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Datasheet for the decision
of 13 June 2024

Case Number:	T 2132/21 - 3.3.02
Application Number:	08728000.4
Publication Number:	2109659
IPC:	C10M161/00
Language of the proceedings:	EN

Title of invention:
DISPERSANT COMBINATION FOR IMPROVED TRANSMISSION FLUIDS

Patent Proprietor:
The Lubrizol Corporation

Opponent:
Afton Chemical Corporation

Relevant legal provisions:
EPC Art. 54, 54(3), 56, 83, 87(1), 123(2)
RPBA 2020 Art. 13(1)

Keyword:
Novelty
Inventive step
Sufficiency of disclosure
Amendments

Decisions cited:
G 0003/14, G 0001/22, G 0002/22, T 0596/99, T 0944/04, T 1072/07, T 1682/15

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2132/21 - 3.3.02

DECISION
of Technical Board of Appeal 3.3.02
of 13 June 2024

Appellant: (Opponent)	Afton Chemical Corporation 500 Spring Street Richmond, Virginia 23219 (US)
Representative:	J A Kemp LLP 80 Turnmill Street London EC1M 5QU (GB)
Respondent: (Patent Proprietor)	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, OH 44092-2298 (US)
Representative:	D Young & Co LLP 3 Noble Street London EC2V 7BQ (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 4 October 2021 rejecting the opposition filed against European patent No. 2109659 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	M. O. Müller
Members:	P. O'Sullivan
	L. Bühler

Summary of Facts and Submissions

I. The appeal of the opponent (hereinafter appellant) lies from the decision of the opposition division to reject the opposition against European patent EP 2 109 659.

II. The following documents *inter alia* were submitted during the course of opposition proceedings:

D1 : US 5,665,685
D2 : US 6,586,365
D3 : US 4,036,767
D4 : US 2002/0086965 A1
D5 : US 2002/0032293 A1
D6 : US 2004/0077509 A1
D7 : WO 2007/070845 A2
D8 : WO 2007/127615 A2
D9 : WO 2007/044820 A1
D9a: US 6,077,909
D10: US 4,021,357
D11: EP 0 355 895 A2
D12: US 2005/0202981
D14: Extract from "Lubricant Additives, Chemistry and Applications", Edited by L Rudnick, 2003
D14a: Extract from "Lubricant Additives, Chemistry and Applications", Edited by L Rudnick, 2003, pages 153-157 and 331
D15: Extract from "Lubricants and Special Fluids", Stepina *et al.*, 1992
D18: Xiong *et al.*, npj Clean Water, 2018, 17, pages 1-9
D19: Extract from "Lubricants and Lubrication", edited by Mang *et al.*, 2007
D26: Declaration of R A Eveland dated 24 July 2020
D27: Further declaration of R A Eveland dated 24 July

2020
D28: Extract from "Chemistry and Technology of Lubricants", Mortier *et al.*, 3rd Editions, 2010
D36: SAE technical paper series 2007-01-3988, "Automatic Transmission and Driveline Fluids"
D37: SAE 2003-01-1996, "Lubricant oxidation monitoring using FTIP analysis - Application to the development of a laboratory bulk oxidation test and to in-service oil evaluation"
D39: JP 2007-197509
D39a: machine translation of D39

III. With the reply to the statement of grounds of appeal the respondent submitted the following documents:

A050: Declaration of A H Wilcox dated 29 June 2022 and
A050a-A050j: associated evidence attached to A050
A051: T 205/14
A052: Declaration of J Dietz dated 5 July 2022
A053: US 3,231,587

IV. With letter dated 31 January 2023 the appellant submitted the following documents:

A054: US 4,450,087
A055: Further extract from "Lubricant Additives, Chemistry and Applications", Edited by L Rudnick, 2003

V. With letter dated 6 September 2023 the respondent submitted

A056: T 873/21

VI. With letter dated 11 November 2023 the appellant submitted the following documents:

A057: Van der Merwe *et al.*, J. Surfact. Deterg. (2017) 20, pages 193-205
A058: further extract from "Lubricant Additives, Chemistry and Applications", Edited by L Rudnick, 2003
A059: WO 01/00688 A1
A060: A letter the Patentee filed at the EPO in connection with A059, dated 18 May 2001
A061: Extract from "Lubricants and related products", D Klamann, 1984
A062: US 4,758,364
A063: Declaration of R Iyer dated 10 November 2023

VII. With letter dated 6 February 2024, the appellant submitted document

A064: Declaration of R Iyer dated 5 February 2024

VIII. In a communication pursuant to Article 15(1) RPBA sent in preparation for oral proceedings, the board *inter alia* expressed the preliminary view that the claimed priority was valid, and that the grounds for opposition under Article 100 (b) and (c) EPC, as well as the ground for opposition under Article 100(a) EPC in combination with Article 54 EPC, did not prejudice the maintenance of the patent as granted.

IX. Oral proceedings by videoconference took place as scheduled on 13 June 2024 in the presence of both the appellant and the patent proprietor (hereinafter respondent).

X. Requests relevant to the present decision

The appellant requested that the decision under appeal be set aside, and that the patent be revoked in its entirety.

The appellant also requested:

- that the new allegations of fact that the dispersant viscosity modifier (DVM) agents in D3 do not satisfy the N content requirement in claim 1 (points 63-65 of the respondent's letter dated 6 September 2023) not be admitted, and
- that technical expert Mr Edwards be permitted to address the board on specific technical issues.

The respondent requested dismissal of the appeal, implying maintenance of the patent as granted (main request).

The respondent also requested:

- that documents D14a, D14b, D28a, D35, D38, D39, D39a, D40, D41, D42a, D42b, D46, D47 not be admitted into the proceedings;
- that documents A57 and A59 to A64 not be admitted;
- that technical expert Mr Edwards not be permitted to address the board; and
- that D35 not be admitted should the appellant introduce it into its arguments in appeal proceedings.

XI. For the text of claim 1 of the main request, reference is made to the reasons for the decision set out below.

XII. For the relevant party submissions, reference is made to the reasons for the decision set out below.

Reasons for the Decision

Main request (patent as granted)

1. Amendments - Articles 100(c) and 123(2) EPC

1.1 The appellant argued that claim 13 as granted comprised added subject-matter in contravention of Article 123(2) EPC.

1.2 Claims 1 and 13 read as follows:

> *"1. A lubricant composition comprising:*
>
> *(a) an oil of lubricating viscosity;*
>
> *(b) a dispersant viscosity modifier comprising a poly(meth)acrylate copolymer containing nitrogen derived from a nitrogen-containing monomer in an amount to provide at least 0.4 percent by weight nitrogen to said dispersant viscosity modifier; and*
>
> *(c) a succinimide dispersant prepared from reaction of an amine with a hydrocarbyl-substituted succinic acylating agent prepared by reaction of polyalkene, at least 70 percent of the chains thereof containing a terminal vinylidene end group, with maleic anhydride in the substantial absence of chlorine.*
>
> *13. The composition of any of claims 1 through 12 wherein the nitrogen content of the succinimide dispersant is 1 to 10 weight percent, on an active chemical or diluent-free basis."*

1.3 Claim 16 of the application as filed (WO 2008/094781 A2) on which claim 13 as granted is based reads as follows:

"16. The composition of any of claims 1 through 15 wherein the nitrogen content of the succinimide dispersant is about 0.8 to about 2.0 weight percent"

1.4 Therefore, in relation to the nitrogen content range of the succinimide dispersant, claim 16 of the application as filed refers to "about 0.8 to about 2.0 weight percent", while claim 13 as granted refers to "1 to 10 weight percent".

1.5 The appellant submitted that granted claim 13 related to a range which was broader than the originally disclosed range, and consequently led to the creation of new combinations of features by virtue of the multiple dependency of claim 13, as well as the two subsequent claims which referred back to it. Furthermore, paragraph [0039] of the application as filed, accepted in the contested decision as adequate basis for claim 13, disclosed a general range of 1 to 10 weight percent of "the dispersant", but was silent with regard to the "*succinimide* dispersant". Since further dispersants in addition to the succinimide dispersant were disclosed in the application as filed, the general disclosure in paragraph [0039] of the nitrogen content of the dispersant did not provide basis for the specific disclosure of the amount of "succinimide dispersant" in claim 13 as granted.

1.6 The board disagrees. As stated by the respondent, it is clear from the application as a whole that paragraph [0039] concerns the succinimide dispersant, since this is the only *dispersant* (not *dispersant viscosity modifier*) disclosed in the application as filed with a defined nitrogen content. The board notes furthermore that the application as filed addresses the dispersant viscosity modifier specifically in paragraphs [0026] to [0029], while the succinimide dispersant is discussed in paragraphs [0030] to [0040] in which paragraph [0039] is comprised. Hence, paragraph [0039] concerns the succinimide dispersant, and not the dispersant viscosity modifier (DVM) of claim 1, component (b).

1.7 The amendment in claim 13 as granted also does not lead to new combinations not disclosed in the application as filed as argued by the appellant. It would be clear to the skilled person that the broader range of 1 to 10 percent disclosed in paragraph [0039] of the application as filed applies to all embodiments of the invention, since paragraph [0039] discloses said ranges generally, and not in the context of any one specific embodiment. Hence the replacement of the range in original claim 16 with the broader range from paragraph [0039] as filed does not add subject-matter.

