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Datasheet for the decision of 27 February 2008

Case Number: T 0232/04 - 3.3.05

Application Number: 00115159.6

Publication Number: 1068892

IPC: B01D 53/94

Language of the proceedings: EN

Title of invention:
Exhaust gas purifying catalyst comprising a zeolitic adsorbing layer

Applicant:
NISSAN MOTOR CO., LTD.

Headword:
Adsorbing layer/NISSAN

Relevant legal provisions:
EPC Art. 84, 123(2)

Keyword:
"Subject-matter extending beyond the content of the application as filed (main request)"
"Lack of clarity (auxiliary request)"

Decisions cited:
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Catchword:
-

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Case Number: T 0232/04 **-** 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 27 February 2008

Appellant: NISSAN MOTOR CO., LTD.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 21 October 2003 refusing European application No. 00115159.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. Raths
Members: B. Czech
H. Preglau

Summary of Facts and Submissions

I. This appeal is from the decision of the examining division refusing European patent application No. 00115159.6.

II. The prior art documents cited in the course of the examination procedure include the following:

D5: EP 0 904 827 A1

III. The refusal of the application by the examining division was based on the grounds of lack of novelty over D5 (claims according to the main request then on file), non-compliance with the requirement of Article 123(2) EPC (claims according to the auxiliary request 1 then on file) and lack of inventive step (claims according to the auxiliary request 2 then on file).

IV. With its statement of grounds of appeal, the appellant filed new main and auxiliary requests comprising two amended sets of claims replacing the ones previously on file. It considered the subject-matter of the fresh claims to be originally disclosed, novel over D5 and inventive over the prior art cited by the examining division.

V. In the annex to the summons to oral proceedings, the board inter alia raised objections under Article 123(2) and 84 EPC against the claims according to the two new requests. The board inter alia considered the expressions "*almost circular*" and "*the volume of hydrocarbon absorbent layer which satisfies a*

difference (Y-Rf) ≥35 μm" comprised in claim 1 and claim 5, respectively, of said two requests to lack clarity.

VI. With its letter of 24 January 2008, the appellant filed three amended sets of claims replacing the ones previously on file as new main and auxiliary requests. It inter alia considered that these claims overcame the objections under Article 123(2) and 84 EPC raised by the board in the annex to the summons to oral proceedings.

Independent claim 1 according to the main request filed with letter of 24 January 2008 reads as follows:

"*1. An exhaust gas purifying catalyst, comprising:*
a monolithic support (1) including a plurality of cells, each having a cross section of a regular N-polygon, in which the N is 3, 4, 5 or 6;
a hydrocarbon absorbent layer (2) formed in each of the plurality of cells and containing zeolite as a main component, the hydrocarbon absorbent layer (2) including an inner wall surface defining a path for exhaust gases; and
a metal—based catalyst layer (3) formed on the inner wall surface of the hydrocarbon absorbent layer (2), the metal-based catalyst layer containing at least one type noble metal selected from the group consisting of platinum, palladium and rhodium,
characterized in that
the inner wall surface is cylindrical without any flat wall portion, and
that a ratio Rc/Rf ≤ 1.6 when N = 3 and the regular N-polygon is a regular triangle,

the ratio Rc/Rf ≤ 1.3 when N = 4 and the regular N-polygon is a regular square,
the ratio Rc/Rf ≤ 1.1 when N = 5 and the regular N-polygon is a regular pentagon, and
the ratio Rc/Rf ≤ 1.1 when N = 6 and the regular N-polygon is a regular hexagon, wherein
Rc is the distance from the center of gravity to the inner wall surface of the hydrocarbon avsorbent [sic] layer (2) along a line extending from the center of gravity of each of the plurality of cells to a corner of the cell, and Rf is the distance from the center of gravity [sic] the inner wall surface of the hydrocarbon layer (2) along a line extending from the center of gravity to one of [sic] sides of the cell."

VII. Oral proceedings took place on 27 February 2008. In the first place the appellant presented its arguments concerning the allowability of the new main request in view of the objections of the board under Article 123(2) EPC (having regard to the feature "*cylindrical without any flat portion*") and under Article 84 EPC (clarity) concerning claims 1 and 5, respectively, according to this request. Subsequently, the appellant expressly withdrew its two auxiliary requests and replaced them by another set of amended claims as the sole remaining auxiliary request. Claim 1 according to this auxiliary request was objected to by the board on the ground that it lacked clarity in view of some of the features added to it.

