Roller Bearings

The invention relates to a roller bearing according to the preamble of claim 1.

Roller bearings of this type or cages for such roller bearings are known for example from DT-C3-14 00 324, DE-A1-31 34 241, DE-C2-34 24 741, DE-A1-44 42 269, DE-A1-196 19 712, DE-A1-196 54 584, EP-B1-O 225 508 and EP-A1-O 392 146.

In the case of these known roller or rolling bearings, the webs of the cages have a considerable width so that only a small number of rollers can be accommodated in the bearing and hence the loading capacity of the roller bearing is relatively small.

The object of the invention consists in producing a roller bearing of the type mentioned initially in which the packing density of the rollers is high and which is easy to assemble.

This object is achieved according to the invention with the features of claim 1.

It is detected that the invention has been realised in the event that a bearing comprises substantially three different parts and a multiplicity of rollers. The rollers are located between an outer and an inner ring and are separated by the cage. The peculiarity of the cage resides in the fact that it comprises two cage rings with different diameters and webs, which generally have a wedge-shaped configuration and ensure that the rollers are disposed at a minimal spacing from each other. Generally, annular recesses or flanges are provided in the inner and/or outer ring and ensure a preferably form-locking accommodation of the cage internally of the rings. As a result, it is ensured at the same time that the cage can be introduced between the two rings in an axial direction but cannot be led right through said rings.

Thus, the packing density of the rollers can be made greater than in the case of known roller bearings so that greater forces can be transferred. The assembly

of the roller bearing can be undertaken simply such that the inner ring of the roller bearing, which is slid onto an engine shaft, is fitted with rollers from an annular magazine, the rollers being maintained by lubricating grease. Afterwards, the shaft is introduced with the inner ring and the rollers into the outer ring, which is fitted with the cage. The cage can be fixed to the outer ring in any manner and the wedge-shaped webs can be disposed between the rollers. Because of the small contact faces which the rollers have with the wedge-shaped lateral face pieces of the cage, friction between the rollers and the cage is minimised.

The running faces, in which the roller bearings are guided, can of course also be configured in the outer ring itself, i.e. not on the inner ring so that the cage is correspondingly changed and mounted on the inner ring.

The different embodiments of the invention thus have in common that the cage serves for separation of the generally cylindrical roller bodies, is mounted in the outer or inner ring of the bearing and can be introduced in an axial direction of the bearing.

Further useful and advantageous embodiments of the invention emerge from the sub-claims.

A particularly useful embodiment of the invention provides that the outer and the inner diameters of the cage rings are adapted to the inner or outer diameters of the rings whilst taking account of the outer diameters of the rollers. It is ensured by these measures that the cage rings, which generally have different diameters, can be introduced between the cage rings but cannot be led right through the roller bearing.

A further useful embodiment of the invention provides that the ring flanges are orientated towards the axes of the rollers. It is ensured by these measures that the rollers are guided either by one or the other cage ring or by both together.

Furthermore, a useful embodiment of the invention provides that the webs are configured as projections which preferably have a substantially trapezoidal or triangular cross section. It is useful within the scope of this inventive idea if the webs have wedge-shaped lateral face pieces. As a result, stability of the cage is ensured, on the one hand, and, on the other hand, also that the spacing between two adjacent rollers respectively can be kept to a minimum.

According to a further embodiment of the invention, the width of the webs in the region of the wedge-shaped lateral face pieces is chosen such that the spacing of the rollers from each other is only the minimum which still permits lubrication of the bearings. Hence, the packing density of the rollers can be configured optimally, which results in good force transference internally of the bearing.

Preferably, the spacing of the rollers is only a few tenths of a millimetre, according to a further embodiment.

It so happens in a further embodiment of the invention that the outer ring has a lateral, annular recess into which the cage ring, which has the greater inner diameter, is fitted in a form-locking manner. A roller bearing of this type is particularly suitable as a double bearing in which the sides of two outer rings, which sides are provided with the recesses, contact each other. The fitting can preferably also be a force fit.

The advantages achieved by the invention consist particularly in the fact that the proposed bearing can be used not only with a centric arrangement of shafts and components but also with an eccentric arrangement. In the case of an eccentric arrangement, additional forces occur as a result of which both the bearing itself and the cage can be especially stressed. In the known case, the cage is guided radially on the rollers and consequently is excessively loaded by the rollers in the case of an eccentric arrangement. On the other hand, the cage can be guided according to the invention on the outer ring and/or on the inner ring, as a result of which the cage can be used advantageously, particularly with an eccentric arrangement of components. Consequently, the

cage is not particularly subjected to additional forces of the roller bearing. The construction of the cage does not need to be especially robust. At the same time, a particularly advantageous assembly of the cage is possible.

