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(54) Benævnelse: **VINDMØLLEGEARMEKANISME**

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DESCRIPTION

[0001] The invention relates to a wind power plant gear mechanism with an axle and a gearwheel, wherein at least one plain bearing bush is arranged between the axle and the gearwheel, as well as a wind power plant comprising a wind power plant gear mechanism.

[0002] Current commercial solutions for the mounting of planet gears in planetary gear systems for wind power plants are exclusively rolling bearing solutions. In these bearings the problem frequently occurs that the outer rings rotate due to rotational cyclical loads and, as a result of additional axial forces, the rolling bearings also axially depart and migrate from their reference position. In order to manage this problem, bearing solutions without outer rings have been proposed.

[0003] Plain bearing solutions for planetary gear systems of wind power plants have also already been disclosed but hitherto not yet commercially implemented. The probability that plain bearings also migrate due to the acting loads, however, is very high. AT509624B1 discloses a wind power plant gear mechanism having the features of the preamble of Claim 1. The object of the present invention, therefore, is to provide a plain bearing for wind power plant gear mechanisms in which the migration of the plain bearings is prevented. In order to achieve the object in a wind power plant gear mechanism it is provided that the at least one plain bearing bush is connected to the gearwheel via a conical press fit, wherein the plain bearing bush has a first end surface and a second end surface which lies opposite the former along a longitudinal centre axis through the plain bearing bush and wherein the first end surface has a diameter d and the second end surface has a diameter D, wherein the diameter D is larger than the diameter d and wherein a bearing surface for the at least one plain bearing bush is formed so as to adjoin the end surface with the diameter D, and a correspondingly configured wind power plant gear mechanism is used in the wind power plant mentioned in the introduction.

[0004] It is advantageous here that the positional stability of the plain bearing bush may be markedly improved by a simple structural measure. Thus no further measures are required therefor, such as for example bonding or welding the plain bearing bush to the gearwheel. Moreover, by the conical press fit improved centring of the gearwheel is also achieved, however, whereby a more uniform running of the gearwheel may be maintained. By this embodiment of the plain bearing bush it may be achieved that even in the worst possible case, when the plain bearing bush starts to rotate due to cyclical loads with the resulting deformations, the plain bearing bush is returned into position by forces acting in the axial direction. Thus the axial migration may be prevented more effectively. Axial forces resulting from the conical bearing seat are supported by the bearing surface for the plain bearing bush, whereby the prevention of the migration of the plain bearing bush is assisted.

[0005] Preferably, the ratio of the large diameter to the small diameter of the plain bearing bush (D/d) is a maximum of 1:2, wherein according to a further variant this ratio D/d is preferably selected from a range of 1.0001 to 1.02 in order to limit thereby the axial force acting on the bearing surface.

[0006] The bearing surface is preferably formed by the gearwheel itself, since the mounting of this sub-assembly may be simplified thereby. To this end, it may be provided that the bearing surface is formed by a radial projection of the gearwheel since this is able to be produced in a simple manner.

[0007] According to a further variant, it may be provided that two plain bearing bushes are arranged between the gearwheel and the axle for supporting the gearwheel, wherein the two plain bearing bushes are arranged such that the two second end surfaces with the larger diameter D point towards one another. Thus the aforementioned effects are further improved, since the axial migration of the plain bearing bushes may be prevented more effectively by the two plain bearing bushes which are installed in a mirror-inverted manner.

[0008] In this variant, the bearing surfaces for the plain bearing bushes may be formed by an annular web which is formed on the gearwheel extending radially inwardly in the direction of the axle. Preferably, this annular web is arranged in the centre on the gearwheel, as viewed in the axial direction. The annular web in this case has the additional advantage that a lubricant may be optionally supplied to the bearing points via this annular web. However, it may also be provided that the bearing surface for a respective plain bearing is formed by the other respective plain bearing, so that in this regard no further measures have to be performed on the gearwheel.

[0009] The plain bearing bush or bushes may be configured as (a) multi-layered plain bearing(s). In addition to the known effect that the tribological properties of the plain bearing may be thus adapted specifically to the respective requirements, primarily it is also achieved thereby that by a corresponding material pairing greater frictional forces may be provided by the gearwheel, whereby the retaining force of the press fit may be increased.

