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(54) Benævnelse: **LEJE-STØTTEARRANGEMENT TIL EN VINDMØLLE, VINDMØLLE OG FREMGANGSMÅDE TIL MONTERING AF ET LEJE-STØTTEARRANGEMENT**

(56) Fremdragne publikationer:
EP-A1- 3 144 550
EP-A1- 3 309 387
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WO-A1-2004/051104
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DESCRIPTION

Technical field

[0001] The disclosure relates to a bearing support arrangement for a wind turbine and a wind turbine comprising such a bearing support arrangement. The disclosure further relates to a method for mounting a bearing support arrangement for a wind turbine.

Background

[0002] A wind turbine may include a rotor that includes a rotor hub having multiple rotor blades. The rotor
blades transform wind energy into a rotational torque that drives a generator via a drive train. The drive train may comprise a rotor shaft, a gearbox, a coupling, a rotor brake and other components. The generator, the gearbox and the other components may be mounted within a nacelle that is positioned on top of a tower.

[0003] EP 3 309 387 A1 relates to a bearing supporting apparatus for a wind turbine generator system, where the wind turbine generator system comprises an impeller and a generator. A hub of the impeller is arranged on an outer side of a main bearing seat of the generator.

[0004] EP 3 144 550 A1 relates to a tensioner for preloading a bearing, the bearing including inner and outer bearing rings. The tensioner including a component having a housing and a carrier element that extends radially inwardly from the housing.

[0005] WO 2011/033256 A1 relates to a bearing assembly for a rotating element that has one race adapted to be fixed relative to ground and to selectively be free for arcuate movement relative to ground. In a preferred embodiment a selective locking device is provided for the relatively fixed/movable race.

[0006] WO 2004/051104 A1 relates to a spare shaft bearing a rotary shaft supported in an ordinary rolling bearing comprising inner ring, outer ring and rolling bodies arranged between the rings, the inner ring being coupled to the shaft and secured by a locating nut and the outer ring being fitted in a housing.

[0007] EP 2 781 740 A2 relates to a support structure for bearings that allows the rotor shaft to rotate about the rotor axis. The support structure may be a housing fixed on a base, which can be coupled to a tower.

[0008] EP 2 538 079 A2 relates to a support structure for bearings with a first portion sized to receive a rotor shaft therethrough and a second portion which is configured to be coupled to a tower, wherein the second portion is integrally formed with the first portion.

[0009] It is desirable to provide a bearing support arrangement for a wind turbine that enables reliable operation and maintenance.

Summary

[0010] The invention relates to a bearing support arrangements according to claim 1, a wind turbine according to claim 11 and a method for mounting a bearing support arrangement according to claim 12.

[0011] Embodiments of the disclosure provide a bearing support arrangement for a wind turbine. In particular, the bearing support arrangement comprises:

- a support structure;
- a bearing housing, the bearing housing being arranged inside the support structure;
- a bearing, the bearing being radially supported by the bearing housing;
- a rotor shaft, the rotor shaft being radially supported by the bearing;
- a removable wedge, the wedge being arranged between the support structure and the bearing housing to clamp the bearing between the rotor shaft and the bearing housing.

[0012] The bearing support arrangement allows a reliable clamping of the bearing between the rotor shaft and the bearing housing. The wedge is designed to apply a radial force on the bearing housing and on the support structure to clamp the bearing.

[0013] The wedge presses the support structure and the bearing housing apart from each other. Thereby a radial force is exerted on the bearing against the rotor shaft. An easy mechanical tensioning of the bearing to the support structure is possible. The bearing is centered relatively to the rotor shaft due to the wedge which is arranged between the support structure and the bearing housing. Furthermore larger manufacturing tolerances in the support structure, the bearing housing, the bearing and/or the rotor shaft are acceptable. The manufacturing of the components can be more reliable and cost effective because very narrow tolerances are avoidable. Furthermore a heating of the components before assembly is avoidable.

[0014] The removable arrangement of the wedge allows to demount the bearing, the rotor shaft and other components in case of damage or for maintenance. Dismantling the individual components of the bearing support arrangement is simplified. For example, the bearing housing, the bearing and the rotor shaft form an assembly which can be removed if the wedge is released. In particular, it is possible to remove this whole assembly in one piece.

[0015] According to embodiments, the support structure comprises two separate parts, an upper part which surrounds the bearing housing, and a lower part which supports the upper part. The lower part may for example be a base or a machine support (also called machine frame or base frame). The upper part and the lower part are fixed together. The lower part for example is rotatably mounted on top of a tower of the wind turbine.

[0016] According to further embodiments, the support structure forms a machine frame, for which the upper part is integrally formed with the lower part and extends from said lower part. Such a machine frame thus for example forms a single, unitary component. Such a machine frame may be realized as one single casting and is for example rotatably mounted on top of the tower.

[0017] According to embodiments, the wedge is not completely removed from the support structure and the bearing housing to demount the arrangement. For example, it is sufficient to release and/or shift the wedge to reduce the radial clamping force such that the fixing of the bearing housing relative to the support structure is loose. Therefore, in the context of this disclosure, the term "remove" can mean: a complete removal, a partial removal, a displacement to reduce the clamping forces and/or a displacement of the wedge relative to the support structure and/or the bearing housing.

[0018] According to further embodiments, the wedge is ring shaped and surrounds the bearing. In particular, the wedge surrounds the bearing and the bearing housing is located between the wedge and the bearing. For example, the wedge is designed rotationally symmetrical. For example, the wedge can be manufactured in a lathe with narrow tolerances. A ring shaped wedge provides good centering of the bearing and a uniform preload of the bearing.

[0019] According to further embodiments, the wedge comprises a mounting interface for removable fixing of the wedge to the bearing housing and/or the support structure. For example, the wedge is mounted to the bearing housing via the mounting interface. Alternatively or in addition, the wedge is mounted to the support structure via the mounting interface.

[0020] According to embodiments, the mounting interface comprises a radial projecting part that reaches to the bearing housing and/or the support structure. This allows an overlap of the wedge and the bearing housing and/or the support structure along the longitudinal direction. Thus, a fixing along the longitudinal direction is possible. Therefore, the fixing is along a direction which is transversal to the radial direction along which the clamping of the bearing is realized.

