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D E C I S I O N
of 1 October 2003

Case Number: T 1091/99 - 3.3.6

Application Number: 94927236.3

Publication Number: 0725892

IPC: F02B 75/12

Language of the proceedings: EN

Title of invention:
The reduction of nitrogen oxides emissions from diesel engines

Applicant:
CLEAN DIESEL TECHNOLOGIES, INC.

Opponent:
-

Headword:
NO_x reduction/CLEAN DIESEL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no; obvious combination of three different prior art processes"

Decisions cited:
-

Catchword:
-

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Case Number: T 1091/99 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 1 October 2003

Appellant: CLEAN DIESEL TECHNOLOGIES, INC.
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Stamford, CT 06901 (US)

Representative: VOSSIUS & PARTNER
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 5 July 1999 refusing European application No. 94927236.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Krasa
Members: G. Dischinger-Höppler
M. B. Tardo-Dino

Summary of Facts and Submissions

I. This appeal is from the decision of the Examining Division to refuse the European patent application No. 94 927 236.3 (international publication number WO-A-95/06805) relating to the reduction of nitrogen oxides emissions from diesel engines, on the ground that the subject-matter of the then pending claims lacked an inventive step in view of documents

(1) US-A-3 876 391 and

(3) US-A-4 629 472.

In its decision, the Examining Division held that it was obvious from document (1) to add urea to water/diesel fuel emulsions and to further add a catalyst in the manner known from document (3) which would then lead to the subject-matter of Claim 1.

II. With its Grounds of Appeal dated 15 September 1999, the Appellant filed an amended set of 17 claims and requested oral proceedings as an auxiliary request if grant of a patent based on the claims as amended should not be allowed.

The Appellant argued that the claimed subject-matter was based on an inventive step since document (1) did not suggest the incorporation of urea in diesel fuel but dealt with emulsions where urea is included for improving the octane number of gasoline emulsions and document (3) did not concern diesel fuel emulsions but related to the inclusion of a catalyst in emulsions for stationary boilers.

III. In a first communication dated 28 December 2001, the Board in a provisional and non-binding opinion addressed questions under Articles 84, 54 and 56 EPC. Concerning inventive step, the Board drew attention to the following situation: The claimed subject-matter appeared to be a combination of the three principles for reducing the NO_x emissions from diesel engines set out in the application in suit, namely the addition of a particular catalyst, the use of diesel/water emulsions with particular water droplet sizes and the selective non-catalytic processes (SNCR) which introduce a NO_x reducing agent into the combustion stream. Following the so-called problem-solution approach and in contrast to documents (1) or (3), any of the prior art cited in this respect could, therefore, be useful as a starting point for assessing inventive step. Since no advantage over such prior art was apparent from the file, the problem solved in view of the prior art cited in the application in suit seemed to consist in providing an alternative process. Given these circumstances, the Board pointed out that the claimed combination of the essential features of the different known processes in one process appeared to be obvious since these features were known to reduce NO_x emissions from diesel engines and since apparently there was no technical difficulty to be overcome with such a combination.

IV. With a letter of 6 March 2002, the Appellant submitted a new set of 5 claims, the only independent claim reading:

"1. A process for reducing nitrogen oxides emissions from a diesel engine comprising forming an emulsion of an aqueous solution in diesel fuel, the emulsion comprising 5% to 70% of an aqueous solution by weight of a compound selected from the group consisting of urea, ammonium carbamate, ammonium carbonate, ammonium bicarbonate, ammonium formate, ammonium oxalate, ammonium hydroxide, bipyridyl, cyanuric acid, urea-formaldehyde reaction product, and stable amines including hexamethylenetetramine, and mixtures of these, wherein said emulsion further comprises a catalyst which comprises a composition or complex of cerium, platinum or a platinum group metal, copper, iron or manganese and further wherein at least 70% of the water droplets in the emulsion have a particle size below 5 microns Sauter mean diameter, and supplying said emulsion to a diesel engine to be combusted therein, whereby combustion of the emulsion leads to a reduction in the nitrogen oxides emissions from the diesel engine when compared with combustion of diesel fuel alone."

