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D E C I S I O N
of 1 October 2004

Case Number: T 0123/02 - 3.3.6

Application Number: 95917106.7

Publication Number: 0706552

IPC: C10L 1/18

Language of the proceedings: EN

Title of invention:

Fuel additive compositions containing an aliphatic amine, a polyolefin and an aromatic ester

Patentee:

Chevron Oronite Company LLC

Opponent:

Exxon Chemical Patents, Inc.
BASF Aktiengesellschaft Patente, Marken und Lizenzen

Headword:

Fuel additive/CHEVRON

Relevant legal provisions:

EPC Art. 56

Keyword:

"Remittal for further prosecution of inventive step on the basis of a different interpretation of the claims"

Decisions cited:

-

Catchword:

-



Case Number: T 0123/02 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 1 October 2004

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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
26 November 2001 concerning maintenance of
European patent No. 0706552 in amended form.

Composition of the Board:

Chairman: P. Krasa
Members: G. Dischinger-Höppler
B. J. Schachenmann

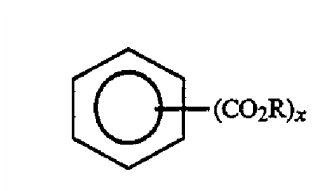
Summary of Facts and Submissions

I. This appeal is from the interlocutory decision of the Opposition Division concerning maintenance in amended form of European patent No. 0 706 552 relating to fuel additive compositions containing an aliphatic amine, a polyolefin and an aromatic ester.

The decision was based on amended sets of claims according to a main request and two auxiliary requests. Independent Claim 1 of the main request read:

"1. A fuel additive composition comprising:

- (a) a fuel-soluble aliphatic hydrocarbyl-substituted amine having at least one basic nitrogen atom wherein the hydrocarbyl group has a number average molecular weight of 700 to 3,000;
- (b) a polyolefin polymer of a C₂ to C₆ monoolefin, wherein the polymer has a number average molecular weight of 350 to 3,000; and
- (c) an aromatic di- or tri-carboxylic acid ester of the formula:



in which R is an alkyl group of 4 to 20 carbon atoms, and x is 2 or 3;

wherein the weight ratio of aliphatic amine (a) to polyolefin polymer (b) to aromatic ester (c) is 1 : 0.5-10 : 0.5-10."

Dependent Claims 2 to 19 related to specific embodiments of the fuel additive composition of Claim 1 and Claims 20 and 21 related to a fuel composition and to a fuel concentrate comprising the additive composition of Claims 1 to 19.

In Claim 1 of the first and second auxiliary request the polyolefin (b) of the composition had been further specified to relate to a polyisobutylene obtainable by polymerization of isobutylene using a BF₃ catalyst (first auxiliary request) and to a polyisobutylene comprising at least 20% of the methylvinylidene isomer (second auxiliary request), respectively.

II. Two notices of opposition had been filed against the granted patent, wherein the Opponents had sought revocation of the patent on the grounds of Article 100(a) EPC for lack of novelty and lack of inventive step (Articles 52(1), 54(2) and 56 EPC). The evidence in support of the oppositions included, inter alia, the following documents

D1 EP-A-0 374 461;

D2 Ullmann's Encyklopädie der technischen Chemie, 4th edition, 1980, vol. 19, pages 216 to 223; and

D4 EP-A-0 244 616.

During the opposition proceedings, the Opponents further relied on a declaration of Mr Rath, co-inventor in D1 and D4, concerning the composition of the polyisobutylene amine (PIBA) product obtained according to D4 via hydroformylation and amination in large-scale production. The Proprietor filed document

D14 Ullmann's Encyclopedia of Industrial Chemistry, 5th edition, 1992, vol. A21, page 555.

III. In its decision, the Opposition Division held that the subject-matter of Claim 1 of the then pending second auxiliary request was both, novel and inventive in view of the cited prior art. Concerning the Appellant's higher ranking requests, the Opposition Division held that the subject-matter claimed therein covered embodiments with component (b) being a saturated polyisobutylene (PIB) polymer and referred in this respect to document

D17 K. Biederbick, "Kunststoffe - kurz und bündig", Vogel-Verlag, Würzburg, 1977, pages 46 to 48.

This embodiment was found not to be based on an inventive step in view of D1 in combination with D4. In particular, it was held to be obvious for those skilled in the art trying to reproduce Examples 21 or 25 of D1 to use the PIBA prepared according to the six examples of D4 by the same method and for the same purpose as in D1, thereby arriving at the claimed subject-matter in four out of six instances.

