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D E C I S I O N
of 31 March 2005

Case Number: T 0319/03 - 3.3.6

Application Number: 96908834.3

Publication Number: 0815185

IPC: C10L 1/30

Language of the proceedings: EN

Title of invention:
Utilization of platinum group in diesel engines

Applicant:
PLATINUM PLUS, INC.

Opponent:
-

Headword:
Diesel catalytic converter/PLATINUM PLUS

Relevant legal provisions:
EPC Art. 84, 56

Keyword:
"Support in the description (Main Request) - no"
"Inventive step (1. Auxiliary Request) - no: meaning of the term "catalytic converter" on a proper reading of the prior art document containing it - technical improvement not convincingly shown for all embodiments encompassed by the claim"
"Inventive step (2. Auxiliary Request) - yes"

Decisions cited:
T 0409/91

Catchword:
-

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Case Number: T 0319/03 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 31 March 2005

Appellant: PLATINUM PLUS, INC.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 10 October 2002 refusing European application No. 96908834.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Krasa
Members: L. Li Voti
U. J. Tronser

Summary of Facts and Submissions

I. This appeal lies from the decision of the Examining Division to refuse European patent application No. 96 908 834.3, concerning a method for improving the operation of a diesel engine.

II. In its decision, the Examining Division, referring to documents

(1): WO-A-9411467 and

(2): WO-A-9502655,

found *inter alia* that the claimed subject-matter was novel but lacked inventive step and argued essentially that:

- the methods disclosed in documents (1) and (2), differing from the claimed subject-matter only insofar as they used a diesel particulate trap (hereinafter referred to as DPT) instead of a diesel pass-through oxidation catalyst (hereinafter referred to as DOC), had already solved all the technical problems dealt with in the patent in suit;

- the technical problem underlying the claimed invention could only be seen in the provision of an alternative method which would provide a reduction of the total particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of a diesel engine without the conversion of SO_2 to SO_3;

- since the description of the patent in suit acknowledged that DOC was known as alternative to DPT for reducing the emission of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of a diesel engine, it was obvious for the notional skilled person to try a DOC as an alternative to a DPT in the methods known from documents (1) or (2).

As regards the exhibits filed by the Applicant (hereinafter Appellant) during examination, the Examining Division found that

- the evidence filed by the Appellant in support of an alleged prejudice against the use of a DOC in combination with a diesel fuel comprising a platinum group metal compound did not convincingly prove that such a prejudice existed at the priority date of the present application;

- moreover, the alleged technical advantage of a reduction of the overall amount of the particulate emitted with the exhaust and, in particular, of the amount of nanoparticles contained therein, had to be disregarded, since it was not mentioned among the technical problems to be solved defined in the application as filed and was discovered only after the priority date of the present application.

The exhibits filed by the Appellant at first instance are *inter alia* the following:

(ii): CARB IDRAC - Meeting Pasadena February 6, 2002 - Contribution TTM/Switzerland, "Why does Switzerland promote Fuel Additives but absolutely prohibit the use

of such Fuel Additives without appropriate Particulate Traps";
(iii): "Diesel Retrofit - German Perspective" by Dr. A. Friedrich, Umweltbundesamt, Berlin, pages 1 to 12;
(A): California Air Resources Board - "DRAFT Control Technology Evaluation";
(B): Engelhard - "Description of a Diesel Oxidation Catalyst", pages 1 to 3;
(D): Ricardo Consulting Engineers Ltd.- "PFC Fuel Additive tests on a diesel passenger car (Fuel tech/Ricardo Project 101)", DP 96/0321, 26 February 1996;
(E): Ricardo Consulting Engineers Ltd.- "CDT Diesel passenger car tests: a summary report of an emissions reduction programme using platinum and cerium fuel additives", DP 97/2730, 27 November 1997;
(F): SAE Paper No. 1999-01-3564 - "Performance Evaluation of Advanced Emission Control Technologies for Diesel Heavy-Duty Engines" by M. Khair et al.;
(G): SAE Paper No. 2000-01-1934, "Emissions Reduction and Improved Fuel Economy Performance from a Bimetallic Platinum/Cerium Diesel Fuel Additive at Ultra-Low Dose Rates" by J.M.Valentine et al.;
(H): Clean Diesel Technologies, Inc. - "PM Reduction Performance of DOC's and FBC/DOC on ULSD"
(I): Clean Diesel Technologies, Inc. - "PM Reduction Performance of DOC's, FBC and FBC/DOC on Normal Sulfur Fuel."

