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File Number: T 0463/92 - 3.4.2
Application No.: 87 901 679.8
Publication No.: 0 263 183
Title of invention: Device for controlling NH₃ injection into denitrification system

Classification: B01D 53/34

DECISION
of 24 May 1993

Applicant: Mitsubishi Jukogyo Kabushiki Kaisha

Headword:

EPC Art. 56, Rule 67

Keyword: "Inventive step: after amendment: yes" -
"Reimbursement of appeal fees, equitable: no"

Catchwords .

If in his statement of grounds of appeal the Appellant (Applicant) has maintained the text of the patent application which had been refused by the Examining Division on the grounds of lack of inventive step and if he has mentioned that further arguments and documents might yet be submitted and that, due to the complexity of the matter, an oral hearing in which the invention could be discussed in comparison with the prior art by direct argument and counter-argument would appear to be desirable, if thus a continuation of the procedure had to be envisaged in any case, then this is an indication that a reimbursement of the appeal fees is not equitable.



Case Number : T 0463/92 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 24 May 1993

Appellant : Mitsubishi Jukogyo Kabushiki Kaisha
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Chiyoda-ku
Tokyo 100 (JP)

Representative : Dr. Fuchs, Dr. Luderschmidt
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Decision under appeal : Decision of the Examining Division of the
European Patent Office dated 23 December 1991
refusing European patent application
No. 87 901 679.8 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : E. Turrini
Members : M. Chomentowski
J-C. Saisset

Summary of Facts and Submissions

I. European patent application No. 87 901 679.8 (publication No. 0 263 183) was refused on the grounds that the claimed NH₃ injection controller lacked an inventive step having regard to

JP-A-53 132 466,

the feature that pulse signals are used to control the injection quantity of NH₃ in the pulse manner so as to be able to follow the frequent variation of a load merely describing a fast response control loop which would be an obvious design possibility for a person skilled in the art of control system design and tuning.

II. The Appellant (Applicant) filed an appeal against this decision. He requested that the decision under appeal be rectified and that the appeal fees be reimbursed since this was equitable in view of a major procedural defect. Moreover, he declared that amended patent application documents might be filed and that an oral hearing might appear to be desirable due to the complexity of the matter.

III. The Board summoned the Appellant to oral proceedings and informed him that it appeared that the only claim lacked clarity and that its subject-matter did not involve an inventive step having regard additionally to

JP-A-60 202 716.

IV. In a subsequent letter, the Appellant filed a new only claim and argued that this claim was clear, that its subject-matter was inventive and that on the basis of the submission in combination with the new patent claim the factual position could possibly be sufficiently clear so that oral proceedings might not be necessary.

- V. In a second communication, the Board informed the Appellant that the new claim also appeared to contain clarity deficiencies because it was not consistent with the description, that an amended new claim meeting the mentioned objections seemed to involve an inventive step but that, however, it did not appear that a reimbursement of the appeal fees would be equitable.
- VI. In the letter dated 7 April 1993, the Appellant filed a new only claim, a complete description and Fig. 1 and 2 of the drawings, requested that a patent be granted on this basis and also suggested that further necessary amendments be effected using the telephone for informing of objections, in order to avoid costly oral proceedings. Moreover, he submitted further arguments in support of his request for reimbursement of the appeal fees.
- VII. During a telephone call of 4 May 1993 reported in a communication of 5 May 1993, the Appellant agreed to the following amendments:

on page 3, fourth line of the claim, substitution of "denitration" in place of "nitration";

deletion of the text from page 7, penultimate paragraph to page 9, first paragraph, as well as the text of page 11, first paragraph to page 12, last paragraph, mentioning drawbacks of the prior art and advantages of the present invention, for avoiding additional subject-matter;

on page 9, paragraph "Disclosure of the invention", substitution of the words "NH₃ injection controller of the invention is distinguished" for the words "solution of this problem is achieved proceeding".

Moreover, the Appellant was asked whether he maintained his auxiliary request for oral proceedings if the only remaining question were that of reimbursement of appeal

fees. The Appellant declared that he withdrew his request for oral proceeding if this were the only question to be dealt with.

