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Datasheet for the decision of 11 May 2017

Case Number: T 1436/15 - 3.3.05

Application Number: 10156879.8

Publication Number: 2319604

IPC: B01D46/24

Language of the proceedings: EN

Title of invention:
Honeycomb filter

Patent Proprietor:
Ibiden Co., Ltd.

Opponents:
STRAWMAN LIMITED
Haldor Topsoe A/S

Headword:
NOx conversion rate after regeneration/IBIDEN

Relevant legal provisions:
EPC Art. 83, 56

Keyword:
Sufficiency of disclosure - main request (yes)
Inventive step - main request (yes) - improvement credible (yes)

Decisions cited:
T 0593/09

Catchword:

Europäisches Patentamt
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Case Number: T 1436/15 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 11 May 2017

Appellant: (Patent Proprietor)	Ibiden Co., Ltd. 1 Kandacho 2-chome Ogaki-shi Gifu 503-8604 (JP)
Representative:	Hoefer & Partner Patentanwälte mbB Pilgersheimer Straße 20 81543 München (DE)
Respondent 1: (Opponent 1)	STRAWMAN LIMITED Orchard Lea Horns Lane Combe Witney, Oxfordshire OX29 8NH (GB)
Representative:	Naylor, Matthew John Mewburn Ellis LLP City Tower 40 Basinghall Street London EC2V 5DE (GB)
Respondent 2: (Opponent 2)	Haldor Topsoe A/S Nymollevej 55, P.O.Box 213 DK-2800 Lyngby (DK)
Representative:	Inspicos P/S Kogle Allé 2 2970 Hørsholm (DK)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 22 May 2015 revoking European patent No. 2319604 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	E. Bendl
Members:	A. Haderlein
	O. Loizou

Summary of Facts and Submissions

I. The present appeal lies from the decision of the opposition division to revoke European patent EP 2 319 604. The patent in suit concerns a honeycomb filter.

II. The opposition division held *inter alia* that the main request underlying the impugned decision complied with the requirement of sufficiency of disclosure but did not meet the requirement of inventive step in view of

D5a: EP 1 491 249 A1 and
D6a: WO 2005/016497 A1.

In particular, the opposition division did not recognise the success of the proposed solution because it was not credible that the NOx conversion rate dropped at thermal conductivity values beyond the upper limit of the claimed range, i.e. above 10 W/mK (see the decision under appeal, page 12, last paragraph).

The following further documents were among those cited in the first-instance proceedings:

E2: JIS R 1611:2010
D10a: EP 1 995 226 A1
D13a: EP 1 935 489 A1.

III. The proprietor of the patent (appellant) lodged an appeal against this decision. With its grounds of appeal it filed *inter alia* a main request.

IV. With its letter dated 12 April 2017, the appellant filed two auxiliary requests.

V. Respondent 1 (opponent 1) filed the following documents:

D26: EP 2 319 603 B1
D27: EP 2 319 605 B1
D28: Table comparing values of the patent in suit, D26 and D27.

VI. The sole independent claim 1 of the main request (corresponding to the main request on which the impugned decision was based) reads as follows:

"1. A honeycomb filter comprising a honeycomb structured body having a large number of cells each sealed at either end thereof and placed longitudinally in parallel with one another with a cell wall therebetween and
a zeolite supported on the cell wall of the honeycomb structured body,
wherein
the honeycomb structured body contains silicon carbide,
a porosity of the cell wall of the honeycomb structured body is 55 to 65%,
an amount of the zeolite supported on the cell wall is 80 to 150 g/L, and
a thermal conductivity of the cell wall supporting the zeolite is 5 to 10 W/mK."

Dependent claims 2 to 7 relate to specific embodiments of the honeycomb filter called for in claim 1.

VII. The arguments of the appellant, as far as relevant to the present decision, may be summarised as follows:

Sufficiency of disclosure

The requirement set forth in Article 83 EPC was met, as confirmed by the first-instance decision.

Inventive step

D6a was the closest prior art. In example 1 of D6a, cordierite was used as the honeycomb substrate. This example also did not disclose a thermal conductivity in the claimed range. As could be readily seen from Table 2 of the patent, the claimed honeycomb filters achieved improved NOx conversion rates even after regeneration. The NOx conversion rates at the beginning of the test were not disclosed in the patent. But even assuming that the comparative examples in Table 2 did not result in a reduction in catalytic activity, the results clearly showed that the claimed honeycomb filters were superior in terms of absolute NOx conversion rates. The results shown in Table 1 of D6a were not comparable with those of the patent. But even if they were, it was clear that example 1 of the patent having the lowest NOx conversion rate was still better than the example of D6a. D5a did not teach to work in the claimed range of thermal conductivity in order to increase the NOx conversion rate even after repeated regeneration.

