Title: BEARING HOUSING FOR A ROLLING BEARING AND A ROLL LINE FOR A CONTINUOUS CASTING MACHINE INCORPORATING SUCH A ROLLING BEARING HOUSING

Abstract: The invention refers to a bearing housing (1) for a rolling bearing provided with an internal passage (7) with an inlet opening (8) and an outlet opening (10) for a cooling medium, which bearing housing is a fully cast body with the cooling medium passage (7) fully integrated in the goods of the bearing housing.

Published: — with international search report (Art. 21(3))

Declarations under Rule 4.17:
— of inventorship (Rule 4.17 (iv))
BEARING HOUSING FOR A ROLLING BEARING AND A ROLL LINE FOR A CONTINUOUS CASTING MACHINE INCORPORATING SUCH A ROLLING BEARING HOUSING

5 Background of the invention

The present invention refers to a bearing housing for a rolling bearing and particularly a rolling bearing housing having an internal passage for a cooling medium. The invention also refers to a roll line for a continuous casting machine equipped with such rolling bearing housings.

Such bearing housings are usually operating under very hot conditions, for instance, but not exclusively in continuous casting machines, and therefore they require to be subjected to cooling, which is generally effected by means of cooling liquid.

For effecting an efficient cooling of the bearing housing and the bearing supported therein, it is preferred to have a cooling medium passage provided in the goods of the bearing housing.

Such cooling medium passages hitherto have usually been provided with channels drilled or machined in different directions in two-part bearing housings, where the channels communicate with a chamber recessed in the outer part of one bearing housing half, and which chamber is closed off by a cover plate welded to the housing over the chamber. Such bearing housings are described and illustrated e.g. in US-A-5,915,843.

An obvious drawback with such a bearing housing is that the manufacture of the bearing housing is rather expensive, due to the different machining steps and the additional welding of the cover plate to the bearing housing in a fluid-tight manner. It is also important that the welding operation is made in an appropriate manner, which is difficult, and the fact that defective welding seams can cause cracks and leakage, makes it desirable to avoid welding.
Purpose and most essential features of the invention

A primary purpose of the present invention is to provide a bearing housing for a rolling bearing provided with an internal passage with an inlet and an outlet opening for a cooling medium, which avoids the drawbacks of prior art and is less expensive to manufacture, and this has been achieved therein that the bearing housing is a fully cast body with the cooling medium passage fully integrated in the goods of the bearing housing.

Further features of the invention will be disclosed in the dependent claims forming part of the invention.

Brief description of the drawings

Hereinafter the present invention will be further described with reference to an embodiment illustrated in the accompanying drawings.

Fig. 1 shows in perspective a bearing housing according to the invention.

Fig. 2 is a perspective view from another angle of the bearing housing according to the invention, shown in a partial cross-section.

Fig. 3 shows the bearing housing according to the invention in cross-section, and

Fig. 4 is a partial section along line IV-IV of the bearing housing shown in Fig. 3.

Brief description of the preferred embodiment

Fig. 1 shows in perspective a bearing housing 1 for a rolling bearing, which is cast in one piece preferably from nodular/ductile iron, which is a rather inexpensive material and which rolling bearing housing incorporates a foot portion 2 integrated with a substantially cylindrical main body 3 forming a cylindrical seat 4 for accommodating a not shown rolling bearing.
The one-piece rolling bearing housing is provided with an internal passage for a cooling medium, preferably cooling liquid, which passage is not visible from the exterior of the bearing housing, but which is situated inside openings 5 sealed off in a liquid-tight manner by means of closure caps 6.

Fig. 2 shows the bearing housing 1 according to Fig. 1 in a somewhat different perspective view, and with a portion of the bearing housing shown in cross-section. From this view can be seen the bottom of the foot portion 2 and how the goods of the bearing housing 1 is equipped with an internal passage 7 extending in arc-form from an inlet opening 8 at the foot portion 2 in close connection to the said cylindrical seat 4 but spaced apart from this by an uninterrupted material layer 9 and which passage 7 (although not visible in this view) communicates with an outlet opening 10 at the foot portion 2.

As it is desirable to let the rolling bearing housing accommodate as big rolling bearings as possible, it is aimed at having a rather thin wall outside the passage 7, and it is preferred if this wall portion is less than 15% of the diameter of the bearing seat 4. A bigger bearing will be able to accommodate larger loads. In an embodiment in continuous casting roll lines, it is crucial to be able to have as large roller bearings as possible and to be able to have a cooling passage 7 surrounding a part of the bearing housing. Such comparatively thin wall sections can be achieved due to use of high precision molding.

The foot portion 2 of the bearing housing 1 has further bottom-holes 11 extending from the exterior of the foot portion 2 a short distance into the material of the bearing housing 1, but separated from the cooling medium passage 7. These bottom-holes 11 serve for attachment of the bearing housing 1 to a supporting structure by means of not shown screws or the like.

