(19) DANMARK

(10) **DK/EP 4062078 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***F 16 C 35/02 (2006.01)*** ***F 03 D 80/70 (2016.01)*** ***F 16 C 17/02 (2006.01)*** ***F 16 C 23/04 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2024-03-11**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-01-03**

(86) Europæisk ansøgning nr.: **20801158.5**

(86) Europæisk indleveringsdag: **2020-09-28**

(87) Den europæiske ansøgnings publiceringsdag: **2022-09-28**

(86) International ansøgning nr.: **EP2020077136**

(87) Internationalt publikationsnr.: **WO2021099017**

(30) Prioritet: **2019-11-19 DE 102019131245**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **Lejearrangement og fremgangsmåde til montering af et sådant**

(56) Fremdragne publikationer:
WO-A1-2011/127510
WO-A1-2015/022309
DE-A1- 19 507 516
US-A- 5 529 399
US-A- 5 669 717

Bearing arrangement and method for mounting such an arrangement

The invention relates to a bearing arrangement for supporting a rotor shaft of a wind turbine, the bearing arrangement comprising an outer housing and a bearing with a plurality of slide bearings, the bearing comprising two annular support bodies, each with a spherical receiving surface, which are arranged on the outer housing, the slide bearings resting with a spherical contact surface on the receiving surfaces. The invention also relates to method for mounting such a bearing arrangement. The outer housing is also referred to as a bearing housing.

Such a bearing arrangement is known from US 5,529,399. US 5,669,717 A describes a bearing arrangement in which positioning pins are arranged between individual slide bearing segments, by means of which the individual segments can be positioned and aligned in relation to each other.

The bearing and/or the bearing arrangement of a rotor shaft of a wind turbine is exposed to high loads and must nevertheless function for as long as possible without maintenance, or at least be easy to maintain. Due to changing wind conditions, it is exposed to different mechanical loads, which are caused in particular by high wind speeds and different wind directions or gearing in the gearbox. Radial bearings and axial bearings are therefore commonly used.

The bearing arrangement for supporting a rotor shaft of a wind turbine is arranged in the nacelle of the wind turbine, meaning it is in the actual tower. Access to this location is difficult, making the maintenance, repair or replacement of components or the entire bearing arrangement difficult, time-consuming and therefore expensive. The position in the nacelle also renders the mounting of the bearing arrangement difficult, as the individual parts of the bearing arrangement preferably have to be brought into the desired position by means of an on-board crane. Therefore, the individual parts of the bearing arrangement should not or must not exceed certain maximum dimensions, in particular a maximum weight. Instead of using an on-board crane that is part of the wind turbine and, for example, is permanently arranged on the nacelle, a mounting crane can be used to mount and dismantle as well as to maintain and repair individual components of the wind turbine. However, such a mounting crane is more expensive and time-consuming to operate compared to an on-board crane.

Given that the output of a wind turbine depends on its rotor diameter and increases as the diameter increases, wind turbines that have been produced and intended for production have become ever larger in recent years. As a result, the bearing arrangements for supporting the rotor shaft have also become larger and, in particular, heavier, rendering them more difficult to operate and transport.

WO 2011/127510 A1 discloses a slide bearing arrangement for supporting a rotor shaft of a wind turbine with two bearing surfaces that are tilted against each other. As a result, the bearing arrangement acts as both an axial bearing and a radial bearing. The respective bearing surfaces are equipped with slide bearing pads which serve as the actual sliding body. However, the replacement of defective pads is only possible once the entire bearing arrangement has been disassembled.

The invention therefore aims to propose a bearing arrangement for the rotor shaft of a wind turbine that is easy to manage, even with larger rotor shafts, and that is also easy to maintain and repair.

The invention solves the addressed task by way of a bearing arrangement according to the preamble of claim 1, which is characterised in that one of the two support bodies is arranged in such a way that it can be removed in the axial direction in relation to the longitudinal direction of a shaft to be supported in the bearing arrangement without having to remove the shaft from the bearing arrangement.

The individual slide bearing segments have a spherical contact surface with which they rest on the receiving surfaces of the support bodies. Said contact surface is preferably arranged on the outside of the slide bearing segments such that the latter rest on the inside of the support bodies. On the opposite side, the slide bearing segments also have an interior surface, which forms the actual slide surface and is occupied as fully as possible and enables the rotor shaft to be reliably supported. In this case, the bearing arrangement acts as a radial bearing. The oil gap separates the slide surface of the bearing, i.e. the slide surfaces of the slide bearing segments in the present case, from the moving shaft. To this end, it is advantageous to have as uniform a slide surface as possible; in particular, it should not have any steps.

The bearing arrangement preferably has so many slide bearing elements that they entirely or at least almost entirely surround the rotor shaft to be supported. The number of slide bearing segments used can be made to depend particularly on size, in particular on the diameter of the rotor shaft to be supported. The larger the diameter of the rotor shaft, the larger the bearing arrangement has to be and the more slide bearing segments should be used. The maximum weight and the geometric dimensions of the slide bearing segments is therefore kept within a manageable range.

The slide bearing segments themselves are arranged on the support bodies positioned between the outer housing and the slide bearing segments. This has the advantage that the outer housing can be produced with relatively large manufacturing tolerances, meaning that production costs can be reduced. Only the support bodies have to be produced with smaller manufacturing tolerances, i.e. more precisely, in order to achieve the best possible fit with the individual slide bearing segments.

The two annular support bodies are designed to be coaxial in relation to one another. They are preferably rotationally symmetrical, so that both the interior receiving surface and an outer contact surface, with which the support bodies come into contact with the outer housing, are annular. The annular support bodies have a central rotation axis located in the centre of the ring formed by the annular support bodies. Due to the coaxial arrangement of the two annular support bodies, the two support bodies have the same rotation axis. In the optimum position, said rotation axis coincides with the longitudinal axis of the rotor shaft to be supported. However, this does not necessarily mean that the distance of the receiving surfaces from the central rotation axis also remains identical along the rotation axis. Rather, it is also possible that this distance and therefore the diameter, especially the inner diameter of the receiving surface and therefore of the respective support body, increases or decreases in the axial direction. This may be advantageous for the positioning of the slide bearing segments in the support bodies.

In a preferred embodiment, the support bodies are arranged and configured in such a way that the spherical receiving surfaces have the same radius and the same central point. The central point of the sphere of the spherical receiving surface lies on the rotation axis of the support body and is clearly defined. The same applies for the sphere radius, i.e. the distance of the receiving surface from said central point. The sphere radius may differ from the radius of the annular support body, i.e. from the distance of a point on the receiving surface from the rotation axis of the support body.

Preferably, the receiving surfaces of both support bodies are spherical rings with the same spherical radius. In this case, it is possible to position the two support bodies in relation to each other in such a way that the two receiving surfaces also have the same spherical central point. This means that the two receiving surfaces are spherical rings and have the same radius and central point.

