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Case Number: T 0625/17 - 3.3.02

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Language of the proceedings: EN

Title of invention:
LOW-FRICTION LUBRICATION ASSEMBLY

Applicant:
Nissan Motor Co., Ltd.
MARTIN, Jean-Michel

Headword:

Relevant legal provisions:
EPC Art. 54, 56
RPBA Art. 12(4)

Keyword:
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

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Beschwerdekammern

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Case Number: T 0625/17 - 3.3.02

D E C I S I O N
of Technical Board of Appeal 3.3.02
of 8 April 2020

Appellant: (Applicant 1)	Nissan Motor Co., Ltd. 2, Takara-cho Kanagawa-ku Yokohama-shi, Kanagawa 221-0023 (JP)
Appellant: (Applicant 2)	MARTIN, Jean-Michel 21, rue clos Chapuis 69380 Chazay d'Azergues (FR)
Representative:	Hoefer & Partner Patentanwälte mbB Pilgersheimer Straße 20 81543 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 October 2016 refusing European patent application No. 07742613.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	M. O. Müller
Members:	P. O'Sullivan
	R. Romandini

Summary of Facts and Submissions

I. The appeal of the applicant (hereinafter "appellant") lies from the decision of the examining division to refuse European patent application 07 742 613.8 pursuant to Article 97(2) EPC.

II. According to the contested decision, the subject-matter of claim 1 of the then pending main request lacked novelty pursuant to Article 54 EPC.

III. The following documents *inter alia* were cited in examination proceedings:

D1 M. Kano et al., Tribology Letters, Vol. 18, No.2, February 2005
D4 EP 1 510 594 A2
D6 US 5,114,603 A

IV. With the statement of grounds of appeal the appellant submitted a further document, denoted in the following as:

D7 "Friction results in SRV tests"

V. The appellant requested that the decision under appeal be set aside and that a patent be granted based on the sole set of claims filed as main request with the statement of grounds of appeal.

VI. Independent claims 1 and 11 of the main and sole request read as follows:

"*1. A low-friction lubrication assembly characterized by comprising:*
a first member relatively slidable against a second member, the first member having chemical affinity with an OH-group on its sliding surface; and
an oxygen containing compound located on the sliding surface of the first member and being able to produce a tribofilm to be located on the sliding surface of the first member having the chemical affinity, through hydrogen bond interactions with the OH-group,
wherein the second member further has chemical affinity with an OH group, and the tribofilm is also able to be formed on a sliding surface of the second member through hydrogen bond interactions with the OH-group in response to sliding motion,
wherein the first member includes a coating of a hydrogen free diamond-like carbon of ta-C type which is a hydrogen free tetrahedral carbon, and the second member includes a coating of a hydrogen free diamond-like carbon of ta-C type,
wherein the oxygen containing compound consists of glycerol ***which is the only lubricant in the low-friction lubrication assembly.***"

11. A watch comprising a low-friction lubrication assembly according to any of claims 1 to 10"

(bold text added compared to claim 1 underlying the contested decision)

VII. The appellant's arguments, insofar as relevant to the present decision, may be summarised as follows:

Novelty - Article 54 EPC

D1 disclosed a low friction assembly wherein a first member was in slidable contact with a second member, both members including a Diamond-like Carbon (DLC) coating of the ta-C type. The lubricant is a polyalphaolefin (PAO) comprising 1% glycerol mono-oleate (GMO). Even if, as concluded by the examining division in the contested decision, GMO comprised residual glycerol, the subject-matter of claim 1 at issue now specified that glycerol was the only lubricant in the low-friction lubrication assembly. The PAO-GMO lubricant disclosed in D1 was thus excluded from the scope of claim 1, and the subject-matter of independent claims 1 and 11 was novel.

Inventive step - Article 56 EPC

The subject-matter of claim 1 was distinguished from the disclosure in D1 in the nature of the lubricant employed. As demonstrated by the tests of D7, the effect of the distinguishing feature with respect to D1 was a lowered friction coefficient. The achievement of this effect was not obvious in view of D1 in combination with D4.

Amendments - Article 123(2) EPC

The text added to claim 1 at issue compared to claim 1 underlying the contested decision was based on *inter alia* paragraph [0019] of the application as filed.

VIII. The appellant with the notice of appeal requested oral proceedings as an auxiliary measure should the board not agree to the patentability of the main request. Oral proceedings had been scheduled for 16 July 2020.

However, since the board with the present decision finds the main request allowable, oral proceedings were cancelled accordingly.

