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(54) **MAINTENANCE METHOD AND KIT FOR A GAS TURBINE ELECTRIC POWER PLANT**

(57) A maintenance method for a gas turbine electric power plant (1) involves replacing the thrust ring (29, 38; 30) of a bearing assembly (16) arranged about a shaft (8) of the plant (1) with a spare thrust ring having a different thickness (NR), intended as the axial length between a thrust face (51) and at least one abutting face (53) of the wall (50) of the thrust ring (29, 38; 30).

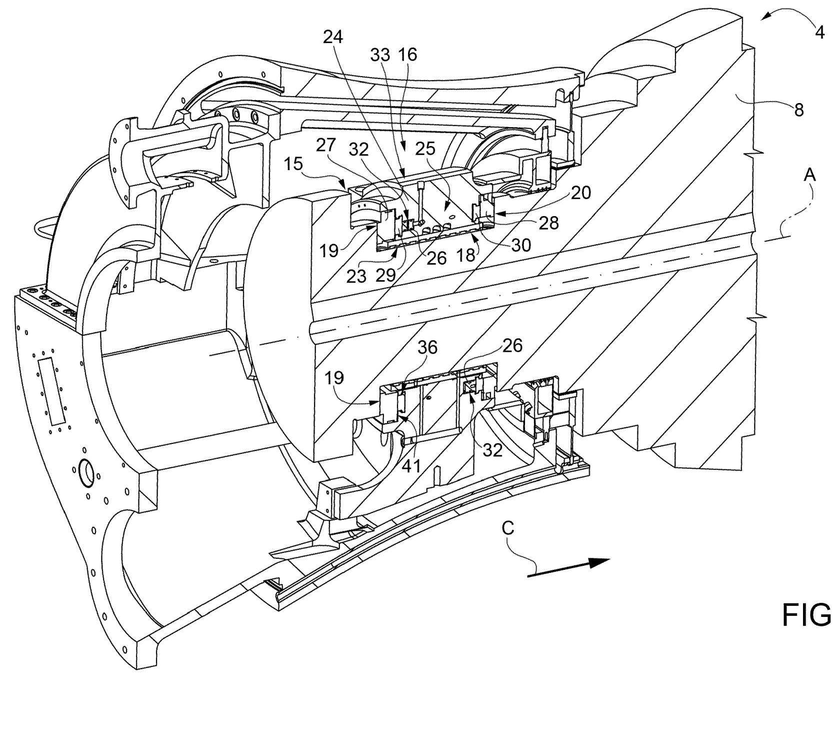

FIG. 2

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Description

[0001] The present invention relates to a maintenance method and kit for a gas turbine electric power plant.

[0002] Gas turbine electric power plants are known comprising a rotor, which extends along a longitudinal axis and is provided with a plurality of rotor blades, and a stator casing, which extends substantially about the rotor.

[0003] The rotor in gas turbine electric power plants of this type is often subjected to axial movements, mainly due to phenomena of thermal expansion and to the centrifugal action to which the rotor is subjected during the operation of the plant.

[0004] During the operability of the plant, the axial movements of the rotor may determine an excessive approach or an excessive distancing between the rotating parts (rotor blades) and the fixed parts (stator casing) of the plant despite the precautions defined in the plant design step. The excessive approaching determines a risk of contact between rotating parts and fixed parts, while the excessive distancing determines an excessive blow-by of the gases between the rotating parts and the fixed parts, with a decrease in the efficiency of the gas turbine of the plant.

[0005] It is thus an object of the present invention to provide a maintenance method for a gas turbine electric power plant capable of obviating the drawbacks mentioned above.

[0006] In particular, it is an object of the present invention to provide a maintenance method capable of minimizing the drawbacks associated with the axial movement of the rotor on a plant already started.

[0007] In accordance with such objects, the present invention relates to a maintenance method for a gas turbine electric power plant according to claim 1.

[0008] It is a further object of the present invention to provide a maintenance kit for a gas turbine electric power plant capable of making the maintenance operation simple, quick and effective and aiming to minimize the drawbacks associated with the axial movement of the rotor on a plant already started.

[0009] In accordance with such objects, the present invention relates to a maintenance kit for a gas turbine electric power plant according to claim 15.

[0010] Further features and advantages of the present invention will become more apparent from the following description of a non-limiting embodiment thereof, with reference to the figures of the accompanying drawings, in which:

- figure 1 is a sectional view, with parts removed for clarity, of a gas turbine electric power plant;
- figure 2 is a perspective view, with sectional parts and parts removed for clarity, of a detail of the plant in figure 1;
- figure 2a is a perspective view, on enlarged scale, of the detail in figure 2;
- figure 3 is a further perspective view, with parts removed for clarity, of the detail in figure 2;
- figure 4 is a perspective view, with parts removed for clarity, of a first step of the method according to the present invention;
- figure 5 is a perspective view, with parts removed for clarity, of a second step of the method according to the present invention;
- figure 6 is a perspective view, with parts removed for clarity, of a third step of the method according to the present invention;
- figure 7 is a perspective view, with parts removed for clarity, of a fourth step of the method according to the present invention.

[0011] Reference numeral 1 in figure 1 indicates a gas turbine electric power plant.

[0012] Plant 1 extends along a longitudinal axis A and comprises a combustion chamber 2, a stator 3 and a rotor 4 (both diagrammatically illustrated in figure 1), which rotates about axis A.

[0013] Stator 3 comprises a stator casing 5, which extends about axis A for the entire length of rotor 4 and is static, a plurality of stator rings 6 centered on axis A, supported by the stator casing 5 and arranged in series along axis A, and a plurality of stator blades 7 fastened to the stator casing 5 and to the respective stator rings 6.

[0014] Rotor 4 comprises a shaft 8 which extends along axis A, a plurality of rotor discs 9, coupled to each other so as to define a single element that rotates about axis A, and a plurality of rotor blades 10 divided into arrays and arranged radially with respect to axis A.

[0015] Each rotor blade 10 is provided with a free end 11 and an end 12 coupled to a respective rotor disc 9.

