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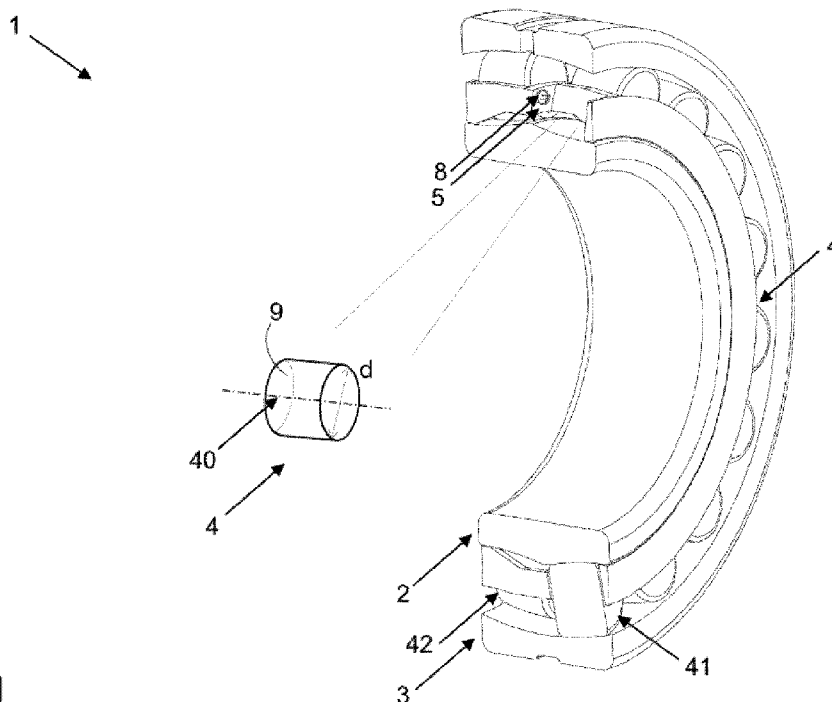


Fig. 1

(57) Abstract: The present disclosure relates to a self-aligning roller bearing (1) comprising an inner ring (2), an outer ring (3) and at least one row (41, 42) of roller elements (4) interposed in-between said inner (2) and said outer ring (3). The self-aligning roller bearing further comprises a cage (5) comprising a ring-formed first cage portion (51) and a plurality of distributed cage pocket bars (52) protruding axially outwardly from an axial side face (6) of said first cage portion (51), delimiting a plurality of cage pockets (7) for the roller elements (4). The cage (5) side face (6) further comprises one or more protrusions (8) adapted to respectively abut a region of an axial end face (9) of a respective roller element (4). The region comprises at least a radial centre (40) of said roller element (4).

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SELF-ALIGNING ROLLER BEARING

TECHNICAL FIELD

The present disclosure relates to self-aligning roller bearings.

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BACKGROUND

Self-aligning roller bearings are known for their ability to handle demanding applications where the loads are high and where shaft deflections also can be expected. By using rollers instead of balls, larger loads can be accommodated. Moreover, the self-aligning capability, i.e. the capability of the bearing's inner and outer rings to be relatively misaligned, protects the bearing from internal stresses caused by shaft deflections, and therefore the bearing's service life is commonly not negatively affected by such deflections.

15 There are different types of self-aligning roller bearings, where one of the most common type is the spherical roller bearing comprising two rows of symmetrical rollers, a common sphered outer ring raceway and two inner ring raceways inclined at an angle to the bearing axis, with the center point of the sphere in the outer ring raceway at the bearing axis. Another example of a self-aligning roller bearing is the commonly known spherical roller bearing having two rows of asymmetrical rollers, and yet another example the commonly known toroidal roller bearing comprising one row of rollers, where the bearing can accommodate both shaft deflections and axial shaft displacements.

A self-aligning roller bearing such as a spherical roller bearing commonly comprises one or two cages, e.g. of window type or prong type, for retaining roller elements interposed in-between the inner and outer bearing rings. Moreover, a self-aligning roller bearing commonly further comprises a guide ring, e.g. a floating guide ring, or a central fixed flange or rib, to prevent the unloaded roller elements to move too much axially towards the center of the bearing. By stopping the axial movement of the unloaded rollers, they are prevented from being squeezed between the raceways when entering the loaded zone again, causing friction and ultimately failure of the bearing. The e.g. floating guide ring is commonly centered either on the inner ring or on the cage or cages.

Friction between different components within self-aligning roller bearings during use of the bearings and/or the implementation of commonly known guide rings, flanges and/or ribs may, however, lead to component wear and further to noise such as rattling noise, which may be undesirable for a wide range of applications, e.g. involving fans and/or elevators.

5

Accordingly, there is room for improvement in order to reduce generated noise from the self-aligning roller bearing.

SUMMARY OF THE INVENTION

- 10 It is therefore an object of the present disclosure to provide a self-aligning roller bearing that, at least to some extent, overcomes or ameliorates at least some of the disadvantages of the prior art, or to provide a useful alternative.

- The object is achieved by a self-aligning roller bearing according to claim 1. Embodiments
15 are set forth in the appended claims, in the following description and in the drawings.