III. An appeal was filed against this decision by the Appellant.

The Appellant filed in writing *inter alia* the following exhibits:

(AA): VERT - "Curtailing emission of Diesel engines in tunnel sites - Results of a 4 year European joint project", December 1997;
(BB): Umweltbundesamt- "Statement on the Application of Fuel Additives as a Regeneration Aid in Diesel Particulate Trap Systems", 11 December 1997;
(CC): Harvard School of Public Health - "Air pollution in many U.S. cities linked to premature death", 9 March 1995;
(DD): Umweltbundesamt - "2nd Statement on the Application of Fuel Additives as a Regeneration Aid in Diesel Particulate Trap Systems", 1 April 1998;
(EE): Manufacturers of Emission Controls Association - "Emission Control of Diesel-Fueled Vehicles", March 1997;
(FF): Victor Ghuman's Declaration of 16 December 2002;
(GG): SAE Paper No. 952355 - "Novel Additive for Particulate Trap Regeneration" by J.-B. Dementhon et al.;
(HH): SAE Paper No. 942067 - "Effect of Cerium Fuel Additive on the Emissions Characteristics of a Heavy-Duty Diesel Engine" by J. Lemaire et al.;
(II): SAE Paper No. 861111 - "Emission Control Options for Heavy-Duty Engines" by S. Unnasch et al.;
(JJ): ACEA- "ACEA Position on Metal Based Fuel Additives", November 2001;
(KK): Radian International LLC - "Final Report - The impact of Platinum in Diesel Exhaust on Human Health", 22 May 1997;
(AAA): Oak Ridge National Laboratory Review, vol. 33 No. 3, 2000, "Toward a Cleaner Diesel Vehicle".

Furthermore, the Appellant filed a new main request consisting of a set of 12 claims under cover of the letter dated 30 August 2004 and, *inter alia*, a new experimental report under cover of the letter dated 28 February 2005.

IV. The Board, citing in writing *inter alia* the following documents:

(3): WO-A-9007561;
(5): SAE Paper no. 902110, 1990, pages 1 to 11, "Catalyst Considerations for Diesel Converters" by D.J.Ball et al.;
(6): SAE Paper no. 930132, 1993, pages 79 to 84, "Latin America's Experience with Diesel Catalytic Purifiers for Urban Buses" by D.L. McKinnon et al.;
(7): SAE Paper no. 940238, 1994, pages 75 to 80, "International Experience Using Diesel Catalytic Converters for Urban Buses" by S.Ozturk et al.;
(8): Automotive Engineering, vol. 100 (1992), no.2, "Reducing truck diesel emissions: A status report", pages 19 to 23;

submitted provisionally *inter alia* that document (3) disclosed a method for reducing the emissions from the exhaust of a diesel engine equipped with a DOC by means of a diesel fuel comprising specific platinum group metal compounds and was thus more relevant than documents (1) or (2) for the evaluation of inventive step of the claimed subject-matter.

V. The support of claim 1 according to the main request under Article 84 EPC was additionally discussed during the oral proceedings held before the Board on 31 March 2005.

During the oral proceedings the Appellant filed first and second auxiliary requests, both of them consisting of only one claim.

VI. Claim 1 according to the main request reads as follows:

"1. A method for improving the operation of a diesel engine, by enabling the operation of a pass-through oxidation catalyst over long periods of time with continued catalytic activity and without the undesirable conversion of SO_2 to SO_3, comprising:
providing a diesel engine, which is a lean-burn diesel engine operating with from 2 to about 12% oxygen greater than stoichiometrically required and includes a combustion chamber, for combusting a diesel fuel and thereby produce combustion gases including particulates, and an exhaust system, for removing combustion gases from the combustion chamber, said exhaust system including a pass-through catalyst support which directs the flow of particulates through a maze of catalyzed surfaces which contact the particulates without trapping them, having sufficient surface to support an active oxidation catalyst for oxidizing at least a portion of the particulates discharged from the engine upon operation of the engine;
introducing a fuel comprising a platinum group metal composition into a combustion chamber of a diesel engine, said platinum group metal composition being stable in the fuel composition prior to combustion and

consumable during combustion to release platinum metal catalyst in active form; and

combusting the fuel within said combustion chamber to release from the fuel upon combustion an active form of catalyst;

discharging the exhaust from the combustion chamber and passing it through the pass-through catalyst support to deposit the active form of the catalyst within the pass-through catalyst support to thereby catalyze the support for selective catalytic activity for reducing the combined total of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of diesel engines."

Dependent claims 2 to 12 of the main request relate to specific embodiments of the claimed method.

The only claim of the first auxiliary request differs from claim 1 according to the main request insofar as the wording between "introducing a fuel comprising" and "combusting the fuel..." reads as follows:

"**an additive containing a platinum group metal compound and a cerium, iron and/or copper compound into a combustion chamber of a diesel engine, said platinum group metal composition being stable in the fuel composition prior to combustion and consumable during combustion to release platinum metal catalyst in active form, and the additive comprising a platinum group metal compound soluble in the diesel fuel which is added in amounts effective to provide concentrations of the metal in the fuel of less than 1 part per million (ppm) and said cerium, iron and/or copper compound in amounts effective to provide concentrations of cerium,**

iron or copper metal in the fuel of from about 1 to about 100 ppm or a platinum group metal compound dispersible in a fuel-water emulsion, said platinum group metal compound being added in amounts effective to provide concentrations of the metal in the fuel of less than 1 part per million (ppm) and said cerium, iron and/or copper compound being added in amounts effective to provide concentrations of cerium, iron or copper metal in the fuel of from about 1 to about 100 ppm;"

The only claim according to the second auxiliary request differs from the claim according to the first auxiliary request insofar as the used fuel **must comprise** an additive comprising a platinum group metal compound and a cerium compound, the wording between "introducing a fuel comprising" and "combusting the fuel..." reading then as follows:

"an additive containing a platinum group metal compound and a cerium compound into a combustion chamber of a diesel engine, said platinum group metal composition being stable in the fuel composition prior to combustion and consumable during combustion to release platinum metal catalyst in active form, and the additive comprising a platinum group metal compound soluble in the diesel fuel which is added in amounts effective to provide concentrations of the metal in the fuel of less than 1 part per million (ppm) and said cerium compound in an amount effective to provide a concentration of cerium metal in the fuel of from 1 to 30 ppm or a platinum group metal compound dispersible in a fuel-water emulsion, said platinum group metal compound being added in amounts effective to provide

concentrations of the metal in the fuel of less than 1 part per million (ppm) and said cerium compound being added in an amount effective to provide a concentration of cerium metal in the fuel of from 1 to 30 ppm;".

