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Datasheet for the decision of 8 September 2009

Case Number: T 1441/05 - 3.3.05

Application Number: 98103727.8

Publication Number: 0862941

IPC: B01D 53/94

Language of the proceedings: EN

Title of invention:
An exhaust gas purification device for an internal combustion engine

Patentee:
Toyota Jidosha Kabushiki Kaisha

Opponent:
Peugeot Citroën Automobiles SA

Headword:
Exhaust gas purificatiaon device/Toyota

Relevant legal provisions:
EPC Art. 54(1)(2), 123(2)

Keyword:
"Novelty: no (main and second auxiliary request)"
"Subject-matter not directly and unambigously disclosed in the application as filed (third auxiliary request)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1441/05 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 8 September 2009

Appellant: (Patent Proprietor)	Toyota Jidosha Kabushiki Kaisha 1 Toyota-cho Toyota-shi Aichi-ken (JP)
Representative:	TBK-Patent Bavariaring 4-6 D-80336 München (DE)
Respondent: (Opponent)	Peugeot Citroën Automobiles SA Route de Gizy F-78943 Velizy Villacoublay Cedex (FR)
Representative:	Gendraud, Pierre PSA Peugeot Citroen Départment Propriété Industrielle 18 Rue des Fauvelles F-92250 La Garenne Colombes (FR)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted 21 October 2005 revoking European patent No. 0862941 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: G. Raths
Members: B. Czech
C. Vallet

Summary of Facts and Submissions

I. The appeal is from the decision of the opposition division revoking European patent No. 0 862 941.

II. In the contested decision the opposition division found that the subject-matter of claim 1 as granted and of the respective claims 1 as amended according to the two auxiliary requests then on file lacked novelty over the disclosure of document

D2: EP 0 580 389 A1.

III. In its statement of grounds of appeal, the appellant (proprietor of the patent) defended the patent as granted. As first auxiliary request, it requested oral proceedings. Moreover, it filed two amended claims 1 as second and third auxiliary requests. It argued inter alia that the claimed subject-matter was novel, since the way in which the SO_x release control was conducted according to the patent in suit differed from the one taught by D2.

IV. Claim 1 as granted (main request) reads as follows:

"*1. An exhaust gas purification device for an engine comprising:*

a NO_x absorbent disposed in an exhaust gas passage of an internal combustion engine, wherein said NO_x absorbent absorbs NO_x in the exhaust gas of the engine when the air-fuel ratio of the exhaust gas is at a lean air-fuel ratio and releases the absorbed NO_x when the oxygen concentration in the exhaust gas is lowered, and wherein said NO_x absorbent absorbs SO_x in the exhaust

gas when the air-fuel ratio of the exhaust gas is at a lean air-fuel ratio and releases the absorbed SO_x when the oxygen concentration in the exhaust gas is lowered and when the temperature of the NO_x absorbent is higher than a SO_x releasing temperature;

SO_x releasing means for raising the temperature of the NO_x absorbent to a temperature higher than the SO_x releasing temperature and for lowering the oxygen concentration of the exhaust gas flowing into the NO_x absorbent to, thereby, release the absorbed SO_x from the NO_x absorbent; and

SO_x control means for controlling the amount of SO_x absorbed in the NO_x absorbent by controlling the SO_x releasing means in such a manner that, when the SO_x control means expects that the temperature of the NO_x absorbent increases to a first predetermined temperature when the air-fuel ratio of the exhaust gas is lean, substantially all of the absorbed SO_x is released from the NO_x absorbent by the SO_x releasing means before the temperature of the NO_x absorbent reaches said first predetermined temperature".

Claim 1 according to the second auxiliary request differs from claim 1 as granted in that the sentence "*when **the SO_x control means expects** that the temperature of the NOx absorbent increases*" is amended to read "*when **it is expected** that the temperature of the NOx absorbent increases*" (emphasis added by the board) and in that the following features are appended to the wording of claim 1 as granted: "***, wherein said NOx absorbent holds the absorbed SO_x therein in the form of a particle of sulfate, and wherein said first predetermined temperature is a temperature at which the***

sulfate particles in the NOx absorbent starts to grow in a lean air-fuel ratio exhaust gas".