IV. This decision was appealed by the Patent Proprietor (Appellant) who filed with its statement of grounds of appeal further documents, inter alia

D14a Ullmann's Encyclopedia of Industrial Chemistry, 5th edition, 1992, pages 555 to 561;

D19 Encyclopedia of Polymer Science and Engineering, 1987, vol. 8, pages 423 to 448;

D20 Kirk Othmer Encyclopedia of Chemical Technology, 4th edition, 1993, vol. 8, pages 934 to 955; and

D21 A. Ravve, "Principles of Polymer Chemistry", Plenum Press, New York, 1995, chapter 5, pages 232 to 233.

Under cover of the letter dated 17 August 2004 and in response to a communication of the Board, the Appellant filed amended sets of claims in a new main request and three auxiliary requests.

Claim 1 of the new main request differs from Claim 1 of the main request considered by the Opposition Division (see above under point I.) in that

- the term "and is derived from a polyisobutylene polymer" has been added to item (a) after "3,000",
- in item (b) the term "a polyolefin polymer of a C₂ to C₆ monoolefin, wherein the polymer has" has been replaced by "a polyisobutylene polymer having" and

- in item (c) the term "polyolefin polymer" has been replaced by "polyisobutylene polymer".

As a further difference, the new main request no longer contains claims relating to subject-matter defined in Claims 4 and 11 to 13 of the main request considered by the Opposition Division.

- V. Upon a request made by the Appellant, oral proceedings before the Board of Appeal were held on 1 October 2004 in the absence of Opponent I as stated in its letter of 31 August 2004. Opponent II was present at the oral proceedings in order to observe the proceedings passively. He did not give any comments as stated in its letter of 30 August 2004. In the course of the oral proceedings, the Appellant withdrew its auxiliary requests.

- VI. The Appellant submitted in writing the following arguments:

- In its proper interpretation, the term "polyisobutylene polymer" stood for a material which included an unsaturated linkage in the polymer molecule.

- Therefore, the calculations concerning the PIBA/PIB ratio in examples 1 to 6 of D4 had to be based only on the ratio of unsaturated PIB present in the PIBA/PIB mixture produced by the hydroformylation/amination reaction. This ratio was considerably lower than in the claimed fuel additive composition. Consequently, carrying out

Examples 21 and 25 of D1 according to D4 would in no case result in a composition as claimed.

- Further, it had been shown in the examples of the patent in suit that the technical problem of improved valve sticking performance without loosing control of engine deposits was solved by the relatively large ratio of PIB : PIBA in the claimed composition.
- However, nothing in the prior art suggested this solution of the technical problem of valve sticking. In particular, D4 did not even mention this problem.
- According to D1 the problem of valve sticking was directly correlated with the presence of PIBA. Therefore, a skilled person would not have been motivated to replace up to 50% of the PIBA in D1 by PIB, as ambiguously suggested in D4, in the expectation to reduce valve sticking.

VII. None of the Opponents (Respondents) filed submissions in reply to the appeal.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request (only request containing Claims 1 to 17) filed with letter dated 17 August 2004.

The Respondents did not file any request.

Reasons for the Decision

1. *Amendments (Articles 84 and 123 EPC)*

The Board is satisfied that no problems under Article 84 EPC have been introduced by the amendments made. The amendments made to the claims further comply with the requirements of Article 123(2) and (3) EPC since they are based on the application as filed (page 8, lines 6 to 17 and page 18, lines 10 to 19) and do not extend the scope of protection.

2. *Novelty*

The Board agrees with the finding of the Opposition Division that the composition of Claim 1 is novel over the disclosure of D1 due to the fact that D1 does not disclose the ratio of PIBA : PIB of 1 : 0.5 - 10.

3. *Interpretation of the claims*

3.1 A key issue relevant for the assessment of inventive step concerns the meaning of the term "polyisobutylene" in the patent in suit, in particular the question whether or not polyisobutylene (PIB) necessarily contains a single double bond, i.e. an unsaturation within the polymer molecule.

3.2 The Opposition Division argued that the term "PIB" referred to a polymer obtained by polymerisation of isobutylene monomers and that, depending upon the reaction conditions and the type of polymerisation reaction, the final product did not exclusively comprise polymers having an unsaturation but could as well be a saturated hydrocarbon. Reference in this

respect was made to D17 according to which polymerisation of isobutylene with BF_3 as catalyst produces both, a saturated and an unsaturated PIB polymer.

- 3.3 This was contested by the Appellant who argued that D17 disclosed that PIB included an unsaturation whereas the saturated product obtained in the presence of a strong nucleophile, such as water, was an alcohol but not PIB. While not denying the existence of "saturated PIB", i.e. hydrogenated PIB, it was argued that the skilled addressee of the patent in suit would understand the term "PIB" to refer to material containing an unsaturated linkage.