VII. As to the support of claim 1 according to the main request under Article 84 EPC, the Appellant explained during oral proceedings that the platinum metal compositions suitable for use in the claimed invention were the compositions of platinum metal group compounds, including complexes, known to be suitable additives for a diesel fuel.

As regards inventive step it submitted orally and in writing *inter alia* that

- the term "catalytic converter" was used by the skilled person in the U.S.A. at the priority date of the present application for indicating a device as used to treat the exhaust from spark-ignited gasoline engines;

- in the absence of a specific indication as to the use of a diesel engine, as e.g. in documents (5), (6) and (7), this term would have not been interpreted by the skilled person to relate to a catalytic converter used for reducing the emissions in the exhaust of a diesel engine;

- moreover, because of the existing concern about the pollution caused by the particulate emissions of diesel engines, there existed a prejudice at the priority date of the present application against the use of a DOC in the absence of a DPT able to trap metal particles for

reducing the emissions in the exhaust of a diesel engine when used in combination with a fuel comprising a metal catalyst such as platinum, as shown e.g. in the Exhibits (ii), (iii) and (AA) through (KK);

- thus, the term "catalytic converter" used in document (3) intended to indicate a device as used to treat the exhaust from spark-ignited gasoline engines and not a DOC as used in the claimed invention and would have been understood as such by the skilled person on a proper reading of this document;

- therefore, document (3) did not disclose the use of a DOC in combination with a diesel fuel comprising a platinum group metal compound;

- in the light of the prejudice existing in the prior art, the skilled person would not have used a diesel fuel comprising a metal compound in combination with a DOC for solving the technical problem underlying the claimed invention, i.e. the provision of a method for reducing over extended periods of operation the combined total of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of a lean-burn diesel engine equipped with a DOC without excessive conversion of SO_2 to SO_3.

As regards the technical improvement obtained by means of the claimed invention the Appellant argued that

- as shown in Exhibits (D) through (I) and in the experimental report filed under cover of the letter dated 28 February 2005, the claimed invention provided unexpectedly a high removal of particulates and of

other gaseous emissions, including NOx, from the exhaust of a lean-burn diesel engine; in particular, the use of a fuel containing a combination of a platinum group metal and a cerium compound provided a reliable and constant reduction of the particulate matter above the 25% reduction obtainable by means of a DOC alone and at and above the threshold of 30% reduction and also a reduction of the NO_2 contained in the emitted NO_x which was not possible to achieve with a fuel containing only a platinum metal compound;

- such an improvement was not to be expected in the light of the teaching of the prior art about DOC and fuels containing metal catalysts, also called FBC (fuel born catalysts);

- moreover, because of the similarities of iron and copper metals with cerium, the same effect obtained by means of a fuel containing a combination of a platinum group metal compound and a cerium compound had to be expected with a fuel comprising a combination of the platinum group metal compound with an iron or copper compound.

As regards documents (1) and (2), cited in the decision under appeal, the Appellant put forward that they related to methods which used a DPT and not a DOC; thus they did not deal with the technical problem underlying the present application of reducing the total amount of particulates, gaseous hydrocarbons and carbon monoxide discharged in the exhaust of a diesel engine equipped with a DOC and could not provide a solution to this technical problem.

The claimed subject-matter was thus novel and inventive.

VIII. The Appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 12 according to the main request submitted under cover of the letter dated 30 August 2004 or of the claim according to the first or second auxiliary requests submitted during oral proceedings, respectively.

Reasons for the Decision

1. *Main Request*

1.1 Article 84 EPC

1.1.1 It is a requirement of Article 84 EPC that the claims must be supported by the description.

This requirement is complied with according to the established jurisprudence of the Boards of Appeal of the EPO if the wording of a claim is justified in the light of the technical contribution to the art of the claimed invention. This means that the features and definitions in a claim should essentially correspond to the scope of the invention as disclosed in the description. Consequently, a technical feature which is to be considered an essential feature of the invention in the light of the description has also to be part of the wording of the independent claim or claims defining this invention (see e.g. T 409/91, OJ EPO 1994, 653, point 3.3 of the reasons for the decision)

1.1.2 The wording of claim 1 according to the main request contains as features *inter alia* that

- a diesel fuel comprising a platinum group metal composition is introduced into a combustion chamber of a diesel engine;

- said platinum group metal composition is stable in the fuel composition prior to combustion and

- said platinum group metal composition is consumable during combustion to release platinum metal catalyst in active form.

Since a composition may consist of one or more components, claim 1 relates in the Board's view to the use of a composition comprising a platinum group metal in any possible form it might occur and, possibly, other unspecified components.