[0016] The stator rings 6 extend about the rotor discs 9 and are spaced apart from each other so that radial arrays of rotor blades 10 are alternated along axis A by radial arrays of stator blades 7.

[0017] The plurality of rotor discs 9, the stator rings 6 and the stator casing 5 define a first compression channel 13 inside of which flows the air to be fed under compression to the combustion chamber 2, and a second expansion channel 14 inside of which flow the hot gases originating from the combustion chamber 2.

[0018] Shaft 8 is provided with at least one annular groove 15 adapted to house a bearing assembly 16.

[0019] With reference to figure 2, the annular groove 15 is delimited by a cylindrical surface 18, by an annular shoulder 19 and by an annular shoulder 20 facing shoulder 19. In particular, groove 15 is arranged close to the intake of the compression channel 13 of plant 1 (figure 1).

[0020] The bearing assembly 16 comprises a slide bearing 23 arranged about shaft 8, a support body 24 arranged about the slide bearing 23 and an moving device 25 configured to axially move rotor 4.

[0021] The moving device 25 comprises a plurality of hydraulic pistons 26, a main thrust block 27, a secondary thrust block 28, a main thrust ring 29 configured to transmit the thrust of the hydraulic pistons 26 to the main thrust block 27, and a secondary thrust ring 30 configured to transmit the thrust of the hydraulic pistons 26 to the secondary thrust block 28.

[0022] The hydraulic pistons 26 are divided into two groups of hydraulic pistons 26, a main one and a secondary one, arranged along two respective concentric annular paths inside respective seats 32 made in the support body 24 and which extend axially (shown in figure 2 and in figure 7). In use, the hydraulic pistons 26 are movable inside the respective seats 32 under the control of a hydraulic circuit 33 (only partly shown in figure 2).

[0023] The hydraulic circuit 33 comprises at least one delivery conduit 34 and at least one return conduit 35 (shown in figure 3) for each group of hydraulic pistons 26. Preferably, the delivery conduit 34 and the return conduit 35 are defined by flexible pipes to facilitate the disassembly and assembly operations, as explained in detail below.

[0024] The hydraulic circuit 33 is configured to activate the two groups of hydraulic pistons 26 alternatively and on command, to determine a movement of rotor 4. By activating the pistons of the main group (and discharging those of the secondary group), rotor 4 is moved in the direction opposite to the compression direction C of a stroke P, as explained in detail below. Thereby, the distance is reduced between the rotor blades 10 and the stator casing 5 in the expansion channel 14, thus reducing the blow-by of the hot gases between rotor parts and stator parts.

[0025] By activating the pistons of the secondary group (and discharging those of the main group), rotor 4 is moved in the compression direction C of a stroke S, as explained in detail below. Thereby, the distance is increased between the rotor blades 10 and the stator casing 5 in the expansion channel 14, thus reducing the risk of contact.

[0026] The main thrust ring 29 is accommodated in a respective main annular seat 36 centered about axis A and made in the support body 24.

[0027] In the non-limiting embodiment herein described and illustrated, the main annular seat 36 comprises two ribs 37 (one shown in figure 4 and one shown in figure 7) configured so as to divide the main annular seat 36 into two main half-ring seats 38 (shown in figures 5-7), which are substantially identical and are arranged so as to define substantially a ring path, and the main thrust ring 29 is divided into two main thrust half-rings 39 (clearly shown in figures 5 and 6), which are substantially identical and are adapted to engage the respective main half-ring seats 38.

[0028] In particular, the main half-ring seats 38 are made along an annular face 41 of the support body 24 which faces shoulder 19 of shaft 8, and are open at such an annular face 41 (figure 2).

[0029] Furthermore, each main half-ring seat 38 is provided with a bottom face 42 along which the openings of the seats 32 are made. The seats 32 accommodate the hydraulic pistons 26 (figures 2, 6-7).

[0030] With reference to figure 2a, the main half-ring seats 38 are shaped so as to define two annular abutments 45 adapted to cooperate with the respective main thrust half-rings 39, as explained in detail below. In the non-limiting embodiment herein described and illustrated, each main half-ring seat 38 has a substantially T-shaped radial section with respect to axis A so as to define a first proximal portion 46 with respect to the annular face 41 of the support body 24 and having a radial height AR1, and a second distal portion 47 with respect to the annular face 41 and having a radial height AR2 which is greater than the radial height AR1. The first portion also has an axial length AL1 and the second portion 47 has an axial length AL2 which is preferably shorter than the axial length AL1.

[0031] Accommodated inside the main half-ring seats 38 are the respective main thrust half-rings 39. Each main thrust half-ring 39 comprises a half-ring wall 50 provided with a thrust face 51 adapted to be arranged, in use, against the respective hydraulic pistons 26, a transmission face 52, adapted to be coupled, in use, to the main thrust block 27, and at least one abutting face 53 adapted to cooperate against at least one abutment 45 of the respective main half-ring seat 38.

[0032] In the non-limiting embodiment herein described and illustrated, each thrust half-ring 39 comprises two abutting faces 53 adapted to cooperate against the respective abutments 45 of the respective main half-ring seat 38.

[0033] Preferably, wall 50 has a substantially T-shaped radial section so as to define two substantially identical half-ring abutting faces 53.

[0034] Thereby, wall 50 defines substantially an annular head portion 54*a*, which extends between the thrust face 51 and the abutting faces 53, and a base portion 54b, which extends between the abutting faces 53 and the transmission face 52.

[0035] Distance M, intended as the length measured along a direction parallel to axis A, between at least one abutting face 53 and the transmission face 52, defines substantially the thickness of the base portion 54b of the main thrust half-ring 39.

[0036] Distance N, intended as the length measured along a direction parallel to axis A, between the thrust face 51 and at least one abutting face 53, defines substantially the thickness of the head portion 54a of the main thrust half-ring 39. Distance N of the head portion 54a is smaller than the axial length AL2 of the second portion 47 of the respective main half-ring seat 38.

[0037] In the non-limiting embodiment herein described and illustrated, each main thrust half-ring 39 is substantially shaped complementary to the shape of the respective main half-ring seat 38, but is sized so as to be axially movable inside the respective main half-ring seat 38.

