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(54) **Bearing assembly for a shaft of a gas turbine**

(57) A bearing assembly for a shaft (5a) of a gas turbine (1) is provided with a supporting body (6), which extends about a first axis (B) coinciding in use with the rotation axis (A) of the shaft (5a); a bearing (7) which is supported by the supporting body (6) to cooperate, in use, with shaft (5a); and a sealing element (8) which is

supported by the supporting body (6) at one end of the supporting body (6) to cooperate, in use, with shaft (5a). The supporting body (6) and the sealing element (8) are configured so that to allow the bearing assembly (4) to rotate about at least a second axis (C; D) orthogonal to the first axis (B) to follow displacements of shaft (5a).

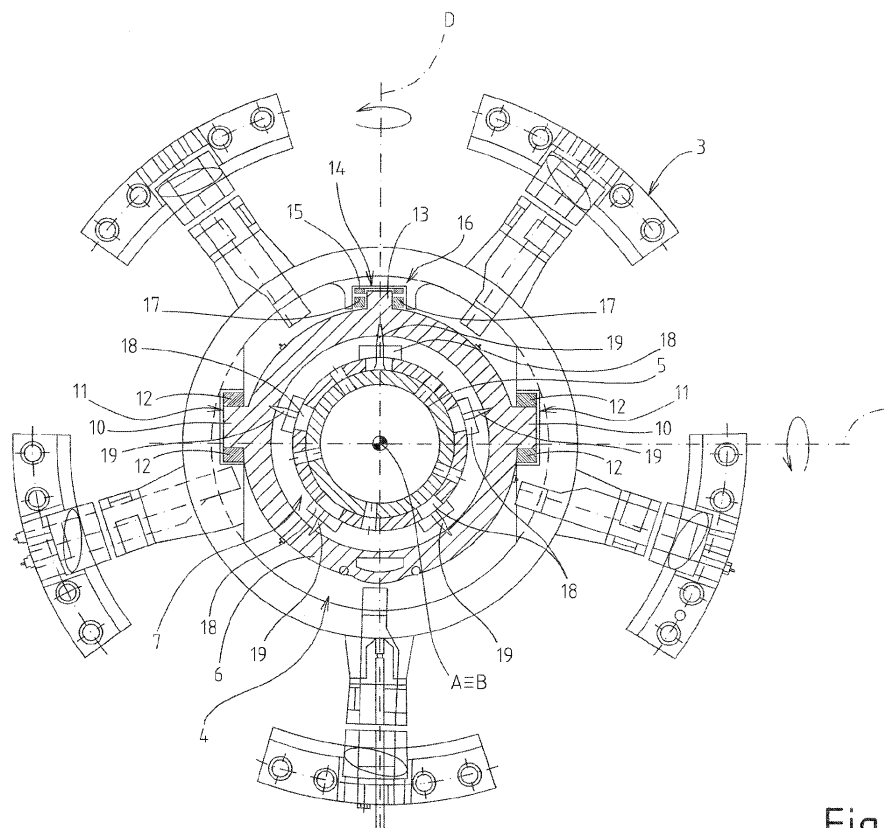


Fig. 2

Description

[0001] The present invention relates to a bearing assembly for a shaft of a gas turbine and to a gas turbine comprising said bearing assembly. In particular, the present invention relates to a bearing assembly for a shaft of a gas turbine of an electric power plant.

[0002] A known type of gas turbine comprises a rotor section provided with a shaft extending along a longitudinal rotation axis, and a bearing assembly, which comprises a supporting structure, a bearing, which is arranged between the supporting structure and the shaft and which is supported by the supporting structure, and a sealing element, which is arranged between the supporting structure and the shaft at an end of the supporting structure.

[0003] The supporting structure is generally provided with alignment holes, which are used to fix the bearing assembly to the stator section of the gas turbine in a position aligned with the shaft.

[0004] The positioning and fixing operations of the bearing assembly take a long time.

[0005] Furthermore, the sealing element of the bearing assembly thus configured is subject to early deterioration during the transient steps in which the shaft is displaced, not guaranteeing correct sealing.

[0006] At rest, the shaft is lowered into the central portion by effect of its weight, while, when running, the shaft is subject to radial displacements mainly caused by thermal expansion phenomena. In particular, the shaft is subjected to radial displacements such as to substantially describe an arch which extends about the rotation axis of the shaft.

