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**D E C I S I O N**  
**of 7 February 2002**

**Case Number:** T 0348/99 - 3.2.4

**Application Number:** 93305656.6

**Publication Number:** 0580389

**IPC:** F01N 3/08

**Language of the proceedings:** EN

**Title of invention:**

Exhaust gas purification apparatus for an internal combustion engine

**Patentee:**

TOYOTA JIDOSHA KABUSHIKI KAISHA

**Opponent:**

- (I) VOLKSWAGEN AG  
(II) Robert Bosch GmbH

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0348/99 - 3.2.4

**D E C I S I O N**  
**of the Technical Board of Appeal 3.2.4**  
**of 7 February 2002**

**Appellant:** Robert Bosch GmbH  
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**Representative:** -

**Respondent:** TOYOTA JIDOSHA KABUSHIKI KAISHA  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 26 January 1999  
rejecting the oppositions filed against European  
patent No. 0 580 389 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** C. A. J. Andries  
**Members:** T. Kriner  
H. Preglau

## Summary of Facts and Submissions

I. The Appellant (Opponent II) lodged an appeal, received at the EPO on 1 April 1999, against the decision of the Opposition Division, dispatched on 26 January 1999, on the rejection of the oppositions against European patent No. 0 580 389. The appeal fee was paid simultaneously and the statement setting out the grounds of appeal was filed on 7 June 1999.

Opponent I withdrew his opposition with the letter of 6 May 1999.

II. The oppositions were filed against the patent as a whole and based on Article 100(a) together with Articles 52(1), 54(1) and 56 EPC.

In its decision the Opposition Division held that the grounds for opposition did not prejudice the maintenance of the patent unamended and that therefore the oppositions were to be rejected.

III. Oral proceedings took place on 7 February 2002.

The Appellant requested that the decision under appeal be set aside and the European patent No. 0 580 389 be revoked.

The Respondent (Patentee) requested that the appeal be dismissed and the patent be maintained unamended.

IV. The argumentation of the Appellant at the oral proceedings was based on the following documents:

- D14: US-A-5 116 800
- D16: SAE-Paper 75 0093
- D19: English translation of JP-A-62/117620
- D20: SAE-Paper 88 1595.

During the written proceedings the Appellant additionally referred to the following documents:

- D5: DE-A-3 709 136
- D10: SAE Paper 78 0607
- D18: JP-A-3/135417 and its English translation
- D21: T. Yamamoto et al.: "Dynamic Behaviour Analysis of Three Way Catalytic Reaction", Traffic Safety and Environmental Pollution Research Center, English translation of SAE of Japan, Paper 88 2087, October 1988
- D22: DE-A-3 735 151.

V. Claim 1 reads as follows:

"An exhaust gas purification apparatus for an internal combustion engine comprising:

an internal combustion engine (2) capable of fuel combustion at lean air-fuel ratios and an exhaust conduit (4) connected to the engine (2);

an NOx absorbent (6, 6A) installed in the exhaust conduit (4) and including at least one element selected from the group consisting of alkaline earth, rare-earth, alkaline metals, and oxides of alkaline earth, rare-earth, and alkaline metals, the NOx absorbent (6, 6A) absorbing NOx included in exhaust gas having excess oxygen therein and releasing the NOx which the NOx absorbent (6, 6A) has absorbed when an oxygen concentration of the exhaust gas decreases; and

operating condition detecting means (10, 10A, 12,

14, 18) for detecting an operating condition of the engine (2),

characterized in that said exhaust gas purification apparatus further comprises:

operating condition determining means for determining whether the exhaust gas includes excess oxygen and for determining whether one of an exhaust gas temperature and an NOx absorbent temperature is high; and

exhaust gas oxygen concentration control means for decreasing the oxygen concentration of the exhaust gas flowing into the NOx absorbent (6, 6A) when the operating condition determining means determines that the exhaust gas includes excess oxygen and that one of an exhaust gas temperature and an NOx absorbent temperature is high."

VI. In support of his request the Appellant relied essentially on the following submissions:

The closest prior art was represented by D19 which disclosed an exhaust gas purification apparatus for an internal combustion engine comprising an NOx absorbent as defined in claim 1 of the patent in suit. This absorbent stored NOx when the combustion engine was operated at lean air-fuel ratios at a high temperature and discharged NOx when a reducer was fed to the absorbent. Having regard to the description on page 8, paragraph 4 and page 9, paragraph 1, it was obvious that the reducer could be formed by the exhaust gases of said combustion engine when operated at a rich air-fuel ratio. Furthermore D19 showed (on page 5, paragraph 2) that the storage capacity of the NOx absorbent was strongly influenced by sulphur compounds.