[0038] The thrust of the hydraulic pistons 26 accommodated in the main half-ring seats 38 therefore determines a movement of the main thrust half-rings 39 of at most one stroke P equal to the difference between the axial length AL2 of the second portion 47 and thickness N of the head portion 54a of wall 50, intended as the length measured along a direction parallel to axis A, between the thrust face 51 and at least one abutting face 53.

[0039] Stroke P of the main thrust half-rings 39 is therefore limited by the relative dimensions of the main half-ring seat 38 and of the respective main thrust half-ring 39.

[0040] Therefore, when they are subjected to the thrust of the hydraulic pistons 26, the main thrust half-rings 39 carry out an axial amplitude, with respect to the respective main half-ring seats 38, of a maximum stroke P equal to the difference between the axial length AL2 of the second portion 47 and thickness N of the head portion 54a of wall 50.

[0041] The main thrust half-rings 39 in turn transmit a thrust to the main thrust block 27 with which they are directly or indirectly coupled.

[0042] In the non-limiting embodiment herein described and illustrated, the main thrust block 29 is coupled to the main thrust half-rings 39 by means of a load transmission system 58 (diagrammatically depicted with a sectional block in figures 2 and 2a). Preferably, the load transmission system 58 comprises at least one lever (not illustrated in the accompanying figures).

[0043] With reference to figure 3, the main thrust block 27 is substantially ring-shaped and comprises a frame 55 and a plurality of main sliding blocks 56.

[0044] Frame 55 is substantially ring-shaped and is arranged substantially against the annular face 41 of the support body 24 and is divided into two substantially identical half-ring portions.

[0045] Each main sliding block 56 has a surface 57 substantially arranged in contact with shoulder 19 of shaft 8 (figure 2), excepting the presence of an oil meatus between shoulder 19 and surface 57. Each main sliding block 56 receives the thrust from the transmission system 58 and originating from the main thrust half-rings 39.

[0046] The secondary thrust ring 30 configured to transmit the thrust of the hydraulic pistons 26 to the secondary thrust block 28 is accommodated in a respective secondary annular seat 60 centered about axis A and made in the support body 24.

[0047] In the non-limiting embodiment herein described and illustrated, the secondary annular seat 60, similarly to the main annular seat 36, is divided into two secondary half-ring seats (not shown in the accompanying figures), which are substantially identical and are arranged so as to define substantially a ring path, and the secondary thrust ring 30 is divided into two secondary thrust half-rings (not shown in the accompanying figures), which are substantially identical and are adapted to engage the respective secondary half-ring seats.

[0048] The geometry of the secondary thrust half-rings and of the secondary half-ring seats is substantially identical to the geometry of the main thrust half-rings 39 and of the main half-ring seats 38 as also shown by the section illustrated in figure 2, and therefore will not be described below. Preferably, the relative dimensions of the secondary thrust half-rings and of the secondary half-ring seats are also substantially similar so as to define a stroke S substantially equal to the difference between the axial length of the second portion of the secondary half-ring seat and the thickness of the annular wall of the respective secondary thrust half-ring.

[0049] The support body 24 of the bearing assembly 16 is preferably defined by an upper portion 65 and by a lower portion 66, which are coupled to each other. The upper portion 65 comprises one of the main half-ring seats 38, one of the main thrust half-rings 39, one of the secondary half-ring seats and one of the secondary thrust half-rings, the lower portion 66 comprises the other of the main half-ring seats 38, the other of the main thrust half-rings 39, the other of the secondary half-ring seats and the other of the secondary thrust half-rings.

[0050] With reference to figures 3-7, the lower portion 66 of the support body 24 is provided with a protrusion 67 adapted to engage a respective seat (not illustrated in the accompanying figures) of casing 5. In particular, the seat engaged by protrusion 67 is made in a portion 5a of casing 5 arranged upstream of the intake of the compression channel 13.

[0051] With reference to figure 4, the maintenance method according to the present invention involves replacing the original main thrust ring 29 with a spare thrust ring (not illustrated) having a wall of different thickness NR with respect to thickness N of the original main thrust ring 29.

[0052] Thereby, it is possible to modify the stroke P of the main thrust ring and determined by the actuation of the hydraulic pistons 26 of the main group.

[0053] At the same time, or alternatively, the maintenance method according to the present invention involves replacing the original secondary thrust ring 30 with a secondary spare thrust ring (not illustrated) having a ring wall of different thickness NR with respect to thickness N of the original secondary thrust ring 30.

[0054] Thereby, it is possible to modify the stroke S of the secondary thrust ring and determined by the actuation of the hydraulic pistons 26 of the secondary group.

[0055] In particular, the present method involves determining, empirically or through calculations and simulations, at least one distance between a rotor part of plant 1 and a stator part of plant 1 (e.g. the distance between end 11 of the rotor blade 10 and the stator casing 5) and replacing the original main thrust ring 29 with a spare thrust ring having a thickness NR of the annular wall different from thickness N of the original main thrust ring 29 on the basis of the distance determined.

[0056] According to the present invention therefore, the maintenance man of plant 1 has a kit comprising a plurality of spare main thrust rings having different thickness and a plurality of spare secondary thrust rings having different thickness. In the non-limiting embodiment herein described and illustrated, the kit comprises a plurality of spare main thrust half-rings and a plurality of spare secondary thrust half-rings.

[0057] Preferably, the kit comprises a plurality of spare main thrust half-rings and a plurality of spare secondary thrust half-rings having thickness comprised between 0.1 and 1000 mm.

[0058] The procedures for replacing the main thrust rings 29 and for replacing the secondary thrust rings 30 are substantially identical and may also be carried out simultaneously. According to a preferred embodiment of the present invention, the replacement of the main thrust rings 29 and of the secondary thrust rings 30 is carried out simultaneously and using spare main thrust rings and spare secondary thrust rings having thickness such as to define a substantially identical stroke P and a stroke S.