Claim 1 according to the third auxiliary request differs from claim 1 according to the second auxiliary request in that the features "***even though the amount of SO_x absorbed in the NOx absorbent is lower than a predetermined amount,***" are inserted between "*... before the temperature of the NOx absorbent reaches said first predetermined temperature*" and the features appended to the claim as quoted in the preceding paragraph.

V. The parties were summoned to oral proceedings. In its communication of 28 July 2009 issued in preparation of the oral proceedings, the board inter alia commented on the terms used in the claims and their interpretation. The board also addressed points of potential relevance in the assessment of novelty and of the clarity and allowability under Article 123(2) EPC of the amendments to claim 1 according to the appellant's third auxiliary request.

VI. In reply to the board's communication, the respondent (opponent) objected to the claims on file inter alia on the ground of lack of novelty over D2. It also raised an objection under Article 123(3) EPC against both auxiliary requests and an objection under Article 123(2) EPC concerning the third auxiliary request.

VII. The arguments of the parties as submitted in writing and/or during the oral proceedings as far as they are relevant for the present decision can be summarised as follows:

The appellant argued that whilst the aim of the patent in suit was to avoid poisoning of the absorbent by sulphates, D2 aimed at regenerating an already poisoned absorbent. According to the invention, the temperature of the absorbent was monitored, and before sulphate could build up and poison the absorbent, SO_x was released by raising the temperature of the absorbent and lowering the oxygen concentration. D2, although disclosing a lowering of the oxygen concentration, did not disclose a heating of the absorbent for the purpose of releasing SO_x. The measure consisting in an injection of extra fuel as disclosed in D2 would not necessarily lead to a combustion of the extra fuel, to a decreased oxygen concentration and to an essential increase of the absorbent temperature. The heating to more than 700°C mentioned in D2 in connection with the fifth embodiment of D2 had nothing to do with the release of absorbed SO_x. The "best summary" of the invention was to be found in column 15, lines 19 to 34 of the patent in suit. Taking into account the entire disclosure of the patent and in particular the quoted passage, it was clear that the "*SO_x control means*" of claim 1 implicitly included means for monitoring and controlling the amount of SO_x absorbed. Such means were also not disclosed in D2.

Concerning the auxiliary requests, the appellant submitted that the amendments were based on the application as originally filed. By the incorporation of the additional features "the technical teaching of claim 1 is further specified to emphasise the gist of the invention, in order to avoid by the outlined control that big sulphate particles are formed in the NO_x absorbent when the engine is driven under lean and

high temperature conditions. To avoid a growth of particles whenever a first predetermined temperature is reached, all SO_x absorbed by the NO_x absorbent is released to allow after this release of the absorbent SO_x a lean high temperature operation without the risk that SO_x particles grow to big particles and can never be released from the NOx absorbent." The added features, which further developed the "*SO_x control means*" features of claim 1, were not disclosed in D2. These features made it clear that the temperature of the absorbent was monitored by means such as the counter "CS" shown in Figure 6 of the patent in suit, that the amount of stored SO_x was controlled, and that the first predetermined temperature was the one at which sulphate particles in the absorbent started to grow by sintering, as was explained in more detail in the description. This temperature could be determined experimentally for each absorbent material. D2 was silent about the sintering of sulphate particles and the corresponding temperature and contained no indications in this direction. Moreover, it was not sure that the triggering temperature of 500°C as disclosed in D2 was below the sintering temperature of the sulphate particles.