The feature that such a composition must be stable in the diesel fuel prior to combustion simply identifies a condition which necessarily has to be met for the incorporation of this fuel to the combustion chamber of a diesel engine and thus does not define more clearly any particularly suitable platinum group metal compound or other possible components of said composition.

The feature that the composition must be consumable during combustion to release a platinum group metal catalyst in active form simply specifies a further function of said composition, i.e. that it must contain or release an active platinum group metal catalyst, but

also does not define more precisely any particularly suitable platinum group metal composition.

The wording of claim 1 thus requires in the Board's view only that said platinum group metal composition must comprise a platinum group metal catalyst or a precursor thereof but it does not contain any limitation as to the type of platinum group metal catalyst or precursor thereof which can be used.

1.1.3 The Appellant explained during oral proceedings that the platinum group metal compositions suitable for use in the claimed invention consisted of platinum group metal compounds, including complexes, and mixtures thereof known to be suitable as additives for a diesel fuel.

The Board finds the Appellant's statement to be in agreement with the teaching of the description of the present application which suggests that not all known platinum group metal catalysts would be effective in a method as claimed and comply with the requirements of the wording of claim 1.

The description teaches, for example, that "the effective platinum group metal compositions are those described by patents and applications incorporated by reference above" (page 12, lines 6 to 7), i.e. those patent and applications mentioned in the passage from page 1, line 9 to page 2, line 9, some of which appear not to have been published before the priority date of the present application and the last of which, i.e. U.S. Patent Application serial No. 07/291,245 is the priority document of the prepublished document (3).

Moreover the description teaches that preferred compositions are the compounds of some prepublished U.S. Patent specifications (see page 12, lines 13 to 20 and page 20, lines 5 to 26) and that these platinum group metal catalysts are contained in an additive composition for the diesel fuel (page 12, lines 21 to 24 and page 13, lines 6 to 7).

1.1.4 The Board concludes that the wording of claim 1, not being limited to the use of those platinum group metal compounds, including complexes, and mixtures thereof known to be suitable as additives for a diesel fuel, does not correspond to the scope of the invention as disclosed in the description but is broader than the technical contribution of the invention as disclosed therein.

Therefore, the Board concludes that claim 1 lacks support in the description and thus contravenes the requirements of Article 84 EPC.

The main request must thus be dismissed.

2. *First Auxiliary Request*

2.1 Articles 123(2), 84 and 54 EPC

2.1.1 The only claim of the first auxiliary request differs from claim 1 according to the main request insofar as it specifies that the added diesel fuel comprises an additive comprising a platinum group metal compound and a cerium, iron and/or copper compound in specific amounts (see point VI above).

The Board is satisfied that the requirements of Article 123(2) EPC are complied with since the application as originally filed contains support for the use of a diesel fuel comprising an additive containing a platinum group metal compound in combination with a cerium, copper and/or iron metal compound in the specified amounts (see page 12, lines 21 to 24; page 13, lines 6 to 7; claims 7 and 8; page 21, line 19 to page 22, line 1 in combination with page 23, lines 1 to 16).

2.1.2 The Board is also satisfied that this claim is clear and supported by the description, since it relates to the use of platinum group metal compounds and cerium, iron and/or copper compounds which are suitable additives for a diesel fuel.

This claim thus complies with the requirements of Article 84 EPC.

2.1.3 The Board is satisfied that the claimed subject-matter is novel over the cited prior art as already found in the decision under appeal.

2.2 Inventive Step

2.2.1 The most suitable starting point for assessing inventive step is, according to the jurisprudence of the Boards of Appeal of the EPO, a document (if available) conceived for the same purpose or aiming at the same objectives as the claimed invention and having the most relevant technical features in common (see

Case Law of the Boards of Appeal of the EPO, 4th edition, 2001, point I.D.3.1 on page 102).

The subject-matter of the only claim according to the first auxiliary request relates to a method for improving the operation of a lean-burn diesel engine, i.e. a diesel engine which, as specified in claim 1 and explained by the Appellant during oral proceedings, operates with from 2 to about 12% oxygen greater than stoichiometrically required, and specifically for reducing the combined total of emissions discharged from the exhaust by means of a DOC and a fuel containing an additive composition comprising a platinum metal group compound and a cerium, iron and/or copper compound in such amounts to give less than 1 ppm of said platinum metal and from about 1 to about 100 ppm cerium, iron or copper metal in the fuel.

The description of the present application identifies the goal of the claimed invention as the reduction over extended periods of operation of the combined total of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of diesel engines equipped with a DOC without excessive conversion of SO_2 to SO_3 (see page 2, lines 14 to 19; page 3, lines 17 to 20; page 8, lines 4 to 25 and page 21, lines 22 to 25).

It should thus be evaluated which document discloses prior art aiming at these objectives and having the most relevant technical features, i.e. the use of a DOC and/or of a diesel fuel containing an additive comprising metal compounds, in common with the subject-matter of the only claim according to the first auxiliary request.

2.2.2 Documents (1) and (2), used in the decision of first instance as starting point for the evaluation of inventive step, relate to methods for reducing the emissions discharged from the exhaust of a diesel engine by using a diesel fuel containing a platinum group metal compound and a DPT without a DOC (see e.g. claim 1 of (1) and claim 18 of (2)).