In this case, it is particularly preferable that the contact surfaces of the various slide bearing segments are also spherical in shape so that they correspond to the receiving surfaces of the support bodies. Particularly preferably, the contact surfaces of the various slide bearing segments also have the same spherical radius and the same spherical central point, so that together they are also spherical rings. Within the context of the present invention, gaps, slits and distances between the individual slide bearing segments do not change this in any way. The design of the common contact surface of the slide bearing segments, which is formed by the individual contact surfaces of the individual slide bearing segments, as part of the spherical surface and the correspondingly designed receiving surfaces of the support bodies enables an especially advantageous mounting of the slide bearing segments on the support bodies when the rotor shaft is positioned in the bearing arrangement. Due to the ball bearing-like mounting, movements of the rotor shaft perpendicular to its longitudinal extension, for example tilting, are possible to a limited extent without tilting occurring. For example, if gusts of wind from different directions act on the rotor, the rotor shaft of which is supported, the bearing arrangement of this design can avoid this transverse load and ensure optimum mounting of the rotor shaft even in this mechanically highly stressed situation.

Preferably, at least one oil groove is provided outside of the slide bearing segments, said groove being designed in such a way that oil contained within it at least partially lubricates the contact area between the receiving surfaces and the contact surfaces. Particularly preferably, the annular support bodies with the spherical receiving surface are not as wide in the axial direction in relation to the supported rotor shaft as the various slide bearing segments. Consequently, there is a space, which is especially preferably designed as a cavity, between the individual annular support bodies in the axial direction, said space being filled with oil. Said oil is located in the cavity, which is likewise designed to be rotationally symmetrical about the longitudinal axis of the shaft to be supported, and thus lubricates the contact between the slide bearing segments and the support bodies.

For this purpose, there are preferably depressions, grooves or other structures, for example in the form of a texture, in the receiving surfaces and/or the contact surfaces, which are fluidically connected to the oil groove. Particularly preferably, the texture is a network of depressions, flutes and/or grooves that are open axially inwards, i.e. towards the oil groove, so that oil can penetrate from the oil groove into the texture and thus develop the lubricating effect. Axially outwards, i.e. facing away from the oil groove, the texture is preferably designed to be closed, so that oil cannot escape from the bearing arrangement.

The oil in the oil groove serves to lubricate the oil gap between the slide surface of the bearing, i.e. the individual slide surfaces of the slide bearing segments, and the shaft. To ensure that the oil can get from the oil groove, which is preferably located radially outside of the slide bearing segments, to the oil gap, at least one oil pocket is preferably provided. An oil pocket is a locally limited cavity between the slide surface and the shaft which is connected to the oil groove by way of at least one channel or one bore. Preferably, multiple oil pockets are provided, which are preferably distributed equidistantly across the circumference of the shaft. Preferably, the oil from the oil groove is not only guided through the oil pocket into the intermediate space between slide surface and shaft, but is also used to lubricate the texture, the depressions, grooves or other structures between the slide bearing segments and the support body.

The cavity that contains the oil is preferably limited radially outwards by the outer housing, radially inwards by the slide bearing segment and in the axial direction by the two support bodies. In this case, the oil groove is easier to manufacture, as no depressions or grooves have to be introduced into existing components.

Preferably, one of the two support bodies is arranged in such a way that it can be removed in the axial direction in relation to the longitudinal direction of the rotor shaft supported in the bearing arrangement without having to remove the rotor shaft from the bearing arrangement. Said axial direction, in which the support body has to be moved in order to remove it from the bearing arrangement, preferably refers to the direction away from the rotor arranged on the rotor shaft. In this case, the one support body is preferably also the support body that is arranged facing away from the rotor of the rotor shaft. To remove the support body from the bearing arrangement, it may be necessary to remove fixing elements, such as screws or bolts, with which the support body is fixed to the outer housing, for example. However, it is important that the support body can be removed without having to remove the shaft from the bearing arrangement or completely dismantle the bearing arrangement.

Particularly preferably, the slide bearing segments can be removed in the axial direction without having to remove the shaft from the bearing arrangement when the support body is removed. Once the support body has consequently been moved in the axial direction and removed from the outer housing, the individual slide bearing segments can preferably also be displaced in the same direction and removed. To do this, it may also be necessary to remove any fixing elements, such as screws, pins, bolts or connecting rods. Said elements may fix the individual slide bearing segments to the remaining support body or to other slide bearing segments and are dismantled before the slide bearing segments are removed. The individual slide bearing segments can then be removed from the remaining components of the bearing arrangement without having to dismantle the shaft.

Consequently, if, for example, one of the slide bearing segments needs to be replaced or serviced in a bearing arrangement embodiment described here, it is not necessary to dismantle the entire bearing arrangement, which would involve an enormous amount of effort in terms of design, logistics and time.

Advantageously, a positioning pin is arranged between two of the slide bearing segments, said pin being positioned in correspondingly designed partial bores in the slide bearing segments. Particularly preferably, there is at least one positioning pin between every two adjacent slide bearing segments. There are preferably partial bores located in the side surfaces of the slide bearing segments facing the respective adjacent slide bearing segments. A “partial bore” refers to any bore partially located in two adjacent slide bearing segments. This can be achieved, for example, by providing depressions or flutes in two side surfaces of two adjacent slide bearing segments, said depressions or flutes together forming a bore into which the at least one positioning pin can be inserted when the two slide bearing segments are arranged next to each other. In such a case, the bore formed by the two partial bores extends, for example, parallel to the longitudinal axis of the supported shaft. However, the bore formed in this manner can also be at an increasing or decreasing distance from the longitudinal axis, meaning it does not extend parallel to the longitudinal axis of the supported shaft.

Alternatively or additionally, partial bores may also be provided which, for example, are completely located in a first section in one of the slide bearing segments, but which extend at an angle in the latter such that a second part of the bore formed by two of these partial bores is located in the adjacent slide bearing segments. Irrespective of the design, two of these partial bores form a bore that accommodates the positioning pin and in which it is arranged. In this case, the positioning pin preferably serves to connect the two slide bearing segments whose partial bores form the bore for said positioning pin and to prevent movements of the two slide bearing segments relative to each other in at least one direction, for example in the circumferential direction or the radial direction in relation to the longitudinal axis of the supported shaft.

At least one of the positioning pins preferably acts as a spacer between two slide bearing segments, so that there is a gap between them. This gap, also referred to as a “mounting gap”, is between 5 mm and 1 cm wide, for example. A mounting gap is advantageous when there is only the final slide bearing segment left to mount and all other slide bearing segments have already assumed their position between the supported shaft and the respective support body. The gap makes it especially easy to position the individual slide bearing segments in relation to each other, as the gap provides a clearance. After positioning the final slide bearing segment, a positioning pin is preferably inserted between the most recently inserted slide bearing segment and an adjacent slide bearing element, so that the gap is still there, but a further movement of the slide bearing segments in relation to each other in this direction is ruled out.

The positioning pins mean that adjacent slide bearing segments can be connected to each other, aligned in relation to each other, positioned in relation to each other and/or inserted and brought into the desired position more effectively.

