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**Datasheet for the decision  
of 9 April 2024**

**Case Number:** T 1175/22 - 3.2.08

**Application Number:** 15835059.5

**Publication Number:** 3187752

**IPC:** F16H55/17, F16H55/06

**Language of the proceedings:** EN

**Title of invention:**

GEAR PAIR

**Patent Proprietor:**

NISSAN MOTOR CO., LTD.

**Opponent:**

Strawman Limited

**Relevant legal provisions:**

EPC Art. 56, 123(3), 83

RPBA 2020 Art. 13(2)

**Keyword:**

Main request - inventive step - (no)

Auxiliary request - amendments - allowable (yes)

Auxiliary request - sufficiency of disclosure - (yes)

Auxiliary request - inventive step - (yes)

Amendment after summons - taken into account (no)

**Decisions cited:**

G 0009/92, G 0001/99, T 1544/07



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Case Number: T 1175/22 - 3.2.08

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.08**  
**of 9 April 2024**

**Appellant:** Strawman Limited  
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**Respondent:** NISSAN MOTOR CO., LTD.  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
11 March 2022 concerning maintenance of the  
European Patent No. 3187752 in amended form.**

**Composition of the Board:**

**Chairwoman** P. Acton  
**Members:** C. Vetter  
K. Kerber-Zubrzycka

## Summary of Facts and Submissions

- I. The appeal was filed by the opponent (appellant) against the interlocutory decision of the opposition division finding that, on the basis of auxiliary request 1 then on file, the patent in suit met the requirements of the EPC.
- II. The opposition division had decided, *inter alia*, that:
- (1) the subject-matter of the claims of this request was novel and involved an inventive step
  - (2) the patent, on the basis of this request, disclosed the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art
  - (3) the subject-matter of the patent according to this request did not extend beyond the content of the application as filed
- III. Oral proceedings were held before the Board.
- IV. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.
- The respondent (patent proprietor) requested that the appeal be dismissed or, alternatively, that the patent be maintained according to one of auxiliary requests 1 to 3 filed with the reply to the appeal of 16 November 2022 (which correspond to auxiliary requests 2 to 4 during opposition proceedings).
- V. Claim 1 of the main request reads as follows (feature designation added by the Board):

**M1.1** A gear pair comprising a first gear and a second gear that are engaged and paired with each other,  
characterized in

**M1.2** - that an arithmetic average roughness Ra of a tooth surface of the first gear is less than 0.10  $\mu\text{m}$ ,

**M1.3** - that an arithmetic average roughness Ra of a tooth surface of the second gear is equal to or greater than 0.15  $\mu\text{m}$ ,

**M1.4** - that the number of teeth of the first gear is less than the number of teeth of the second gear, and

**M6** - that a surface hardness of the tooth surface of the first gear is less than a surface hardness of the tooth surface of the second gear.

Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that feature **M6** is *replaced* by feature **M2** (claim 2 as granted), which requires that

**M2** the arithmetic average roughness Ra of the tooth surface of the first gear is equal to or less than 0.05  $\mu\text{m}$ .

VI. In the present decision, reference is made to the following documents:

D8 EP 1 954 960 B1

D9 EP 1 887 103 A2

D23 England, Gordon, "Calculator for Conversion between Vickers Hardness Number and SI Units MPa and GPa"

VII. The arguments of the parties relevant to the decision are set out below in the Reasons for the Decision.

### **Reasons for the Decision**

1. Main request - inventive step

1.1 D9 discloses in figure 2 a gear pair with the following characteristics (references in parentheses refer to D9):

**M1.1** A gear pair comprising a first gear (pinion gear 9) and a second gear (disc 8) that are engaged and paired with each other, wherein

**M1.4** - the number of teeth of the first gear is less than the number of teeth of the second gear (paragraph [0090]: "the number of teeth: 24 (pinion gears) and 60 (gear of the disc)").

