BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [ ] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 13 December 2011

Case Number: T 0612/10 - 3.2.08

Application Number: 04016980.7

Publication Number: 1510589

IPC: C21D 1/78, C21D 9/36, C23C 8/32, C23C 8/80, F16C 33/30

Language of the proceedings: EN

Title of invention:
Bearing's component, heat treatment method thereof, heat treatment apparatus, and rolling bearing

Applicant:
NTN Corporation

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56
RPBA Art. 13(1)

Keyword:
"Main request, first and second auxiliary request: inventive step - no"
"Third auxiliary request: not admitted"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0612/10 - 3.2.08

D E C I S I O N
of the Technical Board of Appeal 3.2.08
of 13 December 2011

Appellant: (Applicant)
NTN Corporation
3-17, Kyomachibori 1-chome
Nishi-ku
Osaka-shi, Osaka (JP)

Representative:
GROSSE SCHUMACHER KNAUER VON HIRSCHHAUSEN
Patent- und Rechtsanwälte
Nymphenburger Strasse 14
D-80335 München (DE)

Decision under appeal:
Decision of the Examining Division of the European Patent Office posted 18 November 2009 refusing European patent application No. 04016980.7 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: T. Kriner
Members: M. Alvazzi Delfrate
E. Dufrasne

Summary of Facts and Submissions

I. By its decision posted on 18 November 2009, the examining division refused European patent application No. 04 016 980.7.

II. The appellant (applicant) lodged an appeal against this decision on 7 January 2010, paying the appeal fee on the same day. The statement setting out the grounds for appeal was filed on 1 March 2010.

III. Oral proceedings before the board of appeal were held on 13 December 2011.

IV. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or, in the alternative, of the (first) auxiliary request, both filed by letter dated 30 October 2009, or of the 2. auxiliary request, filed on 5 November 2009, or of the 3. auxiliary request, filed during the oral proceedings.

V. Claim 1 of the main request reads as follows:

"A heat treatment method of plurality of bearing's components, wherein said bearing's component is carbonitrided at a carbonitriding temperature (T_1) higher than an A_1 transformation point of steel for said bearing's component and then cooled to a temperature lower than the A_1 transformation point, and subsequently, using a heat treatment apparatus that successively moves and heats each individual bearing's component, reheated to a range of quenching temperature (T_2) of no less than said A_1 transformation point and

less than said carbonitriding temperature to be quenched and wherein the temperature raising rate in heating to quenching temperature (T_2) is set to be at least 3°C/min at a depth of 2 mm from the surface of the bearing's component, wherein said bearing's component is made of steel JIS SUJ2."

Claim 1 of the (first) auxiliary request differs from claim 1 of the main request by the addition of the following feature:

"… the quench severity of the cooling medium in quenching is set to be at least 0.1 cm^{-1}".

Claim 1 of the 2. auxiliary request reads as follows:

"A heat treatment method of plurality of bearing's components, wherein said bearing's component is carbonitrided at a carbonitriding temperature (T_1) higher than an A_1 transformation point of steel for said bearing's component and then cooled to a temperature lower than the A_1 transformation point, and subsequently reheated to a range of quenching temperature (T_2) of no less than said A_1 transformation point and less than said carbonitriding temperature to be quenched, wherein the bearing's components (21) are placed on a carrier member (25) individually of a heat treatment apparatus (30), the carrier member (25) continuously and endlessly rotates from the front side of the heat treatment apparatus (30), and the bearing's components (21) are successively moved by the carrier member (25) through heating means (23) of the heat treatment apparatus (30) for heating the bearing's components individually, and the bearing components (21) are

subsequently quenched by dropping the bearing's components into a container (31) comprising a cooling medium individually and successively, wherein said bearing's component is made of steel JIS SUJ2."

Claim 1 of the 3. auxiliary request reads as follows:

"A heat treatment method of plurality of bearing's components, wherein said bearing's component is carbonitrided at a carbonitriding temperature (T_1) higher than an A_1 transformation point of steel for said bearing's component and then cooled to a temperature lower than the A_1 transformation point, and subsequently, using a heat treatment apparatus that successively moves and heats each individual bearing's component, reheated to a range of quenching temperature (T_2) of no less than said A_1 transformation point and less than said carbonitriding temperature to be quenched and wherein the temperature raising rate in heating to quenching temperature (T_2) is set to be at least 3°C/min at a depth of 2 mm from the surface of the bearing's component and wherein in quenching from quenching temperature (T_2) the average cooling rate for lowering the temperature by 400°C from the heating temperature at a depth of 2 mm from the surface of a bearing's component is set to be at least 20°C/sec, wherein said bearing's component is made of steel JIS SUJ2, and the bearing components (21) are subsequently quenched by dropping the bearing's components into a container (31) comprising a cooling medium individually and successively."