- As such, the present disclosure relates to a self-aligning roller bearing comprising an inner ring, an outer ring, and at least one row of roller elements interposed in-between the rings. The bearing has a cage comprising a ring-formed first cage portion and a plurality of
20 distributed cage pocket bars protruding axially outwardly from an axial side face of the first cage portion, delimiting a plurality of cage pockets for the roller elements. The side face of the ring-formed first cage portion comprises one or more protrusions adapted to respectively abut a region of an axial end face of a respective roller element, which region comprises at least a radial centre of the roller element.

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- Accordingly, instead of having the roller elements rubbing against a large surface related to the guide ring or central rib/flange to start with, the roller elements first come into contact with the side face of the cage via the protrusions at the centres of the roller elements. This enables for abutment with the roller elements where their tangential
30 velocity – during use of the bearing – is zero or essentially zero. Thus, the sliding contact has reduced both in terms of contact surface and the relative speed of the abutting surfaces. The benefit of which is reduced noise, friction and component wear, thus potentially increasing component life and subsequent noise generation due to future wear as well.

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Optionally, the protrusions and/or the first cage portion is/are further adapted for guiding the respective roller element into an axial position. Since the one or more protrusions and/or the first cage portion further optionally may be adapted for guiding the respective roller element into an axial position, the protrusions and/or the first cage portion may

5 prevent the roller elements from moving axially towards the centre of the bearing completely. Accordingly, guiding of the roller elements may be provided by means of the protrusions and/or the first cage portion, thus eliminating or at least reducing a need for a guide ring, flange and/or rib commonly used for guiding roller elements between the two roller rows. Consequently, the introduced roller bearing may potentially be provided

10 without a guide ring, flange and/or rib. A benefit of reducing the guide ring or flange and/or rib is primary having fewer components and/or surfaces that may provide a rattling noise, or noise from rubbing against each other. Further, it provides a bearing with lower weight and with fewer components, which make it easier to assemble (in the case of guide ring) and/or to manufacture (in the case of reduced rib). Further, the space formerly used by

15 the guide ring or central rib may be provided with grease instead, enhancing the lubricating properties and performance of the bearing.

Optionally, the outer ring has an outer ring raceway with an average surface roughness equal to or lower than 0,25 Ra. Further optionally, the inner ring has an inner ring raceway

20 with an average surface roughness equal to or lower than 0,25 Ra. A raceway is the surface where the rollers and rings are in rolling contact.

Surface roughness may contribute to for instance guiding of rollers and/or enhancing lubricating properties, but also contribute to generation of noise. A benefit of having a Ra value equal to or less than 0,25 Ra is a reduction of noise generated during operation.

25

Surface roughness – also known as surface profile Ra – is a measurement of surface finish. It is topography at a scale that might be considered "texture" on the surface. Profile roughness (Ra) can be extracted as a line through an area. Ra is calculated as the "Roughness Average" of a surfaces measured microscopic peaks and valleys. Surface

30 roughness is a quantitative calculation of the relative roughness of a linear profile or area, expressed as a single numeric parameter (Ra). Ra (μm) is used as an evaluation of the roughness amplitude on a profile, i.e. irregularities which are inherent in the production process (e.g. from a cutting tool or abrasive grit).

Optionally, the outer ring raceway has a peak waviness equal to or lower than 90 μ r.
Further optionally, the inner ring 2 raceway has a peak waviness equal to or lower than 90 μ r.

- 5 Waviness is used to describe how for instance a roller or ring deviate from its intended shape/profile. Waviness to the component may result from vibrations, chatter or work deflections during machining of the component and/or strains in the material, and contribute to noise generated as matching surfaces deviates from the intended shape.
- 10 Waviness is an imperfection of the rolling element and raceway surfaces which is stretched out over the entire length of the circumference. In other words it is the form deviation of the roller, IR and OR from the ideal geometry (perfect circle) caused during the manufacturing process.
- 15 Waviness can be measured in different parameters and different units. "Peak waviness" is a measure to indicate the highest deviation from a reference, e.g. a nominal circle. It can be measured in "micro meter" (μ m) specifying the deviation from e.g. a nominal circle.

- "Waviness length" is measured in "micro radian" (μ r), specifying the length of a curve in an
20 angle. "Peak waviness length" is a parameter to measure the maximum length of a curve, or a wave, in an angle, i.e. in a unit of radians.

- Optionally, the self-aligning roller bearing has a roller raceway with a peak waviness length equal to or lower than 80 μ r. A benefit of having a peak waviness length of the
25 roller raceway equal to or less than 80 μ r is a reduction of noise generated during operation.

- Optionally, the self-aligning roller bearing is a sealed roller bearing. By "sealed" bearing is meant a bearing having seals on both sides of the bearing. A benefit of having the bearing
30 sealed on both sides is that it contains noise generated inside of the bearing, making it more silent. Moreover, the seals also prevent debris from coming inside the bearing, causing vibrations and noise.

- Optionally, the sealed self-aligning roller bearing further comprises a lubricant, such as oil
35 or grease. The seals prevent lubricants, such as grease or oil, from leaking outside, which

has several benefits, e.g enhancing the lubricating properties of the bearing and preventing lubricants from leaking out and affecting the surrounding environment and/or machinery. An additional benefit of having the seals containing a lubricant, such as a grease, inside the bearing is that it helps dampening noise and vibrations further.

5

Optionally, the sealed self-aligning roller bearing has a grease fill level of more than 30%. Normally a sealed bearing may have up to 30% grease fill level, to get most benefits in terms of lubricating properties and, reduced friction, while preventing “over greasing” and leakage of grease during operation due to increased pressure inside the bearing and/or
10 due to temperature increase, causing the grease to expand. It has been found that having a grease fill level of more than 30% contributes to reduce the noise level generated while keeping the leakage of grease to acceptable levels.