Independent claim 1 according to the auxiliary request filed during the oral proceedings reads as follows:

"*1. An exhaust gas purifying catalyst, comprising:*

a monolithic support (1) including a plurality of cells, each having a cross section of a regular N-polygon, in which the N is 3, 4, 5 or 6;
a hydrocarbon absorbent layer (2) formed in each of the plurality of cells and containing zeolite as a main component, the hydrocarbon absorbent layer (2) including a gas passing portion in the center of each of the cells; and
a metal—based catalyst layer (3) formed on the inner wall surface of the hydrocarbon absorbent layer (2), the metal-based catalyst layer containing at least one type noble metal selected from the group consisting of platinum, palladium and rhodium,
characterized in that
the gas passing portion specified by the metal-based catalyst layer (3) is an almost circular hollow portion, which is built on the almost circular cavity built by the HC adsorbent layer, wherein
a ratio Rc/Rf ≤ 1.6 when N = 3 and the regular N-polygon is a regular triangle,
the ratio Rc/Rf ≤ 1.3 when N = 4 and the regular N-polygon is a regular square,
the ratio Rc/Rf ≤ 1.1 when N = 5 and the regular N-polygon is a regular pentagon, and
the ratio Rc/Rf ≤ 1.1 when N = 6 and the regular N-polygon is a regular hexagon, wherein
Rc is the distance from the center of gravity to the inner wall surface of the hydrocarbon avsorbent [sic] layer (2) along a line extending from the center of gravity of each of the plurality of cells to a corner of the cell, and Rf is the distance from the center of gravity [sic] the inner wall surface of the hydrocarbon layer (2) along a line extending from the center of gravity to one of [sic] sides of the cell,

and wherein a difference (Y-Rf) is set to be more than or equal to 35 μm, where Y is the shortest distance from the center of gravity of the cell sectional shape to the cell sides and Rf is the distance from the center of gravity of the regular N-polygon to the inner surface of the HC adsorbent layer and the volume of the HC adsorbent layer satisfying the above relationship occupies more than or equal to 50% of the overall volume of the HC adsorbent layer in the entire monolithic support."

VIII. The appellant requested that the contested decision be set aside and that a patent be granted on the basis of the claims according to the main request filed with the letter of 24 January 2008 or alternatively according to the auxiliary request filed during the oral proceedings.

IX. The essential arguments of the appellant, as far as pertaining to the allowability and clarity of the respective claims 1 according to its two final requests, can be summarised as follows:

The appellant argued in writing that the phrase "*the inner wall surface is cylindrical without any flat wall portion*" in claim 1 of the main request replaced the previously used vague expression "*almost circular*" and had no different meaning. The cylindrical form resulted from the use of a HC absorbent slurry having a high viscosity and a high surface tension. At the oral proceedings, referring to the first paragraph on page 6 of the application as filed, the appellant argued that the application as filed disclosed cavities or cells which were almost circular, i.e. cylindrical, in the sense that they only deviated from the circular or

cylindrical shape due to some dimensional variations at the inner surface of the adsorbent layer, which were due to the fact that the layer was deposited using slurries of solid particles. However, it was clear that the cavities disclosed only had curved walls, i.e. no flat wall portions such as those shown in Figure 1 of D5.

Concerning the basis for the amendment consisting in the additional incorporation of the features "*and wherein a difference (Y-Rf) … entire monolithic support*", the appellant pointed out the paragraph bridging pages 7 and 8 of the application as filed. In the appellant's view, the added features were clear and further limited the claimed invention.

Reasons for the Decision

Main request

1. Amendments - Allowability under Article 123(2) EPC

1.1 The feature "*the inner wall surface is* ***cylindrical without any flat wall portion***" (emphasis added by the board) in amended claim 1 has no literal basis in the application as filed. The passage on page 6, lines 1 to 6, of the application as filed, which was invoked by the appellant as a basis for the amendment, merely refers to an "*almost circular*" cavity with "*a radius R*" formed by the adsorbent (zeolite) layer within a cell with a square cross-section. No other part of the application as filed literally refers to an inner wall

surface being "*cylindrical*" or having an "*almost circular*" cross-section.

Figure 1, to which said passage on page 6 refers, shows an inner wall surface having a cross-section which is strictly circular. The other cell cross-sections shown in Figures 2A to 3C of the application as filed are also strictly circular. An adsorbent layer having such a strictly circular cross-section along the entire length of the cell would define an inner wall surface of strictly cylindrical shape, i.e. without any flat wall portions.