[0059] In the non-limiting embodiment herein described and illustrated in which the main thrust rings 29 and the secondary thrust rings 30 are divided into half-rings, the procedure is as follows:

- uncoupling the delivery conduits 34 and the return conduits 35 and placing them on the side of the bearing assembly 16; such an operation is facilitated by the implementation of flexible pipes for making delivery conduits 34 and return conduits 35;
- removing the upper portion 66 of the support body 24;
- removing the respective main thrust half-ring 39 from the upper portion 66 and replacing it with a spare main thrust half-ring 39 conveniently selected between the plurality of spare main thrust half-rings and/or removing the respective secondary thrust half-ring from the upper portion 66 and replacing it with a spare secondary thrust half-ring conveniently selected between the plurality of spare secondary thrust half-rings;
- pulling, by means of sliding and lifting, the upper half-ring portion of the main thrust block 23 (if the main thrust half-rings 39 are to be replaced) and/or pulling, by means of sliding and lifting, the upper half-ring portion of the secondary thrust block 28 (if the secondary thrust half-rings are to be replaced);
- pulling, by means of sliding, the lower half-ring portion of the main thrust block 27 and/or pulling, by means of sliding, the lower half-ring portion of the secondary thrust block 28 until the configuration in figure 5 is obtained; such a step does not require disassembling shaft 8, the rotor parts, or the lower portion 66 of the support body 24;
- pulling, by means of sliding, the respective main thrust half-ring 39 (configurations in figure 6 and figure 7) and/or pulling, by means of sliding, the respective secondary thrust half-ring; preferably such a step is carried out by means of the aid of a tool (not illustrated) conveniently shaped so as to selectively engage a hole made in the main thrust half-ring 39 and/or a hole made in the secondary thrust half-ring; such a step does not require disassembling shaft 8, the rotor parts, or the lower portion 66 of the support body 24;
- inserting, by means of sliding, a spare main thrust half-ring conveniently selected between the plurality of spare main spare thrust half-rings on the basis of, for example, the value determined of the distance between rotor parts and stator parts of plant 1 and/or inserting, by means of sliding, a spare secondary thrust half-ring conveniently selected between the plurality of spare secondary thrust half-rings on the basis, for example, of the value determined of the distance between rotor parts and stator parts of plant 1; such a step does not require disassembling shaft 8, the rotor parts, or the lower portion 66 of the support body 24;
- repositioning and assembling the main thrust block 27 and/or the secondary thrust block 28; such a step does not require disassembling shaft 8, the rotor parts, or the lower portion 66 of the support body 24;
- coupling the upper portion 66 back to the lower portion 65 of the bearing assembly 16;
- repositioning and reconnecting the delivery 34 and return 35 conduits to the respective mouths on the upper portion 65 of the support body 24; as already mentioned, the repositioning operation is facilitated by the implementation of flexible pipes for making delivery conduits 34 and return conduits 35.

[0060] Due to the maintenance method and kit herein described and illustrated, it is possible to correct the axial movement determined by the bearing assembly 16 in a simple and quick manner.

[0061] In particular, the present maintenance method allows the axial stroke P to be modified (on the main side) and/or the axial stroke S to be modified (on the secondary side) determined by the bearing assembly 16 by means of a simple and quick intervention, which does not require the removal of rotor 4 or of the lower portion 66 of the support body 24, and can be carried out during a routine maintenance stop of a plant already in operation.

[0062] The present method is advantageously applicable directly on-site without the need of bringing parts into the workshop.

[0063] Finally, the present maintenance method allows the axial strokes P and S determined by the bearing assembly 16 to be directly modified on the plant with respect to the original values set by the manufacturer in order to adjust them to the specific operating conditions of the plant which may depend on the implementation of upgrading packages or on individual site characteristics, or following damage originating from contact between rotor parts and stator parts.

[0064] Advantageously, the present method does not involve removing the lower part 66 of the bearing assembly 16, or replacing the lower part 66, with apparent advantages in terms of maintenance times and costs.

[0065] Finally, it is apparent that modifications and variants may be made to the method and kit herein described without departing from the scope of the appended claims.

Claims

1. A maintenance method for a gas turbine electric power plant (1) comprising a shaft (8) extending along a longitudinal axis (A) and a bearing assembly (16) arranged about the shaft (8); the bearing assembly (16) comprising a plurality of actuators (26), at least one thrust ring (29, 38; 30) and at least one annular seat (36) centered on the axis (A) and engaged by the respective thrust ring (29, 38; 30); the thrust ring (29, 38; 30) comprising a wall (50) provided with a thrust face (51) adapted to receive a thrust from at least one actuator (26) and with at least one abutting face (53) adapted to cooperate against a respective abutment (45) of the annular seat (36); the method comprising the step of replacing the thrust ring (29, 38; 30) with a spare thrust ring having a thickness (NR), intended as the axial length between the thrust face (51) and at least one abutting face (53) of the wall (50), different from the thickness (N) of the original thrust ring (29, 38; 30).

2. A method according to claim 1, wherein the bearing assembly (16) comprises a thrust block (27, 28); the thrust ring (29, 38; 30) being configured to transmit the thrust of the plurality of actuators (26) to thrust block (27, 28) and vice versa.

3. A method according to claim 1 or 2, wherein the annular seat (36) is made along an annular face (41) of the bearing assembly (16) facing an annular shoulder (18, 19) of the shaft (8).

4. A method according to any one of the preceding claims, comprising the step of determining at least one distance between a rotor part (10) of the plant (1) and a stator part (5) of the plant (1).

5. A method according to claim 4, comprising the step of selecting the spare thrust ring between a plurality of spare thrust rings having different thickness (NR) at least on the basis of the distance determined between a rotor part (10) of the plant (1) and a stator part (5) of the plant (1).

6. A method according to any one of the preceding claims, wherein the thrust ring (29; 30) comprises two thrust half-rings (38) which are substantially identical; the step of replacing the thrust ring (29; 30) with a spare thrust ring comprising the step of replacing the thrust half-rings (38) with respective spare thrust half-rings having thickness (NR) different from the thickness (N) of the original thrust half-rings (38).