Reasons for the Decision

Main Request

1. Admittance

1.1 The main request was filed with the statement of grounds of appeal. According to Article 12(4) RBPA 2007, the board has the discretion *inter alia* not to admit requests which could have been presented in the first instance proceedings.

1.2 According to the minutes of oral proceedings before the examining division (point 4.2), the (then) applicant, at the end of oral proceedings, stated that it did not wish to file a further request. However, as can be derived from the *obiter dictum* annexed to the contested decision (page 5, point 2), the subject-matter of claim 1 of the now pending main request was proposed earlier in the oral proceedings. This is reflected in the minutes according to which the applicant suggested to "limit the lubricant to the oxygen containing compound in claim 1" (point 2.2), subsequent to which the proceedings were interrupted (point 2.3). After resuming oral proceedings, inventive step was discussed **before** giving the applicant the opportunity to file a further set of claims (point 3). It is evident from the subsequent paragraphs (3.1 - 3.6) that the ensuing discussion was directed to the subject-matter of the proposed new claim 1 according to paragraph 2.2 of the minutes, and not to that of the then pending main

request, which the examining division had argued lacked novelty (point 2.1). Paragraph 3.6 of the minutes records that the examining division provided the opinion that a technical effect over the closest prior art could not be established. It was **after** this discussion that the applicant chose not to file a further request (point 4.2), i.e. when already informed (at least) of the examining division's opinion with respect to the absence of a technical effect in the proposed claim, if not already in the knowledge that the examining division considered such a claim to lack inventive step.

1.3 Furthermore, in its *obiter dictum,* the examining division provided detailed reasoning as to why in its opinion, although novel, the subject-matter of such a proposed claim 1 would lack inventive step.

1.4 Thus, while claim 1 of the present main request was not formally submitted as a written copy during examination proceedings, it is readily apparent from the minutes of oral proceedings, as well as the *obiter dictum* annexed to the decision, that it was proposed and discussed extensively during oral proceedings before the examining division. Consequently, the examining division was not prevented from setting out its opinion with regard to the subject-matter of claim 1 at issue.

1.5 For this reason, the board decided to admit the main request into appeal proceedings pursuant to Article 12(4) RPBA 2007.

2. Novelty - Article 54 EPC

2.1 The examining division considered the claims before it to lack novelty over D1.

2.2 D1 is a journal publication and concerns the ultralow friction of Diamond-Like Coatings (DLC) in the presence of glycerol mono-oleate (GMO)(D1, title). Specifically, D1 discloses *inter alia* the evaluation of lubrication between members comprising hydrogen-free DLC coatings of the ta-C/ta-C type using polyalphaolefin (PAO) mixed with 1 wt.% GMO (hereinafter PAO+GMO; D1, page 247, right hand column, line 15 and 16; paragraph 3.2, lines 3-7; figure 5).

2.3 The members comprising the hydrogen-free DLC coatings of the ta-C/ta-C type correspond to the first and second members and their respective coatings as defined in claim 1 at issue.

2.4 According to the contested decision, commercially available GMO comprised residual amounts of glycerol (D6, column 2, lines 5-21 and column 3, lines 19-21), corresponding to the oxygen containing compound of claim 1. In view of the presence of glycerol, the examining division concluded that the subject-matter of the then pending claim 1 lacked novelty over the disclosure of D1.

2.5 In contrast to claim 1 pending before the examining division, claim 1 at issue is however limited to a low-friction lubrication assembly in which glycerol is the oxygen containing compound and is the **only** lubricant in the low-friction lubrication assembly. D1 fails to disclose such a system.

2.6 It follows that the subject-matter of independent claims 1 and 11 are novel vis à vis D1. The same holds true for dependent claims 2-10.

3. Inventive step - Article 56 EPC

3.1 In the *obiter dictum* annexed to the contested decision, the examining division set out the opinion that even if then pending claim 1 were to be amended to include the feature that glycerol was the sole lubricant in the low-friction assembly, the claimed subject-matter would lack inventive step.

3.2 Closest prior art

3.2.1 The present application aims to provide a low-friction lubrication assembly showing improved sliding characteristics over the low friction assemblies of the prior art (paragraph [0005]).

3.2.2 In its *obiter dictum*, the examining division considered D1 to be the closest prior art. The board agrees that D1 serves as a suitable closest prior art disclosure, since similar to claim 1 at issue, it concerns investigations into the ultralow friction observed in a ta-C/ta-C type DLC assembly in the presence of a lubricant (D1, paragraph 3.2, lines 3-7; figure 5).

