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Datasheet for the decision of 7 October 2015

Case Number: T 0542/13 - 3.3.05

Application Number: 06000921.4

Publication Number: 1666127

IPC: B01D53/94, B01J21/00, B01J23/58, B01J23/63

Language of the proceedings: EN

Title of invention:
Catalyst for lowering the amount of nitrogen oxides in the exhaust gas from lean burn engines

Patent Proprietor:
Umicore AG & Co. KG

Opponent:
Johnson Matthey Public Limited Company

Headword:
NOx catalyst/UMICORE

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (yes) - improvement

Decisions cited:

Catchword:

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Case Number: T 0542/13 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 7 October 2015

Appellant: (Opponent)	Johnson Matthey Public Limited Company 5th Floor 25 Farringdon Street London EC4A 4AB (GB)
Representative:	Turberville, Simon Johnson Matthey PLC Gate 20 Orchard Road Royston, Herts SG8 5HE (GB)
Respondent: (Patent Proprietor)	Umicore AG & Co. KG Rodenbacher Chaussee 4 63457 Hanau-Wolfgang (DE)
Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB Siebertstrasse 3 81675 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 28 January 2013 maintaining European Patent No. 1666127 in amended form.**

Composition of the Board:

Chairman	G. Raths
Members:	J.-M. Schwaller
	P. Guntz

Summary of Facts and Submissions

I. The present appeal lies from the interlocutory decision of the opposition division to maintain European patent No. 1 036 048 in amended form on the basis of the set of claims according to the main request filed during the oral proceedings of 7 December 2012, with independent claim 1 reading:

"*1. Catalyst for lowering the amount of nitrogen oxides in the exhaust gas from lean burn engines comprising at least one noble metal of the platinum group of the periodic table of the elements, as well as at least one nitrogen oxides storage material comprising at least one nitrogen oxides storage component on one or more support materials, in combination with a homogeneous Mg/Al mixed oxide of magnesium oxide and aluminum oxide, wherein magnesium oxide is present in a concentration of between 5 and less than 28 wt.-%, based on the total weight of the Mg/Al mixed oxide and wherein the nitrogen oxides storage components are oxides, carbonates or hydroxides of elements, selected from the group consisting of magnesium, calcium, strontium, barium, alkali metals, rare earth metals or mixtures thereof, and wherein the support material for the nitrogen oxides storage components consists of one or more high-melting metal oxides which are selected from the group consisting of cerium oxide and cerium mixed oxides.*"

II. The following documents cited in the opposition proceedings are relevant for the present decision:

D1A: Translation of Japanese patent 8-117601

D3: CA 2 280 631

III. With its grounds of appeal dated 4 June 2013, the appellant contested the first instance decision, arguing that the claimed subject-matter lacked inventive step in view of document D3 taken in combination with the teaching of document D1A.

IV. The respondent contested these conclusions in its letter dated 17 October 2013.

V. In a letter dated 13 March 2014, the appellant filed two additional prior art documents and referred to the decision revoking the sister patent EP 1317953 on the grounds that it lacked inventive step over the same documents on which the present patent was maintained.

VI. With letter dated 7 September 2015, the respondent submitted a technical report in support of its arguments on inventive step. Further, it filed a set of claims as an auxiliary request.

VII. At the oral proceedings, which took place on 7 October 2015, the discussion focused on the interpretation of the claimed subject-matter and on inventive step starting from Examples 1 and 16 of D3 as the closest state of the art. In this respect, the question arose whether D1 suggested the solution proposed in claim 1 of the main request. During the oral proceedings, the respondent filed an auxiliary request and the appellant filed a sheet summarising the results of catalysts C4a, C4b, C6a, C6b, C7a and C7b on the basis of Figures 7 and 11 and the corresponding tables of the contested patent.

VIII. Requests:

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed or, alternatively, that the patent be maintained on the basis of the claims of the auxiliary request filed during the oral proceedings or, alternatively, of the auxiliary request dated 7 September 2015.

Reasons for the Decision

1. Main request - Interpretation of the claimed subject-matter

1.1 Due to a different interpretation by the parties of the wording of claim 1 at issue, in particular because of the presence of the word "comprising", it is necessary to analyse in detail the content of the patent in order to construe the claimed subject-matter.

