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D E C I S I O N
of 13 December 2002

Case Number: T 0800/98 - 3.3.6

Application Number: 91304405.3

Publication Number: 0457589

IPC: C10L 1/22

Language of the proceedings: EN

Title of invention:
Fuel compositions with enhanced combustion characteristics

Patentee:
ETHYL PETROLEUM ADDITIVES, INC.

Opponent:
Exxon Chemical Patents Inc.

Headword:
Combustion improver/ETHYL PETROLEUM

Relevant legal provisions:
EPC Art. 88(4), 56

Keyword:
"Priority (yes) - all features of the claims disclosed in priority document"
"Inventive step (no) - claimed use as a consequence of the obvious use known from the prior art"
"Remittal (no) - document late filed at first instance not relevant for the evaluation of inventive step"

Decisions cited:
T 0730/96, T 0115/98, T 0910/90, T 0189/95, T 0706/95, G 0002/88, G 0006/88, T 0323/97

Catchword:
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Case Number: T 0800/98 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 13 December 2002

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 8 June 1998 revoking European patent No. 0 457 589 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: P. Krasa
Members: L. Li Voti
C. Rennie-Smith

Summary of Facts and Submissions

I. The present appeal is from the decision of the Opposition Division to revoke the European patent no. 0 457 589, claiming priorities of 17 May 1990 (US Ser. No. and 19 November 1990 (US Ser. No. 615,322), relating to the use of a fuel soluble combustion improver for reducing the fuel emissions during combustion.

Claim 1 as granted had the following wording:

"1. The use of a fuel-soluble combustion improver consisting essentially of 2-ethylhexyl nitrate incorporated in a hydrocarbonaceous middle distillate fuel, said fuel having the following distillation profile:

	°C
IBP	121-260
10%	154-288
50%	177-316
90%	204-371
EP	232-399

and having a sulfur content of less than 500 ppm, prior to combustion, in a proportion of 1000 to 5000 parts by weight per million parts of fuel for reducing emissions of at least two of NOx, CO and unburned hydrocarbons during combustion of said fuel in a diesel engine in the presence of air."

Dependent claims 2 to 8 related to particular embodiments of the claimed use.

II. In its notice of opposition the Respondent (Opponent) sought revocation of the patent on the grounds of Articles 100(a) and (b) EPC.

The following documents were inter alia cited during the first instance proceedings:

(2)= SAE technical paper n. 740692, September 1974, "Effect of Diesel Fuel Properties on emissions and performance" by L.C. Broering et al.;

(4)= SAE technical paper n. 880635, 1988, "Diesel Engine Performance and Emissions Using Different Fuel/additive Combinations" by DL Sutton et al.;

(6)= SAE Technical Paper n. 892072, September 1989, "Investigation of the Effects of Fuel Composition on Heavy-Duty Diesel Engine Emissions" by T.L. Ullman;

(7)= Combustion and Flame 75: 415-416 (1989), "Thermal Decomposition of Isooctyl Nitrate" by H.O. Pritchard.

III. In its decision, the Opposition Division found in particular that

- the claimed subject-matter was not entitled to the priority date of 17 May 1990 since the priority document US 524,498 did not contain any explicit teaching that the use of a 2-ethylhexyl nitrate as combustion improver would bring about a reduction of NO_x, CO and hydrocarbon emissions;

- the claimed invention complied with the requirements of Article 100(b) EPC;

- the claimed subject-matter was novel over the cited prior art but did not involve an inventive step in the light of the teaching of, inter alia, documents (6) or (4);

- document (6) showed in the comparison of fuel no. 2 vs. fuel no. 0 (page 16, Appendix Table 2) that the use of 2-ethylhexyl nitrate as a combustion improver brought about a reduction of NO_x, CO and hydrocarbon emissions in fuels having a greater sulfur content than in the patent in suit; document (4) disclosed the similar use of isooctyl nitrate; a skilled person would have thus expected that a similar reduction of the emissions could be achieved in the same way in fuels having a lower sulfur content;

- the Appellant and Patent Proprietor had not provided any evidence for the achievement of a surprising technical advantage by the selection of a lower sulfur content for the used fuel or of 2-ethyl hexyl nitrate as combustion improver.