The Appellant requested that the decision of the Examining Division be set aside and the patent be granted on the basis of these amended claims while maintaining its request for oral proceedings.

The Appellant argued in essence that there was not only no hint in the art to combine the three known principles for reducing NO_x emissions from diesel effluents but there were also too many reasons for a skilled person to expect failure rather than success

from such a combination. One such reason was that any measures for reducing the NO_x effluent, e.g. adding particular catalysts or using diesel/water emulsions would increase the carbon-based pollutants. Moreover, diesel engines operated at temperatures above 2000°F which was too high for SNCR since any nitrogenous reagent added to the combustion stream with the intention to reduce NO_x emissions would rather increase it if supplied at this temperature. Therefore, it was not obvious from the prior art cited in the application in suit to employ the specific catalysts in the particular diesel/water emulsion used in accordance with the claimed process which further contains an NO_x reducing agent and to supply this emulsion to the combustion stream in a diesel engine in order to meet a tradeoff between NO_x reduction and increase in carbon-based pollutants.

V. A summons to oral proceedings to be held on 10 December 2002 was sent to the Appellant on 18 September 2002 accompanied by a communication explaining in more detail the observations made in the first communication as to the possible non-compliance of the application with the requirements of Article 56 EPC.

The Board referred to the following documents cited in the application in suit to which it had access:

US-A-4 892 562, US-A-4 696 638, US-A-3 900 554, US-A-4 208 386 and US-A-4 325 924,

but indicated its willingness to discuss during the oral proceedings any of the other cited documents if the Appellant so wished and provided such documents

were duly filed one month before the date for oral proceedings. The Board, in particular indicated that the arguments submitted in the Appellant's letter dated 6 March 2002 seemed to be based on the assumption that the object set out in the application in suit was achieved by the claimed process in comparison with the prior art but that no evidence in support thereof was on file.

VI. Pursuant to a letter dated 31 October 2002, wherein the Appellant requested to postpone the oral proceedings until summer 2003, in order to prepare experimental data demonstrating the effects of the claimed process, the oral proceedings were rescheduled for 1 October 2003.

VII. In a letter dated 29 July 2003, the Appellant informed the Board that it would not attend the oral proceedings and requested a decision "on the record of the case", i.e. based on the new set of five claims mentioned above under point IV.

VIII. No new arguments or evidence were contained in these two last letters.

IX. On 1 October 2003, 9 a.m., the Chairman opened the oral proceedings and noted that the duly summoned Appellant was not represented. After deliberation the Chairman announced the decision of the Board and closed the proceedings.

Reasons for the Decision

1. *Amendments (Articles 84 and 123(2) EPC)*

The Board is satisfied that the amendments made to the claims comply with the requirements of Articles 84 and 123(2) EPC. Since the appeal fails on the grounds of lack of inventive step, there is no need to give further details.

2. *Inventive step*

2.1 As indicated in the two communications mentioned above under III and V, the Boards of Appeal normally apply the so-called problem-solution-approach as a tool for the assessment of inventive step. The approach consists in the following four steps (see Case Law of the Boards of Appeal of the European Patent Office, 4th ed., 2001, I.D.2.):

(i) identifying an appropriate starting point in the prior art ("closest prior art");

(ii) assessing the technical results or effects achieved by the claimed invention when compared with the said starting point;

(iii) defining the technical problem to be solved as the object of the invention to achieve these results; and

(iv) examining whether or not a skilled person, having regard to the state of the art, would have suggested the claimed features for obtaining the results achieved.

2.2 Concerning (i)

It is a premise that, for a document to be suitable as a starting point for evaluating the inventive merits of an invention, it must be directed to the same purpose or effects as the invention (see Case Law of the Boards of Appeal of the European Patent Office, 4th ed., 2001, I.D.3.2).