1.1.1 In this respect, for the board the expression

i) "*wherein the nitrogen oxides storage components* ***are*** *oxides, carbonates or hydroxides of elements, selected from the group consisting of magnesium, calcium, strontium, barium, alkali metals, rare earth metals or mixtures thereof*"

means that:

the components eligible for "*nitrogen oxides storage components*" **are limited to** oxides, carbonates or hydroxides of magnesium, calcium, strontium, barium, alkali metals, rare earth metals, or to mixtures of

these compounds. The reason therefor is that the use of the word "are" in expression i) limits *"the nitrogen oxides storage components"* to the list of individual compounds quoted after the word "are", or to mixtures of these compounds.

1.1.2 Similarly, the expression

*ii) "wherein **the** support material for **the** nitrogen oxides storage components **consists** of one or more high-melting metal oxides which are selected from the group consisting of cerium oxide and cerium mixed oxides"*

means that:

the only components eligible as support material (for the nitrogen oxides storage components) are cerium oxide or cerium mixed oxides; in other words, only cerium oxide or cerium mixed oxides serve as support material for the "*nitrogen oxides storage components*" listed in point 1.1.1 above.

The reason is that the closed wording used in expression ii) excludes the presence of any other supporting material for the "nitrogen oxide storage components".

1.1.3 The board does not accept the appellant's argument that the use of the word "comprising" in the definition of the catalyst would widen the meaning of the expressions i) and ii) because - as explained before - the wording of these expressions is closed and restricted to the components quoted under point 1.1.1 and 1.1.2. For the board, the presence of the word "comprising" is therefore to be construed as meaning that one or more further "nitrogen oxides storage material" or "nitrogen

oxides storage component", **different from those listed in point 1.1.1**, for instance one or more - supported or unsupported - zeolites, may optionally be present in the catalyst.

1.2 It follows from the above interpretation that the "nitrogen storage components" defined in point 1.1.1, in particular barium, cannot be supported on the "*homogeneous Mg/Al mixed oxide of magnesium oxide and aluminum oxide*" defined in claim 1 at issue.

In this respect, the appellant's argument that this interpretation would be in contradiction with claim 4 cannot be accepted, because claim 4 indeed defines the surface of the Mg/Al mixed oxide as being loaded with one or more rare oxides, but as explained by the respondent and in the patent specification (paragraph [0028]), when the mixed oxide is superficially impregnated with one or more rare earth oxides, its **thermal stability** is improved.

It is moreover credible that the rare earth oxides do not act as "nitrogen storage components" in this configuration, as evidenced by Figures 7 and 11, which show that there is no substantial improvement in the NO_x storage efficiency between catalysts containing an Mg-Al mixed oxide impregnated with one or more rare earths (see catalysts C6a, C6b, C7a and C7b) and catalysts which have not been impregnated therewith (see catalysts C4a and C4b).

1.3 It follows from the above interpretation that the support on which the loading of nitrogen storage components takes place consists of cerium oxide or cerium mixed oxides and not of "*homogeneous Mg/Al mixed oxide of magnesium oxide and aluminum oxide*".

The catalyst according to claim 1 at issue thus **does not contain** one or more nitrogen storage components selected from an oxide, carbonate or hydroxide of magnesium, calcium, strontium, barium, alkali metals, rare earth metals supported on a homogeneous Mg/Al mixed oxide of magnesium oxide and aluminum oxide, wherein magnesium oxide is present in a concentration of between 5 and less than 28 wt.-%, based on the total weight of the Mg/Al mixed oxide.

1.4 This interpretation should be kept in mind when dealing with inventive step or other aspects of patentability.

2. Main request - Inventive step

2.1 Invention

The invention relates to a catalyst for lowering the amount of nitrogen oxides in the exhaust gas from lean burn engines.

2.2 Closest prior art

As regards the closest state of the art, the parties agreed that the catalysts according to examples 1 and 16 of document D3 were the most suitable starting point to assess the inventive step of the claimed subject-matter. The board does not see any reason not to follow this view, since these catalysts have the same purpose as those presently claimed, namely to convert nitrogen oxides from lean burn engines. These catalysts are essentially composed of a mixture of a) cerium/zirconium mixed oxide particles coated with barium oxide as the nitrogen oxides storage material, b) platinum deposited on an aluminum oxide powder, and c) rhodium deposited on an aluminum oxide powder.

