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Aktenzeichen

File Number

Numéro du dossier

T 880 / 91 - 3.42

In der Anlage erhalten Sie

eine Kopie des Berichtigungsbeschlusses

ein korrigiertes Vorblatt (Form 3030)

einen Leitsatz / Orientierungssatz (Form 3030)

Please find enclosed

a copy of the decision correcting errors

a corrected covering page (Form 3030)

a headnote / catchword (Form 3030)

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une copie de la décision rectifiant des erreurs

une page de garde (Form 3030) corrigée

un sommaire / une phrase vedette (Form 3030)

Anmeldung Nr. / Patent Nr.:

(soweit nicht aus der Anlage ersichtlich)

Application No. / Patent No.:

(if not apparent from enclosure)

Demande n° / Brevet n°:

(si le n° n'apparaît pas sur l'annexe)

A		B		C	X
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File Number: T 0880/91 - 3.4.2

Application No.: 82 302 612.5

Publication No.: 0 067 558

Title of invention: Method of producing bearing component and bearing
comprising the bearing component

Classification: C25D 7/10, F16C 33/12

D E C I S I O N
of 26 April 1993

Proprietor of the patent: Hitachi, Ltd.

Opponent: SKF GmbH

Headword:

EPC Art. 56 and 113(1)

Keyword: "Inventive step (yes)"
"Substantial procedural violation (yes)"



Case Number : T 0880/91 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 26 April 1993

Appellant : Hitachi, Ltd.
(Proprietor of the patent) 5-1, Marunouchi 1-chome
Chiyoda-ku
Tokyo 100 (JP)

Representative : Paget, H.C.E.
MEWBURN ELLIS & CO.
2/3 Cursitor Street
London EC4A 1BQ (GB)

Respondent : SKF GmbH
(Opponent) Postfach 14 40
W - 8720 Schweinfurt (DE)

Decision under appeal : Interlocutory decision of the Opposition Division
of the European Patent Office dated 22 August 1991
concerning maintenance of European patent
No. 0 067 558 in amended form pursuant to
Article 102(3) EPC.

Composition of the Board :

Chairman : E. Turrini
Members : C. Black
L.C. Mancini

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Summary of Facts and Submissions

I. The Appellant is proprietor of European patent No. 0 067 558.

II. At the end of oral proceedings held on 19 January 1989 during opposition proceedings, the Chairman of the Opposition Division informed the parties as follows:

"The Patentee is/are to be given a period of 2 months upon receiving of the Minutes within which to amend the description and the claims according to the main request of 01.12.88 with the insertion of "layer 8" in Claim 1 on page 2, line 2, after "lubricant" and with clarification in Claim 1 of what is actually produced (a bearing instead of a bearing component). Having heard the arguments presented at the oral proceedings the Opposition Division holds the view that the documents cited in the examination and Opposition do not lead the man skilled in the art to the subject-matter as claimed. At the present state the auxiliary requests need not be considered".

III. The Patentee's response was received on 17 March 1989. The Opposition Division issued a communication pursuant to Rule 58(4) EPC on 9 June 1989 informing the parties of the text in which it intended to maintain the patent. The wording of Claims 1 and 2 was amended slightly as compared to that submitted by the Patentee, but in the Opposition Division's view reflected the intention of the Patentee in the response of 17 March 1989.

IV. A communication from the Opponent dated 11 April 1989, received 31 May 1989, amplified earlier argumentation

and introduced a further document D5 (see paragraph XX below). A further communication from the Opponent dated 5 July 1989, received 12 July 1989 was in response to the Rule 58(4) communication and contained further argumentation concerning patentability.

