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Datasheet for the decision of 10 August 2010

Case Number: T 0957/07 - 3.3.05

Application Number: 99954924.9

Publication Number: 1137592

IPC: C01B 21/20

Language of the proceedings: EN

Title of invention:
Reducing NO_x emissions from an engine by temperature-controlled urea injection for selective catalytic reduction

Applicant:
Clean Diesel Technologies, Inc.

Headword:
Urea quality/CLEAN DIESEL

Relevant legal provisions:
EPC Art. 123(2)

Relevant legal provisions (EPC 1973):
EPC Art. 83, 84, 111(1)

Keyword:
"Added subject-matter: no"
"Clarity: yes"
"Sufficiency of disclosure: yes"
"Remittal for further prosecution: yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0957/07 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 10 August 2010

Appellant: Clean Diesel Technologies, Inc.
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Representative: Vossius & Partner
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 20 December 2006 refusing European patent application No. 99954924.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. Raths
Members: B. Czech
S. Hoffmann

Summary of Facts and Submissions

I. The appeal is from the decision of the examining division to refuse European patent application No. 99954924.9.

II. In the contested decision (points 1.6 and 1.7 of the reasons) the examining division found that - having regard to the main and first auxiliary requests then on file - the application did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by the skilled person as required by Article 83 EPC 1973, more particularly because a "quality sensor" (reference sign 152) was unknown to the skilled person, who therefore "remains at loss which quality of the urea solution is monitored" and "how to decide whether or not the urea solution is a 'defective' solution".

III. In its statement of grounds of appeal, the appellant contested the reasons for refusing the application given by the examining division. It defended the main and auxiliary requests refused by the examining division and asked for the remittal of the case to the department of first instance if the board were to consider that the requirements of Article 83 EPC 1973 were met, but not the requirements of Articles 54 or 56 EPC 1973. In support of its argumentation, the appellant referred to evidence already on file, namely Exhibits 1, 2 and 3 (printed presentation slides), a dictionary excerpt (Merriam-Webster On Line, entry "quality") and three patent publications relating to various types of relevant sensors. Additionally, the appellant filed a list of references (US patents and

links to internet sites) and a copy of a scientific article relating to the determination of urea in seawater.

IV. In a first communication issued in preparation of oral proceedings, the board inter alia pointed out the difference to be made between a quality and the quality of a urea solution and questioned the probative value of the documentation relied on by the appellant. The board also commented on the allowability of the amendments to the claims under Article 123(2) EPC, the clarity of the claims and their support in the description and sufficiency of disclosure. Finally, the board indicated that, provided the pending objections were overcome, it intended to remit the case to the examining division for further examination.

V. Under cover of its reply of 30 July 2010, the appellant filed two amended sets of claims as new main and auxiliary requests, replacing the ones previously on file, as well as a declaration by Mr Sprague. The appellant maintained that the wording used in the claims was clear within the meaning of Article 84 EPC 1973 and could not give rise to objections under Article 83 EPC 1973.

VI. In a second communication dated 3 August 2010, the board objected that a "quality sensor" as referred to in some of the claims was an unclear concept, notwithstanding the opinion of Mr Sprague. Moreover, it questioned whether the independent apparatus claims on file actually comprised all the essential features of the invention.

VII. Oral proceedings were held on 10 August 2010. In the course of the oral proceedings, the appellant filed an amended new main request replacing the requests previously on file.

Independent claims 1 and 12 according to this request read as follows (amendments to the corresponding claims of the application as filed highlighted by the board):

"1. A method for reducing the emissions of NO_x from a lean-burn engine, comprising:
monitoring the quality, temperature and level of urea **solution** in a storage vessel;
generating sensor signals representative of the quality, temperature and level of urea solution in the storage vessel;
comparing the sensor signals to reference values;
generating control signals representative of the results of the comparison;
responsive to the control signals, controlling the flow of urea solution **by either clearing it from injectors and feed lines or injecting it into the exhaust gases at a rate sufficient for SCR;** and
passing the exhaust gas through an SCR reactor."

"12. An apparatus for reducing the emissions of NO_x from a lean-burn engine, comprising:
~~in one embodiment comprises~~
a storage vessel;
an assembly for feeding an aqueous urea solution from the storage vessel through a line to an injector, the assembly comprising ~~a quality sensor, a temperature sensor, a level sensor~~ **means for generating sensor signals representative of the quality, temperature and**

level of urea solution in the storage vessel and a pump;

injector means for injecting urea solution into the exhaust gases at an exhaust 30 gas temperature effective for SCR;

a line extending from the storage vessel to the injector; ~~and~~

exhaust passage means leading from the injector means to an SCR reactor;

means for comparing the sensor signals to reference values;

means generating control signals representative of the results of the comparison;

and means responsive to the control signals, for controlling the flow of urea solution, either clearing it from injectors and feed lines or injecting it into the exhaust gases at a rate sufficient for SCR."

