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**Datasheet for the decision
of 20 October 2006**

Case Number: T 0893/04 - 3.2.02

Application Number: 97905401.2

Publication Number: 0825270

IPC: C22C 38/00

Language of the proceedings: EN

Title of invention:

Bearing material

Applicant:

JFE Steel Corporation, et al

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) "

Decisions cited:

-

Catchword:

-



Case Number: T 0893/04 - 3.2.02

DECISION
of the Technical Board of Appeal 3.2.02
of 20 October 2006

Appellant:

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Representative:

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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted 4 March 2004
refusing European application No. 97905401.2
pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: T. K. H. Kriner
Members: R. Ries
E. Dufrasne

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 4 March 2004 to refuse European patent application No. 97 905 401.2.

The ground of refusal was that claim 1 of the main and auxiliary requests then on file did not involve an inventive step, having regard to the documents:

D1: JP-A-62294150 (with abstract in English language)

D3: Stahleisen-Berichte: "Spurenelemente in Stählen",
Table 5.4, page 20, Verlag Stahleisen, 1986,
Düsseldorf, Germany

D4: GB-A-2 256 201.

Furthermore, the document

D2: JP-A-01306542 (with abstract in English language)

has been cited by the examining division.

II. On 14 May 2004, the appellant (applicant) lodged an appeal against the decision and paid the prescribed fee on the same day. On 6 July 2004 the statement setting out the grounds of appeal was filed.

III. In the official communication annexed to the summons to oral proceedings and setting out the preliminary opinion on the case, the board referred to document

D5: R. Scheel, W. Pluschkell, R. Heinke, R. Steffen:
"Sekundärmetallurgie zur Erzielung niedrigster
Gehalte an Begleitelementen in Stahlschmelzen",
Stahl und Eisen 105, (1985), pages 607 to 615.

IV. Oral proceedings were held on 20 October 2006 at which the appellant submitted a translation of document D1 into English language and requested that

- the decision under appeal be set aside and
- a patent be granted in the following version:
 - claims 1 to 5 of the main request filed at the oral proceedings,
 - description pages 1 to 18 filed at the oral proceedings,
 - figures 1 to 8 as originally filed.

Claim 1 of the main request reads as follows:

"1. A bearing material comprising: 0.95 to 1.10 mass% of C, 0.15 to 0.70 mass% of Si, 1.15 mass% or less of Mn, 0.90 to 1.60 mass% of Cr and 0.025 or less mass% of P, and further 0.025 mass% or less of S and 0.0012 mass% or less of O as elements forming nonmetal inclusions, 0.0010 mass% or less of Sb, optionally 0.10 to 0.25 mass% of Mo, and the balance being Fe and incidental impurities; the bearing material containing 0.020 mass% or less of AlN."

Dependent claims 2 to 5 relate to preferred embodiments of the bearing material set out in claim 1.

V. The appellant's arguments are summarized as follow:

The appellant concurred with the position of the examining division that the claimed bearing material differed from the steel alloy described in document D1 by the content of Sb which was not referred to in this document. Based on the disclosure of document D3, trace amounts of about 20 ppm Sb were typically expected in conventional steel. The examining division concluded that the residual amounts of Sb in the alloy given in document D1 exceeded the antimony contents of 10 ppm or less tolerated in the application and consequently, novelty of the claimed bearing material vis-à-vis the disclosure of document D1 and that of the remaining documents was accepted.

As to inventive step, however, the examining division's view that document D1 in combination with D3 motivated a skilled person to reduce the Sb content in order to improve the bearing steel's fatigue life property was based on hindsight. Although the metallurgist always aimed at reducing the level of impurities and residuals in steel, the key feature of the claimed bearing steel resided in restricting exclusively the Sb-content to 10 ppm or less. This limitation was not obvious since none of the prior art documents provided any indication to do so in order to solve the problem underlying the present application, i.e. to extend the rolling contact fatigue life of the bearing material.

The claimed subject matter was therefore novel and inventive vis-à-vis the prior art represented by documents D1 to D5.

Reasons for the Decision

1. The appeal is admissible.
2. Amendments:

The wording of Claim 1 results from the combination of claims 1 to 3 as originally filed. Dependent claims 2 to 4 are based on claims 4, 6 and 9 as originally filed and the subject matter of dependent claim 5 has a basis in the originally filed description, page 8, second full paragraph.

The amended pages 1 to 18 of the description are based on the originally filed pages and have been suitably adapted to the revised claims.

Hence there are no objections with respect to Article 123(2) EPC.