[0007] It is an object of the present invention to make a bearing assembly for a shaft of a gas turbine which is free from the drawbacks of the prior art described above; in particular, it is an object of the invention to make an efficient, reliable bearing assembly.

[0008] In accordance with such objects, the present invention relates to a bearing assembly for a shaft of a gas turbine in accordance with claim 1.

[0009] It is a further aspect of the present invention to make a reliable gas turbine.

[0010] In accordance with such objects, the invention relates to a gas turbine in accordance with claim 13.

[0011] Further features and advantages of the present invention will be apparent from the following description of a non-limitative embodiment thereof, with reference to the figures in the accompanying drawings, in which:

- figure 1 is a side view with parts removed for clarity, of a portion of a gas turbine comprising a bearing assembly according to the present invention;
- figure 2 is a front view with parts in section and parts removed for clarity of the bearing assembly in figure 1;
- figure 3 is a side view, with parts in section and parts

removed for clarity, of a detail of the bearing assembly for a gas turbine in figure 1;

- figure 4 is a perspective view, with parts removed for clarity, of a first detail of the bearing assembly in figure 1;
- figure 5 is a perspective view, with parts in section and parts removed for clarity, of a second detail of the bearing assembly in figure 1.

[0012] In figure 1, a gas turbine is indicated with the reference number 1 (only one portion is shown in figure 1 for the sake of simplicity) comprising a rotor section 2, a stator section 3, and a bearing assembly 4. The rotor section 2 rotates about a longitudinal rotation axis A and is provided with a shaft 5a, which comprises a plurality of rotor discs 5b (known and shown in part in the accompanying figures) and a tie rod 5c, which keeps the rotor discs 5b compacted during rotation about axis A.

[0013] The stator section 3 is fixed and supported by a supporting structure on the ground (not shown in the accompanying figures).

[0014] The bearing assembly 4 is arranged about the shaft 5a substantially at the exhaust of the gas turbine 1 and is coupled to the stator section 3.

[0015] The bearing assembly 4 comprises a supporting body 6, a bearing 7 (shown only in figures 2 and 3), which is arranged between the supporting body 6 and the shaft 5a and is supported by the supporting body 6, and a sealing element 8.

[0016] The supporting body 6 has a substantially cylindrical shape and extends about an axis B, coinciding in use with the rotation axis A of shaft 5a.

[0017] With reference to figure 2, the supporting body 6 is coupled with the stator section 3 of the gas turbine 1. In particular, the supporting body 6 is provided with two cylinders 10, which are coaxial and extend along an axis C orthogonal to axis B.

[0018] The cylinders 10 are arranged diametrically opposite on the middle plane and are adapted to engage respective seats 11 of the stator section 3 of the gas turbine 1. The cylindrical coupling between the seats 11 and the cylinders 10 allows the bearing assembly 4 to rotate about axis C to follow the movements of the shaft 5a during operation of the gas turbine 1 (as shown by the arrow in figure 2).

[0019] Preferably, the shape of the cylinders 10 is complementary to that of the respective seats 11, but undersized. The cylinders 10 are housed in the respective seats 11 using shims 12 for adjusting the position of the supporting body 6 with respect to the shaft 5a so that the rotation axis A of the shaft 5a substantially coincides with axis B of the supporting body 6. Preferably, the shims 12 are fixed to the stator section 3.

[0020] The supporting body 6 is further provided with a cylinder 13, which extends along an axis D orthogonal to axis B and to axis C and adapted to engage a respective ring 14 of a plate 15, which slides in a respective seat 16 of the stator section 3 of the gas turbine 1.

[0021] The cylindrical coupling between the ring 14 of the plate 15 and cylinder 13 allows the bearing assembly 4 to turn about axis C (as shown by the arrow in figure 2) to follow the movements of the shaft 5a during operation of the gas turbine 1.

[0022] The seat 16 of the stator section 3 extends parallel to axis B and the plate 15 slides in the seat 16 parallel to axis B to allow the supporting body 6 to turn about axis C.