The respondent emphasised that claim 1 as granted related to a device and that the features further specifying the "*SO_x releasing means*" and the "*SO_x control means*" did not delimit the claimed device over the devices disclosed in D2. D2 disclosed the same NOx absorbents as the patent in suit and also dealt with the problem of avoiding their poisoning by growing amounts of sulphates when the engine was run at lean air/fuel ratios. The device of D2 comprised means for

simultaneously lowering the oxygen concentration in the exhaust gas (injection of additional fuel) and for increasing the temperature of the exhaust gas and of the NO_x absorbent (injection of additional fuel and delayed ignition timing as referred to in Figure 12), thereby releasing absorbed SO_x and before it poisoned the NO_x absorbent. D2 also disclosed means for controlling the SO_x releasing means, for monitoring the absorbent temperature and for triggering the SO_x release when a certain absorbent temperature was reached. Hence D2 disclosed a device with control means for performing the measures referred to in claim 1. The respondent acknowledged that D2 did not mention the monitoring of the amount of SO_x absorbed but it held that the respective claims 1 according the appellant's requests did not require such means either. The reference, in the respective claims 1 according to both auxiliary requests, to a temperature at which the sulphate particles started to grow did not further limit the claimed device. Irrespective of the actual value of the said temperature, the device according to claim 1 operated in the same manner, i.e. triggering the SO_x release when the lower threshold temperature was reached.

Concerning both auxiliary requests, the respondent objected, under Article 123(3) EPC, to the replacement of "*when the SO_x control means expects*" by "*when it is expected*". Concerning the third auxiliary request, it submitted that the amendment consisting in the incorporation of the additional features taken from the description amounted to an intermediate generalisation which was not allowable under Article 123(2) EPC.

VIII. The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or, alternatively, on the basis of the claims according to one of the second or third auxiliary requests filed with the statement of grounds of appeal dated 23 February 2006.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

Main request - Claim 1 - Novelty over document D2

1. D2 undisputedly discloses (see e.g. column 1, lines 1 to 7 and Figure 1) an exhaust gas purification device for an engine comprising a NO_x absorbent 6 disposed in an exhaust gas passage 4 of an internal combustion engine 2. The NO_x absorbent as exemplified in D2 comprises platinum and barium on a carrier and functions as required by present claim 1. It absorbs NOx when the exhaust gas comprises excess oxygen, i.e. when it has a "*lean air/fuel ratio*" in the sense of present claim 1, and releases NO_x when the oxygen concentration of the exhaust gas decreases, i.e. when it is lowered. The NO_x absorbent also absorbs SO_x in the form of barium sulphate when the exhaust gas contains excess oxygen, i.e. when the exhaust gas is at a "*lean air/fuel ratio*", and releases the absorbed SO_x when the temperature of the NO_x absorbent is (sufficiently) high, i.e. necessarily "*higher than a SO_x releasing temperature*" as required by present claim 1 and when the oxygen concentration in the exhaust gas is lowered simultaneously. In this respect reference is in

particular made to column 2, lines 17 to 26 and lines 42 to 55; column 4, line 39 to column 5, line 13.

Thus the NO_x absorbent disclosed in D2 meets all the requirements imposed on the NO_x absorbent of the device according to present claim 1.

2. D2 also discloses means 16 (Figure 1) for controlling the oxygen concentration of the exhaust gas comprising an electronic control fuel injection valve which can control the air/fuel ratio by controlling the amount of fuel injected in the intake duct of the engine (Figure 1; column 5, line 56 to column 6, line 2).

2.1 The injection of fuel causes a reduction of the air/fuel ratio, thus leading to a rich (see e.g. column 5, line 8) or stoichiometric (see e.g. Figure 12, step 210) air/fuel ratio, and hence to an exhaust gas having a lowered oxygen concentration. The devices disclosed in D2 also comprise temperature sensors 10 and 10A for detecting the temperature of the exhaust gas and of the absorbent, respectively (see Figure 1 and column 5, lines 26 to 33). According to the features in common to all embodiments (see column 4, lines 7 to 9; column 5, line 3 to column 6, line 7) when the control system detects high temperatures whilst, in the terms of present claim 1, "*the air/fuel ratio of the exhaust gas is lean*", it lowers the oxygen concentration of the exhaust gas repeatedly or continuously within a relatively short period of time to release the absorbed SO_x and suppress SO_x-poisoning of the absorbent (column 2, lines 42 to 55; column 5, lines 13 to 16).