- V. In their communication dated 17 January 1990, the Opposition Division in effect re-opened the proceedings, found D5 was pertinent in combination with D4 (previously discussed in the proceedings) in respect of inventive step in the product claims, and requested the Patentee to delete these claims.
- VI. The Patentee, in a response received 25 April 1990, expressed dissatisfaction with the conduct of the proceedings thus far, contested the finding of the Opposition Division as regards inventive step and requested further oral proceedings, or re-opening of the previous oral proceedings.
- VII. Oral proceedings were appointed for 20 February 1991. In the communication accompanying the summons, the Opposition Division indicated that the Opponent's communication received 12 July 1989 had been interpreted as disapproval of the text within the meaning of Rule 58(4) EPC and that the proceedings had therefore been continued in accordance with Rule 58(5) EPC.
- VIII. A communication from the Opponent received 12 October 1990 sought to introduce a further document D6 (DE-A-909 236).
- IX. The Patentee subsequently decided not to attend said oral proceedings (communication received 8 November 1990), objected to the late introduction of D6 and

requested a decision on the basis of a main and an auxiliary request.

- X. The Opposition Division, in a communication dated 10 December, drew the Patentee's attention to the fact that the second oral proceedings had been appointed for the sole reason that its composition had changed in the meanwhile. Pending a response from the Patentee, the proceedings would not be cancelled. It was also stated that D6 (see paragraph VIII above) would be disregarded.

- XI. The oral proceedings were in due course cancelled with the agreement of both parties and after the Patentee's request had been clarified.

- XII. The interlocutory decision within the meaning of Article 106(2) EPC was issued on 22 August 1991, maintaining the patent in amended form on the basis of the Patentee's auxiliary request. The Patentee's main request was rejected, the Opposition Division finding that the product claims lacked an inventive step having regard to a combination of the teachings of documents D3 and D5.

- XIII. The present appeal lies against this decision, the Appellant requesting grant of a patent on the basis of the said main request or, as a precautionary auxiliary measure, on the basis of the said auxiliary request. Reimbursement of the appeal fee was requested on the ground of substantial procedural violation.

- XIV. The Respondent (Opponent) in replying to the Grounds of Appeal, requested revocation of the patent in its entirety, that is, also on the basis of the method

claims found to be allowable by the Opposition Division.

XV. The Appellant then drew attention to Decision T 369/91, observing in effect that the Respondent, not having filed an appeal, could not, following T 369/91, challenge that part of the decision against which he could have appealed, but did not.

XVI. In a communication accompanying a summons to oral proceedings, the Board observed that the question of whether an Appellant could be worse off as the result of filing an appeal had been put to the Enlarged Board (see Decisions T 60/91; T 96/92). It expressed the opinion that in the present case it was not necessary to wait for the Enlarged Board's decision, at least before proceeding with examination of the Appellant's main request, to the extent that this related to the product claims found by the Opposition Division to be not allowable. If the Board were to find these claims allowable, then it seemed unlikely that any line of argument could lead to rejection of the process claims. On the other hand, if the Board were minded to reject the product claims, the Appellant could simply withdraw the appeal and the end result would be the same as allowing the auxiliary request. The Board also gave a provisional view on the pertinence of the documents D3 and D5.

XVII. The Respondent, in a communication indicating that he would not be represented at the oral proceedings, also commented on the proposal of the Board that the appeal could be withdrawn, arguing inter alia that it was improper that a final instance should thus permit a patent containing invalid claims to remain in force.

XVIII. In the course of the oral proceedings, the Appellant submitted a main and three auxiliary requests, of which the second auxiliary request was that he be given the opportunity to withdraw the appeal and the third was that the patent be maintained in the form found allowable by the Opposition Division. The Board indicated that it was minded to allow claims at least in accordance with the first auxiliary request, and the Appellant accordingly withdrew the second and third auxiliary requests.

XIX. The Appellant's main request is therefore that the decision under appeal be set aside and that the patent be maintained on the basis of the documents according to his main request received 22 December 1990, and sheets 1 and 2 of the drawings of the granted patent. The drawings are not in fact referred to in said request, but in the Board's view this was an inadvertent omission.