Document (3) discloses a method for reducing the emissions from the exhaust of an internal combustion engine. According to this disclosure a fuel, e.g. a diesel fuel, comprising an additive composition containing specific platinum group metal compounds in amounts providing, preferably, less than 1 ppm platinum group metal in the fuel (which compounds are soluble in the diesel fuel or dispersible in a fuel-water emulsion), can be added to the combustion chamber of the respective internal combustion engine, e.g. a diesel engine, in order to reduce the amounts of particulates, gaseous hydrocarbons, carbon monoxide and nitrogen monoxide emitted without excessive conversion of SO_2 to SO_3. Such additive compositions can be used in combination with a DPT and, when used in combination with a "catalytic converter", are able to increase its efficiency and extend its life (see page 5, lines 10 to 14; page 6, lines 8 to 10; page 6, last four lines to page 7, line 2; page 7, lines 9 to 12; page 10, lines 3 to 16; page 15, line 18 to page 16, line 13; page 17, last six lines; claim 22).

The disclosure of document (3) is thus similar to that of documents (1) and (2) but it still remains to be evaluated if the term "catalytic converter" used in

this document identifies a "diesel catalytic converter" and is equivalent to the term "diesel pass-through oxidation catalyst", i.e. DOC, of the only claim according to the first auxiliary request.

2.2.3 The Appellant argued that

- document (3) related to a method applicable generally to any hydrocarbon fuel such as diesel fuel, gasoline or gasohol (page 6, lines 10 to 11) and thus its teaching was not limited to the use of a diesel engine;

- the wording "catalytic converter" was used in the U.S.A. at the priority date of document (3) for identifying a catalytic converter for spark-ignited gasoline engines and not the structurally different DOC;

- even though DOC's were already known at the priority date of document (3), the skilled person would not have interpreted the term "catalytic converter" to relate to a DOC without a specific indication of its use in a diesel engine as occurred, for example, in documents (5) to (7) (see (5), page 3, right column, lines 18 to 19; page 10, right column, lines 1 to 6 below heading "Summary"; (6), page 79, right column, lines 23 to 24; page 80, line 5; page 84, points 1 and 3 of "Conclusions"; (7), page 75, title and right column, heading "Diesel Catalytic Converter Technology"; page 79, points 1 and 2 of "Conclusions"); this was confirmed by the use in document (AAA) of the term "catalytic converter" for a device used in gasoline cars (see page 1, last three lines);

- moreover, as shown in the exhibits (ii) (first three pages and conclusions on the last page), (iii) (page 9, second chart and last page), AA (page 36, lines 5 to 17), BB (page 1, lines 1 to 13 below "Introduction", page 3, lines 20 to 21), CC (passage bridging pages 1 and 2), DD (page 1, lines 10 to 13 below "Introduction", page 4, lines 4 to 5), EE (page 14, lines 1 to 25; page 16, line 7 to page 17, line 25, conclusions on page 20, first and fifth paragraph), FF, GG (page 87, left column, lines 10 to 17 below "Introduction" and right column, lines 16 to 22), HH (page 189, left column, lines 20 to 29, page 199, left column, lines 12 to 15 below "Summary..."), II (page 1, left column, line 17 below "Introduction" to page 2, right column, line 4), JJ (page 5, last three lines, page 7, lines 1 to 7 of "Conclusions", annex I, lines 1 to 3), KK (page 4-3, lines 1 to 2), AAA (passage bridging pages 1 and 2), there existed in the prior art and after the priority date of the present application a technical prejudice against the use of a DOC in combination with a diesel fuel comprising metal compounds, i.e. a FBC, because of the concern about the possible impact of such metals on the environment and on human beings; the skilled person would have thus be prompted to use a DPT able to trap metal particles instead of a DOC which is only able to oxidize particles but not to trap them;

- the term "catalytic converter" used in document (3) thus did not intend to identify a DOC as required in the present application and would have been understood by the notional skilled person, on a proper reading of this document, as relating to an embodiment involving the application of the disclosed invention to a gasoline engine;

- document (3) thus disclosed the use of a diesel fuel containing a platinum group metal compound only in combination with, e.g., a DPT (see page 15, line 25 to page 16, line 1) but not with a DOC;

- document (3) was thus not closer to the claimed invention than documents (1) or (2).

2.2.4 It is the established jurisprudence of the Boards of Appeal of the EPO that a prior art disclosure must be read giving the information it contains the meaning that the notional skilled person would have given it at its publication date (i.e. 12 July 1990 in the case of document (3)) and disregarding information which would be understood by a skilled person to be wrong; however, any teaching which would not be recognized as wrong by a skilled person has to be accepted as state of the art (see Case Law of the Boards of Appeal of the EPO, 4th ed. 2001, point I.C.1.1 on page 39 and T 412/91, unpublished in the OJ EPO, point 4.6 of the reasons for the decision).