Preferably at least one of the support bodies has a spherical axial receiving surface facing away from the other support body, wherein an axial bearing ring with a spherical axial contact surface rests on said axial receiving surface. Preferably at least one bearing element is arranged on the axial bearing ring, said bearing element acting as an axial bearing for the supported shaft. As a result, the rotor shaft of the wind turbine to be supported by the bearing arrangement is supported in both the axial and radial direction. The slide bearing segments form the radial bearing and the at least one bearing element the axial bearing. Preferably, there are multiple bearing elements, for example slide bearing elements or tilting pad bearing elements, which are distributed across the circumference of the axial bearing ring. Particularly preferably, the bearing elements are distributed equidistantly across the circumference.

In a preferred embodiment, a stop ring is arranged on the axial bearing ring, the former resting on the axial bearing ring. The at least one bearing element is arranged on said stop ring. The previously described multiple bearing elements are preferably not positioned directly on the axial bearing ring, but on the stop ring resting on it.

The slide bearing segments are preferably tensioned in the axial direction by at least one tensioning device. The tensioning device preferably has at least one centring ring, at least one clamping jaw as well as least one pin. In this case, the centring ring and the at least one clamping jaw are preferably arranged on opposite sides of the slide bearing segments. They are connected to each other and tensioned via the pin. The pin transfers a tensile force in the axial direction between the clamping jaw and the centring ring. The pin is preferably designed as a screw. In this case, the clamping jaw and/or the centring ring have/has a bore with an inner thread, which corresponds to the thread of the screw. Particularly preferably, multiple clamping jaws are provided. Each of them is connected to the centring ring via at least one pin. Preferably, a clamping jaw is arranged between every two adjacent slide bearing segments so that the number of clamping jaws distributed around the circumference corresponds to the number of slide bearing segments. In the present case, if there is a clamping jaw between two adjacent slide bearing segments, it means that it transmits the force transferred by the pin to the clamping jaw to both adjacent slide bearing segments.

The invention also solves the addressed task by way of a bearing for a bearing arrangement according to the embodiments presented here, which comprises two annular support bodies, each of which has a spherical receiving surface and a plurality of slide bearing segments.

The invention also solves the addressed task by way of a method for mounting a bearing arrangement of the type described here, which is characterised by the following steps:

- providing the first annular support body on the outer housing, the rotor shaft extending through the support body,
- arranging the slide bearing segments between the rotor shaft and the first annular support body,
- positioning the second annular support body between the slide bearing segments and the outer housing.

First of all, the first annular support body is provided on the outer housing. To this end, an annular support body, which is designed as a separate component, can be arranged on the outer housing, for example. In addition, said first annular support body can be fixed to the outer housing, for which fixing elements such as screws, pins or bolts can be used. The first annular support body can be designed as a single piece or comprise multiple sections, which are designed as separate elements and fixed to the outer housing. The outer housing can also be designed as a single piece or in multiple pieces. Alternatively, the first annular support body can also be designed as a single piece with the outer housing.

In an especially preferred embodiment, the outer housing comprises at least two parts: a lower part and an upper part. In this case, the shaft to be supported is preferably arranged above the lower part of the housing for mounting the bearing arrangement. The first annular support body, which in this case is preferably designed as a single piece, is threaded over the shaft to be supported, so that the shaft extends through the first annular support body. The first annular support body is then fixed to the lower part of the outer housing before the upper part of the outer housing is connected to the lower part of the outer housing so that a connection is also established between the first annular support body and the upper part of the outer housing. This connection does not have to, but can be secured by additional fixing elements.

In this state, the shaft to be supported is held by a separate support arrangement, which is not described in further detail here, as the inner diameter of the first annular support body is significantly larger than the outer diameter of the supported shaft. The slide bearing segments are now inserted into the resulting intermediate space, which can be done particularly preferably by displacing them in an axial direction along the held shaft until their contact surface lies radially on the outside of the receiving surface of the first annular support body. Particularly preferably, they are displaced towards the rotor of the rotor shaft during this displacement.

Once two adjacent slide bearing segments are arranged in their final position between the rotor shaft and the first annular support body, the positioning pins can be inserted into the partial bores provided in the slide bearing segments, if said pins are available and necessary. Alternatively, all slide bearing segments can also initially be brought into the desired position before the positioning pins are inserted. In a further embodiment, the positioning pins and the slide bearing segment are brought into the desired position together.

Once the slide bearing elements and, where applicable, the positioning pins have been arranged and fixed on the respective components, the second annular support body is positioned between the slide bearing segments and the outer housing. In a preferred embodiment, the second support body is designed to be multi-part and thus composed of at least two, but possibly more, ring parts. This has the advantage that the second annular support body does not have to be thread over the supported shaft for mounting, but can be fixed in multiple parts. To this end, the various ring parts, which form the second support body, are likewise displaced in the axial direction, especially preferably towards the rotor of the rotor shaft, and inserted into the intermediate space between the slide bearing segments and the outer housing. The fewer ring parts form the second support body, the less disruptive the influence of manufacturing tolerances and assembly tolerances is and the more precisely the receiving surface is a spherical surface.

The support bodies are preferably made from a metal or a plastic. Plastic has the advantage that it is electrically insulating, thereby electrically separating the shaft and the slide bearing segments from the outer housing without the need for additional components or production steps. Electric insulation may also be achieved, for example, by way of a coating made of an electrically insulating material applied to the receiving surface and/or the contact surface.

In the reverse order, the bearing arrangement can be dismantled to the point that the individual components can be serviced, repaired or replaced. In this case, it is also advantageous if the second annular support body is designed to be multi-piece, as the individual ring parts can thus be easily removed and taken away.

In a preferred embodiment of the bearing arrangement, the contact surfaces of the slide bearing segments and/or the receiving surfaces of the annular support bodies are coated. This coating may be a plastic so as to reduce the friction between the various components, for example. Alternatively or additionally, the coating may also be an electrically insulating coating, for example for electrically insulating the bearing relative to the housing, which is especially advantageous since a wind turbine is a power-generating system.

In the following, a number of embodiment examples of the invention will be explained in more detail with the aid of the accompanying drawings. They show:

Figure 1 - the schematic three-dimensional view of parts of a bearing arrangement,

Figures 2 - 6 - sectional views through said parts following various process steps during mounting,

Figure 7 - the schematic view of a first support body,

Figure 8 - the schematic representation of a second support body,

Figures 9 - 11 - the schematic representation of various partial bores and

Figure 12 - the schematic representation of a part of a bearing,

Figure 13 - further parts of the bearing according to a further embodiment example of the present invention.

Figure 1 schematically depicts a part of a bearing arrangement according to a first embodiment example of the present invention. It comprises a first support body 2 and a second support body 4, both of which are annular. In the embodiment example shown, the first support body 2 is designed as a single piece, while the second support body 4 comprises two ring parts 6. Multiple slide bearing segments 8 are located radially inwards of the first support body 2 and the second support body 4, said segments each comprising a slide surface 10 radially inwards. There are partial bores 14 on their circumferential side walls 12 which, in the state shown, in which two slide bearing segments 8 are arranged next to each other, each form a bore 16 into which a positioning pin 18, not shown, can be inserted. In the example embodiment shown a mounting gap 20 is depicted which makes mounting easier, especially of the last of the slide bearing elements 8 depicted.