7. A method according to claim 6, wherein the annular seat (36) comprises two ribs (37) configured to divide the annular seat (36) into two half-ring seats (39) which are substantially identical and adapted to house the respective thrust half-rings (38).

8. A method according to claim 7, wherein the bearing assembly (16) is defined by an upper portion (65) and by a lower portion (66) which are coupled; the upper portion (65) comprising one of the half-ring seats (39) and the lower portion (66) comprising the other of the half-ring seats (39).

9. A method according to claim 8, wherein the step of replacing the thrust ring (29, 38; 30) with a spare thrust ring comprises substantially:

   - uncoupling the upper portion (65) of the bearing assembly (16) from the lower portion (66) of the bearing assembly (16);
   - removing the respective thrust half-ring (38) from the half-ring seat (39) of the upper portion (65) and inserting in said half-ring seat (39) a spare thrust half-ring selected between a plurality of spare thrust half-rings having different thickness (NR);
   - removing the thrust half-ring (38) from the respective half-ring seat (39) of the lower portion (65) of the bearing assembly (16) and inserting in said half-ring seat (39) a spare thrust half-ring selected between a plurality of spare thrust half-rings having different thickness (NR).

10. A method according to claim 9, wherein the steps of removing the thrust half-rings (38) comprise pulling the thrust half-rings (38) by sliding inside the respective half-ring seats (39) without carrying out disassembling operations on the lower portion (66) of the bearing assembly (16) or on the shaft (8).

11. A method according to claim 9 or 10, comprising the step of coupling the upper portion (65) of the bearing assembly (16) to the lower portion (65) of the bearing assembly (16).

12. A method according to any one of the preceding claims, wherein the bearing assembly (16) is provided with a further annular seat (60) centered on the axis (A) and engaged by a further thrust ring (30; 29); the further thrust ring (30; 29) comprising a further wall provided with a further thrust face, adapted to receive a thrust from at least one further actuator, and with at least one further abutting face adapted to cooperate against a further respective abutment of the further annular seat (60); the method comprising the step of replacing the further thrust ring (30; 29) with a further spare thrust ring having a further thickness, intended as the axial length between the

further thrust face and at least one further abutting face of the further wall, different from further thickness of the further original thrust ring (30; 29).

13. A method according to claim 12, wherein the bearing assembly (16) comprises a further thrust block (28, 27); the further thrust ring (30; 29) being configured to transmit the thrust of the plurality of further actuators (26) to the further thrust block (27, 28) and vice versa.

14. A method according to claim 12 or 13, wherein the further annular seat is made along a further annular face of the bearing assembly (16) facing a further annular shoulder (19; 18) of the shaft (8).

15. A maintenance kit for a gas turbine electric power plant (1) comprising a plurality of spare thrust rings, having different thickness (NR), intended as the axial length between a thrust face adapted to receive a thrust from at least one actuator of a bearing assembly (16) of the plant (1) and at least one abutting face adapted to cooperate against a respective abutment of an annular seat (36) of a bearing assembly (16) of the plant (1).

16. A kit according to claim 15, wherein the thickness NR of the plurality of spare thrust rings is comprised between 0.1-1000 mm.

17. A kit according to claim 15 or 16, comprising a plurality of further spare thrust rings having different thickness; the thickness of the plurality of further spare thrust rings is comprised between 0.1-1000 mm.

18. A kit according to any one of claims from 15 to 17, comprising a plurality of tools for disassembling the bearing assembly (16) arranged about a shaft (8) of the plant (1).

