Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 16 December 2020

Case Number: T 1893/19 - 3.4.02

Application Number: 12864266.7

Publication Number: 2800951

IPC: G01F1/86, G01M15/10, G01F1/00, G01N1/22, G01F1/74, G01N33/00

Language of the proceedings: EN

Title of invention:
METHOD AND SYSTEM FOR MEASURING THE MASS FLOW BY MEANS OF DILUTION OF AN EXHAUST GAS FROM INTERNAL COMBUSTION

Applicant:
Rototest International AB

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (yes) - after amendment

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1893/19 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 16 December 2020

Appellant: (Applicant)	Rototest International AB Salemsvägen 20 144 40 Rönninge (SE)
Representative:	Ehrner & Delmar Patentbyrå AB Drottninggatan 33, plan 4 111 51 Stockholm (SE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 12 February 2019 refusing European patent application No. 12864266.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	B. Müller
Members:	A. Hornung
	F. J. Narganes-Quijano

Summary of Facts and Submissions

I. The applicant appealed against the decision of the examining division refusing European patent application number 12864266.7 on the basis of Article 56 EPC (main request and three auxiliary requests).

II. According to the statement of grounds of appeal, the applicant requested that the decision of the examining division be set aside and that a patent be granted on the basis of the main request underlying the appealed decision or on the basis of one of the first to third auxiliary requests filed with the statement of grounds of appeal.

III. In a telephone conversation, the board informed the applicant that claim 1 of the main request on file appeared to lack at least clarity (Article 84 EPC) and that a patent could likely be granted on the basis of claim 1 of the second auxiliary request on file.

IV. In response to the board's attendance note about the telephone conversation, the applicant filed by a letter dated 2 December 2020 a new main request (claims 1 to 9, and pages 1 to 19 of the description) based on the second auxiliary request which had been filed with the statement of grounds of appeal.

V. The present decision refers to the following documents:

D1: US 3,881,351,

D5: GB 1 531 347.

VI. Independent claim 1 of the present main request reads as follows, the features of the claim being preceded by the numbering A to G based on the numbering A to F used by the

applicant in its statement of grounds of appeal, page 2, for numbering the features of claim 1 of the main request previously on file:

"**A** Method for measuring at least one compound in an exhaust gas stream (220, 420) resulting from internal combustion, said method including:
B - by means of a first sensor (204, 404), measuring a first relative proportion of oxygen in the exhaust gas stream (220, 420) ,
the method being **characterised in:**
C - downstream said first sensor (204, 404), adding a defined flow of air to said exhaust gas stream (220, 420),
D - by means of a second sensor (209, 409), measuring a second relative proportion of oxygen in the combined stream of said exhaust gas stream (220, 420) and said added air,
E - determining a mass flow of oxygen in said exhaust gas stream (220, 420) resulting from said combustion in said internal combustion by means of said first and second relative proportions of oxygen, said defined flow of said air and a flow of said exhaust gas stream (Q_e), and
F - by means of a control unit (115), adjusting said defined flow of said air being added to the exhaust gas stream (220, 420) in dependence on said determined mass flow of oxygen in said exhaust gas stream (220, 420), the method further comprising:
G - determining the flow *(Q_e)* of said exhaust gas stream as:

$$Q_e = (Q_d\ C_{de} - Q_d\ C_d) / (C_e - C_{de}),$$

where Q_d is said defined flow of air, C_d is the proportion of oxygen occurring in air, C_e is said first relative proportion of oxygen, and C_{de} is said second relative proportion of oxygen."

Independent claim 6 of the present main request reads:

"Computer program product, **characterised in** code means, which when run on a control unit or computer being integrated in or connected to a measurement device for causes the control unit or computer to execute the method according to any of the claims 1-5."

Independent claim 7 of the present main request reads:

"System for measuring at least one compound in an exhaust gas stream (220, 420) resulting from internal combustion, said system including:
- a first sensor (204, 404) for measuring a first relative proportion of oxygen in the exhaust gas stream (220, 420), the system being **characterised in:**
- means (205, 411) for adding a defined flow of air to said exhaust gas stream (220, 420) downstream said first sensor (204, 404),
- a second sensor (209, 409) for measuring a second relative proportion of oxygen in the combined stream of said exhaust gas stream (220, 420) and said added air,
- means for determining a mass flow of oxygen in said exhaust gas stream (220, 420) resulting from said combustion in said internal combustion by means of said first and second relative proportions of oxygen, said defined flow of air and a flow of said exhaust gas stream (Q_e), and
- a control unit (115) for adjusting said defined flow of said air being added to the exhaust gas stream (220, 420) in dependence on said determined mass flow of oxygen in said exhaust gas stream (220, 420), the system further comprising means for:
- determining the flow *(Q_e)* of said exhaust gas stream as:

$Q_e = (Q_d\ C_{de} - Q_d\ C_d) / (C_e - C_{de})$,

where Q_d is said defined flow of air, C_d is the proportion of oxygen occurring in air, C_e is said first relative proportion of oxygen, and C_{de} is said second relative proportion of oxygen."

Reasons for the Decision

1. Amendments

The board is satisfied that the present set of claims 1 to 9 fulfils the requirements of Article 123(2) EPC. In particular, present claim 1 is generally based on claims 1, 13 to 15, 19 and 23 as originally filed.