In example 16, the Pt-Al_2O_3 and Rh-Al_2O_3 powders are further coated with barium oxide.

2.3 Problem

According to the contested patent, the problem underlying the invention was to provide an improved catalyst which, in comparison with conventional ones, has an increased thermal stability, a wider temperature window and an improved nitrogen conversion in that window (paragraph [0016]).

2.4 Solution

As a solution to this problem, the contested patent proposes a catalyst according to claim 1 at issue, which is characterised in that it further *comprises "a homogeneous Mg/Al mixed oxide of magnesium oxide and aluminum oxide, wherein magnesium oxide is present in a concentration of between 5 and less than 28 wt.-%, based on the total weight of the Mg/Al mixed oxide".*

2.5 Success of the solution

For the board, it is credible that the problem identified in point 2.3 above has been successfully solved because, as shown by the technical report filed with the respondent's letter of 7 September 2015 - the content of which has not been contested by the appellant - the substitution of Al_2O_3 by an Mg/Al mixed oxide (20/80) in a catalyst similar to the one disclosed in Example 16 of D3 leads to an improvement of the maximum NO_x conversion rate and a broadening of the temperature window for the nitrogen oxides storage.

The respondent argued that these effects were the inevitable result of the thermal stabilisation of alumina by magnesium. However, in the absence of evidence for this allegation, an improvement is to be acknowledged.

2.6 Obviousness

As to the question of obviousness, it has to be determined whether the proposed solution was obvious in the light of the state of the art, in particular in the light of document D1A, that the appellant held to suggest the solution.

2.6.1 D1A (paragraph [0005]) discloses that the NO_x clean-up performance of $Pt/Ba/Al_2O_3$ catalysts deteriorates after prolonged use, because at elevated temperatures barium reacts with alumina, so that Ba is lost and NO_x cleaning performance declines.

D1A therefore proposes (see paragraph [0008] and claims to support the catalyst on a complex MAl_2O_4 support to which has been added an alkali metal, with M being an alkaline earth, preferably magnesium. According to the examples of D1A (see table 2), the combination of Li as the alkali metal with $MgO.nAl_2O_3$, with n being 1.5 or 2.0, provides for the best NO_x cleaning performance after prolonged use.

2.6.2 Owing to this teaching of D1A, the board agrees with the appellant that the skilled person faced with the problem underlying the invention may have an incentive to implement the above combination of features on the catalyst of D3. However, by doing this, he would not arrive at the subject-matter of claim 1 at issue, since

the substitution of Al_2O_3 in the catalyst 16 of D3 by a combination of Li and a mixed oxide $MgO_nAl_2O_3$ (n = 1.5 or 2.0) would lead to a catalyst comprising Ba supported on ($MgO.nAl_2O_3$ (n = 1.5 or 2.0) + Li), and not to a catalyst corresponding to claim 1 as interpreted in point 1 above, since Ba supported on such an Mg/Al mixed oxide is excluded from the wording of claim 1 at issue (see point 1.3).

Regarding example 1 of D3, the skilled person has no incentive to replace Al_2O_3 in the catalyst of this example, since barium is deposited on a cerium/ zirconium mixed oxide, not on alumina. So, he would also not arrive at the subject-matter of claim 1 at issue.

2.6.3 The remaining documents cited in the opposition proceedings were not relied upon by the appellant at the appeal stage. In the board's judgment neither of these documents contain further information which would point towards the claimed solution of the problem stated above.

2.6.4 It follows from the above considerations that, having regard to the state of the art, the subject-matter of claim 1 at issue is not obvious to a person skilled in the art.

So claim 1 at issue, and by the same token dependent claims 2 to 19, which include all the features of claim 1, involve an inventive step within the meaning of Articles 52(1) and 56 EPC.

3. Conclusion

As the appellant has not succeeded in establishing that

the set of claims as maintained by the opposition division does not meet the requirements of the EPC, its appeal must fail and the decision of the opposition division becomes final.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated