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Datasheet for the decision of 2 March 2015

Case Number: T 1893/13 - 3.2.08

Application Number: 04004451.3

Publication Number: 1455102

IPC: F16C33/62

Language of the proceedings: EN

Title of invention:
Transmission component, method of manufacturing the same, and tapered roller bearing

Applicant:
NTN Corporation

Headword:

Relevant legal provisions:
EPC Art. 54, 56, 87(1), 123(2)

Keyword:
Novelty - (yes)
Inventive step - main request (no)
Amendments - added subject-matter (yes)
Priority - (yes)
Inventive step - auxiliary request (yes)

Decisions cited:

Catchword:

Beschwerdekammern
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Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1893/13 - 3.2.08

D E C I S I O N
of Technical Board of Appeal 3.2.08
of 2 March 2015

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 80335 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 8 April 2013 refusing European patent application No. 04004451.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	T. Kriner
Members:	M. Foulger
	D. T. Keeling

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the Examining Division, dispatched on 8 April 2013, to refuse the European patent application 04004451.3. The Examining Division held that the main request did not comply with the requirements of Article 123(2) EPC, that the subject-matter of claim 1 of the first, second and third auxiliary requests did not involve an inventive step in the sense of Article 56 EPC. Moreover, it was held that the second auxiliary request did not comply with the requirements of Article 123(2) EPC.

II. The appeal was duly filed and reasoned.

III. The following documents are relevant for the present decision:
D1: EP 1 411 142 A1
D2: EP 0 600 421 A1
D3: DE 42 04 982 A1
D4: US 6,224,688 B1
D5: US 6,149,734 A
D6: US 6,440,232 B1
D7: US 6,342,109 B1
D8: US 6,165,289 A
D9: US 4,971,634 A
D10: EP 1 070 760 A2
D11: US 2003/123769 A1
D12: "Ball and Roller Bearings", Eschmann, Hasbargen and Weigand, p.26.

IV. The appellant requested that the decision under appeal be set aside, and that a patent be granted on the basis of the claims according to the main request, or the auxiliary requests 1-7. Should none of the requests be

allowable, then oral proceedings were requested.

V. Claim 1 of the main request reads as follows:
" A transmission capable of changing a rotational speed of an output shaft (12) relative to a rotational speed of an input shaft (11) by means of mesh of toothed wheels (14a to 14k), comprising a transmission component, wherein said transmission component
- has a nitriding layer at a surface layer, an austenite grain with a grain size number measured in accordance with Japanese Standard JIS G 0551 falling within a range exceeding 10, a fracture stress value of at least 2650 MPa, and a hydrogen content of at most 0.5 ppm and
- is formed of bearing steel."

Claim 1 of the first auxiliary request further specifies that the nitriding layer is formed by a carbonitriding process.

Claim 1 of the second auxiliary request further specifies that the rolling bearing component has a Charpy impact value of at least 6.20 J/cm^2 and at most 6.65 J/cm^2.

Claim 1 of the third auxiliary request reads as follows:
"A transmission capable of changing a rotational speed of an output shaft (12) relative to a rotational speed of an input shaft (11) by means of mesh of toothed wheels (14a to 14k), comprising a transmission component, wherein said transmission component is a rolling bearing component, wherein the rolling bearing component
- has a nitriding layer at a surface layer, wherein the nitriding layer is formed by a carbonitriding process,

an austenite grain with a grain size number measured in accordance with Japanese Standard JIS G 0551 falling within a range exceeding 10, a fracture stress value of at least 2650 MPa, and a hydrogen content of at most 0.5 ppm and
- is formed of JIS-SUJ2."

The remaining auxiliary requests do not play a role in this decision.

VI. The appellant argued essentially that:

a) Main request.

Inventive step
D2 could not be regarded as being the closest prior art because it referred to sintered steel which could not be considered as a bearing steel as claimed. The feature "bearing steel" of claim 1 implied a high carbon chromium steel. Even if the person skilled in the art were to combine the teachings of D2 and D6 or D7, then this would result in a transmission component made of low carbon steel i.e. not "bearing steel" as claimed. Thus the subject-matter of claim 1 involved an inventive step.

b) First auxiliary request
The above arguments regarding inventive step applied equally to the first auxiliary request.

c) Second auxiliary request
Regarding the allowability of the amendments, the feature that the bearing component has a Charpy impact value of at least 6.20 J/cm^2 and at most 6.65 J/cm^2 was disclosed in Table 1 and on page 22, line 22 of the description as originally filed.

d) Third auxiliary request

Support for the amendments to claim 1 of this request could be found on pages 17 and 23 of the description of the application as originally filed. The requirements of Article 123(2) EPC were therefore fulfilled.