[0021] According to further embodiments, the bearing support arrangement comprises fixing elements, for example screws, studs, nuts and/or bolts, for removable fixing of the wedge to the bearing housing and/or the support structure. The fixing elements for example interact with the mounting interface to provide a holding and retention force along the longitudinal axis. Thus the wedge can be tensioned between the support structure and the bearing housing by moving along the longitudinal direction while fastening the fixing elements. Due to the outer shape of the wedge this induces the radial force and clamping of the bearing.

[0022] According to further embodiments, a radial thickness of the wedge decreases along a longitudinal axis of the support structure. For example, the radial thickness of the wedge decreases along the longitudinal axis from an outer side of the support structure towards an inner side of the support structure. For example, one outer side faces the rotor and another outer side faces the generator in ready-to-operate condition. The inner side is located between the two outer sides along the longitudinal direction. Accordingly, the wedge comprises a conical cross section at least partly along the longitudinal axis. This allows an easy push in and pull out of the wedge and allows sufficient clamping of the bearing.

[0023] According to further embodiments, the bearing support arrangement comprises a cone ring. The cone ring is arranged radially between the bearing housing and the wedge. A radial thickness of the cone ring increases along a longitudinal axis from both outer sides of the support structure towards an inner side of the support structure. The cone ring allows an easy and reliable mounting and disassembly of the bearing support arrangement without the need for major adjustments to the bearing housing.

[0024] According to further embodiments, one of the bearing housing and the support structure comprises a contact surface which is in contact with the wedge and which has an inclined orientation with respect to the longitudinal axis. The inclined orientation of the contact surface allows an easy push in and pull out of the wedge which slides along the contact surface. Furthermore the contact surface allows a reliable transmission of the radial forces.

[0025] According to the invention, the bearing support arrangement comprises a second bearing in addition to the first bearing described above. The second bearing is radially supported by the bearing housing. The bearing support arrangement comprises a second removable wedge in addition to the first removable wedge described above. The second wedge is arranged between the support structure and the bearing housing to clamp the second bearing between the rotor shaft and the bearing housing. Providing two bearings and two corresponding wedges allows a reliable support of the rotor shaft. Thereby compensation of radial assembly play and/or radial manufacture tolerances is possible.

[0026] According to further embodiments, the first bearing and the first wedge are arranged at a first axial end region of the support structure. The second bearing and the second wedge are arranged at a second axial end region of the support structure. The second axial end region is arranged opposite to the first axial end region. Thus, an easy assembly of the wedges by sliding them along the longitudinal direction in opposite directions is possible. The removal of the wedges is also simplified. The second wedge is for example removable along a first axial direction. The first wedge is removable along a second axial direction. The first axial direction is opposite to the second axial direction.

[0027] Further embodiments of the disclosure provide a wind turbine. In particular, the wind turbine comprises a nacelle. The wind turbine comprises a bearing support arrangement according to at least one of the described embodiments. The wind turbine allows a simplified mounting and demounting of the bearings and of the rotor shaft without the need of changing the whole nacelle. Also maintenance of the bearing, the bearing housing and the rotor shaft is simplified.

[0028] Further embodiments of the disclosure provide a method for mounting a bearing support arrangement for a wind turbine, in particular for mounting a bearing support arrangement according to one of the described embodiments. In particular, the method comprises:

- inserting a wedge along an axial direction between a support structure and a bearing housing, and thereby
- clamping a bearing between a rotor shaft and the bearing housing,
- fixing of the wedge to the support structure and/or the bearing housing.

[0029] The advantages and features described in connection with the bearing support arrangement also apply to the method and vice versa.

[0030] The method allows an easy and reliable clamping of the bearing, in particular without the need of heating solid components. Furthermore the components of the bearing support arrangement can be provided with larger tolerances.

[0031] According to further embodiments the method comprises steps for removing the rotor shaft. To remove the rotor shaft the fixing of the wedge to the support structure and/or the bearing housing is released. The wedge is removed from the support structure along the axial direction of the support structure, in particular together with the rotor shaft, the bearing housing and the bearing. Thus, an assembly which for example comprises the bearing housing, the bearing(s) and the rotor shaft is demounted after releasing of the wedge(s). The rotor shaft is removed out of the support structure along the axial direction of the support structure. In particular, the rotor shaft can be dismantled and removed non-destructively and without the need to heat the components. The removal of the wedges reduces the radial tension and the clamping of the components in order to allow the components to move with respect to each other along the axial direction.

[0032] For example, the method comprises a tightening of fixing elements to fix the wedge. The method comprises loosening of fixing elements to release the fixing. For example, screws are screwed in and tightened to fix the wedge and clamp the bearing. The screws are loosened and unscrewed to allow a removal of the wedge and to release the clamping of the bearing.

Brief description of the drawings

[0033] The present invention will be further described with reference to the accompanying drawings, wherein:

Figure 1 is a schematic view of a wind turbine according to an embodiment,

Figure 2 is a schematic view of a drive train of the wind turbine according to an embodiment,

Figure 3 is a schematic view of a bearing support arrangement according to the embodiment of Figure 2,

Figure 4 is a schematic view of a bearing support arrangement according to an embodiment,

Figure 5 is a schematic view of a bearing support arrangement according to an embodiment,

Figure 6 is a schematic view of a bearing support arrangement according to an embodiment,

Figures 7A and 7B are schematic views of the bearing support arrangement during dismantling according to embodiments.

[0034] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the invention defined by the appended claims. Throughout the drawings, identical components and components of the same type and effect may be represented by the same reference signs.

Detailed description of illustrative embodiments

[0035] As shown in Figure 1 the wind turbine 100 comprises a tower 102. The tower 102 is connected to a foundation 104 fixed on the ground. On a top end of the tower 102 opposite to the foundation 104 a nacelle 106 is arranged. The nacelle 106 houses the drive train. Inside the nacelle 106 for example a generator is arranged which is connected via a gearbox and a rotor shaft 205 with a rotor 108. The rotor 108 comprises a rotor hub 112 and several rotor blades 110. The rotor blades 110 are mounted on the rotor hub 112. The rotor hub 112 is connected to the rotor shaft 205.

[0036] The rotor 108 is driven in operation by an air flow, for example wind. The rotational movement of the rotor 108 is transmitted via the rotor shaft 205 to the generator. The generator converts the energy of the rotor 108 into electrical energy.