The subject-matter of claim 1 of the patent in suit differed from the apparatus shown in D19 only in that it comprised means for switching from a lean air-fuel ratio to a rich air-fuel ratio for regenerating a single NO<sub>x</sub> absorbent, instead of means for switching between a first and a second NO<sub>x</sub> absorbent in such a way that one of the absorbents was used for absorbing NO<sub>x</sub> of the exhaust gases and the other one was regenerated in a reducing atmosphere.

Therefore, starting from D19, the problem to be solved could be regarded as being to provide an exhaust gas purification apparatus which enabled the regeneration of a NO<sub>x</sub> absorbent in a less complicated way, in particular without the use of a second NO<sub>x</sub> absorbent.

D14 referred to a catalyst including barium or lanthanum oxide. Since this catalyst corresponded to the composition of the catalyst defined in claim 1 of the patent in suit, it inevitably worked as a NO<sub>x</sub> absorbent. For the regeneration of the catalyst, in particular for the cleaning of sulphur compounds, D14 suggested (see example 7) the provision of control means for switching the feed gas composition for the corresponding combustion engine from lean to rich when the temperature of the catalyst was high (550°C). It was obvious to use such means in the apparatus according to D19 in order to solve the problem set out above. Since the skilled person knew that the temperature of the NO<sub>x</sub> absorbent was essential for the storage capacity of an absorbent, it was also obvious to switch from the lean to the rich feed gas mixture in dependence on the temperature. Therefore, under consideration of D19 and D14, the subject-matter of claim 1 of the patent in suit did not involve an

inventive step.

D20 referred to a further catalyst which included cerium, and therefore also inevitably worked as a NOx absorbent. The ability of the catalyst to absorb NOx was also apparent from Figure 5 which showed that the NOx conversion efficiency of a catalyst according to D20 in comparison to a usual three-way catalyst remained high for a short period after the feed gas composition changed from rich to lean. Additionally D20 suggested the provision of an exhaust gas purification apparatus comprising an NOx absorbent and a control means for switching from a lean to a rich feed gas composition in order to regenerate the absorbent. Consequently also a combination of D19 and D20 would lead in an obvious way to the subject-matter of claim 1 of the contested patent.

Furthermore D16 showed (in particular on page 5, "sulfur storage") that a catalyst which had been poisoned by sulphur could be regenerated at a high temperature. Hence it was obvious to regenerate a catalyst only when the catalyst temperature was high.

VII. The Respondent disputed the views of the Appellant. His arguments can be summarized as follows:

D19 which in fact represented the most relevant state of the art cited by the Appellant disclosed an exhaust gas purification apparatus comprising two NOx absorbents which were alternately exposed to the exhaust gases of an internal combustion engine to absorb NOx, or to a reducer supplied from a separate source for regenerating the absorber. The switching between the absorbers happened exclusively in

dependence on time and not in dependence on temperature. The statements on page 5, paragraph 2 and page 6, paragraph 2 showed that the authors of D19 did not recognize the problem of sulphur storage in an NOx adsorbent, but merely on a NOx adsorbent. Consequently, D19 did not deal with the problem of SOx poisoning of a NOx adsorbent at high temperatures.

D14 referred to a catalyst for an internal combustion engine which produced a minimal amount of foul smelling hydrogen sulphide. This document did not deal with the problem of degradation of a NOx adsorbent as a result of SOx storage, and did not suggest such a control of the combustion engine that an NOx adsorbent could be regenerated. Example 7 described in columns 7 and 8 of D14 suggested only the avoidance of a rich air-fuel mixture to suppress the release of hydrogen sulphide.

D16 dealt with the problem of hydrogen sulphide release from a catalyst, too. According to this document, hydrogen sulphide was only released at high temperatures and could be avoided at low temperatures.

Consequently the skilled person would not consider either D14 or D16 when confronted with the object of recovering a NOx adsorbent poisoned by SOx by controlling an operation of the combustion engine. However even if he considered D14 or D16, these documents could at best suggest the avoidance of a rich air fuel mixture and a high temperature in order to suppress the release of hydrogen sulphide.