2.2 In the board's view, it is not apparent why the additional fuel injected into the intake duct of the engine running at a lean air/fuel ratio will not be combusted to some extent, thereby increasing the temperature of the exhaust gas. Whether or not D2 also implicitly discloses a corresponding significant increase of the temperature of the absorbent (which also comprises a noble metal potentially acting as catalyst for the oxidation of fuel resent in the exhaust gas) needs not to be decided, since D2 discloses an embodiment ("fifth embodiment") comprising means for lowering the exhaust gas oxygen concentration by changing the air/fuel ratio from lean to stoichiometric and dedicated means for simultaneously increasing the temperature of the NOx absorbent to a temperature of 700°C or more by delaying the ignition timing; see Figure 12 and column 11, line 24 to column 12, line 9. The purpose of lowering the oxygen concentration according to D2 being the decomposition and hence the release of previously absorbed SO_x (see e.g. column 2, lines 42 to 55, and column 4, lines 7 to 9; column 5, lines 3 to 16), it is evident that the heating means according to D2 (ignition delaying means) raise the temperature of the NOx absorbent to a temperature which must be "*higher than the SO_x releasing temperature*" of the absorbent.

2.3 It follows that D2 also discloses all the features of the "*SO_x releasing means*" according to present claim 1.

3. According to D2, the fuel injection valve as well as the changes in ignition timing are controlled by an "ECU" (electronic control unit) 8, which also monitors the temperatures of the exhaust gas and of the NOX

absorbent (see e.g. column 5, line 26 to column 6, line 2, and Figure 12). Since the means controlled by the ECU are provided for permitting the release of SO_x absorbed previously, the ECU 8 constitutes - in the broadest sense of the wording used in present claim 1 - "*SO_x controlling means for controlling the amount of SO_x absorbed in the NOx absorbent by controlling the SO_x releasing means*" in the sense of present claim 1.

3.1 What remains to be answered is thus whether or not the control routine referred to in present claim 1 - in functional terms only - in connection with the "*SO_x control means*" (last paragraph of claim 1) implies any differences - in terms of the means required for carrying out the routine - between the claimed device and the device disclosed in D2.

3.2 In the present case, in order to permit a comparison between the claimed subject-matter and the disclosure of D2 and the subject-matter of claim 1 in terms of device features, the meaning of some of the functional terms used in present claim 1 needs to be determined first.

3.2.1 Firstly, it is noted that the wording used in claim 1 for defining the "*SO_x control means*" (i.e. "*for controlling the amount of SO_x absorbed by the NO_x absorbent by controlling the SO_x releasing means ...*") does not require means for counting or monitoring the amount of SO_x absorbed. Such means are only referred to in the description of the patent in suit (see e.g. column 10, line 34 to column 11, line 5; Figures 2 and 6, reference numbers 203 and 603, respectively;

column 15, lines 15 to 27; column 16, lines 43 to 58; Figure 6, reference number 603).

3.2.2 Secondly, claim 1 itself is silent as to the meaning of the term "*expects*". The general part of the description of the patent in suit (see sections [0012] and [0013]) merely reflects the wording of claim 1 without providing additional information as to the meaning of the term "*expects*". According to the embodiments disclosed in the detailed description of the patent in suit, the SO_x release may be triggered when a certain level of absorbed SO_x is reached (see e.g. column 10, lines 37 to 58, column 15, lines 15 to 22; column 16; lines 55 to 58).

However, on the one hand, it is neither indicated nor apparent in what way such a control routine based on the amount of absorbed SO_x could be considered to correspond to an expectation of higher temperatures as referred to in claim 1. On the other hand, in the detailed description of the embodiment shown in figures 5 and 6, it is expressly indicated that the SO_x releasing phase may additionally be triggered when the temperature of the lean exhaust gas reaches a certain threshold level although the amount of absorbed SO_x is lower than a predetermined amount (column 15, lines 22 to 27).

