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BEARING DEVICE, IN PARTICULAR FOR YARN FEEDERS

The invention relates to a bearing device, which is intended in particular for textile industry devices, such as yarn feeders.

Textile industry devices, yarn feeders or the like often have rotatably supported shafts or similar elements, with which other elements, such as yarn guide drums or the like, have to be supported precisely. Relatively stringent demands are made of the precision of the bearing as a rule. Furthermore, the bearings must usually be smooth-running. Preceding transmission elements, such as toothed belts or other belts, often have a relatively high resilience. If appropriate bearings are not constantly smooth-running, then the affected elements usually run unevenly, which usually cannot be tolerated.

While the demands made for bearing precision are thus high as a rule, still textile industry devices usually have to be easy to put together and maintain. Often, parts or housings are also made of plastic, which can shrink or swell as a consequence of aging or environmental factors (moisture, temperature), and furthermore plastic parts are always subject to a certain tolerance in production. Such tolerances and time- or ambient- dictated dimensional changes should of course not lead to a functional impairment of such devices.

From US Patent 5,860,298, for instance, a yarn feeder (positive feeder) is known, in which a vertically oriented shaft is rotatably supported on a basic retainer. For bearing purposes, two ball bearings are provided, which are received in suitable cylindrical pockets of the basic carrier.

The bearing seat has to adhere to close tolerances, in order to assure a good seating of the outer bearing ring. Installing and removing the bearings is usually not readily possible.

From European Patent Disclosure EP 0 742 304 A1, a yarn delivery apparatus with a horizontally divided housing is also known, in which a plurality of horizontally disposed shafts that pass through the housing wall are rotatably supported. In the housing wall, bearing seats are formed, which are penetrated by the dividing seam that is formed



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between the two halves of the housing. Adaptation to production tolerances or other dimensional fluctuations is accomplished by the inherent resilience of the housing material, in conjunction with an only regional contact of the outer bearing ring with the corresponding faces of the bearing seat, by an O-ring disposed between the outer bearing ring and the bearing seat, or by special elastically resilient spring elements in the bearing seat.

In this yarn feeder, the bearings are inserted from the dividing seam of the housing into the appropriate pockets, with the housing open. The bearing is then firmly clamped between the housing parts. The construction is not very vulnerable to tolerances but does require a housing seam that passes through the bearing seat.

With this as the point of departure, it is the object of the invention to create a bearing device, particularly for such textile industry devices as yarn feeders, which is not vulnerable to tolerances and in which the bearing seat can be undivided, that is, can be in one piece.

This object is attained with a bearing device in accordance with claim 1.

The bearing device has a bearing seat, which defines a receiving chamber for a roller bearing and a squeeze element. The squeeze element is squeezed together at regions spaced apart from one another, so that material of the squeeze element is positively displaced out of the squeeze zones. Regardless of any tolerances of the bearing seat, the squeeze element secures the roller bearing nonrotatably in the bearing seat and at the same time makes it possible for the roller bearing to be inserted easily into the bearing seat. If needed, the bearing seat can therefore be embodied in undivided fashion.

The squeeze element can be embodied as a closed ring or as a striplike element that is put together to form a ring. It is preferably made of an elastomer. It can have either a uniform thickness throughout or locally thickened regions. Thus the squeeze zones can be defined by the shape of the bearing seat or the shape of the squeeze element. The deformation of the squeeze element locally reduces its thickness by positively displacing material. For compensation, its thickness increases in the vicinity of the compressed or squeezed region.

If the squeeze elements have thickened portions, then the bearing seat can for instance be embodied cylindrically. If the squeeze elements are uniformly thick, then the shape of the bearing seat is other than circular, so that the spacing from the roller bearing is not uniform along the circumference.