Optionally, the sealed self-aligning roller bearing has a grease fill level of between 35-
15 45%. This has proven to be a beneficial interval when testing the noise generation and comparing it with amount of grease leakage to come to an acceptable grease leakage level. A benefit of having a grease fill level of 35-45% is that noise generation is reduced as much as possible, while still keeping the grease leakage at an acceptable level.

20 Optionally, the self-aligning roller bearing comprises a grease with particles of solid lubricants. The particles of solid lubricants has been found to keep the metallic surfaces of the bearing at a distance from each other to a larger extent than normal greases. A benefit of having a grease with particles of solid lubricants is a reduction of noise generated during operation.

25

Optionally the solid lubricants comprise 3-5vol% of the grease. Optionally the solid lubricants being at least in part one of molybdenum disulphide and/or graphite. Optionally the size of the particles is controlled and kept uniform for better noise reduction properties. Optionally, the size of the graphite particles is between 0,04–0,06mm.

30 Optionally, the size of the molybdenum disulphide particles is between 4–6µm.

Optionally, the self-aligning roller bearing (1) is a double row self-aligning roller bearing with two rows of roller elements, such as a spherical double-row bearing.

According to a second aspect, the object is achieved by an elevator traction motor comprising the self-aligning roller bearing according to any of the embodiments of the self-aligning roller bearing as disclosed herein. A benefit of having an elevator traction motor equipped with the self-aligning roller bearing according to any embodiment of the present disclosure is reduced noise and vibrations. The reduction of noise and vibrations is particularly important in elevator applications, as they are located indoors where people also may live or work. Also, it is particularly appreciated for elevator applications in order to generate confidence in the reliability and quality of the equipment used by its passengers.

10

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will be described more in detail below, using appended figures as a base to exemplify further non-limiting embodiments.

15 In the drawings:

Fig. 1 shows a three-dimensional cross sectional view of an exemplifying bearing according to an embodiment of the present disclosure.

20 Fig. 2 shows a cage according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Non-limiting embodiments of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the disclosure are shown. This disclosure may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Like reference characters refer to like elements throughout.

30 In the following, according to embodiments herein which relate to a self-aligning roller bearing, there will be disclosed an improved and/or alternative self-aligning roller bearing.

Referring now to the figures and Fig. 1 in particular, there is depicted a schematic three-dimensional cross section view of an exemplifying self-aligning roller bearing 1 according to embodiments of the disclosure.

The self-aligning roller bearing 1 comprises an inner bearing ring 2, an outer bearing ring 3 and at least one row 41, 42 of roller elements 4 interposed in-between the inner and the outer bearing rings 2, 3. The roller bearing 1 further comprises a cage 5, which cage 5 –
5 as illustrated in Fig. 2 - comprises a ring-formed first cage portion 51 and a plurality of distributed cage pocket bars 52 protruding axially outwardly from an axial side face 6 of the first cage portion 51, delimiting a plurality of cage pockets 7 for the roller elements 4.

Optionally, and as illustrated in exemplifying Fig. 2, the cage 5 may – as known in the art -
10 further comprise a ring-formed second cage portion 53 axially parallel with the first ring portion 51, which second cage portion 53 connects together end portions of the cage pocket bars 52 axially. Thereby, the second cage portion 53 contributes to the holding of the roller elements 4 inside the cage pockets 7, and further limits the axial movement of the roller elements 4 inside the cage pockets 7 towards the e.g. outside of the self-
15 aligning roller bearing 1.

Optionally, and as illustrated in exemplifying Fig. 1, the self-aligning roller bearing 1 may be a double row self-aligning roller bearing with two rows 41, 42 of roller elements 4, such as a spherical double-row bearing. Further optionally, the spherical double-row bearing
20 may be without guide ring, flange and/or rib. Yet further optionally, the self-aligning roller bearing 1 may be adapted for rotating speeds higher than a threshold orbital speed at which the roller elements 4 are affected by centrifugal forces that exceeds the gravity forces.

25 Optionally, the self-aligning roller bearing 1 may have any dimensions suitable for the intended application. Further optionally, the self-aligning roller bearing 1 may have an outer ring 3 diameter of 200mm or less. Yet further optionally, the self-aligning roller bearing 1 may have an inner ring 2 diameter between 100-120mm. In one example, the bearing has a combination of outer ring 3 diameter of 200mm or less and an inner ring 2
30 diameter of between 100-120mm. By the diameter dimensions is meant the distance to the radially outer surfaces of the respective rings 2, 3 when measured from the bearings 1 radial center.

Moreover, the expression “roller bearing” may potentially refer to “spherical roller bearing”
35 and/or “spherical double-row bearing”. The inner bearing ring 2 - which may take on any

dimensions deemed feasible - may be represented by any commonly known inner ring suited for a self-aligning roller bearing such as a spherical double-row bearing, and further comprise any known applicable material. The inner bearing ring 2 may thus as shown in exemplifying Fig. 1 comprise - on its outer radial periphery - two axially adjacent

5 raceways, each in the form of a truncated sphere, where roller elements 4 of the same row 41, 42 may roll on only one of the raceways of the inner ring 2. Correspondingly, the outer bearing ring 3 may be represented by any commonly known outer ring suited for a self-aligning roller bearing such as a spherical double-row bearing, and further comprise any known applicable material. The outer ring 2 may thus as shown in exemplifying Fig. 1

10 comprise - on its inner radial periphery - a raceway in the form of a truncated sphere, where the roller elements 4 may roll. Both the inner bearing ring 2 and the outer bearing ring 3 may be rotatable around an axis of symmetry of the self-aligning roller bearing 1.