[0023] Preferably, the shape of the cylinder 12 is not complementary with the seat 16, but is undersized. The cylinder 13 is housed in the respective seat 16 using shims 17 for adjusting the position of the supporting body 6 with respect to the shaft 5a so that the rotation axis A of the shaft 5a substantially coincides with axis B of the supporting body 6. Preferably, the shims 17 are fixed to the stator section 3.

[0024] With reference to figures 2 and 3, the bearing 7 is an oscillating slide bearing, which comprises five slides 18, arranged equidistant along the inner face of the bearing 7. Each slide 18 is free to move about a respective supporting pin 19.

[0025] In use, the slides 18 follow the movement of the shaft 5a.

[0026] With reference to figure 3, the sealing element 8 is supported by the supporting element 6 at an end of the supporting body 6 and extends about the shaft 5a.

[0027] In particular, the sealing element 8 is supported by the end of the supporting body 6 facing the inlet of the gas turbine 1.

[0028] The sealing element 8 separates the lubrication zone of the bearing 7 from the zone of the rotor section 2 in which a cooling fluid circulates. The sealing of the sealing element 8 is fundamental because the leakage of oil from the lubrication zone to the rotator section 2 could cause fires and severe damage to the gas turbine 1.

[0029] With reference to figures 1, 3 and 4, the sealing element 8 comprises a gasket 20 and a slide 21.

[0030] Both the gasket 20 and the slide 21, are arranged along the inner surface of the sealing element 8. In particular, the slide 21 and the gasket 20 are provided in sequence along axis B so that in use the slide 21 is in contact with the lubrication oil of the bearing 7 and the seal 20 is in contact with the cooling fluid which circulates in the rotor section 2.

[0031] The gasket 20 is preferably metallic and comprises a plurality of metallic foils 22, which are arranged so as to form an array of rings substantially equidistant adapted to prevent the passage of lubrication oil and cooling fluid.

[0032] Specifically, the metallic foils 22 must be made so as to leave a thin gap between the metallic foils 22 and the surface of the shaft 5a (in particular the surface of the respective plate of the shaft 5a), which will be occupied during use by a thin oil film which contributes to the correct sealing action of gasket 20.

[0033] Air, conveyed by means of specific channels, circulates between each metallic foil 22, and contributes

to cool the foils and creates a pressure on the foils which contrasts the pressure generated by the cooling fluid, so as to prevent the fluid from flowing into the lubrication zone of the rotor and, vice versa, the oil from leaking into the cooling fluid passage zone.

[0034] A variant not shown of the present invention contemplates that gasket 20 comprises a sealing ring, e.g. of the type commonly called "Corteco", which comprises a spiral metallic ring, coated with a rubber ring which ensures the seal for direct contact with shaft 5a.

[0035] The slide 21 is substantially a ring fixed to the inner surface of the sealing element 8 and has a contact face 24 made of low friction coefficient material. Preferably, the contact face 24 is coated with white metal. As for the metallic foils 22, the slide 21 has a diameter such as to leave a thin gap between the slide 21 and the surface of the shaft 5a (in particular the surface of the respective disc 5b of the shaft 5a). Such gap will be occupied during use by a thin film of oil which contributes to the correct sealing action of slide 21.

[0036] With particular reference to figure 5, the slide 21 has a coupling edge 25, having a so-called "dovetail" shape, which engages the respective slide 26 made along the inner surface of the sealing element 8.

[0037] Preferably, slide 21 is lubricated with the pressurized oil of the oscillating slides 18 of bearing 7.

[0038] Advantageously, the particular configuration of the sealing element 8 and of the supporting structure 6 allow the bearing assembly 4 to follow the position oscillations of the shaft 5a, particularly evident during the transient steps in which there is a variation of the rotation speed of shaft 5a. In this manner, stressing of the sealing element 8 is avoided, avoiding early deterioration of the sealing element 8 itself.

[0039] Furthermore, the particular configuration of the sealing element 8 and of the supporting structure 6 allows to avoid the long, demanding step of fixing of the supporting structure to the rotor section 2. By virtue of such a configuration, indeed, the supporting structure 6 must not be rigidly fixed to the stator section 3 by means of the traditional holes and alignment pins. This implies a considerable reduction of assembly and/or overall times and costs of the bearing assembly 4.

[0040] It is finally apparent that changes and variations can be made to the bearing assembly 4 and to the gas turbine 1 described herein without departing from the scope of protection of the appended claims.