To that end, the bearing seat can be shaped polygonally or in other ways, for instance being provided with protrusions in the direction of the roller bearing. In one embodiment, the receiving chamber has ribs extending substantially parallel to the pivot axis of the roller bearing. On their side toward the roller bearing, the ribs have end faces that are located on a circle which is somewhat greater than the circle defined by the outer bearing ring of the roller bearing. Thus between the end faces and the cylindrical outer face of the roller bearing, a play arises, which is filled up by a squeeze element. This element is placed radially outward on the end faces of the ribs, while it is braced radially inward on the outer face of the outer ring. The squeeze element adjusts to the actual play present, so that deviations in shape and dimension of the bearing seat and dimensional changes caused by aging, down to the range of a tenth of a millimeter, do not impair the seating of the roller bearing. Because the squeeze element contacts the ribs only in strips, the roller bearing can moreover be pressed with only slight impression forces axially into the bearing seat and removed from it again as needed. The squeeze element rests preferably over a large surface area on the outer face of the roller bearing, so that it can be inserted with the roller bearing into the bearing seat. The static friction between the outer ring and the squeeze element prevents the squeeze element from displacement counter to the outer ring, while conversely it slides easily along the ribs, with which it has only a narrow striplike contact. This not only facilitates installation and removal but also prevents an axial warping of the roller bearing. Once the roller bearing is seated in the bearing seat, its outer ring is reliably secured against rotation. Moreover, the squeeze element cushions the outer bearing ring against the housing and compensates for deviations in shape of the bearing seat.

The receiving chamber is preferably open axially to one side, to allow access to the roller bearing. If needed, the receiving chamber can be closed with a cover element.

The ribs are preferably relatively narrow, and they are disposed at a comparatively wide spacing from one another. This makes it possible for the bearings, provided with

squeeze elements, to be inserted axially with only slight force into the bearing seats, yet even so a secure, precise seat of the bearing is always attained.

It is advantageous if the gaps or recesses between the ribs have a greater volume than the volume of the applicable portion of the squeeze element to be received. Toward the seat, the bearing is supported essentially only via the ribs. The squeeze element distributes the striplike or linear load to a somewhat larger area on the outer circumference of the roller bearing.

On the side toward the roller bearing, the ribs can have an edge or a narrow bearing face. This edge or face may be plane or curved. It is expedient to attempt to attain only a narrow linear or striplike contact face between the squeeze element and the rib. Because axial mounting is possible, the bearing seat makes do without a dividing seam. The clamping force with which the bearing is retained in the bearing seat can thus be brought to bear and generated independently of fastening elements, which for instance hold housing parts together. The bearing seat may be closed (seamless).

The squeeze elements furthermore allow a certain change of angle of the bearings, so that it is readily possible to provide bearing seats for bearings of a shaft on different housing parts. Centering means can preferably be provided, which at least approximately assure an alignment of the bearing seats.

The squeeze regions can be disposed at equal circumferential intervals. If a load absorbing preferential direction is desired, then the spacings can also be defined as unequal, for instance being placed closer together in the load-absorbing direction.

Further details of advantageous embodiments of the invention will become apparent from the drawing, description or dependent claims.

Shown in the drawing is one embodiment of the invention. Shown are:

Fig. 1, a yarn feeder in an overall perspective view;

Fig. 2, the yarn feeder of Fig. 1 in a sectional view;

Fig. 3, a bearing with a squeeze element and bearing seat of the yarn feeder of Figs. 1 and 2, in an axial plan view and on a different scale;

Fig. 4, the bearing of Fig. 3, in a fragmentary view and on a different scale;

Fig. 5, the distribution of pressure on the outer bearing ring in the vicinity of the rib of the bearing seat, in the form of a graph;

Fig. 6, a bearing with a cylindrical bearing seat and a squeeze element with defined squeeze regions, in a simplified sectional view;

Fig. 7, the squeeze element of the bearing of Fig. 6 with undeformed squeeze regions, in a fragmentary sectional view; and

Fig. 8, a modified embodiment of the bearing, in a simplified section view.

In Fig. 1, a yarn feeder 1 is shown that is used for delivering a yarn 2 to a textile machine. To that end, the yarn feeder 1 has a yarn guide drum 3, which is supported by a shaft 4 (Fig. 2). The shaft 4 is rotatably supported on a basic carrier 5, which is embodied as a two-shell housing. The basic carrier 5 includes an upper housing part 6 and a lower housing part 7, which adjoin one another and are held together at a dividing seam 8. To that end, fastening means (screws) 9, 10, 11 visible in Fig. 2 are provided.

The shaft 4, on its end remote from the yarn guide drum 3, is provided with two drive disks 14, 15, which are rotatably supported on the shaft 4 and can be coupled to the shaft 4 in a manner fixed against relative rotation as needed via a coupling disk 16.