VIII. As far as they concern said new main request, the arguments of the appellant can be summarised as follows:

The appellant held that the amended claims according to the new main request found a basis in the application as filed and were clear and supported by the description.

Although the claims were broadly worded, they were clear to the skilled person in the context of the application and supported by the description. The term "quality" as used in the claims did not, or at least did not only, refer to a subjective characterisation (poor/good) of the urea solution. For the skilled person, urea solution quality included the concentration as well as many other parameters of

importance in carrying out the claimed NO_x reduction method, for the monitoring of which suitable sensors were known. Even without more specific indications in the description, the skilled person could choose parameters of interest to him and devise a urea solution flow control according to the claims.

Consequently, the disclosure of the patent in suit, considered in the light of common general knowledge in the technical field concerned, was sufficient to enable the person skilled in the art to carry out the invention without undue burden.

IX. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed during the oral proceedings.

Reasons for the Decision

1. *Allowability of the amendments (Article 123(2) EPC)*

1.1 Claims 1, 7, 9 and 11 as amended now refer precisely and coherently to a "urea solution", which is the preferred reagent exemplified in the application as filed, and to the level and temperature thereof in the storage vessel (see the published PCT application: page 5, lines 27 to 29; page 15, lines 2 and 3; page 10, lines 1 to 24; claims 5, 6, 10 and 14; and Figure 2 in connection with page 12, line 30 to page 13, line 3).

1.2 Claim 1 was also amended to specify that the flow of the urea solution is controlled "by either clearing it from injectors and feed lines or injecting it into the

exhaust gases at a rate sufficient for SCR", as explained on page 5, lines 1 to 3, of the published PCT application.

1.3 The sole remaining independent apparatus claim 12 is a combination of claims 12 and 14 as filed, containing all the features of the latter in a concise form. The replacement of the features "a reagent quality sensor, a reagent temperature sensor, a reagent level sensor" by the features "means for generating sensor signals representative of the quality, temperature and level of urea solution in the storage vessel" does not generate subject-matter going beyond the content of the application as filed since "means for generating sensor signals" imply the presence of corresponding "sensors" and since by virtue of the disclosure of the process according to claim 1, the application implicitly discloses a functionally defined apparatus suitable for carrying out the said process.

1.4 The board is thus satisfied that all the amendments to the claims find a basis in the application as filed and concludes that the amendments meet the requirement of Article 123(2) EPC.

2. *Clarity and support by the description (Article 84 EPC 1973)*

2.1 The board is also satisfied that the present amended claims are clear and supported by the description as required by Article 84 EPC 1973. In particular, the amended independent apparatus claim 12 now comprises the essential apparatus features required for implementing the control process referred to in the

independent method claim 1 but no longer comprises the term "quality sensor". Having regard to the meaning to be given to certain terms and expressions used in the claims, the board notes the following.

2.2 The present independent claim 1 is restricted to a method for reducing the emissions of NO_x from a lean-burn engine (in the broadest sense of the term "engine", see page 8, last paragraph, and page 9, first paragraph, of the published PCT application) by means of SCR with injection of a urea solution. The present independent claim 12 is restricted to an apparatus comprising the means required for carrying out said method.

2.3 The claims now unambiguously relate to a method (and the corresponding apparatus) wherein the SCR reducing agent injected into the exhaust gases is specifically a solution of urea. The appellant expressly confirmed at the oral proceedings that the use of solutions comprising other ammonia-generating reducing compounds instead of solutions containing significant amounts of urea was no longer encompassed by the present amended claims.

2.3.1 The description of the application as filed however refers more generally to a "reagent" (see e.g. page 5, fifth paragraph, and claims 12 and 15) and will thus need to be adapted correspondingly in case a patent is to be granted.

2.3.2 In this connection the board also takes the view that the paragraph bridging pages 9 and 10 of the application as filed, where reference is made to urea solutions "containing" other potentially ammonia

generating compounds, cannot be understood to refer to "commercial forms of urea" or solutions thereof which are not solutions of urea, despite some earlier statements of the applicant to this effect (see written submission dated 9 October 2006, page 2, lines 5 to 10).

