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Datasheet for the decision of 9 May 2025

Case Number: T 0853/23 - 3.3.06

Application Number: 15857459.0

Publication Number: 3216845

IPC: C10L1/08, C10L1/185, C10L1/19, C10L1/22

Language of the proceedings: EN

Title of invention:
GASOLINE PRODUCT CONTAINING COMBUSTION IMPROVER AND MANUFACTURING METHOD THEREFOR

Applicant:
Zhou, Xiangjin

Headword:
Gasoline/Zhou

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - obvious alternative

Decisions cited:

Catchword:

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Boards of Appeal

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Case Number: T 0853/23 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 9 May 2025

Appellant: (Applicant)	Zhou, Xiangjin Room 2101 22 North Chaoyangmen Street Chaoyang District Beijing 100728 (CN)
Representative:	CPW GmbH Kasinostraße 19-21 42103 Wuppertal (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 17 October 2022 refusing European patent application No. 15857459.0 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	R. Elsässer
	C. Heath

Summary of Facts and Submissions

I. The appeal was directed against the decision of the examining division to refuse European patent application n° 15857459.0 because none of the requests then on file, namely the main request filed on 15 August 2022 and auxiliary requests 1 and 2 filed during the oral proceedings, met the requirements of Article 56 EPC.

II. Independent claims 1 and 6 of the main request read as follows:

"1. A method for preparing a gasoline product, comprising: adding the combustion improver to gasoline to reduce an ignition point of the gasoline, so that the gasoline can be ignited through compression by a compression-ignition internal combustion engine; the said combustion improver is an additive having the ability to reduce the octane number of gasoline; wherein the gasoline product has an octane number in the range from -10 to 59 (research octane number, RON).

6. A gasoline product prepared by the method according to any one of claims 1 to 5, wherein the gasoline product has an octane number of -10 to 59, and is capable of being ignited through compression by an internal combustion engine having a compression ratio in the range from 9 to 22."

III. In the contested decision, the division was *inter alia* of the opinion that the subject-matter of above claim 1 was obvious departing from **D2** (*EP 2 592 248 A1*) when considering the additional teaching of **D8** (*Dempsey A. B. et al: "Effect of Cetane lmprovers on Gasoline,*

Ethanol, and Methanol Reactivity and the Implications for RCCI Combustion", SAE International Journal of Fuels and Lubricants, vol. 6, no. 1, 8 April 2013, pages 170-187).

IV. With the grounds of appeal and with the submission of 20 March 2025, the appellant contested the reasoning of the examining division and the preliminary opinion of the board, respectively.

V. At the end of the oral proceedings held on 9 May 2025, the appellant confirmed its request to set aside the decision under appeal and to grant a patent on the basis of the main request as filed on 15 August 2022.

Reasons for the Decision

1. Main request - Inventive step

1.1 The board has come to the conclusion that the subject-matter of claim 6 at issue is rendered obvious by **D2**, when taking into account the teaching of **D8** for the following reasons:

1.2 The invention is directed to a low octane gasoline fuel for a compression ignition combustion engine and a method of making such a fuel.

1.3 The examining division found that **D2** is a suitable starting point for the assessment of inventive step, a finding that was not contested by the appellant, and also the board has come to the conclusion that this document is a suitable starting point because it is directed to compression ignition gasoline engines and the corresponding low octane fuels. Specifically, example 1 discloses a gasoline product having an octane

number in the range of -10 to 59 capable of being ignited through compression in an internal combustion engine having a compression ratio in the range from 9 to 22.

1.4 **D2** does not disclose that the gasoline used has been obtained by blending a gasoline with a higher octane number and a combustion improver able to reduce the octane number of gasoline. Further differences have neither been pointed out by the appellant nor were they apparent to the board.