In the Appellant's opinion it was evident from D14/D14a that the only process used for manufacturing PIB on an industrial scale was a cationic polymerisation of isobutylene in the presence of a Friedel-Crafts type catalyst and that this process resulted in PIB having an unsaturation. Therefore, a person skilled in the art would have understood the term "PIB" to refer to a polymer having a single double bond per molecule. Further reference in this context was made to D2 and D19 to D21.

- 3.4 D17 actually discloses that cationic polymerisation of isobutylene can be terminated either via forming back of the catalyst complex, i.e. $\text{H}^+[\text{BF}_3\text{OH}]^-$ or $\text{H}^+[\text{BF}_3\text{Cl}]^-$ to produce a hydrocarbon having an unsaturation or via addition of an anion from the catalyst complex (i.e. $-\text{OH}$ or $-\text{Cl}$) to form an alcohol or a chloride (pages 46 to 48, item 2.1.3.1). In the absence of any arguments or evidence to the contrary, the Board agrees

with the Appellant that the respective alcohol or chloride is identified as polyisobutyl alcohol or chloride and different to PIB.

D2 (dated 1980) was filed by Opponent I with its notice of opposition. It discloses that PIB is manufactured industrially via cationic polymerisation in the presence of a Friedel-Crafts type catalyst (D2, page 217, "Mechanismus der Polymerisation"). On page 220 (see "6.3. Struktur") the structure of the polymer obtained by the cationic polymerisation is shown. It contains an unsaturation. The Board notes that this fact was explicitly recognised by Opponent I in its notice of opposition (see point 2.1).

D14/D14a (dated 1992) which is the English version of the subsequent edition of D2 still contains the same information (D14a, page 555, "Polymerization Mechanism" and page 558, "4.3. Structure") and shows that the general technical knowledge of those skilled in the art has not changed in this regard over a period of about 12 years and up to two years before the priority date of the patent in suit.

This is corroborated by D19 to D21 which all confirm that the term "PIB" was given the above meaning by those skilled in the art between 1987 and 1995:

- Thus, D19 (dated 1987) shows the unsaturated structure of the product of cationic isobutylene polymerisation at the bottom of page 427 and states in relation with the structure of PIB on page 437 (first two paragraphs) that the "chain ends of low molecular-weight polymers show

unsaturation because of chain transfer and termination". It is to be noted that the PIB used according to the patent in suit is also a low molecular weight PIB (see e.g. D14/D14a, page 555, left-hand column, lines 3 to 13).

- D20 (dated 1993), i.e. one year before the priority date of the patent in suit, states in relation with the molecular structure of PIB that "one chain-end is typically unsaturated due to chain transfer and termination mechanisms (page 944, lines 2 to 13), whereas in relation with the chemical properties, it is stated that "PIB has the chemical properties of a saturated hydrocarbon" (page 944, last but one line). However, the next sentence refers directly to the unsaturated end groups of the polymer and their chemical reactivity, in particular in low molecular weight PIB (page 944, last line to page 946, first two lines). The Board, therefore, agrees with the Appellant that the above statement concerning the chemical properties of PIB must be understood as expressing the relative insignificance of the single unsaturation in the polymer molecule in view of the overwhelming saturated structure of the rest of the molecule.

- Finally, D21 which is dated 1995 and thus evidence representing the general technical knowledge at the filing date of the patent in suit, states in chapter 5.3 entitled "Polyisobutylene" that "all commercially important PIB's are linear, head-to-tail polymers, with tertiary butyl groups at one end of the chains and vinylidene groups at the

other" and then shows a structure for PIB which has a double bond, i.e. an unsaturation, at one end (page 233, first paragraph).

- 3.5 In the light of all this evidence, the Board finds it plausible that, up to the priority and filing date of the patent in suit, a person skilled in the art would have understood the term "PIB" to include an unsaturation whereas "saturated PIB" or compounds like polyisobutylchloride may be derived therefrom by hydrogenation or chlorination.

Since no evidence to the contrary exists, the Board agrees with the Appellant that the term "PIB" in the patent in suit has to be given the meaning of a polymer obtained by polymerisation of isobutylene monomers and that the polymer has an unsaturation within the molecule.

4. *Inventive step*

- 4.1 The patent in suit relates to a fuel additive composition, in particular to a composition containing an aliphatic amine, a polyolefin and an aromatic ester (page 2, paragraph [0001]). It is concerned with the general technical problem created by deposits formed on the surface of components of automobile engines, such as carburetor ports, throttle bodies and intake valves, due to the oxidation and polymerisation of hydrocarbon fuel. These deposits often cause noticeable problems with regard to drivability, fuel consumption and exhaust pollutants, even when present in relatively minor amounts (page 2, paragraph [0002]).