3.2.3 From the above, the board concludes that in view of the total disclosure of the patent in suit, the phrase in claim 1 which reads "*when the control means expects that the temperature of the NOx absorbent increases to a first predetermined temperature*" can be understood - in a technically sensible manner - to refer to control

means which trigger the SO_x release when the air/fuel ratio of the exhaust gas is lean and a certain preset elevated temperature is reached. Consequently, the mere reference to a possible increase of the NO_x absorbent temperature "*to a first predetermined temperature*", which is higher than the preset triggering temperature, during some subsequent stage of the operation of the engine, does not in the board's view constitute a further limitation of the claimed device.

3.2.4 The SO_x control means according to claim 1 as construed by the board are thus based on a routine implying the monitoring of the absorbent and/or exhaust gas temperatures at lean air/fuel ratios but not necessarily implying the monitoring of the amount of SO_x absorbed. The SO_x release may thus be triggered at the preset temperature irrespective of whether the amount of absorbed SO_x is lower than a predetermined amount. For the board, the narrower interpretation of claim 1 as defended by the appellant, according to which means for counting and monitoring the amount of absorbed SO_x, as mentioned in the description only, should be understood as being implicitly included in a device according to present claim 1, is not acceptable in the present case.

3.2.5 A control routine according to claim 1 as construed by the board is also disclosed in D2 (see in particular the fifth embodiment referred to under point 2.2 hereinabove). Notwithstanding the fact that the control routine shown in Figure 12 additionally comprises a step 504 for determining whether or not the absorbent temperature is below 700°C (column 11, lines 45 to 47), the control means according to the fifth embodiment of

D2 trigger the SO_x releasing measures when the exhaust gas is lean and the absorbent temperature is equal to or higher than the preset temperature of 500°C (see Figure 12, step 208), as required by present claim 1.

3.2.6 The very purpose of all the various control measures suggested by D2 is the avoidance of an irreversible poisoning of the NO_x absorbent due to an accumulation of sulphate throughout the absorbent under high temperature and lean exhaust gas conditions; see e.g. column 1, lines 29 to 46, column 2, lines 42 to 55; column 5, lines 3 to 16; column 9, lines 22 to 31 and lines 39 to 42.

Hence, the board concludes that all of the SO_x releasing means described in D2 are also controlled in a manner leading to the release of "*substantially all*" of the absorbed SO_x, as required by present claim 1.

3.2.7 The features in the last half-sentence of claim 1, i.e. "*before the temperature of the NOx absorbent reaches said first predetermined temperature*" do not constitute a further limitation of the claimed device, since they merely refer to conditions that may occur during the use of the claimed device, i.e. during a subsequent stage of the engine operation under lean high temperature conditions.

3.3 The board concludes that at least the device disclosed as fifth embodiment in D2 also comprises "*SO_X control means*" operating in a manner falling within the ambit of present claim 1.

4. The subject-matter of claim 1 thus lacks novelty over D2 (Article 52(1) and 54(1)(2) EPC).

5. Consequently, the appellant's main request cannot be granted.

Second auxiliary request

6. The board has doubts whether the replacement of "*when the SO_x control means expects*" by "*when it is expected*" in the context of claim 1 actually constitutes a broadening of scope objectionable under Article 123(3) EPC. This question can, however, be left open, since the subject-matter of the present amended claim 1 as amended is lacking novelty irrespective of whether or not this amendment is considered to extend the scope of claim 1 as granted (see following points).

7. Present claim 1 is based on a combination of claims 1 and 2 of the application as filed (and of claims 1 and 2 as granted) and is thus not objectionable under Article 123(2) EPC.

8. However, the additional features comprised in present claim 1 do not establish novelty over the disclosure of D2 for the following reasons.

8.1 As already mentioned under point 1 above, D2 also discloses a NO_x absorbent holding the absorbed SO_x in the form of sulphate particles. This was not disputed.

8.2 The further features incorporated in present claim 1, do not, for the following reasons, imply any difference

in terms of the means making up the claimed device in comparison to the device of D2.