1.5 It remained to examine if any technical effect results from the sole distinguishing feature.

1.6 The examining division found that the addition of a combustion improver to a gasoline had the effect to lower the octane number and thus formulated the problem to be solved as to how adapt or modify the teaching of **D2** so as to reduce the octane number of the gasoline. This formulation of the problem can however not be correct since the example of **D2** discloses gasolines having an octane number as low as 12.5, while the claim encompasses gasolines having octane numbers as high as 59. Clearly, when starting from **D2**, claim 1 at issue does not provide for a reduction of the octane number across its whole scope.

1.7 Paragraph [0046] of the application as filed identifies a problem solved compared to conventional, high-octane gasolines, which is not relevant for similar reasons, since the gasolines of example 1 of the closest prior art **D2** already have low octane numbers in the claimed range.

1.8 The appellant further referred to paragraph [0047] of the application stating that the present invention provides for a low-cost method for converting gasoline unsuitable to be used as a compression ignition fuel into efficient low-octane gasoline which is suitable to be ignited by compression. Expanding on this disclosure, the appellant argued that the supply of low-octane gasoline, and thereby gasoline suitable for the specific engine disclosed in **D2**, was limited, since only 35% of total straight run gasoline had suitably low octane numbers, so that additional sources of gasoline had to be identified to allow for the large-scale application of the engine of **D2**. While the existing methods, such as blending (labelled "the second method" in the submission of 20 March 2025) or reforming ("the third method") were unsuitable or costly, the invention ("the fourth method") provided a cost effective method to provide additional resources of low octane fuel.

1.9 Regardless of whether economic considerations can be taken into account in the assessment of inventive step (generally denied in the context of the EPC), the appellant's arguments have failed to convince the board, in particular because it has not been shown that the gasoline of claim 1 has any cost-advantage compared to the one of example 1 of **D2**. First of all, **D2** does not disclose how and at which cost the gasoline was produced. The appellant appears to assume that it was sourced from that part of straight run gasoline that has a low octane number, which seems reasonable to the board. However, even if this were the case, there is no evidence on file to show that this type of low-octane gasoline is more expensive than a gasoline produced according to claim 1. Rather, it appears from the second paragraph from the bottom on page 4 of the

submission of 20 March 2025 that the appellant accepts that this is not the case.

Likewise, there is no evidence on file that the gasoline of the invention is more cost efficient than low-octane gasoline obtained by alternative methods, such as reforming. Rather, this is an unproven allegation.

Finally, the argument that after a large scale role-out of the engine of **D2** the available 35% of low-octane gasoline would not be sufficient so that new sources of such a gasoline would have to be found is based on a hypothetical, speculative scenario which cannot be taken into account, in particular because it must be expected that in such a situation, the cost of the existing alternatives to the gasoline of the invention, such as reformed gasoline, would also be different from what they are today, so that no reliable assessment of any cost advantage for such a scenario can be made.

Finally, the argument referring specifically to gasoline having an octane number of -10 (first paragraph of the submission of 20 March 2025) is not relevant since the claim is manifestly not limited to such gasolines.

1.10 For these reasons, the board has concluded that a cost advantage for the gasoline according to claim 6, compared to the one disclosed in **D2** has not been convincingly shown, let alone proven, so that it cannot be taken into account in the formulation of the problem to be solved, which is therefore to be formulated in less ambitious terms, namely as the provision of a further or alternative low-octane fuel.

1.11 As a solution to this problem, claim 6 proposes a gasoline that comprises a combustion improver.

1.12 This solution is however already known from and therefore rendered obvious by **D8**, where the effect of cetane improvers on gasoline are reported. Cetane improvers are substances that are conventionally added to diesel fuels to reduce their ignition point (i.e. to increase their tendency to ignite), which is reflected in a corresponding increase of their cetane number. The document discloses that the same effect, namely a reduction of the ignition point, can be achieved in gasolines, whereby the summary (page 186) explicitly discloses that this effect goes along with a lowering of the octane number of the gasoline. A very similar observation is already made in the starting document **D2**, where paragraph [0012] discloses that a high cetane number corresponds to a low octane number and that both are indicative of a strong tendency of a fuel to compressively ignite. Thus, starting from the disclosure of **D2**, the skilled person would realise that the teaching of **D8** allows to obtain a low-octane fuel by adding a cetane or combustion improver to high-octane gasoline. By incorporating this teaching into the disclosure of **D2**, the skilled person arrives at the subject-matter of claim 6 without having to exercise any inventive skills.