The openings 5, which in this stage are not closed by closure caps, are positioned in order to communicate with the passage 7, thus that the interior of the passage 7 can be in contact with the exterior of the bearing housing 1 when the closure caps are removed.

In Fig. 3 is shown a planar side view in cross-section of the bearing housing 1
according to the invention.

It is here shown that the passage 7 extends between the inlet opening 8 and the outlet opening 10 for the cooling medium, and that the passage 7 circumvents a part of the cylindrical bearing seat 4 inside the cylindrical main body 3 of the bearing housing 1. It can also be seen in this view that there, in the embodiment illustrated, are four closed off openings 5 evenly distributed along the passage 7. The openings 5 are here, as in the case according to Fig. 1, closed by closure caps 6 in a medium-tight manner.

In an embodiment, the passage 7 extends around the top part of the rolling bearing housing in close connection to said cylindrical seat 4 but spaced apart from this by an uninterrupted material layer 9, and wherein the internal passage 7 extends at least over more than half the circumference around the top part of the cylindrical bearing seat 4. An advantage with having a casted one-piece bearing housing with an internal passage 7 for cooling fluid is that the risk of leakage from the passage 7 is minimized. In earlier embodiments, including welded cover plates on the bearing housing and split bearing housings, the risk of leakage of cooling fluid was high. Thus, the one-piece bearing housing according to the invention enables the passage 7 to extend over more than half the circumference of the cylindrical bearing seat 4 without passing a split bearing housing plane and/or without being in connection with a cover plate, which can be seen in figure 3.

As it is desired - as earlier mentioned - to have such a thin wall between the passage 7 and the upper part of the rolling bearing housing, on which the heavy slabs or other load is acting, it is possible to provide the passage 7 with one or more internal fins 13, which serve as a reinforcement supporting the outer wall.

In Fig. 4 is shown a section along line IV-IV in Fig. 3, and from this view it can be seen that there might be more than one fin 13, and furthermore these fins can be positioned in different parts of the passage 7, where they also can act for giving a turbulent flow of cooling medium, in order to increase the ability of carrying away as much excessive heat as possible. The shape of the fins can be designed in many different ways. By designing the fins, it is possible to get a different flow of the cooling medium and the strength of the fin may be improved. For instance, in an embodiment not shown in the figures, the fins have an essentially circular cross section.
The bearing housing 1 according to the invention is, as earlier mentioned cast in one piece preferably from nodular/ductile iron, which is a comparatively inexpensive material, and the openings 5 communicating with the passage 7, which forms a cooling medium jacket, are intended for facilitating the manufacture of the casting with the integrated passage 7. With the new inventive bearing housing, there is no need to select a material which is suitable for welding.

For casting a rolling bearing housing with at least one internal cooling passage 7 it is appropriate to use high precision molding, such as shell molding, wax molding or green sand molding. By using such molding methods it is possible to obtain a rolling bearing housing in a tolerance class CT8, as compared to CT10 or CT12 at common molding techniques, and with such high tolerances it is not necessary to let the rolling bearing housing be subjected to finish machining, as it already after molding has a sufficiently high surface finish.

As can be seen in Fig. 2 the passage 7 is filled with a core-forming material 12, such as sand, which is stabilized, in a manner known per se, by a material, which under influence of the increased casting temperature, will degasify and thereby loose its stabilizing effect after the casting has been made.

After the casting has been made the core material can be removed via the openings 5, which are thereupon closed in a fluid-tight manner by means of the closure caps 6. In an embodiment, the closure caps 6 may be fixated to the bearing housing 1 by a threaded connection (not shown in the figures). It shall be noticed that none of the openings 5 are positioned at the upper part of the bearing housing, as this part of the rolling bearing housing will be subjected to load and an adverse, harsh environment, particularly if the rolling bearing housing is used in a roll line for a continuous casting machine, where the upper part of the rolling bearing housing will carry the load of the material slabs conveyed on the roll line, and where the rolling bearing housing is subjected to heat from the slabs, humidity and dirt.

The fact that the bearing housing is a one-piece cast member produced from nodular iron with integrated water jacket formed by the passage 7, and the fact that there will be no welding of protective covers over the passage, means together that the bearing
housing in question can be produced at a significantly lower cost than the earlier embodiments with welded covers and/or split bearing housings, and it is neither afflicted with possible product quality problems, mainly cracks and corrosion problems, caused by welding seams. Thus, the service life of the bearing housing will also increase. The nodular iron also creates a passive surface layer, prohibiting housing corrosion. The inventors have realized that even in harsh environments such as in continuous casting, the nodular iron will create a passive surface layer.

As the molded goods might have a certain porosity, at least the outer surface of the rolling bearing housing 1 is preferably equipped with an impregnation for sealing off any pores appearing after the casting process. It is preferred that the impregnation is anyone of a polymer and a resin.

The nodular/ductile iron can be substituted e.g. by martensitic steel, which however is a more expensive material than the nodular/ductile iron. An advantage of the present invention is that there is an increased freedom when choosing appropriate housing materials, due to the fact that the selected material does not need to be suited for welding.

