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(54) Benævnelse: **GEOMETRIKONCEPT FOR EN RULLE-KANT-KONTAKT VED RULLELEJER**

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DESCRIPTION

The present invention relates to a geometric concept for a roller-rib contact for rolling bearings, more particularly for a tapered roller-rib contact for tapered roller bearings.

Guide rims in roller bearings, such as for example tapered roller bearings, can be configured either straight or spherical. Straight rims are mainly used for roller bearings having smaller diameters and thus also smaller rim widths. A rim width is often too small here to provide a defined profile on an available rim surface. Spherical rims are used for the most part in roller bearings having larger diameters and thus also larger rim widths. A spherical rim is characterised in that a radius which describes a rim form facing a roller raceway has its origin substantially on an axis of rotation of the rollers (roller rotational axis), wherein slight deviations as a result of alignment errors are permitted.

For a more detailed explanation of roller bearings with spherical rims Figure 1 shows in a diagrammatic illustration a longitudinal section through a roller bearing 10 which is configured by way of example as a tapered roller bearing. The roller bearing 10 has a bearing inner ring 11, a bearing outer ring 12 and a plurality of rollers 13 which can roll on raceways or tracks 14, 15 formed by the inner sides of the bearing rings 11, 12. In the case of a tapered roller bearing the rollers or rolling bodies 13 are tapered rollers correspondingly.

The tapered rollers 13 can roll on an inner raceway 14 which is formed in the bearing inner ring 11, and on an outer raceway 15 which is formed in the bearing outer ring 12. The raceways 14, 15 seen three-dimensionally are configured as cone sleeves in the case of a tapered roller bearing. In the longitudinal section of the tapered roller bearing 10 shown in Fig. 1 the raceways 14, 15 define in a hypothetical extension an inner straight line 16 and an outer straight line 17 which meet at a pivot point 19 on a rotational or turning axis 18 of the roller bearing 10.

During operation of the bearing 10 each (tapered) roller 13 rotates about its own roller axis 20 wherein a hypothetical extension of the roller axis 20 likewise intersects the pivot point 19. The relative position of the inner straight line 16, outer straight line 17, bearing rotational axis 18 and roller axis 20 which all intersect in the pivot point 19 produces the rolling condition for the tapered rollers 13 on the raceways 14, 15 so that during relative rotation of the bearing inner ring 11 and bearing outer ring 12 the tapered rollers 13 roll on the raceways 14, 15 substantially without any slip and a proportion of the sliding friction related thereto is minimized.

In order to optimize friction occurring also in the axial direction, i.e. in the direction of the bearing rotational axis 18, when taking up axial forces, in the case of roller bearings the rollers 13 used have on their end side 21 a first curvature which is determined by a first radius R_{21}, so that a part of a spherical face is produced as the end side face of the rollers 13 which, as shown in the enlarged view in Figure 1, is in contact at a contact point 22 with a straight or spherically configured edge rim 23 of by way of example the bearing inner ring 11. In order to obtain a defined contact point 22 the spherically curved rim face has a second curvature which is defined by a second radius R_{23} and which is smaller than the first curvature of the spherical end face 21 of the rollers 13.

In the case of roller bearings, such as by way of example cylinder, barrel or tapered roller bearings which are configured with straight or planar rims, the roller-rim contact has, compared with the rims of spheroid configuration, a higher surface pressure area (Hertzian pressure) between the roller end side 21 and the rim face which faces the latter. Hertzian pressure is taken to mean the greatest stress which prevails in the centre of the contact face between two elastic bodies. If, as in the case of roller bearings with straight rims, two elastic bodies are pressed against one another (curved roller end side and straight or planar rim), then they contact in the idealised case only in punctiform manner.

However in the real case scenario as a result of the elasticity a flattening out and thus a contact surface arises at the contact point 22. In both bodies a characteristic stress distribution (surface pressure) arises at the contact surface wherein the stress is always highest in the middle. If, as here, a spherical surface and a planar rim surface contact one another, then a touching or contact ellipse is formed. As a result of the comparatively high surface pressure, with roller bearings having straight rims there generally results a relatively poor build-up of lubricating film in the event of higher acting forces. Furthermore straight or planar rims compared with spherical rims lead to smaller contact ellipses between the roller end side and the rim surface facing the latter, which can thus result in an overlap of the contact ellipse with the rim edges only in the event of extreme loads. Similarly in general with straight or planar designed rims there is a low susceptibility of the contact point 22 in respect of alignment errors so that a defined contact point 22 between the roller 13 and rim is possible. Whereas with rims of planar configuration on the one hand a greater tilted position of the rollers 13 is possible, on the other hand a comparatively poor guidance of the rollers is produced as they run.

Tapered roller bearings in the large-size bearing sector can, as shown in Figure 1, be configured with spherical rims 23 which compared with straight or planar rims result in a lower surface pressure between the roller end face 21 and the rim face facing the roller 13. Compared with straight rims, spherically configured rims 23 lead moreover to greater contact ellipses between the roller end face 21 and the opposing rim surface so that it can frequently result in overlaps of the contact ellipses with the rim edges and thus to edge stresses. In general in the case of spherically configured rims 23 a higher susceptibility of the contact point 22 in respect of alignment errors exists than is the case with planar or straight rims. Although spherical rims on the one hand result in a less tilted position of the roller 13, on the other hand as a result of the close osculation between the roller end face 21 and the rim face facing the roller 13, the roller 13 can be guided better during running. In theory through the different choice of radii of curvature (and/or their origins) of the roller end face 21 and the spherical rim face a defined contact point 22 between the roller 13 and rim 23 is also possible with spherical rims.

One of the main drawbacks of a spherical rim is however the resulting susceptibility of the contact point 22 between the roller end side 21 and rim 23 in respect of alignment errors. Deviations in the raceway angle, roller angle, rim radius as well as roller end face radius all have a decisive influence on this.

CH 212693 A discloses a roller bearing according to the preamble of claim 1.