Claims 1, 2 and 7 read as follows:

"1. A method of producing a bearing comprising an inner ring (2), an outer ring (1), a rolling element (3) and optionally a shaft (6), one of the bearing components having a solid lubricant at a frictional surface part of a metal substrate constituting that bearing component, characterized in that the method comprises the steps of:

(a) providing a coating layer (6',7) of a material on the frictional surface part of said metal substrate, the solubility of said material in the substrate metal and in the solid lubricant being higher than the mutual solubility between the substrate metal and the solid lubricant,

(b) providing on a surface part of said coating layer a solid lubricant layer (8) which consists of a metal having a lower solubility in said substrate metal, and
(c) when the said inner ring (2), outer ring (1) and rolling element (3) are assembled together and with a powder of a non-metallic solid lubricant placed between these assembled components, maintaining said solid lubricant layer (8), said coating layer (6',7) and said metal substrate (3) at a temperature below both the maximum operating temperature of the bearing component and the melting point of the solid lubricant layer (8) for a period of time sufficient to induce mutual diffusion between the substrate metal, the coating material and the solid lubricant layer, thereby increasing the strength of bonding between them.

2. A method of producing a bearing comprising an inner ring (2), an outer ring (1), a rolling element (3) and optionally a shaft (6), one of the bearing components having a solid lubricant of silver at a frictional surface part of a metal substrate of ferrous material constituting that bearing component, characterized in that the method comprises the steps of:

(a) providing a coating layer (6',7) on said frictional surface part of said metal substrate by electroplating, the solubilities of the coating material in said ferrous material and in the silver lubricant being higher than the mutual solubility of the ferrous material and the silver lubricant, said coating layer comprising a nickel layer (6') bonded to said frictional surface part and a gold or copper layer (7) bonded to said nickel layer, the thickness of the nickel layer being larger than that of the gold or copper layer;

(b) electroplating a solid lubricant layer (8) on a surface part of said coating layer (6',7) which

consists of silver having a low solubility in said ferrous material and is thicker than said nickel layer; and

(c) when the said inner ring (2), outer ring (1) and rolling element (3) are assembled together and with a powder of a non-metallic solid lubricant placed between these assembled components, maintaining said solid lubricant layer (8), said coating layer (6',7) and said metal substrate at a temperature below the maximum operating temperature of the bearing component for a period of time sufficient to induce mutual diffusion of the substrate metal, the coating material and the solid lubricant layer while permitting elemental silver to remain on the surface part of the solid lubricant layer, thereby increasing the strength of bonding between the metal substrate, the coating layer and the solid lubricant layer and strengthening by alloying the coating layer and the interior of the solid lubricant layer.

7. A bearing having as bearing components an inner ring (2), an outer ring (1) and rolling elements (3) and having a layer of solid lubricant on at least one of the frictional surfaces of metal substrates constituting said bearing components, characterized in that said bearing component having said layer of solid lubricant comprises an intermediate coating layer (6',7) provided between the solid lubricant layer (8) and the metal substrate, the solubility of the material of the coating layer in the metal substrate and in the solid lubricant layer being higher than the mutual solubility between the metal substrate and the solid lubricant layer, the bonding strength between the solid lubricant layer (8) and the intermediate coating layer (6',7) and that between the intermediate coating layer (6',7) and the metal substrate being increased by

mutual diffusion, and the solid lubricant layer (8) being a metallic material and in that there is present between said bearing components a powder of non-metallic solid lubricant."

The claims according to the auxiliary request differ in that Claims 7, 8 and 9 have been combined and consequential renumbering effected.

The Appellant confirmed the request for reimbursement of the appeal fee.

XX. The prior art documents referred to in this decision are the following:

D3: DD-C- 71 264

D4: FR-A-981 367

D5: GB-A-859 721.

XXI. The gist of the Appellant's written and oral submissions is as follows:

The whole point of D5 is the retention of the lubricant M_0S_2 or WS_2 on the bearing, and there is no suggestion that the silver or lead layer which assures this retention might itself act as a lubricant. Nor is the problem of exfoliation mentioned. The only improvements which might suggest themselves to the average skilled person are the provision of a reservoir of lubricant or the labelling of the bearing with an indication of its maximum working life.