Figures 2 to 6 each depict a schematic sectional view through the bearing arrangement following various process steps during mounting of the bearing arrangement. Figure 2 shows the rotor shaft 34. It is located in the outer housing 28, a circumferential intermediate space 36 forming between the housing 28 and the rotor shaft 34. Further components are inserted into said intermediate space. In the embodiment example shown, the rotor shaft 34 has a flange 40, which is designed as a single piece with the rotor shaft 34 and serves as an axial bearing. The intermediate space 36, which extends in a ring shape about the rotor shaft 34, has an expansion that increases from left to right in the embodiment example shown. In the embodiment example shown, the rotor of the rotor shaft 34 extends on the left-hand side, however it is not depicted.

Figure 3 shows the illustration from figure 2 into which the first support body 2 has been inserted from the right, i.e. in the axial direction. Radially outwards it has a projection with which it rests on a projection of the outer housing 28 that protrudes radially inwards so that the first support body 2 cannot be displaced further to the left. The intermediate space 36 is still between the receiving surface 22 and the outer surface of the rotor shaft 34 so that, in this state, the rotor shaft 34 has to be held by a device, not depicted here.

Compared with the illustration in figure 3, the slide bearing segments 8 have now been inserted in addition to the first support body 2. In the embodiment example shown, the slide bearing elements 8 are inserted into the device from the right in the axial direction so that they are arranged in the interior space 36 between the rotor shaft 34 and the outer housing 28. The slide bearing segments 8 are inserted into the bearing arrangement until their contact surface 24 rests on the receiving surface 22 of the first support body 2. It is therefore not possible to displace the slide bearing segments 8 further to the right in the embodiment example shown. The spherically curved receiving surfaces 22 and contact surfaces 24 optimise the alignment of the components.

Figure 5 depicts the further mounted bearing arrangement. Compared with figure 4, the second support body 4 has been additionally inserted from the right in the radial direction, said support body being arranged in the intermediate space between the outer housing 28 and the slide bearing segments 8. Here too, the spherically curved receiving surface 22 comes into contact with the likewise spherically curved contact surface 24 in such a way that alignment occurs automatically. The complete or partial dismantling of the bearing arrangement is carried out in the reverse order. The individual components can be removed from the arrangement to the right, for which any fixing elements present may have to be loosened. However, it is not necessary to dismantle the entire bearing arrangement or even remove the rotor shaft 34 from the bearing arrangement.

Figure 6 shows a sectional view through the mounted arrangement. In addition to the state shown in figure 5, a second axial flange 42 has been mounted which, together with the flange 40, supports the rotor shaft 34 in both axial directions.

One can see that the slide bearing segments 8 have receiving surfaces 24 on their radially outer side, said surfaces also being spherically curved and designed to correspond to the receiving surfaces 22. An oil groove 26 is located between the two support bodies 2, 4, said groove being filled with oil that can penetrate through structures, depressions or textures, not depicted here, into an intermediate space between the receiving surfaces 22 and the contact surfaces 24 and thus develop a standing effect.

Figure 7 schematically depicts a first support body 2. On the rear side in figure 7 it has the projection 38 with which it rests on a correspondingly designed projection of the outer housing 28, as illustrated particularly in figures 4, 5 and 6. The first support body 2 is designed as a single piece in the embodiment example shown.

In contrast, figure 8 schematically shows a second support body 4, which comprises two ring parts 6. It too has a projection 38 with which it rests on a projection on the outer housing 28, this projection being shown in figure 6. The multi-part design makes it possible to remove individual ring parts 6 if, for example, only the second support body 4 needs to be repaired, replaced or serviced. Furthermore, the multi-part design renders it possible to remove the entire second support body 4 from the bearing arrangement without having to un-thread it from the rotor shaft 34.

Figures 9 to 11 schematically show differently designed bores 16. Adjacent slide bearing segments 8 can be seen, of which only parts are shown in each case. In figure 9, partial bores 14 are arranged in the side walls 12 of the two slide bearing segments 8, wherein each of said bores is designed as a depression and can be manufactured like a groove. In the position shown in figure 9, they together form a continuous arc 16 into which a positioning pin 18, not shown here, can be inserted. The lower area of figure 9 contains sections of the two slide bearing segments 8 between which the bore 16 is located. In this axial view in relation to the longitudinal axis of the supported shaft, the bore 16 forms a straight line that extends in the viewing direction. This design of the bore 16 enables two adjacent slide bearing segments 8 to be positioned relative to each other in a radial direction. The individual slide bearing segments 8 can continue to be moved relative to each other in the axial direction. This design has the advantage that individual slide bearing segments 8 can be replaced without having to remove the positioning pin 18 contained in the bore. However, it is usually beneficial to remove the positioning pin 18.

Figure 10 depicts a slightly different view. Here too, the upper area contains a sectional view in which the two partial bores 14 can be recognised. However, they now extend at a slight angle compared to the view shown in figure 9. The lower part of figure 10 therefore shows that the bore 16 formed by the two partial bores does not completely extend in the viewing direction, but at a slight angle to it. Nevertheless, at each point of the bore 16, a part of the bore is arranged in each of the two slide bearing segments 8 involved.

This changes in figure 11. Here, the bore 16 extends so far out of the axial viewing direction that the first partial bores 14 and the second partial bores 14 are located completely in one of the two slide bearing segments 8 at certain points, namely in the upper and lower areas of the upper area of figure 11. Due to the different design and orientation of the bore 16, different movements of the slide bearing segments 8 relative to each other can be prevented by a positioning pin 18 contained therein.

Due to the designs in figures 10 and 11, alongside the positioning of adjacent slide bearing segments 8 relative to each other in the radial direction, a positioning in the axial direction and the circumferential direction are also achieved. Slide bearing segments 8 connected in this way cannot be separated from each other or removed from the bearing arrangement without removing a positioning pin. The two designs are advantageous for different loads. The arrangement of the bore 16 and the positioning pin 18 therein shown in figure 10 are particularly advantageous in the event of a radial load that acts locally in the area of the positioning pin.

Figure 12 depicts a part of a bearing arrangement according to a further embodiment example of the present invention. One can recognise slide bearing segments 8, which are mounted in a ring. There is a mounting gap 20 between two of the slide bearing segments 8, said gap being created, for example, by a positioning pin, not shown here. The slide surface 10 is designed with a depression 44, which has an oil feed 46. The intermediate space between the rotor shaft, not depicted, and the slide surface 10 is lubricated.

Figure 13 shows a section of a sectional view of two parts of the bearing. A cut through a part of the first support body 2 is shown on the right in the figure. It has the receiving surface 22, which is spherical and rests on the contact surface 24 of the slide bearing segments 8, not shown in figure 13, when the bearing is mounted. In addition, the support body 2 has an axial receiving surface 48, which is preferably also spherical.