The object of the present invention is thus to reduce this susceptibility of the contact point between the roller end face and rim in respect of alignment errors.

In order to reduce the susceptibility of the roller-rim contact point in respect of alignment errors but still to be able to guarantee sufficient guidance of the roller during running, a correspondingly optimized rim surface geometry is proposed here. The proposed rim surface geometry has for this on the one hand a spherical section which is to guarantee the roller guidance as well as a low Hertzian pressure. On the other hand the proposed rim geometry also has a, in the following termed widening, section which would give a greater gap dimension i.e. a greater distance, between the roller end face and the rim surface facing the latter, than would be provided with a rim of purely spherical configuration.

Exemplary embodiments of the invention provide a roller bearing having a bearing ring with a raceway for at least one roller which has a roller end face of at least partially spheroid configuration with a first curvature. The bearing ring has for dissipating axial forces a rim which is arranged on the end side with respect to the roller with a rim face which faces the roller end face, wherein the rim face comprises a spherical rim face section with a second curvature which can be configured constant or variable on the spherical rim face section. The first and the second curvatures are selected so as to obtain a first gap dimension (which can also be an average gap dimension depending on the roller rim geometry) between the roller end face of spheroid configuration and the spherical rim face section. Furthermore the rim face has a widening rim face section with a smaller curvature than the second curvature for a larger gap dimension than the first gap dimension between the roller end face and the widening rim face section.

According to a further aspect a method is also provided for manufacturing a bearing ring for a roller bearing having a roller raceway for at least one roller wherein the roller has a roller end face of spheroid configuration with a first curvature. The method comprises a step for providing a rim arranged for diverting axial forces at the end to the roller with a rim face facing the roller end face, wherein the production step has in turn the following steps:

- Providing a spherical face section of the rim face with a second curvature wherein the second curvature is selected relative to the first curvature so that a first gap dimension is obtained between the roller end face of spheroid configuration and the spherical rim face section; and

- Producing a widening face section of the rim face with a smaller curvature than the second curvature so that a larger gap dimension than the first gap dimension is obtained between the roller end face of spheroid configuration and the widening face section.

The second curvature of the spherical rim face section can be configured constant or variable according to exemplary embodiments.

A first tangential plane at a rim face running hypothetically purely spherically instead of the widening face section in this region, and a second tangential plane at the widening rim face section include according to exemplary embodiments a maximum angle α which is greater than 0° and smaller than or equal to 30°.

The spherical rim face section extends according to exemplary embodiments over a region of at least one third of the rim face.

According to several exemplary embodiments the spherical rim face section extends from a corner region between the raceway and the rim face towards a radial end of the rim or a rim edge. The spherical rim face section can in the case of a bearing inner ring thus lie in a lower region, facing an inner raceway surface, of the rim adjoining a rim or groove edge, wherein the widening rim section in this case, adjoining the spherical rim face section, lies in the upper region of the rim. With a bearing outer ring it is correspondingly reversed, i.e. the spherical rim face section lies here in an upper region of the rim adjoining a rim or groove edge, wherein the widening rim section is then located in the lower region of the rim facing away from the outer raceway surface.

According to other exemplary embodiments it is however likewise possible that the spherically configured section does not adjoin the rim edge between the raceway and the rim, so that widening rim face regions are located above and below the spherical section. In this case a first widening rim face section extends from a corner region between the raceway and the rim face wherein the spherical rim face section adjoins in a radial direction the first widening rim face section. At a region of the spherical rim face section facing away from the first widening rim face section a second widening rim face section extends in the radial direction from the spherical rim face section out towards a radial end of the rim.

According to exemplary embodiments the roller bearing is a tapered roller bearing. The roller is then configured correspondingly as a tapered roller.

Further advantageous configurations and developments form the subject of the dependent claims.

As a result of the proposed roller-rim contact geometry in the form of a spherical rim face section in combination with a directly adjoining widening rim face section the roller guide can remain during running a result of the spherically configured rim portion. The spherical rim face section furthermore ensures a low Hertzian pressure. The widening rim section can reduce the size of the contact ellipse compared with purely spherical rims whereby an overlap of the contact ellipse with the rim edges can be avoided. As a result of the widening rim regions there is likewise a lower susceptibility of the position of the contact point between the roller end side and the rim in respect of alignment errors so that a defined contact point is possible between the roller and the rim.

The proposed roller-rim geometry is designed so that the contact point or region between the roller end side and rim in the case of ideal geometry lies in the spherical rim region.

The susceptibility of the contact point in respect of alignment errors is in the spherical rim region comparable with the susceptibility of a purely spherical rim. If the contact point is however moved as a result of shape deviations in the widening rim region then the susceptibility is markedly reduced, which can prevent “wandering” of the theoretical contact point beyond the rim edges and thus also the high edge stresses already mentioned above.

Exemplary embodiments of the present invention will now be explained below with reference to the accompanying figures. The drawings show:

Fig. 1 a diagrammatic longitudinal section through a roller bearing with spherical rims;

Fig. 2 a diagrammatic longitudinal section through a roller bearing with a rim face with a spherical rim face section and a widening rim face section according to an exemplary embodiment of the present invention;

Fig. 3 an enlarged view of the roller-rim contact region according to Fig. 2;

Fig. 4 a diagrammatic longitudinal section through a roller bearing with a rim face with a spherical rim face section and a widening rim face section according to a further exemplary embodiment of the present invention;

Fig. 5 an enlarged view of the roller rim contact region according to Fig. 4; and

Fig. 6 a diagrammatic flow chart for a method for manufacturing a roller bearing with a rim with a spherical rim region and a widening rim region.

Fig. 2 shows in a diagrammatic longitudinal section a section of a roller bearing according to an exemplary embodiment of the present invention.

A part of a bearing ring 30 is shown for the roller bearing with a raceway 14 for at least one roller 13. The roller 13 has a curved roller end face 21 which can be for example of partially spheroid configuration, with a first curvature. The bearing ring 31 for dissipating axial forces has a rim 31 arranged at the end or on the end of the roller 13 with a rim face 32 which faces the roller end face.