IV. An appeal was filed against this decision.

The Appellant submitted in writing and during the oral proceedings held before the Board on 13 December 2002 inter alia that

- claim 1 benefited from the priority date of 17 May 1990 since the priority document US 524,498 indicated any of the nitrates disclosed therein as suitable for achieving the reduction of all the emissions in question;

- document (6), though disclosing that the quantity of polluting emissions obtained by the use of fuel no. 0 containing 2-ethylhexyl nitrate as a combustion improver was lower than with the similar fuel no. 2

without combustion improver, did not contain any teaching that the same effect could be achieved in a fuel having a lower sulfur content; on the contrary, it taught that the fuel features to be controlled for reducing the polluting emissions were its content in sulfur and aromatics and its 90 °C boiling point and suggested increasing the sulfur content to reduce emissions, as was also stated in Mr. Ullman's declaration of 4 May 1998, filed at first instance;

- the additional experimental evidence, filed with the statement of the grounds of appeal, showed that the reduction of the polluting emissions, including those of nitrogen oxides, was unexpectedly more pronounced in a low sulfur fuel according to the patent in suit;

- documents (2) and (4) taught that the increase of the cetane number in a fuel having a greater sulfur content than in the patent in suit brought about a reduction of the polluting emissions; however, document (2) did not specify any suitable class of combustion improvers and document (4) suggested only the use of the general class of isooctyl nitrates;

- Mr. Henly's declaration, submitted with the statement of the grounds appeal, stated that the efficiency of a combustion improver depended also on its chemical structure and that "it is not possible to predict whether, or how, the effect on cetane number and on gaseous emissions of any one alkyl nitrate compound will vary when compared with any other alkyl nitrate compound, even between isomers of the same alkyl moiety";

- therefore, there was no suggestion in the prior art that a reduction of the emissions could be obtained in a fuel having less than 500 ppm sulfur by using 2-ethylhexyl nitrate as combustion improver;

- finally, since the opposition division had considered document (6), filed only one month before the oral proceedings at first instance, as being very relevant and had refused the Appellant's request to postpone the oral proceedings in order to be able to provide additional experimental evidence taking into account of the teaching of this document, the Appellant's case at first instance had been seriously prejudiced by this refusal.

V. The Respondent did not submit any observations or requests.

VI. During the oral proceedings held before the Board it was also discussed whether the granted claims, especially claims 7 and 8, benefited from the priority date of 17 May 1990, whether the most suitable starting point to be selected for the assessment of inventive step was document (6), (4) or (2), whether it was common general knowledge at the priority date of the patent in suit that an increase of the cetane number would bring about a reduction in the emissions and whether the submitted experimental evidence was relevant.

The Appellant thus filed a new set of 5 claims to be considered as the main request, wherein claim 1 corresponded to claim 6 as granted.

This claim differs from claim 1 as granted only insofar as the wording "**at least two of**" between "for reducing emissions of" and "NOx, CO and unburned hydrocarbons..." is missing.

Claims 2 to 5 were in identical terms to the corresponding granted claims.

VII. The Appellant requests that the decision of the first instance be set aside and as a main request that the patent be maintained on the basis of the main request submitted during oral proceedings or as auxiliary request that the case be remitted to the first instance for further prosecution.

VIII. At the end of the oral proceedings, the chairman announced the decision of the Board.

Reasons for the decision

1. *Main Request*

1.1 Priority

The Board is satisfied that all the claims of the main request benefit from the priority date of 17 May 1990 since the priority document US 524,498, taken in its entirety, explicitly discloses all the features of these claims (see point IV above, in particular the second paragraph).

Since this request fails on other grounds there is no need to give further details herein.

1.2 Novelty and Sufficiency of disclosure

The Board is satisfied with the finding of the first instance that the claimed subject-matter is novel over the cited prior art and that the claimed invention is sufficiently disclosed.

There is therefore no need to give further details herein.

1.3 Inventive step - Most suitable starting point

1.3.1 The patent in suit and in particular claim 1 relates to the use of a combustion improver, i.e. an additive able inter alia to increase the cetane number of a fuel, in a hydrocarbon middle distillate fuel for reducing atmospheric pollution (page 2, lines 3 to 15).

The most suitable starting point for assessing inventive step is, according to the jurisprudence of the Boards of Appeal of the EPO, not necessarily a document disclosing a state of the art having the most features in common with the claimed subject-matter but a document (if available) disclosing a piece of prior art which was conceived for the same purpose as the claimed invention and, possibly, having the most relevant technical features in common with the latter (see e.g. T 0115/98, point 4.1.2 of the reasons for the decision, and T 0730/96, point 2.1 of the reasons for the decision, both decisions unpublished in the OJ EPO).

1.3.2 Document (6), as correctly submitted by the Appellant (see point IV above), deals mainly with the influence of the variation of some fuel properties such as the sulfur content, the aromatics content and the 90 °C boiling point on the emissions of a fuel having a sulfur content higher than in the patent in suit, and it does not deal with the variation in emissions due to the use of a combustion improver in such a fuel (page 1, left-hand column, lines 1 to 12; page 2, left-hand column, lines 16 to 19; page 11, left-hand column, lines 1 to 7).
The effect of the variation of the cetane number is, in fact, explicitly disregarded in the calculation of the theoretical impact on emissions (page 11, left-hand column, lines 4 to 10).