Claims

1. Bearing assembly for a shaft (5a) of a gas turbine (1); the gas turbine (1) comprising a rotor section (2) provided with a shaft (5a) extending along a longitudinal rotation axis (A) and a stator section (3); the bearing assembly (4) comprising:

a supporting body (6), which extends about a

- first axis (B), coinciding, in use, with the rotation axis (A) of the shaft (5a);
 a bearing (7), which is supported by the supporting body (6) to cooperate, in use, with the shaft (5a); and
 a sealing element (8), which is supported by the supporting body (6) at an end of the supporting body (6) to cooperate, in use, with the shaft (5a); the bearing assembly (4) being **characterized in that** the supporting body (6) and the sealing element (8) are configured in such a way to allow the bearing assembly (4) to rotate about at least a second axis (C; D) orthogonal to the first axis (B) to follow displacements of the shaft (5a).
2. Bearing assembly according to claim 1, wherein the supporting body (6) and the sealing element (8) are configured in such a way to allow the bearing assembly (4) to rotate about a third axis (D; C) orthogonal to the first axis (B) and the second axis (C; D). 20
 3. Bearing assembly according to anyone of the foregoing claims, wherein the supporting body (6) comprises at least one cylinder (10; 13), which extends along the second axis (C; D) and is apt to be rotatably coupled to the stator section (3) of the gas turbine (1) to allow the supporting body (6) to rotate about the second axis (C; D). 25
 4. Bearing assembly according to anyone of the foregoing claims, wherein the sealing element (8) comprises a slide (21) having a contact face (24) made of low friction coefficient material. 30
 5. Bearing assembly according to claim 4, wherein the contact face (24) of the slide (21) is made of white metal. 35
 6. Bearing assembly according to claim 4 or 5, wherein a thin gap is present between the slide (21) and the shaft (5a) for the lubricating oil passage. 40
 7. Bearing assembly according to anyone of the claims from 4 to 6, wherein the sealing element (8) comprises a gasket (20). 45
 8. Bearing assembly according to anyone of claims from 7 to 9, wherein the slide (21) and the gasket (20) are arranged in sequence along a direction parallel to the first axis (B) in such a way that the slide (21) is in contact with the lubricating oil of the bearing (7) and the gasket (20) is in contact with the cooling fluid which flows in the rotor section (2) of the gas turbine (1). 50
 9. Bearing assembly according to claim 7 or 8, wherein the gasket (20) comprises at least a sealing ring. 55
 10. Bearing assembly according to any one of claims from 7 to 9, wherein the gasket (20) is a metallic gasket.
 11. Bearing assembly according to any one of claims from 7 to 10, wherein the gasket (20) comprises a plurality of metallic foils (22), which are arranged as to form an array of substantially equidistant rings.
 12. Bearing assembly according to claim 11, wherein a thin gap between the metallic foils (22) and the shaft (5a) is present for the lubricating oil passage.
 13. Gas turbine for an electric power plant comprising a bearing assembly (4) according to anyone of the foregoing claims.