As can also be seen in the enlarged view of Fig. 3, in addition to Fig. 2, the rim face 32 which faces the roller end face 21 comprises a spherical rim face section 33 with a second curvature, wherein the first and the second curvatures are selected so as to obtain a first gap dimension d_1 with a maximum $_{d1,max}$ between the roller end face 21 of spheroid configuration and the spherical rim face section 33. The rim face 32 furthermore has a widening rim face section 34 with a smaller curvature than the second curvature so that a larger gap dimension d_2 than the (maximum) first gap dimension $d_{1,max}$ is obtained between the roller end face 21 and the widening rim face section 34. The second curvature of the spherical rim face section 33 can be configured constant or variable according to exemplary embodiments.

By curvature is meant here in the present case a change in direction per unit of length. The curvature of e.g. a straight line is equal to zero throughout, because its direction does not change. A circle with a radius r has the same curvature (namely 1/r) throughout because its direction changes equally throughout. With all other curves the curvature changes from curve point to curve point. The curvature of one curve at one point thus indicates how much the curve deviates from a straight line in the immediate surroundings of the point. Of a curved surface, such as by way of example the rim face 32, its curvature is noted by way of example by its tangential plane at a deviation of the face which increases outwards in quadratic form. An increased curvature is then noticeable as a greater deviation from the plane. For the present case this thus means by way of example that the spherical rim face section 33 deviates per path length more from a tangential plane at the widening rim face section 34 of the rim face 32 than regions of the widening rim face section 34 itself.

The spheroid roller end face 21 is described by a first radius R_{21} which can have its origin substantially on the axis of rotation 20 of the roller 13. The spherical rim face section 33 is described by a second radius R_{33} which is greater than the first radius R_{21} (i.e. $R_{21} < R_{33}$) and which can have its origin substantially on the axis of rotation 18 of the roller bearing 10. The radii R_{21} and R_{33}, and the faces 21 and 33 described by them, can be arranged concentrically in principle, i.e. with an identical origin on the axis of rotation 20 of the roller. In order however to obtain at least theoretically a defined contact point 22 between the roller end face 21 and the spherical rim face section 33, the radii R_{21} and R_{33}, and the faces 21 and 33 described by them, can as a rule (such as here) not be arranged concentric, i.e. with a non-identical origin on the axis of rotation 20 of the roller or axis of rotation 18 of the bearing. In each case the first radius R_{21} and the second radius R_{33} and their origins are selected so as to obtain a first gap dimension d_1 between the roller end face 21 of spheroid configuration and the spherical rim face section 33 which (dimension) can assume a maximum value $d_{1,max}$. The widening rim face section 34 now however has according to the invention a smaller curvature than the spherical rim face section 33 so that a second gap dimension d_2 arises between the widening rim face section 34 and the spheroid roller end face 21, which (dimension), starting from the maximum value $d_{1,max}$, becomes increasingly larger towards a radial end of the widening rim face section 34 or towards a rim edge 36, which faces away from the raceway 14, up to a maximum value $d_{2,max}$, i.e. $d_{1,max} \leq d_2 \leq d_{2,max}$.

With the exemplary embodiment illustrated in Figs. 2 and 3, the spherical rim face section 33 extends from a corner region 35 between the raceway 14 and the rim face 32 in the direction of the rim edge 36 which faces away from the raceway 14. The spherical rim face section 33 can thus by way of example in a bearing inner ring lie in a lower region of the rim 31 which faces an inner raceway 14 adjoining a rim or groove edge 35, wherein the widening rim section 34 in this case lies in the upper region of the rim 31. With an exemplary embodiment for a bearing outer ring it would be correspondingly reversed, i.e. the spherical rim face section 33 would here lie in a radially upper region of the rim adjoining a rim or groove edge, wherein the widening rim section would then lie in the lower region of the guiding rim which faces way from an outer raceway. Obviously also here the spherical rim face section would lie adjoining the raceway.

As shown in Fig. 3 the spherical rim face section 33 and the widening rim face section 34 directly adjoin one another in a border region 37. I.e. in the border region 37, by way of example a border line, the spherical rim face section 33 and the widening rim face section 34 merge directly into one another. The rim face 32 preferably runs smoothly in the border region 37, thus without corners, bends or angled edges so that it is possible to place a tangential plane at the rim face 32 through a limiting point in the border region 37.

According to exemplary embodiments the widening rim section 34 enables in relation to the spherical rim face section 33 a widening of the rim 31 or rim face 32 in an angular range α of more than 0° to 30°, preferably in a range $0°\ 0'\ 6'' \leq \alpha \leq 30°$. The widening angle α of the widening rim face section 34 compared to the spherical rim face section 33 can be obtained by way of example by determining the largest angle between a tangential plane 38 at the spherical rim face section which is extended hypothetically into the widening rim face section, and a tangential plane 39 at the widening rim face section 34. For this the largest angle can be determined between a group of tangential planes 38 at the spherical rim face section extended hypothetically into the widening rim face section, and a group of tangential planes 39 at the widening rim face section 34. The spherical rim face section extended hypothetically into the widening rim face section is marked in Fig. 3 by reference numeral 40. The (largest) angle α is thus produced by tilting the tangential plane 39 at the widening rim face section 34 towards the tangential plane 38 at the imaginary spherical rim face section, extended into the widening rim face section, of a rim of spherical configuration complete with radius R_{33}. The tangential planes are here each meant at the radially outer lying rim end of the widening rim face section 34 and the corresponding rim end of the imaginary spherical rim face section extended into the widening rim face section.