Herein, the word "axial" or "axially" may refer to a direction parallel to the axis of symmetry

15 of the roller bearing 1, a roller element 4 and/or the cage 5, as applicable, whereas the word "radial" or "radially" may refer to a direction perpendicular to the axis of symmetry of the bearing 1, a roller element 4 and/or the cage 5, as applicable.

The roller elements 4 may be represented by any commonly known rollers suited for a

20 self-aligning roller bearing such as a spherical double-row bearing, and further comprise any known applicable material.

The roller elements 4 may for instance - as shown in exemplifying Fig. 1 - be arranged in two axially adjacent rows 41, 42. The expression "roller elements" may refer to "rollers"

25 and/or "rollers of essentially cylindrical shape" as well as to "spherical roller elements" according to an example of embodiment herein.

The cage 5 which similarly may have any dimensions deemed feasible, may be represented by any commonly known roller bearing cage suited for a self-aligning roller

30 bearing such as a spherical double-row bearing, e.g. of window type or prong type, with the exception of the additional features discussed herein. The cage 5 may be inner ring guided, or alternatively e.g. outer ring guided or guided by the roller elements 4. The expression "cage" may refer to "roller bearing cage", whereas the phrase "cage comprising" according to an example may refer to "cage for retaining and/or guiding the

35 roller elements, the cage comprising". Moreover, the expression "ring-formed" first/second

cage portion may refer to “annular” and/or “circular” first/second cage portion, whereas cage “portion” may refer to cage “core”. “First cage portion” may according to an example refer to “inner cage portion” and/or “inner part”. “Distributed” cage pockets bars may refer to “evenly distributed” cage pockets bars, whereas “protruding axially outwardly” may refer to “protruding essentially axially outwardly”. Moreover, the phrase “plurality of cage pockets for the roller elements” may refer to “plurality of evenly distributed cage pockets for the roller elements” and/or “plurality of cage pockets for the roller elements such that there is provided a respective cage pocket for each respective roller element of the at least one row of roller elements”.

10

According to the introduced concept, the side face 6 of the cage’s 5 first cage portion 51 comprises one or more protrusions 8 adapted to respectively abut a region of an axial end face 9 of a respective roller element 4, which region comprises at least a radial centre 40 of the roller element 4. Thereby, at least a first protrusion 8 protruding from a side surface 6 of the cage 5 facing the roller elements 4, abuts an end 9 - such as an inner end - of a roller element 4 at a contact area at and/or around a rotational axis of the roller element 4, at least during use of the bearing 1 and/or during roller element 4 axial displacement and/or roller element 4 skewing. Accordingly, the roller elements 4 come into contact with the side face 6 of the cage 5 via the protrusions 8 at the centres 40 of the roller elements 4, thus enabling for abutment with the roller elements 4 where their tangential velocity – during use of the bearing 1 – is zero or essentially zero. Thus, sliding in the contact with the roller elements 4 - and subsequently component wear - may be avoided or at least kept at a minimum, potentially increasing component life.

Moreover, optionally, the one or more protrusions 8 and/or the first cage portion 51 may further be adapted for guiding the respective roller element 4 into correct axial position. Thereby, the protrusions 8 and/or the first cage portion 51 may prevent the roller elements 4 from moving axially towards the centre of the bearing 1, and accordingly, guiding of the roller elements 4 may be provided by means of the protrusions 8 and/or the first cage portion 51, thus eliminating or at least reducing a need for a guide ring, flange and/or rib commonly comprised in bearings such as spherical double-row bearings of the state of the art for guiding roller elements between the two roller rows. Consequently, the introduced roller bearing 1 may potentially be provided without a guide ring, flange and/or rib, thus enabling for weight and/or cost of a roller bearing and/or noise such as rattling noise during use of the roller bearing, to potentially be lowered.

For instance, the first cage portion 51 may be designed to drive respective roller element 4 back into correct axial position by including similarities of known guide ring, flange and/or rib geometry. For instance, a distance between the first cage portion 51 and the inner ring 2 may be adapted to match known guide ring, flange and/or rib solution in a manner such that the first cage portion 51 is the first part to touch the inner ring 2 thus acting as an inner ring centered roller guidance. The term “correct” axial position may refer to “optimal”, “desired” and/or “a predeterminable” axial position, whereas the expression “guiding the respective roller element into correct axial position” may refer to “guiding the respective roller element into correct axial position at least during use of the self-aligning roller bearing” and/or “guiding the respective roller element into correct axial position at least during roller element axial displacement and/or roller element skewing”.

Optionally, the one or more protrusions 8 may be distributed along the side face 6 such that a respective protrusion 8 is provided for each cage pocket 7.