[0010] In this case it may be provided that the multi-layered plain bearing has a sliding layer in the region of the axle, in the known manner, wherein according to a further variant the sliding layer has a uniform layer thickness in the axial direction over the length of the plain bearing bush.

[0011] The sliding layer may be formed up to the area of the end surface with the diameter D and/or up to the area of the end surface with the diameter d. Thus in the case of the rotation of the plain bearing bush(es), even in the radial direction, a corresponding sliding surface is provided, i.e. an axial bearing, whereby in this case the plain bearing bush(es) may be protected more effectively from damage.

[0012] In order to assist the press fit, the plain bearing bush and/or plain bearing bushes may be additionally connected to the gearwheel in a form-fitting manner, whereby the positional stability of the plain bearing bush(es) may be further improved.

[0013] However, it may also be provided that a surface of the plain bearing bush or bushes bearing against the gearwheel has or have a roughened surface. By means of the roughened surface, the retaining force of the press fit may be further increased, whereby the positional stability of the plain bearing bush may also be further improved.

[0014] In the variant of the gearwheel with the aforementioned annular web, said annular web may be designed to be spaced apart from the axle, forming an intermediate space. Thus a simple facility for supplying lubricant may be provided.

[0015] However, it is also possible that a connecting line opens into the intermediate space which connects the intermediate space to the surrounding atmosphere, whereby with regard to the distribution of lubricant the throttle action of the bearing points may be reduced.

[0016] For improved understanding of the invention, said invention is described in more detail with reference to the following figures.

[0017] In each case in a highly schematic simplified view:

Fig. 1 shows a detail of a wind power plant gear mechanism in side view in section;

Fig. 2 shows a detail of a variant of the wind power plant gear mechanism in side view in section;

Fig. 3 shows a detail of a further variant of the wind power plant gear mechanism in side view in section;

Fig. 4 shows a detail of a further variant of the wind power plant gear mechanism in side view in section.

[0018] It should be noted first that in the differently described embodiments the same parts are provided with the same reference numerals and/or the same component descriptions, wherein the disclosures contained in the entire description may be expediently transferred to the same parts with the same reference numerals and/or the same component descriptions. Also, the positional information selected in the description, such as for example top, bottom, to the side, etc. refers to the figure currently described and shown, and may be expediently transferred to the new position when the position is changed.

[0019] In the known manner, wind power plants comprise a tower, a nacelle being arranged at the upper end thereof, and the rotor with the rotor blades being located in said nacelle. This rotor is operatively connected via a wind power plant gear mechanism to a generator which is also located in the nacelle, wherein via the wind power plant gear mechanism the low rotational speed of the rotor is translated to a higher rotational speed of the generator rotor. Since such embodiments of wind power plants form part of the prior art, at this point reference should be made to the relevant documentation.

[0020] In Fig. 1 a detail of a first variant of a wind power plant gear mechanism 1 according to the invention is shown. Said wind power plant gear mechanism comprises at least one gearwheel 2. This gearwheel 2 in the wind power plant gear mechanism 1 is arranged so as to be in meshing engagement between a second and a third gearwheel (neither being shown). To this end, the at least one gearwheel 2 comprises an external spur toothing 3.

[0021] In the embodiment of the wind power plant gear mechanism 1 as a planetary gear mechanism, in particular as a main gear mechanism of a wind power plant, the second gearwheel is configured as a sun gear with a spur toothing, which is connected fixedly in terms of rotation to a shaft which leads to the generator rotor. The sun gear is generally surrounded by a plurality of gearwheels 2, the planet gears, for example two, preferably three or four.

[0022] The third gearwheel is designed as a ring gear which surrounds the at least one gearwheel 2 and/or the gearwheels 2 in the radial direction and which also at least partially has a toothing on an internal surface, which is in meshing engagement with the external spur toothing 3 of the gearwheel 2 and/or the gearwheels 2. The ring gear is connected fixedly in terms of rotation to the rotor shaft of the rotor of the wind power plant or fixedly in terms of rotation to the housing of the wind power plant gear mechanism 1.

[0023] The toothings of the gearwheels 2 in the wind power plant gear mechanism 1 may be designed as spur toothing or in particular as oblique toothing.