1.2 Paragraph [0091] of D9 discloses that all gears are made of the same material. After gear cutting, the gears are subjected to carburising, quenching and tempering so as to have a surface hardness of 720 Hv (Vickers hardness), which is equal to 7.1 GPa (D23).

This is the final state for the disc 8, i.e. the second gear, since it is not subjected to any further treatment.

The pinion gears 9, in turn, are ground and coated with "DLC films or film" (D9, paragraph [0091]). The resulting surface hardnesses of the first and, if present, second DLC films on the pinion gears 9 are listed in Table 1 of D9.

1.3 Comparative Example 5 of D9 comprises only a single DLC film, which was undisputed by the respondent, and which follows from the fact that in Table 1 of D9 the relevant columns under the heading "Upper layer (second DLC film)", in particular the columns "Film formation process" and "DLC film formation region", are crossed out by a dash.

According to Table 1, the surface hardness of the DLC film of Comparative Example 5 is 6 GPa.

Hence, Comparative Example 5 discloses a gear pair in which the surface hardness of the tooth surface of the first gear (pinion gears 9) is 6 GPa, and the surface hardness of the tooth surface of the second gear (disc 8) is 7.1 GPa. This anticipates feature **M6**, according to which

**M6** - a surface hardness of the tooth surface of the first gear is less than a surface hardness of the tooth surface of the second gear.

1.4 Regarding the surface roughness Ra of the second gear, paragraph [0091] of D9 discloses that the gear of the disc 8 has a surface roughness (Ra) of 0.2. This applies to all examples and comparative examples, and in particular to Comparative Example 5, since the disc 8 is not subjected to any further treatment (see above point 1.2). Thus, D9 also discloses feature **M1.3**, according to which

**M1.3** - an arithmetic average roughness Ra of a tooth surface of the second gear is equal to or greater than 0.15  $\mu\text{m}$ .

- 1.5 Regarding the surface roughness Ra of the first gear, Table 1 of D9 discloses for Comparative Example 5 that the arithmetic average roughness Ra of the DLC film is 0.10 (D9, table 1).
- 1.6 Consequently, the subject-matter of claim 1 differs from the disclosure of D9 in that an arithmetic average roughness Ra of the tooth surface of the first gear is less than 0.10  $\mu\text{m}$  (feature **M1.2**).
- 1.7 The effect of this distinguishing feature, alleged by the respondent, is an improvement of the transmission efficiency of the gears and an improvement of the pitting fatigue life of the tooth surfaces (patent, paragraph [0008]). Paragraphs [0011] and [0012] of the patent provide an explanation for this alleged effect:

[0011] ... In the gear pair, the second gear is formed to have a rougher tooth surface than the first gear so that so-called initial conformation (running-in) can occur.

[0012] ... That is, when the gear pair rotationally transmits power through the first and second gears, the first gear having fewer teeth is subjected to a larger number of slides on the tooth surface. In the gear pair, the first gear having fewer teeth is configured to have a tooth surface with small arithmetic average roughness Ra so that the second gear has a rougher tooth surface. Accordingly, abrasion due to misaligned contact between the tooth faces or tooth flanks occurs in the first gear that is subjected to a larger number of stress loads, which eventually reduces the pitting fatigue life.



1.8 The arithmetic average roughness Ra indicates the deviation of a surface from a mean height. It does not, however, characterise the actual topography of the surface. In fact, a surface with pronounced peaks can have the same Ra value as a surface with pronounced valleys, although they greatly differ in their topography and hence their respective appearance and characteristics.

It is common general knowledge that the running-in characteristics of a surface with pronounced peaks are very different from those of a surface with pronounced valleys. Therefore, in the present case, if the second gear has a topography with pronounced peaks, and the first gear with pronounced valleys, it will be the *second* gear that will suffer the most wear (the peaks will be blunted), regardless of the slightly higher Ra value. The reverse is true if the second gear has pronounced valleys and the first gear has pronounced peaks. It is therefore the actual surface topography that determines the running-in characteristics, and not the Ra value in isolation.