Therefore, this document, though including one example relating to a fuel containing a combustion improver as used in the patent in suit (see point IV above), is not in the Board's view the most realistic starting point for the evaluation of inventive step.

1.3.3 Document (4) deals inter alia with the influence of the increase of the cetane number on exhaust emissions and suggests the use therefor of an isooctyl nitrate, i.e. of a combustion improver belonging to the same chemical class as that used in the patent in suit, in amounts of e.g. 1000 ppm for reducing emissions including particulates (page 1, left-hand column, lines 1 to 11; page 2, right-hand column, lines 16 to 22; the passage bridging pages 3 and 4 and figure 7 on page 4).

Therefore the Board finds this document, dealing with the use of a combustion improver for reducing emissions, the most suitable starting point for evaluating inventive step.

1.4 Technical problem

1.4.1 It is the established jurisprudence of the Boards of Appeal of the EPO that the technical problem underlying a claimed invention must be formulated objectively considering the technical features distinguishing the claimed subject-matter from the prior art representing the starting point for the evaluation of inventive step, in the present case document (4), and the presentation of this problem in the patent in suit (see T 0910/90, not published in the OJ EPO, point 5 of the reasons).

1.4.2 The technical problem dealt with in the patent in suit as presented in the description can be summarized as the provision of a combustion improver which would, in a fuel having a sulfur content lower than 500 ppm,

produce reduced carbon monoxide, nitrogen oxides and hydrocarbon emissions during engine operation without increasing particulate emissions (see page 2, lines 3 to 20).

The disclosure of document (4) differs apparently from the subject-matter of claim 1 insofar as the used combustion improver is an unspecified "isooctyl nitrate", the treated fuel has a higher sulfur content, its distillation profile is not specified and the example reported in figure 4 achieves only a reduction of hydrocarbons and CO emissions and not of nitrogen oxides.

However, document (4) reads in the already cited passage bridging pages 3 and 4: " The improvement in exhaust emissions by increasing the cetane number of a fuel has been demonstrated in many instances with various engine designs". This statement confirms the teaching of document (2), a document 14 years older, which had already indicated the cetane number as one of the decisive features affecting emissions (see page 1, left-hand column, last three lines; page 4, left-hand column, last 4 lines and right-hand column, last six lines; page 11, left-hand column, lines 6 to 9 below the heading "CONCLUSION").

The Board concludes therefore that it was common general knowledge at the priority date of the patent in suit that the addition of a combustion improver brings about an increase of the cetane number and that the increase of the cetane number has a positive effect on the reduction of emissions.

This is further confirmed by the statement contained in point 10 of Mr. Ullman's declaration which reads: "Even if at the May 1990 priority date of the Patent it was known that 2-ethyl hexyl nitrate could be used to reduce emissions...".

Therefore, the reduction of the polluting emissions has to be considered in the Board's view as an implicit consequence of the known use of the combustion improver for increasing the cetane number of the fuel and does not constitute a new functional technical feature within the meaning of G 0002/88 and G 0006/88 (see T 0189/95, OJ EPO points 2.3 and 2.4 of the reasons for the decision and T 0706/95, point 2.5 of the reasons, both unpublished in OJ EPO, as well as G 0002/88, OJ EPO 1990, 093, point 10.3 of the reasons for the decision and G 0006/88, OJ EPO 1990, 114, point 9 of the reasons for the decision).

The teaching of document (4) thus differs from the claimed subject-matter only insofar as the combustion improver used is an unspecified "isooctyl nitrate", the treated fuel has a higher sulfur content and its distillation profile is not specified and these are the only distinguishing features which should be considered in formulating the technical problem objectively dealt with in the patent in suit.

1.4.3 The Board finds therefore that the technical problem underlying the patent in suit, seen in the light of document (4), has to be reformulated in less ambitious terms as the provision of an alternative combustion improver that would bring about reduced emissions when added to a fuel having a sulfur content below 500 ppm.

The Board has no reason to doubt that the claimed use has solved this existing technical problem.

1.5 Evaluation of inventive step

1.5.1 Since it was common general knowledge at the priority date of the patent in suit that the addition of a combustion improver brings about a reduction of the polluting emissions, it was obvious for the skilled

person to try for the same purpose any known combustion improver and thus also an "isooctyl nitrate", as suggested in document (4), in a fuel having a lower sulfur content.

Since 2-ethyl hexyl nitrate was a combustion improver commercially available at the priority date of the patent in suit as shown e.g. in document (7) and confirmed by the Appellant, it was obvious to use it as "isooctyl nitrate".

