Title: SEALED BEARING ASSEMBLY WITH MAGNET ON SEALING DISC TO ATTRACT METALLIC PARTICLES

Abstract: This bearing assembly (A) comprises a fixed element (2), an element (4) rotatable with respect to the fixed element (2) around a rotation axis (X-X) of the assembly (A), and a bearing (6) arranged between the fixed element (2) and the rotatable element (4). The bearing (6) comprises a first ring (60) fast with the fixed element (2) to form a fixed ensemble (2, 60), and a second ring (62) rotatable with respect to the first ring (60) around the rotation axis (X-X) of the assembly (A) and fast with the rotatable element (4) to form a rotatable ensemble (4, 62). A sealing gasket (10) separates a raceway chamber (7), extending between the fixed ensemble (2, 60) and the rotatable ensemble (4, 62), from the outside of the assembly (A). At least one metallic particulate attracting magnet (106) is mounted on a side of the sealing gasket (10) oriented towards the raceway chamber (7), the magnet (106) being located within said chamber (7) to magnetically attract any metallic particulate at an interface (11, 12) between two parts (60/64, 62/64) of said bearing (6) which move one with respect to the other when the bearing assembly (A) works.
SEALED BEARING ASSEMBLY WITH MAGNET ON SEALING DISC TO ATTRACT METALLIC PARTICLES

TECHNICAL FIELD OF THE INVENTION

The invention concerns a bearing assembly.

BACKGROUND OF THE INVENTION

Plain or rolling bearing assemblies can be damaged by metallic particulates. In case metallic particulates reach interfaces between the fixed and rotating elements of the bearing assembly, wear marks and damages can appear on the slide or rolling races of the assembly and therefore reduce the service life of the bearing.

To overcome this issue, it is known from the prior art to use ceramic rolling elements in a rolling bearing, or to perform a carbonitriding of the races. These technical solutions are expensive and induce high production times.

SUMMARY OF THE INVENTION

The aim of the invention is to provide a new bearing assembly in which metallic particulates are prevented from damaging the elements of the assembly in a more efficient way than in the prior art, and by using simpler and cheaper techniques.

To this end, the invention concerns a bearing assembly comprising a fixed element, an element rotatable with respect to the fixed element around a rotation axis of the assembly, a bearing arranged between the fixed element and the rotatable element, the bearing comprising a first ring fast with the fixed element to form a fixed ensemble, and a second ring rotatable with respect to the first ring and fast with the rotatable element to form a rotatable ensemble, and a sealing gasket separating a raceway chamber, extending between the fixed ensemble and the rotatable ensemble, from the outside of the assembly. This bearing assembly is characterized in that at least one metallic particulates attracting magnet is mounted on a side of the sealing gasket oriented towards the raceway chamber, the magnet being located within said chamber to magnetically attract any metallic particulate at an interface between two parts of said bearing which move one with respect to the other when the bearing assembly works.

Thanks to the invention, metallic particulates are attracted by the or each magnet away from the interface, thus preventing wear and damages on the interfaces between the two rings of the bearing or between one ring and a rolling body.

According to further aspects of the invention which are advantageous but not compulsory, such a bearing assembly may incorporate one or several of the following features:
The bearing is a plain bearing.
- The bearing is a rolling bearing further comprising rolling elements arranged between the fixed ring and the rotatable ring, whereas the sealing gasket is arranged between the fixed ring and the rotatable ring of the rolling bearing.
- The sealing gasket is mounted on the rotatable ring.
- The sealing gasket is mounted on the fixed ring.
- The rotatable ring is the inner ring of the bearing.
- The rotatable ring is the outer ring of the bearing.
- The sealing gasket is adapted to contact the ring with respect to which the sealing gasket rotates.
- The sealing gasket comprises a core, whereas the or each magnet is fast to the core.
- The or each magnet forms a part of a core of the sealing gasket.
- The or each magnet is covered with a layer of non-magnetic material.
- The or each magnet has the shape of a parallelepiped.
- The sealing gasket comprises a single magnet extending on a limited angular sector.
- The sealing gasket comprises several magnets distributed on or in the sealing gasket.
- The magnets distributed on or in the sealing gasket are arranged so that two adjacent magnets have opposite magnetic polarities.
- A sensor element is provided for reading the arrangement of magnets in or in the sealing gasket.
- The magnets are angularly spaced apart with respect to each other.

BRIEF DESCRIPTION OF THE DRAWINGS
The invention will now be explained in correspondence with the annexed figures, as an illustrative example. In the annexed figures:
- figure 1 is a sectional view, along an axial symmetry plane of a portion of a bearing assembly according to the invention,
- figure 2 is a view, at a larger scale, of a sealing gasket belonging to the bearing assembly of figure 1,
- figure 3 is a front view, along arrow III on figure 2, of the sealing gasket of figure 2;
- figure 4 is a schematic perspective view of magnets belonging to the sealing gaskets of figures 2 and 3;
- Figure 5 is a view similar to figure 4, of a sensor and magnets belonging to a rolling bearing assembly according to a second embodiment of the invention.

**DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT**

The bearing assembly A represented on figure 1 comprises a fixed housing 2, a rotating axle 4 adapted to rotate with respect to housing 2 along an axis X-X', and a rolling bearing 6.

Rolling bearing 6 comprises an outer ring 60 fast in rotation with housing 2, and an inner ring 62 fast in rotation with axle 4. Inner ring 62 rotates with respect to outer ring 60 around axis X-X'. Each of outer ring 60 and inner ring 62 forms a respective raceway 601 and 621. Raceways 601 and 621 face each other on a respective inner surface 603 of outer ring 60 and an outer surface 623 of inner ring 62. Balls 64 are arranged between outer ring 60 and inner ring 62 so as to make a contact with raceway 601 at an outer interface 61, and with raceway 621 at an inner interface 62. Balls 64 are held by a cage 65. Inner ring 62 and axle 4 form a rotatable ensemble, while outer ring 60 and housing 2 form a fixed ensemble. The space between inner ring 62 and outer ring 60, more generally the space between the fixed ensemble and the rotatable ensemble, forms a raceway chamber 7.

According to non-shown embodiments, balls 64 could be replaced by another type of rolling element, such as rollers or needles.

Bearing assembly 4 comprises a sealing element 8 adapted to prevent exterior contaminants from reaching the interior raceway chamber 7 through a gap formed between axle 4 and a radial portion 605 of outer ring 60.

Bearing assembly A further comprises a sealing gasket 10 which separates raceway chamber 7 from the outside. Sealing gasket 10 is adapted to prevent exterior contaminants from reaching the interior raceway chamber 7 through an annular opening visible on the right of figure 1, between outer ring 60 and inner ring 62. Sealing gasket 10 limits raceway chamber 7 on its side opposite to portion 605 with respect to balls 64.

Sealing gasket 10 comprises a core or armature 100, which can be metallic, around which an elastomeric body 102 is arranged. Sealing gasket 10 is fast in rotation with outer ring 60. Body 102 makes a contact with inner surface 603 on one hand, and comprises a lip 104 in sliding contact with outer surface 623 on the other hand.

Core 100 has a substantially L-shaped radial section. On a surface 1001 of core 100 facing balls 64, sealing gasket 10 comprises magnets 106 provided within raceway chamber 7. Magnets 106 are distributed on or in the sealing gasket 10. Magnets 106 may be glued, bolted, clipped, overmolded or welded on core 100.
Sealing gasket 10 can be fast in rotation either with outer ring 60 or with inner ring 62. In case sealing gasket 10 is fast in rotation with rotatable ring 62, magnets 106 are distributed regularly along the circumferential direction on or in the sealing gasket 10 so as to avoid a mechanical imbalance when the rotatable ring 62 is rotating.

Magnets 106 induce a magnetic field which attracts metallic particulates such as fretting corrosion and filings. This permits to concentrate the metallic particulates around magnets 106 and to prevent such particulates from reaching interfaces 11 and 12 and to damage raceways 601 and 621 and/or balls 64. To maximize the amount of particulates attracted, magnets 106 are preferably angularly spaced apart with respect to each other by gaps 108. Each magnet 106 is spaced apart with respect to two adjacent magnets 106 by two gaps 108. This allows to store and retain attracted particulates further away from raceways 601 and 621.

As represented on figure 3, magnets 106 have preferably the shape of a parallelepiped. In another preferred embodiment, all magnets 106 have the same shape and size.

The intensity of the magnetic field induced by magnets 106 may be set so as to not attract too large elements. According to a non-shown embodiment, each magnet may be covered with a layer of non-magnetic material so as to avoid any direct contact of the attracted particles with the magnets.

As shown on figure 4, portions 107 of two adjacent magnets 106 oriented towards balls 64 may have the same polarity. In a non illustrated embodiment, the front portions 107 of all magnets may be of the same polarity, that is to say positive or negative. Alternatively, the polarity of the front portions 107 may be randomly distributed.

According to a second embodiment illustrated on figure 5, the or each magnet 106 can form an impulse ring to be read by a sensor element 12 for sensing the rotation speed of the rotating part of assembly A, or other data. In this case, magnets 106 can advantageously be arranged so that the portions 107 of two adjacent magnets 106 which are facing the sensor 12 have opposite magnetic polarities. Advantageously, sensor 12 may be arranged inside raceway chamber 7.