[0037] As shown in Figure 2 and in greater detail in Figure 3 a bearing support arrangement

200 according to an embodiment comprises a support structure 201 forming a machine frame realized with a first part surrounding a bearing housing 203 and a second part forming an interface to a yaw bearing 202. The first and the second part for example are formed as a one-piece component. The support structure 201 is screwed to the yaw bearing 202. The yaw bearing 202 is located at the top end of the tower 102 and enables the rotation of the support structure 202 and other components mounted to the support structure 202 with respect to a longitudinal axis of the tower 102. The support structure 201 is configured to hold and support the rotor shaft 205 of the wind turbine 100.

[0038] The support structure 201 surrounds the rotor shaft 205 at least in part. To allow a rotation of the rotor shaft 205 relative to the support structure 201 a bearing 204 is arranged between the rotor shaft 205 and the support structure 201. According to embodiments, two bearings 204 and 240 are provided to allow the rotational movement of the rotor shaft 205.

[0039] The bearing housing 203 surrounds the bearings 204, 240 radially opposite the rotor shaft 205. The bearing housing 203 is arranged between the support structure 201 and the bearings 204, 240. The bearings 204, 240 are arranged between the rotor shaft 205 and the bearing housing 203. To fix the bearings 204, 240 as well as the bearing housing 203 with respect to the support structure 201 wedges 210, 220 are provided.

[0040] The wedges 210, 220 each have a conical shape in a cross section along a longitudinal axis 230. The wedges 210, 220 have a ring like shape around the longitudinal axis 230. The wedges 210, 220 have a shape that allows to provide a clamping force and tensioning force along a radial direction 233 which is oriented transversely to the longitudinal axis 230.

[0041] The wedges 210, 220 are comparably structured and designed. For example, the wedges 210, 220 have different diameters to each other. For example, angles of a cone shape of the wedges 210, 220 can be the same or different to each other. The wedges 210, 220 clamp the bearing housing 203 and the bearings 204, 240 against the support structure 201 and against the rotor shaft 205.

[0042] The wedges 210, 220 are arranged between the support structure 201 and the bearing housing 203 along the radial direction 233. Starting from outside, the support structure 201 followed by the wedges 210, 220, the bearing housing 203, the bearings 204, 240 and the rotor shaft 205 are arranged coaxial with respect to the longitudinal axis 230. The functionality of the wedges 210, 220 to radially jam, clamp and hold the bearings 204, 240 is the same on both axial end regions 218, 219 of the support structure 201.

[0043] Features describes in connection with one of the wedges 210, 220 may also apply for the other of the wedges 210, 220.

[0044] In order to clamp the bearing 204 against the rotor shaft 205 the wedge 210 is introduced between the bearing housing 203 and the support structure 201 along a first axial direction 231 at the first axial end region 218 of the support structure 201. The wedge 210 slides along a contact surface 227 of the support structure 201 and along a contact surface 217 of the bearing housing 203. The contact surface 227 is parallel to the longitudinal axis 230. The contact surface 217 is inclined such that a distance between the contact surface 217 and the contact surface 227 becomes smaller along the longitudinal axis 230 from an outer side 207 of the support structure 201 to an inner side 209 of the support structure 201. The shape of the contact surfaces 217 and 227 corresponds to the shape of the wedge 210. Due to the conical shape of the wedge 210 and the inclined contact surface 217 the radial force between the bearing 204 and the support structure 201 is realized.

[0045] According to embodiments, the contact surface 217 is not inclined as illustrated in Figure 3. Instead, the contact surface 217 is parallel to the longitudinal axis 230. The contact surface 227 is then inclined such that a distance between the contact surface 217 and the contact surface 227 becomes smaller along the longitudinal axis 230 from an outer side 207 of the support structure 201 to an inner side 209 of the support structure 201. The wedge 210 is then shaped accordingly.

[0046] The wedge 210 comprises a thickness 214 along the radial direction 233. The thickness 214 becomes less along the first axial direction 231. Thus, the cone-like outer contour is achieved. The thickness 214 of the wedge 210 is greater on the side facing the outer side 207 of the support structure 201 than on the side facing the inner side 209 of the support structure 201.

[0047] The wedge 210 is held in position by a fixing element 213. The fixing element 213 comprises for example a multitude of screws that are aligned along the longitudinal axis 230. The fixing element 213 effects a holding force along the longitudinal axis 230.

[0048] The wedge 210 comprises a mounting interface 211 that interacts with the fixing element 213. For example, the mounting interface is arranged outside the support structure 201. For example, the wedge 210 comprises a radial projecting part 212. The radial projecting part 212 projects along the radial direction 233 to reach over the bearing housing 203. The radial projecting part 212 may be a flange or may be a multitude of spaced-apart projecting noses.

[0049] The fixing element 213 reaches through the mounting interface 211 to the bearing housing 203 to axially hold the wedge 210 in position.

[0050] The second bearing 240 is clamped between the bearing housing 203 and the rotor shaft 205 in a corresponding way. The second wedge 220 is pushed between the bearing housing 203 and the support structure 201 along a second axial direction 232. The first axial direction 231 and the second axial direction 232 are aligned opposite to each other. Due to the conical shape of the wedge 220 and the shape of the contact surface of the bearing housing 203 and the support structure 201, the wedge 220 effects a radial force between the support structure 201, the bearing housing 203 and the second bearing 240. The second wedge 220 is held in place by fixing elements 232 that reach through a radial projecting part 222 of a mounting interface 221 of the wedge 220. The fixing elements 223 connect the second wedge 220 to the bearing housing 203. The fixing elements 223 hold the second wedge 220 along the longitudinal axis 230.

[0051] The second wedge 220 comprises a thickness 224 along the radial direction 233. The thickness 224 becomes less along the second axial direction 232. Thus, the cone-like outer contour is achieved. The thickness 224 of the second wedge 220 is greater on the side facing the outer side 208 of the support structure 201 than on the side facing the inner side 209 of the support structure 201.

[0052] The bearing housing comprises shoulders 234, 235 that function as alignment elements for the respective bearings 204, 240 along the longitudinal axis 230.

[0053] The fixing of the wedges 210, 220 can be realized in different ways. According to the embodiment of Figure 4, which corresponds basically to the bearing support arrangements as described in connection with Figures 2 and 3, the wedge 210 for clamping the bearing 204 is fixed to the support structure 201. The corresponding fixing element 213 reaches through the projecting part 212 into the support structure 201. Therefore, the projecting part 212 projects outwardly along the radial direction 233.

