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F2A
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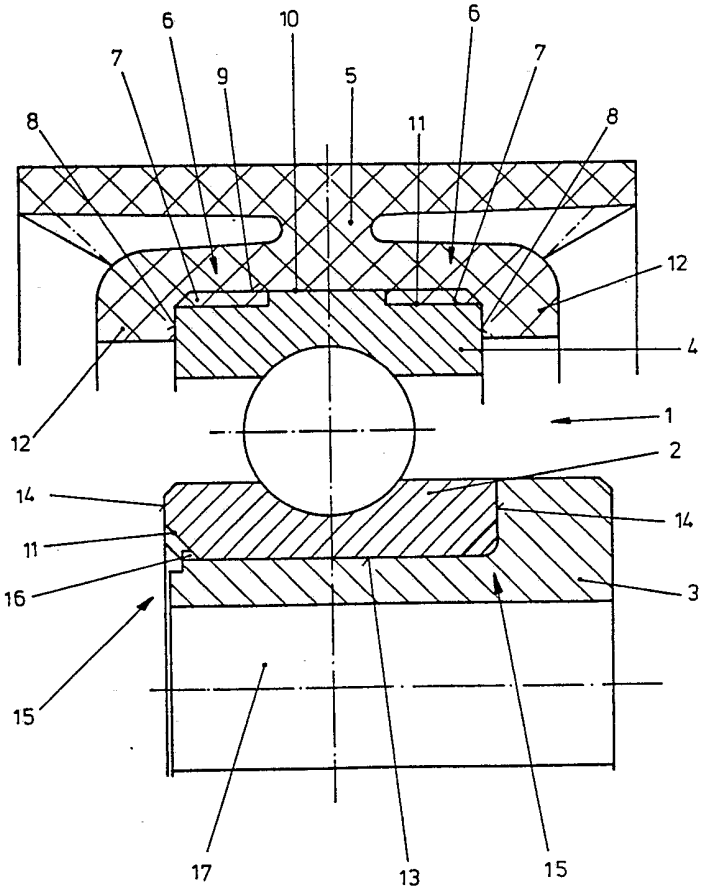
(54) Mounting bearings

(57) In order to connect two machine members i.e. a bearing and its support in a coaxially precise manner protected against torsion, the harder of the two e.g. the bearing race comprises, starting from a central smoothly cylindrical region 10, knurled regions 6 extending on both sides as far as the lateral faces 8. As a result, machining by grinding in the hardened state is possible in the usual manner as in unknurled machine members. In the course of this, knurled projections 7 are removed to the same level as the cylindrical seating 10. Alternatively, knurled portions 15 may also be provided inclined in a taper at the edges of the machine members. The constructions are suitable for a connection by means of injection-moulding, casting, riveting or beading.