1.13 The appellant submitted two lines of arguments. First, that **D8** did not disclose a specific octane number, and second, that **D2** would not be combined with **D8**.

1.14 As to the first point, the PRF-number to which **D8** refers on many occasions actually does correspond to the octane number, which is specifically mentioned in the abstract on page 1 and equation 2 on page 174.

The appellant also contested that the wording "suppressing the octane number" (summary, page 186) meant that the octane number was reduced since it could also mean "limiting the increase" of the octane number.

The board has however come to the conclusion that, while the isolated wording used in the summary might be ambiguous, the teaching of the document D8 as a whole is clear in this respect. Already the abstract links a high octane number of a gasoline to its low reactivity and explains that the reactivity of the gasoline can be increased by the addition of a cetane improver, notably 2-ethylhexyl nitrate. Thus, the skilled reader would understand that the increased reactivity is linked to a lowering of the octane number of the gasoline. Similar disclosures can be found throughout **D8**, such as on page 171, left column (*"... it has been proposed to use port injected low reactivity fuel and direct inject the same low reactivity fuel mixed with a small percentage of a cetane improver to serve as the high reactivity fuel"*) or in figures 12 and 23. For these reasons, the board has no doubt that the skilled person is taught by **D8** that reactive, low octane fuel can be obtained by adding cetane improvers to low reactivity, high octane fuels.

1.15 Concerning the second point, the appellant's argument that the engine types disclosed in the two documents were different and non compatible so that no combination of **D2** and **D8** would be made is not convincing, either.

The board in particular has doubts whether the degree of detail (or rather lack thereof) disclosed in **D2** allows to draw the conclusion that the engines are in fact not compatible.

Even if giving the appellant the benefit of doubt in this respect, the teaching of **D8** is more general than submitted by the appellant. While it is correct that the observations are made in the context of an RCCI engine, they are not limited thereto. This applies in particular to the observation that the addition of cetane improvers allows to lower the octane number of gasolines, which is a general teaching that is not limited to specific engines.

For these reasons, the board has come to the conclusion that, when faced with the problem to be solved, the skilled person would in any case consider **D8** since it teaches a method of obtaining low-octane gasoline.

1.16 The remaining arguments of the appellant are not convincing, either. The appellant argued that **D2** already disclosed a low-octane fuel so that the skilled person had no motivation to look any further ("*If the skilled person tries to find new solutions on the premise that the technical solutions of D2 can meet the needs of D2, this is the beginning of an invention activity*").

However, according to the problem-solution approach developed by the boards of appeal of the European Patent Office, the problem to be solved is routinely formulated as the provision of an alternative, if - as in the case a hand - no technical effect has been shown. In such a case, the skilled person is considered to be generally motivated to look for suitable alternatives, such as the low-octane gasoline disclosed in **D8**.

1.17 The appellant also referred to evidence 2-4 and 7, filed on 22 December 2021 and 15 August 2022,

respectively. However, the fact that attempts have been made to solve the problem in ways that do not lead to the claimed subject-matter, even by very competent people, does not invalidate the reasoning set out above.

1.18 Finally, the appellant pointed out that **D8** was only filed four years after the first office action and was therefore found only with the knowledge of the invention. This argument fails to convince since the search for prior art is always done with the knowledge of the invention. In the context of the assessment of inventive step, **D8** is a piece of prior art, nothing more, nothing less.

1.19 For the reasons set out above, the subject-matter of claim 6 is obvious from the known state of the art and so lacks an inventive step under Article 56 EPC. Essentially the same reasons apply to the subject-matter of claim 1 at issue.

2. As the claims of the sole request on file do not meet the requirement of Article 56 EPC, the appeal does not succeed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Hampe J.-M. Schwaller

Decision electronically authenticated