8.2.1 The board notes that the patent in suit is silent about the method used for determining said "*a first predetermined temperature*" which is "*a temperature at which the sulphate particles in the NOx absorbent starts* [sic] *to grow in a lean air-fuel ratio exhaust gas*". According to the appellant, this temperature can be determined experimentally by the skilled person for a given absorbent material.

8.2.2 From D2 it can be gathered that the poisoning of the NO_x absorbent by excessive barium sulphate formation and growth occurs under lean conditions at absorbent temperatures higher than about 500°C and exhaust gas temperatures higher than about 550°C; see e.g. column 2, lines 18 to 26; column 6, line 49 to column 7, line 2; see column 10, lines 51 to 56. According to the fifth embodiment of D2 already discussed hereinabove, the SO_x release is triggered when the absorbent temperature is 500°C or more (Figure 12, step 208). Since the very purpose of the measures suggested in D2 is the avoidance of non-recoverable poisoning of the absorbent by excessive sulphate growth (see column 5, line 3: "sulphate grows"), the board concludes that the preset switching temperature of 500°C of the device according to the fifth embodiment of D2 must definitely be lower than the temperature at which sulphate "*starts to grow*" referred to in present claim 1.

8.2.3 In the broadest sense of its present wording, claim 1, like D2, refers to the growth sulphate particles in the NO_x absorbent which leads to the poisoning of the

absorbent when no counter measures are taken. The fact that D2 does not mention growth by sintering of individual particles is not relevant since there is no reference to sintering in present claim 1.

8.3 Consequently, the subject-matter of the present claim 1 also lacks novelty over D2 (Article 52(1) and 54(1)(2) EPC).

9. Consequently, the appellant's second auxiliary request is not allowable either.

Third auxiliary request

10. Concerning the respondent's objection under Article 123(3) EPC against the replacement of "*when the SO_x control means expects*" by "*when it is expected*" in claim 1, the question whether this amendment amounts to a broadening of scope can be left open, since the other amendment consisting in the incorporation of the features "*even though the amount of SO_x absorbed in the NOx absorbent is lower than a predetermined amount*" does not meet the requirement of Article 123(2) EPC for the following reasons.

10.1 The passage of the patent in suit (column 15, lines 22 to 27) relied upon by the appellant as basis for the amendment does not belong to the general part of the description but to the description of a specific embodiment. Said embodiment relies on specific means including an ECU which monitors the exhaust gas temperature and the amount of SO_x absorbed by means of a counter "*CS*", compares the amount of SOx absorbed to a predetermined amount "CS_0", and performs an SO_x recovery

operation when the amount of absorbed SO_x reaches the predetermined amount, irrespective of the exhaust gas temperature; see column 15, lines 19 to 27; Figure 6, left part; column 16, lines 43 to 58.

10.2 In the present case, the features incorporated into claim 1 were isolated from other mandatory features of said specific embodiment which were not, or at least not expressly taken up in the claim.

10.2.1 The features incorporated into device claim 1 merely refer to a condition of the absorbent (predetermined amount of absorbed SO_x) that is not reached, without expressly incorporating the specific control means disclosed in connection with the said specific embodiment. According to the appellant's submissions at the oral proceedings, the wording of the added features implied the presence of means for counting the amount of SO_x absorbed for comparing the latter to a predetermined amount.

10.3 The board accepts this view, but notes that present claim 1 omits some important features of the specific embodiment of the application as filed upon which the amendment is supposed to be based, namely

- the means for monitoring the exhaust gas temperature, and
- the SO_x control means which trigger the release of SO_x when the predetermined amount of absorbed SO_x is reached, irrespective of the temperature of the monitored exhaust gas temperature.

These features are, however, in close functional relationship with the features additionally

incorporated into claim 1 according to the present request.

10.4 Insofar as claim 1 relates to a device with SO_x control means implicitly comprising means for counting and comparing the amount of SO_x absorbed, but not necessarily comprising the features identified under point 10.3 hereinabove, it therefore relates to subject-matter not directly and unambiguously disclosed in the application as filed.

11. In view of the above deficiencies, the appellant's third auxiliary request cannot be granted either.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar | The Chairman

C. Vodz | G. Raths