1.2 However, the board observes that claim 1 is expressly not restricted to catalysts wherein the hydrocarbon adsorbent layer has a strictly circular cross section, i.e. a strictly cylindrical inner wall surface, with a constant radius or, in other words, a Rc/Rf ratio of 1 (see page 6, lines 29 to 31 of the application as filed). On the contrary, according to claim 1 the Rc/Rf ratio may deviate substantially from this value. For instance, it may be as high as 1.6 in the case of a triangular cell cross section and as high as 1.3 in the case of a square cell cross section. Moreover, it can be gathered from the Rc/Rf values reported in table 2 (fourth column) of the application as filed that the particular fabrication method used never led to values lower than 1.4 for triangular cell cross sections or lower than 1.1 for square cross sections, let alone to strictly cylindrical inner wall surfaces. Furthermore, the application as filed contains no element from which it could be derived that the deviations from a strictly circular cross section of the absorbent layer envisaged by the authors of the application were due to the fact

that a slurry of solid particles was used to form the adsorbent layer, and were not merely due to the tendency of the deposited layer to conform to the shape of the cell corners.

1.3 At the oral proceedings, document D5 was referred to in order to illustrate the difference between catalysts having inner wall surfaces with flat portions and catalysts having no such flat portions, i.e. catalysts according to present claim 1. The appellant acknowledged that D5 (see claim 1 and Figures 1(a) and 1(b)) discloses catalysts comprising a hydrocarbon adsorbent layer 2 formed on the inner cell walls and defining a cavity having a square cross-section with rounded corners, the straight sides in the cross sectional view defining a tubular duct with flat wall portions within each cell. The adsorbent layers disclosed in D5 thus implicitly have an Rc/Rf ratio differing from and being higher than 1. Hence, D5 shows that adsorbent layers with such Rc/Rf ratios do not necessarily have curved walls only, but may also have flat wall portions.

1.4 Even accepting, purely for the sake of argument, that adsorbent layers with a Rc/Rf ratio of 1.3 within a cell of square cross-section could be considered as "*almost circular*" in the sense of the application as filed, and as defining a cylindrical inner wall surface in the sense of present claim 1, there is no disclosure in whatever form in the application as filed of a requirement that such deformed cylindrical cavities must have curved walls only, i.e. no "*flat wall portions*". More particularly, the passages quoted by the appellant do not refer to an adsorbent layer with

an Rc/Rf value of up to 1.3 in a cell of square cross-section.

1.5 In view of the above the board concludes that the amendments to claim 1 find no basis in the application as filed at least insofar as amended claim 1 relates to catalysts with adsorbent layers having Rc/Rf values as high as 1.3 in connection with a square cell cross section and including an inner wall surface "*without any flat portions*". The amended application thus contains subject-matter which extends beyond the content of the application as filed.

1.6 Since claim 1 does not, therefore, meet the requirements of Article 123(2) EPC, the appellant's main request is not allowable.

Auxiliary request

2. Clarity (Article 84 EPC) - Claim 1

2.1 Claim 1 according to the present request differs from claim 1 of the application as filed inter alia in that it additionally comprises the following features: "*and wherein a difference (Y-Rf) is set to be more than or equal to 35 μm, where Y is the shortest distance from the center of gravity of the cell sectional shape to the cell sides and Rf is the distance from the center of gravity of the regular N-polygon to the inner surface of the HC adsorbent layer and the volume of the HC adsorbent layer satisfying the above relationship occupies more than or equal to 50% of the overall volume of the HC adsorbent layer in the entire monolithic support.*"

2.2 The board considers that in view of the wording of claim 1 alone it is not possible, at least for some of the embodiments covered, to unambiguously establish whether or not some particular regions of the adsorbent layer within the cells of a given catalyst belong to the volume of adsorbent layer "*satisfying*" the "*relationship*" according to which "*a difference (Y-Rf) is set to be more than or equal to 35 μm*". More particularly, claim 1 contains no indications of how to translate the said "*relationship*" relating to the mono-dimensional parameter "*a difference (Y-Rf)*" into a cross sectional area of a particular shape and further into the three-dimensional parameter "*volume of the HC adsorbent layer satisfying the above relationship*".