The Board finds that the term "catalytic converter" was commonly used at the publication date of document (3) and up to and after the priority date of the present application, i.e. 14 March 1995, for indicating the converter used for reducing the emissions of a gasoline engine as indicated, for example, in document (AAA); however, contrary to the Appellant's statement, this term was used in the prior art and also in the U.S.A. before and after the publication date of document (3) for identifying a diesel flow-through oxidation converter, i.e. a DOC, at least in a context relating to the functioning of diesel engines (see documents (5)

abstract; page 3, left column, lines 5 to 14 and passage bridging left and right columns; page 4, last seven lines; page 5, first four lines; summary on page 10 and page 11, references 2, 3 and 11; (6) page 80, left column, lines 7 to 31 and page 84, conclusions; and (7) pages 75, 76, 79, 80 and conclusions).

In particular, the documents (5) to (7), dealing with the reduction of emissions from the exhaust of a diesel engine, did use both terms "diesel catalytic converter" and "catalytic converter" for identifying a DOC (see e.g. document (5) page 3, left column lines 5 to 12; right column, lines 27 to 28; page 5, left column line 22; (6), page 84, point 2 of conclusions; (7), page 77, left column, line 2).

Therefore the term "catalytic converter" used in document (3) cannot be considered to relate **necessarily** to an embodiment relating to the use of a gasoline engine only as argued by the Appellant.

As to the existence of a technical prejudice which would have prompted the skilled person to interpret this term, on a proper reading of document (3), as relating only to the use of a gasoline engine, the Board agrees that health risks caused by the emissions of diesel engines were already under investigation before and after the publication of document (3).

However, the evidence (ii), (iii), (AA), (BB), (CC), (DD), (EE), (FF), (GG), (HH), (JJ), (KK) and (AAA), filed by the Appellant, is based substantially on technical knowledge acquired well after the publication

date of document (3), which, as explained above, is the valid date for the interpretation of this document, or even after the priority date of the present application as also remarked by the first instance in its decision (see point II above). Therefore this evidence cannot prove the existence of a technical prejudice against the use of DOC in combination with a fuel comprising a platinum group metal compound at the publication date of document (3) and lasting until the priority date of the present application, as explained hereinafter in point 2.2.8.

The only documents referring explicitly to the general technical knowledge of the skilled person about the health hazards caused by the emissions of diesel engines or by additives for diesel fuels at a time preceding the publication date of document (3) are documents (II) and part of (JJ).

However, document (JJ) mentions that a number of fuel additives had been banned by the Congress in the U.S.A. since 1977 but cites specifically only MMT, i.e. a manganese compound (page 8, lines 1 to 3). Moreover, this document, published in 2001, i.e. long time after the priority date of the present application, reports technical prejudice against the use of metallic fuel additives (page 7, lines 1 to 7 of "Conclusions") but does not suggest that this prejudice already existed at the publication date of document (3).

On the contrary, in the Board's view the prior art clearly indicated that metal catalysts had been tried as additives for diesel fuels at least up to the priority date of the present application, i.e. even

after the publication date of document (3) (see e.g. (GG), right column, lines 2 to 12; (HH), page 189, left column lines 17 to 19 below "Abstract"; page 6, line 12 to page 7, line 12 of the present application).

Document (II), published in 1986, describes the health hazard caused by the emissions of diesel engines and suggests the use of a long-life DPT or of alternative fuels (page 1, left column, line 17 below "Introduction" to page 2, right column, line 4; conclusions on page 8). This document is, however, silent about the influence of fuels containing metal catalysts.

The Board notes also that according to the teaching of the prior art DPT's had generally not reached commercial acceptance up to the priority date of the present application because of their short life due to the difficulty of regeneration; the common general teaching before and at the publication date of document (3) was to try to improve the functioning of DOC's instead of using a DPT (see documents (5), passage bridging pages 2 and 3 and following paragraph on page 3 relating to the references 2. and 8, both of them published in 1988; (8) page 20, middle column, last 15 lines before the heading "Diesel oxidation catalysts" and first 11 lines below the heading "Diesel oxidation catalysts"; (EE) page 6, chapter IV, lines 1 and 2; page 7, lines 1 to 3 below "Operating Characteristics", page 13, first paragraph below heading "Trap oxidizer system evolution"; (GG), published in 1995, reading in the passage bridging right and left column on page 87, relating to DPT: "This technology, which has been studied for years,

never came to extended production, essentially because of the need for a periodic regeneration which makes the system costly, hard to control, and with a trap durability affected by frequent thermal stresses.").

Thus, the Board concludes that it did not exist any technical prejudice at the publication date of document (3) that would have prompted the skilled person to disregard the interpretation of the term "catalytic converter" in that document as relating to the use of a DOC.

The description of document (3), describing in detail the effects obtained by means of the disclosed invention, teaches that

- the used additive compositions improve the efficiency of internal combustion engines and reduce their emissions (page 15, lines 18 to 25);
- describes the technical advantage obtained by using them in combination with a diesel particulate trap, i.e. DPT (page 15, line 25 to page 16, line 4);
- describes those obtained by using them in combination with a "catalytic converter" (page 16, lines 5 to 13);
- describes other advantages obtained by using them in diesel fuels. (page 16, line 14 to page 17, line 7).

The description describes the effects obtained by the addition of these catalyst compositions to other fuels such as gasoline or gasohol only in the passage on page 17, lines 8 to 24, thus in a passage lying in the description far away from and not being linked to that relating to the "catalytic converter".

Therefore, the Board concludes that, on a proper reading of document (3), the notional skilled person would have understood the passage relating to a "catalytic converter", lying between other passages relating exclusively to embodiments involving the use of a diesel engine, as relating also to these embodiments, the other possible embodiments being dealt with in a separate part of the description.