VIII. The arguments of the respondents (opponents 1 and 2), as far as relevant to the present decision, may be summarised as follows:

Sufficiency of disclosure

According to respondent 1, the main request lacked sufficiency of disclosure, "for the reasons explain

(sic) in our letters of 1 February 2013 and 11 November 2014" (respondent 1's reply to the grounds of appeal, page 2, fifth paragraph). According to respondent 2, the skilled person was at a loss when trying to reproduce the invention because the thermal conductivity depended on a number of parameters such as porosity and particle diameter. Also, the thermal conductivity depended strongly on the temperature at which it was measured. This temperature not being indicated in the patent, it was not possible for the skilled person to carry out the invention.

Inventive step

D6a was the most promising starting point for assessing inventive step, although D10a and D13a could also be considered the closest prior art. D6a did not disclose a thermal conductivity value falling within the claimed range of 5 to 10 W/mK. Although the honeycomb filters used in the examples of D6a were made of cordierite, silicon carbide was disclosed in D6a as being equally suitable. It was not credible that the problem of improved NOx removal rate after regeneration was solved. In particular, it was evident from Table 2 of the patent that the increased conversion rate was due to a change in porosity and not to thermal conductivity. The results given in D6a were not comparable with those of the patent in terms of the specific values of the conversion rate, but were comparable qualitatively. The problem to be solved was the provision of an alternative honeycomb filter. In view of this problem, it was obvious to have the thermal conductivity in the claimed range, in particular in view of the teachings of document D5a.

IX. Requests

The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request filed with its statement of grounds of appeal or, in the alternative, of one of two auxiliary requests filed with its letter dated 12 April 2017.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. Main request - sufficiency of disclosure

1.1 In the impugned decision the opposition division arrived at the conclusion that the requirement of sufficiency of disclosure was complied with. The decision under appeal contains detailed reasons in this respect (see 2.2 to 2.2.4 of the reasons). In its reply to the grounds of appeal, respondent 1 did not deal with these reasons but only referred in general to "reasons explain (sic) in our letters of 1 February 2013 and 11 November 2014" (see page 2, fifth paragraph), i.e. to submissions made in the proceedings before the opposition division.

While it is normally not sufficient to refer in general terms to the first-instance proceedings in order to substantiate an objection in the proceedings before the boards of appeal, such reference is in any event in itself insufficient to show that the opposition division's conclusions were wrong in this respect. This reference to submissions made during the first-instance proceedings therefore fails to persuade the board that

the opposition division's findings were wrong.

1.2 As to respondent 2's argument that the skilled person was at a loss when trying to reproduce the invention because the thermal conductivity depended on a number of parameters such as porosity and particle diameter, the board observes that the patent in suit contains a number of examples (see paragraph [0091] et seq.) in which parameters such as porosity and zeolite amount are varied (see also Table 2). Conversely, respondent 2 has not shown that these examples cannot be reworked.

1.3 As to respondent 2's argument that it was not possible for the skilled person to carry out the invention because the temperature at which thermal conductivity was to be measured was not indicated, the board observes as follows:

In its decision the opposition division held that the skilled person would rely on the JIS referred to in E2 (corresponding essentially to the JIS standards mentioned in paragraph [0114] of the patent in suit) and would measure the thermal conductivity at ambient conditions because conducting the measurement at conditions different from the ambient ones would be more complex (see paragraph 2.2.3.1 of the reasons for the impugned decision). In its reply to the grounds of appeal, respondent 2 did not contest these findings but merely reiterated the argument that it had already presented before the opposition division, i.e. that the thermal conductivity was temperature-dependent.

In view of this the board finds that the absence of any explicit indication in the patent in suit of the temperature at which the thermal conductivity was to be measured is not a bar to the sufficiency of disclosure

of the invention.

1.4 The board also does not see that thermal conductivity, a property well-known to the skilled person, would constitute an "ill-defined" parameter in the sense of T 593/09 (3.6 of the reasons) cited by respondent 2.