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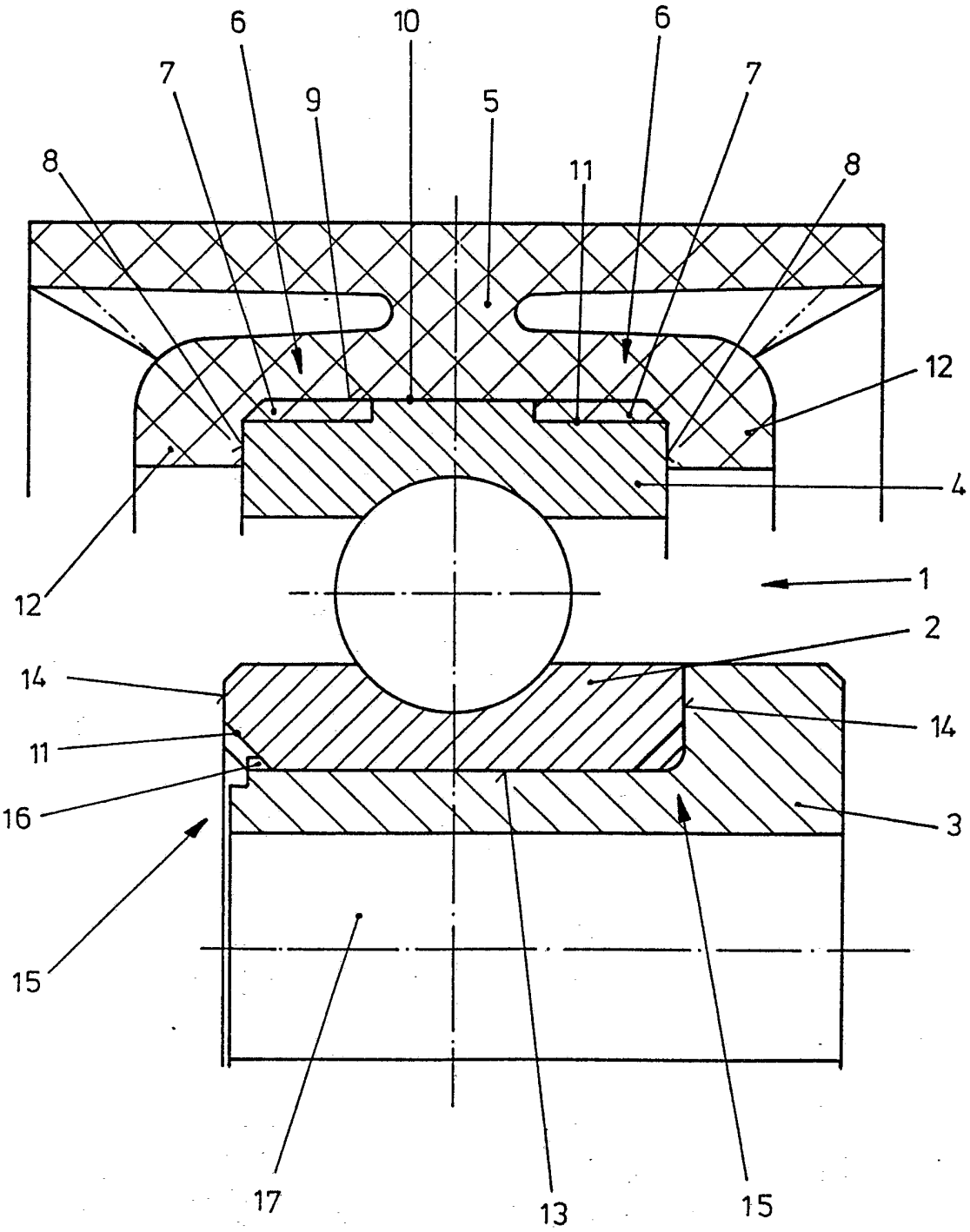
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SPECIFICATION

Annular machine member

This invention relates to an annular machine member of relatively hard material and of the type comprising a substantially cylindrical seating and at least one annularly knurled portion, for use with a machine member of relatively soft material which has a corresponding seating and can be positively connected thereto, coaxially.

For the positive connection of two machine members disposed coaxially one above the other via seatings, knurling extending round in the form of a ring is provided in known manner on one of the machine members. As a result, a protection against torsion between the machine members is achieved. The machine members may either be pressed mutually in and on respectively or the contact with the knurling is effected by deformation such as riveting, beading, or upsetting of one of the machine members. Such a positive connection is also achieved, however, if the softer machine member is formed in the knurling by the casting or injection-moulding technique. A shrinkage or expansion process would also be conceivable with appropriate materials. The knurling is often not provided over the whole seating but in sections with unknurled grooves or edges following therein. As a result, an axial location is additionally achieved. The knurling may, of course, be provided on an outer peripheral surface or a bore surface and is preferably provided on the harder of the two machine members so that the shape of the knurling is not altered during the connection. Some forms and arrangements of knurling are to be found in the literature. In "S. Hildebrand, Feinmechanische Bauelemente Carl Hauser Verlag, 1978" an intermittent arrangement of knurling for embedding is described on page 160 et seq. Knurling for protection against torsion on machine members to be riveted or beaded is to be found on page 176 et seq. In "Erhard/Strickle Mashinenelemente aus thermoplastischen Werkstoffen Band 1, VDJ-Verlag, 1978" methods of embedding by means of ultrasonics or by pressing in are also additionally described on page 88 et seq. The machine members illustrated and described all have a continuously knurled cylindrical surface or grooves or edges disposed between knurled portions. This arrangement causes problems, particularly in the case of hardened machine members which have to be connected to others in very precise alignment and precisely coaxially. The knurling is usually machined in the still soft material before the hardening. After the hardening, these machine members are generally conveyed to a grinding operation which produces the final accuracy of shape and dimensions. This applies in particular, for example, to rolling-bearing rings which are connected, after manufacture, generally in the state already assembled as a rolling bearing, to a second machine member such as a roller covering or supporting member. In the case of such machine members, the finish machining by grinding cannot be carried out for example by means of the holding fixture usual for normal, non-knurled types. The same applies for centreless machining.As a result of the knurling, not only are depressions formed but also displaced portions of material also flow radially beyond the former radial level of the surface and cause a larger diameter of this machine member. The groove or edge region provided in the known constructions knurled intermittently is also unsuitable for the usual holding fixture or the centreless process because the diameter deviates from the normal dimension. The said problems exist in a similar manner in the case of knurled bore surfaces of hardened machine members.