[0054] The second wedge 220 is fixed to the bearing housing 203 as explained in connection with Figure 3. Therefore the projecting part 222 projects inwardly along the radial direction 233.

[0055] Different combinations of the fixing of the two wedges 210, 220 are possible. Both wedges 210, 220 can comprise inward projecting parts 212, 222 and can be fixed to the bearing housing 203 as shown in Figure 3. Both wedges 210, 220 can comprise outward projecting parts 212, 222 and are both fixed to the support structure 201. According to further embodiments one of the wedges 210, 220 can be fixed to the support structure 201 and the other to the bearing housing 203, as shown in Figure 4. It is also possible that the second wedge 220 for clamping the second bearing 240 is fixed to the support structure 201 via an outward projecting part 222 and the wedge 210 for clamping the first bearing 204 is fixed to the bearing housing 203 via an inward projecting part 212. It is also possible that one or both of the wedges are fixed to both the support structure 201 and the bearing housing 203.

[0056] Figure 5 shows the bearing support arrangement 200 according to a further embodiment. The bearing support arrangement 200 according to Figure 5 corresponds basically to the bearing support arrangements as described above. In contrast the bearing support arrangement 200 according to the embodiment of Figure 5 comprises an additional cone ring 215.

[0057] The cone ring 215 is arranged between the wedges 210, 220 and the bearing housing 203 along the radial direction 233. The cone ring 215 comprises a radial thickness 216 along the radial direction 233. The radial thickness 216 increases from the outer side 207 in the direction to the inner side 209 along the longitudinal axis 230. From the inner side 209 to the outer side 207 the radial thickness 216 of the cone ring 215 decreases. The radial thickness 216 is smaller at the two axial ends of the cone ring 215 and is greater at the middle part of the cone ring 215. Thus, the cone ring 215 provides an inclined surface that interacts with the wedges 210, 220 to clamp the bearing 240. The inclined surfaces are not provided at the bearing housing 203 but at the extra component cone ring 215. This allows to use a conventional bearing housing 203 and to provide the clamping functionality via the wedges 210, 220 and the cone ring 215.

[0058] The bearings 204, 240 are held in place along the longitudinal axis 230 by a distance ring 236. The distance ring 236 is arranged between the bearing housing 203 and the rotor shaft 205 along the radial direction 233 and between the bearings 204 and 240 along the longitudinal axis 230. This makes it possible to provide the bearing housing 203 without the alignment shoulders 234, 235.

[0059] Figure 6 schematically shows an embodiment of the bearing support arrangement 200 which corresponds to the embodiment according to Figures 2 and 3. The bearing housing 203 is provided with shoulders 234 and 235 and the inclined contact surface 217. The wedges 210, 220 are spaced apart and are each clamped between the support structure 201 and the bearing housing 203.

[0060] A combination of the embodiments of Figures 5 and 6 is possible. For example, the cone ring 215 is provided to interact with the wedges 210, 220 for the clamping force. The bearing housing 203 comprises two shoulders 234, 235 to provide an axial alignment of the bearings 204, 240.

[0061] Figures 7A and 7B show a way of demounting the rotor shaft 205 from the support structure 201. The rotor shaft 205 is fixed to the generator or a gearbox or another element inbetween the rotor shaft 205 and the generator by fixing elements 206. These fixing elements are removed. Also fixing elements 213 and 223 holding the wedges 210, 220 are removed.

[0062] As shown in Figure 7B wedge 210 is moved away from its operating position along the second axial direction 232. Thus, the wedge 210 is no longer between the support structure 201 and the bearing 204.

[0063] Correspondingly, the second wedge 220 is moved away from its operating position along the first axial direction 231. Thus, the second wedge 220 is no longer between the support structure 201 and the second bearing 240.

[0064] By removing the wedges 210, 220 the radial clamping force between the support structure 201, the bearing housing 203, the bearings 204, 240 and the rotor shaft 205 is reduced and loosened. This allows the rotor shaft 205 to be pulled out of the support structure 201. For example, the rotor shaft 205 comprises an access point 237. For example, a crane can engage at the access point 237 and lift out the rotor shaft 205.

[0065] The wedges 210, 220 each comprise tapered shapes. The bearing housing 203 comprises at least two seats for the bearings 204, 240. The bearing housing 203 and the seats can be manufactured precisely in one clamping. The bearing housing 203 together with the wedges 210, 220 is therefore capable of aligning the two main bearings 204, 240 to each other in an ideal tolerance position. Thus, a cone clamping connection is realized. In addition to transmit torque the bearing support arrangement 200 primarily compensates for radial mounting play or radial manufacturing tolerance.

[0066] The bearing support arrangement 200 offers interchangeability, as the taper clamping connection can be loosened by means of screws. The bearing support arrangement 200 can be assembled, transported and exchanged in compact design and as a pre-assembly unit. In the case of a rotor lock in a closed support structure 201, the drive train, in particular the rotor shaft 205, is reliably positioned by the taper clamping connection of the bearing support arrangement 200. The bearing support arrangement 200 realizes a mechanical bracing of the bearings 204, 240 to the support structure 201. The bearing support arrangement 200 allows larger manufacturing tolerances in the support structure 201.

[0067] The bearing support arrangement 200 ensures the functional tolerance chain in the drive train by centering the rotor shaft 205 to the support structure 201. The bearing support arrangement 200 allows a division into modules with permissible transport masses. The bearing support arrangement 200 can be dismantled in case of damage, for example a damage to the bearings 204, 240.