Finally, even though the examples of figure 7 of document (4) do not disclose the distillation profile of the used fuel, this feature of claim 1 encompasses a very broad range of boiling points which include standard values for such a kind of fuels (see documents (2), table 1 on page 2 and (4), tables on page 3 and appendix 2).

Moreover, the selection of such broad ranges of boiling points does not contribute to the solution of the underlying technical problem and has thus to be disregarded in the evaluation of inventive step (see T 0323/97, OJ EPO 2002, 476, point 4.2 of the reasons).

1.5.2 The Appellant argued that the structure of the combustion improver could affect its capacity to reduce emissions as submitted in Mr. Henly's declaration and that therefore it could not be foreseen that 2-ethyl hexyl nitrate brings about a reduction of the polluting emissions.

The Board notes that Mr. Henly's declaration does not call into question that the addition of an alkyl nitrate compound to a fuel would reduce the polluting emissions but states only that predictions cannot be made with respect to the dependency of the variation of

this effect on the structure of the respective additive (see point IV).

However, claim 1 does not contain any quantitative limitation as to the reduction to be achieved. Therefore, since it was common general knowledge that an increase of the cetane number would bring about a reduction in emissions, the same had to be expected at the priority date of the patent in suit by using any combustion improver and it would have thus been obvious for the skilled person to try the commercially available 2-ethyl hexyl nitrate for such a purpose, even when a quantitative prediction of its effect was not possible.

1.5.3 The Appellant also argued that the skilled person would have expected a reduction of the sulfur content in the fuel to bring about an increase in polluting emissions as allegedly taught in document (6) and explained in point 10 of Mr. Ullman's declaration.

The Board does not contest the results presented in document (6); however, this document explicitly states that there is not a clear relationship between the three properties investigated in that document and the resulting emissions and that further studies are therefore necessary (see page 13, right-hand column, lines 15 to 22). Therefore, the skilled person would not find this teaching to constitute a prejudice against the use of a combustion improver in a low sulfur fuel for increasing cetane number and reducing emissions.

1.5.4 Finally, the Appellant referred to the experimental evidence submitted. This shows, allegedly, that the addition of 2-ethyl hexyl nitrate surprisingly brings about a reduction in nitrogen oxides which was not to be expected in the light of the prior art teaching and

that its capacity to reduce emissions is greater in the low sulfur fuels used in the patent in suit than in fuels having a greater sulfur content.

The Board does not express any opinion upon the correctness of these statements; however, these alleged effects also result from the known properties of the combustion improver of increasing the cetane number and reducing emissions (see point 1.4.2 above) and as such cannot contribute to inventive step. Therefore, there is no need to discuss in detail the experimental evidence submitted by the Appellant.

1.5.5 For the reasons put forward above, the Board concludes that it was obvious for the skilled person at the priority date of the patent in suit to try a 2-ethyl hexyl nitrate as combustion improver in a fuel having a sulfur content lower than 500 ppm and to expect reduced emissions in the light of the teachings of documents (4) and (2).

Therefore, the subject-matter of claim 1 does not involve an inventive step and the main request has thus to be dismissed.

2. *Auxiliary request*

The Appellant requested the case to be remitted for further prosecution to the first instance, since the opposition division had considered document (6), filed only one month before the oral proceedings at first instance, as being very relevant and had refused the Appellant's request to postpone the oral proceedings in order to be able to provide additional experimental evidence taking into account the teaching of this document.

Since the main request has to be dismissed on the basis of the teaching of some of the documents submitted in time before the first instance, i.e. documents (4) and (2), and the teaching of document (6) has no bearing on this decision, the question whether a remittal of the case to the first instance for further prosecution would be appropriate does not arise.

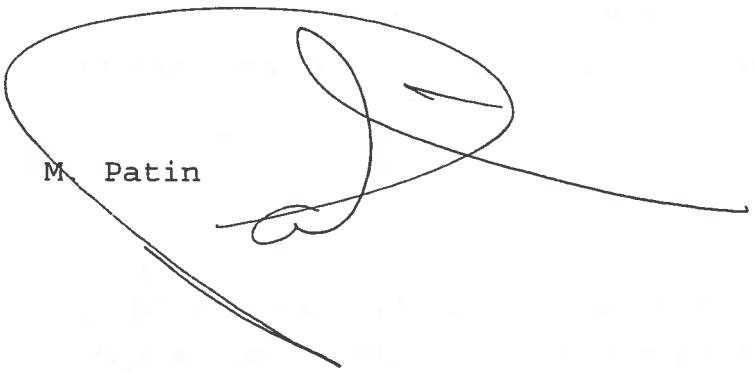
The request for remittal to the first instance for further prosecution has thus to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:



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