1.8 Consequently, the ground for opposition under Article 100(c) EPC does not prejudice maintenance of the patent as granted.

2. Priority (Article 87(1) EPC)

2.1 The appellant argued that the patent was not entitled to the claimed priority date on both formal and substantive grounds. Priority was relevant in view of intermediate documents D7 to D9, which the appellant argued were prejudicial to the novelty (D7 and D8) or inventive step (D9) of the claimed subject-matter.

As stated in the board's communication pursuant to the Article 15(1) RPBA, and not challenged by the appellant, the validity of the priority is not relevant to the patentability of the claimed subject-matter vis à vis D7 and D8. Specifically, both documents claim a priority date earlier than that of the contested patent, and were published after the priority date of the contested patent but before the filing date thereof. Hence, independently of whether the priority date of the patent is valid, D7 and D8 are still relevant for novelty, either as prior art under Article 54(2) EPC (if the priority of the contested patent is deemed invalid) or under Article 54(3) EPC (if the priority is deemed valid). Hence, the validity of the claimed priority is only relevant in relation to D9.

2.2 Lack of priority on formal grounds

2.2.1 The patent claims a priority date of 30 January 2007 from US application US 60/887,192, filed in the name of the four inventors. In the filing of the PCT application leading to the patent, said four inventors were named as applicants for the US only, while the respondent, the Lubrizol Corporation, was named as the applicant for all other states, including EP.

2.2.2 The appellant submitted that absent any evidence that the priority rights were transferred to the respondent before the PCT application was filed, the default position must be that a lack of priority arises.

2.2.3 It was acknowledged by both parties in written proceedings (appellant: point 5.24 of the grounds of appeal; respondent: points 109 - 111 of the reply) that the outcome of referrals G 1/22 and G 2/22 were relevant for the question of the validity of the claim to priority in the present patent.

2.2.4 The consolidated decision of the Enlarged Board has subsequently been issued. The Enlarged Board decided (see the Order of the decision) *inter alia* that the EPO is competent to assess whether a party is entitled to claim priority under Article 87(1) EPC, and that there is a rebuttable presumption under the autonomous law of the EPC that the applicant claiming priority in accordance with Article 88(1) EPC and the corresponding Implementing Regulations is entitled to claim priority.

2.2.5 Of particular relevance to the present appeal, the Enlarged board stated that in a situation where a PCT application is jointly filed by parties A and B, (i) designating party A for one or more designated States and party B for one or more other designated States, and (ii) claiming priority from an earlier patent application designating party A as the applicant, the joint filing implies an agreement between parties A and B allowing party B to rely on the priority, unless there are substantial factual indications to the contrary (Order, final paragraph).

2.2.6 The same situation arises in relation to the present dispute. In short, the joint filing of the PCT application, in the absence of evidence to the contrary, is sufficient proof for an implied agreement on the joint use of the priority right.

2.2.7 In consequence, in relation to the present patent, the respondent is entitled to claim the priority date of 30 January 2007 from US application US 60/887,192.

2.2.8 Hence, on formal grounds, the priority claim is to be considered valid.

2.3 Lack of priority on substantive grounds

2.3.1 The appellant argued lack of priority on substantive grounds based on the following objections (i) to (iii).

2.3.2 (i) the expression "containing nitrogen derived from a nitrogen-containing monomer" in component (b) of claim 1 as granted

Claim 1 of the priority document refers to a copolymer "containing a nitrogen-containing monomer". Claim 1 as granted on the other hand refers to a copolymer "containing nitrogen derived from a nitrogen-containing monomer".

The appellant argued that the change in wording brought about a change in the technical meaning of the expression. Specifically, claim 1 of the priority document required that the nitrogen belong to the monomer building block of the DVM copolymer whereas the formulation of claim 1 of the main request, while requiring that the nitrogen was "derived" from a nitrogen-containing monomer, did not limit the position of the nitrogen in the polymer to the original monomer moiety. To illustrate, the appellant argued that, contrary to claim 1 of the priority document, claim 1 as granted allowed the covalently bound nitrogen in the monomer to rearrange in the reaction leading the formation of the DVM copolymer, i.e. to attach to a part of the polymer which did not correspond to the original nitrogen-containing monomer. This embodiment would lie within the scope of claim 1 as granted, but outside the scope of claim 1 of the priority document, and hence the priority was not valid.

The board disagrees. As stated by the respondent, following a technically sensible interpretation, it is implicit from the priority application that the nitrogen in the DVM is "derived" from the nitrogen-containing monomer - indeed, it would be clear to the skilled person that the DVM copolymer cannot "contain" a monomer *per se*, but rather a moiety derived from the monomer which has been integrated into the copolymer. Hence, this amendment in claim 1 of the main request merely serves to confirm the understanding of the skilled person reading claim 1 of the priority document. Furthermore, the embodiment described by the appellant according to which claim 1 as granted would be allegedly broader than claim 1 of the priority document would not be understood by the skilled person as such, and merely amounts to a hypothetical concept. The appellant in this regard provided no evidence that such a rearrangement of a nitrogen atom from a monomer to another part of the polymer is known such that it would be part of the common general knowledge of the skilled person. Consequently, this objection failed to convince the board.

2.3.3 (ii) the term "succinimide dispersant" in claim 14 as granted

The appellant submitted that the amendment of the term "borated succinimide dispersant" in claim 14 of the priority application to "succinimide dispersant" in claim 14 as granted, i.e. the deletion of "borated", was not derivable from the priority document.

The board disagrees. Claim 14 as granted contains the feature that "the succinimide dispersant is present in an amount of 0.1 to 10 weight percent". Claim 14 of the priority document refers instead to the feature that "the **borated** succinimide dispersant is present in an amount of about 0.1 to about 10 weight percent". As stated by the respondent, paragraph [0038] of the priority application indicates that the dispersant may be present in an amount to 0.1 to 10 weight percent. As established above in relation the Article 123(2) EPC, this paragraph concerns the succinimide dispersant. Hence, in a similar manner as set out above in relation to Article 123(2) EPC for granted claim 13, the priority document discloses that the presence of the succinimide dispersant in an amount of 0.1 to 10 weight percent is not limited specifically to borated succinimide dispersants, but is generally applicable. Hence, this objection failed to convince the board.

2.3.4 (iii) the various dependencies of the granted dependent claims

Finally, the appellant submitted that the various dependencies of the granted dependent claims did not find basis in the priority application.

However, as set out in the board's communication pursuant to Article 15(1) RPBA, the validity of the priority claim for the dependent claims is not relevant in the present appeal proceedings, as no objections under novelty or inventive step were raised in respect of specific dependent claims using one of D7 to D9 as basis for the objection.

Since this view was not challenged by the appellant, there is no need for the board to assess this objection.

2.3.5 Consequently, also on substantive grounds, the claimed priority is valid, at least in respect of granted claims for which a novelty or inventive step objection was raised.

3. Sufficiency of disclosure - Article 100(b) EPC

3.1 The appellant submitted that the person skilled in the art wishing to carry out the invention defined in the claims was unable to analyse a given succinimide of component (c) to verify, based on the information in the patent or the common general knowledge, whether it fulfilled the product-by-process features in claim 1. Hence a lack of sufficient disclosure arose.

3.2 The succinimide dispersant of component (c) of granted claim 1 is defined as being prepared from reaction of an amine with a hydrocarbyl-substituted succinic acylating agent prepared by reaction of polyalkene, at least 70 percent of the chains thereof containing a terminal vinylidene end group, with maleic anhydride in the substantial absence of chlorine.

3.3 The board disagrees with the appellant's position. As stated by the respondent, this question is not relevant for the assessment of sufficiency of disclosure for a product claim, but is rather a question of clarity under Article 84 EPC, which is not a ground for opposition and cannot be invoked in the present case according to G 3/14 (OJ EPO 2015 A102, headnote).

3.4 The relevant question in the assessment of sufficiency of disclosure is whether the skilled person is able to prepare the succinimide dispersant as claimed. This has not been questioned by the appellant, and the board sees no reason to doubt it on the basis of the information provided in the patent.

3.5 Consequently, the ground for opposition under Article 100(b) EPC does not prejudice maintenance of the patent as granted.

4. Novelty - Articles 100(a) and 54 EPC

The appellant submitted that the subject-matter of granted claim 1 lacked novelty over D1 to D8. Since the patent validly claims the priority date of 30 January 2007 as set out above, D7 (published on 21 June 2007) and D8 (published on 8 November 2007) are state of the art pursuant to Article 54(3) EPC.

4.1 Novelty vis à vis D1 to D7 - claim interpretation

4.1.1 According to the contested decision, novelty over D1 to D7 was acknowledged by virtue of component (c) of claim 1. Also in appeal, the respondent relied solely on this feature of claim 1 to establish novelty over these documents.

4.1.2 Claim 1 concerns a lubricant composition comprising *inter alia* component (c), defined as follows:

"*a succinimide dispersant prepared from reaction of an amine with a hydrocarbyl-substituted succinic acylating agent prepared by reaction of polyalkene, at least 70 percent of the chains thereof containing a terminal* *vinylidene end group, with maleic anhydride in the substantial absence of chlorine*."