A protrusion 8 may have any dimensions and or shapes deemed feasible to – at least during use of the bearing 1 and/or during roller element 4 axial displacement and/or roller element 4 skewing – abut with a region of the end face 9 of a roller element 4 which region comprises the radial centre 40 of the roller element 4. Similarly, the region of a roller element end face 9 may have any dimensions deemed feasible, and for instance range from less than a millimetre radius up to several hundreds of millimetres radius, and/or range from a radius of less than one percent of the roller element’s 4 radius up to 50 percent of the roller element’s 4 radius. In a similar manner, the end face 9 of a roller element 4 – which is substantially perpendicular to the rotational axis of the roller element 4 - may take on any dimensions and or shapes deemed feasible. According to an example, the end faces 9 may be flat. Alternatively, the end faces may be for instance domed, concave etc.

The expression side “face” may refer to side “surface”, whereas “side” face may refer to “outer” face. “Protrusions”, on the other hand, may according to an example refer to “bulges” and/or “bumps”, whereas “abut” may refer to “come into contact with”. The phrase “adapted to respectively abut” may according to an example refer to “adapted to at least during use of the self-aligning roller bearing respectively abut” and/or “adapted to at least during roller element axial displacement and/or roller element skewing respectively

abut". The expression "a region" of an axial end face may refer to "an area", "a contact area" and/or "a portion" of an axial end face, whereas end "face" may refer to end "surface". "Radial centre" of the roller element may refer to "radial essentially centre" of the roller element, and further to "axis" and/or "rotational axis" of the roller element.

5

Optionally, the one or more protrusions 8 may respectively have a shape free from edges. Thereby, component wear may be limited in that no edges protrude from the first cage portion's 51 side face 6. Further optionally, the one or more protrusions 8 may respectively have a shape of a truncated sphere. The expression "edges" may refer to
10 "sharp edges", whereas "truncated sphere" may refer to "dome".

Moreover optionally, the one or more protrusions 8 may respectively have a maximum extension in a normal direction exceeding at least 0.5% of a diameter d of the roller elements 4, preferably exceeding at least 1% of the roller diameter d. Thereby, the
15 protrusion extension is large enough not to allow a bottom i.e. corners of a cage pocket 7 to interfere with the roller element end face 9. The expression "extension" may refer to "height", whereas "normal direction" according to an example may refer to "axial direction". "An axial length", on the other hand, may refer to "a width".

20 At least a portion of the cage 5 and/or the one or more protrusions 8 may be made from a metallic material such as steel, cast iron or brass. Optionally, at least a portion of the cage 5 and/or the one or more protrusions 8 may comprise a polymer material. Thereby, the protrusions 8 and/or the cage 5 as a whole or in part may comprise commonly utilized material for cages known in the art, such as e.g. PA66 and/or PEEK. Additionally or
25 alternatively, at least a portion of the cage 5 and/or the one or more protrusions 8 may be made from synthetic material, and/or a composite material comprising polymer.

Optionally, the one or more protrusions 8 together with the first cage portion 51 and/or the cage 5 may form a single entity. Thereby, protrusions 8 may be integrated with at least
30 the first cage portion 51 into a single piece, thus enabling for fewer components and/or less complexity.

Optionally, the bearing outer ring 3 has an outer ring 3 raceway with an average surface roughness equal to or lower than 0,25 Ra. Further optionally, also the inner ring 2 has an
35 inner ring 2 raceway with an average surface roughness equal to or lower than 0,25 Ra.

By raceway is meant the surface where the rollers and rings are in rolling contact.

Surface roughness may contribute to for instance guiding of rollers and/or enhancing lubricating properties, but also contribute to generation of noise. A benefit of having a Ra value equal to or less than 0,25 Ra is a reduction of noise generated during operation.

- 5 The “pattern” of this surface roughness may be evenly distributed, with lines from for instance a honing operation along the direction of the raceway, when seen in magnified view. Alternatively, the pattern may be of a light cross pattern, generating better lubricating performance.
- 10 Optionally, the outer ring 3 raceway has a peak waviness length equal to or lower than 90µr. Waviness is used to describe how for instance a roller 4 or ring 2, 3 deviate from its intended shape/profile. Waviness on the bearing 1 components can cause high vibration levels in most applications. Waviness to the component may result from vibrations, chatter or work deflections during machining of the component and/or strains in the material, and
- 15 contribute to noise generated as matching surfaces deviates from the intended shape. Further optionally, the inner ring 2 raceway has a peak waviness length equal to or lower than 90µr.

Waviness can be measured in different parameters and different units. “Peak waviness” is

- 20 a measure to indicate the highest deviation from a reference shape, e.g. a nominal circle. It can be measured in “micro meter” (µm) specifying the deviation from a nominal shape, e.g. a nominal circle. “Peak waviness length” can be measured in “micro radian” (µr), specifying the length of a the largest curve in an angle. A benefit of having a peak waviness length of the outer ring 3 raceway equal to or less than 90µr is a reduction of
- 25 noise generated during operation.

Optionally, the self-aligning roller bearing 1 has a roller 4 raceway with a peak waviness length equal to or lower than 80 µr, which further reduce noise generated during operation.

- 30 Optionally, the self-aligning roller bearing 1 may be a sealed roller bearing (seals are not shown in figs. 1 and 2). By “sealed” bearing 1 is meant a bearing 1 having seals on both sides of the bearing 1. This contains noise generated inside of the bearing 1, making it more silent. Moreover, the seals also prevent debris from coming inside the bearing 1,
- 35 causing vibrations, noise and eventually failure to the bearing 1.