References

[0068]

100
    wind turbine
102
    tower
104
    foundation
106
    nacelle
108
    rotor
110
    rotor blade
112
    rotor hub
200

bearing support arrangement
201
support structure
202
yaw bearing
203
bearing housing
204
bearing
205
rotor shaft
206
fixing element
207, 208
outer side of the support structure
209
inner side of the support structure
210, 220
wedge
211, 221
mounting interface
212, 222
radial projecting part
213, 223
fixing elements
214, 224
radial thickness of the wedge
215
cone ring
216
radial thickness of the cone ring
217
contact surface of the bearing housing
218
first axial end region of the support structure
219
second axial end region of the support structure
227
contact surface of the support structure
230
longitudinal axis
231
first axial direction
232

second axial direction

233

radial direction

234, 235

shoulder

236

distance ring

237

access point

240

second bearing

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

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- EP3144550A1 **[0004]**
- WO2011033256A1 **[0005]**
- WO2004051104A1 **[0006]**
- EP2781740A2 **[0007]**
- EP2538079A2 **[0008]**

P A T E N T K R A V

1. Leje-støttearrangement (200) til en vindmølle (100), omfattende:

- en støttestruktur (201);

- et lejehus (203), hvor lejehuset (203) er anbragt inde i støttestrukturen (201);

- et leje (204, 240), hvor lejet (204, 240) er radialt støttet af lejehuset (203);

- en rotoraksel (205), hvor rotorakslen (205) er radialt støttet af lejet (204);

- en aftagelig kile (210, 220), hvor kilen (210, 220) er anbragt mellem støttestrukturen (201) og lejehuset (203) for at klemme lejet (204, 240) mellem rotorakslen (205) og lejehuset (203), **k e n d e t e g n e t ved**

- et andet leje (204, 240), hvor det andet leje (204, 240) er radialt støttet af lejehuset (203);

- en anden aftagelig kile (210, 220), hvor den anden aftagelige kile (210, 220) er anbragt mellem støttestrukturen (201) og lejehuset (203) for at klemme det andet leje (204, 240) mellem rotorakslen (205) og lejehuset (203).

2. Leje-støttearrangement ifølge krav 1, hvor kilen (210, 220) er ringformet og omgiver lejet (204).

3. Leje-støttearrangement ifølge krav 1 eller 2, hvor kilen (210, 220) omfatter en monteringsgrænseflade (211, 221) til aftagelig fiksering af kilen (210, 220) til lejehuset (203) og/eller støttestrukturen (201).

4. Leje-støttearrangement ifølge krav 3, hvor monteringsgrænsefladen (211, 221) omfatter en radial udragende del (212, 222), som når til lejehuset (203) og/eller støttestrukturen (201).

5. Leje-støttearrangement ifølge et hvilket som helst af kravene 1 til 4, omfattende fikseringselementer (213, 223) til aftagelig fiksering af kilen (210, 220) til lejehuset (203) og/eller støttestrukturen (201).

6. Leje-støttearrangement ifølge et hvilket som helst af kravene 1 til 5, hvor en radial tykkelse (214, 224) af kilen (210, 220) aftager langs en længdeakse (230) fra en ydre side (207, 208) af støttestrukturen (201) mod en indre side (209) af støttestrukturen (201).

7. Leje-støttearrangement ifølge et hvilket som helst af kravene 1 til 6, omfattende en keglering (215), hvor kegleringen (215) er anbragt radialt mellem lejehuset (203) og kilen (210, 220), hvor en radial tykkelse (216) af kegleringen (215) øges langs længdeaksen (230) fra en ydre side (207, 208) af støttestrukturen (201) mod en indre side (209) af støttestrukturen (201).

8. Leje-støttearrangement ifølge et hvilket som helst af kravene 1 til 6, hvor mindst én af lejehuset (203) og støttestrukturen (201) omfatter en kontaktflade (217, 227), hvor kontaktfladen (217, 227) er i kontakt med kilen (210, 220) og omfatter en skrå orientering i forhold til den langsgående akse (230).

9. Leje-støttearrangement ifølge krav 1, hvor lejet (204) og kilen (210) er anbragt

ved et første aksialt endeområde (218) af støttestrukturen (201), og det andet leje (240) og den anden kile (220) er anbragt ved et andet aksialt endeområde (219) af støttestrukturen (201), hvor det andet aksiale endeområde (219) er anbragt modsat det første aksiale endeområde (218).

10. Leje-støttearrangement ifølge krav 1 eller 9, hvor den anden kile (220) er aftagelig langs en først aksial retning (231), og kilen (210) er aftagelig langs en anden aksial retning (232), hvor den første retning (231) er modsat den anden retning (232).

11. Vindmølle, omfattende:

- en nacelle (106);

- et leje-støttearrangement (200) ifølge et hvilket som helst af kravene 1 til 10, som er anbragt inden i nacellen (106).

12. Fremgangsmåde til montering af et leje-støttearrangement (200) til en vindmølle (100), omfattende:

- at indsætte en kile (210, 220) langs en aksial retning (231, 232) mellem en støttestruktur (201) og et lejehus (203), og derved

- at klemme et leje (204, 240) mellem en rotoraksel (205) og lejehuset (203),

- at fiksere kilen (210, 220) til støttestrukturen (201) og/eller lejehuset (203); og

- at indsætte en anden kile (210, 220) langs en aksial retning (231, 232) mellem støttestrukturen (201) og lejehuset (203), og derved

- at klemme et andet leje (204, 240) mellem en rotoraksel (205) og lejehuset (203),

- at fiksere den anden kile (210, 220) til støttestrukturen (201) og/eller lejehuset (203).

13. Fremgangsmåde ifølge krav 12, omfattende at fjerne rotorakslen (205):

- at frigøre fikseringen af kilen (210, 220) til støttestrukturen (201) og/eller lejehuset (203);

- at fjerne kilen (210, 220) langs den aksiale retning (231, 232);

- at fjerne rotorakslen (205) ud af støttestrukturen (201) langs den aksiale retning (231, 232).

14. Fremgangsmåde ifølge krav 12 eller 13, omfattende:

- spænding og løsning af fikseringselementer (213, 223) for at fiksere kilen (210, 220) og for at frigøre fikseringen.