According to exemplary embodiments of the present invention the spherical rim face section 33 extends over a rim face section corresponding to at least a third of a rim height h of the rim 31. I.e. a height h_{33} of the spherical rim face section 33 corresponds to at least one third of the overall rim height h, thus $h_{33} \geq 1/3h$. Correspondingly a height h_{34} of the widening rim face section 34 directly adjoining here amounts to a maximum of two thirds of the overall rim height h, thus $h_{34} \leq 2/3h$. A height h_{33} of the spherical rim face section 33 preferably lies in a range from $1/3h \leq h_{33} \leq 3/4h$ and correspondingly the height h_{34} of the widening rim face section 34 lies in a range $1/4h \leq h_{34} \leq 2/3h$.

There are different possibilities for configuring the widening rim region 34. Although Figures 2 and 3 outline one exemplary embodiment in which the widening rim face section 34 is formed by a further spherical, but less sharply curved rim face section 34 radially adjoining the spherical rim face section 33, and which is thus defined larger by a radius R_{34} than the second radius R_{33}, other exemplary embodiments of the present invention can also provide that the widening rim face section 34 is formed by a straight or planar rim face section tangentially adjoining the spherical rim face section 33. This planar rim face section then has quasi an infinitely large radius R_{34} which consequently is also larger than the radius R_{33} which describes the spherical rim face section 33.

Furthermore the radius R_{34} of the widening region 34 – starting from R_{33} - can also increase continuously from inside to outside inside the widening rim face section 34.

As exemplary embodiments were described with reference to Figs. 2 and 3 in which the spherical section 33 is arranged in the lower region of the rim 31 (adjoining the rim edge/groove edge 35) and the widening rim section 33 is arranged in the upper region of the rim 31, other exemplary embodiments will be described below with reference to Figs. 4 and 5 in which the spherically configured section 33 does not adjoin the rim edge 35 so that a widening rim region 34 is located each time above and below the spherical section 33.

According to the exemplary embodiment illustrated in Figs. 4 and 5 a first widening rim face section 34a extends from a corner region 35 between the raceway 14 and the rim face 32. Directly adjoining this, the spherical rim face section 33 adjoins the first widening rim face section 34a in the radial direction. At an end of the spherical rim face section 33 facing away from the first widening rim face section 34a a second widening rim face section 34b directly adjoins the spherical rim face section 33 in the radial direction and extends up to the radial end or edge 36 of the rim 31.

According to Figs. 4 and 5 the spherical rim face section 33 is thus embedded between two widening rim face sections 34a, 34b which adjoin different ends of the spherical rim face section 33. Also here the height h_{33} of the spherical rim face section 33 corresponds to at least a third of the overall rim height h, thus $h_{33} \geq 1/3h$. In the case of the exemplary embodiments the height h_{33} of the spherical rim face section 33 preferably lies in a range $1/3h \leq h_{33} \leq 1/2h$. Consequently the sum of the heights h_{34a}, h_{34b} of the directly adjoining widening rim face sections 34a, b amount to a maximum of two thirds of the overall rim height h, thus $(h_{34a} + h_{34b}) \leq 2/3h$. The heights h_{34a}, h_{34b} of the widening rim face sections 34a, 34b preferably do not fall below 1/6h. The rim sections 34a, 34b can also have different heights h_{34a} and h_{34b} (e.g. h_{33} = 1/3h; h_{34a} = 1/6h; h_{34b} =3/6h).

With all the exemplary embodiments the roller-rim contact geometry is selected so that the contact point 22 lies in the region of the spherical rim face section 33. The widening regions 34 which can likewise be configured spherical, but with a smaller curvature than the spherical region 33, or planar or straight, each enable a widening α of the rim 31 guiding the roller 13 of about 0° 0′6′′ to 30° compared with a rim geometry with a rim of completely spherical configuration.

Using Fig. 6 and now for completeness a method 60 of production will be explained for manufacturing a bearing ring for a roller bearing having a raceway for at least one roller 13. The roller 13 has a roller end face 21 of spheroid or partially spheroid configuration with a first curvature.

The method of production 60 comprises a step 61 for providing a rim 31 arranged on the end side with respect to the roller in order to dissipate axial forces with a rim face 32 which faces the roller end face 21.

The step 61 can be broken down in turn into a first sub-step 611 for providing/producing a spherical rim section 33 of the rim face 32 with a second curvature wherein the second curvature is selected in respect of the first curvature so as to obtain a first gap dimension d_1 between the roller end face 21 of spheroid configuration and the spherical rim face section 33.

According to a second sub-step 612 a widening face section 34 of the rim face 32 is also provided or produced with a smaller curvature than the second curvature for an enlarged gap dimension d_2 in comparison with the first gap dimension d_1 between the roller end face 21 and the widening rim face section 34. This was already dealt with in detail above.

To sum up, the proposed rim form thus endeavours to reduce the susceptibility of the roller-rim contact point 22 in respect of alignment errors and crooked positions of the bearing during use, but to nevertheless ensure a sufficient guidance of the roller 13 during running on the raceway. The rim geometry according to the invention has a spherical section 33 which can ensure the roller guidance as well as a low Hertzian pressure. Furthermore the proposed rim geometry has at least one widening section 34 which produces a greater gap dimension between the roller end face 21 and the rim face 32, than would be provided with a purely spherical rim.

The spherical section 33 can be used by way of example in the lower region of the rim 31(adjoining the rim edge/groove edge), wherein the widening rim section 34 lies in this case in the upper region of the rim (see Fig. 2+ 3). It is likewise possible that the spherically configured section 33 does not adjoin a rim edge so that widening rim regions 34a, b are located above and below the spherical section (see Figs. 4+ 5).

The roller rim contact geometry according to the invention of a spherical rim in combination with a widening section has the following advantageous properties:

- As a result of the spherical rim section 33 the roller guide remains ensured during running

- Low Hertzian pressure as a result of the spherical rim section 33

- The widening rim sections 34 reduce the size of the contact ellipse in comparison with the purely spherical rims, whereby an overlap of the contact ellipse with the rim edges is avoided

- As a result of the widening rim regions 34 there is a lower susceptibility of the position of the contact point 22 between the roller end side 21 and rim 31 in respect of alignment errors

- A defined contact point 22 is possible between the roller 13 and rim 31.