1.5 The board thus concludes that the requirement of sufficiency of disclosure set forth in Article 83 EPC is complied with.

2. Main request - inventive step

2.1 The patent concerns a honeycomb filter.

2.2 At the oral proceedings, only D6a was invoked as the closest prior art by the parties present. In the written proceedings, D13a and D10a were also referred to by respondent 1 as the closest prior art.

2.2.1 The patent is concerned with the NOx removal rate after regeneration (see paragraph [0014]), i.e. after using the honeycomb filter for a certain time period including multiple regeneration cycles. The purpose of D6a, too, is the NOx removal rate after using the honeycomb filter for a certain time period (see in particular page 20, lines 18 et seq., and page 21, lines 18 et seq.). In contrast, D13a is concerned with pressure loss (see paragraphs [0006], [0008] and Table 4). D10a is also a less suitable starting point for assessing inventive step because it does not relate to the NOx removal rate after regeneration or ageing, but rather to strength, pressure loss and dimensional accuracy (see paragraph [0012]).

2.2.2 Therefore, D6a is to be considered the closest prior art.

2.2.3 The parties agree that the examples of D6a (example 1, example 4, cf. page 21, line 8) disclose all features of claim 1 of the main request in combination except for thermal conductivity. Moreover, they agree that in these examples the honeycomb structured body is made of cordierite and not of silicon carbide, the latter material being disclosed in the general part of D6a as one of several preferred materials for the substrate (see page 13, lines 1 et seq.).

The board thus concludes that the subject-matter of claim 1 of the main request differs from the honeycomb filter disclosed in the examples of D6a by the thermal conductivity and by the presence of silicon carbide.

2.3 According to the patent in suit, the problem to be solved was to provide a honeycomb filter having increased NOx conversion rates even after repeated regeneration (cf. paragraphs [0014], [0020], Table 2 on page 13).

2.4 The patent according to claim 1 of the main request proposes to solve this problem by means of a honeycomb filter characterised in that the thermal conductivity of the cell wall supporting the zeolite is 5 to 10 W/mK and the honeycomb structured body contains silicon carbide.

2.5 The issue of the success of the solution was the most heavily discussed matter during the appeal proceedings.

2.5.1 According to a first line of argument of the respondents, the data provided in the patent in suit

did not credibly show that any improvement was due only to the thermal conductivity being in the claimed range. Rather, the improvement shown in Table 2 was due to a change in porosity.

The board notes that all examples covered by claim 1 of the main request (see Table 2 on page 13, examples 1 to 5) have a higher NOx conversion rate after repeated regeneration compared to those examples not covered by claim 1 (example 6 and comparative examples 1 to 5). While it is true that the patent does not contain data in which an example and a comparative example differ only in their thermal conductivity, this alone is not sufficient reason to cast serious doubt on an improvement over the closest prior art. Moreover, the respondents' argument that any improvement shown in Table 2 of the patent was due to the porosity must fail, as some of the comparative examples and example 6, which are not covered by the claimed range, comprise examples having a porosity within the claimed range but still have a lower NOx conversion rate after regeneration than those examples covered by claim 1. Also, the mere fact that the comparative examples of the patent partly possess a thermal conductivity in the claimed range is not sufficient to cast reasonable doubt on the success of the solution because, when assessing the success of the solution, the combination of features known from the closest prior art with the distinguishing features is to be considered.

With regard to the closest prior art it must be born in mind that the honeycomb filter of D6a, i.e. the one disclosed in examples 1 and 4 of D6a, is even more remote from the claimed honeycomb filter than the comparative examples of the patent in suit because the honeycomb filter of examples 1 and 4 of D6a is made of

cordierite (cf. page 17, line 10, and page 21, line 8), whereas the honeycomb filters of the comparative examples of D6a are made of silicon carbide (see Table 1 of the patent).

2.5.2 According to a second line of argument of the respondents, the test procedure used in D6a (see page 20, lines 18 et seq.), while not quantitatively comparable with the test procedure used in the patent in suit (paragraph [0119]), was at least qualitatively comparable with the one used in the patent in suit. This meant that D6a cast serious doubt on whether an improvement was achieved by the claimed subject-matter.