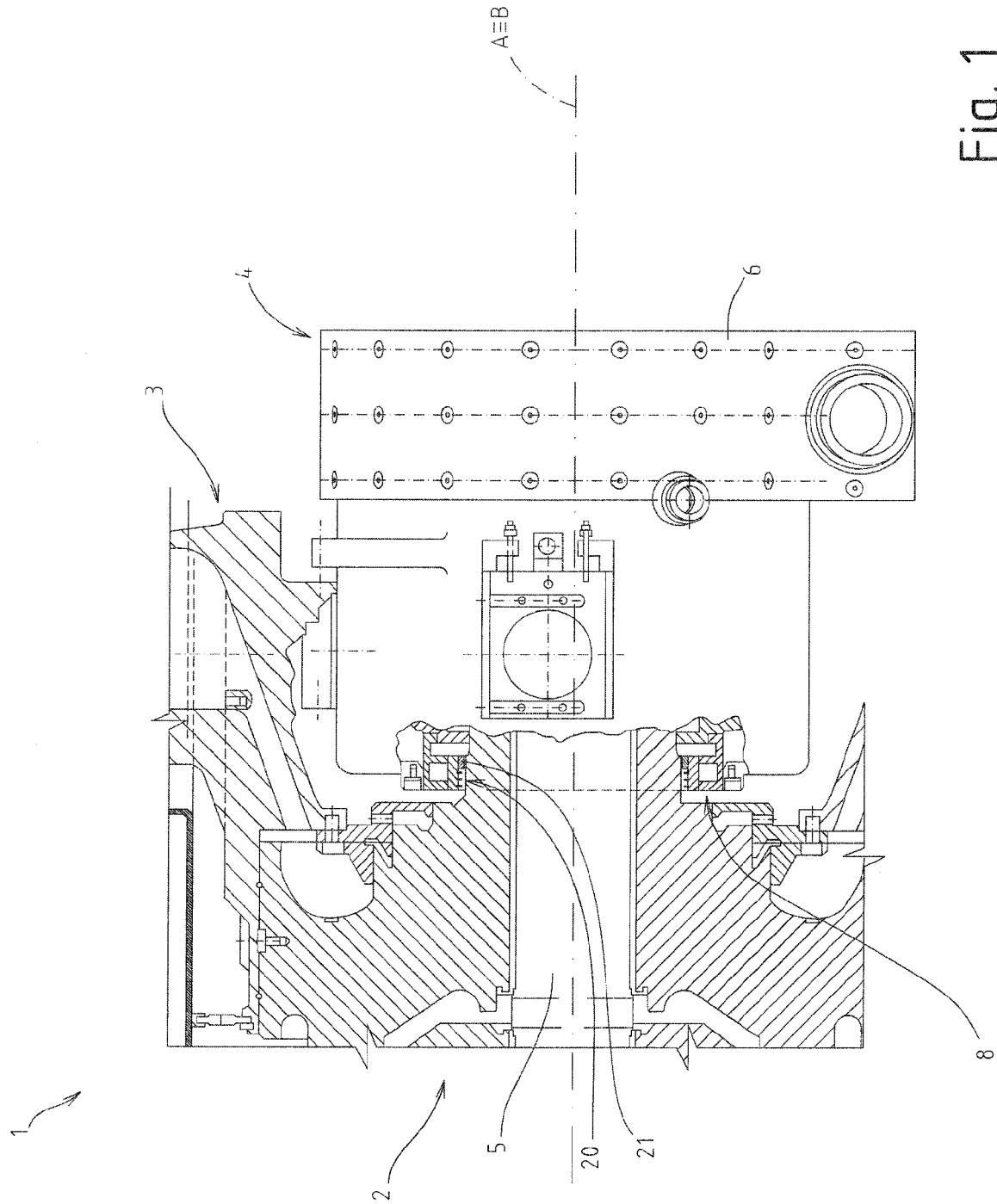


Fig. 1