The proposed roller rim geometry is designed so that the contact point between the roller end side and rim lies with an ideal geometry in the spherical rim region. The susceptibility of the contact point in respect of alignment errors is in the spherical rim region identical with the susceptibility of a purely spherical rim. If the contact point is moved as a result of alignment errors into the widening rim region then the susceptibility is considerably reduced which can prevent “wandering” of the theoretical contact point beyond the rim edges and thus also high edge stresses.

There are different possibilities for configuring the widening rim region. On the one hand a straight rim region would be conceivable which adjoins the arc of the spherical rim region at a tangent. The widening rim region could also be defined by a radius which is larger than the radius of the spherical region.

Although the present invention was described with reference to an embodiment with tapered roller bearings and tapered rollers, exemplary embodiments are not restricted to such configurations. The present invention can also be applied in principle to other rollers and roller bearings, such as e.g. to cylinder and barrel-type bearings.

LIST OF REFERENCE NUMERALS

10	Roller bearing
11	Bearing inner ring
12	Bearing outer ring
13	Roller
14	Inner roller raceway
15	Outer roller raceway
16	Inner straight line
17	Outer straight line
18	Axis of rotation of bearing
19	Pivot point
20	Roller axis
21	Roller end side
22	Contact point
23	Spherical rim
24	Rim face radius
30	Part of a bearing ring
31	Partially spherical, partially widened rim
32	Rim face
33	Spherical rim face section
34	Widening rim face section
35	Corner region between raceway and rim face
36	Rim edge facing away from raceway
37	Border between spherical and widening rim face section
38	Tangential plane at spherical rim face section extended hypothetically into widening rim face section
39	Tangential plane at widening rim face section
40	Rim face geometry with purely spherical rim
60	Method of production
61	Step for providing a rim which is arranged on the end side with respect to the roller in order to dissipate axial forces with a rim face facing the roller end face
611	Sub-step for providing a spherical face section
612	Sub-step for providing a widening face section

Patentkrav

1. Rulleleje med en lejering (30) med en løbebane (14; 15) til i det mindste en rulle (13) i rullelejet, som har en i det mindste delvist kugleformet rulleendeflade (21) med en første krumning, idet lejeringen omfatter:
en til udledning af aksiale kræfter for enden af rullen (13) placeret kant (31) med en hen mod rullens endeflade vendende kantflade (32), som har et sfærisk kantfladeafsnit (33) med en anden krumning,
idet den første og den anden krumning er valgt således, at der mellem den kugleformede rulleendeflade (21) og det sfæriske kantfladeafsnit (33) opnås et første spaltemål (d_1),
kendetegnet ved, at kantfladen (32) desuden har et åbnende kantfladeafsnit (34) med en mindre krumning end den anden krumning til et større spaltemål (d_2) end det første spaltemål (d_1) mellem rulleendefladen (21) og det åbnende kantfladeafsnit (34).

2. Rulleleje ifølge krav 1, idet en vinkel (α) mellem et første tangentialniveau (38) på et hypotetisk ind i det åbnende kantfladesnit (34) forlænget sfærisk kantfladeafsnit (40) og et andet tangentialniveau (39) på det åbnende kantfladeafsnit (34) ligger i et område, der er større end 0° til 30°.

3. Rulleleje ifølge et af de foregående krav, hvor det sfæriske kantfladeafsnit (33) strækker sig over et kantfladeafsnit svarende til i det mindste en tredjedel af en kanthøjde (h) på kanten (31).

4. Rulleleje ifølge et af de foregående krav, hvor det sfæriske kantfladeafsnit (33) strækker sig ud fra et hjørneområde (35) mellem løbebanen (14) og kantfladen (32).

5. Rulleleje ifølge et af kravene 1 til 3, hvor et første åbnende kantfladeafsnit (34a) strækker sig ud fra et hjørneområde (35) mellem løbebanen (14) og kantfladen (32),

idet det sfæriske kantfladeafsnit (33) i radial retning slutter sig til det første åbnende kantfladeafsnit (34a), og idet et andet åbnende kantfladeafsnit (34b) i et område, som vender væk fra det første åbnende kantfladeafsnit (34a) i radial retning strækker sig ud fra det sfæriske kantfladeafsnit (33) til en radial ende (36) på kanten (31).

6. Rulleleje ifølge et af de foregående krav, idet det åbnende kantfladeafsnit (34) dannes ved hjælp af et tangentialt til den sfæriske kantfladeafsnit (33) tilsluttende plant kantfladeafsnit.

7. Rulleleje ifølge et af kravene 1 til 5, idet det åbnende kantfladeafsnit (34) dannes ved hjælp af et yderligere sfærisk kantfladeafsnit, som slutter sig til det sfæriske kantfladeafsnit (33), og som har en mindre krumning end den anden krumning på det sfæriske kantfladeafsnit (33).

8. Rulleleje ifølge et af de foregående krav, idet rullelejet er et konisk rulleleje, og rullen (13) er udformet som konisk rulle.

9. Rulleleje ifølge et af de foregående krav, idet lejeringen (30) er en inderlejering.

10. Fremgangsmåde (60) til fremstilling af en lejering (30) til et rulleleje med en løbebane (14; 15) til i det mindste en rulle (13), idet rullen har en kugleformet rulleendeflade (21) med en første krumning, med et trin (61) til tilvejebringelse af en til udledning af aksiale kræfter for enden af rullen (13) placeret kant (31) med en mod rulleendefladen (21) vendt kantflade (32), idet trinnet (61) til tilvejebringelse af kanten (31) har følgende trin:
tilvejebringelse (611) af et sfærisk fladeafsnit (33) i kantfladen med en anden krumning, idet den anden krumning i forhold til den første krumning er valgt således, at der mellem den kugleformede rulleendeflade (21) og det sfæriske kantfladeafsnit (33) opnås et første spaltemål (d_1);

kendetegnet ved

en frembringelse (612) af et åbnende fladeafsnit (34) i kantfladen med en krumning, der er mindre end den anden krumning, til et i forhold til det første spaltemål (d_1) forstørret spaltemål (d_2) mellem rulleendefladen (21) og det åbnende kantfladeafsnit (34).