[0024] The at least one gearwheel 2 (only one gearwheel 2 is described hereinafter, wherein these embodiments may also be transferred to all and/or a plurality of these gearwheels 2 of the wind power plant gear mechanism 1) is mounted via a plain bearing in the form of a plain bearing bush 4, in particular a multi-layered plain bearing on an axle 5, i.e. for example a planet shaft (the so-called planet axle). This axle 5 may either be configured integrally with at least one part of a gearwheel carrier 6, in particular a planetary carrier, or it is inserted as a separate component in a bore of the gearwheel carrier 6.

[0025] It should be mentioned that not only single-stage embodiments of such wind power plant gear mechanisms 1 are possible within the scope of the invention but also multi-stage embodiments, for example two-stage or three-stage, further spur gear stages being able to be integrated to this end in at least one gearwheel 2, in particular a planet gear. Additionally, parallel gears, as for example disclosed in EP 2 284 420 B1, are also able to be represented within the scope of the invention. Therefore, reference should also be made to this publication which in this context forms part of the description according to the invention. Accordingly, the wind power plant gear mechanism 1 may comprise a single planetary gear mechanism and a parallel two-stage or multi-stage planetary gear mechanism or generally a plurality of planetary gear mechanisms.

[0026] Moreover, it should also be mentioned that, although preferred, the invention is not only used in planetary gear mechanisms of wind power plants but may be used generally in gear mechanisms for wind power plants, in particular for translating the slow rotational speed of the rotor of a wind power plant into a higher rotational speed.

[0027] The plain bearing bush 4 is connected fixedly in terms of rotation to the gearwheel 2 via a press fit. The press fit is of conical configuration. To this end, the plain bearing bush 4 is configured to be frustoconical and along a longitudinal centre axis 7 has end surfaces 8, 9 opposing one another. The first end surface 8 has an outer diameter d 10 and the second end surface 9 has an outer diameter D 11, wherein the first diameter d 10 is smaller than the second diameter D 11.

[0028] The absolute size of the diameters d 10 and D 11 is adapted according to the respective gear size. Preferably, however, in this case the ratio D/d is a maximum of 1.2, in particular a maximum of 1.1. In particular the ratio D/d is selected from a range of 1.0001 to 1.02, preferably from a range of 1.0001 to 1.008.

[0029] In particular, the diametric cone widening may be between 0.01% and 0.6%, for example 0.1% of the outer diameter D 11.

[0030] The plain bearing bush 4 may be configured in one layer and in this case consists of a sliding material, i.e. a material which has a reduced friction relative to the material of the axle 5. To this end, this sliding material may be selected from the following cited materials for a sliding layer.

[0031] The plain bearing bush 4 according to the invention may be already produced in the corresponding shape, for example from a corresponding sheet metal blank. However, it is also possible to form this plain bearing bush from a cylindrical plain bearing bush by widening with a corresponding tool. For example, this widening may take place at the same time as the pressing of the plain bearing bush 4 into the gearwheel 2 to form the press fit.

[0032] In Figs. 2, 3 and 4, details of further embodiments and optionally independent embodiments of the wind power plant gear mechanism 1 are shown, wherein in turn the same reference numerals and/or component descriptions are used as in the aforementioned Fig. 1. In order to avoid unnecessary repetition, to this end the detailed description of Fig. 1 is referred to and/or reference is made thereto.

[0033] In the variant of the wind power plant gear mechanism 1 according to Fig. 2 the gearwheel 2 in the region of the second (large) diameter D 11 of the end surface 9 of the plain bearing bush 4 has a radial projection 12 which is preferably configured as a circular ring. The radial projection 12 serves as the axial securing of the plain bearing bush 4 so that said plain bearing bush bears at least partially with the end surface 9 against the radial projection 12, i.e. said radial projection forms a bearing surface 13 for the plain bearing bush 4 in the axial direction. To this end, the radial projection 12 protrudes radially inwardly, so that - viewed in the axial direction - an overlap with the plain bearing bush is present.

[0034] The radial projection 12 may extend continuously over the entire circumference of the plain bearing bush 4. However, it is also possible that only one single radial projection 12 or a plurality of radial projections 12 is/are arranged so as to be distributed over the inner circumference of the gearwheel 2, and which extend(s) only over a portion of 360º of the circumference.

[0035] It is also possible that the radial projection 12 extends as far as the axle 5 and is spaced apart therefrom.

[0036] The radial projection 12 is preferably configured in one piece with the gearwheel 2. However, it is also possible that said radial projection is formed by a separate component which is connected to the gearwheel 2.