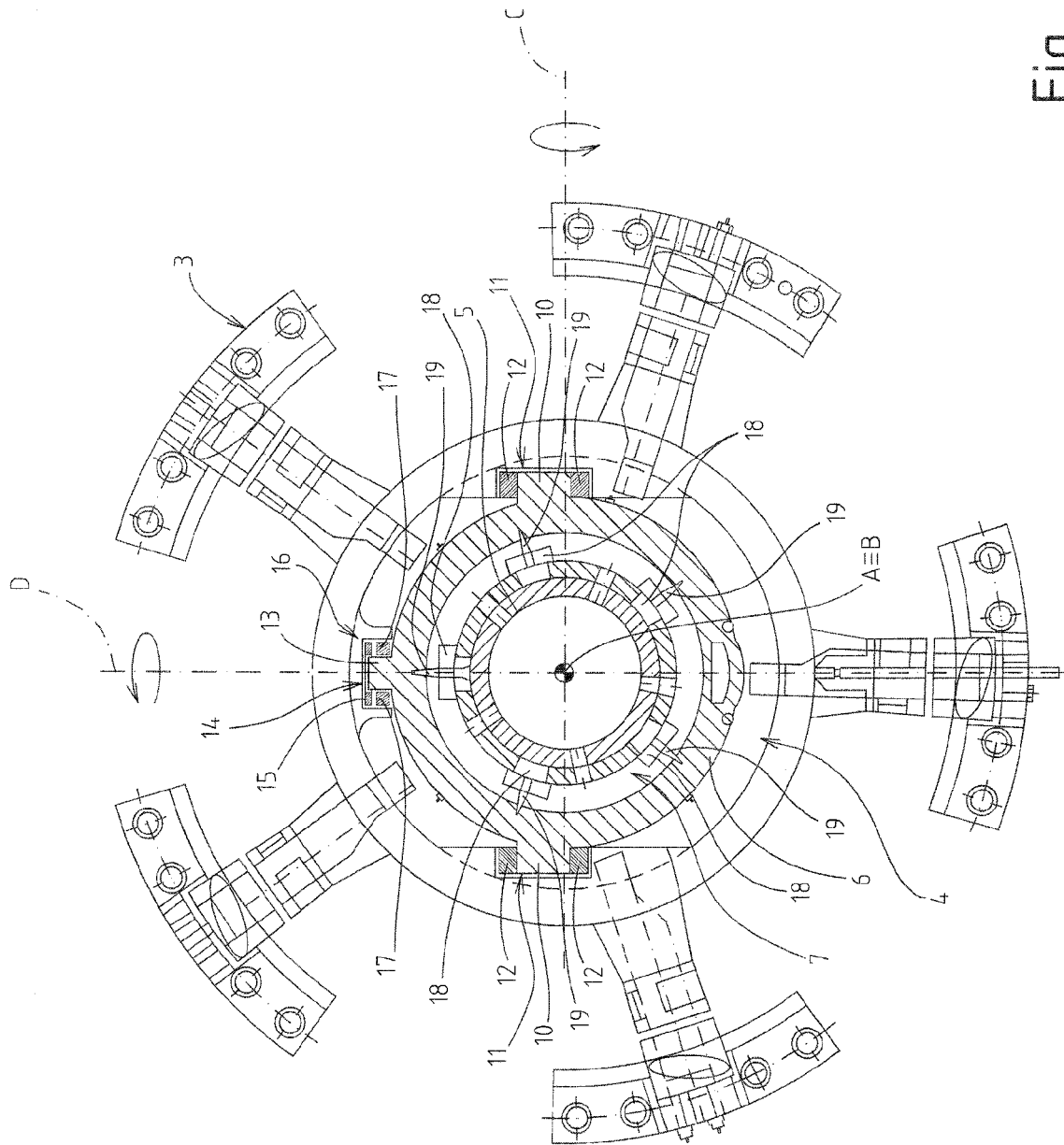
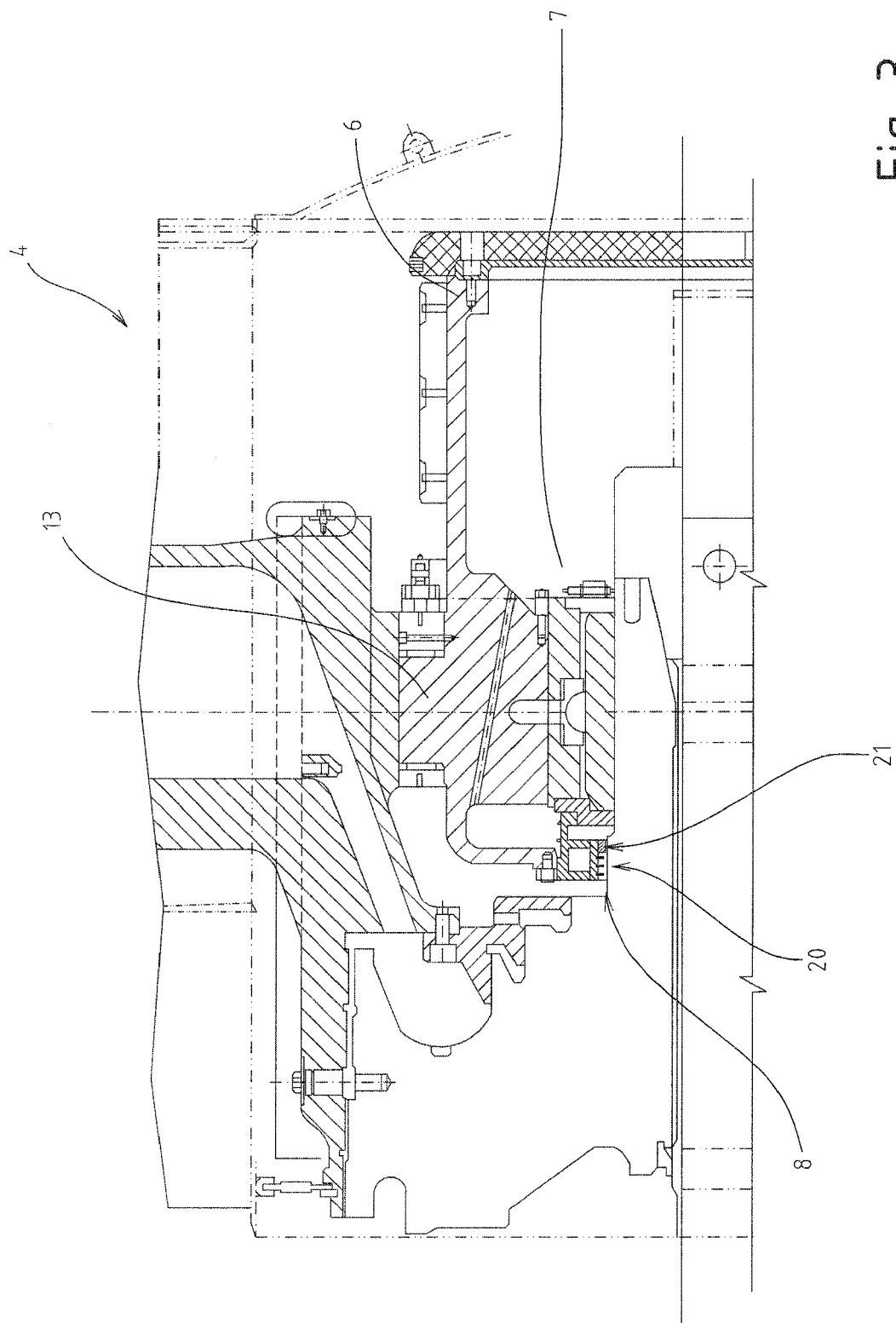