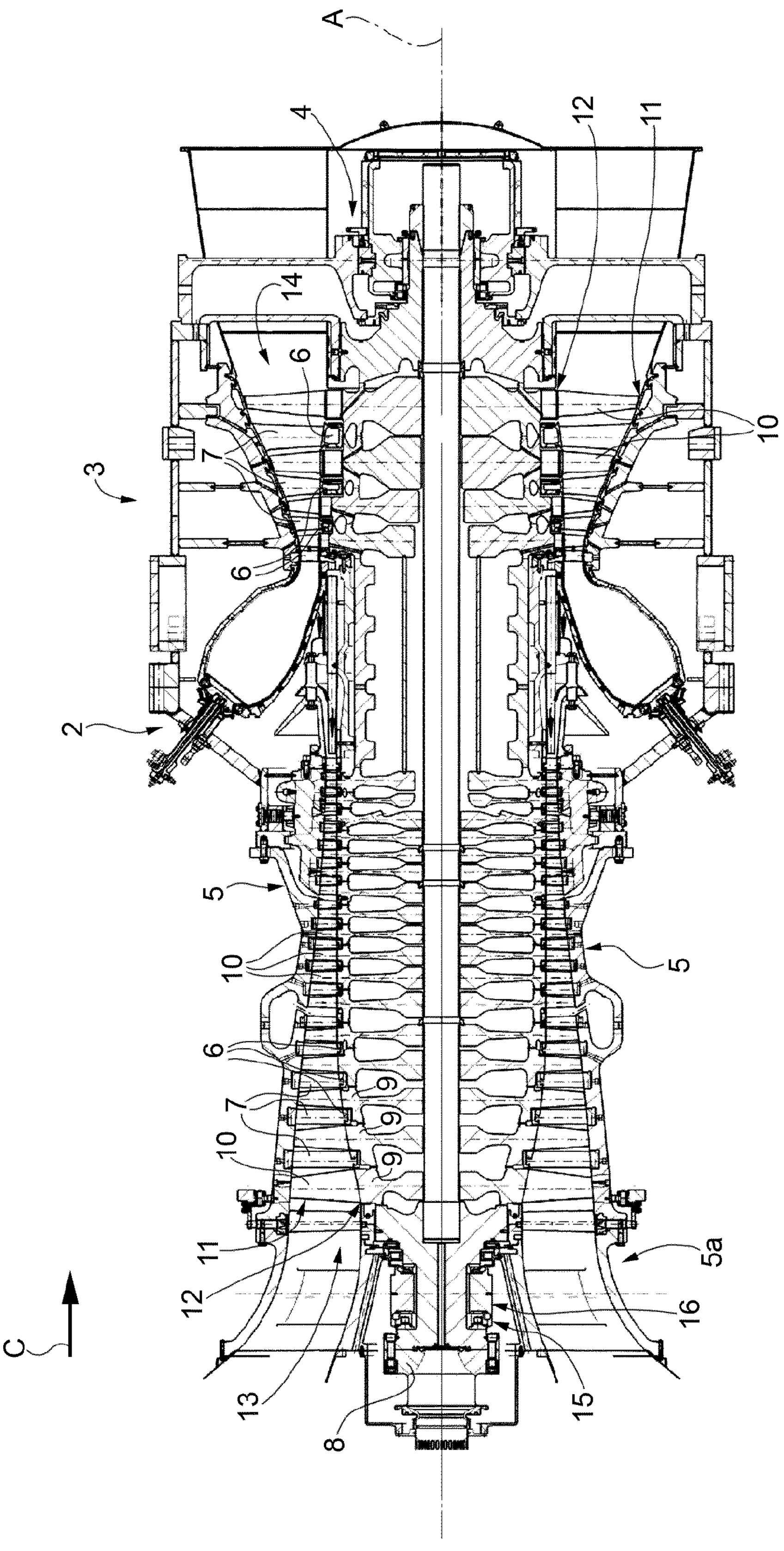

FIG. 1

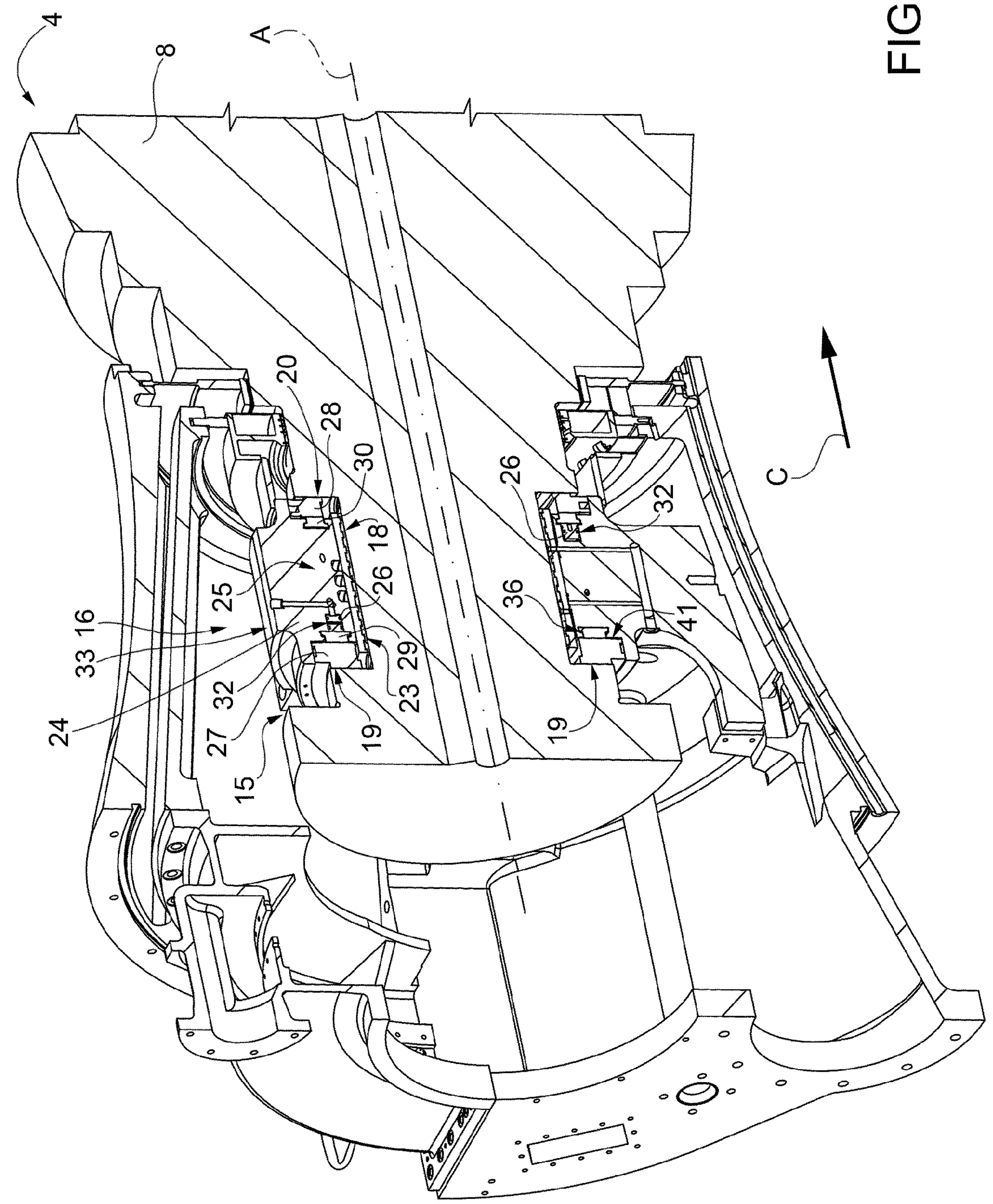

FIG. 2