[0037] According to one variant, the radial projection 12 may be arranged on the axle 5 instead of on the gearwheel 2 (see Fig. 1), for example as an annular web.

[0038] This radial projection 12, for taking up axial forces, is also present in the variant according to Fig. 1.

[0039] It is also visible from Fig. 2 that, viewed in the radial direction, the plain bearing bush 4 does not necessarily have to be arranged aligned with the gearwheel 2, as shown in Fig. 1, but also an arrangement which is offset in the axial direction is possible, wherein in this case the plain bearing bush 4 preferably protrudes in the region of the first diameter d 10 in the axial direction over the gearwheel 2.

[0040] In Fig. 2 the variant of the plain bearing bush 4 is also shown in dashed lines as a multi-layered plain bearing.

[0041] The multi-layered plain bearing consists of at least one support layer 14 which, for example, consists of steel, and a sliding layer 15 which is applied radially inwardly onto the support layer 14. The sliding layer 15 in this case forms a running surface 16 for the axle 5 (see Fig. 1).

[0042] In addition to this two-layered embodiment of the multi-layered plain bearing, within the scope of the invention the possibility also exists that intermediate layers are arranged between the sliding layer 15 and the support layer 14, for example a bearing metal layer and/or at least one binding layer and/or a diffusion barrier layer.

[0043] Examples of materials for the individual layers of the multi-layered plain bearing are disclosed in AT 509 624 B1, reference being made thereto in this regard and which in this context forms part of the description of the present invention.

[0044] However, single-layered variants of the plain bearing bush 4 are also possible. Thus, for example, these variants may consist of a copper alloy, in particular bronze or brass.

[0045] The sliding layer 15 and/or all layers of the multi-layered plain bearing bush may also have a frustoconical shape. On the other hand, there is the possibility as shown in Fig. 2 that the sliding layer 15 has a uniform layer thickness over the length of the plain bearing bush 4 in the axial direction.

[0046] According to a further variant of the plain bearing bush 4, it may be provided that the sliding layer 15 is configured in the region of the end surface with the diameter D, as shown in dashed lines in Fig. 2. The sliding layer 15 thus not only has an extent in the longitudinal direction of the plain bearing bush 4 but also in the radial direction. In principle, in this case the sliding layer 15 may be applied separately to the end surface 9 of the plain bearing bush 4.

[0047] Naturally, there is also the possibility that such a sliding layer is also applied to the end surface 8 of the plain bearing bush 4, so that the support layer 14 is thus at least partially coated on both sides on the end surfaces 8, 9.

[0048] In the axial path respectively adjacent to the end surface 8 and/or the end surface 9 of the plain bearing bush 4, in each case a run-on disk may also be provided between the plain bearing bush 4 and the gearwheel carrier 6 (see Fig. 1). In this case, the sliding layer 15 of the plain bearing bush 4 may be extended as far as the end surface of the run-on disk.

[0049] The plain bearing bush 4, therefore, may also fulfil an axial bearing function in addition to the radial bearing function.

[0050] In the variant of the wind power plant gear mechanism 1 according to Fig. 3, instead of the radial projection 12 according to Fig. 2, in particular a disk-shaped component 17 may be arranged, said disk-shaped component being able to be connected either to the gearwheel 2 or to the axle 5 (see Fig. 1) and forming the bearing surface 13 for the plain bearing bush 4.

[0051] It is also shown in Fig. 3 in dashed lines that additionally or alternatively the plain bearing bush 4 may also be connected via at least one form-fitting element 18 to the gearwheel 2. This form-fitting element 19, for example, may be a longitudinal web arranged on the outer surface of the plain bearing bush 5 which faces the gearwheel 2 and which is inserted into a corresponding longitudinal groove of the gearwheel 2. The longitudinal web may in this case extend over at least a portion of the length or over the entire length between the two end surfaces 8, 9 of the plain bearing bush 4.

[0052] Also, more than one longitudinal web may be arranged on the outer surface of the plain bearing bush 4, for example two, three, four, etc., wherein these longitudinal webs in this case may be preferably arranged distributed symmetrically over the circumference of the plain bearing bush 4.

[0053] The form-fitting element 18, however, may also have a different appropriate shape.