D20 did not disclose an adsorbent which was able to absorb NOx, but a catalyst which was able to accumulate oxygen. As a result of the capability to accumulate



oxygen, after a change of the feed gas composition from rich to lean, there remained, for a short period, a reducing atmosphere at the surface of the catalyst which still enabled a NO<sub>x</sub> conversion as shown in Figure 5. Furthermore, D20 taught the combination of such a catalyst with a fuelling control strategy according to which the degree and duration of enrichment during acceleration was increased. The enrichment was however not dependent on the temperature of the catalyst. Therefore D20 was also not suitable to lead the skilled person to the subject-matter of the patent in suit.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *The claimed subject-matter*
  - 2.1 The patent in suit refers to an exhaust gas purification apparatus which is not only intended to be used in an internal combustion engine, but which explicitly comprises an internal combustion engine capable of fuel combustion at lean air-fuel ratios and having an exhaust conduit connected to the combustion engine.
  - 2.2 The claimed apparatus additionally comprises a NO<sub>x</sub> absorbent which according to claim 1 includes at least one element selected from the group consisting of alkaline earth, rare earth, alkaline metals and oxides of alkaline earth, rare earth, alkaline metals, and which is able to absorb NO<sub>x</sub> included in the exhaust gas

having excess oxygen therein and releasing the absorbed NOx when an oxygen concentration of the exhaust gas decreases.

With respect to the ingredients of the NOx absorbent, the Respondent admitted that the statement in column 4, lines 26 to 35 of the patent specification, according to which the at least one element which has to be selected could consist solely of a noble metal catalyst having oxidizing and reducing abilities or an oxide of such a noble metal catalyst [i.e. possibility (a)], is wrong and in contradiction to claim 1. However, with respect to the complete description of the patent in suit (see in particular column 4, line 50 to column 5, line 26), this statement obviously has to be understood in such a way that the NOx absorbent includes at least one element selected from the group of a noble metal catalyst having oxidizing and reducing abilities, and another additional element selected from the group consisting of alkaline earth, rare earth, alkaline metals and oxides of alkaline earth, rare earth, alkaline metals.

The Respondent also admitted that the sentence in lines 35 to 38 in column 4 is wrong and in contradiction to claim 1.

Although these passages (i.e. column 4, lines 28 to 31 - possibility (a) - and lines 35 to 38) should have been deleted from the description during examination stage in view of Article 69 EPC, the Board did not urge the Respondent to file a new adapted description, since no further substantial amendments were required to maintain the patent as granted.

With respect to the function of the NOx absorbent, it is clear from the whole patent that the expression "NOx absorbent" is a generic name for a special type of exhaust gas purification device which can cope with the NOx exhausted by an internal combustion engine operating at lean air-fuel ratios and which otherwise would be exhausted to the atmosphere. Moreover, a "NOx absorbent" in the meaning of the patent in suit is a device which is not only able to absorb NOx from the exhaust gases of an internal combustion engine operating at lean air-fuel ratios over a certain time period, but also to release the absorbed NOx when the oxygen concentration of the exhaust gases decreases.

- 2.3 According to the last feature of claim 1, the oxygen concentration of the exhaust gas flowing into the NOx absorbent is decreased amongst other things when one of an exhaust gas temperature and a NOx absorbent temperature is high.

The term "high" has no well-recognized meaning in the field of combustion engines. However, with respect to column 7, paragraph 2; column 10, lines 48 to 53; column 11, lines 29 to 31 and 46 to 48; and column 13, lines 32 and 33 of the patent in suit, it is obvious that this term defines an exhaust gas temperature of about 550°C or a NOx absorbent temperature of about 500°C.

- 2.4 Furthermore, claim 1 describes explicitly only an apparatus which decreases the oxygen concentration of the exhaust gas under predetermined circumstances in order to regenerate the NOx absorbent. However, although claim 1 does not include a feature according to which the oxygen concentration is also re-increased

after such a decrease, it is obvious and thus implicitly claimed that the apparatus increases the oxygen concentration when the predetermined circumstances are not given so that the combustion engine operates again at lean air-fuel ratios, particularly since the patent in suit discloses an internal combustion engine operating at lean air-fuel ratios and intends to solve problems linked with such a lean air-fuel ratio operation.