Finally, it is significant that the cage according to the invention permits an especially small width of the roller bearing because the cage rings can have a narrow cross section. At the same time, the cage rings can be sufficiently high because there is adequate space for their cross section height in the radial direction. The most important object of the cage consists in separation of the rollers, a uniform distribution of the rollers being assured at the same time on the circumference of their running path. The cage is generally made of plastic material and can be produced by injection moulding.

The invention is now explained in greater detail with reference to embodiments, given by way of example, which show:

Fig. 1 an exploded perspective illustration of a roller bearing,

Fig. 2 a radial section through the assembled roller bearing according to Fig. 1,

Fig. 3 another radial section through the assembled roller bearing according to Fig. 1,

Fig.3a the roller bearing according to Fig. 3, but without the cage,

Fig. 4 an axial plan view of the cage illustrated in Fig. 1, with a peripheral partial section VI,

Fig. 5 a section through the cage along the line V-V in Fig. 4,

Fig. 6 an enlargement of the partial section VI in Fig. 4,

Fig. 7 an enlargement of the detail VII in Fig. 8,

Fig. 8 a reduced, perspective view of the cage illustrated in Fig. 4,

Fig. 9 a radial section through the assembled roller bearing according to a second embodiment,

Fig. 10 another radial section through the assembled roller bearing according to a second embodiment,

Fig. 10a the roller bearing according to Fig. 10, but without the cage,

Fig. 11 an axial plan view of the cage illustrated in Fig. 9, with a peripheral partial section XIII,

Fig. 12 a section through the cage along the line XII-XII according to Fig. 11,

Fig. 13 an enlargement of the partial section XIII in Fig. 11,

Fig. 14 an enlargement of the detail XIV in Fig. 15,

Fig. 15 a reduced, perspective view of the cage illustrated in Fig. 9,

Fig. 16 a radial section through the assembled roller bearing according to a third embodiment,

Fig. 17 another radial section through the assembled roller bearing according to a third embodiment,

Fig. 17a the roller bearing according to Fig. 17, but without the cage,

Fig. 18 an axial plan view of the cage illustrated in Fig. 17, with a peripheral partial section XX,

Fig. 19 a section through the cage along the line XIX-XIX according to Fig. 18,

Fig. 20 an enlargement of the partial section XX in Fig. 18,

Fig. 21 an enlargement of the detail XXI according to Fig. 22,

Fig. 22 a reduced, perspective view of the cage illustrated in Fig. 16,

Fig. 23 a radial section through the assembled roller bearing according to a fourth embodiment,

Fig. 24 another radial section through the assembled roller bearing according to a fourth embodiment,

Fig. 24a the roller bearing according to Fig. 24, but without the cage,

Fig. 25 an axial plan view of the cage illustrated in Fig. 23, with a peripheral partial section XXVII,

Fig. 26 a section through the cage along the line XXVI-XXVI according to Fig. 25,

Fig. 27 an enlargement of the partial section XXVII according to Fig. 25,

Fig. 28 an enlargement of the detail XXVIII according to Fig. 29, and

Fig. 29 a reduced, perspective view of the cage illustrated in Fig. 23.

The roller bearing in Fig. 1 comprises an inner ring 10, a set of cylindrical rollers 12, a cage 100 and an outer ring 30 and is mounted rotatably about the axis 40a.

The inner ring 10 is provided on its axial ends with an annular flange 10b or 10c respectively which delimit a running face 10a for the rollers 12. Because of the annular flanges 10b, 10c, the rollers are safeguarded against axial

displacement. The spacing A of the rollers 12 from each other when inserted in the inner ring 10 is preferably approx. 0.1 mm. The rollers 12 can be inserted for example from a not-shown, annular magazine into the inner ring 10 by means of lubricating grease. The axial length of the rollers 12 corresponds approximately to the spacing of the annular flanges 10b and 10c from each other.