[0054] In the lower part of the plain bearing bush 4 in Fig. 3 a variant of the form-fit of the plain bearing bush 4 is shown in dashed lines, with the bore in the gearwheel 2 receiving the plain bearing bush 4, wherein the view is not in proportion in order to improve the clarity. In this variant, which may be provided alternatively or additionally to the form-fitting element 18, a surface 19 of the plain bearing bush 4 bearing against the gearwheel 2, i.e. the outer surface thereof, has a roughened surface over at least a portion, in particular the entirety thereof. The roughened surface may be produced by corresponding abrasive removal of material, for example by sand blasting or by erosion. In particular, in this case the surface 19 may have an arithmetical average roughness value Ra according to DIN EN ISO 4287 which is selected from a range with a lower limit of 1 µm and an upper limit of 20 µm, in particular selected from a range with a lower limit of 4 µm and an upper limit of 10 µm. Moreover, this surface 19 may have a maximum roughness profile depth Rz according to DIN EN ISO 4287, which is selected from a range with a lower limit of 2 µm and an upper limit of 100 µm, in particular selected from a range with a lower limit of 20 µm and an upper limit of 70 µm.

[0055] In Fig. 4 a detail of a further variant of the wind power plant gear mechanism 1 is shown in side view in section. Shown in turn is the gearwheel 2 which is mounted on the axle 5 via two plain bearing bushes 4, 20, the plain bearing bushes being arranged to this end between the axle 5 and the gearwheel 2.

[0056] The plain bearing bushes 4, 20 in turn have a conical shape and are arranged in conical receivers in the gearwheel 2, whereby the conical press fit is formed. In this case the arrangement is implemented such that the end surfaces 9 with the respectively larger diameter 11 of the two plain bearing bushes 4, 20 face one another. In other words, the plain bearing bushes 4, 20 in the gearwheel 2 are arranged with a cross section tapering outwardly in the axial direction. As a result, the two plain bearing bushes 4, 20 are arranged in a mirror-inverted manner in the gearwheel 2.

[0057] An intermediate space 21 is configured between the two plain bearing bushes 4, 20, an annular web 22 of the gearwheel 2 protruding therein. The annular web 22 forms the bearing surfaces 13 for the end surfaces 9 of the two plain bearing bushes 4, 20.

[0058] According to a preferred variant, the annular web 22 does not extend in the radial direction as far as the axle 5 so that said annular web is arranged spaced apart from the surface of the axle 5, forming an intermediate space 23. This intermediate space 23 may be used for supplying a lubricant, in particular a lubricating oil, to this end a supply line 24 for the lubricant opening into this intermediate space 23. Preferably, the supply line 24 is guided through the axle 5 but may also be guided through the gearwheel 2.

[0059] Alternatively or additionally, the possibility exists that the lubricant is supplied directly to the running surfaces 16 as shown in dashed lines in Fig. 4.

[0060] The intermediate space 24, however, may also be connected by a connecting line 25 to the surrounding atmosphere. Preferably, the connecting line 25 is guided through the axle 5 (as shown in dashed lines in Fig. 4) but may also be guided through the gearwheel 2. The throttle action of the bearing points may be reduced thereby.

[0061] According to a specific variant of the wind power plant gear mechanism 1 according to Fig. 4, it may be provided that the annular web 22 is dispensed with and the two plain bearing bushes 4, 20 are arranged such that they bear against one another with their end surfaces 9.

[0062] Thus in each case one of the two plain bearing bushes 4, 20 forms the bearing surface 13 for the other plain bearing bush 4, 20.

[0063] With regard to the further possible embodiments of the wind power plant gear mechanism 1 of this variant, in particular with regard to the plain bearing bushes 4, 20, reference should be made to the aforementioned embodiments.

[0064] To form the conical press fit, in all variants of the invention, cylindrical plain bearing bushes 4, 20 may be used. These cylindrical plain bearing bushes are inserted into the corresponding receivers in the gearwheel 2 and subsequently widened with a corresponding tool to form the conical shape.

[0065] For the sake of formality, it should finally be mentioned that for better understanding of the construction of the wind power plant gear mechanism 1, this wind power plant gear mechanism and/or the components thereof have been shown partially not to scale and/or enlarged and/or reduced in size.