VIII. The Board cancelled the oral proceedings accordingly.

IX. The only claim reads as follows: "An NH_3 injection controller which controls a quantity of NH_3 injected into a denitrating apparatus (3) for exhaust gas containing NO_x , provided with

- metering means (7) for measuring NO_x concentration at the inlet of the denitrating apparatus (3) with a concentration detector (analyzer 8) followed by signal stages (9, 11)
- metering means (27) for measuring NO_x concentration at the outlet of the denitrating apparatus (3), with a concentration detector (analyzer 28), followed by signal stages (29, 30)
- metering means (31) for measuring NH_3 concentration at the outlet of the denitrating apparatus (3), with a concentration detector (analyzer 32) followed by signal stages (33, 34)
- metering means (21) for measuring the flow-rate of NH_3 injected, with a flow-meter (23) followed by signal stages (24, 25, 26)
- metering means (16) including a detector and signal stages (17-20) for measuring the flow-rate of exhaust gas introduced into the denitrating apparatus (3), and
- control means (10) for combining the output signals of these signal stages to determine the pour-in amount of NH_3 and to produce corresponding output signals to the NH_3 injector (5),
characterised in that

- said control means (10) consist of a single computer stage (10), on whose inlet the output signal of the metering means (21) for measuring the flow-rate of injected NH_3 is also imposed,

- the detector of said metering means (16) for measuring the flow-rate of exhaust gas is coupled with load-controller (13) of the exhaust gas generator, in connection with load variation detector means (12) with a detector and signal stages (14, 15) for detecting rapid variation in the setting of said load-controller,

- said control means (10) are provided with
 - means for determining a base quantity (B_1) of NH_3 injected on the basis of a signal from said metering means (16) for measuring the flow-rate of exhaust gas, producing an output signal corresponding to the base quantity,

 - means for determining pulsed amount (B_2) of NH_3 injected on the basis of a signal from the load variation detector means (12), producing a pulsed signal varying in amplitude and width of the pulses corresponding to a rapid increase of the load and therefore of the flow of exhaust gas and/or NO_x concentration,

 - means for determining pulsed amounts (B_3) of NH_3 injected on the basis of a pulse signal varying in amplitude and width of the pulses corresponding to a difference between the measured value of NO_x at the outlet of the denitrating apparatus (3) and a set value of NO_x , whereby the set value is an estimated value of NO_x concentration at the outlet of the denitrating apparatus (3) on the basis of

the measured NOx concentration at the inlet of the denitrating apparatus and the denitration rate, in a model type denitration reaction;

- means for determining pulsed amounts (B_4/B_5) of NH_3 injected on the basis of a correcting pulse signal varying in amplitude and width of the pulses corresponding to a difference between the measured value of NH_3 at the outlet of the denitrating apparatus and a set value of NH_3 , whereby the set value is an estimated value of NH_3 concentration at the outlet of the denitrating apparatus (3) on the basis of the flow-rate of the exhaust gas, the NOx concentration in the exhaust gas, the denitration rate in the model type denitration reaction and the base quantity (B_1) of the injected NH_3 ,
- there are means (35, 36, 37) for controlling a quantity of NH_3 injected into the denitrating apparatus in accordance with the base quantity signal (B_1) of the injected NH_3 and the pulse signals (B_2 ; B_3 ; B_4) of NH_3 ."

X. The Appellant submitted the following arguments in support of his requests:

The NH_3 injection controller known from **JP-A-53 132 466** has drawbacks

- because the signals output by the NH_3 injection controller at the inlet of the denitration reactor are not transmitted to the central computer,
- because the flowmeter used for measuring the flow of exhaust gas to be denitrated in the reactor is comparatively inaccurate and slow, and
- because the NOx and NH_3 detectors are also slow;

thus, since the response of the controller is delayed, there is excess NH₃ in the outlet of the reactor. The present invention solves this problem in particular by providing a connection from the output of the NH₃ detector at the inlet towards the computer, and by measuring by rapid sensors the load of the machine which exhausts the gas containing NO_x to be denitrated. This is not suggested by the prior art.

Concerning the procedural violation: after a first communication containing a sweeping but incorrectly substantiated objection concerning the lack of inventive step, the Applicant had filed an amended claim and submitted arguments, thereby making a serious effort for replying to the objection; however, without any more warning a negative decision was issued which repeated the objection, for the first time in a somewhat more elaborated way, but which also contained new objections for instance concerning the one part form adopted for the only claim. Therefore, a reimbursement of the appeal fees is equitable.

Reasons for the Decision

1. The appeal is admissible.
2. Allowability of the amendments and clarity of the claims
 - 2.1. The Board is satisfied that the European patent application has not been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed in the sense of Article 123(2) EPC and that the only claim is clear in the sense of Article 84 EPC.

3. Novelty

3.1 Since no system including all the features of the present only claim is known from the prior art, its subject-matter is novel in the sense of Article 54 EPC.