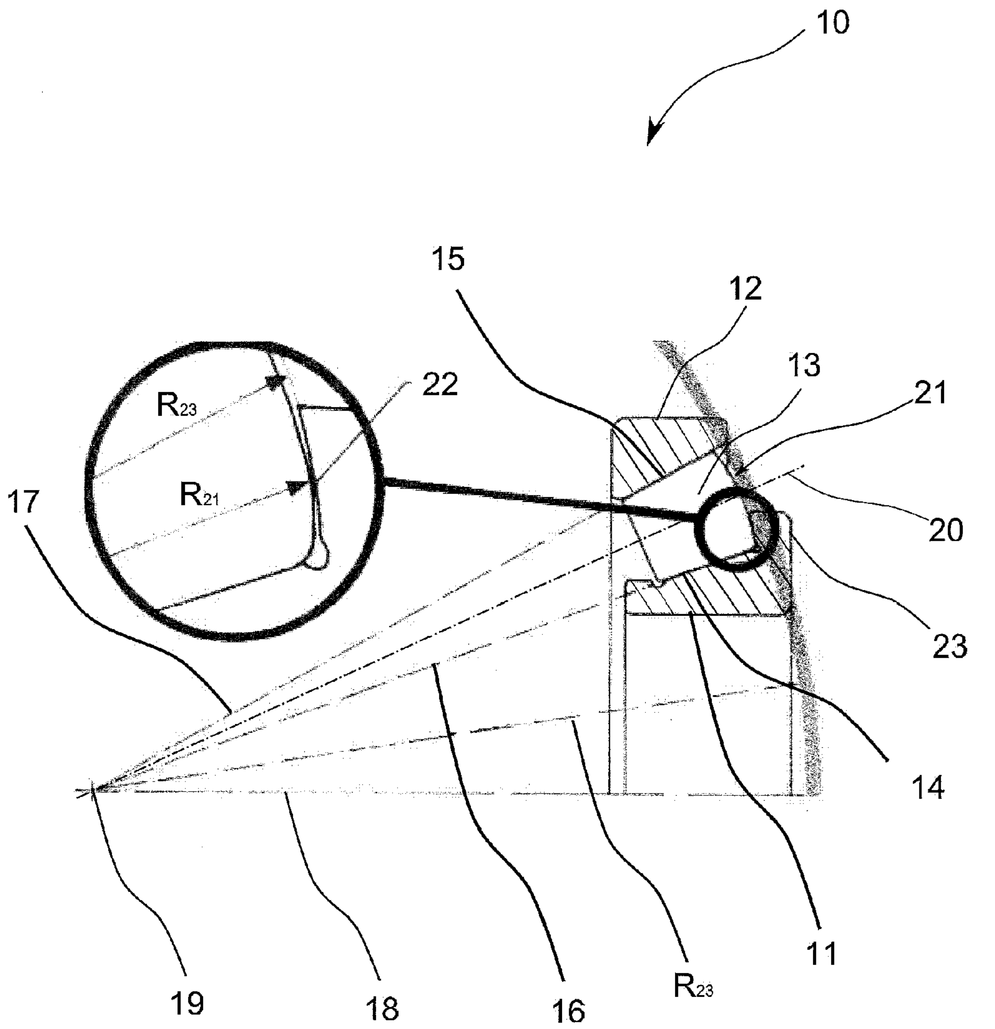

Fig. 1

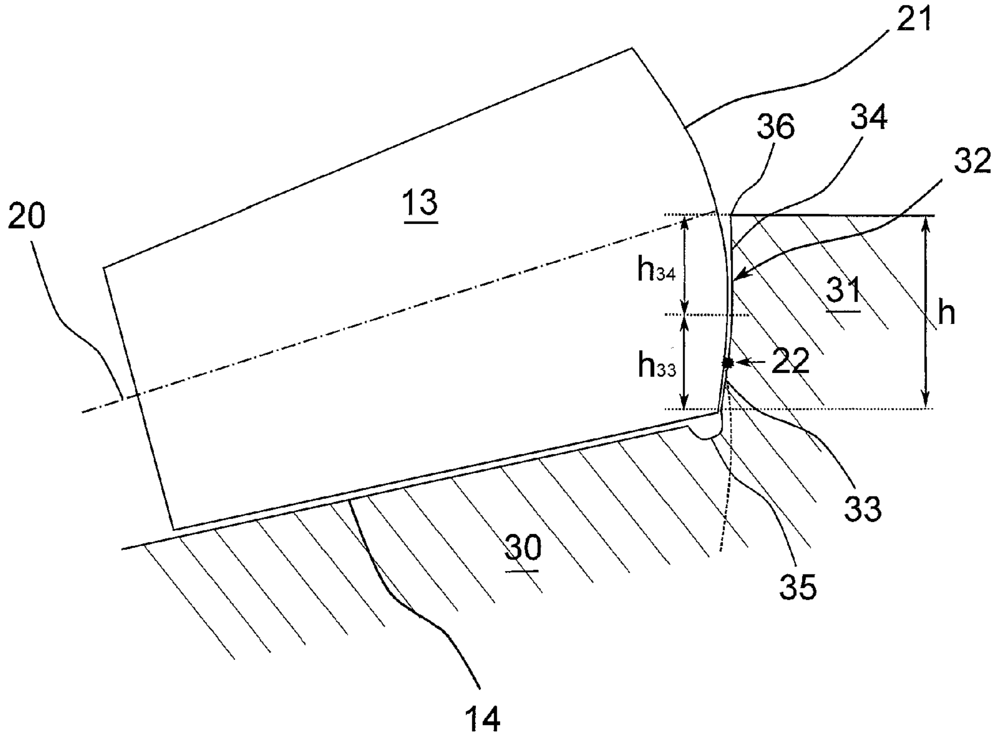

Fig. 2