On the left in figure 13 is a cut through a part of an axial bearing ring 50, which in the section shown has a bore 52 in which a bearing element is arranged, for example by means of a screw, said bearing element acting as an axial bearing. Alternatively, a stop ring can also be arranged at this point as a support for the actual axial bearing and/or its elements. On the side facing the first support body 2 the axial bearing ring 50 has an axial contact surface 54, which is also designed to be spherical. Its radius of curvature corresponds to the radius of curvature of the axial receiving surface 48. In the mounted state, the axial receiving surface 48 and the axial contact surface 54 rest on each other, thus enabling a movement of the supported shaft relative to the housing of the bearing.

Reference list

2	first support body
4	second support body
6	ring part
8	slide bearing segment
10	slide surface
12	side wall
14	partial bore
16	bore
18	positioning pin
20	mounting gap
22	receiving surface
24	contact surface
26	oil groove
28	outer housing
30	upper section
32	lower section
34	rotor shaft
36	intermediate space
38	projection
40	flange
42	axial flange
44	depression
46	oil feed
48	axial receiving surface
50	axial bearing ring
52	bore
54	axial contact surface

PATENTKRAV

1. Lejearrangement til lejring af en rotoraksel (34) i et vindkraftanlæg, hvor lejearrangementet omfatter et ydre hus (28) og et leje med en flerhed af glidelejesegmenter (8), hvor lejet omfatter to ringformede støttelegemer (2, 4) med en sfærisk optageflade (22) hvert især, som er anbragt på det ydre hus (28), hvor glidelejesegmenterne (8) hviler på optagefladerne (22) med en sfærisk anlægsflade (24), **kendetegnet ved, at** et af de to støttelegemer (2, 4) er anbragt på en sådan måde, at det kan fjernes i aksial retning i forhold til længderetningen af en aksel (34), som skal lejres i lejearrangementet, uden at akslen (34) skal fjernes fra lejearrangementet.

2. Lejearrangement ifølge krav 1, **kendetegnet ved, at** støttelegemerne (2, 4) er anbragt og udformet på en sådan måde, at de sfæriske optageflader (22) har den samme radius og det samme midtpunkt.

3. Lejearrangement ifølge krav 1 eller 2, **kendetegnet ved, at** der radialt uden for glidelejesegmenterne (8) forekommer mindst en olienot (26), som er udformet på en sådan måde, at olie indeholdt i den i det mindste delvist smører kontaktområdet mellem optagefladerne (22) og anlægsfladerne (24).

4. Lejearrangement ifølge krav 3, **kendetegnet ved, at** der i optagefladerne (22) og/eller i anlægsfladerne (24) forekommer mindst en tekstur, som står i fluidteknisk forbindelse med olienoten (26).

5. Lejearrangement ifølge et af de foregående krav, **kendetegnet ved, at** glidelejesegmenterne (8) kan fjernes i aksial retning, uden at akslen (34) skal fjernes fra lejearrangementet, når støttelegemet (2, 4) er fjernet.

6. Lejearrangement ifølge et af de foregående krav, **kendetegnet ved, at** der mellem mindst to af glidelejesegmenterne (8) er anbragt en positioneringsstift (18),

som er positioneret i glidelejesegmenterne (8) i korresponderende udformede delboringer (14).

7. Lejearrangement ifølge krav 6, **kendetegnet ved, at** mindst en positioneringsstift (18) virker som afstandsholder mellem to glidelejesegmenter (18) og er anbragt på en sådan måde, at der mellem disse forekommer en montagespalte (20).

8. Lejearrangement ifølge et af de foregående krav, **kendetegnet ved, at** mindst et af støttelegemerne (2, 4) omfatter en sfærisk aksial optageflade (48), som vender væk fra det andet støttelegeme (4, 2), hvorpå en aksial lejering (50) hviler med en sfærisk aksial anlægsflade (54).

9. Lejearrangement ifølge krav 8, **kendetegnet ved, at** en anløbsring med mindst et, fortrinsvis flere, aksiale lejeelementer hviler på den aksiale lejering (50).

10. Lejearrangement ifølge et af de foregående krav, **kendetegnet ved, at** glidelejesegmenterne (8) er forspændt i aksial retning ved hjælp af mindst en spændeindretning, hvor den mindst ene spændeindretning fortrinsvis omfatter mindst en centreringsring, mindst en spændebakke og mindst en stift, hvor centreringsringen og spændebakken er anbragt i aksial retning på indbyrdes modsatliggende sider af glidelejesegmentet (8) og er forbundet ved hjælp af stiften.

11. Leje til et lejearrangement ifølge et af de foregående krav, som omfatter to ringformede støttelegemer (2, 4) med en sfærisk optageflade (22) og en flerhed af glidelejesegmenter (8) hvert især.

12. Fremgangsmåde til montering af et lejearrangement ifølge et af de foregående krav 1 til 10 med følgende trin:

- at tilvejebringe det første ringformede støttelegeme (2) på det ydre hus (28), hvor rotorakslen (34) forløber gennem støttelegemet (2),
- at anbringe glidelejesegmenterne (8) mellem rotorakslen (34) og det første ringformede støttelegeme (2),
- at positionere det andet ringformede støttelegeme (4) mellem glidelejesegmenterne (8) og det ydre hus (34).

13. Fremgangsmåde ifølge krav 12, **kendetegnet ved, at** det andet støttelegeme (4) består af flere, fortrinsvis to ringdele (6).

