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# (54) A self-aligning two row thrust roller bearing.

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# A self-aligning two row thrust roller bearing

This invention relates to a self-aligning thrust roller bearing incorporating two relatively rotatable elements, each of which being provided with at least one coaxial race track and a number of rollers provided between and in engagement with the race tracks, the angle between the bearing axis and the roller axes exceeding 20°, the race tracks and the rollers being curved in axial section.

Spherical thrust roller bearings are earlier known. These bearings generally have one row of unsymmetrical rollers, one bearing ring with a spherical race track and one bearing ring with a roller guiding flange.

Rings having flanges are expensive to manufacture and bearings having such rings have a high starting friction. It is thus desirable to avoid the need of the flange. A possible method for avoiding a flange is to use symmetrical rollers. A roller is in this respect considered to be symmetrical if it can be divided in two congruent halves with a cross sectional plane half way between the ends of the roller. Symmetrical rollers having such a large axial extension and being arranged with such a large angle between the roller axis and the bearing axis as the rollers appearing in spherical thrust bearings are, however, difficult to guide with a desired precision. Furthermore, the sliding in the contact points between the roller and the race track will be large, which leads to power losses and a risk for bearing failure due to the generated friction heat.

The purpose of the present invention is to provide a bearing of the type defined in the preamble, wherein a good roller guiding is obtained without a flange on one of the rings and which has a low friction at start and during operation.

This is achieved according to the invention thereby that the bearing is given the characteristics defined in the accompanying claim 1.

Due to the fact that all rollers of the bearing have the same revolution angular speed about the bearing axis only one cage for the rollers is needed, which saves space and cost. A good roller guiding can easily be obtained by the rollers being arranged to contact each other adjacent the inner race ring or by means of a guiding ring at the outer race ring. Both roller rows are subjected to load when the bearing takes up axial load, which guarantees a good guiding of all rollers. By using two rollers instead of one roller with a corresponding axial extension it is possible to halve the bearing friction losses, since the relative sliding between the roller and the race track, i.e. the relation between the sliding speed and the rolling speed, is about proportional to the length of the roller.

Hereinafter the invention will be further described with reference to the accompanying drawing, which shows an axial section through a bearing according to an embodiment of the invention.

The bearing has two rings 1 and 2 each having $CO_2$ axial race tracks for a number of symmetrical rollers 3,4 provided between the rings, which rollers are arranged in double rows, and the rollers in both rows are preferably identical. The roller rows are situated side by side and the axes 5, 6 of the rollers in each roller row are inclined in the same direction relative to the bearing axis 7. The race track of the ring 2 has preferably a spherical surface, which means that the ring 1 and the set of rollers with the rollers 3, 4 and roller cage 8 can be freely tilted relative to the ring 2 without causing a too high contact pressure at the contact between the roller and the race track. If only a limited self-alignment is aimed at, it is possible to let the surface of the race track be non-spherical.

As both roller rows will take up load when the bearing is subjected to axial load the load capacity of the bearing is of the same size as the load capacity of a one row bearing, the rollers of which are twice as long as the rollers 3 and 4 and has a corresponding contact angle. The limited length of the rollers 3, 4 together with the fact that both roller rows are exposed to load means that the guiding of the rollers will not cause any great difficulties. In order to obtain a good roller guiding it is possible to allow the ends of the rollers of rollers in different rows to contact each other adjacent the inner race ring 1 such as shown in point 9. Alternatively it is possible to arrange a loose guiding ring 10 between the roller rows adjacent the outer race ring.

In all roller bearings having curved race track profiles and correspondingly curved roller profiles a certain sliding will take place at the contact points between the roller race track and the roller, which will cause friction losses. An estimation of how large these losses are in a bearing is the size of the relative sliding in these contact points. The relative sliding is defined as the ratio between the sliding speed and the rolling speed in the contact points. It can be shown that in a bearing having symmetrical rollers and in which a pure rolling takes place in only one rolling contact point the relative sliding is proportonal to the length of the roller. If the available length of the roller is divided on several rollers, such as in the present invention, the relative sliding is reduced and thereby also the friction losses as also the load is divided on several rollers.

The rollers of the two rows in a bearing according to the invention always have the same revolution angular speed relative to each other. A single cage can thus be used for both roller rows without risking that the rollers of one row will influence the rollers of the other row through the cage. Besides being space saving

the use of one single cage means that the bearing will be more easy to manufacture and to handle as it incorporates as few separate parts as possible.

