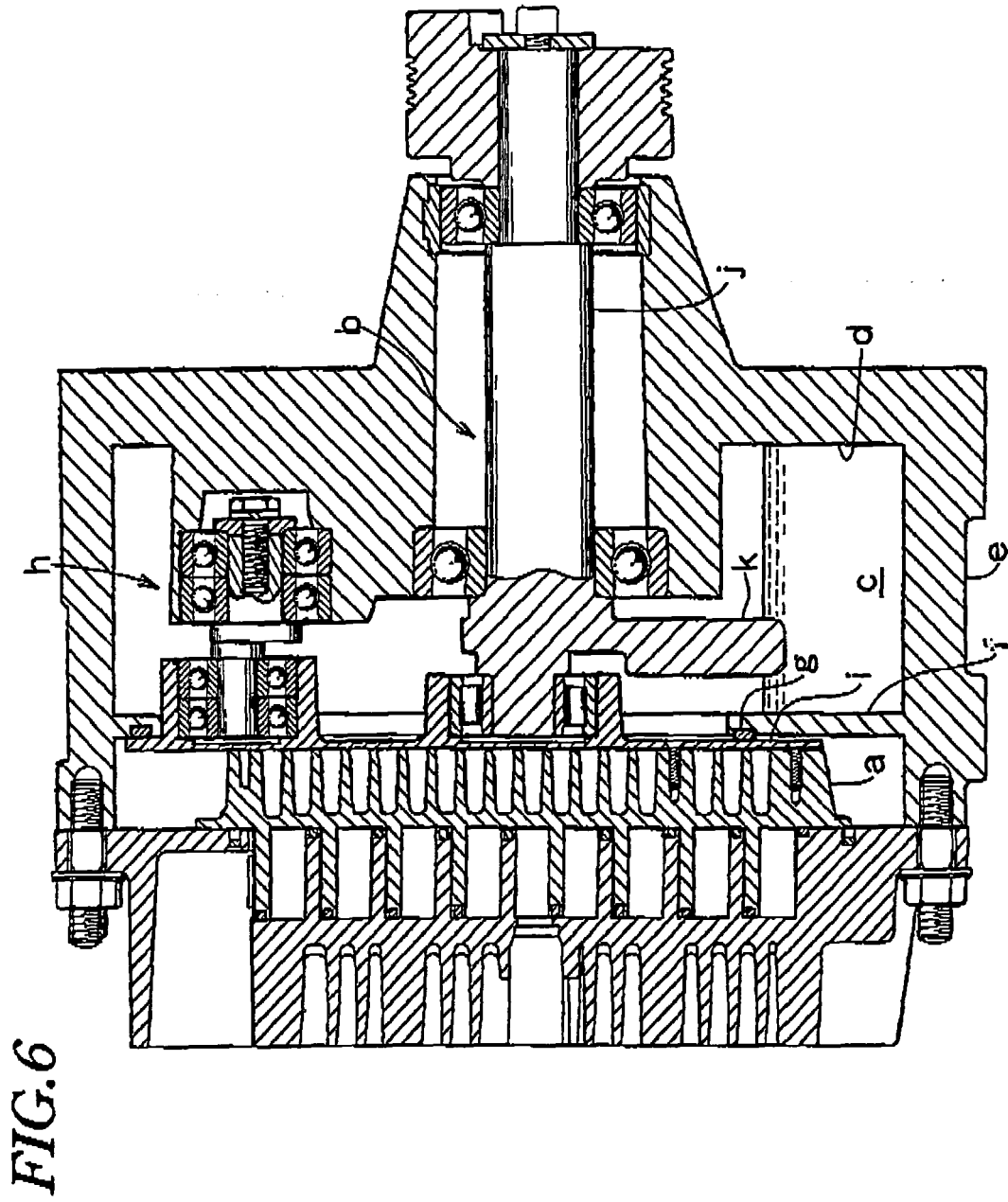


FIG.5





REFERENCES CITED IN THE DESCRIPTION

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