3. Novelty:

The board has no reason to doubt the examining division's assessment that, on the reading of document D3, the typical amount of Sb in conventionally produced steel is about 0.002% (about 20 ppm). Thus it can be assumed that this finding also applies to the bearing steel referred to in document D1 which is silent as to the amount of Sb. The residual amount of

"typically" about 20 ppm is corroborated by the Sb contents of 28 ppm or 29 ppm, respectively, of the conventional materials (samples 1 and 9) which were tested as comparative material in the present application. Given that the upper limit for Sb defined in claim 1 of the present application corresponds to half the expected amount in the prior art steels, the claimed bearing material is novel with respect to the disclosure of D1. Evaluation of the remaining cited prior art shows that none of the documents discloses all the technical features (i.e. the composition and microstructure) of the bearing alloy set out in claim 1. Since novelty is not an issue in the impugned decision, there is no need to deal with this question in more detail.

4. Inventive step:

4.1 Like the opposed patent, D1 relates to a high quality bearing steel consisting of 0.80 to 1.2% C, $\leq 2.0\%$ Si, $\leq 2.0\%$ Mn, 0.3 to 2.5% Cr, 0.010 to 0.070 % Al_{sol} , $\leq 0.006\%$ P, $\leq 0.005\%$ S, $\leq 0.0007\%$ O, $\leq 0.006\%$ N, $\leq 0.002\%$ Ti, $\leq 0.001\%$ (Al+TiN), optionally 0.05 to 1.0% Mo, the balance being Fe and residual impurities (cf. D1, abstract). The composition of the known steel composition overlaps that of the claimed bearing material. The composition of example 1 in Table 1 of D1 falls within the elemental ranges set out in claim 1. Given that both the contents of Al_{sol} (0.020%) and N (30 ppm) of example 1 meet the limitations set out in the present application on page 4, lines 46 to 48 of the A1-publication, the claimed feature of "0.02% or less AlN" is also assumed to be met by the steel known from D1. This document is, however, silent with regard

to the amounts of residual impurities and trace elements present in the steel.

4.2 Starting from D1 as one closest prior art, the problem underlying the present application resides in improving the rolling contact fatigue life B_{10} of the known bearing material. This problem is successfully solved by strictly adhering to antimony contents of 10 ppm or less. It is clearly evident from Figure 6 that the B_{10} life is significantly enhanced by this limitation of the Sb-content in the steel.

4.3 Documents D1, D2 and D4 are essentially concerned with reducing the non-metallic inclusions in the bearing steel but do not even remotely address the presence of Sb in steel. Therefore these documents do not give any indication as to whether the presence of this trace element either adversely or beneficially affects the rolling contact fatigue properties (B_{10} -life) of the bearing steel.

Document D3 merely specifies an antimony content of about 20 ppm as being "typical" in steel alloys without giving any teaching as to its influence on the rolling contact fatigue life.

Likewise, document D5 identifies antimony as an "undesirable residual element" which is introduced and concentrated over time in steel melts when recycling scrap. Antimony cannot be simply removed from steel by known secondary metallurgy processing, but requires a special metallurgical treatment, i.e. refining the melt with calcium ("calcium metallurgy"; cf. page 613: Begleitelemente and page 614). It, however, appears from Figure 13 of D5 that antimony in 18/8 Cr/Ni steel is reduced in three stages from rather high contents of

about 550 ppm to the "typical" levels of about 20 ppm referred to in D3. Like other prior art documents, D5 is silent about the effect of Sb upon the steel properties in general, and more importantly, upon the steel's rolling contact fatigue property. Hence, the disclosure of D5 cannot be said to provide a clear pointer to the solution of the above mentioned problem either.

- 4.4 The board does not dispute the examining division's position that reducing the levels of impurity and trace elements in general represents an obvious measure within the daily routine of a skilled person and itself cannot lead to an inventive step. This is particularly true if the reduction of these levels results in a slight and foreseeable improvement in the alloy's overall properties.

In the present case, however, the confinement of the Sb-content to less than 10 ppm achieves a significant and surprising enhancement of the rolling contact fatigue life (B_{10} -life) of a bearing steel, as depicted in Figure 6 of the application. In the assessment of inventive step, the question to be answered is, therefore, not whether the skilled person could have reduced the residual amount of antimony, but whether he would have done so in the expectation of an improvement the B_{10} -life of the bearing steel. As shown above, no indication is found in the cited prior art documents that would motivate a skilled person faced with the above mentioned problem to turn specifically to this trace element and to minimise its content, all the more so since reducing the level of antimony generally involves great technical effort and expense.

The subject matter of claim 1 therefore involves an inventive step.

5. The dependent claims 2 to 5 relate to preferred embodiments of the bearing material set out in claim 1 and are, therefore, likewise allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent on the basis of:
 - claims 1 to 5 of the main request filed at the oral proceedings;
 - description pages 1 to 18 filed at the oral proceedings;
 - figures 1 to 8 as originally filed.

The Registrar:

The Chairman:

V. Commare

T. K. H. Kriner