DRAWINGS

Fig. 1

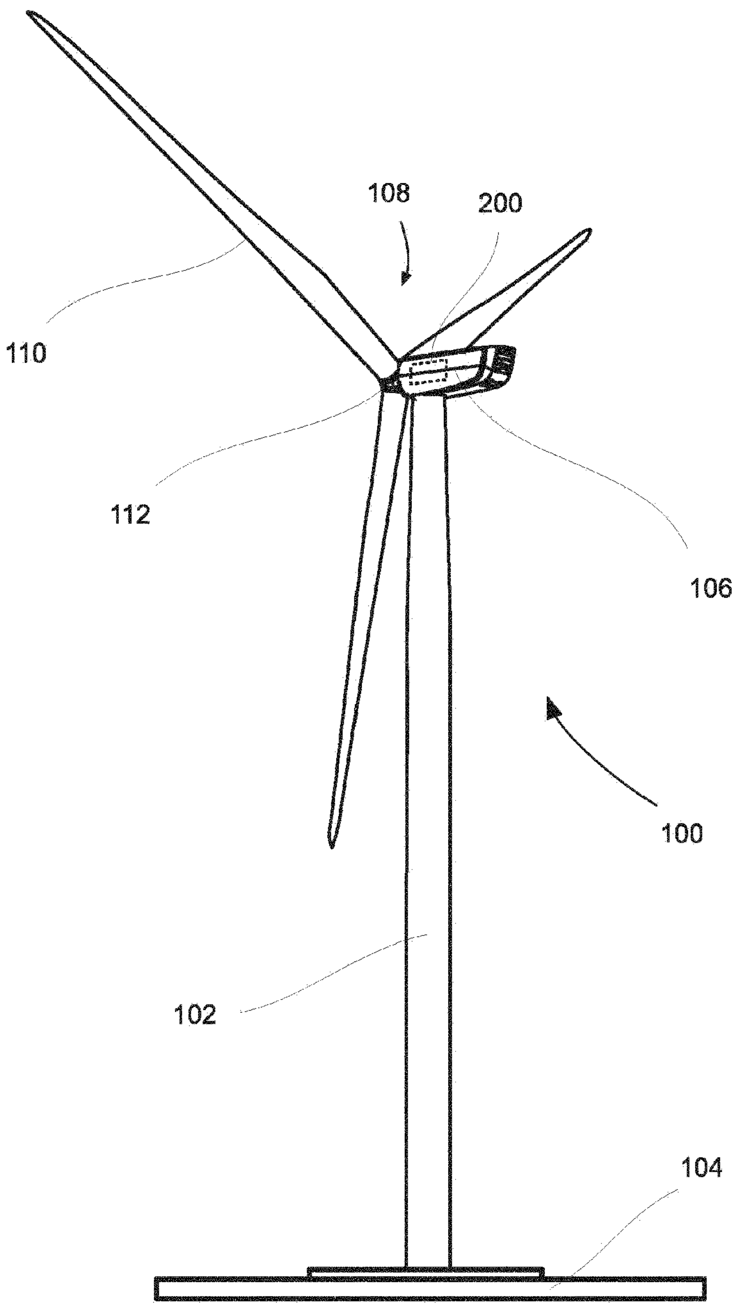


FIG 2

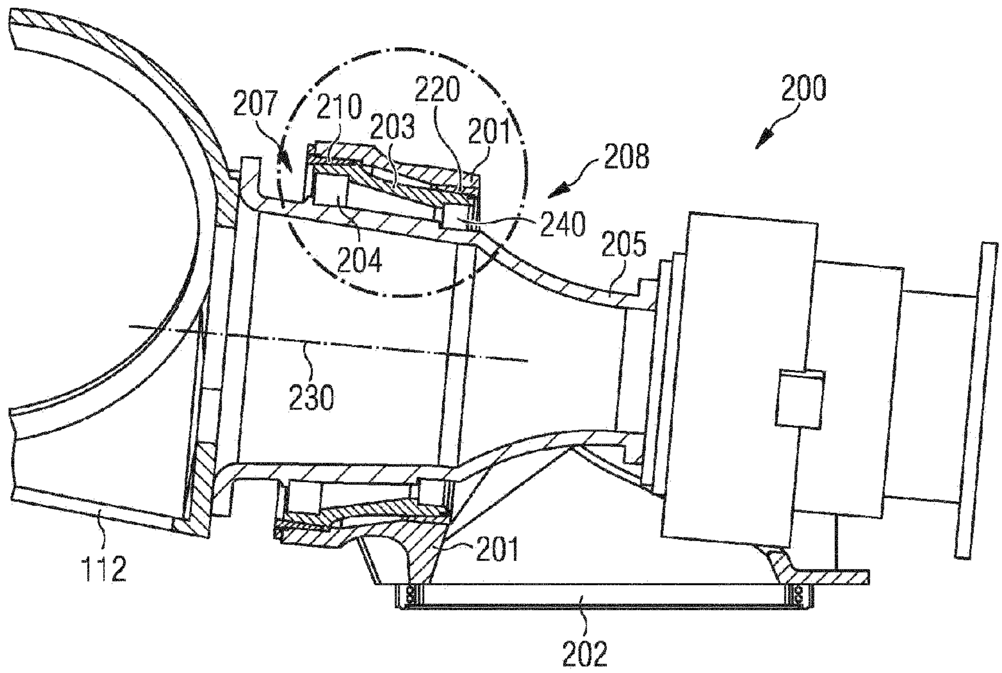
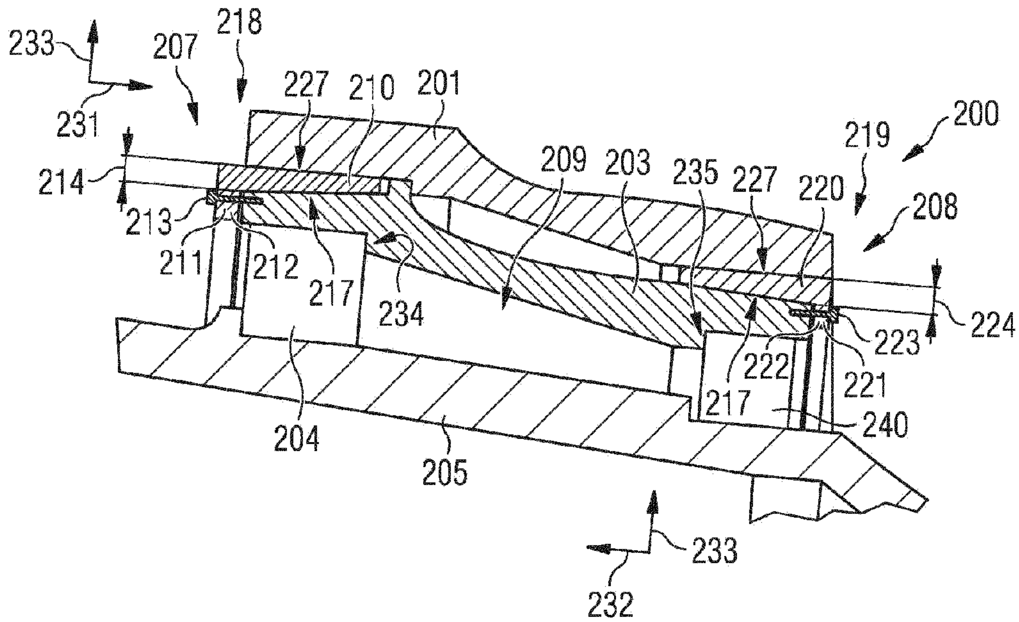