The application in suit relates to a process useful for reducing the NO_x emissions from diesel engines (page 1, lines 5 to 9).

The Board agrees with the Appellant insofar as documents (1) and (3), on the basis of which the application in suit was refused, are irrelevant with respect to this technical field since they do not relate to the purpose of reducing the NO_x emissions from diesel engines. The Appellant did not, however, indicate which other prior art could be useful as starting point, i.e. as the so-called "closest prior art". The Board, therefore, pointed out that any of the prior art cited in the application in suit could be used as a starting point for assessing inventive step of the claimed process since all of them relate to the reduction of the NO_x emissions from diesel engines. This prior art consists in the following three different principles:

(a) Addition of a catalyst such as platinum group metal additives, to the diesel fuel (page 3, lines 6 to 32). US-A-4 892 562 which is mentioned as representative, discloses such a method for the reduction of NO_x emissions from diesel engines by

adding a platinum group metal catalyst to the diesel fuel (e.g. column 3, line 6 to column 4, line 4).

(b) Use of emulsions of diesel fuel and water, with amounts of water and water droplet sizes as in Claim 1 of the application in suit (page 4, lines 1 to 24).
US-A-4 696 638 which is mentioned as representative discloses a method for NO_x reduction from diesel engines by using emulsions of water in diesel fuel containing preferably 30 to 70 vol.-% of water and wherein the water droplets most preferably have a diameter below 5 microns (e.g. column 3, lines 5 to 39).

(c) SNCR processes which introduce a NO_x reducing agent, e.g. urea (page 5, lines 1 to 24). US-A-3 900 554, US-A-4 208 386 and US-A-4 325 924 which are mentioned as representative disclose a method for NO_x reduction from combustion effluents by SNCR processes which introduce a NO_x reducing agent into the combustion stream. Contrary to what is suggested in the application in suit (page 5, lines 19 to 24), US-A-4 208 386 and US-A-4 325 924 both mention explicitly to apply the method to diesel engines (see in US-A-4 208 386, column 1, line 54 to column 2, line 12 and US-A-4 325 924, column 1, lines 48 to 68).

2.3 Concerning (ii) and (iii)

The object of the application in suit is defined as providing "a method and composition which can achieve

significant reductions in the NO_x emissions from diesel engines without requiring substantial retrofitting of the engines, nor an increase in emissions of other pollutants" (page 2, paragraph 2).

However, no evidence is on file which supports that this object has actually been achieved in comparison with any of the above cited prior art. Thus, the object of "providing a method for significantly reducing the NO_x emissions from diesel engines ..." cannot be taken into consideration in determining the problem underlying the invention and therefore in assessing inventive step (see Case law, 4th ed., 2001 I.D.4.4).

Therefore, the only technical result or effect which can be accepted as having been achieved by the claimed process when compared with any of the above prior art, consists in providing simply another process for reducing, to some degree, the NO_x emissions from diesel engines.

2.4 Concerning (iv)

The Board indicated in its second communication that it did not matter in the present case which one of the above prior art documents is used as the starting point or "closest prior art" for the assessment of inventive step, since the other documents recommend those features which are missing in such "closest prior art" for the same purpose of reducing the NO_x emissions from diesel engines. Further, the degree of NO_x reduction was undefined in the application in suit and thus no feature to be taken into consideration when evaluating inventive step. Therefore, it was sufficient for a skilled person to know that the above different processes were all useful for the same purpose of reducing the NO_x emissions from diesel engines, to combine them all in one process in order to provide simply another process.

The Appellant did not rebut this line of argumentation by submitting any further reasoning or evidence.

2.5 Therefore, the Board concludes that for the purpose of providing a further process for reducing the NO_x emissions of diesel engines the skilled person would with a reasonable expectation of success have combined the three different prior art processes, thereby arriving in an obvious manner at the claimed process.

Consequently, the subject-matter of Claim 1 lacks an inventive step and does not meet the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Rauh P. Krasa