4. Inventive step

4.1 An NH₃ injection controller which controls a quantity of NH₃ injected into a denitrating apparatus for exhaust gas containing NO_x is known from **JP-A-53 132 466** (see the figure and, on the same page, the explanation of the reference numerals; see also the abstract in English); the controller is provided with

- metering means (5) for measuring NO_x concentration at the inlet of the denitrating apparatus (1) followed by signal stages, i.e. a computer stage (10) through delay circuit component (8);
- metering means (12) for measuring NO_x concentration at the outlet of the denitrating apparatus (1), followed by signal stages, i.e. the computer stage (10);
- metering means (11) for measuring NH₃ concentration at the outlet of the denitrating apparatus (1), followed by signal stages, i.e. the computer stage (10);
- metering means for measuring the flow-rate of NH₃ injected, with a flow-meter (14) followed by signal stages, i.e. the NH₃ controller (15) and the control valve (13);
- metering means (4, 6) including a detector and signal stages, i.e. the computer (10) through the delay circuit components (4, 6) for measuring in particular the flow-rate of exhaust gas introduced into the denitrating apparatus (1), and

- control means (10) for combining the output signals of these signal stages to determine the pour-in amount of NH_3 and to produce corresponding output signals to the NH_3 injector (5).

However, contrary to the presently claimed controller, the known device does not comprise the features recited in the characterising portion of the claim.

- 4.2 As credibly argued by the Appellant, the known NH_3 injection controller has in particular the following drawbacks:

The flow of exhaust gas to be treated is measured with a flowmeter (4) directly at the inlet, whereby however direct measurement of gas quantity is technically difficult, inaccurate and uneconomical. There is also a controller (14, 15, 16) for the supply of NH_3 at the inlet (2) of the denitrating reactor (1), but this controller does not input information into the computer (10), which thus cannot take it into account; moreover, due to inertia, i.e. to the comparatively slow response of conventional NO detectors (5, 12), rapid changes of the concentration of NO at the inlet or at the outlet can only be recorded and compensated with delay; it is also to be noted that the same applies to the measurement of non-utilised NH_3 , at the outlet of the reactor (1). Thus, there are unacceptably high unreacted amounts of NO_x and NH_3 at the outlet of the reactor (1).

The object of the present invention consists in creating an NH_3 injection controller in which through an undelayed precise determination of the amount of NH_3 injected in the inlet of the reactor and an undelayed precise determination of the exhaust gas quantity to be treated, the delay effects in the treatment of the gas in the denitrating reactor are eliminated.

As credibly argued by the Appellant, this object is achieved in particular by the following features of the present controller:

- the output signal of the NH_3 measuring means at the inlet of the reactor, i.e. an important information concerning the amount of injected NH_3 , is transmitted to the computer and there taken into account;
- the detector for measuring the flow rate of the exhaust gas at the inlet of the reactor is coupled with the load-controller of the machine which during function generates exhaust gas containing in particular NO_x ; load variation detection means and signal stages for detecting rapid variations in the setting of said load-controller, which are provided for this purpose, are much more rapid than flowmeters because directly related to the function of the machine.

The further features of the characterising portion of the present only claim, for instance the pulsing means and the simulation means are real time reaction means which also allow to avoid response delays and thus to eliminate unacceptable unreacted NO_x or NH_3 .

- 4.3 Indeed, **JP-A-60 202 716** (see the English translation and the Figures) discloses a system for controlling the injection rate of NH_3 in a denitrating reactor for eliminating NO_x in waste gas; in this method, the measured values of flows or concentrations are compared to corresponding set values or target values and the necessary injection rate of NH_3 is calculated. However, in **JP-A-60 202 716** the flow of exhaust gas is also measured as in the above-mentioned known device, thereby resulting in the same drawbacks. Moreover, in **JP-A-60 202 716**, past values of the injection of NH_3 and NO_x are set and there is no indication that the load-control means of the machine forming the exhaust gas

to be denitrated is directly connected to the input of the central controlling means for real time reaction.

4.4 Therefore, since the subject-matter of the only claim does not result from a combination of the cited documents of the prior art, it involves an inventive step in the sense of Article 56 EPC.