4.1.3 As stated by the respondent, this feature defines the succinimide dispersant as the reaction product of two separate product-by-process steps.

4.1.4 In the first product-by-process step, a "hydrocarbyl-substituted succinic acylating agent" is prepared by reaction of a polyalkene, defined as having at least 70 percent of the chain thereof containing a terminal vinylidene end group, with maleic anhydride in the substantial absence of chlorine.

4.1.5 In the second product-by-process step, said acylating agent resulting from the above process is reacted with an amine to provide the desired succinimide dispersant product.

4.1.6 It is accepted by both parties that none of D1 to D7 explicitly disclose the preparation of a succinimide dispersant following these specific process steps.

4.1.7 The appellant however argued that said product-by-process features did not exclude the succinimide dispersant products disclosed in the compositions of D1 to D7 from the scope of claim 1. Specifically, the conclusion of the opposition division according to which the process features of component (c) led to a specific "fingerprint" which distinguished component (c) of claim 1 from the corresponding products of D1 to D7 was incorrect.

4.1.8 The board disagrees, and shares the respondent's view that component (c) defines specific process steps which introduce distinct product characteristics to the claimed succinimide dispersant, rendering it distinguishable from the succinimide dispersants disclosed in D1 to D7. The reasons are explained in the following.

4.1.9 At the outset, it is relevant to note that, as stated by the respondent, the "succinimide dispersant" of component (c) of claim 1 is not to be considered as a specific succinimide compound *per se*, but rather a mixture resulting from the stipulated process by which the dispersant is obtained. As stated by the respondent, it is part of the common general knowledge that such succinimides mixtures are reaction products of alkenyl succinic anhydrides and polyamines (as evidenced by *inter alia* D15 (page 316; first sentence of point 4.2.3.1) and supported by paragraph [0030] of the patent, lines 30-33).

4.1.10 The consequence of this is that to conclude a lack of novelty, the prior art must disclose a **mixture** obtainable from the claimed processes, not merely a specific succinimide dispersant compound which could theoretically be obtained by such a process.

4.1.11 According to the description of the patent, and as not disputed by the appellant, two distinct routes were known in the art for preparing succinimide dispersants. According to paragraph [0030], the succinimide dispersants of claim 1, component (c) are prepared from hydrocarbyl-substituted succinic acylating agents which are in turn prepared by the so-called "direct alkylation" or "thermal" route, rather than the so-called "chlorine" route. These routes differ in the method by which the polyalkene (typically polyisobutylene) substituent is prepared and by which it is affixed to a maleic anhydride moiety.

4.1.12 In the preparation of a polymer substrate for the conventional "chlorine route", isobutylene is polymerised in the presence of $AlCl_3$; the resultant polymer mixture comprises predominantly trisubstituted and tetrasubstituted olefin end groups, with only a very small amount of chains containing a terminal vinylidene group (so-called "conventional polyisobutylene"; patent, paragraph [0030]).

4.1.13 According to paragraph [0031] of the patent, such a conventional polyisobutylene (hereinafter "PIB") reacts with maleic anhydride in the presence of chlorine to provide certain succinic materials via Diels-Alder reactions (see structure VI in paragraph [0031]).

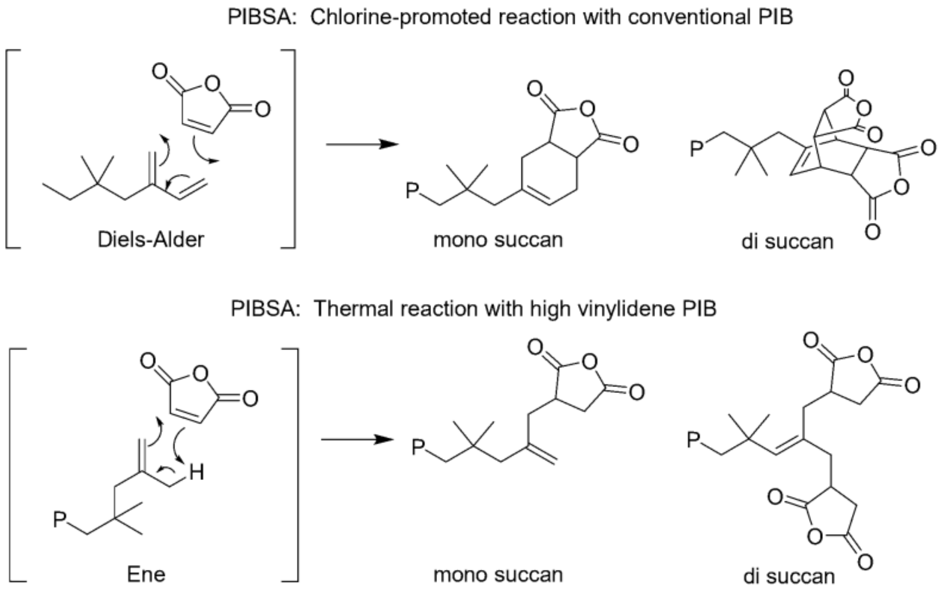
4.1.14 In contrast, in the preparation of a polyalkene substrate for a "chlorine-free" or "thermal" or "direct alkylation" (hereinafter "thermal") route, isobutylene is polymerised in the presence of a BF_3 catalyst to produce a mixture of polymers comprising predominantly (for instance, at least 70 percent) terminal vinylidene groups, with smaller amounts of tetrasubstituted end groups and other structures. These polyisobutene polymers are sometimes referred to as "high vinylidene PIB" (patent, paragraph [0032]). In the thermal route, high vinylidene PIB reacts thermally with maleic anhydride in the absence of chlorine by a series of thermal "ene" reactions to produce a mixture of mono and di-succininated polymeric materials (see e.g. structure VII in paragraph [0032]).

4.1.15 According to the patent therefore, the chlorine and thermal routes use different PIB starting materials and provide different succinimide products via different reactions and reaction mechanisms.

4.1.16 This is also evident for example from book excerpt D28, which indicates that depending on how the PIB is made (i.e. whether prepared conventionally, or as a high vinylidene PIB), one of two routes are used for the reaction with maleic anhydride. When conventional PIB is used, an equivalent of chlorine and maleic anhydride are added, setting up a Diels-Alder reaction (the "chlorine route"). Alternatively, when BF_3-sourced PIB (i.e. high vinylidene PIB) is used, excess maleic anhydride is added and the two materials are heated together at high temperature (i.e. the "thermal route"; D28, page 229, first paragraph, and reaction sequence 7.7). Similar teachings are derivable from book excerpt D14 (figures 9 and 10) in which a clear distinction is drawn between the thermal route using a vinylidene PIB (D14, figure 9) and the chlorine route using a tetrasubstituted ("conventional") PIB (D14, figure 10).

4.1.17 The same documents D28 and D14 also demonstrate that the use of high vinylidene polyalkene, in the absence of chlorine (i.e. the thermal route), introduces **distinct product characteristics** different to those obtained when conventional polyalkenes are employed using the chlorine route (compare the products of the reactions set out in figures 9 and 10 of D14, and Reaction Sequence 7.7 of D28, page 229).

4.1.18 The teaching of D28 and D14 is also consistent with that of declaration D26, which illustrates that the thermal and chlorine routes proceed with different starting materials and via different reaction mechanisms. Specifically, in the chlorine route, a diene is generated from a trisubstituted or tetrasubstituted olefin, and a Diels-Alder reaction occurs between said diene and maleic anhydride to provide the product (D26, figures 1, 2 and 3). In contrast to tri- and tetra-substituted olefins, a diene cannot be formed from a vinylidene olefin; rather treatment with chlorine ultimately leads to the formation of a vinyl chloride (see D26, figure 6). For such vinylidene olefins, the thermal route is used, and involves an "ene" reaction (D26, figure 7). The different starting materials, mechanisms and resultant products obtained via the chlorine and thermal routes are summarised in figure 1 of D26:



4.1.19 The accuracy of D26 in terms of the different reactions and mechanisms (Diels-Alder versus ene-reactions) involved in the chlorine versus the thermal routes were not disputed by the appellant.

4.1.20 From the above figure, it can be seen that the structures of the succinimides obtained using the thermal and chlorine routes are different.

4.1.21 In agreement with the respondent, the expression "in the substantial absence of chlorine" in claim 1, component (c), in the light of the common general knowledge, is to be interpreted as requiring the thermal route addressed above to prepare the succinimide dispersant.

4.1.22 First, the expression itself, by the substantial absence of chlorine, indicates that the route to the succinimide dispersants does not involve the chlorine route, which *requires* the presence of substantial amounts of chlorine. Furthermore, as set out in detail by the respondent, the requirement in component (c) that at least 70% of the chains of the polyalkene contain a terminal vinylidene end group in combination with the "substantial absence of chlorine" would be understood by the skilled person from common general knowledge as referring to the thermal "ene" route to prepare the succinimide dispersant, to the exclusion of the chlorine route.

4.1.23 Consequently, claim 1 is to be interpreted as being limited to the thermal route in the preparation of component (c).

4.1.24 Hence, in agreement with the contested decision (point 5.3.3), there is indeed a "fingerprint" on the succinimide dispersant of component (c) of claim 1 resulting from its process of preparation. Consequently, in order for the prior art to disclose a succinimide dispersant mixture according to claim 1, component (c), it is necessary that the same process for the preparation of said dispersant also be disclosed, namely the thermal route starting from a high vinylidene polyalkene.