3. *State of the art*

3.1 D19 is the only document cited by the Appellant which refers to a catalyst for absorption of NO<sub>x</sub> (see for example page 2: claim 1; page 6, first paragraph). This document discloses an exhaust gas purification apparatus for an internal combustion engine comprising an internal combustion engine capable of fuel combustion at lean air-fuel ratios (see last paragraph of page 2) and an exhaust conduit connected to the engine, two NO<sub>x</sub> absorbents (A, B) each installed in parallel exhaust conduits and including at least one element selected from the group consisting of alkaline earth, rare-earth, alkaline metals, and oxides of alkaline earth, rare-earth, and alkaline metals (see page 8, paragraph 1), the NO<sub>x</sub> absorbent absorbing NO<sub>x</sub> included in exhaust gas having excess oxygen therein (see page 6, paragraph 1) and releasing the NO<sub>x</sub> which the NO<sub>x</sub> absorbent has absorbed when a reducer is supplied to the NO<sub>x</sub> absorbent (see last paragraph of page 6).

However D19 does not disclose that the absorbent releases the NO<sub>x</sub> when the oxygen concentration of the exhaust gas decreases, and the apparatus of D19 does

not comprise any operating condition detecting means, operating condition determining means or exhaust gas oxygen concentration control means as defined in claim 1 of the patent in suit.

The Board does not share the Appellant's opinion that D19 already described the influence of sulphur compounds on the storage capacity of a NOx absorber. The statements on page 5, paragraph 2 do not refer to the NOx absorbent shown in D19, but to a NOx adsorber according to the state of the art, since it is indicated that the adsorber must be exchanged or adsorbed substances must be released by heating following a decrease in efficiency. That efficiency can of course only be the adsorption efficiency and not the wrongly translated "absorption" efficiency. While this paragraph explains that the adsorption efficiency of a customary adsorber is negatively influenced by sulphur compounds, paragraph 2 of page 6 emphasizes that the adsorption capacity of the absorber according to D19 is relatively immune to environmental conditions. Consequently D19 does not indicate that sulphur compounds have an influence on the storage capacity of a NOx absorber.

- 3.2 D14 refers to a catalyst for installation in an exhaust conduit of an internal combustion engine, said catalyst including at least one element, i.e. barium oxide, and optionally lanthanum oxide (see column 2, lines 59 to 67) which are elements mentioned in claim 1 of the patent in suit.

The Appellant's argumentation according to which the catalyst described in D14 inevitably worked as a NOx absorbent is not convincing. Barium oxide or lanthanum

oxide is deposited on the support of the catalyst shown in D14 and functions as a promoter in place of nickel, iron or cerium oxide in order to achieve a high durability and minimal hydrogen sulphide emission (see column 2, lines 44 to 49, lines 59 to 65, and column 4, lines 31 to 39). A function as a NOx absorbent is neither described nor intended. There is also no parameter mentioned which is used to switch from lean to rich combustion. With respect to the special location of the barium or lanthanum oxide within the catalyst and the object of these oxides, the skilled person would not consider the catalyst of D14 to work as a NOx absorbent, let alone as a NOx absorbent absorbing NOx included in exhaust gas having excess oxygen therein and releasing the NOx when an oxygen concentration of the exhaust gas decreases.

3.3 D16 describes laboratory and engine dynamometer studies which were conducted to determine the effect of various catalyst and engine operating parameters on the formation of hydrogen sulphide over alumina-supported Pt and Pd catalysts. These studies show amongst other things that a maximum sulphur accumulation on such catalysts occurs at a temperature of 425°C and decreases to nil at a temperature of 760°C (see page 5, sulfur storage).

3.4 D20 discloses an exhaust gas purification apparatus for an internal combustion engine comprising an internal combustion engine capable of fuel combustion at lean air-fuel ratios (see page 2, right hand column, paragraph 2) and an exhaust conduit connected to the engine (see figure 1), a catalyst installed in the exhaust conduit and including at least one element, i.e. cerium (see page 4, right hand column,

paragraph 3) which is an element from the group mentioned in claim 1 of the patent in suit, and exhaust gas oxygen concentration control means for decreasing the oxygen concentration of the exhaust gas flowing into the catalyst (see page 2, right hand column, last paragraph).

In contradiction to the Appellant's opinion, the mere facts that the catalyst according to D20 includes cerium and that the NOx conversion efficiency of such a catalyst remains high for a short period after the feed gas composition changes from rich to lean, is not sufficient to conclude that the catalyst of D20 inevitably works as a NOx absorbent. As described on page 4, right hand column, paragraph 3 of D20, the ceria component of the catalyst achieves to maintain a high HC/CO activity even during the rich phase. D20 is however silent on the influence of cerium on the capability of the catalyst to absorb NOx. Moreover D20 does not contain any indication that the retention of NOx conversion on return to the lean phase is based on an absorption effect of NOx. Therefore the Board does not agree that the catalyst disclosed in D20 is or works as a NOx absorbent.