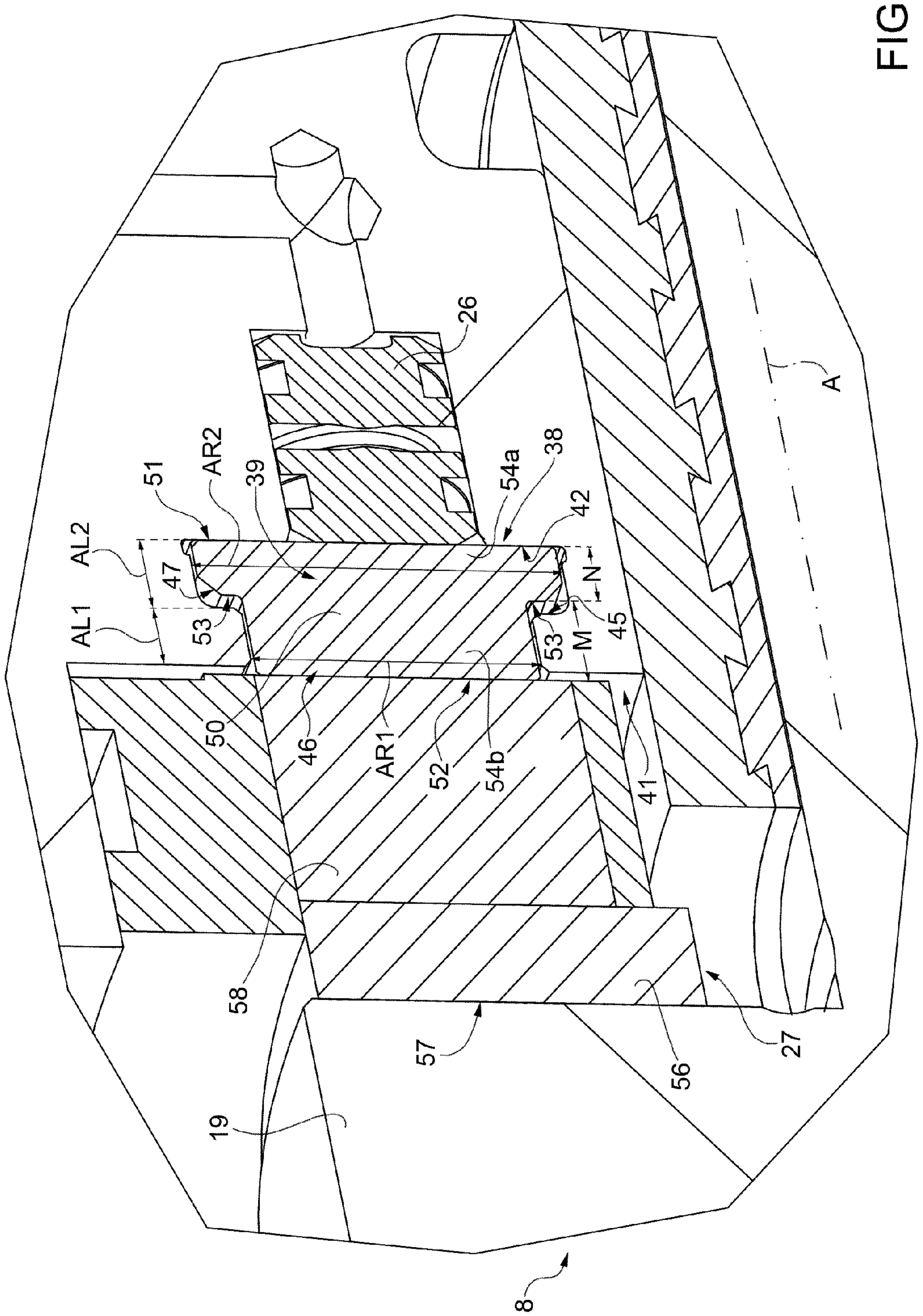
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FIG. 2A