List of reference numerals

[0066]

1 Wind power plant gear mechanism
2 Gearwheel
3 External spur toothing
4 Plain bearing bush
5 Axle

6 Gearwheel carrier
7 Longitudinal centre axis
8 End surface
9 End surface
10 Diameter

11 Diameter
12 Radial projection
13 Bearing surface
14 Supporting layer
15 Sliding layer

16 Running surface
17 Structural element
18 Form-fitting element
19 Surface
20 Plain bearing bush

21 Intermediate space
22 Annular web
23 Intermediate space
24 Supply line
25 Connecting line

PATENTKRAV

1. En vindmøllegearmekanisme (1) med en aksel (5) og et tandhjul (2), mindst en almindelig lejebøsning (4, 20) arrangeret mellem akslen (5) og tandhjulet (2), **kendetegnet ved**, at den mindst ene almindelige lejebøsning (4, 20) er forbundet med tandhjulet (2) ved hjælp af en konisk prespasning, hvor den mindst ene almindelige lejebøsning (4, 20) har en første endeflade (8) og en anden endeflade (9), som ligger overfor den første langs en langsgående centerakse (7) gennem den mindst almindelige lejebøsning (4, 20), og hvor den første endeflade (8) har en diameter d (10) og den anden endeflade (9) har en diameter D (11), sidstnævnte diameter D (11) er større end diameteren d (10) og hvor en lejeflade (13) for den mindst ene almindelige lejebøsning (4, 20) er udformet således at den forbinder endefladen (9) med diameteren D (11).

2. Vindmøllegearmekanismen (1) ifølge krav 1, **kendetegnet ved**, at størrelsesforholdet mellem D (11) og d (10) maksimalt er 1,2.

3. Vindmøllegearmekanismen (1) ifølge krav 2, **kendetegnet ved**, at størrelsesforholdet mellem D (11) og d (10) er valgt ud fra et størrelsesforhold 1,0001 til 1,02.

4. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 1-3, **kendetegnet ved**, lejefladen (13) er dannet af tandhjulet (2).

5. Vindmøllegearmekanismen (1) ifølge krav 4, **kendetegnet ved**, at lejefladen er dannet af et radialt fremspring (12) af tandhjulet (2).

6. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 1-5, **kendetegnet ved**, to almindelige lejebøsninger (4, 20) er arrangeret mellem tandhjulet (2) og akslen (5) for at understøtte tandhjulet (2), hvor de to almindelige lejebøsninger (4, 20) er arrangeret således at de to sekundære endeflader (9) med den større diameter D (11) peger imod hinanden.

7. Vindmøllegearmekanismen (1) ifølge krav 6, **kendetegnet ved**, at lejefladerne (13) er dannet af en ringformet web (22), der er dannet på tandhjulet (2) og strækker sig radialt indad i retningen af akslen (5).

8. Vindmøllegearmekanismen (1) ifølge krav 6, **kendetegnet ved**, lejefladen (13) for et respektivt simpelt leje (4, 20) er dannet af det andet respektivt simple leje (20, 4).

9. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 1-8, **kendetegnet ved**, at den/de almindelige lejebøsning eller lejebøsninger (4, 20) er konfigureret som mangelags simple lejer.

10. Vindmøllegearmekanismen (1) ifølge krav 9, **kendetegnet ved**, det mangelags simple leje har et glidelag (15) i området ved akslen (5).

11. Vindmøllegearmekanismen (1) ifølge krav 10, **kendetegnet ved**, at glidelaget (15) har en ensartet lagtykkelse i aksial retning over længden af den almindelige bøsning (4).

12. Vindmøllegearmekanismen (1) ifølge krav 10 eller 11, **kendetegnet ved**, at glidelaget (15) op til området af endefladen (9) er dannet med den større diameter D (11) og/eller med diameteren d (10) op til området af endefladen (8).

13. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 1-12, **kendetegnet ved**, at den/de almindelig(e) bøsning eller bøsninger (4, 20) yderligere er forbundet med tandhjulet (2) på formpassende måde.

14. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 1-.13, **kendetegnet ved**, at en flade (19) af den/de almindelig(e) lejebøsning eller lejebøsninger (4, 20), som danner leje mod tandhjulet (2), har en ru overflade.

15. Vindmøllegearmekanismen (1) ifølge ethvert af kravene 7-14, **kendetegnet ved**, at den ringformede web (22) er udformet til at være adskilt fra akslen (5) ved at danne et mellemrum (23).