3.5 All further documents cited by the Appellant are less relevant than the documents cited above.

D5 refers to an exhaust gas purification apparatus for an internal combustion engine (30) capable of fuel combustion at lean air-fuel ratios (see column 2, lines 35 to 39) comprising operation condition detecting means (44, 48, 58, 60, 62, 64), operating condition determining means (see figure 3, P1, P2) and exhaust gas oxygen concentration control means (see

figure 3, P3 and column 7, line 49) as defined in claim 1 of the patent in suit. These means are however used to avoid a rapid deterioration of the catalytic activity of rhodium contained in a three-way catalyst, and not for the regeneration of a NOx absorbent.

D10 describes investigations concerning the relationship between modulated air-fuel ratios and the selectivity window of a three-way catalyst.

D18 discloses an exhaust gas purification apparatus for an internal combustion engine capable of fuel combustion at lean air-fuel ratios (see page 3, paragraph 1) comprising a NOx adsorption device (4).

D21 discloses a dynamic behaviour analysis of a three way catalytic reaction. On the basis of the tests described in this document, the authors assume amongst other things that the accumulation of oxidizing substance (O<sub>2</sub>, NO, etc.) in a catalyst caused by holding a given air-fuel ratio for a long time is not to be seen as taking place on the surface of the catalyser, but as absorption into the inside of the catalyser (see page 4, lines 14 to 17).

D22 describes a catalyst accumulating NOx on the catalyst surface and reducing NOx to nitrogen and oxygen. Although D22 states that NOx is "absorbed" (see page 2, lines 37 to 41), it is obvious that "adsorbed" is meant because the described reaction is a reduction and happens at the surface of the catalyst.

#### 4. *Inventive step*

4.1 The subject-matter of claim 1 differs from the



apparatus shown in D19 (which indisputably represents the most relevant state of the art) by operating condition detecting means for detecting an operating condition of the engine, operating condition determining means for determining whether the exhaust gas includes excess oxygen and for determining whether one of an exhaust gas temperature and a NOx absorbent temperature is high; and exhaust gas oxygen concentration control means for decreasing the oxygen concentration of the exhaust gas flowing into the NOx absorbent when the operating condition determining means determines that the exhaust gas includes excess oxygen and that one of an exhaust gas temperature and a NOx absorbent temperature is high, whereby the NOx which the NOx absorbent has absorbed is released.

- 4.2 According to the case law of the Boards of Appeal an objective definition of the problem to be solved should normally start from the problem described in the contested patent. Only if an examination showed that the problem disclosed had not been solved or if inappropriate prior art were used to define the problem, was it necessary to investigate which other problem objectively existed (see Case Law of the Boards of Appeal of the European Patent Office, 3rd edition 1998, English version, page 115, paragraph 4).

In the present case the problem to be solved by the patent in suit is the provision of an exhaust gas purification apparatus for an internal combustion engine, wherein the NOx absorbent poisoned by SOx may be recovered to a nearly original non poisoned state (see the patent specification column 1, lines 44 to 50).

Since there is no doubt that this problem is a realistic and technically relevant one and has furthermore been solved by the apparatus of claim 1, and since no inappropriate prior art has been used to define this problem, there is no reason to consider another problem, such as for example the one set out by the Appellant (see paragraph VI above) which in addition was not based on the proper difference as indicated in section 4.1 above.

4.3 The provision of the operating condition detecting means, operating condition determining means and exhaust gas oxygen concentration control means defined in claim 1 of the patent in suit, in order to solve the above mentioned problem, is not suggested by the available state of the art.

4.3.1 The Appellant's argumentation according to which it was obvious that the reducer described in D19 could be formed by the exhaust gases of a combustion engine is not convincing. In accordance with D19 itself the reducer is supplied from a separate reservoir (5) and consists of hydrogen, ammonia, carbon monoxide or methane which may be diluted with an inert gas such as nitrogen (see page 9, paragraph 1, 2). It is correct that exhaust gases of a combustion engine include hydrogen and carbon monoxide. However these are only two compounds out of a multitude of compounds existing in the exhaust gas. Since the reducer is intended to be used without further compounds, except an inert gas, it is not likely that the skilled person would replace the reducer described in D19 by exhaust gases, particularly since the teaching of D19 is clearly to avoid exhaust gases (see claim 1 which requires stopping the exhaust gas supply to the catalyst during its regeneration).