It is the object of the invention to provide an annular machine member of the type mentioned at the beginning wherein the unaltered finish machining can be carried out even in the knurled version for later connection to a further machine member and the knurling of which causes a firm connection protected against torsion and, in particular, a precise coaxial alignment of the machine members with one another.

The problem is solved in that the knurled portion is disposed at least at one axial end of the hard machine member and, starting from the cylindrical seating, extends as far as the lateral face.

Knurled portions are preferably provided at both axial ends of the hard machine member. In this case, a cylindrically smooth region remains which is disposed between the knurled portions and is used, even in the case of continuously smooth, cylindrical machine members, to hold them during the finish machining by grinding. If the machine elements are constructed in the form of race rings for rolling bearings, the same grinding apparatus as hitherto for normal non-knurled race rings can be used without problems without them having to be converted, adjusted or the like. Afterwards, the knurled types also advantageously correspond to the standard dimensions. A further advantage consists in that, as a result of the marginal position of the knurled portions, the relatively thinner portion of material in the region of the track is not weakened, particularly in bearings with shoulders or edges. A machine member constructed according to the invention, for example the said race ring, is appropriately knurled during the soft machining, then hardened and subsequently finish-machined in the manner described. As a result, an accurately shaped race ring with precise dimensions is formed in accordance with the normal version. Each of the knurled portions

disposed at the two axial ends of the race ring preferably has a width of 20 to 30% of the total width of the race ring. This now hard construction can now be connected to the softer machine member in known manner by injection-moulding round, casting round, pressing in, rolling in, riveting, shrinking or the like, as a result of which a coaxial unit in precise alignment results such as is necessary for example for castors or secured in a housing. The same advantages according to the invention result if the knurling is arranged on a bore surface and supporting members are injection-moulded in or cast in as plastics parts or pin-shaped machine members are riveted in or sleeve-shaped supporting members are beaded in. In all cases, an axially positive connection is also achieved because positive connection surfaces result between the knurled projections and their cylindrically smooth intermediate region.

The knurled portion provided at both ends and the lateral portions of the knurling are preferably arranged at the same level as the cylindrical seating. As a result, a continuous, cylindrical seating is achieved which is formed, in the region of the knurling, by a plurality of summit faces of the knurled projections. In this manner, precise dimensions are also achieved in the region of the knurling and further optimize the precise alignment and the coaxial arrangement of the two machine members after the connection. A sufficient depth remains between the knurled projections for the protection against torsion. This construction according to the invention is achieved in that the knurled projections, at first projecting radially between the cylindrical seating after the knurling are eroded during the finish machining by grinding of the central smooth cylindrical region, in that the machining is effected over the whole width of the machine member.

In a further example of embodiment of the invention, the knurled portion, starting from the cylindrical seating, extends inclined in a taper as far as the lateral face. This construction of the knurled portions in the form of a chamfered marginal region is preferably provided for the connection by beading or riveting. Here, too, however, there is nothing in the way of a connection by injection-moulding round or in. In the case of relatively small bores, in particular, knurling at the cylindrical bore surface is often impossible for reasons of space. Here the knurled portion according to the invention, extending in the form of a taper, offers an advantage. In the application of this form of the invention to the inner ring of a ball bearing, the knurled portions are preferably inclined with a taper angle of 40° to 60° and each has a width of 10 to 20% of the total width of the inner ring.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing.