1.9 Consequently, the objective technical problem is to be formulated less ambitiously as the provision of a gear pair in which the tooth surface of the first gear has an alternative arithmetic average roughness Ra.

1.10 Starting from D9 as the closest prior art, which teaches an arithmetic average roughness Ra of 0.10  $\mu\text{m}$  for the tooth surface of the first gear, the skilled person would have considered it equally suitable to use a first gear with a tooth surface having an arithmetic average roughness Ra that is infinitesimally smaller than 0.10  $\mu\text{m}$ .

1.11 Therefore, the skilled person, starting from D9 and taking into account the common general knowledge, would have arrived at the claimed subject-matter in an obvious manner.

2. Auxiliary request 1 - request for non-admittance

2.1 During the oral proceedings the appellant requested not to admit auxiliary request 1 into the appeal proceedings, because it violated the principle of *reformatio in peius*. The appellant argued that the prohibition of *reformatio in peius* was an "important aspect" and therefore constituted an exceptional circumstance within the meaning of Article 13(2) RPBA 2020. Moreover, according to the appellant, the Board had to apply the prohibition of *reformatio in peius* of its own motion.

2.2 The respondent requested that the appellant's request and objection of breach of the prohibition of *reformatio in peius* not be admitted into the appeal proceedings pursuant to Article 13(2) RPBA 2020.

2.3 Article 13 (2) RPBA 2020 provides that any amendment to a party's appeal case made after notification of a communication under Article 15 (1) RPBA 2020, shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

2.4 The Board cannot follow the appellant in its allegation that the prohibition of *reformatio in peius* should be more "important" than the provisions of the EPC.

Furthermore, the Board is not obliged to examine this prohibition of its own motion. From the pertinent

decisions G 9/92, G4/93 and G 1/99 of the Enlarged Board of Appeal it is not derivable that the Board had to apply the prohibition of *reformatio in peius* of its own motion. Moreover, in previous case law it was held that, if the opponent and sole appellant does not invoke the prohibition of *reformatio in peius* against a claim request submitted by the respondent/patentee which extends the scope beyond that of the claims as maintained by the opposition division, the Board does not see any reason why it should apply the principle of the prohibition of *reformatio in peius* of its own motion (T 1544/07, point 2.5 of the Reasons).

- 2.5 It is generally accepted that in appeal proceedings the principle of party disposition applies, meaning that parties can put forward, withhold or withdraw their requests or objections as they see fit. Following this principle, any right protecting the appellant against an outcome that puts it in a worse position than if it had not appealed, may be waived, withheld or withdrawn.
- 2.6 The admissibility of the appellant's request and objection is therefore subject to the "regular" admissibility provisions as laid down in the Rules of Procedure of the Boards of Appeal (RPBA).
- 2.7 Auxiliary request 1 corresponds to auxiliary request 2 during opposition proceedings. It was resubmitted with the reply to the statement setting out the grounds of appeal of 16 November 2022. Hence, the appellant could have objected to this request at any stage of the appeal proceedings. It chose, however, to withhold the objection until the oral proceedings before the Board without invoking any exceptional circumstances or giving any reasons for the late submission.

2.8 Therefore, the new request and objection of the appellant were not admitted into the appeal proceedings under Article 13(2) RPBA.

3. Auxiliary request 1 - amendments

3.1 The application as originally filed contained no unit for the arithmetic average roughness Ra. Only during the examination phase, the unit " $\mu\text{m}$ " was added in claim 1.

3.2 It is common ground that the arithmetic average roughness Ra is not a dimensionless parameter, and that two units are commonly used in the technical field concerned, which are micro meter " $\mu\text{m}$ " and micro inch " $\mu\text{in}$ ". It is also common ground that the conversion factor between  $\mu\text{m}$  and  $\mu\text{in}$  is 39.37. That is, 1  $\mu\text{m}$  is equal to 39.37  $\mu\text{in}$ . Conversely, for example, 0.10  $\mu\text{in}$  is equal to 0.0025  $\mu\text{m}$ .