4.1.25 Since it was not disputed by the appellant that none of D1 to D7 disclosed the thermal route for preparing the succinimide dispersants disclosed therein, it must be concluded that claim 1 of the main request is novel.

4.1.26 The further arguments of the appellant to the contrary failed to convince the board.

4.1.27 First, the appellant argued at oral proceedings that claim 1, by virtue of the open "comprising" language employed, covered compositions comprising a succinimide dispersant mixture prepared as for component (c) of claim 1 in addition to further succinimide dispersant mixtures, for example, made by the chloride route. Such mixtures could have been prepared in D1 to D7 by both thermal and chlorine reactions taking place together, or one after the other. Hence, claim 1 lacked novelty over D1 to D7.

The board disagrees. Even though claim 1 does not exclude the presence of further succinimide dispersant prepared by processes different from the thermal route, it remains the case that none of D1 to D7 directly and unambiguously disclose the presence of a succinimide dispersant prepared as required for component (c) of claim 1.

4.1.28 Second, the appellant referred to claim 9, which was dependent on claim 1 and included the further limitation that the succinimide dispersant contains at least one succinic moiety attached to the hydrocarbyl substituent through a non-cyclic linkage. Since such compounds were products of the chlorine route, claim 1 was to be interpreted as covering succinimide dispersant components (c) in which the succinimides exclusively had cyclic linkages of the type that arise in succinimide dispersants made using conventional PIB via the chlorine route.

The board disagrees. As essentially argued by the respondent, the appellant's interpretation lies in direct contrast to the explicit wording of claim 1 which specifies the substantial absence of chlorine, and therefore excludes the presence of such cyclic compounds in component (c). Hence, while there may be an inconsistency and resultant lack of clarity under Article 84 EPC between granted claims 1 and 9, this does not result in a repercussive effect lending claim 1 an interpretation which goes against the explicit wording thereof.

4.1.29 Third, it was argued that the fingerprint interpretation, i.e. that the product-by-process features of claim 1, component (c) lent the succinimide dispersant distinct characteristics, was inconsistent with the information in the patent. Specifically, the appellant referred to the requirement in component (c) of claim 1 for a polyalkene having "at least 70 percent of the chains thereof containing a terminal vinylidene end group" and argued that this was inconsistent with the definition of "high vinylidene PIB" in paragraph [0030] of the patent (page 6, final line), stated in table 1 as comprising 50-90% of chains having the terminal vinylidene component represented by structure I. Furthermore, claim 1 did not specify PIB, but defined any polyalkylene where at least 70% of the chains had a terminal vinylidene group.

As observed by the respondent however, the note to table 1 (patent, page 7) states that "Structure I may also be present in high vinylidene PIB at 70-90%". Furthermore, high vinylidene PIB is an exemplary polyalkene. The appellant did not submit any credible reasons as to why the teaching for PIB could not be extrapolated to polyalkenes in general meeting the requirement set out in claim 1, component (c). Finally, since all of the documents cited for novelty concern PIB, it is only this embodiment falling within the scope of claim 1 which is relevant for novelty. Hence, the appellant's reasons for not applying the fingerprint interpretation set out above are not convincing.

4.2 In summary, the product-by-process features of component (c) of claim 1 necessarily imply a certain specific mixture of products at least having structural characteristics derived from the nature of the PIB used, as well as from the specific mechanism of the thermal process employed. Hence, to be relevant for novelty of the succinimide dispersant component (c) of claim 1, the prior art must directly and unambiguously disclose the process by which the succinimide was prepared, as well as the nature of the PIB material in terms of the substitution of the terminal alkylene groups. Since such a disclosure is lacking in D1-D7, this requirement is not fulfilled.

4.3 Consequently, claim 1 is novel vis à vis D1 to D7.

4.4 Novelty vis à vis D8

4.4.1 Claim 1 of D8 discloses a lubricating composition comprising:

(a) 0.1 to 15 wt% of a polymer with (i) a weight average molecular weight of 100,000 to 500,000, and (ii) a shear stability index of 10 to 60;
(b) a phosphorus-containing acid, salt or ester;
(c) a dispersant; and
(d) an oil of lubricating viscosity.

4.4.2 The appellant submitted that polymer component (a) and dispersant component (c) of claim 1 of D8 corresponded to the dispersant viscosity modifier component (b) and the succinimide dispersant component (c) of contested claim 1 respectively.

4.4.3 Accordingly, in relation to component (c) of contested claim 1, the appellant submitted that claim 28 of D8, which is dependent on claim 1, stated that the dispersant comprised *inter alia* a succinimide dispersant. According to claim 29, which was dependent on claim 28, the succinimide comprised a PIB-substituted succinimide with a certain number average molecular weight range. In the description on page 22, lines 11 to 13, D8 taught that the PIB "may have a vinylidene double bond content of 5 to 69%, in a second instance of 50 to 69% and in a third instance of 50 to 95%". In relation to the upper end of the latter range, the requirements for contested claim 1, component (c) were met, since the use of 95% vinylidene PIB implied the thermal route to prepare the succinimide dispersants.

Hence, the appellant argued, D8 disclosed component (c) of claim 1.

4.4.4 The appellant further argued that component (b) of contested claim 1 required a dispersant viscosity modifier comprising a poly(meth)acrylate copolymer containing nitrogen derived from a nitrogen-containing monomer in an amount to provide at least 0.4 percent by weight nitrogen to said dispersant viscosity modifier. In relation to corresponding component (a) of D8, claim 16 and 17 thereof disclosed that the polymer component (a) may be a polymethacrylate which can contain from 0 to 10 wt% of a nitrogen-containing monomer.

Furthermore, preparative example 3 of D8 (paragraph [0136]) disclosed such a polymer having a nitrogen content of 0.7%, thus falling within the range of at least 0.4 percent stipulated in contested claim 1.

Hence, the appellant argued that D8 disclosed component (b) of claim 1.

4.4.5 However, as stated by the respondent, a series of selections within the disclosure of D8 is required in order to arrive at a composition falling within the claimed scope.

4.4.6 First, in relation to component (c) of claim 1, as stated by the respondent, the choice of dispersants in D8 is not limited to a succinimide but includes the two further possibilities stipulated in claim 28, namely a succinic acid ester or a Mannich dispersant. Furthermore, the dispersant in D8 is not limited to the 3 possibilities stipulated in claim 28, but extends to a broader list including an ester-containing dispersant, a condensation product of a fatty hydrocarbyl monocarboxylic acylating agent with an amine or ammonia, an alkyl amino phenyl dispersant, a hydrocarbyl-amine dispersant, a polyether dispersant or a polyetheramine dispersant (D8, paragraph [0092]). A first selection is thus required to arrive at succinimide dispersants. A second selection is then required to choose PIB having a vinylidene double bond content of 95% from the list of possibilities set out in the ranges disclosed on page 22 of D8.

4.4.7 Further selections are required in relation to component (b) of contested claim 1. Thus, the selection of a nitrogen-containing monomer is optional in D8 (it may be present at 0%), and therefore a selection is needed. Although preparation example 3 of D8 discloses the presence of a nitrogen-containing monomer in an amount sufficient to meet the requirements of claim 1, component (b), a component corresponding to component (c) of claim 1 is absent in this example. There is also no pointer to combine this example with the further selections needed to arrive at a succinimide dispersant meeting the requirements of contested claim 1, component (c).

4.4.8 Accordingly, in view of the multiple selections required and the lack of any pointer thereto, D8 fails to directly and unambiguously disclose the subject-matter of contested claim 1.

4.4.9 Consequently, the ground for opposition under Article 100(a) EPC in combination with Article 54 EPC does not prejudice the maintenance of the patent as granted.

5. Inventive step - Articles 100(a) and 56 EPC

5.1 Closest prior art

5.1.1 The appellant submitted that the claimed subject-matter lacked inventive step starting from any of documents D1, D3 or D10 as closest prior art. In written proceedings as well as during oral proceedings, the appellant focussed on D1, stating that for all three documents the reasoning as to why claim 1 lacked inventive step was essentially the same (grounds of appeal, point 7.2). No arguments were submitted according to which, in the event that inventive step were acknowledged starting from D1, the claimed subject-matter would nevertheless lack inventive step starting from either of D3 or D10. Therefore, in the following, inventive step is addressed only in relation to D1 as closest prior art.

5.1.2 It was common ground among the parties that patent document D1 represented the closest prior art.

Similarly to the contested patent, D1 relates to gear and transmission lubricant compositions useful for automotive gear and transmission fluids and having improved sludge dispersibility and resistance to oxidation (column 1, lines 10-15; column 6, lines 45-48). Mineral oil compositions of formula I or II were prepared comprising the ingredients listed in the table in column 5, lines 30-43. Formulation I comprised Hitec E638, a polybutenylsuccinimide. In examples 1, 2, 4 and 5 in table 2, formulation I was mixed with a copolymer formulation prepared according to table 1. The formulations of these examples were tested for resistance to oxidation by measuring the amounts of sludge (column 5, lines 45-47). It was concluded that the compositions provided extremely small amounts of sludge and showed excellent sludge dispersibility and resistance to oxidation, and were suitable for automatic transmission fluids (column 6, lines 45-52).