For bearing the shaft 4, two ball bearings 18, 19 are provided, one of which is retained by the upper housing part 6 and the other by the lower housing part 7. To that end, respective bearing seats 21, 22 in the form of shallow, approximately cylindrical pockets are formed in the housing parts 6, 7. The bearing seats 21, 22 are formed by tubular protrusions or extensions on the housing parts 6, 7. The embodiment of the bearing seats 21, 22 is particularly apparent from Fig. 3, in which the bearing seat 21 is shown in plan view. The bearing seat 22 is structurally identical, so that the description below applies accordingly to it.

The bearing seat 21 has a prismatic or cylindrical internal shape. From the wall composed of curved or plane surface regions 24, 25, ribs 26 protrude radially inward; they are aligned parallel to a pivot axis 27 determined by the ball bearing 18. The ribs 26 are embodied identically to one another and are distributed at equal intervals along the circumference of the wall of the bearing seat 21. Each rib 26 has an approximately trapezoidal cross section, as seen particularly in Fig. 4. The ball bearing 18 has a cylindrical outer ring 29, whose outer face 31, with a striplike end face 32 oriented toward the outer ring 29, defines a narrow gap 33. Between adjacent ribs 26, receiving chambers 34 are formed, in which the gap defined between the surface region 24 (or 25) and the outer face 31 of the outer bearing ring 29 is markedly greater. Furthermore, as seen from Fig. 3, the spacing between adjacent ribs 26 is markedly greater than the width of an individual rib 26. The end faces 32, which are shown in Fig. 4 as narrow, striplike, substantially plane surface regions, can also reduce these end faces 32 to narrow edges that have a relatively short radius of curvature.

The end faces 32 are oriented parallel to the pivot axis 27, for example, and thus define a cylinder, which is disposed concentrically to the pivot axis 27. Alternatively, the end faces 32 may also be inclined somewhat from the pivot axis 27 and can thus define a conical outer shape.

Between the bearing seat 21 and the outer bearing ring 29 of the ball bearing 18, a squeeze element 36 is disposed, which is formed of a deformable material, preferably a material capable of resilient, yielding deformation, such as an elastomer. The squeeze element 36, in the present exemplary embodiment, is an annular element, which is seated on the cylindrical outer face 31 of the outer ring 29. It may be somewhat undersized, so that given a certain expansion it can rest with tension on the outer face 31. The width of the squeeze element 36 measured in the axial direction preferably matches the width of the outer bearing ring 29. In the radial direction, it has a thickness which is somewhat greater than the gap width 33, yet smaller than the spacing or gap formed between the wall 24 and the outer bearing face 31. The squeeze element 36 may also be formed by a band or by a plurality of pieces separated from one another.

As seen from Fig. 2, the shaft 4 is supported via the two spaced-apart ball bearings 18, 19, which are disposed in coaxial alignment with one another. To that end, the two housing parts 6, 7 are aligned with one another by aligning or centering means 41. The centering means 41 include a tubular extension 42, formed for instance on the lower housing part 7; this extension is disposed concentrically with both the bearing seat 22 and the shaft 4 and extends through the interior of the housing 5 to the upper housing part 6. The ladder has an annular collar 43, which extends toward the tubular extension 42, and is also disposed concentrically with the shaft 4. The lengths and diameter of the extension 42 and of the collar 43 are dimensioned such that the extension 42 engages the collar 43 with little or no play when the two housing parts 6, 7 are put one on the other and joined together. A certain axial play is possible. To make it easier for the extension 42 to find its way into the collar 43, the free end of the extension 42 may be embodied conically. In addition or as an alternative, the collar 43 may be provided with an introduction funnel. In this way, a centering device is formed that assures the alignment of the ball bearings 18, 19 even if the housing parts 6, 7 are subject to certain production variations. This can happen for instance if the housings are made by injection molding techniques, for instance of plastic.