As mentioned in the introductory part of the description, a rolling bearing housing of the type described and defined in the accompanying claims, although useful in many applications, is particularly well suited for use in any type of roll line of a continuous casting machine, and the application therefore also incorporates a claim directed to a roll line for a continuous casting machine, equipped with bearing housings as claimed in the previous claims. The inventive bearing housing has a combination of features which makes the bearing housing well suited for a continuous caster environment, which is characterized by lack of available space, high loads and a harsh environment including very high temperatures and different surrounding chemicals.

The invention is not limited to the embodiment shown in the accompanying drawings and described with reference thereto, but variants and modifications are possible within the scope of the appended claims.
CLAIMS

1. A bearing housing (1) for a rolling bearing provided with at least one internal passage (7) with an inlet opening (8) and an outlet opening (10) for a cooling medium, characterized therein that the rolling bearing housing (1) is a fully cast body with the cooling medium passage (7) fully integrated in the goods of the bearing housing.

2. A rolling bearing housing (1) as claimed in claim 1, wherein the bearing housing (1) is cast in one piece from a nodular/ductile iron.

3. A rolling bearing housing (1) as claimed in claim 1, wherein the bearing housing (1) is cast in one piece from a martensitic steel.

4. A rolling bearing housing (1) as claimed in anyone of claims 1 to 3, wherein at least the outer surface of the bearing housing (1) is equipped with an impregnation for sealing off any pores appearing after the casting process.

5. A rolling bearing housing (1) as claimed in claim 4, wherein the impregnation is anyone of a polymer and a resin.

6. A rolling bearing housing (1) as claimed in anyone of the preceding claims, wherein the at least one internal passage (7) has a number of further openings (5), which are used for emptying core material (12) after the casting process, and which further openings (5) are closed off by means of fluid-tight closure caps (6).

7. A rolling bearing housing (1) as claimed in claim 6, wherein the further openings (5) are positioned in other parts of the bearing housing than the top part thereof.

8. A rolling bearing housing (1) as claimed in anyone of the preceding claims, wherein there is provided at least one stabilizing fin (13) in the cooling medium passage (7).

9. A rolling bearing housing (1) according to claim 8, wherein the stabilizing fin (13) creates a turbulent cooling medium flow in the passage (7).
10. A rolling bearing housing (1) as claimed in anyone of the preceding claims, wherein the thickness of the material in the bearing housing wall outside the cooling medium passage (7) at the uppermost portion of the bearing housing is less than 15% of the diameter of a bearing seat (4) arranged inside the bearing housing (1) for accommodating a rolling bearing.

11. A rolling bearing housing as claimed in claim 8 or 9, and 10, wherein said at least one stabilizing fin (13) is provided in the top part of the cooling medium passage (7) for reinforcing the outer wall of the cooling medium passage (7) against deformation caused by load acting on the top part of the roller bearing housing.

12. A rolling bearing housing (1) having an internal cylindrical seat (4) for accommodating a bearing and as claimed in anyone of the preceding claims, wherein the internal passage (7) extends in arc form around the top part of the rolling bearing housing and in close connection to said cylindrical seat (4) but spaced apart from this by an uninterrupted material layer (9), and wherein the internal passage (7) extends at least over more than half the circumference around the top part of the cylindrical bearing seat (4).

13. A rolling bearing housing (1) as claimed in claim 12, wherein the internal passage (7) extends in arc-form around the top part of the rolling bearing housing from an inlet opening (8) at a foot portion (2) of the bearing housing to an outlet opening (10) at a foot portion (2) of the bearing housing.

14. A roll line for a continuous casting machine, characterized therein that it incorporates at least one bearing housing as claimed in anyone of claims 1 to 13.
Fig. 2
**INTERNATIONAL SEARCH REPORT**

**International application No.**

PCT/SE2010/000231

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**A. CLASSIFICATION OF SUBJECT MATTER**

IPC: see extra sheet

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

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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC: F16C, B22D

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

SE, DK, FI, NO classes as above

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
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<td>US 4883369 A (JUDE, DANIEL ET AL), 28 November 1989 (28.11.1989), figures 1, 2, abstract</td>
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**See patent family annex.**

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**Date of the actual completion of the international search**

26 January 2011

**Date of mailing of the international search report**

27-01-2011

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**Name and mailing address of the ISA/ Swedish Patent Office**

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<td>A</td>
<td>WO 2004065040 A1 (SMS DEMAG AKTIENGESELLSCHAFT), 5 August 2004 (05.08.2004), figure 2, abstract</td>
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<td>A</td>
<td>US 20070074399 A1 (NARAYANAN, RAJMOHAN ET AL), 5 April 2007 (05.04.2007), figures 1-11, abstract</td>
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International patent classification (IPC)
F16C 37/00 (2006.01)
B22D 15/02 (2006.01)
B22D 19/00 (2005.01)
F16C 35/00 (2006.01)

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.
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