5.2 Distinguishing feature

As stated above in relation to novelty, examples 1, 2, 4 and 5 of table 2 of D1 differ from the claimed compositions solely in that D1 does not disclose the method by which the polybutenylsuccinimide Hitec E638 comprised in the formulations of the relevant examples of D1 was prepared. Hence, D1 fails to disclose a succinimide dispersant prepared according to the product-by-process features of claim 1, component (c).

5.3 Technical effect and objective technical problem

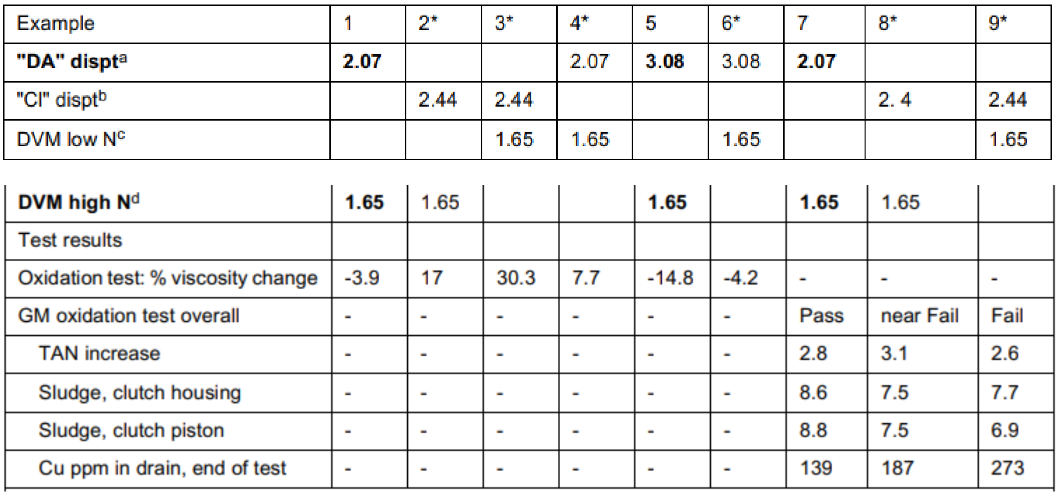
5.3.1 As regards the technical effect, the respondent relied on the examples of the patent. In these examples, lubricant formulations suitable for use in automatic transmission fluids were prepared (patent, paragraph [0053]).

5.3.2 Formulations 1, 5 and 7 of these examples are according to claim 1. Comparative formulations 2 and 8 differed from the claimed subject-matter in that they comprised a succinimide dispersant prepared via the chlorine route ("Cl dispt"), thus not according to claim 1 for component (c).

5.3.3 Formulations 1 to 6 were subjected to an oxidation test to evaluate the undesirable increase in viscosity of lubricants due to oxidative deterioration. This test involved the treatment of a sample of the oil with 200 ppm copper and 250 ppm iron and heating under air purging from about 500 hours at 157°C. The viscosity of the samples after the oxidation treatment was measured and compared with the viscosity before treatment, and the percentage change in viscosity was recorded (paragraph [0054]). Hence, the avoidance of an increase in viscosity was indicative of resistance to oxidation.

5.3.4 Formulations 7, 8 and 9 were subjected to a "GM oxidation test", an engine test which is part of the specification for fluids for certain General Motors automatic transmissions, and uses a motored 4L60E automatic transmission run at steady state conditions for 450 hours, after which tests samples are drawn and sent for analysis of viscosity, total acid number (TAN), and elemental analysis (Cu). The transmission is also disassembled and rated for sludge build up on a scale of 1 to 10, with higher numbers representing superior performance. All of these parameters give an indication on the level of oxidation occurring in the automatic transmission fluid (patent, paragraph [0055]).

5.3.5 The formulations of the examples and the results of the above tests are set out in a table on pages 11 and 12 of the patent, reproduced below for convenience:



Example	1	2*	3*	4*	5	6*	7	8*	9*
"DA" dispt[a]	**2.07**			2.07	**3.08**	3.08	**2.07**		
"Cl" dispt[b]		2.44	2.44					2. 4	2.44
DVM low N[c]			1.65	1.65		1.65			1.65
DVM high N[d]	**1.65**	1.65			**1.65**		**1.65**	1.65	
Test results									
Oxidation test: % viscosity change	-3.9	17	30.3	7.7	-14.8	-4.2	-	-	-
GM oxidation test overall	-	-	-	-	-	-	Pass	near Fail	Fail
TAN increase	-	-	-	-	-	-	2.8	3.1	2.6
Sludge, clutch housing	-	-	-	-	-	-	8.6	7.5	7.7
Sludge, clutch piston	-	-	-	-	-	-	8.8	7.5	6.9
Cu ppm in drain, end of test	-	-	-	-	-	-	139	187	273

As set out above, examples 1, 5 and 7 concern formulations according to contested claim 1.

5.3.6 As stated by the respondent, a comparison of comparative example 2 with example 1 shows that replacing the "Cl dispt" (hereinafter chlorine route dispersant) with "DA dispt" (hereinafter thermal route dispersant), i.e. with a component (c) as defined in claim 1, leads to an improvement in the results obtained in the oxidation test: comparative example 2 displayed a viscosity change of 17%, while for the formulation of example 1, the viscosity change was -3.9%, indicating an improved resistance to oxidation.

5.3.7 Additionally, a comparison of comparative example 8 with example 7 shows that replacing the chlorine route dispersant with the thermal route dispersant according to claim 1 leads to an improvement in the GM oxidation engine test: the comparative example provided an overall test result of "near fail", while example 7 according to the invention passed the test.

5.3.8 Hence, at least *prima facie*, the examples demonstrate an improvement in oxidation resistance linked to the distinguishing feature over D1, namely that the succinimide dispersant is prepared via the thermal route as set out in claim 1 for component (c).

5.3.9 The appellant noted that the two succinimide dispersants used in the examples of the patent are described as "a borated succinimide dispersant wherein the precursor alkylsuccinic acid is prepared by a direct alkylation (chlorine-free, thermal) route", and "a borated succinimide dispersant wherein the precursor alkylsuccinic acid is prepared by a chlorine-promoted route" (table on page 12, footnote).

5.3.10 In this context, the appellant argued that given the lack of further information in the patent, the thermal route and chlorine route dispersants used in the examples could potentially differ in ways that would be expected to influence the performance of the formulations and hence the results observed in the patent. First, the dispersants could differ in terms of the polydispersity index (PDI), a measure of the molecular weight distribution of the polyalkene used in the alkylation reaction. Second, the purities of the dispersants could differ in terms of the amount of residual (i.e. unreacted) polyalkene which they comprised. Both of these differences would affect the performance of the resultant succinimide dispersant. Consequently, the examples and comparative examples did not provide a pound for pound comparison, and hence the effect demonstrated in the examples was not convincingly shown to have its origin in the distinguishing feature over D1.

5.3.11 The board does not agree. First, in relation to the potentially differing PDI, the following applies. Even if it were accepted, to the appellant's advantage, that the PDI of the polyalkene affects the performance of the resultant succinimide dispersant in the tests carried out in the examples of the patent, this would not lead to a conclusion that the effects demonstrated cannot be attributed to the distinguishing feature.

5.3.12 Specifically, as noted by the respondent, and as set out above in relation to novelty, the distinguishing feature of the claimed subject-matter over D1 is the distinct and identifiable product characteristics of the succinimide dispersant component (c) resulting from the thermal route used in its preparation. The characteristics imparted to the product by virtue of the thermal route, in contrast to the assertion of the appellant, are not limited to the generation of cyclic versus non-cyclic rings, but encompass any product characteristics which directly result from the process, including differences in PDI which may result from the differing methods of preparation for the conventional PIB polyalkene and the high vinylidene PIB starting materials.

5.3.13 In this context, in declaration D27 the respondent provided more information regarding the nature of the chlorine route and thermal route succinimide dispersants used in the example of the patent. The author of D27 confirmed *inter alia* that:

- the thermal route dispersant was prepared with a high vinylidene PIB having at least 70% of chains with a terminal vinylidene group, and the chlorine route dispersant was prepared with a conventional PIB having less than 5% of chains with a terminal vinylidene group,
- both dispersants were prepared by reacting PIBSA, Amine-A, boric acid, and terephthalic acid, the amine, boric acid and terephthalic acid being identical for both dispersants,
- the PIB tail of both dispersants was approximately 1000, and
- identical ratios of reactants were used for both dispersants (D27, points 6, 7 and 8).

5.3.14 Hence, the two succinimide dispersants used in the examples of the patent differ only by the PIB type and the process of preparation. Any difference in PDI, despite the approximately identical molecular weight as set out in D27, is therefore attributable to the different processes (thermal versus chlorine) by which the polyalkenes are prepared, and therefore is included in the distinguishing feature of claim 1 over D1, namely the fingerprint of the product-by-process features of claim 1, component (c).