The cage 100 has a front cage ring 102, a rear cage ring 101 and a number of webs 104, which number corresponds to the number of rollers 12, which webs extend transversely between the cage rings 101, 102 and are distributed uniformly on the circumference of the cage 100. The webs 104 are configured in a wedge-shaped cross section, a trapezoidal one here, as Figs. 4 and 6 show in particular. In general, the webs are configured such that they taper towards the axes 12c of the rollers 12. The webs 104 have, as is shown most clearly in Fig. 7, wedge-shaped lateral face pieces 104a and 104b, which are configured at the ends of said webs respectively as projections, and opposite to which pieces (104a and 104b) central wedge-shaped lateral face pieces 104c are offset towards the interior. The wedge-shaped lateral face pieces 104a, 104b serve to guide the rollers 12, while the wedge-shaped lateral face pieces 104c are not in contact with the rollers 12. The contact faces of the webs 104 with the rollers 12 are therefore very small. The rollers 12 are rotatable about their axes 12c and provided with cylindrical running faces 12a. The axial end-side 12b of the rollers 12 is in contact with the face 101b. The front cage ring 102 has a larger inner diameter d1 (Fig. 3) than the inner diameter d2 of the outer ring 30 while the rear cage ring 101 has a smaller outer diameter d3 than the inner diameter d2 of the outer ring 30. Consequently, the cage 100 can, on the one hand, be pushed over the rollers 12 or vice versa the rollers 12 can be pushed into the cage 100 and, on the other hand, the cage 100 can be pushed into the outer ring 30, during assembly of the roller bearing. When the roller bearing is mounted, the rear end-side 12b of each roller 12 abuts against the inner face 101b of the cage ring 101 (Fig. 3).

In the front lateral wall of the outer ring 30 there is provided an annular recess 30' with a diameter d4 by means of which a vertical receiving face 30'a and a

horizontal receiving face 30'b are formed, and the radial inner side defines a further running face 31 for the rollers 12 (Fig. 2, 3a). The front cage ring 102 is fitted into this recess 30' such that the inner face 102a of said cage ring is situated opposite the vertical outer face 30'a while the edge face 102b of the cage ring 102 is situated opposite the horizontal receiving face 30'b. The outer face 102c of the cage ring 102 thereby terminates flush with the front lateral face of the outer ring 30 or, with respect to the latter, is offset towards the interior. The arrangement of the cage 100 on the outer ring can be effected in any manner. However, the arrangement is effected preferably by receiving of the front cage ring 102 in the recess 30' in which said arrangement is mounted with clearance and in a floating manner.

It also emerges from Fig. 2 that the outer face 104d of each strut 104 is offset towards the interior relative to the edge face 101a of the rear cage ring 101 so that a larger gap 29 is formed between the running face 31 of the outer ring 30 and the outer face of the strut 104d. This gap ensures better passage of the lubricating grease. The cage 100, illustrated in Figs. 4, 5 and 8, with the cage rings 101, 102 has the measurements d1 and d5 or d3 in the radial direction. The larger cage ring 102 has two radially orientated faces 102a and 102c and an axially orientated face 102b while the smaller cage ring 101 is provided with faces 101a, 101c and 101b (cf. Fig. 3). There applies thereby: $d3 \leq d2 \leq d1$ and $d5 \leq d4$.

The dimensions here are chosen such that the cage in the confines of its radial clearance does not "fall" onto the rollers, otherwise the result could be radial guidance of the cage on the rollers, which is undesirable. Rather, the cage is guided via its radial faces 101a and 102b on the faces 30'b and 31.

A second embodiment of the invention is illustrated in Figs. 9 to 15, the parts which have the same function as the parts according to Figs. 1 to 8 being provided with the index "1". The peculiarity of the embodiment consists in the fact that the inner ring 10.1 has only one annular flange 10b.1, the outer ring 30.1 has an annular flange 30".1 and the cage 100.1 is configured such that it can be disposed between the two rings for operation.

The peculiarities of the cage 100.1 consist in the fact that its rear cage ring 100.1 is offset in steps, its face 101a.1 and 101b.1 co-operating with the flange 30".1. The rollers 12 are guided between the annular flanges 10b.1 and 30".1. There applies thereby $d3 \leq d6 \leq d1 \leq d2 \leq d5 \leq d4$.

A third embodiment of the invention is illustrated in Figs. 16 to 22, the parts which have the same function as the parts according to Figs. 1 to 8 being provided with the index "2".