Optionally, the sealed self-aligning roller bearing 1 further comprises a lubricant, such as oil or grease. The seals prevent the lubricant from leaking outside, which has several benefits, e.g. enhancing the lubricating properties of the bearing and preventing lubricants from leaking out and affecting the surrounding environment and/or machinery. An additional benefit of having the seals containing a lubricant, such as a grease, inside the bearing is the grease further helps dampening noise and vibrations.

Optionally, the sealed self-aligning roller bearing 1 has a grease fill level of more than 30%. Normally a sealed bearing may have up to 30% grease fill level pre-greased from the factory, as this may be all the grease the bearings will ever need, as the re-lubrication interval may be longer than the expected life of the bearing. Too much grease fill volume (over greasing) in a bearing will cause the rotating bearing elements to begin churning the grease, pushing it out of the way, resulting in energy loss and rising temperatures. This can result in accelerated wear of the rolling elements and then component failure.

Further, the leaked grease may affect the surrounding machinery and/or area in a negative way. It has been found that having a grease fill level of more than 30% contributes to reduce the noise level generated while keeping the negative effects from over greasing and the leakage of grease to acceptable levels.

Optionally, the sealed self-aligning roller bearing 1 has a grease fill level of between 35-45%. This has proven to be a beneficial interval when testing the noise generation and comparing it with amount of grease leakage to come to an acceptable grease leakage level. A benefit of having a grease fill level of 35-45% is that noise generation is reduced as much as possible, while still keeping the grease leakage at an acceptable level for a variety of sizes. In one example, the bearing has a combination of outer ring 3 diameter of 200mm or less and an inner ring 2 diameter of between 100-120mm when measured between the radial center of the bearing 1 to the rings 2, 3 radially outer surfaces. Further optionally, the grease fill level is between 37 - 43%. Yet further optionally, the grease fill level is 39-41%. Yet even further optionally, the grease fill level is ~40%.

Optionally, the self-aligning roller bearing 1 comprises a grease (not shown) with particles of solid lubricants. The particles of solid lubricants has been found to keep the metallic surfaces of the bearing at a distance from each other to a larger extent than normal

greases. A benefit of having a grease with particles of solid lubricants is a reduction of noise generated during operation.

Optionally the solid lubricants comprise 3-5vol% of the grease. Further optionally the solid lubricants being at least in part one of molybdenum disulphide and/or graphite. Optionally the size of the particles is controlled and kept uniform for better noise reduction properties. Further optionally, the size of the graphite particles is between 0,04 – 0,06mm. Yet further optionally, the size of the molybdenum disulphide particles is between 4 – 6µm. In a further example of an embodiment, the grease comprises ~2% graphite particles of ~0.05mm and ~2% molybdenum disulphide (MoS₂ D50) particles of ~4-6µm.

The self-aligning roller bearing 1 may be part of an elevator traction motor. A benefit of having an elevator traction motor equipped with the self-aligning roller bearing 1 according to any embodiment of the present disclosure is reduced noise and vibrations. The reduction of noise and vibrations is particularly important in elevator applications, as they are located indoors where people also may live or work. Also, it is particularly appreciated for elevator applications in order to generate confidence in the reliability and quality of the equipment used by its passengers.

Optionally, the self-aligning roller bearing 1 has a radial clearance within the lower half of "group N" and upper half of "group 2" with reference to the ISO clearance classes in ISO 5753. This further tightens the components and reduces the noise and vibrations.

The person skilled in the art realizes that the present disclosure by no means is limited to the preferred embodiments described above. On the contrary, many modifications and variations are possible within the scope of the appended claims. It should furthermore be noted that the drawings not necessarily are to scale and the dimensions of certain features may have been exaggerated for the sake of clarity. Emphasis is instead placed upon illustrating the principle of the embodiments herein. Additionally, in the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

CLAIMS

1. A self-aligning roller bearing (1), comprising:
 - an inner ring (2);
 - an outer ring (3);
 - 5 at least one row (41, 42) of roller elements (4) interposed in-between said inner (2) and said outer ring (3); and
 - a cage (5) comprising a ring-formed first cage portion (51) and a plurality of distributed cage pocket bars (52) protruding axially outwardly from an axial side face (6) of said first cage portion (51), delimiting a plurality of cage pockets (7) for
 - 10 said roller elements (4),
 - wherein said side face (6) comprises one or more protrusions (8) adapted to respectively abut a region of an axial end face (9) of a respective roller element (4), which region comprises at least a radial centre (40) of said roller element (4).
- 15 2. The self-aligning roller bearing (1) according to claim 1, wherein said one or more protrusions (8) and/or said first cage portion (51) is/are further adapted for guiding said respective roller element (4) into an axial position.
3. The self-aligning roller bearing (1) according to any of the preceding claims,
- 20 wherein an outer ring raceway has an average surface roughness equal to or lower than 0,25 Ra.
4. The self-aligning roller bearing (1) according to any of the preceding claims,
- 25 wherein the outer ring raceway has a peak waviness length equal to or lower than 90µr.
5. The self-aligning roller bearing (1) according to any of the preceding claims,
- wherein a roller raceway has a peak waviness length equal to or lower than 80 µr.
- 30 6. The self-aligning roller bearing (1) according to any of the preceding claims,
- wherein said self-aligning roller bearing (1) is a sealed roller bearing.
7. The self-aligning roller bearing (1) according to claim 6, further comprising grease,
- and wherein a grease fill level is more than 30%, preferably between 35-45%.