3.3 Problem solved

3.3.1 Claim 1 at issue differs from the disclosure in D1 in the use of glycerol as the sole lubricant, while in D1 glycerol is at most a component of the PAO+GMO lubricant employed therein.

3.3.2 Examples 5-9 of the application (table 2, page 13) demonstrate that in an SRV friction test (paragraph [0047]), ta-C/ta-C type DLC coated members lubricated with glycerin (glycerol) provided a friction coefficient of 0.007.

3.3.3 As evidence of an effect arising from this distinguishing feature over the lubricant disclosed in D1, the appellant filed D7.

3.3.4 D7 discloses a friction test of PAO+GMO and the results thereof in the form of a bar chart. According to the appellant, the result for ta-C/ta-C lubricated with PAO+GMO (which reflected the disclosure of D1) could be directly compared with examples 5 to 9 of the application, since the test employed had been performed using the same equipment, the same test conditions and the same temperature. Thus, the friction coefficient of approximately 0.03 obtained from the SRV tests disclosed in D7 for the ta-C/ta-C type DLC with PAO+GMO as lubricant (the highlighted entry in the graph of D7) was much higher than the coefficient of 0.007 obtained according to examples 5-9 of the application. The effect of the distinguishing feature over D1 was thus the lowering of the friction coefficient.

3.3.5 However, the test of D7 cannot be compared with those examples 5-9 of the application. In contrast to the appellant's statement, the test conditions stated in D7 are not the same as those recited in the application (table 1, paragraph [0049]): the application recites a "maximum Hertizan contact pressure" of 270 MPa, while the SRV test of D7 recites a "pressure" of 0.7 GPa (700 MPa); the "test time" is 15 minutes according to the application, while "time" is 60 minutes according to D7; the application cites data for "amplitude" and

"number of vibration", while D7 is silent in this regard; and D7 cites velocity V, while the application is silent for this variable. Thus the test conditions are in fact different, and a direct comparison of the results obtained is therefore not possible.

3.3.6 In contrast, the results provided in D1 itself are in fact directly comparable with those provided in the application. In the investigations disclosed in D1, two types of friction tests are described, namely "pin-on-disc sliding tests" (page 246, paragraph 2.2, lines 1-16), and "SRV sliding tests" (page 246, paragraph 2.2, lines 16-29). The latter test corresponds to the test used in the application for the experiments with glycerol (page 11, lines 24-28). The test conditions employed in D1 for the SRV sliding test (page 246, paragraph 2.2, final 5 lines of the first paragraph) correspond exactly to those employed in the application (table 1, paragraph [0049]). In D1, the friction coefficient obtained in the SRV test for the material combination ta-C/ta-C type DLC using PAO+GMO as lubricant was found to be approximately **0.03** (D1, figure 5, material combination ta-C/ta-C). According to the application, the same test on the same material combination using glycerol as the sole lubricant displayed a consistent friction coefficient of **0.007**, thus approximately 4 times lower than that obtained in D1 (application, table 2, page 13, examples 5-9). Thus the use of glycerol as sole lubricant in the assembly according to claim 1 at issue represents a clear improvement in the friction coefficient compared to the same assembly in D1 using PAO+GMO as the lubricant.

3.3.7 The board furthermore notes that this conclusion still applies despite some variation in the thickness of the ta-C layer across the tests. Thus, according to D1,

ta-C coatings were applied to the substrate to a thickness of 0.5 µm (page 246, section 2.1). In examples 5-9 of the application, the ta-C film thicknesses employed were not identical in any given pin and disc combination, and varied across all members from 0.3 to 1.1 µm. Despite this variation however, the friction coefficient of 0.007 obtained for all of said examples indicates that the differences in thickness within the ranges exemplified do not affect the final result.

3.3.8 In view of the foregoing, the objective technical problem underlying the subject-matter of claim 1 at issue is the provision of an **improved** low-friction lubrication assembly comprising two members, both having a hydrogen free DLC coating of the ta-C type.

3.4 Obviousness

3.4.1 According to examining division, the technical problem underlying claim 1 would be the provision of a mere alternative lubricant assembly. It concluded that such a claim would lack inventive step over D1 as closest prior art in combination with D4.

3.4.2 The board disagrees. In view of the objective technical problem as formulated above, D4 provides the skilled person with no pointer nor incentive to employ glycerol in a ta-C/ta-C type DLC lubricant assembly with a view to solving said problem, as set out in the following.