VI. The following documents play a role in the present decision:

D1: US-A- 2003/ 0 123 769;
D2: DE-A- 42 04 982; and
D3: G.E. Totten et al.: "Limitations of the Use of Grossman Quench Severity Factors" (filed by the appellant by letter dated 11 November 2011).

VII. The appellant's arguments can be summarised as follows:

D1, which disclosed a heat-treatment method for bearings made of JIS SUJ2 steel, represented the most relevant prior art. Starting from this prior art, the claimed invention achieved the object of providing an efficient process which resulted in improved mechanical properties of the bearing's components. This object was achieved in particular

(a) by the use of a heat-treatment apparatus that successively moves and heats each individual bearing's component to reheat them to the quenching temperature, and

(b) by the fact that the temperature-raising rate in said reheating step is set to be at least 3°C/min at a depth of 2 mm from the surface of the bearing's component.

These features allowed increased process productivity and resulted in bearings with improved mechanical properties, in particular the values of the Charpy impact and fatigue life, as shown in the examples.

Said features were independent of each other and were not rendered obvious by the prior art. It was not obvious to use a continuous furnace for achieving said object, since such a furnace was not conventionally used in the prior art for this kind of treatment. Moreover, although it was true that D2 disclosed the use of a continuous furnace and reheating at a rate of 20 to 80°C/min, this document did not relate to a treatment for a JIS SUJ2 steel but to one for case-hardening steels. Hence, it would not have been obvious for the person skilled in the art to take its teaching into consideration when trying to achieve the objects above. Additionally, D2 was completely silent on the importance of the heating rate at a depth of 2 mm from the surface.

Therefore, the subject-matter of claim 1 of the main request involved an inventive step.

A quenching severity in accordance with claim 1 of the (first) auxiliary request was not only a clearly defined parameter, as evidenced for instance by D3, but also provided a further distinguishing feature, since D1 did not mention this parameter. Said quench severity, which was not mentioned by D2 either, was also important for the achievement of the improved mechanical properties. Hence, albeit from D3 it appeared that oil quenching had a severity as per claim 1 of the (first) auxiliary request, the claimed subject-matter involved an inventive step also for this reason.

Furthermore, neither D1 nor D2 disclosed that the bearing components were successively quenched by

dropping the bearing's components into a container comprising a cooling medium individually and successively, as required by claim 1 of the second auxiliary request. Therefore this feature was not obvious, so the subject-matter of claim 1 of the 2. auxiliary request involved an inventive step.

Claim 1 of the 3. auxiliary request was a combination of claim 1 of the higher-ranking requests, wherein the quenching step was not defined as in the (first) auxiliary request but by an equivalent and more precise parameter.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 D1, from the same applicant, discloses a heat-treatment method of bearing's components, wherein said bearing's components are carbonitrided at a carbonitriding temperature higher than an A_1 transformation point of steel for said bearing's components and then cooled to a temperature lower than the A_1 transformation point, and subsequently reheated to a range of quenching temperature of not less than said A_1 transformation point and less than said carbonitriding temperature to be quenched (see claim 1), wherein the bearing's components are, for instance, made of steel JIS SUJ2 (see paragraph [0064]).

However, D1 discloses neither the type of furnace nor the temperature-raising rate used for the reheating step.

2.2 Starting from the method disclosed in D1, the object of the claimed invention can be seen as providing an efficient process.

It is true, as pointed out by the appellant, that the examples of the application in suit exhibit improved values of the Charpy impact and fatigue life. However, it has not been proven that these improvements are linked to the provision of a continuous furnace or to the specific temperature-raising rate as per claim 1 and not to some other process parameters. Hence, the object of the claimed invention cannot be considered to comprise improving the mechanical properties of the bearings.

2.3 The object mentioned above is achieved as per claim 1 in the first place by choosing to use, in the reheating step, a heat-treatment apparatus that successively moves and heats each individual bearing's component, in other words by choosing to reheat the components in a continuous furnace.

2.4 D2 relates to the same type of process as D1, namely to a heat-treatment method wherein the component is carbonitrided at a carbonitriding temperature higher than an A_1 transformation point of steel for said component and then cooled to a temperature lower than the A_1 transformation point, and subsequently reheated to a range of quenching temperature of not less than said A_1 transformation point and less than said

carbonitriding temperature to be quenched (see Figure). Therefore, although this document does not specifically disclose a treatment for a JIS SUJ2 steel but generally refers to case-hardening steels ("Einsatzstähle"), it was obvious, contrary to the appellant's view, to take its teaching into consideration when trying to achieve the object above.

D2 discloses that the reheating step can be carried out in a continuous furnace (see column 2, lines 28-34). Since it is clear that the use of a continuous furnace contributes to the process' efficiency, D2 rendered it obvious to achieve the object above by the use of a continuous furnace, i.e. by a heat-treatment apparatus that successively moves and heats each individual bearing's component.

Moreover, D2 discloses that the use of a continuous furnace results in a typical heating rate of 20 to 80°C/min. It is true, as submitted by the appellant, that D2 does not explicitly disclose the heating rate at a depth of 2 mm from the surface of the component to be treated. However, in view of the good thermal conductivity of steel, the heating rates disclosed in D2 as typical for a continuous furnace inherently result in a heating rate at said depth of at least 3°C/min, i.e. a heating rate in accordance with present claim 1. The contrary has not been demonstrated by the appellant. Hence, the choice of a continuous furnace and the heating rate as per claim 1 cannot be considered as representing two independent features. On the contrary, they are linked to each other. This is also consistent with the application in suit, which states that choosing to use a continuous furnace in the

reheating step results in an increased temperature-raising rate in said step (see paragraph [0008] of the A-publication). Therefore, by teaching the use of a continuous furnace, D2 also renders it obvious to heat to quenching temperature at a temperature-raising rate of least 3°C/min at a depth of 2 mm from the surface of the bearing's component. Accordingly, the subject-matter of claim 1 of the main request does not involve an inventive step.

Also accepting, for the sake of argument, that the heating rate as per claim 1 provides improved mechanical properties as submitted by the appellant, this would not change the finding above since an unexpected advantageous effect cannot confer inventiveness on an obvious solution.

3. (First) auxiliary request

It is true, as submitted by the appellant, that neither D1 nor D2 mentions the quench severity of the cooling medium. However, both documents disclose that oil is used as a cooling medium for the quench (see D1, paragraph [0060] and D2, column 2, lines 48 to 53). Oil quench has quench severities which typically fall within the range of present claim 1 (see D3, Figure 1). This fact is also in accordance with the application itself (see Table 1). Hence, the choice of an oil quenching with a quench severity as per claim 1 would be typical when carrying out the process of D1. Accordingly, the subject-matter of claim 1 of the (first) auxiliary request does not involve an inventive step either.

4. 2. auxiliary request

It is also true that D2 does not state that the bearing components are successively quenched by dropping them into a container comprising a cooling medium individually and successively. However, this would be the first technically reasonable choice for performing a quenching after treating the components in a continuous furnace. Since, as explained above, it was obvious to use a continuous furnace for the reheating step, this type of quenching was also obvious for the person skilled in the art. Hence the subject-matter of claim 1 of the 2. auxiliary request does not involve an inventive step either.

5. 3. auxiliary request

According to Article 13(1) of the Rules of Procedure of the Boards of Appeal (OJ EPO 11/2011, page 536), any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the Board's discretion. This discretion is to be exercised in view of *inter alia* the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

In the present case, the 3. auxiliary request was filed at a very late stage of the proceedings, namely towards the end of the oral proceedings. The need for procedural economy requires that a request filed at such a late stage be admitted only if it at least complies without doubt with the formal requirements of the EPC and constitutes a promising attempt to counter the objection raised.

With respect to the present 3. auxiliary request this is not the case. As acknowledged by the appellant itself, claim 1 of the 3. auxiliary request is a combination of claim 1 of the higher-ranking requests, wherein the quenching step is not defined as in the (first) auxiliary request but by an equivalent parameter. Hence, the features of the method as per claim 1 are identical or equivalent to those already taken into consideration when assessing, and refuting, the inventiveness of the subject-matter of claim 1 of the higher-ranking requests. Therefore, the 3. auxiliary request cannot constitute a promising attempt to counter the objection of lack of inventive step. As a consequence, it is not admitted into the appeal proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare T. Kriner