5. Therefore, a patent may be granted (Art. 97(2) EPC).

6. Reimbursement of the appeal fees

6.1 The Appellant has requested the reimbursement of the appeal fees since this was equitable in view of a major procedural defect, for the following reasons:

In the first communication of the Examining Division, a document was cited as sole reference and it was summarily asserted that the patent claim was not grantable over this prior art due to the lack of inventive step, because said document also proposed additional monitoring of ammonia and NOx concentration at the reactor outlet and incorporation of these signals into the control system, and because the feature concerning the use of "pulse signals" was obvious to the expert. Although the patent claim contained more features, nothing was mentioned in this respect. The first communication thus was not factually substantiated and elaborated and only dealt superficially with the first document and its technical relationship with the patent. In the letter of reply, the Applicant filed an amended claim and provided arguments concerning in particular the features of the claimed device which were not derivable from the first document. The Applicant was astonished to receive the decision to refuse the application immediately after the first communication, and this is viewed as a breach of the Examination Guidelines (see C-VI-4.3). Moreover, the Applicant had made a serious effort and dealt with all the objections in the communication. Even if after the

letter of reply no prospect of granting a patent had been envisaged by the Examining Division, the Applicant should have been warned first that the application would be refused if new, more convincing arguments or suitable amendments of the patent documents were not submitted within a specified term. This did not occur although such assistance was explicitly requested in the letter of reply. The decision under appeal further contained an objection concerning the form of the claim which was never made before, and contained incorrect arguments such as the lack of indication of any problem of the prior art and of the advantages of the invention in the present patent application. Therefore, the decision should be rectified by way of interlocutory revision in accordance with Article 109(1) EPC and thus it is equitable to reimburse the appeal fees.

- 6.2 According to Rule 67 EPC the reimbursement of appeal fees shall be ordered in the event of interlocutory revision or where in particular the Board of Appeal deems it to be equitable by reason of a substantial procedural violation.

However, in the present case, although the statement of grounds of appeal contained arguments relating to the objections in the decision under appeal, no new amended patent application document was filed. Moreover, the statement of grounds of appeal specified that further arguments and documents might yet be submitted and that, due to the complexity of the matter an oral hearing in which the invention could be discussed in comparison with the prior art by direct argument and counter-argument would appear to be desirable. Thus the Appellant was not ready for filing amended patent application documents even after having received the decision under appeal and taken account of the content thereof as if it were a further communication in the examination procedure, in particular in relation with his request that said decision be rectified; the Appellant also admitted for

the first time that the matter was complex and that an oral hearing would appear to be desirable. However, the prior art document cited in said decision was the same as that mentioned in the communication before. It can also be concluded that the Appellant could already have recognized that the matter was complex for the following reasons: the original claim contained, in accordance with the form suggested by Rule 29(1) EPC, a statement indicating those features which are necessary for the definition of the subject-matter but which, in combination, are part of the prior art, and a characterising portion stating the technical features which in combination with the above-mentioned features, it is desired to protect; after the communication of the Examining Division, there was not submitted a new claim in the same form but, without any explanation about the reasons why the above-mentioned form of the claim would not be appropriate, a claim in the one-part form wherein the new features cannot be distinguished from the known ones in a simple and direct way.

Moreover, the Board of Appeal informed the Appellant that said same text of the claim which had been refused and which was the only one submitted appeared in particular to lack an inventive step especially having regard to i.a. the same cited prior art document. This resulted in a sequence of communications of the Board and of amendments of the patent application during the appeal procedure.

Therefore, it was apparent after the first communication of the Examining Division that the matter might be complex and that amendments might be necessary and that consequently the Applicant and now Appellant could have requested oral proceedings at least auxiliarily at that time but did not do it; it was also apparent that with the text maintained in the statement of grounds of appeal which admittedly might be amended as a result of the complexity of the matter, a continuation of the procedure

on an indefinite basis had to be envisaged. Therefore, it cannot be concluded that it would be equitable in the sense of Rule 67 EPC to reimburse the appeal fees and the request of the Appellant is rejected.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The request for reimbursement of the appeal fees is rejected.
3. The file is remitted to the first instance with the order to grant a patent on the basis of the following documents:

Description: pages 1 to 21, filed with letter dated 7 April 1993, with the following amendments:

the text from page 7, penultimate paragraph to page 9, first paragraph, and from page 11, first paragraph to page 12, last paragraph, is deleted;

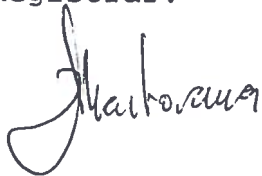
on page 9, paragraph "Disclosure of the invention", the words "NH₃ injection controller of the invention is distinguished" are substituted for the words "solution of this problem is achieved proceeding";

Claim: the only claim filed with letter dated 7 April 1993, with the following amendment:

on page 3, fourth line of the claim, the word "denitration" is substituted for "nitration";

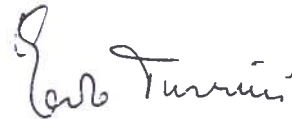
Drawings: Fig. 1 and 2 filed with letter dated 7 April 1993, Sheets 3/5 to 5/5 (Fig. 3 to 6) as originally filed.

The Registrar:



P. Martorana

The Chairman:



E. Turrini

MCH