The board is not persuaded by this argument. While it can be fairly assumed that the test procedure used in D6a at least implicitly uses multiple regeneration cycles, so that the results obtained in D6a after "ageing" can be said to be obtained after repeated regeneration, and while it is also common ground that the conversion rate disclosed in Table 1 of D6a cannot be directly compared to the conversion rates disclosed in Table 2 of the patent in suit, the board notes that, even on the assumption that these values were readily comparable, the conversion rates of examples 1 to 5 of the patent covered by claim 1 have a higher conversion rate (at least 57%) compared to the conversion rate obtained in D6a (Table 1, Trial# 6: 55%).

The board also notes that the respondents have not provided any evidence, such as comparative tests, that would show that the data discussed above is wrong and that the claimed honeycomb filters do not result in an improved NOx conversion rate even after repeated regeneration when compared to the honeycomb filter

disclosed in D6a.

2.5.3 As to documents D26 to D28, they were submitted by respondent 1 in order to show that the NOx conversion rates contained in Table 2 of the patent allegedly corresponded to the initial NOx conversion rates, i.e. in their "fresh" state prior to undergoing multiple regeneration cycles. According to respondent 1, this proves that the comparative examples of the patent also showed no decrease in NOx conversion rates after regeneration.

This argument must fail because, even assuming that the comparative examples of the patent do not show any decrease in NOx conversion rate after repeated regeneration compared to its initial value, the NOx conversion rates of the examples covered by claim 1 are still higher even in absolute terms (see Table 2 of the patent, examples 1 to 5).

With reference to documents D26 to D28, respondent 1 also questioned whether the NOx conversion rates given in Table 2 of the patent in suit were indeed values obtained after repeated regeneration or rather related to the initial conversion rates.

The board observes that throughout the patent specification reference is made to repeated regeneration (see in particular paragraphs [0116] to [0126]) and in the examples reference is made to the measurement of regenerated samples (see in particular paragraph [0121]). It is therefore not credible that the NOx conversion rates listed in Table 2 of the patent were measured at the beginning of the test procedure described in paragraph [0119] of the patent. This, of course, does not exclude that the values

measured correspond in fact to values that would have been obtained if the conversion rate had also been measured at the beginning of the test procedure (cf. 2.5.3 *supra*, second paragraph).

2.5.4 Finally, the respondents also submitted that it was not credible that the upper limit of the claimed range for thermal conductivity (i.e. 10 W/mK) was a critical value in that it was not credible that the NOx conversion rate dropped above that value (cf. the opinion of the opposition division, II. *supra*).

This argument must fail because, for the success of the solution, it is immaterial whether an improvement would also occur outside the claimed range as long as it is credible that the improvement vis-à-vis the closest prior art occurs within it. It cannot be held against the proprietor that it does not claim embodiments that would also result in an improvement.

2.5.5 The board is therefore satisfied that the problem mentioned in 2.3 *supra* has been successfully solved. It is therefore not necessary to reformulate the problem.

2.6 As to obviousness, the respondents referred to D5a, disclosing a thermal conductivity value of 10 W/mK (see paragraph [0053]).

The board also notes that D5a discloses a substrate made of silicon carbide in combination with the above thermal conductivity range (see paragraph [0053]). D5a is mainly concerned with the activation of the catalyst (see paragraphs [0012] and [0013]) and also mentions regeneration and improved durability, i.e. maintaining the NOx conversion rate even after multiple regeneration cycles (see for instance paragraph

[0100]). In D5a, however, NOx conversion rates are not measured, but rather conclusions are drawn from measured temperature differences (cf. Table 4; paragraph [0098]). Therefore, the skilled person would learn from D5a at most that a possible decrease in NOx conversion rate due to multiple cycles of regeneration can be avoided when adopting the teachings of D5a. This problem, however, does not arise in D6a, the closest prior art, because the NOx conversion rate in D6a does not decrease after multiple regeneration cycles (cf. Table 1, Trials 4 and 6), but rather increases from 51% to 55%. So, D5a proposes to solve a problem that does not occur in D6a. What is more, D5a does not teach that the NOx conversion rate disclosed in D6a can be increased by having the thermal conductivity in the claimed range and by having the porous substrate made of silicon carbide.

For these reasons, it was not obvious in view of the problem stated in 2.3 *supra* to arrive at the proposed solution.

2.7 Therefore, the requirement set forth in Article 56 EPC is met for the main request.

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 maintain the patent in amended form on the basis of the main request filed with the statement of grounds of appeal and a description to be adapted thereto.

The Registrar: The Chairman:

C. Vodz E. Bendl

Decision electronically authenticated