2.4 As a response to corresponding "control signals" the method of claim 1 entails injecting the urea solution at a rate sufficient for SCR, i.e. for reduction of the NOx in the exhaust gas. Alternatively, the response consists in clearing the urea solution from injectors and feed lines, the method thereby coming to an end unless the reduction of the NOx emissions is subsequently achieved without the use of a urea solution by means of additional engine control measures such as exhaust gas recirculation, engine timing or derating to produce less power (see claim 9).

2.5 The reference to "the quality of the urea solution" appearing in the independent claims 1 and 12 is rather broad in meaning and the application as filed does not mention any specific examples unambiguously illustrating which properties of the urea solution or which quality criteria (see claim 10) could be used as descriptors for "the quality of the urea solution". However, for the board, the broadness of said claims , in the present case does not imply a lack of clarity for the following reasons.

2.5.1 Amended claim 1 expressly refers to the steps of "monitoring the quality ... responsive to the control signals, controlling the flow" that either lead to an interruption of the urea solution injection or to an injection at a sufficient rate. By implication, this

means that "the quality" of the urea solution may be monitored in terms of urea solution properties (or qualities, such as the urea concentration of the solution), having an impact on the injection rate, as well as in terms of its compliance with given criteria (see also claim 10 dependent on claim 1). The non-compliance with said criteria for "quality" (in the sense of suitability or degree of excellence of the solution), e.g. a too high turbidity or impurity content, leads to the interruption of the injection.

2.5.2 The fact that the application contains no unambiguous specific indications as to the properties or criteria to be monitored in controlling the flow of urea solution is not to be equated with a lack of clarity. Rather, claims 1 and 12 must be considered to be so broad as to encompass all the possibilities at hand for the skilled person to define quality in terms of urea solution properties or in terms of criteria to be fulfilled and to devise the sensor and control means accordingly.

2.6 The present amended method and apparatus claims no longer refer to a "quality sensor", which the examining division considered to be something unknown to the person skilled in the art.

2.6.1 However, the board shares the view of the examining division that, at the priority date of the application in suit, the expression "quality sensor", which is still present in the description of the application in suit, represents a concept unknown to the person skilled in the art and is thus unclear (Article 84 EPC 1973).

2.6.2 None of the evidence submitted by the appellant convincingly supports its view that said concept had a precise meaning and was common general knowledge. Exhibits 1, 2 and A (presentation slides) submitted to this effect bear dates (2004, 2003 and 2000, respectively) which are later than the priority date to be considered (13 October 1998) and are not comparable with a text-book. The declaration by Mr Sprague is not in full accordance with earlier statements of the appellant insofar as it defines a "urea quality sensor" as a sensor "that could determine a. nitrogen content, b. turbidity and/or c. refractive index", whereas the appellant considered that "urea solution quality includes urea concentration as well as many other parameters", such as chemical form or identity, purity, and state (see statement of grounds of appeal, page 4, lines 2 to 4, page 5, second to fourth paragraphs). Moreover, the declaration is not supported by documents illustrating the alleged common general knowledge concerning a "urea solution quality sensor" at the priority date.

3. *Sufficiency of the disclosure (Article 83 EPC 1973)*

3.1 The board takes the view that on the basis of common general knowledge the person skilled in the art is perfectly able to identify relevant urea solution properties and to define quality criteria to be used in controlling the NO_x reduction method, despite the absence of unambiguous specific indications to this effect in the application as filed. Moreover, once the skilled person has defined the specific urea solution properties and quality criteria he wishes to focus on in the implementation of the claimed urea solution flow

control, he will experience no particular difficulty in selecting the means required for generating the corresponding sensor signals (e.g. commercially available sensors for concentration, turbidity, refractive index etc.). Nor does devising the flow control responsive to varying solution properties or to non-compliance with self-defined criteria impose an undue burden on the person skilled in the art of NO_x emission control by means of SCR.

3.2 The board thus concludes that the application in suit discloses the invention as now claimed in a manner sufficiently clear and complete for it to be carried out by the person skilled in the art without undue burden. Consequently, the requirements of Article 83 EPC 1973 are met.

4. *The further procedure*

4.1 The decision to refuse the application in suit was essentially based on an objection under Article 83 EPC 1973. Accordingly, the issues of novelty and inventive step have not yet been considered by the examining division. However, several documents of the "E" and "X" category, i.e. documents at least potentially of high relevance, are cited in the Supplementary Partial European Search Report.

4.2 Under these circumstances, and also taking into account the appellant's request for remittal, the board considers it appropriate to exercise its discretionary power under Article 111(1) EPC 1973 to remit the case to the examining division for completion of the

substantive examination, as foreshadowed in its first communication (see point IV above).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The registrar | The chairman

C. Vodz | G. Raths