It was moreover not obvious to apply the process of carbonitriding to a steel such as JIS-SUJ2. The subject-matter of claim 1 was therefore not obvious to a person skilled in the art.

Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Novelty

The novelty of the subject-matter of claim 1 has not been disputed by the Examining Division. The Board sees no reason to depart from this finding. In particular D1, which is state of the art according to Article 54(3) EPC, does not disclose a transmission.

2.2 Inventive step

2.2.1 The Board considers that D2 represents the most relevant prior art and discloses:
a transmission capable of changing a rotational speed of an output shaft relative to a rotational speed of an input shaft by means of mesh of toothed wheels (see

page 3, lines 5-6), comprising a transmission component, wherein said transmission component
- has an austenite grain with a grain size number measured in accordance with Japanese Standard JIS G 0551 falling within a range exceeding 10, a fracture stress value of at least 2650 MPa, (see Table 3) and
- is formed of bearing steel (as the steel is suitable for use in bearings, see page 3, lines 5-6, it is to be considered as a "bearing steel").

2.2.2 The Board cannot agree with the appellant's argument that D2 does not disclose a "bearing steel". D2 discloses the use of the steel of D2 for a bearing (D2, page 1, line 6). It is therefore to be considered as a "bearing steel". The extract from the "Dictionary of terminology for metals" supplied by the appellant also supports this view because it is the suitability for the use in supporting a shaft that is important. The argument that "bearing steel" implies a high carbon chromium steel is not convincing because it is clear from the cited passage that this type of steel is merely "often" used in this application. The passage then goes on to define other steels for bearing use depending on the application. These other steels (high speed tool steel etc.) are also regarded as "bearing steels". Given that even the evidence submitted by the appellant shows that "bearing steel" merely means steel suitable for use in a bearing, the appellant's argument is not convincing.

2.2.3 The Board notes that although D2 discloses nitriding of the surface layer (page 5,lines 17-27) this is not disclosed in combination with the details of example 3, table 3. D2,page 6, example 1, line 39 discloses that the forged body is carburized. In the examples 2-4,7 of D2 the forged body is "heat treated similarly to

Example 1". In example 5 the forged body is gas-carburized (page 9, line 16). Example 6 does not specify a particular heat treatment. Given that nitriding is not disclosed in combination with the other features of example 3, then it must be concluded that this also constitutes a difference with the subject-matter of claim 1.

2.2.4 The subject-matter of claim 1 therefore differs from the transmission of D2 in that:
said transmission component has a nitriding layer at a surface layer and
a hydrogen content of at most 0.5 ppm.

2.2.5 The problem to be solved may be regarded as being to provide a transmission which has a longer fatigue life (see application, [0006]).

2.2.6 The skilled person would regard the reduction in hydrogen content in bearing steels as being normal practice. It is well known in the art that an increase in hydrogen content in the steel leads to a reduction in the fatigue life, see for example D12. The skilled person would therefore apply this to the transmission of D2 in order to solve the above problem.

Regarding the heat treatment, D2, page 5, lines 20-22 suggests alternative forms of surface hardening i.e. carburization, carbonitriding, nitriding. The skilled person would therefore be motivated by the disclosure of D2 to at least try the other heat treatments presented therein, especially as they were presented as being comparable to the carburising of the specific example.

2.2.7 Given the above, in seeking to solve the problem posed, the skilled person would arrive at the subject-matter of claim 1 without the exercise of inventive skill.

3. 1st Auxiliary Request

As D2 also discloses carbo-nitriding, see D2, page 5, line 21, the subject-matter of claim 1 according to the first auxiliary request also does not involve an inventive step for the reasons given above for the main request.

4. 2nd Auxiliary Request

Claim 1 of the 2nd auxiliary request does not comply with Article 123(2) EPC because the given values for Charpy impact value were only disclosed in connection with the specific examples B-F in table 1. These samples were made from JIS-SUJ2. The skilled person reading the application as originally filed would not consider that the given values were achievable without being made from JIS-SUJ2.