8. The self-aligning roller bearing (1) according to any of the preceding claims, wherein the bearing further comprises a grease with particles of solid lubricant, the particles of solid lubricant being at least in part made from molybdenum disulphide and/or graphite.

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9. The self-aligning roller bearing (1) according to any of the preceding claims, wherein said self-aligning roller bearing (1) is a double row self-aligning roller bearing with two rows (41, 42) of roller elements (4), such as a spherical double-row bearing.

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10. An elevator traction motor comprising the self-aligning roller bearing (1) according to any of the preceding claims.

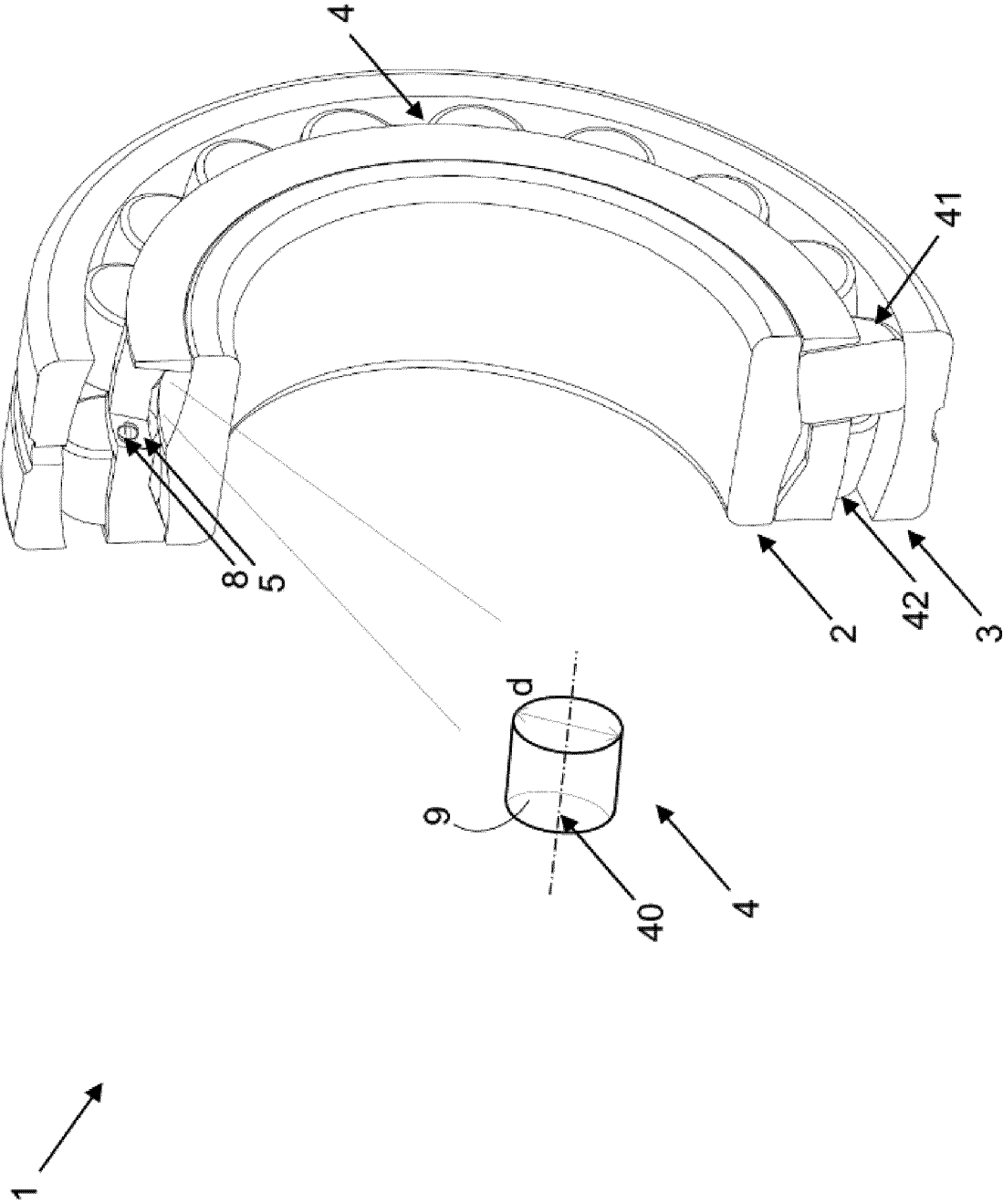


Fig. 1

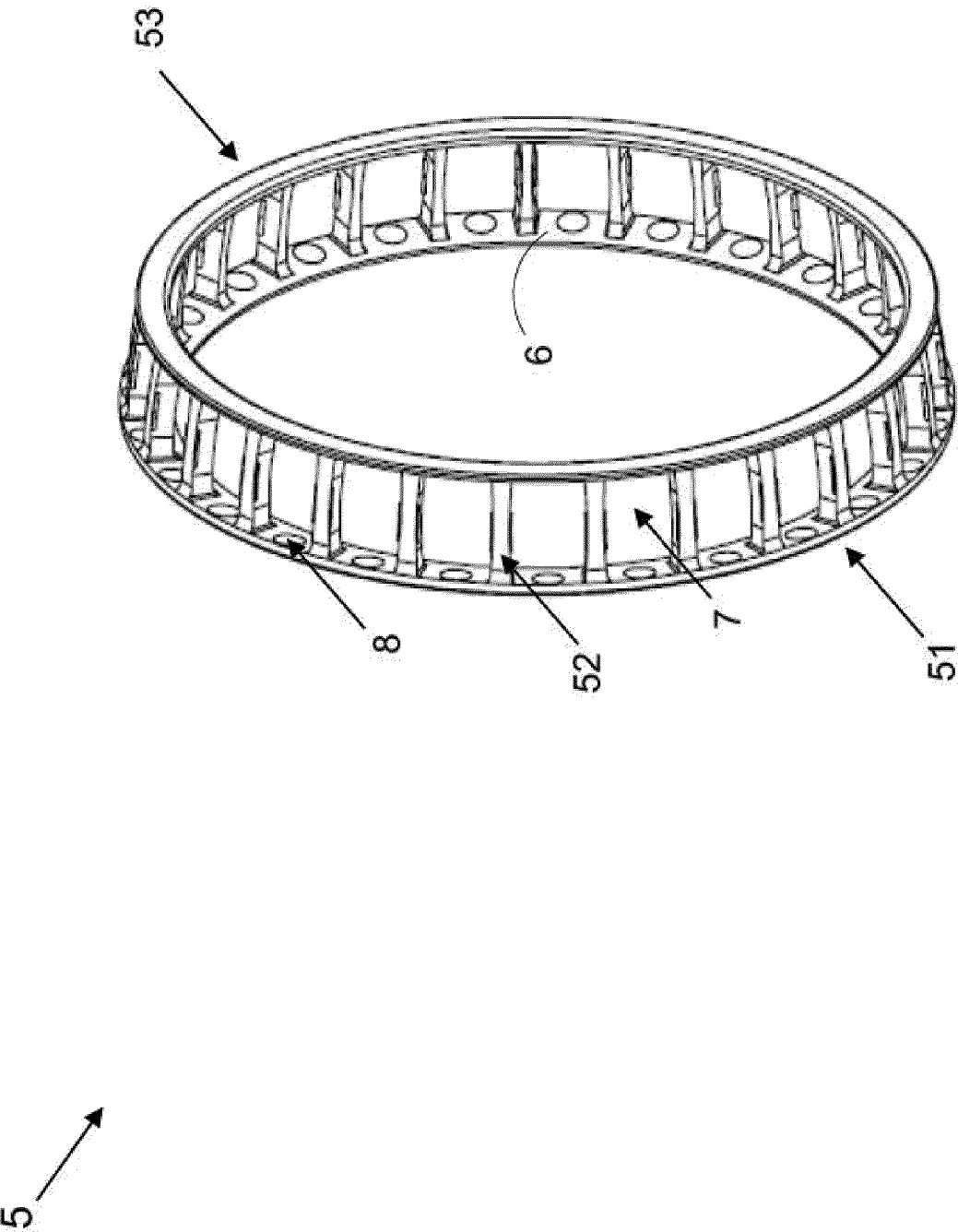


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/070495

A. CLASSIFICATION OF SUBJECT MATTER INV. F16C19/38 F16C19/18 F16C23/08 F16C33/46 F16C33/58 F16C33/66 ADD. According to International Patent Classification (IPC) or to both national classification and IPC																				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F16C Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data																				
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category*</th> <th style="width: 70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">X</td> <td>JP 2007 127167 A (NSK LTD) 24 May 2007 (2007-05-24) figures 1, 11-13,15 -----</td> <td style="text-align: center;">1-10</td> </tr> <tr> <td style="text-align: center;">X</td> <td>DE 10 