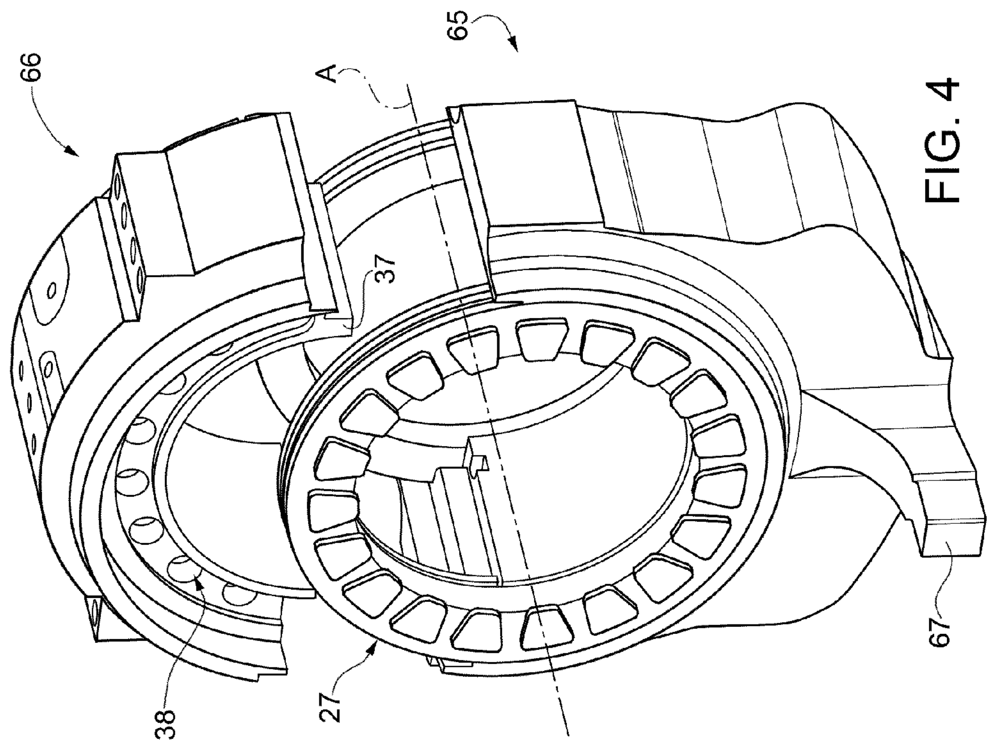

FIG. 4

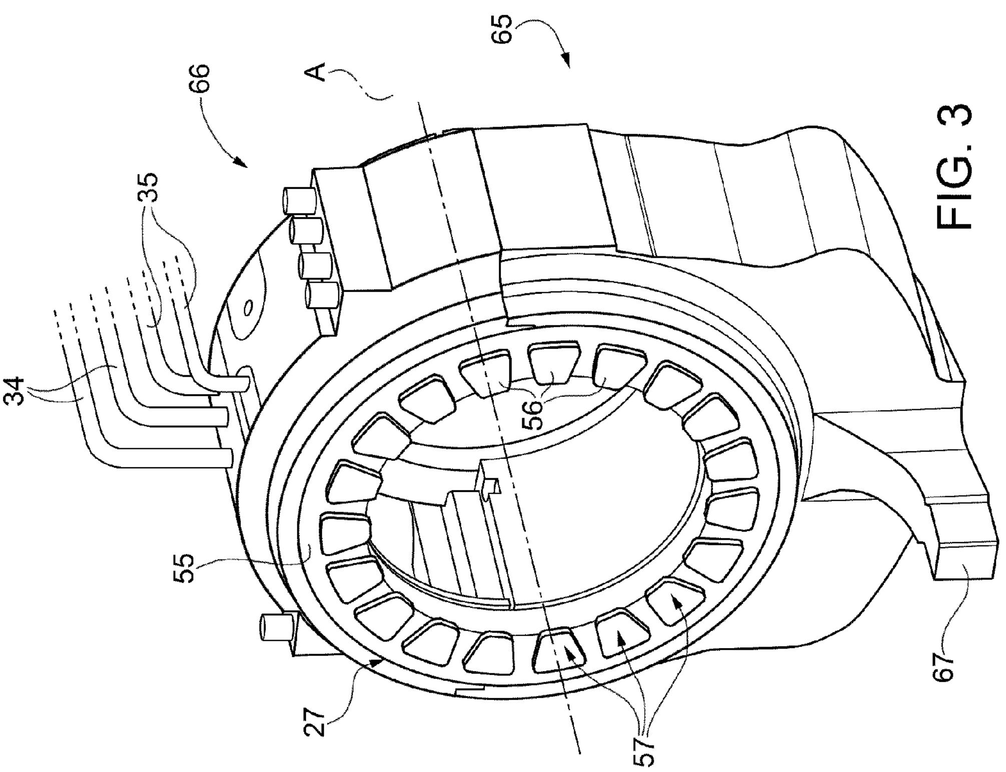

FIG. 3

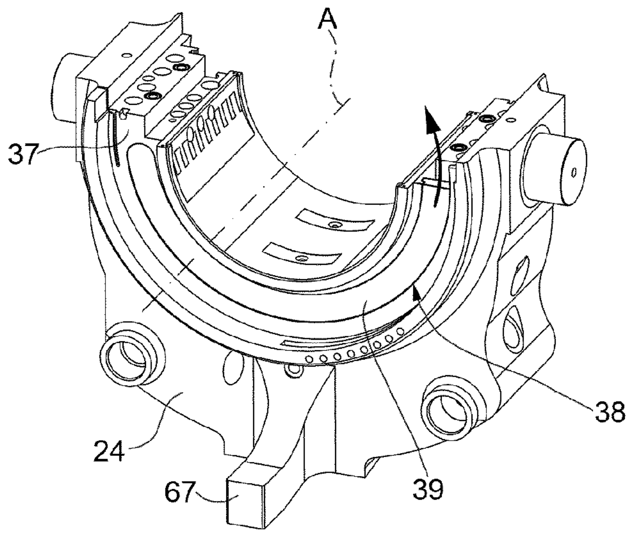

FIG. 5

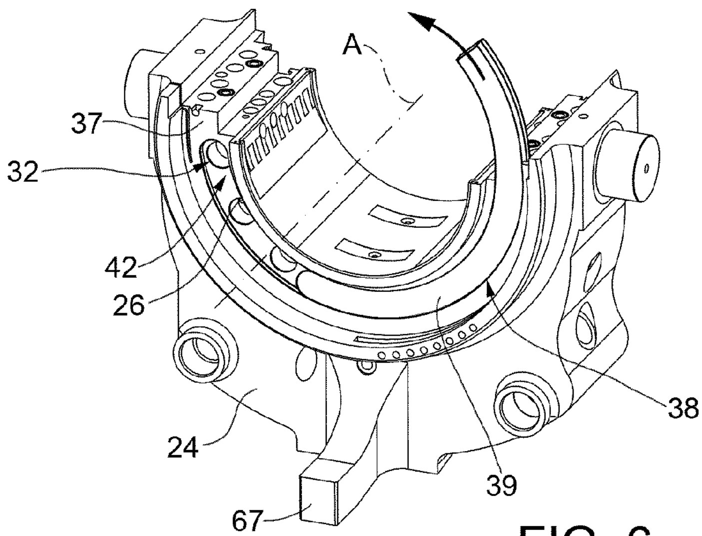

FIG. 6

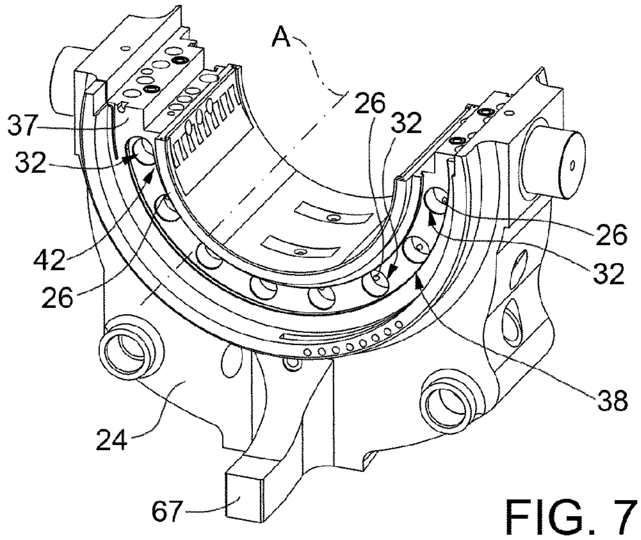

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 0980

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 242 910 A1 (ANSALDO ENERGIA SPA [IT]) 27 October 2010 (2010-10-27) * figure 4 * -----	1-18	INV. F01D3/04
			TECHNICAL FIELDS SEARCHED (IPC)
			F01D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	17 December 2015	Rolé, Florian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 18 0980

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-12-2015

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		ES 2407629 T3	13-06-2013
		WO 2009083789 A1	09-07-2009

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