Furthermore the lower limit of 6.20 J/cm2 is taken from an example E which is not an example of the invention - see paragraph [0095] - because the grain size of this example is outside the claimed range. The subject-matter of claim 1 therefore contains subject-matter which goes beyond that of the application as originally filed.

5. 3rd Auxiliary Request

5.1 Added subject-matter

Claim 1 comprises the features of claim 1 as originally

filed together with the features of "rolling bearing" taken from paragraph [0043], "fracture stress value..." taken from paragraph [0044], "hydrogen content..." taken from [0046], and of "carbonitriding" taken from paragraph [0079]. The added feature that the component is "formed of JIS-SUJ2" is taken from examples 1 and 2 (see paragraphs [0078] and [0101]). This feature is therefore disclosed in combination with the other features of claim 1 and therefore the amendment fulfills the requirements of Article 123(2) EPC.

Claim 5 relates to a method of manufacturing a transmission according to at least claim 1. The actual method steps are disclosed in the embodiment illustrated in Fig. 4 of the application. The Examining Division found (see decision, page 4, 2nd paragraph) that these steps were not disclosed in combination with the material JIS-SUJ2 specified in claim 1. The Board cannot agree with this conclusion and considers that Figures 3 and 4 are presented in the application as "exemplary embodiments of the present invention" (paragraph [0053]). As both examples of the rolling bearing component of the invention are made using JIS-SUJ2 then the person skilled in the art would understand that the method of Figure 4 also used this material.

The requirements of Article 123(2) EPC are therefore fulfilled.

5.2 Priority

D11 was published on 3 July 2003 i.e. between the two claimed priority dates. It was categorised in the European search report as a document being particularly relevant when taken on its own. It is thus necessary to

examine whether the earliest priority is valid in order to determine whether D11 belongs to the state of the art or not.

The priority application JP 2003-053748 corresponds substantially with the present application as originally filed. In particular the parts of the present application providing a basis for the independent claims are also included in the priority application. Thus the priority application relates to the same invention as the present application and therefore fulfills the requirements of Article 87(1) EPC.

5.3 Novelty

None of the cited documents disclose a bearing made of steel of type JIS-SUJ2 with the other parameters defined in claim 1. The subject-matter of claim 1 is therefore new.

5.4 Inventive step

5.4.1 Closest prior art

The Board considers that the following features of claim 1 are generally known: "A transmission capable of changing a rotational speed of an output shaft relative to a rotational speed of an input shaft by means of mesh of toothed wheels, comprising a transmission component, wherein said transmission component is a rolling bearing component".

In this respect, the Board notes that D2 discloses a gear or a bearing but not a transmission comprising

a rolling bearing component.

5.4.2 The subject-matter of claim 1 therefore differs in that the rolling bearing component
- has a nitriding layer at a surface layer, wherein the nitriding layer is formed by a carbonitriding process, an austenite grain with a grain size number measured in accordance with Japanese Standard JIS G 0551 falling within a range exceeding 10, a fracture stress value of at least 2650 MPa, and a hydrogen content of at most 0.5 ppm and
- is formed of JIS-SUJ2.

5.4.3 The problem to be solved may be regarded as being to propose a transmission with a longer fatigue life (cf [0006] of the application).

5.4.4 The claimed solution is not made obvious by the available prior art. Although the use of JIS-SUJ2 for a bearing component may be considered as being obvious for the person skilled in the art, the cited prior art neither suggests this steel with the claimed properties nor a heat treatment that would lead to the claimed properties. In seeking to solve the above problem, the skilled person would have to further develop the known steels and their heat treatment methods and then apply this to the generally known transmission. These modifications would have required inventive skill due to the lack of further hints in the available prior art.

5.4.5 In conclusion, the subject-matter of claim 1, according to the third auxiliary request, involves an inventive step in the sense of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent in the following version:

Description:
Pages 1-28 as filed on 10 October 2014 with the letter dated 10 October 2014.

Claims:
Nos. 1-5, according to the third auxiliary request, as filed on 10 October 2014 with the letter dated 10 October 2014.

Drawings:
Sheets 1/13-13/13 as originally filed.

The Registrar: The Chairman:

V. Commare T. Kriner

Decision electronically authenticated