The bearing seat 21, squeeze element 36 and ball bearing 18 form a bearing device 46, whose function is explained below:

When the housing 5 is put together, the extension 42 centers the lower housing part 7 relative to the housing part 6, so that the bearing seats 21, 22 are sufficiently aligned with one another. For further assembly, the roller bearings 18, 19 are now each provided with one squeeze element 36 and inserted axially into the bearing seats 21, 22. In the process, the ribs 26, which may have a funnel-like insertion bevel on their outward-pointing end, slide onto the squeeze element 26 and press into the initially cylindrically braced outside of the squeeze element, deforming it. There is enough room for the positively displaced material in the interstices between the ribs 26, so that the ball bearing 18 can slide unhindered into the receiving chamber surrounded by the bearing seat 21. The static friction between the squeeze element 36 and the outer face 31 prevents the squeeze element 36 from being pushed downward by the outer bearing ring 39. The friction between the squeeze element 36 and the ribs 26 is limited to small surface regions, so that the static friction that occurs here is substantially less. The ball bearing 28 can therefore be inserted easily into the bearing seat 21. This is true regardless of the precise width of the gap 33. If shape deformations should lead to different gap widths along the circumference of the ball bearing 18, or if the gap widths increase or decrease by a few tenths of a millimeter, this has no effect on the seat of the ball bearing 18.

In any case, the ball bearing 18 is held nonrotatably in the bearing seat. It is secured against the squeeze element 36 by the large-area contact and the resultant static friction. As Fig. 5 shows, the squeeze element rests with radial tension on the outer face 31. The radial tension is locally increased in the region of the rib 26, but otherwise exists over the entire circumference of the outer ring 29, and as a result adequate static friction is generated.

In the installed state, the squeeze element 36 is secured with positive engagement against rotation relative to the bearing seat 21. The ribs 26 press into the squeeze element 36, so that with respect to a rotation, there is positive engagement, while with respect to an axial motion, there is frictional engagement.

The squeeze element 36 centers the ball bearing 18 in the bearing seat 21. Because of its elastic resilience, dimensional and shape deviations can be compensated for. If needed, the ribs 26 may also be designed such that the pivot axis

of the ball bearing 18 is pivotable about relatively small angles. For instance, the ribs 26 may be crowned or curved toward the pivot axis; that is, the gap width 33 is then at a local minimum approximately in the center of the bearing.

In Fig. 6, a further embodiment of the bearing device 46 is shown, which deviates from the above-described embodiment with regard to the squeeze element 36 and the bearing seat 21. The elements are identified by the same reference numerals, each provided with an apostrophe to distinguish them.

The squeeze element 36' is embodied in striplike or annular fashion and has an average thickness which is less than a spacing a between the bearing seat 21 and the outer face 31 of the roller bearing 18. Beginning at a thin, striplike basic body 36a, squeeze regions 36b are provided, spaced apart at equal intervals circumferentially, which as shown in Figs. 7 have a preferably approximately circular cross section in the relaxed state. The diameter of this cross section is greater than the spacing a (Fig. 6). The squeeze regions 36b are therefore deformed, so that material of the squeeze element 36', which is made of a polymer, is positively displaced laterally (in the circumferential direction). In the axial direction, the squeeze regions 36b are approximately rectilinear. They form axially extending ribs, which protrude to the inside and/or outside, on the squeeze element 36'.

The bearing seat 21 has a substantially cylindrical or slightly conical inside surface, so as to firmly tighten the roller bearing 18 upon axial insertion into the bearing seat 21.

A further-modified embodiment is shown in Fig. 8. The bearing seat 21 has a polygonal, for instance octagonal, contour. The spacing from the outer face 31 of the roller bearing 18 is at its least approximately in the middle of the edge of each of these substantially plane surface regions 26, so that squeeze regions are created here for the elastomer squeeze element 36. Its relaxed radius R_e is shorter than the least spacing from the inside surface of the bearing seat 21. At the corners of the polygonal bearing seat 21, the spacings are markedly greater, so that here receiving chambers are created for material 37 of the squeeze element 36 that is positively displaced laterally (circumferentially). In this embodiment as well, as in all the embodiments described above, the total volume of the chamber defined between the bearing seat 21 and the outer bearing face 31 is greater than the volume of the squeeze element 36. The average thickness of the squeeze element 36 is thus less than the average spacing between the inside face of the bearing seat 21 and the outside face 31 of the roller

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bearing 18. The squeeze element 36 spans the spacing and fills up the interstice regionally. The chambers or spaces remaining at the corners of the bearing seat 21 are suitable for receiving the squeeze element 36 both in its original thickness and with an increased thickness as a consequence of the material 37 additionally positively displaced laterally.