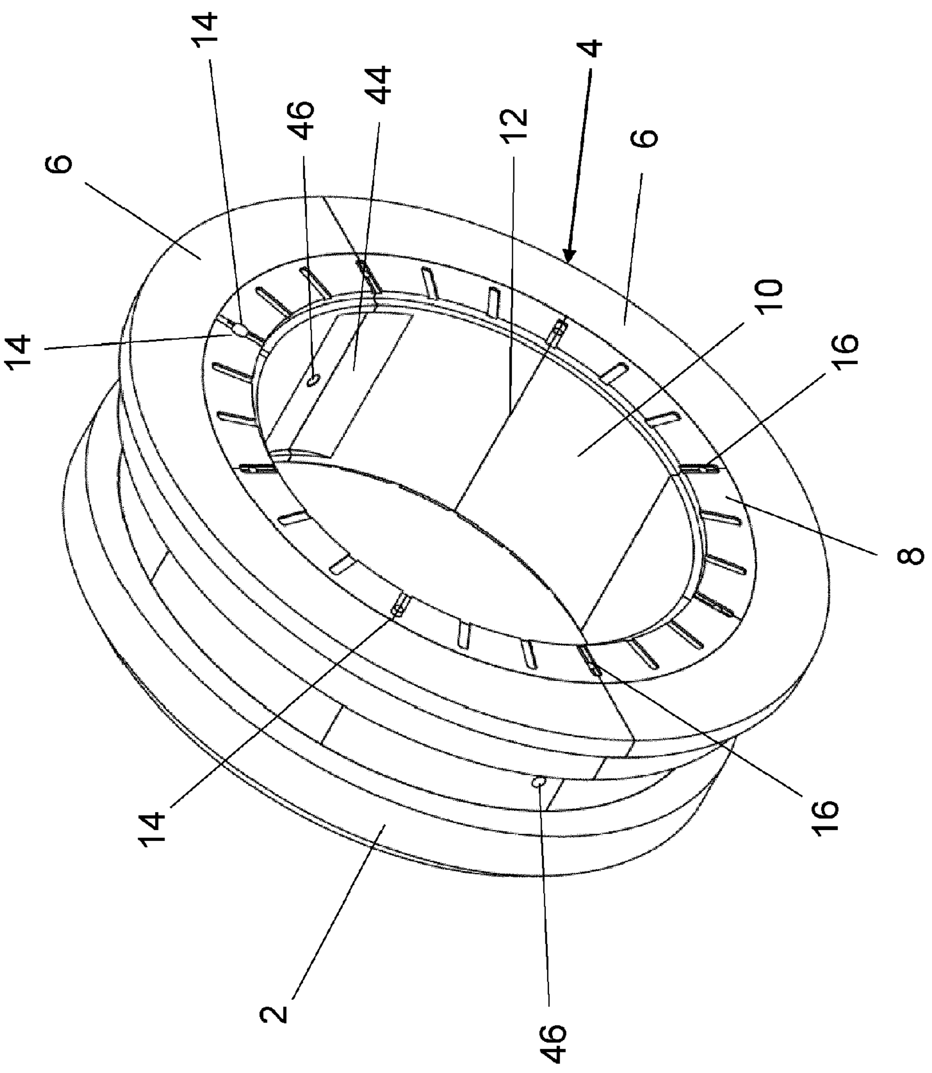


Fig. 1

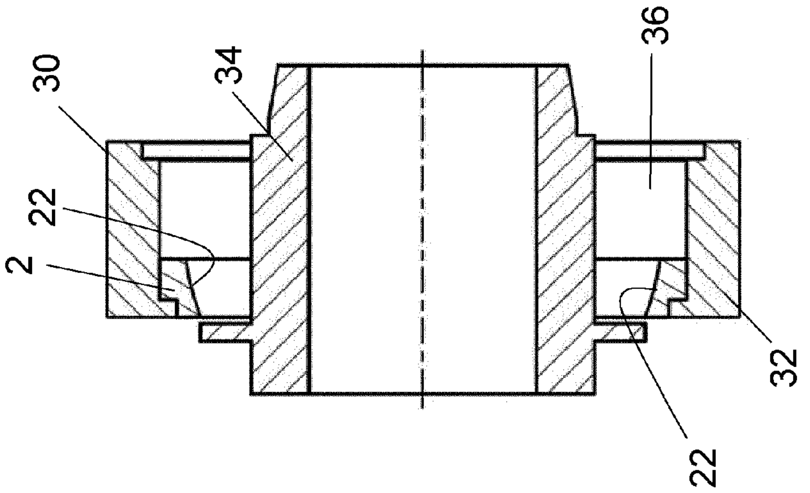


Fig. 3

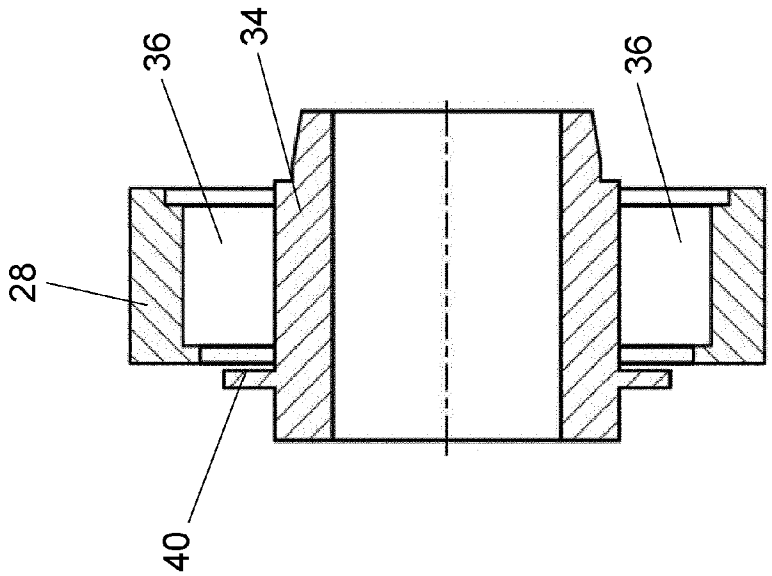
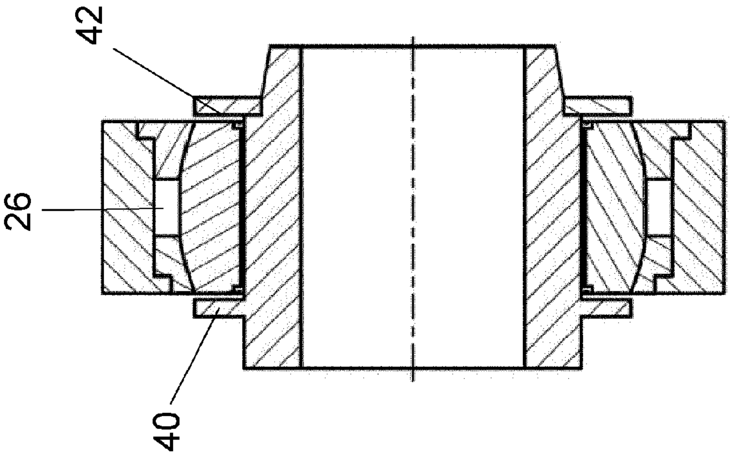


Fig. 2



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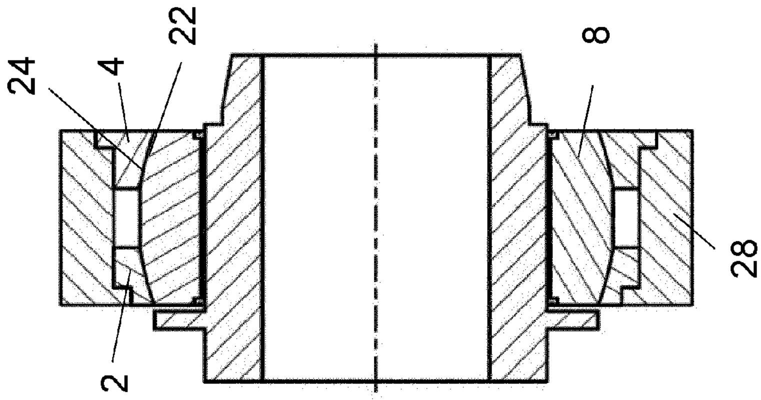