The single Figure shows a castor consisting of a ball bearing 1, a supporting member 3 secured in its inner ring 2 and a castor covering 5 of plastics material secured to the outer ring 4. Knurled portions 6, closed in the form of a ring at both sides and having a plurality of knurled projections 7 extending axially are provided on the peripheral surface 10 of the outer ring 4. The portions 6 each occupy about 30% of the total width of the outer ring 4 and extend as far as its lateral faces 8. The summit faces 9 of the knurled projections 7 are removed, together with the remaining, intervening, smooth region of the peripheral surface 10 by a common finish-machining after the hardening of the outer ring 4, by grinding, and are therefore at the same level as this region. The castor covering 5 is produced by the plastics injection-moulding technique in a mould with the ball bearing 1 inserted, during which the plastics material flows into the depressions 11 in the knurling and a positive connection, protected against torsion, is formed between castor covering 5 and outer ring 4. An axially positive securing which can be extremely heavily loaded, is afforded by the annular flange projections 12 bearing against the lateral faces 8 of the outer ring 4.

The inner ring 2 comprise knurled portions 15 originating from the bore surface 13 at both sides, inclined in a taper and extending as far as its lateral faces 14. The effective width of each of these portions 15 is 15% of the total width of the inner ring 2. The large number of knurled projections 7 extends in the axial/radial direction of inclination. The supporting member 3 is a metal member which is relatively soft in comparison with the hardened inner ring 2. The marginal region 16 at the free end or in the region of the knurled portion 15 is forced into the depressions 11 in the knurling by wedging over at some places or even over the whole circumference. As a result an axially positive connection protected against torsion is formed. As a result of the knurled portion 15 of identical construction, provided at the other side, attention does not have to be paid to introducing the supporting member 3 at the correct side during assembly. The supporting member 3 may, however, additionally comprise a corner region appropriately extending in the form of a taper at this point, which causes an additional protection against torsion. The castor can be secured in the supporting member 3 via a bore 17.

The embodiment illustrated is only an example. Naturally, the most varied machine members can be provided with the knurling according to the invention for securing. The knurling may consist of parallel or intersecting grooves, splines or ridges, or any other arrangement of protuberances or surface deformations designed to increase resistance to

relative rotation between the machine members.

CLAIMS

1. An annular machine member of relatively hard material having a substantially cylindrical seating (10, 13), comprising at least one annularly knurled portion (6, 15), for a machine member (3, 5) of relatively soft material which has a corresponding seating and can be positively connected thereto, coaxially, characterised in that the knurled portion (6, 15) is disposed at least one axial end of the hard machine member 12, 4) and, starting from the cylindrical seating (10, 13), extends as far as the lateral face (8, 14) of the hard machine member.

2. An annular machine member as claimed in claim 1, characterised in that the knurled portion (6) is provided at both ends and the summit portions (9) of the knurling are disposed at the same level as the cylindrical seating (10).

3. An annular machine member as claimed in Claim 1, characterised in that, starting from the cylindrical seating (13), the knurled portion (15) extends inclined in a taper as far as the lateral face (14) of the hard machine member.

4. An annular machine member as claimed in any of Claims 1 to 3, characterised in that this is constructed in the form of a hardened outer ring (4) for a rolling bearing (1), that each of the knurled portions (6) disposed at the two axial ends of the peripheral surface (10) has a width of 20 to 30% of the total width of the outer ring (4) and that the machine member which can be connected coaxially is a plastics member (5), such as a roller, wheel, casing or the like injection-moulded round the outer ring.

5. An annular machine member as claimed in any of Claims 1 to 3, characterised in that this is constructed in the form of a hardened inner ring (2) for a rolling bearing (1), that the knurled portions (15) extending in a taper and disposed at the two axial ends of the bore surface (13) are inclined with a taper angle of 40° to 60° and have a width of 10 to 20% of the total width of the inner ring (2) and that the machine member which can be connected coaxially is a pin-shaped or cup-shaped supporting member (3) of soft material having a marginal region (16) beaded round or riveted against one of the knurled portions (15).

6. An annular machine member forming the inner or outer ring of a ball bearing castor, substantially as hereinbefore described with reference to the accompanying drawing.

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