5.3.15 Second, in relation to the amount of residual (i.e. unreacted) polyalkene in the dispersants of the examples, the appellant referred to D15 which taught that reactions between a polyalkene and maleic anhydride are never fully complete, and the residual polyalkene, which is virtually impossible to extract, becomes part of the resulting product and affects its viscosity (page 316, final paragraph). Hence, the appellant argued that it was to be expected that both succinimides used in the examples of the patent contained unreacted polyalkene. In particular, it seemed likely that the alkylation yield would have been higher for the thermal route succinimide, thereby providing comparatively more succinimide dispersant (and less unreacted polyalkene) for any given amount than for succinimides prepared by the chlorine route. If this were to occur, the thermal route succinimide would have an unfair advantage, and the data in the patent would not demonstrate a pound for pound advantage linked to said thermal route succinimides. Hence, also for this reason, the effect demonstrated in the examples was not convincingly shown to have its origin in the distinguishing feature over D1.

5.3.16 The board disagrees. Even if the amount of unreacted PIB resulting from the thermal route differs from the amount resulting from the chlorine route, similarly to the PDI feature, such a difference would also be encompassed by the process features defining a "fingerprint" in the product of component (c) of claim 1 and hence part of the distinguishing feature over D1.

5.3.17 Furthermore, even if the amount of unreacted polyalkene were not considered part of said fingerprint, the hypothetical possibility that the amount thereof in the exemplified dispersants may differ is not sufficient for concluding that the effect shown does not convincingly originate in the distinguishing feature over D1. Despite the respondent conceding that each of the PIBSA used in the examples of the patent may include between 15 and 20% unreacted PIB (reply, point 282), it also stated that it was not possible to identify the exact figure of unreacted PIB in the succinimide dispersant (reply, point 283), let alone whether the chlorine route dispersant comprised more unreacted PIB than the thermal route dispersant, as alleged by the appellant. Indeed, despite the appellant's assertions, the concrete facts of the matter in relation to the actual amount of unreacted PIB in the examples of the patent have not been made available to the board. As noted by the respondent, it is established case law in such a situation that if a board's investigation is unable to verify beyond reasonable doubt the facts alleged, this goes to the detriment of the party who relies on these facts (Case Law of the Boards of Appeal, 10th Edition, III.G.5.1.1). In the present case, the hypothetical assertions of the appellant in relation to the presence of differing amounts of unreacted polyalkene in the succinimide dispersants of the example of the patent, and more specifically, the presence of more unreacted polyalkene in the dispersants prepared via the chlorine route, is not supported by any evidence, and hence fails for this reason alone.

5.3.18 The appellant's further arguments to the contrary failed to convince the board.

The appellant referred to decision T 1682/15 to argue that the data in the patent fell short of showing convincingly that the choice of succinimide in claim 1 is associated with a technical effect. In particular, according to that decision (reasons, 7.3), where comparative tests are chosen to establish inventive step on the basis of an effect produced over the claimed area, the comparison with the closest prior art must show convincingly that the effect was attributable to the feature distinguishing the invention.

5.3.19 However, as argued by the respondent, the facts of T 1682/15 are not relevant to the facts of the present case. Specifically, in that case, evidence for the alleged effect (a reduction of somnolence) related to the distinguishing feature over the closest prior art was provided in the form of two different studies denoted 024T and 7831. The board concluded however that the outcomes of the two studies could not be combined, and consequently no comparison with the closest prior art had been provided. It was therefore concluded that the effect of reduced somnolence was not linked to the distinguishing feature, and must be disregarded when following the problem and solution approach (reasons 7.3).

5.3.20 In contrast, in the present case as set out above, there is no reason on the basis of the examples in the patent to doubt that the technical effect has been demonstrated to originate in the distinguishing feature over D1.

5.3.21 In a similar further argument the appellant submitted that the data in the patent were not suitable for showing that all thermal route products were better than all chlorine route products. The analogy was provided that just because one diesel car may be faster than one petrol car, it does not follow that all diesel cars are faster than all petrol cars. Thus, the alleged technical effect, even if demonstrated for the specific examples in the patent, could not be extrapolated across the scope of claim 1, and hence could not be taken into account in the formulation of the objective technical problem.

5.3.22 The board also disagrees. As stated by the respondent, absolute proof of the alleged technical effect is not required. Rather, in order to take a technical effect into account when formulating the objective technical problem, it must be credible that said effect is achieved across the scope of the claim, in particular if there is no reason to assume the contrary.

5.3.23 Additionally, in the view of the board, the analogy proposed by the appellant is not appropriate. Proof that one diesel car is faster than one petrol car would indeed not be sufficient to demonstrate that all diesel cars are faster than all petrol cars. The reason however, is that the skilled person would know from common general knowledge that this result was not generally applicable: how fast a car may be is not necessarily linked to the type of fuel employed. Hence the underlying contention in the analogy is not credible. In the present case in contrast, there is no allegation nor evidence of common general knowledge on the basis of which the effect demonstrated by the examples of the patent could not credibly be extrapolated across the scope of claim 1.

5.3.24 Finally, it is not the case that all thermal route dispersants must credibly represent an improvement over all chlorine route dispersants, but rather that the effect is credible to the extent that the only difference between the above-discussed examples according to claim 1 and comparative examples lies in the particular process employed for component (c), i.e. in which the reactants are the same to the extent possible given the requirements for component (c) of claim 1.

5.3.25 In a separate line of argumentation, the appellant submitted a further reason as to why any effect demonstrated in the examples of the patent did not convincingly originate in the distinguishing feature. Specifically, the data for certain examples in the patent demonstrated a reduction in viscosity after ageing (indicated in the table in paragraph [0053] of the patent by a negative viscosity change). Such a reduction would however not be expected merely by virtue of the presence of an additive to increase oxidative resistance. Rather, at most, one would expect the viscosity to remain unchanged, or to increase to a lesser extent. Hence it was not credible that the decrease in viscosity was a result of the additives reversing oxidative degradation that has already occurred. Rather, a more credible explanation in the view of the appellant was that the measured loss in viscosity was due to oxidative degradation of the DVM component (b) of claim 1. More specifically, referring to D12 and in particular to D18 (page 3, right hand column, second paragraph), the appellant postulated that the iron used in the high temperature test of the examples of the patent (paragraph [0054]; 250 ppm of iron was added) was responsible for a break down of polyacrylamide units in the DVM component (b). The role of the DVM was to improve the viscosity index of lubricating oil compositions, and their ability to do this relied on their large size (D14, page 343, penultimate paragraph). Hence, if a DVM molecule was broken down into smaller molecules, a decrease in viscosity would be expected. Since the "DVM high N" used in the examples comprised more (nitrogen-containing) polyacrylamide units susceptible to breakdown as set out above, than the "DVM low N", the breakdown in the former, would be expected to be greater. Consequently, the viscosity change recorded in the examples of the patent was due to a higher level of breakdown for the DVM according to claim 1, component (b), and was therefore not convincingly shown to originate in the distinguishing feature over D1. The appellant further referred to journal articles D36 and D37 in support if its position, in particular to argue that breakdown of viscosity modifiers under mechanical action (shearing) conditions and resultant decrease in viscosity were generally known to occur.

5.3.26 The board disagrees for the reason that the data in the patent does not support the appellant's position. As noted by the respondent, both examples 1 and 2 of the patent include the same amount of "DVM high N" and differ only in the succinimide dispersant (thermal versus chlorine route). Example 1 shows a % viscosity change of -3.9 and Example 2 a % viscosity change of 17, thus demonstrating that the change was not linked to the nature of the DVM, i.e. whether it was "low N" or "high N". Similarly, although not falling with the scope of claim 1, comparative examples 3 and 4, which both comprise the same amount of "DVM low N" and differ only in the nature of the succinimide dispersant, demonstrate an improvement in viscosity linked to the use of the thermal route succinimide alone (30.3% versus 7.7% viscosity change). Hence, the improvement in viscosity demonstrated in the examples is not attributable to the nature of the DVM, and there is no reason on the basis of this argument to conclude that the effect demonstrated in the examples does not originate in the distinguishing feature over D1.

5.3.27 Two additional relevant arguments, not yet addressed by the interpretation of component (c) as being limited to thermal route succinimides, were submitted by the appellant in relation to the question of whether the effect reported in the examples of the patent could be extrapolated across the scope of contested claim 1.

5.3.28 First, it was submitted that claim 1 lacked a limitation on the concentration of the DVM and succinimide agents (components (b) and (c)), such that embodiments were included in which these components were present in minor amounts that would not be expected to give rise to a meaningful technical effect.

5.3.29 The board disagrees. Even if it can be accepted that lowering the amounts of components (b) and/or (c) used in the examples will lower the extent of the effect, the fact remains that without any proof to the contrary, an effect remains in absolute terms, and therefore must be taken into account in the formulation of the objective technical problem.

5.3.30 Second, the appellant argued that claim 1 only required the presence of two additive components, namely the DVM component (b) and the succinimide dispersant component (c), while the compositions of the examples of the patent included various other additives that would be expected to influence the results of the oxidation tests.

5.3.31 As stated by the respondent however, this argument is not supported by any evidence and therefore amounts to mere speculation. Furthermore, according to the patent, the formulations of the examples also contain several additional components in specified amounts (paragraph [0053]), and there is no indication that the examples of the patent differ from each other in terms of the these further components. Hence, the appellant's arguments are not relevant already for this reason. Hence,the effects demonstrated in the examples are considered to be credibly achieved across the claimed scope.