Fig. 2



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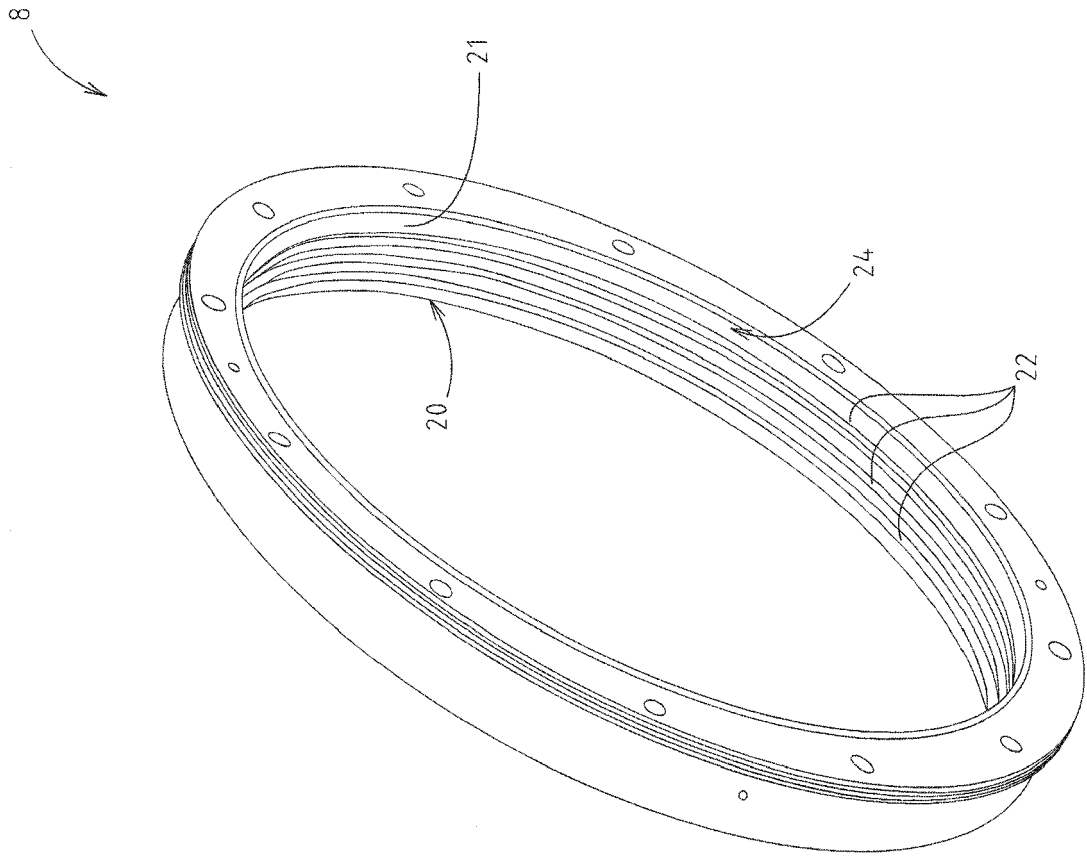