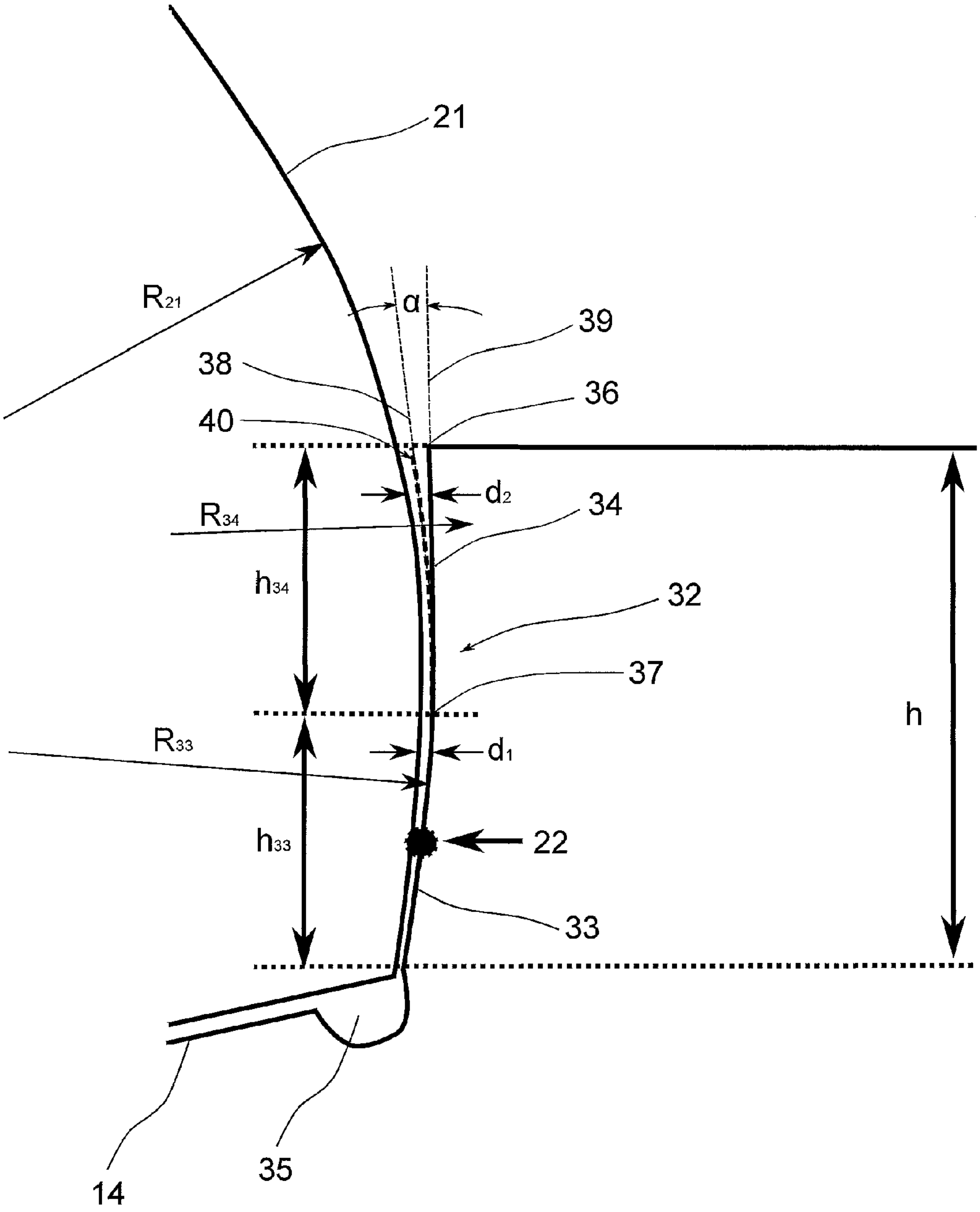

Fig. 3

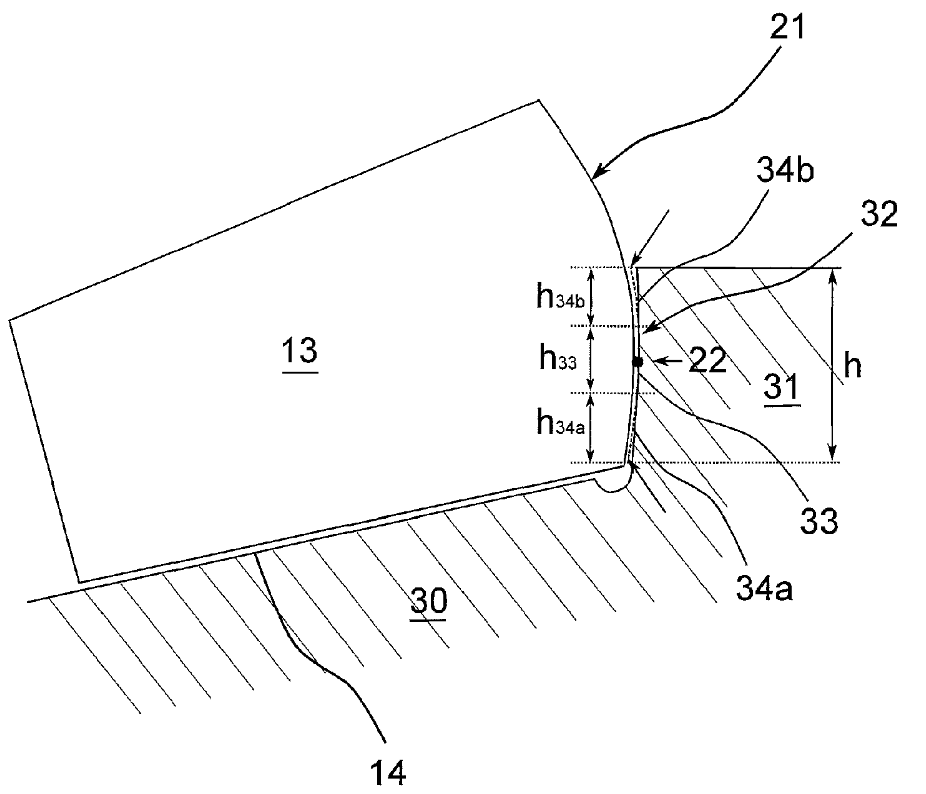

Fig. 4