3.3 The appellant argued that in view of the fact that there are two usual units for Ra, the insertion of the unit " $\mu\text{m}$ " was not directly and unambiguously derivable from the application as originally filed. Moreover, D8 disclosed in claim 2 a gear with a surface having an arithmetic mean roughness of 0.1  $\mu\text{in}$ , which proved that " $\mu\text{in}$ " was a reasonable unit for the arithmetic average roughness value of 0.10 mentioned in feature **M1.2**.

3.4 The application as originally filed discloses in Table 1, Examples 1 to 10, first gears with an Ra value between 0.028 and 0.096, each obtained by "barrel polishing". In the light of the table set out in paragraph 13.12 of the decision under appeal, an Ra value of 0.028  $\mu\text{m}$  is a realistic result for barrel polishing. However, an Ra value of 0.028  $\mu\text{in}$  would

correspond to 0.0007  $\mu\text{m}$ , which is a factor of 20 smaller than the smallest Ra value achievable by any of the polishing methods disclosed in said table, including lapping and superfinishing. It is even a factor of 4 lower than the Ra value mentioned in D8, which is undisputedly not a surface roughness value achievable by barrel polishing.

Therefore, the skilled person would consider an Ra value of 0.028  $\mu\text{in}$  not to be a realistic result for barrel polishing, so that  $\mu\text{m}$  is the only reasonable choice between the two options " $\mu\text{m}$ " and " $\mu\text{in}$ " for the examples mentioned in the patent.

3.5 Claim 1 as originally filed requires that the Ra value of the first gear is less than 0.10 without specifying the unit. In case the unit was understood as being  $\mu\text{in}$ , the claim would require an Ra value of the first gear, expressed in  $\mu\text{m}$ , of less than 0.0025  $\mu\text{m}$ . Examples 1 to 10 have Ra values of the first gear between 0.028  $\mu\text{m}$  and 0.096  $\mu\text{m}$ . Hence, if the unit in claim 1 as originally filed were to be understood as being  $\mu\text{in}$ , then none of the examples would be encompassed by the claim. Conversely, if the unit in claim 1 as originally filed were to be understood as being  $\mu\text{m}$ , then all of the examples would be encompassed by the claim. Therefore, also for the Ra values mentioned in claim 1 as originally filed, the only reasonable choice between the two units " $\mu\text{m}$ " and " $\mu\text{in}$ " is  $\mu\text{m}$ .

3.6 Therefore, amended claim 1 of auxiliary request 1 fulfills the requirements of Article 123(2) EPC.

4. Auxiliary request 1 - sufficiency of disclosure

4.1 The objection under Article 83 EPC was based on the argument that the effect of an improved pitting fatigue life was not achieved over the whole scope claimed.

4.2 Since improved pitting fatigue life is not a feature of the claim, this effect is not to be considered under Article 83 EPC, but for the assessment of inventive step.

4.3 Therefore, the patent is considered to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

5. Auxiliary request 1 - novelty and inventive step

5.1 The appellant had no objections under Articles 54 and 56 EPC against auxiliary request 1. It declared that the subject-matter of this request was new and involved an inventive step.

5.2 In the absence of any objection under Articles 54 and 56 EPC, and as the Board does not see problems under these provisions either, the subject-matter of claim 1 of auxiliary request 1 is considered to be novel and to involve an inventive step.

## Order

### **For these reasons it is decided that:**

The decision under appeal is set aside. The case is remitted to the opposition division with the order to maintain the patent as amended in the following version:

#### Claims:

No. 1 to 9 according to auxiliary request 1 filed with letter of 16 November 2022 ("New Claims 1 to 9 - APPEAL AUX 1")

#### Description:

Pages 2 to 12 received during oral proceedings before the Board on 9 April 2024

The Registrar:

The Chairwoman:



C. Moser

P. Acton

Decision electronically authenticated