Fig. 4

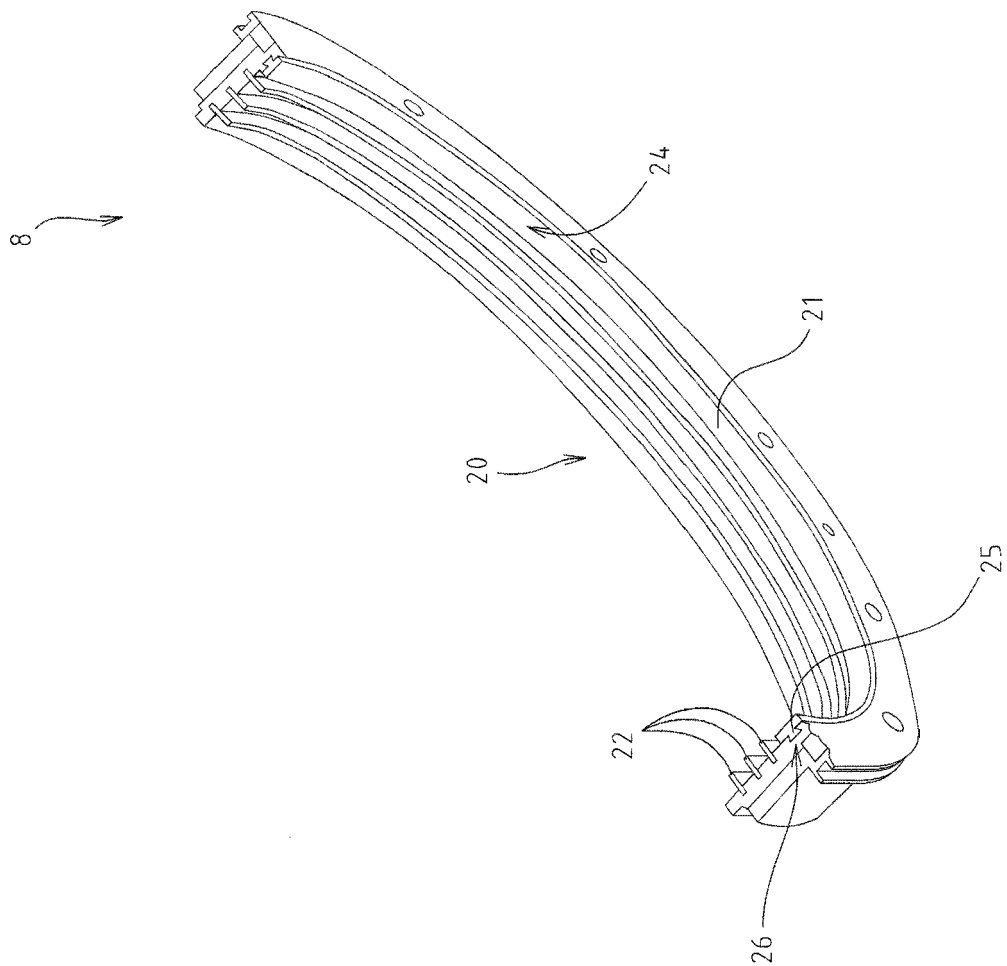


Fig. 5



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Application Number
EP 11 15 5903

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Place of search The Hague		Date of completion of the search 20 May 2011	Examiner Steinhauser, Udo
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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