According to a non-shown embodiment of the invention, sealing gasket 10 may comprise a single magnet 106 fast with core 100 and extending on a limited angular sector of sealing gasket 10.

According to a non-shown embodiment of the invention, core 100 may be formed by a single magnet 106 itself, or by several magnets 106 fast with one another. In that case, elastomeric body 102 may be directly moulded on the or each magnet 106.
According to a non-shown embodiment, sealing gasket 10 may make no contact with inner ring 62 and extend at a limited radial distance from surface 621.

According to another non-shown embodiment, the rotating ring can be outer ring 60, while housing 2 rotates with respect to axle 4.

According to a non-shown embodiment, bearing 6 may comprise no rolling elements and may be formed by a plain bearing comprising only a first ring fast with axle 4 and a second ring fast within housing 2. Raceway chamber 7 is then formed between axle 4 and housing and limited, on one side, by bearing 6, and by sealing gasket 10 on the other side. Sealing gasket 10 is arranged between housing 2 and axle 4 so that magnets 106 are arranged within raceway chamber 7.

The features of the embodiments previously described can be combined in the scope of the invention.
1. Bearing assembly (A) comprising:
   - a fixed element (2),
   - an element (4) rotatable with respect to the fixed element (2) around a rotation axis (X-X’) of the assembly (A),
   - a bearing (6) arranged between the fixed element (2) and the rotatable element (4), said bearing (6) comprising a first ring (60) fast with the fixed element (2) to form a fixed ensemble (2, 60), and a second ring (62) rotatable with respect to the first ring (60) around the rotation axis (X-X’) of the assembly (A) and fast with the rotatable element (4) to form a rotatable ensemble (4, 62), and
   - a sealing gasket (10) separating a raceway chamber (7), extending between the fixed ensemble (2, 60) and the rotatable ensemble (4, 62), from the outside of the assembly (A),

wherein at least one metallic particulates attracting magnet (106) is mounted on a side (1001) of the sealing gasket (10) orientated towards the raceway chamber (7), the magnet (106) being located within said chamber (7) to magnetically attract any metallic particulate at an interface (11, 12) between two parts (60/64, 62/64) of said bearing (6) which move one with respect to the other when the bearing assembly (A) works.

2. Bearing assembly according to claim 1, wherein the bearing (6) is a plain bearing.

3. Bearing assembly according to claim 1, wherein the bearing is a rolling bearing (6) further comprising rolling elements (64) arranged between the fixed ring (60) and the rotatable ring (62), and wherein the sealing gasket (10) is arranged between the fixed ring (60) and the rotatable ring (62) of the rolling bearing (6).

4. Bearing assembly according to claim 4, wherein the sealing gasket (10) is mounted on the rotatable ring (62).

5. Bearing assembly according to claim 4, wherein the sealing gasket (10) is mounted on the fixed ring (60).

6. Bearing assembly according to one of claims 4 to 6, wherein the rotatable ring is the inner ring (62) of the bearing (6).
7. Bearing assembly according to one of claims 4 to 6, wherein the rotatable ring is the outer ring (60) of the bearing (6).

8. Bearing assembly according to one of claims 4 to 8, wherein the sealing gasket (10) is adapted to contact the ring (62) with respect to which the sealing gasket (10) rotates.

9. Bearing assembly according to one of the previous claims, wherein the sealing gasket (10) comprises a core (100), and wherein the or each magnet (106) is fast to the core (100).

10. Bearing assembly according to one of claims 1 to 8, wherein the or each magnet (106) forms a part of a core (100) of the sealing gasket (10).

11. Bearing assembly according to one of the previous claims, wherein the or each magnet (106) is covered with a layer of non-magnetic material.

12. Bearing assembly according to one of the previous claims, wherein the or each magnet (106) has the shape of a parallelepiped.

13. Bearing assembly according to one of the previous claims, wherein the sealing gasket (10) comprises a single magnet (106) extending on a limited angular sector.

14. Bearing assembly according to one of claims 1 to 12, wherein the sealing gasket (10) comprises several magnets (106) distributed on or in the sealing gasket (10).

15. Bearing assembly according to claim 14, wherein the magnets (106) are arranged so that two adjacent magnets (106) have opposite magnetic polarities.

16. Bearing assembly according to claim 15, wherein a sensor element (12) is provided for reading the arrangement of magnets (106) distributed circumferentially on or in the sealing gasket (10).

17. Bearing assembly according to one of claims 14 to 16, wherein the magnets (106) are angularly spaced apart (108) with respect to each other.
A. CLASSIFICATION OF SUBJECT MATTER
INV. F16C33/78
ADD. F16C19/16 F16C33/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C. See patent family annex.

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European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
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Authorized officer: De Jongh, Cornel
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