D3 discloses bearing components having metal coatings thereon. While in Examples 1 to 3 there is some degree of interdiffusion between adjacent layers, this does not occur between the steel bearing and the adjacent

copper layer and moreover could not occur in the specified conditions (heating at 600°C for a short time). This is corroborated by the document "Binary alloy phase diagrams (American Society for Metals) Vol. 1, page 14 (D8). Examples 4 to 6 appear to disclose interdiffusion between the bearing metal and the adjacent coating layer; here however only a single layer is applied and the outer layer does not have lubricating properties. The average skilled person accordingly derives the teaching that no alloying to the bearing metal takes place unless only one coating layer is applied. D3 is in any case seeking to provide hard layers and is not concerned with lubrication or with bonding strength.

Only with hindsight can D3 and D5 be combined in such a way as to arrive at the subject-matter of Claim 7, by selecting portions of their disclosures without regard to this teaching as a whole.

The request for reimbursement of the appeal fee is justified inter alia on the grounds that in the reasons for the decision, argumentation based on the combination of D3 and D5 was made for the first time.

The Respondent's arguments may be summarised as follows:

D3 discloses a bearing component comprising a substrate metal which may be steel coated with an intermediate layer which in Example 3 is a copper alloy and an outer layer which in Example 3 is lead. In the patent in suit the solid lubricant layer may be lead and an intermediate layer between the substrate and lead layer may be a copper alloy. Further, D3 discloses interdiffusion between adjacent layers, including the substrate metal

(column 3, lines 54 to 64). The subject-matter of Claim 7 differs from D3 only in the provision of a further lubricating layer consisting of M_0S_2 or WS_2 .

D5 discloses a bearing component in which a steel body is coated with silver, lead or an alloy thereof and a lubricating layer consisting of M_0S_2 or WS_2 .

The average skilled person has therefore only to apply the additional M_0S_2 or WS_2 lubricant known from D5 in the bearing known from D3, or the intermediate layer known from D3 in the bearing known from D5 in order to arrive at the subject-matter of Claim 7.

The further distinctions in method Claim 1 relating to heat treating to effect interdiffusion after the bearing components have been assembled together and the choice of temperature for the heat treatment are features falling within the competence of the average skilled person. Moreover, these features are not reflected in the wording of Claim 7.

Reasons for the Decision

1. The appeal is admissible.
2. The questions of compliance with Article 123(2) and (3) and of novelty are not at issue, and the Board sees no reason to go into these questions.
3. Main request
 - 3.1 The patent relates to bearing components having a layer of metal solid lubricant on the bearing metal substrate. In such an arrangement exfoliation can occur

because of incompatibility of the metal lubricant with the substrate and to overcome this an interlayer of metal compatible with both is provided. By appropriate heat treatment partial interdiffusion at the interfaces takes place. In what was originally a particular embodiment, the heat treatment is carried out after assembling the bearing components together, whereby the bearing components are accurately located. To prevent them sticking together during the heat treatment, a further lubricating layer of M_0S_2 or WS_2 is provided.

- 3.2 The method claims were restricted to the above during the opposition proceedings. The restriction (provision of M_0S_2 or WS_2 lubricant in addition to the metal solid lubricant) is also included in product Claim 7, though of course this claim cannot reflect the timing of the heat-treatment after assembly of the components, except to the extent that these are accurately located.
- 3.3 As indicated in paragraph XII above, the Opposition Division found the process claims allowable but not the product claims.
- 3.4 The Board agrees with the Opposition Division that D3 and D5 are the most pertinent documents. In the multi-layer bearing assembly disclosed in D4, heat treatment brings about complete alloying of adjacent coating layers rather than the partial interdiffusion required by the patent in suit.
- 3.5 D3 relates to bearing components wherein the substrate may be a ferrous metal as is disclosed in the patent in suit. One or more metal coatings are applied to the substrate metal and a heat treatment under specified conditions brings about a pre-diffusion between the metals in successive layers and/or between these and