207
210
220
203
201
200
208
240
204
205
230
112
201
202

FIG 3


233
207
218
227
210
201
231
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203
235
227
220
219
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208
214
213
211
212
217
234
222
223
224
221
204
217
240
205
233
232

FIG 4

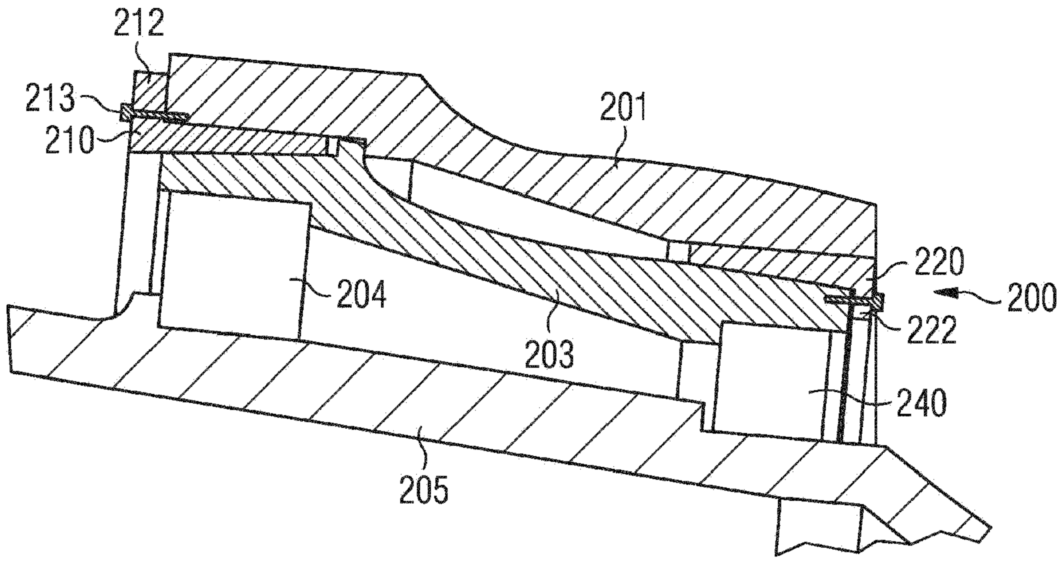
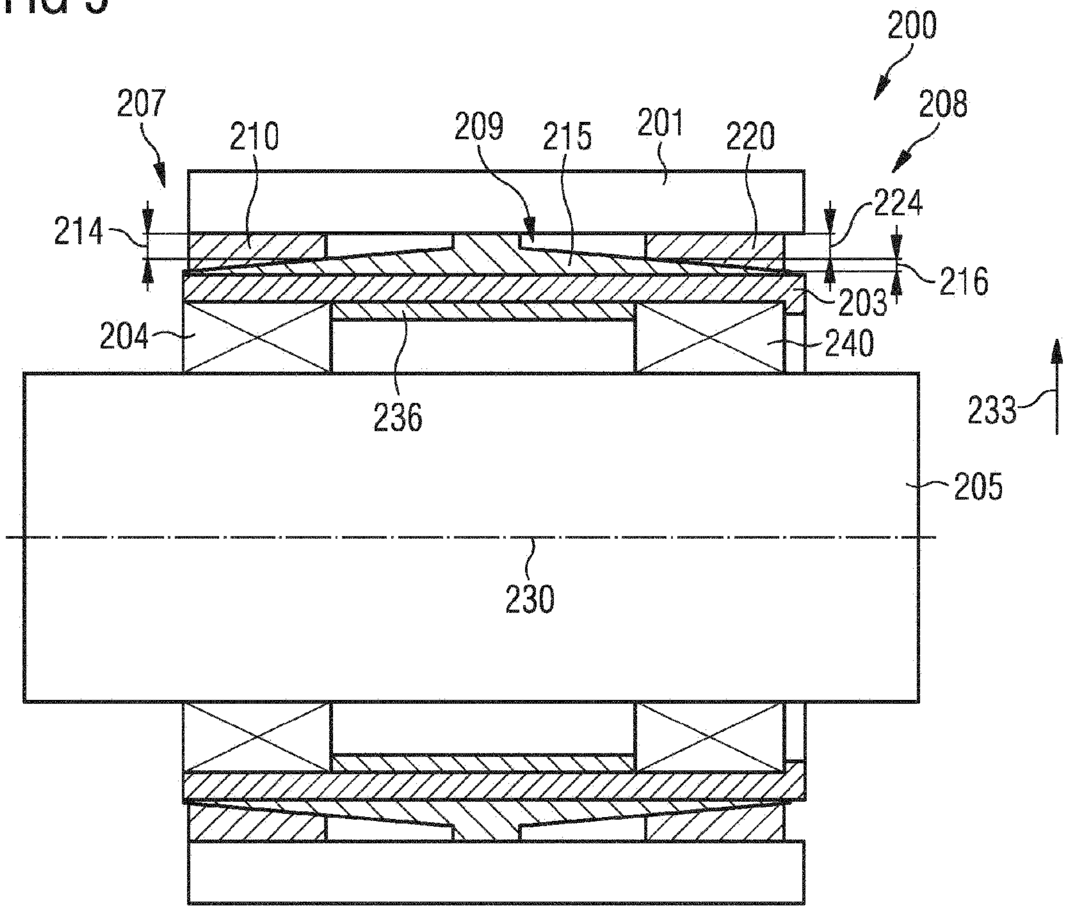


FIG 5


200
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210
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215
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220
224
214
216
203
204
240
236
233
205
230