2016 223408 A1 (SCHAEFFLER TECHNOLOGIES AG [DE]) 30 May 2018 (2018-05-30) paragraph [0021]; figures 1-3 -----</td> <td style="text-align: center;">1-10</td> </tr> <tr> <td style="text-align: center;">X</td> <td>DE 10 2018 117839 A1 (SCHAEFFLER TECHNOLOGIES AG [DE]) 30 January 2020 (2020-01-30) paragraphs [0033], [0032], [0037]; figures 1,2,3,6,7 -----</td> <td style="text-align: center;">1-10</td> </tr> <tr> <td style="text-align: center;">X</td> <td>DE 10 2005 059032 A1 (SCHAEFFLER KG [DE]) 14 June 2007 (2007-06-14) figures 1,2,4 -----</td> <td style="text-align: center;">1-8,10</td> </tr> <tr> <td style="text-align: center;">A</td> <td></td> <td style="text-align: center;">9</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	JP 2007 127167 A (NSK LTD) 24 May 2007 (2007-05-24) figures 1, 11-13,15 -----	1-10	X	DE 10 2016 223408 A1 (SCHAEFFLER TECHNOLOGIES AG [DE]) 30 May 2018 (2018-05-30) paragraph [0021]; figures 1-3 -----	1-10	X	DE 10 2018 117839 A1 (SCHAEFFLER TECHNOLOGIES AG [DE]) 30 January 2020 (2020-01-30) paragraphs [0033], [0032], [0037]; figures 1,2,3,6,7 -----	1-10	X	DE 10 2005 059032 A1 (SCHAEFFLER KG [DE]) 14 June 2007 (2007-06-14) figures 1,2,4 -----	1-8,10	A		9
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Date of the actual completion of the international search 14 October 2021		Date of mailing of the international search report 22/10/2021																		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Kovács, Endre																		

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2021/070495

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