Within the scope of the invention it is possible to vary the bearing design within wide ranges. The bearing can be provided with three or more rows of rollers if it is desired to produce an extra large load capacity and a low relative sliding. The race tracks can also be arranged on more than two rings.

**Claims**

1. A self-aligning thrust roller bearing incorporating two relatively rotatable elements, each of which being provided with at least one coaxial race track, and a number of rollers provided between and in engagement with the race tracks, the angles between the bearing axis and the roller axes exceeding 20°, the race tracks and the rollers being curved in axial section, characterized by that said rollers are arranged in at least two rows beside each other, that the axes (5, 6) of the rollers are inclined in the same direction relative to the bearing axis, and that all rollers are symmetrical around central cross-sectional planes through the respective rollers, no roller guiding flange being provided on any of said elements.

2. A self-aligning thrust roller bearing according to claim 1 characterized thereby that it has a single roller cage (8).

3. A self-aligning thrust roller bearing according to any one of claims 1 or 2, characterized thereby that it incorporates a loose roller guiding ring (10) provided between the rows of rollers.

4. A self-aligning thrust roller bearing according to any one of claims 1 or 2, characterized thereby that the adjacent ends of rollers in different rows are arranged to engage each other.

**Revendications**

1. Butée à rotule sur rouleaux comprenant deux éléments pouvant être mis en rotation relative, chacun d'eux comportant au moins un chemin de roulement coaxial, et un certain nombre de rouleaux disposés entre les chemins et en contact avex eux, les angles entre l'axe de la butée et les axes des rouleaux dépassant 20° et les chemins et les rouleaux présentant en coupe axiale une courbure, butée caractérisée par le fait que lesdits rouleaux sont disposés sur au moins deux rangées côte à côte, que les axes (5, 6) des rouleaux sont inclinés dans la même direction par rapport à l'axe de la butée et que tous les rouleaux sont symétriques par rapport aux plans de coupe transversale passant respectivement par leurs centres, aucun desdits éléments ne comportant d'épaulement de guidage pour les rouleaux.

2. Butée à rotule sur rouleaux selon la revendication 1, caractérisée par le fait qu'elle ne comporte qu'une seule cage à rouleaux (8).

3. Butée à rotule sur rouleaux selon l'une quelconque des revendications 1 et 2, caractérisée par le fait qu'elle comporte une bague de guidage libre (10) pour les rouleaux, disposée entre les rangées de rouleaux.

4. Butée à rotule sur rouleaux selon l'une quelconque des revendications 1 ou 2, caractérisée par le fait que les faces adjacentes des rouleaux de différentes rangées sont disposées de manière à être en contact réciproque.

**Patentansprüche**

1. Selbsteinstellendes Axial-Rollenlager, bestehend aus zwei relativ zueinander drehbaren Lagerscheiben, von denen jede mit mindestens einer koaxialen Laufbahn versehen ist, und aus einer Anzahl zwischen den Lagerscheiben angeordneter und mit den Laufbahnen in Berührung stehender Rollen, wobei die Winkel zwischen der Lagerachse und den Achsen der Rollen größer als 20° und die Laufbahnen und die Mantelflächen der Rollen im Axialschnitt gekrümmt sind, dadurch gekennzeichnet, daß die Rollen (3, 4) in zwei nebeneinander liegenden Reihen angeordnet sind, daß die Achsen (5, 6) der Rollen (3, 4) in der gleichen Richtung im Bezug auf die Lagerachse (7) geneigt sind, daß alle Rollen (3, 4) symmetrisch zu den Mittenebenen durch die entsprechenden Rollen (3, 4) sind un daß die beiden Lagerscheiben (1, 2) ohne einen festen Führungsflansch ausgebildet sind.

2. Selbsteinstellendes Axial-Rollenlager nach Anspruch 1, gekennzeichnet durch einen einzigen Käfig (8) für die (beiden Reihen von) Rollen (3, 4).

3. Selbsteinstellendes Axial-Rollenlager nach einem der Ansprüche 1 oder 2, gekennzeichnet durch einen losen zwischen den beiden Reihen von Rollen (3, 4) angeordneten Führungsring (10).

4. Selbsteinstellendes Axial-Rollenlager nach einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die einander zugewandten Stirnseiten der Rollen (3, 4) beider Reihen in Berührung miteinander sind.

FIG.1