3.4.3 D4 concerns improvements in low-friction sliding members (paragraph [0002]), and thus is in the same technical field as the present application. D4 focuses on the nature of the low friction sliding members, and discloses that according to the invention they are

coated with a DLC material which preferably has a low hydrogen content (paragraphs [0008] and [0009]). Specifically, a coating of DLC of the a-C type is disclosed (paragraph [0017]). A coating of hydrogen free ta-C type DLC according to claim 1 at issue is not disclosed.

3.4.4 Oxygen-containing compounds form a tribo-film with the sliding members (D4, paragraph [0016]). Paragraphs [0036] - [0038] disclose the oxygen-containing compounds that can be employed; the extremely broad range of compounds are described in more detail in paragraphs [0039]-[0065]. Among these, paragraph [0046] discloses tri- and higher- polyalcohols which may be used, and include glycerin (glycerol) in a long list. The examples of D4 in table 1 (page 20) include example 3 in which glycerol is used as the sole lubricant. The members (a disc and 3 pins) are coated with an a-C type DLC coating (the disc), or not coated (the pins). This combination provides a friction coefficient of **0.045**. The method used to measure the friction coefficient according to D4 was the pin-on-disc method (D4, paragraphs [0014], [0140] and figure 1), which corresponds to the first method described in D1 ("pin-on-disc sliding tests"; page 246, paragraph 2.2, lines 1-16), which as set out above, is different from the SRV friction test applied in the application.

3.4.5 Examples 6-9 of D4 differ from example 3 in that it is the pins which have an a-C type DLC coating, and the disc which is uncoated. However, the surfaces tested against each other are the same. Furthermore, examples 6-9 employ as lubricant PAO+GMO, PAO+ether, PAO+amide or PAO+amine, respectively. The friction coefficients obtained for these examples are **0.048, 0.041, 0.046 and 0.041** respectively. These results show that in a

lubricant assembly comprising one member having an a-C type DLC coating and one uncoated member, the friction coefficient obtained using glycerol (0.045) appears similar to that obtained when using PAO+GMO (0.048).

3.4.6 Thus even assuming that the friction results obtained in D4 for an a-C type DLC material coating and an uncoated material would be understood by the skilled person as equally applicable to the ta-C type coatings of D1, there is no teaching derivable from D4 according to which the skilled person would select glycerol as providing a solution to the technical problem as set out above.

3.4.7 Therefore, the subject-matter of independent claims 1 and 11 involves an inventive step. The same conclusion applies to dependent claims 2-10.

4. Amendments - Article 123(2) EPC

4.1 Claim 1 at issue finds basis in a combination of claims 1 and 2 as filed. The feature that both the first and second members include a coating of ta-C type DLC is supported at least by paragraph [0042] of the application as filed, lines 15-16. Finally, the feature added with respect to claim 1 underlying the contested decision, namely that glycerol is the only lubricant in the low-friction assembly, is supported by paragraphs [0019], [0041], [0043] of the application as filed, and the examples of table 2, all of which indicate that glycerol may be the sole lubricant in the assembly.

4.2 Dependent claims 2-10 find basis in claims 3, 4, 5, 6, 7, 12, 17, 29 and 30 respectively of the application as filed. Independent claim 11 is based on claim 43 of the application as filed.

Claims 1-11 are thus compliant with Article 123(2) EPC.

5. Claims - Article 84 EPC

5.1 Claim 1 comprises several functional expressions, namely "slidable against a second member", "having a chemical affinity with an OH group on its sliding surface", and "an oxygen containing compound ... being able to produce a tribofilm ... through hydrogen bond interactions with the OH-group". While these functional definitions in themselves may be seen to lack clarity, the claim itself is rendered clear by the subsequent specification that both members include a coating of a hydrogen free diamond-like carbon of the ta-C type, and that the oxygen containing compound consists of glycerol, which is the only lubricant in the assembly. Thus the first and second member as well as the oxygen containing compound are precisely defined in terms of their technical features, rendering claim 1 clear and thus in compliance with Article 84 EPC.

5.2 The board furthermore sees no lack of clarity in the subject-matter of dependent claims 2-10 and independent claim 11.

5.3 It follows that the subject-matter of claims 1-11 meets the requirements of Article 84 EPC.

Conclusion

6. The set of claims according to the main and sole request fulfills the requirements of the EPC and is thus allowable.

Order

For these reasons it is decided that:

1. The decision is set aside.

2. The case is remitted to the examining division with the order to grant a patent with the following claims and a description to be adapted thereto:

   Claims 1 to 11 filed with the statement of grounds of appeal.

The Registrar: The Chairman:

N. Maslin M. O. Müller

Decision electronically authenticated