This situation is in the Board's view similar to that of documents (5) to (7) discussed hereinabove wherein the term "catalytic converter" is also occasionally used, since the subject- matter of those documents relates unequivocally to diesel engines.

The term "catalytic converter" used in document (3) identifies thus in the Board's judgement unequivocally a "diesel catalytic converter", i.e. a DOC.

Furthermore, the wording of claim 1 "pass-through catalyst support which directs the flow of particulates through a maze of catalyzed surfaces which contact the particulates without trapping them" defines in the Board's judgement just the structure of a conventional DOC (see e.g. documents (5), passage bridging pages 5 and 6; (8), figure 1 on page 20, (B), page 1; (EE), figure 1 on page 7) and thus describes features comprised by any possible conventionally used DOC at the publication date of document (3) and cannot distinguish further the claimed subject-matter from the teaching of document (3).

Consequently the Board considers document (3), relating to a technical problem similar to that mentioned in the present application and having more essential technical features in common with the subject-matter of claim 1 than documents (1) or (2) relating to the use of a DPT and not of a DOC, as the most suitable starting point for the evaluation of inventive step.

2.2.5 In the light of the evaluation above the Board finds that the subject-matter of claim 1 differs from the disclosure of document (3) only insofar as the claimed method is carried out in a lean-burn engine operating with from 2 to about 12% oxygen greater than stoichiometrically required and the used fuel comprises an additional amount of a cerium, copper or iron metal compound sufficient to give in the fuel an amount of about 1 to 100 ppm of the respective metal.

Since document (3), as explained above, already provided a method for reducing over extended periods of operation the combined total of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of diesel engines equipped with a DOC without excessive conversion of SO_2 to SO_3, the objective technical problem underlying the present invention could thus apparently be identified in the light of the passage on page 21, lines 22 to 25 of the present application reading "...the additives can be employed with other metallic compounds utilized for improving economy, reducing emissions of pollutants such as hydrocarbons and carbon monoxide, and for improving the operation of particulate traps or oxidation catalysts. Among the useful metallic compounds are salts of manganese, iron, copper, cerium..." as a further

improvement of the overall emission reduction already achieved in document (3) when using a lean-burn diesel engine.

2.2.6 The Appellant submitted in writing and during oral proceedings that

- it was already known in the prior art that a DOC was able to reduce to a large extent the particulate emission of a diesel engine;

- even if occasionally it was possible to achieve therewith a 30% reduction in particulate emission or greater, a DOC allowed generally a reduction of up to 25% of the particulate emission;

- therefore, it was not possible to achieve constantly and reliably the threshold of 30% reduction of emitted particulates with a lean-burn diesel engine equipped with a DOC;

- furthermore, it was not possible to control therewith efficiently the emissions of NOx and in particular, the further oxidation of NO to NO_2 (see e.g. (A), page 1 and (B) pages 2 and 3).

In regard to the disclosures of documents (3) (page 15, lines 18 to 25) and (HH) (page 190, left column, lines 1 to 3 below "Objectives" and lines 5 to 9 below "Test plan", page 192, right column, lines 13 to 21 and page 199, lines 12 to 15 below "Summary...", already suggesting that NO_x emissions could be reduced by using a fuel containing a platinum group metal compound or a

cerium compound, the Appellant submitted during oral proceedings that

- the use of a fuel comprising only a platinum group metal in combination with a DOC as used in document (3) would not be sufficient for achieving constantly and reliably the threshold of 30% reduction in particulate emission and would not achieve a control and reduction of the amount of NO_2 in the total NO_x emissions;

- since a metal catalyst would be expected to affect the efficiency of a DOC, e.g. to modify or increase its oxidative efficiency, it was difficult to predict which overall effect it would have when added to a fuel used in combination with a DOC and, in particular, if the overall particulate and NOx emissions would be further reduced.

The Appellant thus put forward that the evidence submitted showed that the use of a fuel comprising both a platinum metal group compound and a cerium compound brought about surprisingly such a constant and reliable 30% reduction in particulate emission from a lean-burn diesel engine and a control and reduction of the amount of NO_2 in the total NO_x emissions (see the experimental evidence contained in the letter of 28 February 2005, examples 1 to 3, and documents (E), point 5 "Conclusions", (F) point 2, right column, last 6 lines before figure 2; (G), tables 1,2,4, figure 11 and page 8 "Conclusions"; (H) and (I)).

A similar effect had thus to be expected throughout the whole scope of the claim, e.g. by using iron or copper compounds instead of cerium compounds or by using amounts of such catalysts of up to 100 ppm.

2.2.7 The Board finds that the evidence submitted by the Appellant convincingly show that this effect is achieved by means of an additive composition comprising platinum and small amounts of a cerium compound, e.g. in the range of 4 to 15 ppm, as specifically used in the experimental evidence submitted.

No evidence was, however, submitted in regard to a an additive composition comprising a combination of the platinum group metal compound with a copper or iron metal compound or with higher amount of cerium compounds, e.g. 100 ppm.

As explained by the Appellant, in the present technical field the combined reduction of emissions appeared to be especially difficult with lean-burn diesel engines and the effect of a metal catalyst added to a fuel used in combination with a DOC could not be predicted.