FIG 6

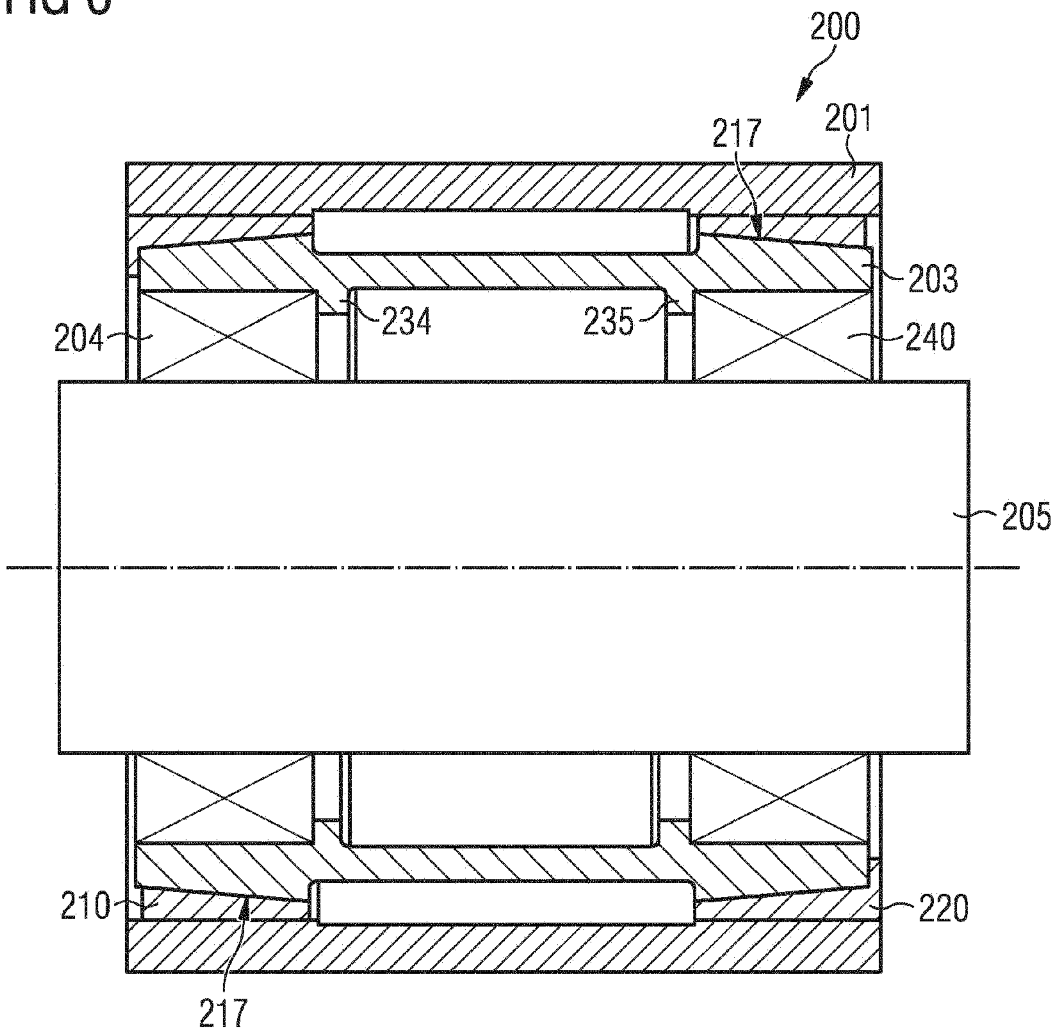


FIG 7A

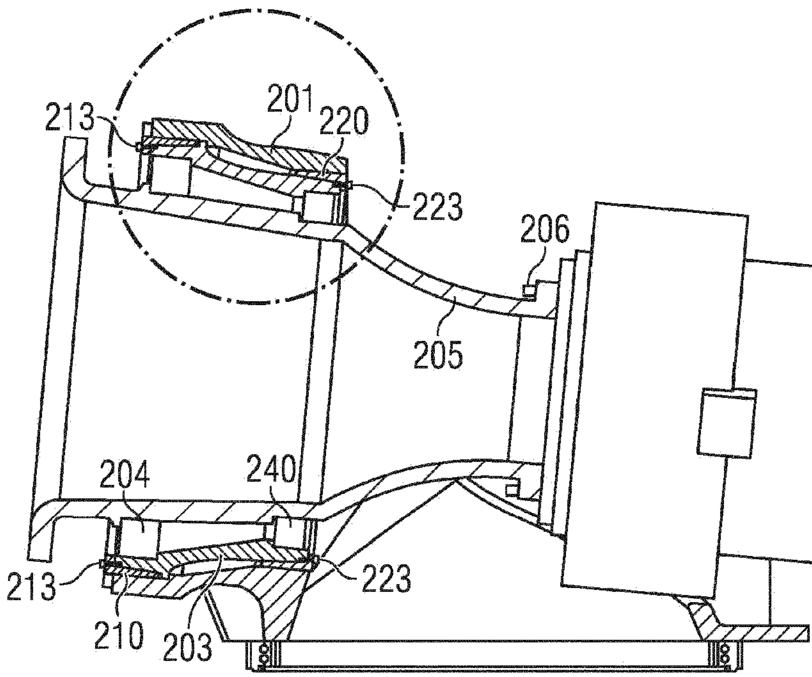
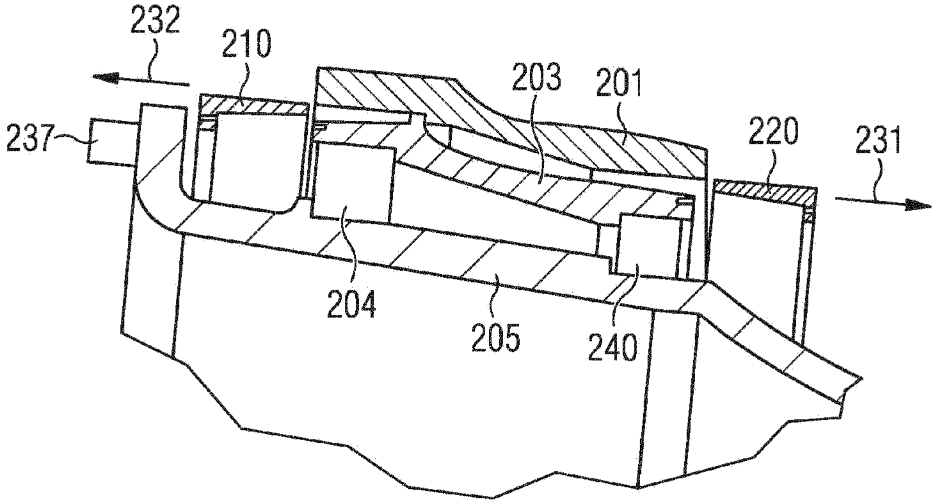

213
201
220
223
206
205
204
240
213
223
210
203

FIG 7B


232
210
203
201
220
231
237
204
205
240