4.3.2 The Board is also not convinced that example 7 of D14 suggests the provision of control means for switching the feed gas composition from lean to rich in order to regenerate a catalyst. D14 does not deal with the regeneration of a catalyst, but with the reduction of foul smelling hydrogen sulphide produced by a catalyst (see for example column 2, lines 44 to 49). Example 7 describes a test developed to measure hydrogen sulphide emissions of different catalysts (see column 7, lines 54 to 55). In accordance with this test sulphur compounds are intentionally stored in a catalyst by contacting its surface with a lean feed gas containing SO<sub>2</sub> for 30 minutes at 550°C. At the end of the storage period the feed gas composition is changed to rich allowing the catalyst to release hydrogen sulphide (see column 7, lines 59 to 64). Finally the amount of the released hydrogen sulphide is detected. D14 does however not disclose that the storage of SO<sub>2</sub> results in a degradation of a catalyst, let alone of a NO<sub>x</sub> absorbent, and that the degradation can be made undone by switching from a lean feed gas to a rich feed gas. On the contrary, since it is the final intention to minimise hydrogen sulphide emissions, the skilled person would be inclined to avoid a rich combustion which would result in these hydrogen sulphide emissions.

4.3.3 Furthermore the Board does not share the Appellant's opinion that D16 could lead the skilled person to the subject-matter of the patent in suit. This document shows (as set out in paragraph 3.3 above) that maximum sulphur accumulation on noble metal catalysts occurs at low temperatures (425°C) and decreases to nil at high temperatures (760°C). The authors of D16 assume that this effect is based on a elusion of hydrogen sulphide

stored on the catalyst during reducing conditions at higher temperatures. This does however not mean that D16 suggests the regeneration of a degraded catalyst at a high temperature. Furthermore, the combination of these conditions, high catalyst temperature and reducing conditions, is presented as being a situation which is unlikely to occur unless the engine or the system is malfunctioning. A skilled person is inclined to avoid such a situation, whereas in the patent in suit this situation is used to release NOx (see page 6, right hand column, first paragraph). D16 (like D14) deals exclusively with the problem of hydrogen sulphide release from a catalyst (see for example page 1, abstract) and teaches at best to reduce hydrogen sulphide formation by avoiding higher temperatures at reducing conditions. D16 does however not refer in any way to the problem of sulphur poisoning of a catalyst or to the regeneration of such a catalyst.

- 4.3.4 The Appellant's argumentation according to which D20 could lead the skilled person in an obvious way to the subject-matter of the patent in suit is also not convincing. It is true that D20 suggests the provision of control means for switching from a lean to a rich feed gas composition. This switching however is solely triggered by the inlet manifold pressure (page 6, first two lines of the last paragraph). Furthermore, this means is provided to prolong the duration of enrichment during acceleration which in combination with a suitable catalyst design results in an improved reduction of NOx emissions (see page 1, left hand column, last two paragraphs). A regeneration of a NOx absorbent is however neither intended nor described in D20.

4.3.5 With respect to the above findings there is no reason for the skilled person to consider any of documents D14, D16 or D20 when confronted with the problem to regenerate a NOx absorbent poisoned by SOx.

Even if the skilled person were to consider any of the teachings of D14, D16 and D20, this would not lead him in an obvious way to the subject-matter of the patent in suit. These documents could at most suggest the provision of control means for controlling the oxygen concentration of the exhaust gas for suppressing the release of hydrogen sulphide (D14, D16) or for prolonging the duration of enrichment during acceleration (D20). They do not however suggest the provision of control means for decreasing the oxygen concentration of the exhaust gas on the basis of the exhaust gas composition and the exhaust gas temperature for the regeneration of n NOx absorbent.

Consequently the skilled person had no reason to replace the apparatus for the provision of a reducer according to D19 by exhaust gas oxygen concentration control means for controlling the oxygen concentration of the exhaust gas. Since the feeding of the NOx absorbent according to D19 with either exhaust gas or a reducer is controlled in dependence on time (see page 7, last paragraph and page 9, second last paragraph), or when the efficiency of nitrogen oxide absorption by the catalyst decreases (page 2, claim 1), there is in particular no reason to control the oxygen concentration in dependence on the detected oxygen concentration and on the exhaust gas or absorbent temperature.

4.4 Therefore the Board comes to the conclusion that the

subject-matter of claim 1 of the patent in suit cannot be derived in an obvious manner from the cited prior art and accordingly involves an inventive step (Article 56 EPC).

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

G. Magouliotis

C. Andries