Therefore in the Board's view it cannot be reasonably expected that catalysts based on copper or iron metals, which do not belong to the same metal group of the periodic table as cerium, cerium being the only one belonging to the rare earth metals, behave in the same way as cerium catalysts and bring about the same unexpected advantages. Similarly, it cannot be reasonably expected that higher amounts of cerium compounds, e.g. 100 ppm, because of their expected influence on the activity of a DOC, would bring about

the same effect brought about by the much lower amounts used in the evidence submitted by the Appellant.

Therefore, in the absence of any pertinent evidence, it cannot be reasonably concluded that the advantage shown in the submitted evidence has been achieved by means of all additive compositions covered by the wording of claim 1 and thus that the alleged technical problem underlying the claimed invention has been solved by all embodiments encompassed by the only claim according to the first auxiliary request.

The objective technical problem underlying the claimed invention has thus to be identified as just the provision of an alternative additive composition for a method for reducing over extended periods of operation the combined total of particulates, gaseous hydrocarbons and carbon monoxide discharged with the exhaust of lean-burn diesel engines equipped with a DOC without excessive conversion of SO_2 to SO_3 as disclosed in document (3).

The Board has no reason to doubt that such a technical problem has been solved by means of the addition of the selected amounts of iron, copper or cerium metal compounds.

2.2.8 It is undisputed that not only platinum metal catalysts as used in document (3), but also other metal catalysts such as copper, cerium ad iron compounds had been tried in the prior art in diesel fuels in the attempt to reduce the noxious emissions of diesel engines (see page 6, line 21 to page 7, line 19 of the present application as well as document (HH) already cited in

point 2.2.6 above and document (3), page 4, lines 12 to 20).

Moreover, the evidence (ii), (iii), (AA), (BB), (DD), (EE) and (FF), filed by the Appellant for supporting the existence of a technical prejudice in the prior art against the use of a diesel engine equipped with a DOC in combination with a fuel comprising a metal catalyst, is based on the technical knowledge acquired after the present priority date, as also stated by the Examining Division in its decision (see point II above) and does not contain any reference to preceding investigations upon any health hazard linked to the use of the selected metals in diesel fuels. Therefore, they cannot prove the existence of a technical prejudice at said priority date.

As regards the remaining pre-published evidence filed by the Appellant for the same purpose, (CC) relates in general to the known polluting effect of particulates present in a diesel exhaust and does not deal with the influence of metals in such exhaust; (HH) and (II) deal mainly with the problems occurring with the regeneration of a DPT and not with any problem occurring by using a DOC; moreover, (HH) suggests instead the use of cerium compounds in a diesel fuel (see point 2.2.4 above).

Furthermore, (KK) shows that at the priority date of the present application the use of platinum group metals in diesel fuels was expected as not to be harmful, since the resulting metal content in the diesel exhaust would be within the safety margins (see point 2.2 on page 2-1; point 3.3 on pages 3-2 to 3-5

and table 4-1 on page 4-1, referring to the pre-published studies (27) and (30) of page 5-3).

Therefore, in the Board's judgement, even if the health hazards caused by the use of metals in diesel fuels was under investigation, there did not yet exist any technical prejudice at the publication date of document (3) (as explained in point 2.2.4 above) and at the priority date of the present application that would have prevented the skilled person from trying metal additives in a diesel fuel used in an engine equipped with a DOC.

Therefore, the Board finds that it would have been obvious for the notional skilled person to replace part of the platinum group metal compound used in document (3) with other known metallic additives or to add further metal compound as additives to the diesel fuels used according to the teaching of document (3) in order to provide alternative additive compositions having a similar effect.

The claim according to the first auxiliary request thus does not involve inventive step.

Therefore, the first auxiliary request has to be dismissed.

3. *Second Auxiliary Request*

3.1 Articles 84, 123(2) and 54 EPC

The only claim according to the second auxiliary request differs from the only claim according to the

first auxiliary request only insofar as the used additive comprises necessarily the combination of a platinum group metal compound and a cerium compound in an amount sufficient to provide the fuel with 1 to 30 ppm of cerium metal, which new range of concentrations is supported by the last two lines of page 21 of the application as originally filed.

Therefore this claim complies with the requirements of Articles 84, 123(2) and 54 EPC for the same reasons put forward in point 2.1 above.

3.2 Inventive step

The Board finds that the experimental evidence submitted by the Appellant and in particular the experiments submitted under cover of the letter dated 28 February 2005 and document (G) convincingly show that the technical problem of further improving the overall emission reduction already achieved in document (3) when using a lean-burn diesel has been solved throughout a range of compositions comprising 4 to 15 ppm cerium (see points 2.2.6 and 2.2.7 above).

This effect can thus be reasonably assumed to occur throughout the whole range of compositions comprising 1 to 30 ppm cerium and in compositions comprising, instead of platinum, any other metal belonging to the platinum group.

Since this effect could not be expected in the light of the teaching of the prior art as submitted by the Appellant (see point 2.2.6 above), the subject-matter of the only claim according to the second auxiliary

request is considered by the Board to amount to an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the claims of the second auxiliary request submitted during oral proceedings and a description being adapted thereto.

The Registrar: The Chairman:

G. Rauh P. Krasa