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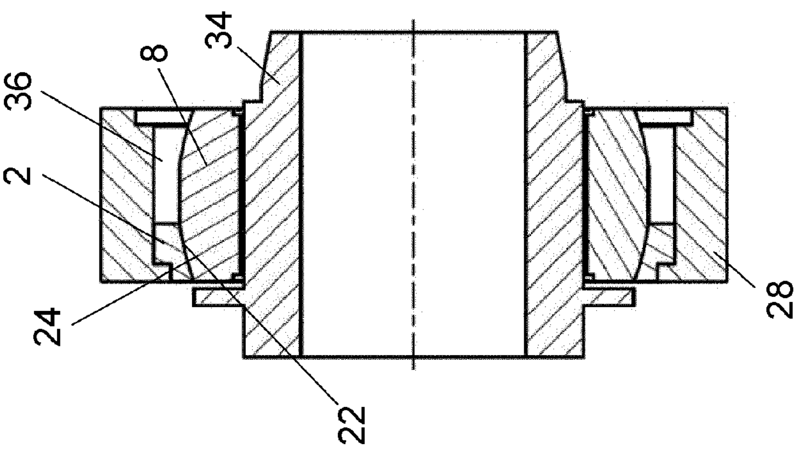
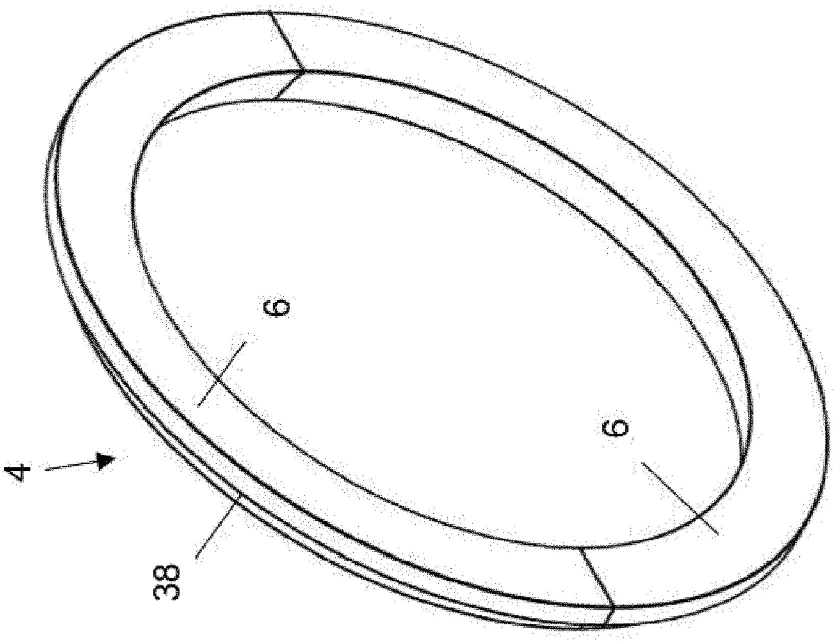


Fig. 4



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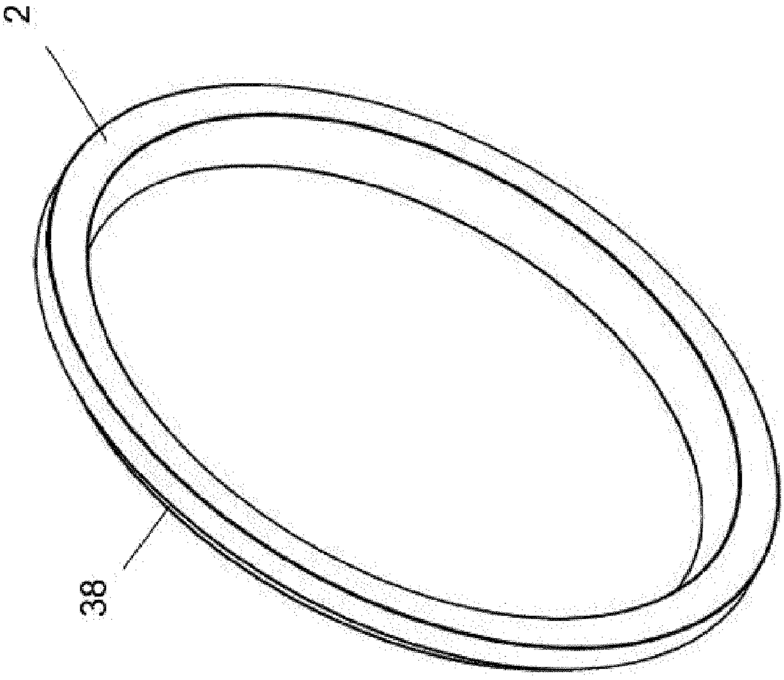

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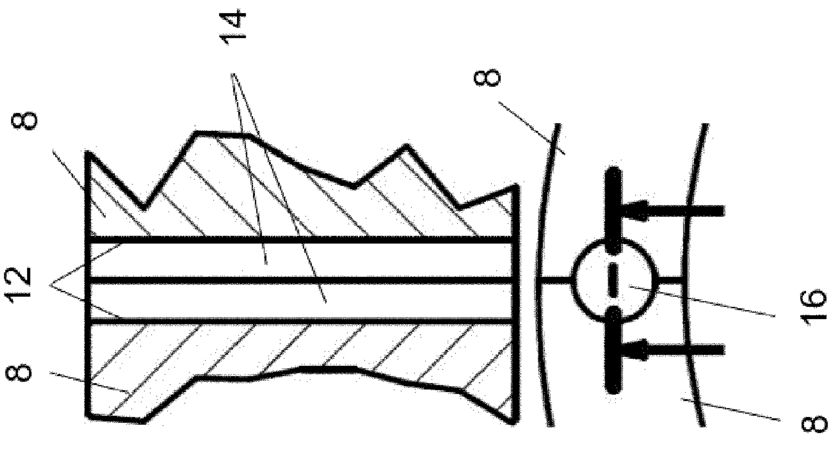

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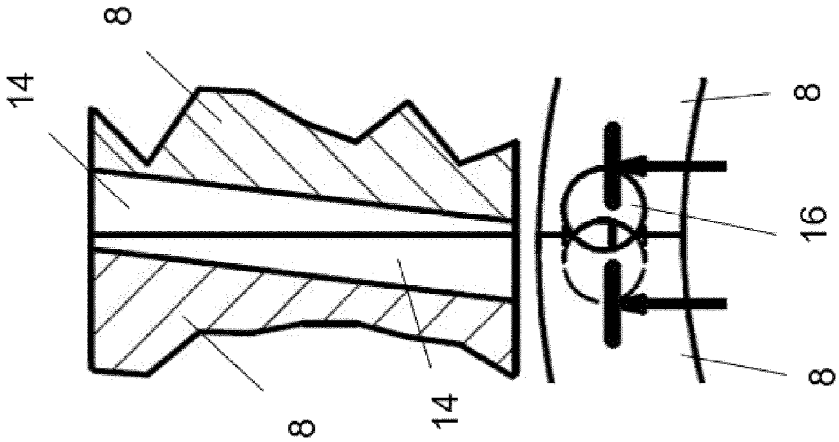
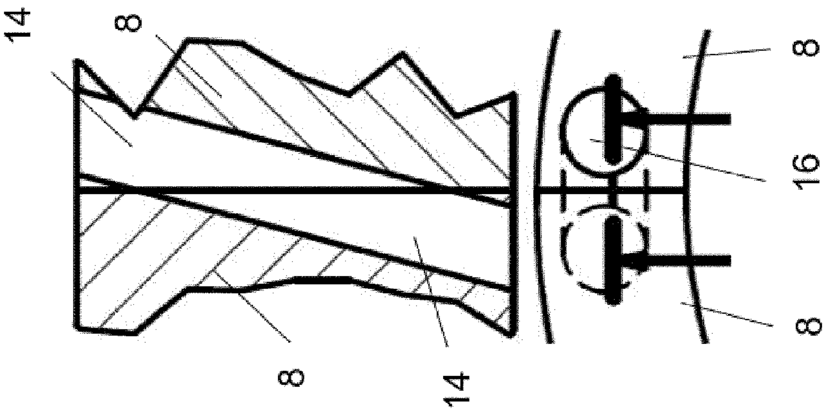