2. Clarity

The board is satisfied that the present set of claims 1 to 9 fulfils the requirements of Article 84 EPC. In particular, it has been clarified in present independent claims 1 and 7 how the mass flow of oxygen is actually determined.

3. Novelty and inventive step

The subject-matter of claim 1 is novel and involves an inventive step in view of the available prior art (Articles 54(1) and 56 EPC).

3.1 According to the appealed decision, point 15.1, first paragraph, "D5 is considered to be the prior art closest to the subject-matter of independent claim 1" of the main request then on file. Claim 1 of the main request then on

file differed from D5 by the so-called features a. and b. corresponding to features E and F of present claim 1 as defined above (see the appealed decision, point 15.2, defining the so-called features a. and b.). The problem to be solved by the invention "may thus be regarded as improving the control over the exhaust gas" (appealed decision, point 15.2.1). According to the examining division, this problem reflected a general desire for improvement, which was intrinsic to the person skilled in the art (appealed decision, point 15.2.2., page 6, first paragraph). In particular, "[k]nowing the absolute content of the exhaust gas contributes to the solution of the posed problem" (appealed decision, point 15.2.2., page 6, second paragraph).

3.2 The principal reason given by the examining division for denying an inventive step in respect of the subject-matter of claim 1 of all the requests then on file was based on the view that the distinguishing features a. and b., i.e. features E and F of present claim 1 as defined above, were obvious in view of D5 in combination with D1.

3.3 The board cannot agree to the examining division's reasoning.

3.3.1 As explained in the applicant's statement of grounds of appeal, e.g. page 8, second paragraph, the objective technical problem identified by the examining division is not realistic in view of D5 because, in D5, there is no deficiency in the control of the exhaust gas. Determining the mass flow is not useful either in D5. The objective in D5 is, on the one hand, to minimize the noxious constituents contained in the exhaust gas. This requires the supply of a stoichiometric air-fuel ratio into the combustion chambers of the engine resulting in a stoichiometric oxygen-combustibles ratio discharged from

the chambers into the catalytic converter necessary for a most effective functioning of the catalytic converter (see D5, page 1, lines 20 to 44). On the other hand, however, the air-fuel mixture provided to the engine must be richer than the mentioned stoichiometric ratio in order to safeguard a stable and smooth running of the engine (D5, page 1, lines 45 to 49). In other words, in D5, only the relative amount of oxygen with respect to fuel is relevant, not the absolute content of oxygen. Therefore, the skilled person has no apparent incentive in the context of document D5 to look for determining the mass flow of oxygen providing the absolute content of oxygen.

3.3.2 Moreover, according to the appealed decision, point 15.2.2, page 6, second paragraph, the skilled person would find D1 which performs "mass flow calculations (...) [while using] a set-up that is very similar to the one of D5, including two concentration analyzers (12, 28) and a gas supply (18) between the two concentration sensors".

In the board's view, there is no convincing reason why the skilled person would consult D1, since D1 relates to a different problem than that dealt with in D5, namely "to determine the [absolute] amount of pollutant in the exhaust gases of an internal combustion engine [wherein] usually these constituents are of very low concentration compared to the total exhaust flow" (D1, column 1, lines 7 to 12). On the other hand, the problem in D5 relates to the determination of the relative amount of oxygen in the exhaust gas, wherein the oxygen proportion is rather high, e.g. ratio 14.8:1 (D1, page 1, line 38). The argument in the appealed decision according to which the skilled person would consult D1 because the set-up of D1 was very similar to the set-up of the invention is not convincing, since the skilled person, starting from D5, cannot be aware of D1 without hindsight.

3.3.3 Still further, the examining division held that the skilled person knew how to determine the mass flow of the oxygen by means of the first and second relative proportions of oxygen and the defined flow of air (appealed decision, point 15.2.2, page 6, fourth paragraph).

However, in the absence of any evidence and in the absence of any motivation for the skilled person to reflect on how to determine the mass flow of oxygen, i.e. the absolute amount of mass of oxygen, the examining division's assertion is not found convincing by the board.

3.4 In conclusion, the board is of the view that there is no obvious reason for the skilled person, starting from D5, to determine the mass flow of oxygen as defined in claim 1. Hence, the skilled person would not modify the method of D5 in a way which would lead them to a method falling under the scope of claim 1.

3.5 The same conclusion applies to the subject-matter of independent claims 6 and 7 because they include the same limitations as claim 1.

3.6 No further objections of lack of inventive step were raised by the examining division on the basis of the other prior art documents mentioned in the appealed decision. The board does also not see how the remaining prior art documents would render the subject-matter of the independent claims 1, 6 or 7 obvious.

4. For the above reasons the board is satisfied that the set of claims of the present main request meets the requirements of the EPC. The description of the patent application has been adapted to the present set of claims.

Furthermore, no objection is to be raised against the present drawing sheets corresponding to the drawing sheets as originally filed. As a consequence, the application documents according to the present main request and the invention to which they relate meet the requirements of the EPC so that a patent can be granted (Article 97(1) EPC).

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 with the order to grant a patent on the basis of the following documents:

Claims 1 to 9 of the main request as filed with the letter of 2 December 2020,

Description pages 1 to 19 as filed with the letter of 2 December 2020,

Drawing sheets 1/4 to 4/4 as originally filed.

The Registrar: The Chairman:

L. Gabor B. Müller

Decision electronically authenticated