2.3 At the oral proceedings, the appellant argued that these features were clear and the only sensible understanding of claim 1 was that the thickness of the adsorbent layer, measured radially outward from the centre of the polygon, had a minimum value "*Y-Rf*" of 35 μm at the cell sides, and that the volume ratio of "*more than or equal to 50 %*" designated the ratio of the volume of the innermost portion of the adsorbent layer, said portion having a roughly tubular shape with a wall thickness value of "*Y-Rf*", to the entire volume of the adsorbent layer formed on the cell wall. The appellant held that this view was also supported by the explanations given on page 24, lines 13 to 16 and the Figures 3A to 3C.

2.4 This understanding cannot, however, be unambiguously derived from the wording of claim 1 itself, i.e. without additional considerations.

2.4.1 More particularly, another possible understanding of the wording of claim 1 would be that the volume of the adsorbent layer "*satisfying*" the said "*relationship*" is the volume of adsorbent material contained within the volume defined by the product of the annular area (Y^2-Rf^2) x π and the length of the cell.

2.4.2 When this understanding is adopted, the value of the ratio Rc/Rf can have an impact on the value of the adsorbent layer volume in question, and two different situations can be distinguished. In the case of catalysts having an Rc/Rf ratio close to 1, such as the ones shown in the Figures 3A to 3C, the two possible understandings of claim 1 (see points 2.3 and 2.4.1 above) are actually one and the same. However, claim 1 also covers embodiments wherein Rc differs substantially from Rf, e.g. by up to 60% in the case of cells with a triangular cross section (Rc/Rf ≤1.6), or by up to 30% in the case of cells with a square cross-section. In these embodiments, the cross-section of the "*inner surface of the adsorbent layer*" is far from being strictly circular and conforms to the shape of the cell corners. Therefore, the volume defined by (Y^2 - Rf^2) x π and the length of the cell will necessarily include less adsorbent material than the volume of the innermost portion, defined by a deformed annulus and the length of the cell, to which the appellant referred at the oral proceedings (see point 2.3 hereinabove).

2.5 The board is also of the opinion that the ambiguity referred to above is not even removed if, purely for the sake of argument, those parts of the description and drawings of the application as filed which relate

to the features in question are additionally taken into account when establishing the meaning of the said features. Moreover, some of the passages relied upon by the appellant give rise to further questions concerning the clarity of the wording of claim 1.

2.5.1 More particularly, original claim 8, page 7, line 34 to page 8, line 16, page 24, lines 13 to 16, page 25, lines 1 to 3, Figures 3A to 3C and table 2, do not contain unambiguous indications concerning the volume ratio referred to in claim 1. From the indications on pages 24 and 25, it also can merely be understood that Y-Rf is the average thickness of the zeolite adsorbent layer "*in the cell flat portion*", i.e. in regions of the cell wall distant from the corners of the cell. Figures 3A to 3C only provide explanations on how the value of Y-Rf is to be determined.

2.5.2 The following further passages of the description make it even more difficult to understand the wording of claim 1. The column at the right of table 2 of the application as filed refers to the "*area having a zeolite layer of more than 50 μm / total inner wall area*", and the column to the left thereof relates to the "*average thickness of a zeolite layer at flat portions in a cell*". The values reported in these two columns appear to be addressed on page 25, lines 1 to 3, which passage however talks about "*a volume occupying rate of the zeolite layer in which the zeolite thickness in the cell flat portion is in excess of 50 μm exceeds 50%*". The references, in table 2, to an "*area having a zeolite layer of more than 50 μm*" and to a "*total inner wall area*" thus cast doubt on the volume ratios actually to be considered according to claim 1.

2.6 Summarising, the board concludes that in view of the wording of claim 1 it is not possible to unambiguously determine, for a given catalyst, the value of the parameter "*volume of the HC adsorbent layer satisfying the above relationship*" referred to in claim 1 in those cases where the Rc/Rf ratio is much higher than 1, e.g. close to 1.6 for a triangular cell cross section or close to 1.3 for a square cell cross section. Consequently, it cannot in all cases be unambiguously established whether the said volume occupies more or less than 50% of the overall adsorbent volume. Hence, the feature according to which said volume "*occupies more than or equal to 50% of the overall volume of the HC adsorbent layer in the entire monolithic support*" does not constitute a clear delimitation of the subject-matter claimed in all the cases covered by claim 1.

2.7 Since claim 1 lacks the clarity required by Article 84 EPC, the appellant's auxiliary request is not allowable either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar | The Chairman

S. Sánchez Chiquero | G. Raths