5.3.32 In view of the foregoing, the effect demonstrated in the examples of the patent has been convincingly shown to originate in the distinguishing feature over D1, and furthermore may be extrapolated across the claimed scope.

5.3.33 Consequently, the objective technical problem underlying claim 1 is the provision of a lubricating composition for an automatic transmission fluid having improved oxidation resistance.

5.4 Obviousness

5.4.1 The appellant submitted that the claimed subject-matter was obvious based on three main lines of argumentation, each of which is addressed in turn in the following:

5.4.2 First, the appellant submitted that the technical effect demonstrated in the examples could not confer inventive step, because the claimed subject-matter could be arrived at by choosing between two routine options, namely the chlorine route or the thermal route, both of which were known from the prior art to provide different performance advantages depending on the application. In this regard, the appellant referred *inter alia* to D14 (page 395-396), D28 (page 229, first paragraph, final 4 lines) and D14a (passage bridging pages 155 and 156) to demonstrate that it was well known that the overall performance of a dispersant depended on the hydrocarbon chain, the connecting group, and the polar moiety, i.e. the head group architecture. Consequently, if succinimides derived from the thermal route were found to outperform those derived from the chlorine route, this could not give rise to inventive step, as slightly different performance levels would have been expected by the skilled person, and it would have been a routine matter to uncover which succinimides were better.

5.4.3 The board disagrees. As noted by the respondent, despite the general information provided in D28 or D14a according to which succinimides prepared via the two methods will provide different performance advantages, neither document discloses nor indicates that one of the products, specifically the thermal route succinimides, would provide a solution to the above-mentioned objective technical problem, i.e. suggest an improvement in oxidation resistance for automatic transmissions fluids. Furthermore, as explained by the respondent, the succinimide dispersant in D1 is an additive which is not identified therein as part of the invention: claim 1 of D1 is directed to a lubricant composition comprising in addition to a mineral oil, a phosphorous-containing metal-free organic compound, and an oil-soluble copolymer. The succinimide (Hitec 638) in D1 is included in both the inventive examples 1-5 and the comparative examples 1-3 of this document (D1, column 5, table 2, formulations I). Hence, starting at D1, there would have been no motivation for the skilled person, with the above-mentioned problem in mind, to focus on the succinimide dispersant, and no reason why the skilled person would have had any reasonable expectation of success in solving said problem.

5.4.4 To support its arguments in this regard, the appellant referred to decisions T 944/04. In the case underlying this decision, the relevant claim concerned a specific enantiomer of a particular compound for use in perfume, while the prior art disclosed the compound but without specifying its stereochemistry. The board in that case accepted that the claimed enantiomer had a stronger odour intensity and a different odour note. However, since it was known in the art that the different stereoisomers of compounds of that type had different odour properties, the board considered that identifying which had the stronger odour intensity amounted to acting routinely without the exercise of inventive ingenuity (reasons, 7.7).

5.4.5 As argued by the respondent however, the situation in T 944/04 is different to the present situation. Specifically, in that case, the conclusion relied upon knowledge in the prior art that the different stereoisomers may have different odour properties i.e. the specific technical effect upon which the technical problem was based. The secondary document taught "a causal link between odour properties and stereoisomers, more particularly enantiomers, of alpha-campholene derivatives encompassing the claimed butenol". Therefore, the skilled person had an incentive to investigate both possible enantiomers known from the prior art as to their different odour properties.

5.4.6 In the present case in contrast, there is no teaching in the prior art of a causal link between the thermal route and chlorine route succinimides and the oxidative deterioration of an automatic transmission fluid. Hence, the facts underlying T 944/04 are different to the present case and the conclusion reached by the deciding board is therefore not relevant to the present situation.

5.4.7 Similarly, the appellant during oral proceedings referred to decision T 1072/07 in the same context. Specifically, in that case, to solve the relevant objective technical problem, the skilled person was required to choose between two alternatives. The board found the choice to be routine and lack inventive step.

5.4.8 As stated by the respondent however, the situation in that case differs from the present in that there was no unknown or surprising effect associated with the claimed alternative. Rather, in that decision, the problem was how to select a suitable type of burner (reasons, 3, second paragraph). The prior art disclosed two different types of burners, and the board decided that it would have been obvious to the skilled person to balance the **known** advantages and disadvantages of each type of burner, and thereby arrive at the claimed subject-matter. In contrast, in the present case, the advantages or disadvantages of the thermal or chlorine route dispersants in relation to oxidation in an automatic transmission fluid were not known to the skilled person. Hence, the conclusion reached in T 1072/07 is not relevant to the present case.

5.4.9 Second, the appellant argued that there was an incentive in the prior art to use thermal over chlorine route succinimides, such that the effect demonstrated in the examples was a mere bonus effect on which inventive step could not be acknowledged. Specifically, the appellant argued that in view of the environmental benefit of avoiding undesirable chlorine in lubricant additives known from e.g. D9a (column 1, lines 31-34 and column 2, lines 22-26), D11 (page 2, lines 13-15) and D19 (page 103, second paragraph), it would have been obvious to the skilled person to use thermal route succinimides in the compositions of D1.

5.4.10 The board disagrees with the appellant's position. As stated by the respondent, there is no one-way street situation in which the skilled person would only choose the thermal route succinimides for environmental reasons. Specifically, even if an environmental benefit in terms of the avoidance of chlorine were known to be associated with the thermal route, there is no clear-cut indication in the cited prior art that this would be enough for the skilled person to exclusively choose said thermal route succinimides. Specifically, even if patent documents D9 and D11 were considered representative of the common general knowledge of the skilled person, they do not unambiguously teach a preference for thermal route succinimides. For example, as stated by the respondent, while D11 states that the thermal route avoids chlorine residues, it also teaches that the thermal process of heating the polyolefin and maleic anhydride together "tends to be inconveniently slow, with a lower conversion of polyolefin, and also to result in the formation of undesirable amounts of tarry by-products ... An additional handicap of the thermal route is the difficulty of preparing polyolefin-succinic derivatives in which the molecular proportion of the succinic component is in significant excess" (D11, page 2, lines 17-20).

5.4.11 Hence, it does not emerge from the teaching of D11 that thermal route succinimides are generally preferable to those prepared via the chlorine route. Textbook extract D19 also does not indicate a preference for thermal route succinimides, merely stating that "in addition to the thermal synthesis of PIBSA a chlorine-catalyzed production process is also still in use".

5.4.12 In the same context of an alleged bonus effect, the parties disagreed on which of the two methods to produce succinimides required more energy input and was therefore less environmentally friendly in that respect. The appellant's position (based on inter alia paragraph [0070] and [0071] of D12) was that the thermal route required less energy, while the respondent argued that *inter alia* on the basis of the examples and paragraph [0053] of patent document A053 that the chlorine route required less energy than the preparation of succinimides via thermal route or the chlorine.

5.4.13 In the board's view it emerges from the parties' respective arguments that it cannot be convincingly concluded that one of the two methods is more energy intensive than the other. Furthermore, although the use of chlorine may be environmentally detrimental, other disadvantages are associated with the thermal route as set out in D11 addressed above. Hence, neither method is without its advantages and disadvantages. Consequently, there is no clear one-way street situation favouring the thermal route succinimides, and the appellant's objection must therefore fail.

5.5 Third, the appellant argued that starting from D1, it would have been obvious in view of either D11 or D12 to use a thermal route succinimide in order to achieve good oxidation resistance.

5.5.1 In combination with D11

Patent document D11 concerns a process for the preparation of succinic anhydride derivates which can be concentrated into additive mixtures having advantageous properties for blending into lubricating oils (page 2, lines 1-3). In the examples of D11, maleic anhydride was reacted thermally with different grades of PIB. One of the polyisobutylene samples, namely "Ultravis-10" has a vinylidene content of 74% (table on page 6, lines 15-19), and thus corresponds to a polyalkene required by claim 1, component (c). In example 9, a succinimide was prepared from this polyalkene and succinic anhydride via the thermal route, followed by further reaction with an amine.

5.5.2 The appellant argued that in the sequence VE engine test of example 10 of D11, the product of example 9 had better sludge performance than a lubricating composition comprising Cl-containing LZ 6418 (D11, table 3, page 11). Similarly, it was argued that example 8 demonstrated that a succinimide prepared from a succinic anhydride obtained by the reaction of a PIB having 74% vinylidene content, had superior dispersing abilities in a carbon black dispersancy test relative to one obtained using low vinylidene PIB, allowing it to more effectively guard against increases in viscosity (D11, page 9, table 2).

5.5.3 Hence, in the view of the appellant, D11 taught that the use of high vinylidene PIB in the preparation of succinimide dispersant may assist in providing protection against oxidation. Consequently, the skilled person starting at D1 in combination with D11 would have arrived at the claimed subject-matter.

5.5.4 The board disagrees. As argued by the respondent, the objective technical problem set out above is the provision of a lubricating composition for an automatic transmission fluid having improved oxidation resistance. Automatic transmission fluids are not equivalent to engine oils, and are required to lubricate the transmission which is a separate component to the engine with its own requirements. Example 10 of D11 however measures sludge performance in an engine test. Such a test is however irrelevant for an automatic transmission fluid because sludge formed in an engine originates from combustion by-products, which is not the case for automatic transmission in which combustion does not occur.

5.5.5 Similarly, as stated by the respondent, the carbon black dispersancy test in example 8 of D11 is not relevant for an automatic transmission fluid because it provides a measure of soot dispersancy, and soot is a combustion product observed in diesel engines, not in automatic transmissions. Furthermore, D39a cited by the appellant in this context does not provide evidence that the carbon black test was used to measure sludge in automatic transmissions as alleged. Rather, as argued by the respondent, although D39a discloses the carbon black dispersibility test (paragraph [0075]), it refers to automatic transmission fluids only as one member of a long list of potential applications, among which dispersion performance is only mentioned in the context of diesel engine oil (paragraph [0002]).

5.5.6 Hence, already for these reasons, there would be no reason for the skilled person seeking a solution to the above-mentioned problem to consult D11. Even if D11 were to be consulted, there is no motivation therein for the skilled person to adjust D1 to arrive at the claimed subject-matter with a view to solving said problem.

5.5.7 Additionally, and independently of the above, the board notes in relation to D11 that example 8 concerns a comparison of succinimides prepared using a conventional polyalkene ("Hyvis") and succinimides prepared using high vinylidene polyalkene ("Ultravis"). However, both succinimides were prepared via a thermal process in the absence of chlorine (see comparative examples 1 and 2). Hence, example 8 does not compare thermal route and chlorine route succinimides, and therefore does not teach any improvement in oxidation resistance related to the choice of the thermal route over the chlorine route. Similarly, the statement in example 10 that the comparative commercially available product LZ 6418 "differ(s) from those in the present invention that they do contain (low levels of residual chlorine)" is vague and does not unequivocally indicate that the only difference between the succinimides compared lay in the nature of the polyalkene and the method by which they were prepared (chlorine versus thermal route).

5.5.8 In combination with D12

Patent document D12 concerns succinimide dispersants for use as lubricant additives (paragraphs [0001] and [0002]). In preparative examples A and B (paragraphs [0070] and [0071]), chlorine route and thermal route hydrocarbyl substituted succinic anhydrides were prepared and converted to the corresponding succinimides(paragraph [0073]). Examples 1-12 disclose compositions comprising 55% dispersant. The results in table 2 show that replacing the chlorine route succinimide with thermal succinimide improved resistance to viscosity increase upon ageing (paragraph [0078]). In table 6, similar results were achieved for a diesel lubricant formulation of examples 38.

5.5.9 The appellant argued that in view of the teaching in D12 that thermal route succinimides were associated with a reduction in viscosity, the skilled person would have combined D1 with the teaching of D12 and would have arrived at the claimed subject-matter.

5.5.10 The board disagrees. As stated by the respondent, the test of D12 concerns the viscosity of additive concentrate formulations after storage for 8 weeks at 65°C (see paragraphs [0077], [0079] and [0080]). This test is not comparable to the tests carried out in the patent, which concerned the viscosity change of a fully formulated lubricant composition after heating for 500 hours at 157°C. Furthermore, the results in table 6 of D12 concern formulations which are said to be "characteristic of diesel engine lubricants" (paragraph [0082]), and are not related to automatic transmission fluids.

5.5.11 Consequently, the skilled person faced with the above-mentioned objective technical problem starting from D1 would not have arrived at the claimed solution in view of D12.

5.6 Admittance of documents A063 and A064 submitted in the context of inventive step

5.6.1 The appellant submitted experimental reports A063 and A064 with letters dated 11 November 2023 and 6 February 2024 respectively. Hence, both A063 and A064 were filed after the reply to the grounds of appeal.

5.6.2 The respondent requested that these documents not be admitted into the proceedings.

5.6.3 A063 is an expert declaration comprising tests which compare the performance of compositions comprising PIB succinimide dispersants made by the chlorine route and those made by the thermal route, as well as the question of whether varying the polydispersity index (PDI) of the PIB group used in preparation of the succinimides had an effect (A063, point 2).

5.6.4 The admittance of A063 into the proceedings is to be assessed in accordance with Article 13(1) RPBA. According to this provision, any amendment to a party's appeal case after it has filed its grounds of appeal or reply is subject to the party's justification for its amendment and may be admitted only at the discretion of the board. Article 12(4) to 12(6) RPBA apply *mutatis mutandis*. The board shall exercise its discretion in view of, inter alia, the current state of the proceedings, the suitability of the amendment to resolve the issues which were admissibly raised by another party in the appeal proceedings or which were raised by the board, and whether the amendment is detrimental to procedural economy.

The appellant's reasons justifying the admittance of A063 into the proceedings are addressed in the following.

5.6.5 First, it was argued that A063 had been submitted in response to the respondent's reply to the appeal, and in particular to criticism of D16, and the teaching therein that varying the PDI of the polyalkene used in the examples of the patent had an impact on the performance of the succinimide dispersants in question. A063 demonstrated categorically that when the PDI was held constant, the effect in the examples of the patent cannot be observed.

5.6.6 This reason is however not convincing. As set out above, a key point under inventive step is whether the examples in the patent can show an effect (resistance to oxidation) linked to the distinguishing feature over D1, namely component (c) prepared via the thermal rather than the chlorine route. This has been the key point under inventive step not only in appeal but in fact from the very start of the opposition proceedings. For example, these issues were addressed by the appellant in the notice of opposition (point 7), and by the respondent in the reply thereto (point 122-127 in particular). Furthermore, as stated above, the examples of the patent *prima facie* appear to provide evidence of a technical effect. Hence, from the beginning of opposition proceedings it was for the appellant to submit counter-evidence demonstrating the contrary at the earliest possible stage of opposition proceedings. The fact that the respondent submitted counter-arguments to the unsubstantiated allegations of the appellant throughout opposition and appeal proceedings does not serve as a justification for the late submission of experimental data intended to directly contradict the effect demonstrated in the examples from the very beginning. In view of this, the appellant should have submitted document A063, which concerns this precise question, already during opposition proceedings.

5.6.7 The appellant also argued that the filing of A063 was responsive to the new data submitted by the respondent on page 12 of the letter dated 6 September 2023, filed after the reply to the grounds of appeal. This data concerned the examples of the patent and provided additional information concerning the initial and final viscosity values measured.

5.6.8 The board disagrees that the admittance of A063 is justified on this basis. Firstly, the respondent's data addressed above was submitted in a timely manner in response to a new argument in relation to said viscosity values, submitted for the first time with the appellant's letter dated 31 January 2023 (page 13, in relation to points 329-335), submitted in response to the respondent's reply to the appeal. Secondly, as stated by the respondent, A063 does not contain any data specifically countering the new viscosity data provided by the respondent, which therefore cannot serve as a justification for the filing of A063.

5.6.9 Finally, the appellant submitted that the filing of A063 was responsive to the respondent's submission of A52 and paragraphs 280-289 of the appeal reply. These concerned further information about the oil-free treat rates of the reagents used to make the dispersants of the examples, and new allegations regarding the level of unreacted PIB in the PIBSA agents, in particular to suggest that unreacted PIB would not have an undue influence on the performance of the exemplified dispersants.

5.6.10 The board does not consider A063 as a timely response to these submissions. The issue of the presence of unreacted PIB was first raised by the appellant with the notice of opposition (point 7.5). With the reply to the notice of opposition, the respondent submitted counter-arguments, and in particular stated that no evidence had been provided by the appellant to support its allegation (reply, point 125). Hence, in relation to the issue of unreacted PIB, should the appellant have wished to submit such evidence, although it should have been submitted at the outset of opposition proceedings as explained above, there was still ample opportunity to do so in opposition proceedings in response to the respondent's reply to the notice of opposition. Consequently, A063 cannot be considered responsive to A52 and paragraphs 280-289 of the appeal reply.

5.6.11 Finally, as stated by the respondent, the data submitted with A063 is complex and potentially raises new issues at a very late stage of appeal proceedings. Consequently, also for reasons of procedural economy, there is no justification for the admittance of A063 into the proceedings pursuant to Article 13(1) RPBA.

5.6.12 Consequently, the board decided not to admit A063 into the proceedings pursuant to Article 13(1) RPBA.

5.6.13 A064 is a further experimental report from the author of A063. It comprises data intended to supplement the data provided in A063, specifically by showing that the effects demonstrated in A063 also arise when some of the additives are used in slightly higher amounts. Article 13(1) RPBA also applies to the admittance of this document.

5.6.14 The appellant submitted that A064 should be admitted into appeal proceedings for the same reasons as provided for A063. However, as set out above, the board decided not to admit A063 into the proceedings. Since A064 was filed later than A063, namely approximately 4 months before oral proceedings before the board, the consideration set out about for A063 apply to A064 *a fortiori*.

5.6.15 Consequently, the board decided not to admit A064 into the proceedings pursuant to Article 13(1) RPBA.

5.7 Hence, claim 1 of the main request involves an inventive step.

5.8 It follows that the ground for opposition under Article 100(a) EPC in combination with Article 56 EPC does not prejudice maintenance of the patent as granted.

6. Since there were no further objections, the main request (patent as granted) is allowable, and the appeal is to be dismissed.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

The Registrar: The Chairman:

Beschwerdekammern des Europäischen Patentamts
Boards of Appeal of the European Patent Office
Chambres de recours de l'Office européen des brevets

U. Bultmann M. O. Müller

Decision electronically authenticated