The bearing device 46 is formed of a bearing seat 21, a roller bearing 18, and a squeeze element 36. The squeeze element rests over a large surface area on the outer ring of the roller bearing 18 and rests only regionally on corresponding regions of the bearing seat 26. The regions are preferably linear or striplike and are oriented substantially axially. This facilitates the insertion and removal of the roller bearing 18 into and out of the bearing seat 21 and prevents slaved rotation of the outer bearing ring even if the bearing seats 21 are provided with relatively generous tolerances.

Claims:

1. A bearing device (46) for devices used in the textile industry having a housing (5) made of plastic,

having at least one roller bearing (18), which has a shaft (4) supported rotatably concentric to a pivot axis (27) and has a substantially cylindrical outer face (31),

having a non-divided bearing seat (21) embodied on the housing (5), which defines a receiving chamber, axially open toward one side, for the roller bearing (18) and defines an interstice between the roller bearing (18) and the bearing seat (21),

having a squeeze element (36) made from an elastomer and disposed in the interstice between the roller bearing (18) and the bearing seat (21) and is compressed at circumferentially spaced-apart points, causing deformation of its cross section.

2. The bearing device of claim 1, characterized in that the squeeze element (36) is embodied in annular fashion, as a closed ring, or in striplike fashion.

3. The bearing device of claim 1, characterized in that the squeeze element (36) has a uniform thickness over its entire circumference.

4. The bearing device of claim 1, characterized in that the squeeze element has regions, distributed along its

circumference, that have a greater thickness than regions in between them.

5. The bearing device of claim 4, characterized in that the bearing seat (21) is formed by a cylindrical face.

6. The bearing device of claim 1, characterized in that the bearing seat (21), for defining squeeze zones, has regions that have a lesser spacing from the roller bearing (18) than regions located in between.

7. The bearing device of claim 1, characterized in that the squeeze element has a thickness which is dimensioned to be greater than the radial spacing between the outer face (31) of the roller bearing and the opposed face (32) of the bearing seat (21).

8. The bearing device of claim 6, characterized in that the bearing seat (21) has ribs extending substantially parallel to the pivot axis (21), which define the squeeze zones, and the squeeze zones are narrower toward the roller bearing (18) than positive-displacement chambers embodied between the squeeze zones.

9. The bearing device of claim 8, characterized in that the radial spacing between the outer face (31) of the roller bearing (18) and the radial inward-pointing faces of the ribs (26) is constant in the axial direction.

10. The bearing device of claim 8, characterized in that the radial spacing between the outer face (31) of the

roller bearing (18) and the radial inward-pointing faces (32) of the ribs (26) decreases in the axial direction.

11. The bearing device of claim 8, characterized in that the ribs (26) are spaced apart from one another circumferentially, and the spacings to be measured circumferentially between the ribs (26) are greater than the width of each rib.

12. The bearing device of claim 11, characterized in that the ribs (26) are spaced apart circumferentially by more than five times their width.

13. The bearing device of claim 8, characterized in that between the ribs (26), receiving chambers (34) are formed, whose size is dimensioned such that both the applicable portions of the squeeze element (46) and material additionally positively displaced out of squeeze zones are received in these chambers without being squeezed.

14. The bearing device of claim 8, characterized in that the radially inward-pointing faces (32) of the ribs (26) are curved or plane and have a substantially trapezoidal cross section.

15. The bearing device of claim 1, characterized in that the squeeze zones are embodied at uniform spacings from one another.

16. The bearing device of claim 1, characterized in that the squeeze zones are disposed at different spacings

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from one another, and the spacings on a load-bearing side of the bearing device (46) are less than in the other regions.

17. The bearing device of claim 1, characterized in that it is embodied on a housing part (6) of a yarn feeder (1) that has a further such bearing device for bearing a shaft (4).

18. The bearing device of claim 17, characterized in that the bearing devices (46) are embodied on different housing parts (6, 7).

19. The bearing device of claim 18, characterized in that the bearing seats (21, 22) of the bearing devices (46) are assigned a centering device (41), which is preferably formed by a preferably tubular extension (42) protruding into a collar (43).