Fig. 10



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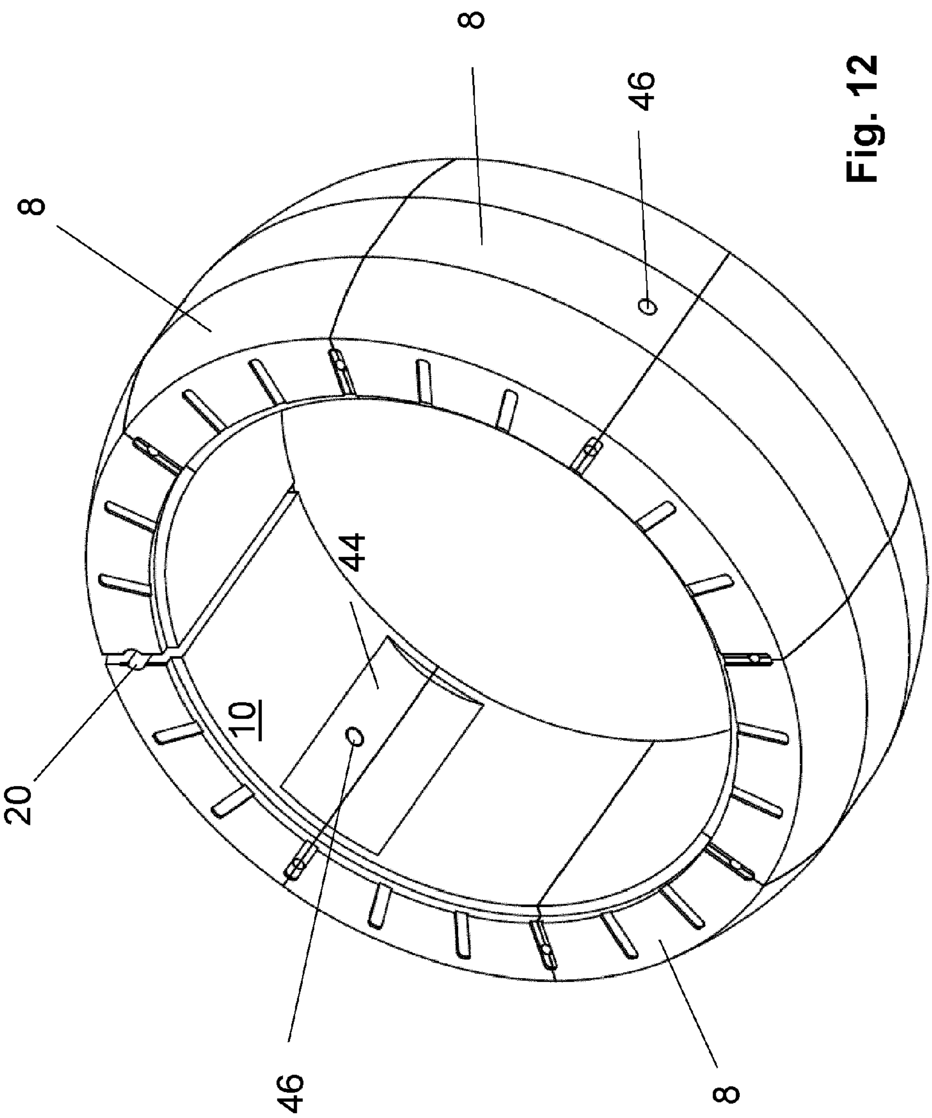

Fig. 12

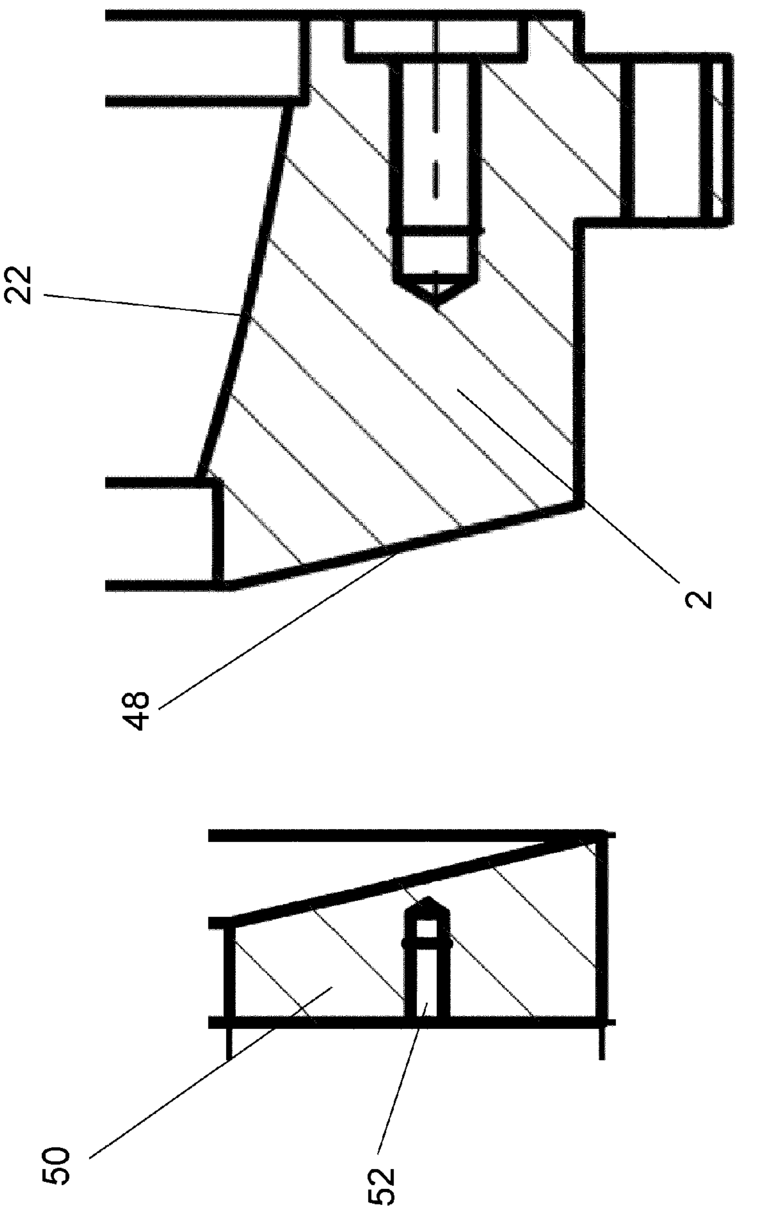

Fig. 13