16. Vindmøllegearmekanismen (1) ifølge krav 15, **kendetegnet ved**, at en forbindelsesline (25), som forbinder mellemrummet (23) med den omgivende atmosfære, åbner sig ind i mellemrummet (23).

17. Et vindmølleanlæg omfattende en vindmøllegearmekanisme (1), **kendetegnet ved**, at vindmøllegearmekanismen (1) er udformet i henhold til ethvert af de foregående krav.

Fig.1

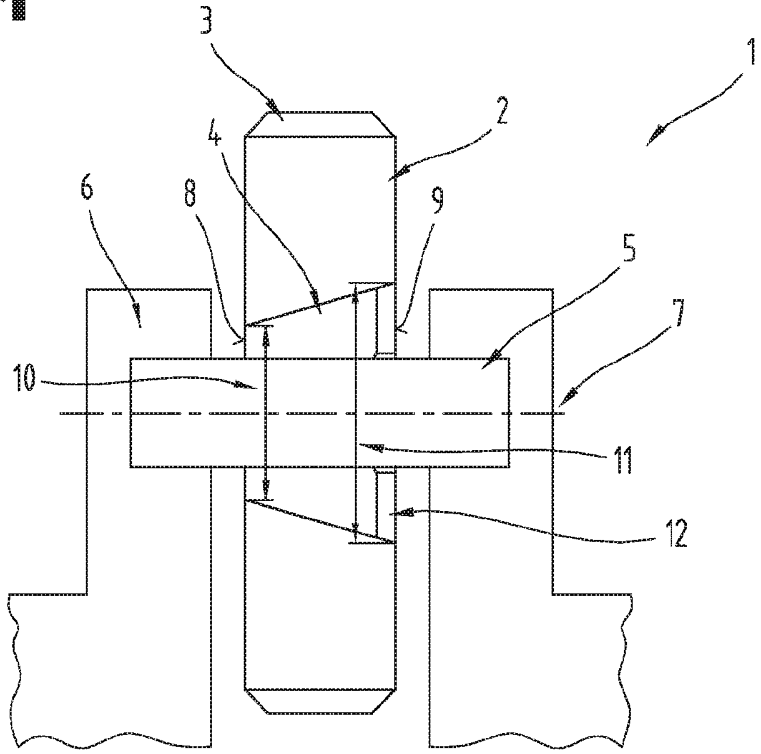

Fig.2

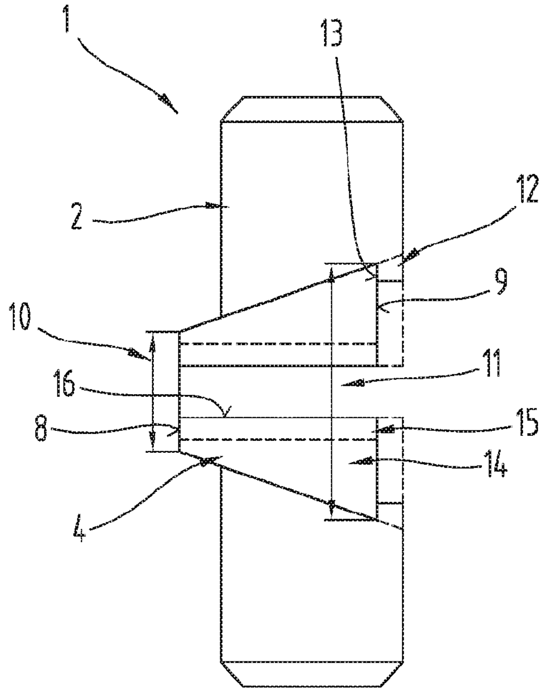

Fig.3

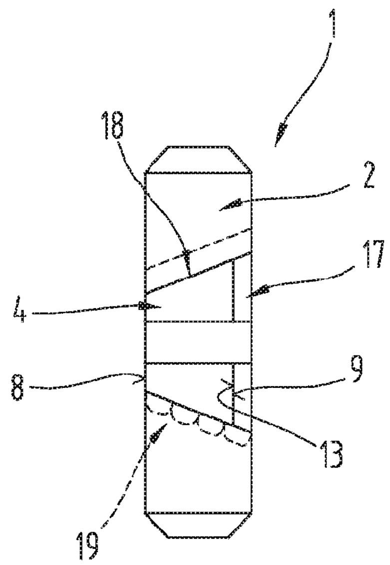

Fig.4