The third embodiment of the invention illustrated in Figs. 16 to 22 has the peculiarity that the outer ring 30.2 is provided with two annular flanges 30'.2 and 30".2, while the inner ring 10.2 has, on the one hand, no annular flange and, on the other hand, an annular recess 10'.2. The cage 100.2 is also configured correspondingly, its webs tapering from the central axis 40a outwardly. This embodiment of the invention differs therefore from the first embodiment according to Fig. 1 in that the outer ring 30.2 has the annular flanges 30'.2, 30".2 and the recess 10'.2 is configured in the inner ring 10.2. There applies therefore a certain kinematic reversal of specific functional parts. There applies thereby $d4 \leq d5 \leq d1 \leq d2 \leq d3$.

The cage 100.2 is thus configured as an "external toothed wheel", while the cage 100 according to Fig. 8 is configured as an "internal toothed wheel".

A fourth embodiment of the invention is illustrated in Figs. 23 to 29, the parts which have the same function as the parts according to Figs. 1 to 8 being provided with the index "3".

The fourth embodiment of the invention illustrated in Figs. 23 to 29 has the peculiarity that the outer ring 30.3 has only one flange 30'.3 while the inner ring 10.3 has, however, an annular recess 10'.3 and an annular flange 10c.3. The cage 100.3 is adapted correspondingly. There applies thereby $d4 \leq d5 \leq d1 \leq d2 \leq d6 \leq d3$.

Claims

1. Roller bearing having an inner ring (10), an outer ring (30), a set of rollers (12), which run between the inner ring (10) and the outer ring (30), and having a cage (100) provided with two cage rings (101, 102), between which the rollers (12) are disposed on webs (104) which maintain a spacing,
characterised in that
the inner ring (10, 10.1, 10.2, 10.3) and/or the outer ring (30, 30.1, 30.2, 30.3) have respectively at least one annular flange (10b, 10c; 10b.1, 30".1; 30'.2, 30".2; 30'.3, 10c.3) for the rollers (12),
in that the webs (104, 104.1, 104.2, 104.3) taper in a radial direction and
in that the inner ring (10, 10.1, 10.2, 10.3) and/or the outer ring (30, 30.1, 30.2, 30.3) has at least one axially open recess (30', 30'.1, 10'.2, 10'.3) for one of the cage rings (101, 102; 101.1, 102.1; 101.2, 102.2; 101.3, 102.3).

2. Roller bearing according to claim1,
characterised in that
the cage (100) can be introduced between the rings (10, 30) in an axial direction and be positioned internally of the latter.

3. Roller bearing according to claim 1 or 2,
characterised in that
the outer and the inner diameters of the cage rings (101, 102) are adapted to the inner or the outer diameters of the rings (10, 30) while taking account of the outer diameters of the rollers (12).

4. Roller bearing according to one of the claims 1 to 3,
characterised in that
the annular flanges (10b, 10c) are orientated towards the axes (12c) of the rollers (12).

5. Roller bearing according to one of the claims 1 to 4,
characterised in that

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the webs (104) are configured as projections.

6. Roller bearing according to one of the claims 1 to 5,
characterised in that
the webs (104) have a substantially trapezoidal or triangular cross section.

7. Roller bearing according to one of the claims 1 to 6,
characterised in that
the webs (104) have wedge-shaped lateral face pieces (104a, 104b).

8. Roller bearing according to one of the claims 1 to 7,
characterised in that
the width of the webs (104) in the region of the wedge-shaped lateral face pieces (104a, 104b) is dimensioned such that the spacing (A) of the rollers (12) from each other is only the minimum which still permits lubrication of the bearing.

9. Roller bearing according to one of the claims 1 to 8,
characterised in that
the spacing of the rollers (12) from each other is 0.1 - 0.8 mm.

10. Roller bearing according to one of the claims 1 to 9,
characterised in that
the lateral recess (30'), into which the one cage ring (102) is fitted, is annular.

11. Roller bearing according to one of the claims 1 to 10,
characterised in that
there is disposed between the wedge-shaped lateral face pieces (104a, 104b) a wedge-shaped lateral face piece (104c), which is offset towards the interior and is not in contact with the rollers (12).

12. Roller bearing according to one of the claims 1 to 11,
characterised in that

the approximately centrally disposed wedge-shaped lateral face piece (104c) is greater than the sum of the faces of the two other wedge-shaped lateral face pieces (104a, 104b).

13. Roller bearing according to one of the claims 1 to 12, characterised in that the recess (30') has a stepped cross section.

14. Roller bearing according to one of the claims 1 to 13, characterised in that the axial outer faces (101c, 102c) of the cage rings (101, 102) are disposed internally of the outer ring (30).

15. Roller bearing according to one of the claims 1 to 14, characterised in that the cage (100) is made of plastic material.

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