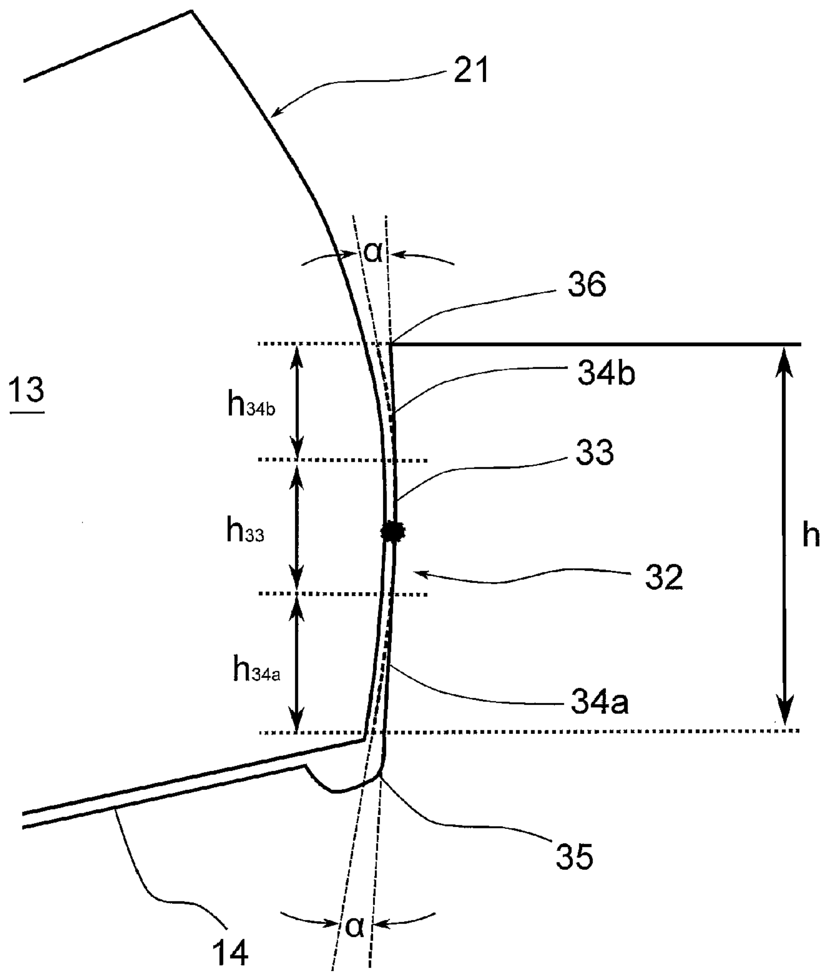

Fig. 5

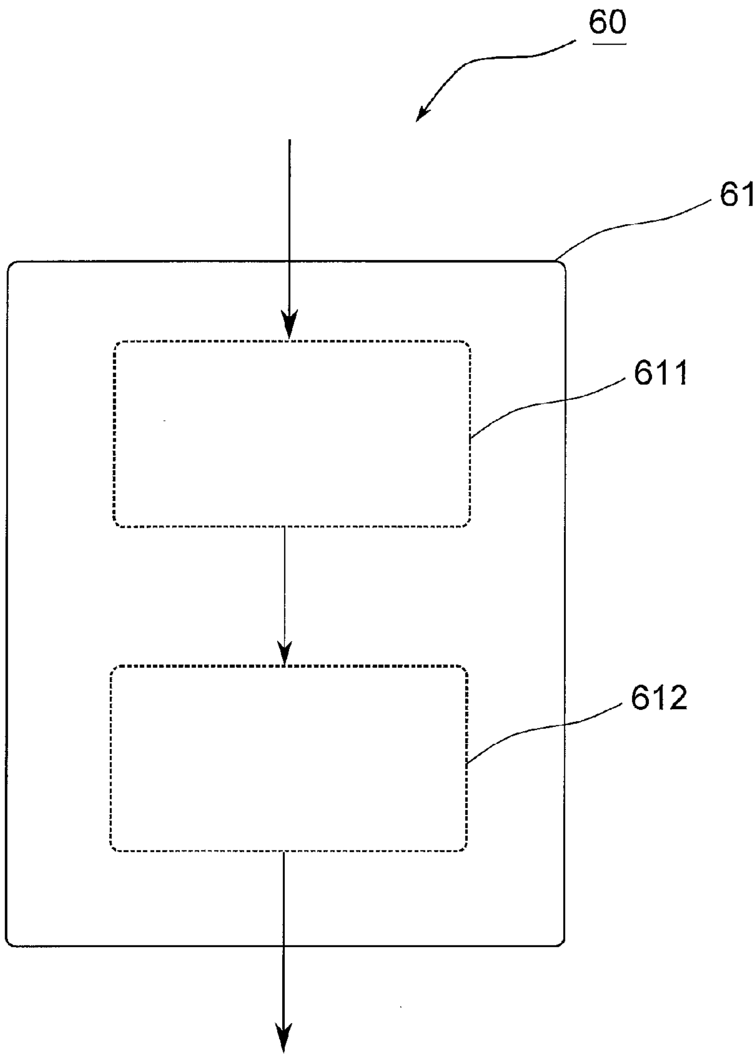

Fig. 6