4.2 The technical problem underlying the patent in suit is stated to consist in the provision of a fuel additive composition for hydrocarbon fuels which provides excellent valve sticking performance while maintaining good control of engine deposits, especially intake valve deposits (page 3, paragraph [0017]).

4.3 D1 is concerned with the same technical problem (page 2, lines 1 to 35) and proposes for this purpose a fuel additive composition comprising PIBA produced via hydroformylation of reactive PIB and subsequent reductive amination with ammonia (page 3, lines 15 to 17) and a mono- or polycarbonic acid ester (Claims 1 and 3). It is shown in the examples of D1, that compositions containing a combination of PIBA and an ester within the definition of Claim 1, items (a) and (c) (see Table 1, examples 1, 5 and 9 relating to PIBA, i.e. detergent A; Table 2, examples 14 to 16 relating to ester types F to H; and Tables 3 and 4, Examples 21, 25, 41, 42, 44, 45, 50 and 51 relating to the combinations) reduces valve deposits to values below 100 mg/valve or even below 10 mg/valve. It is, therefore, plausible that the above technical problem is actually solved by the above compositions disclosed in D1.

4.4 It is known from D4 that the PIB is incompletely reacted during hydroformylation and amination. According to the examples, the conversion rate is between 36 and 81% (Examples 1 to 6 and Table on page 8). This is corroborated by the declaration of Mr Rath filed during the opposition proceedings according to which only 40 to 75% wt of the product manufactured according to D4 consists of PIBA.

Further, it is uncontested and also shown in that declaration that the remainder consists of hydrogenated PIB (22.5 to 54% wt of the product) and small amounts of unreacted PIB (2.5 to 6% wt of the product). It follows, therefore, that the composition of D1 also contains PIB within the meaning of item (b) of Claim 1.

4.5 However, given the above interpretation of the term "PIB" (point 3), it is evident that the compositions according to Examples 21, 25, 41, 42, 44, 45, 50 and 51 of D1 do not contain PIBA and PIB (i.e. unsaturated PIB) in a ratio of 1 : 0.5-10 as required in accordance with Claim 1 of the patent in suit but in a ratio of between 1 : 0.15 (40% PIBA : 6% PIB) and 1 : 0.03 (75% PIBA : 2.5% PIB) in accordance with the above declaration of Mr Rath or in a ratio of between 1 : 0.18 and 1 : 0.02 if the conversion rates in D4 are considered.

4.6 As a consequence, the line of argument on which the contested decision is based (see above point III), is not considered to be sound. Therefore, inventive step has to be newly assessed. According to the so-called problem-solution approach normally applied by the Boards of Appeal (Case Law of the Boards of Appeal of the European Patent Office, 4th ed., 2001, I.D.2.), it has to be determined which technical results or effects are achieved by the claimed invention when compared with the prior art document identified as a proper starting point (the "closest prior art") in order to be able to define the technical problem solved in view of this prior art and thereafter examine whether a skilled

person would have considered the claimed features in the expectation of a solution of said technical problem.

4.7 The Appellant, whilst admitting that there was no evidence on file comparing the claimed subject-matter with the embodiments of D1, argued that, nevertheless, the claimed additive had the effect of further improving the valve sticking performance. This was apparent from the examples in the patent in suit showing that in the absence of PIB the valve sticking performance was considerably worsened (see Table 6, fuel composition B2 versus fuel composition B4).

4.8 The Board would not accept this argument as sufficient evidence of an effect provided by the claimed subject-matter in comparison with the embodiments of D1 since the examples of the patent in suit differ therefrom with respect to the kind and amounts of the PIBA and the ester used, and since no comparison has been made with a composition containing PIB in a ratio as low as in the embodiments of D1 (4.5 above). Therefore, the effect presented in Table 6 of the patent in suit cannot be simply assigned to the presence of a higher ratio of PIB.

5. *Remittal*

Due to the above divergent interpretation of the term "PIB", the issue of identifying an effect of the claimed subject-matter in view of D1 becomes essential for further prosecution. This issue was not addressed in the contested decision, nor was the Appellant confronted with it so far. The Board, therefore, deems it appropriate to remit the case for further

prosecution of inventive step on the basis of the definition of Claim 1 as set out in point 3 above.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division for further prosecution.

The Registrar:

The Chairman:

G. Rauh

P. Krasa