the substrate metal (column 3, lines 54 to 60). In a further step partial or complete interdiffusion occurs (lines 61 to 64). The object of the process according to D3 is to impart hardness to the bearing surface. However, in Example 3 the outer layer is lead, which is not only soft, but an example of the metal solid lubricant required by the patent in suit. Nevertheless, there is no suggestion in D3 that the lead layer in this embodiment exercises any lubricating function. Moreover, in said Example 3, and in Examples 1 and 2 for that matter, the metal coating layer adjacent the steel substrate is copper and it is not stated that copper and steel alloy on heat treatment. As pointed out by the Appellant this is in accordance with the Fe-Cu phase diagram (D8) which indicates practically no alloying at 600°C. As also pointed out by the Appellant only Examples 4 to 6 disclose alloying between the substrate and the adjacent coating layer, and in these examples there is a single coating layer. The Board notes that the wording and/or in D3, column 3, line 58, indicates that alloying between the substrate and adjacent layer need not occur in D3. Accordingly, the subject-matter of Claim 7 differs from the disclosure in D3, with particular reference to Example 3, not only in the absence of a second lubricating layer of M_0S_2 or WS_2 , but also in the absence of interdiffusion between the substrate and adjacent coating layer.

- 3.6 D5 discloses a bearing component of hard steel having a metal coating layer which may be silver or lead and an outer lubricant layer of M_0S_2 or WS_2 . It will be noted that silver and lead are examples of the metal solid lubricant according to the patent in suit. However, in D5 the function of the metal layer is to retain the M_0S_2 or WS_2 on the bearing and there is no suggestion that this layer itself might function itself as a lubricant,

though of course it will have this property even though it is not mentioned. The subject-matter of Claim 7 therefore differs from the disclosure in D5 in that there is between the substrate and the silver or lead layer a layer or layers which will diffusion bond with the substrate and the silver or lead layer.

3.7 The problem which is the basis of the patent in suit, that is the combination of the part-problems of exfoliation, accuracy of alignment of the bearing components and avoidance of sticking together of the components during heat-treatment are not hinted at in D3 or D5. In the Board's view therefore the average skilled person has no reason to combine their teaching and in any case even if he did so he would not arrive at an arrangement wherein the substrate metal and adjacent coating layer were interdiffused (see paragraph 3.6 above).

3.8 Accordingly, the subject-matter of Claim 7 is seen as involving an inventive step. It is true that its wording does not reflect the essential process feature of carrying out the heat-treatment after assembly of the bearing components. Nevertheless, the product will have the corresponding advantageous feature of accurately aligned parts. Moreover, the Board can accept the Appellant's contention that the presence of the additional M_0S_2 or WS_2 lubricant assists in the running in of the bearing.

4. The Board has noted the Respondent's objections to the process claims. However, since Claims 1 and 2 require inter alia that a heat-treatment to effect interdiffusion is effected on the assembled bearing components, and that all the features of Claim 7 are reflected in corresponding process features, Claims 1

and 2 must be seen as being narrower in scope than Claim 7 and therefore allowable at least for the same reasons as Claim 7. The question submitted to the Enlarged Board referred to in paragraph XVI above has therefore no bearing on the present case.

5. Since the Appellant's main request has been found allowable, it is not necessary to consider the auxiliary request.

6. As regards the request for reimbursement of the appeal fee, the Board is of the opinion that this is justified because of a substantial procedural violation. In its decision, the Opposition Division found the product claims to be not allowable, using for the first time in its reasoning a combination of the teachings of D3 and D5. In a previous communication it had based its reasoning on a combination of D4 and D5. It is true that D3 had been discussed extensively during the opposition proceedings. Nevertheless, in the Board's view, the Appellant was not given an opportunity to comment on the actual case against him, so that the requirement of Article 113(1) EPC was not met. In view of the foregoing it is not necessary for the Board to consider the other reasons put forward by the Appellant for reimbursement of the appeal fee.

7. Since the Appellant's main request has been met, it is not necessary for the Board to consider the Respondent's objection (paragraph XVII above) to the Board's suggestion (paragraph XVI above) concerning withdrawal of the appeal, except to mention Decision G 8/91 of the Enlarged Board of Appeal, which provided the justification for the suggestion.

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 maintain the patent in accordance with the main request (see paragraph XIX above).
3. The appeal fee is to be reimbursed.

The Registrar:

The Chairman:

P. Martorana

E. Turrini