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**Datasheet for the decision
of 27 February 2015**

Case Number: T 0792/11 - 3.2.06

Application Number: 06123526.3

Publication Number: 1752630

IPC: F01N3/02, B01D39/20, F01N3/022,
F01N3/28, B01J35/04

Language of the proceedings: EN

Title of invention:
HONEYCOMB STRUCTURAL BODY

Patent Proprietor:
Ibiden Co., Ltd.

Opponents:
THE DOW CHEMICAL COMPANY
Saint-Gobain Centre de Recherches et
d'Etudes Européen
Young Thought Limited

Relevant legal provisions:
EPC Art. 84, 56, 123(2), 123(3)

Keyword:
Inventive step - obvious combination of known features



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Case Number: T 0792/11 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 27 February 2015

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 8 February 2011
revoking European patent No. 1752630 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman M. Harrison
Members: G. de Crignis
 K. Garnett

Summary of Facts and Submissions

- I. European patent No. 1 752 630 was revoked by the opposition division by way of its decision posted on 8 February 2011, the opposition division finding that the subject-matter of claim 1 according to the main request and first to third auxiliary requests lacked an inventive step (Article 56 EPC).
- II. European patent No. 1 752 630 is based on European application No. 06123526.3 which is a divisional application of 04745652.0 (the latter being referred to in this decision as the "parent" application).
- III. On 7 April 2011 the appellant (patent proprietor) filed an appeal against this decision and paid the appeal fee. A statement setting out the grounds of appeal was received at the European Patent Office on 17 June 2011 together with a main request (corresponding to the third auxiliary request as filed during the opposition proceedings) and two auxiliary requests.
- IV. Respondent OI (Opponent I) declared in its letter of 25 August 2011 that it did not wish to make any substantive reply to the grounds of appeal. Respondent OII (Opponent II) initially requested dismissal of the appeal, and later withdrew its opposition.
- V. With its letter of 21 July 2011, respondent OIII (Opponent III) requested oral proceedings and dismissal of the appeal, but did not make any submissions of a substantive nature.
- VI. With its communication annexed to a summons to oral proceedings, the Board gave its provisional opinion in

respect of various objections, noting that none of the appellant's requests appeared to be allowable.

- VII. With letter of 27 January 2015, the appellant filed amended claims in the form of a main request as well as first and second auxiliary requests, all in a "main" version and a version "A".
- VIII. With its letter of 3 February 2015, Respondent OI announced that it would not attend the oral proceedings before the Board, and relied on its written submissions.
- IX. With its letter of 16 February 2015, Respondent OIII announced that it would not be represented at the oral proceedings. It also withdrew its request for oral proceedings.
- X. Oral proceedings were held before the Board on 27 February 2015, in the absence of respondents OI and OIII.

The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the amended version of Variant A of its Main request as filed at 12:05 during the oral proceedings, alternatively on the basis of Variants A of its first or second Auxiliary Requests as filed with its letter dated 27 January 2015 (with amendments corresponding to those made to the said amended Variant A of the Main request).

- XI. Claim 1 according to the Main request reads:

"Use of a honeycomb structural body made of a columnar porous ceramic block in which a large number of through

holes are placed in parallel with one another in the length direction with wall portions interposed therebetween,

wherein the porous ceramic block is constituted by combining a plurality of columnar porous ceramic members, each having a plurality of through holes that are placed in parallel with one another in the length direction with partition walls constituting the wall portions interposed therebetween, with one another through sealing material layers,

wherein the material of said porous ceramic block is silicon carbide,

wherein said large number of through holes comprises: a group of large-capacity through holes, each of which is sealed at one end of said honeycomb structural body; and

a group of small-capacity through holes, each of which is sealed at the other end of said honeycomb structural body,

the large capacity through holes having an octagonal shape of cross section perpendicular to the length direction of the through holes, and the small capacity through holes have a square shape of a cross section perpendicular to the length direction of the through holes, the large capacity through holes and the small capacity through holes are alternately arranged, the total sum of the areas of said group of large-capacity through holes on a cross section perpendicular to said length direction is larger than the total sum of the areas of said group of small-capacity through holes on said cross section,

gases are allowed to flow from the through holes in said group of large-capacity through holes to the through holes in said group of small-capacity through holes through the wall portions, and

wherein the wall portions have a porosity in the range of 20% to 80%,
a surface roughness R_y of the wall face of said through holes being set in a range from 10 to 100 μm ,
wherein a density of through holes on a cross section perpendicular to a length direction is set in a range from 15.5 to 62 pcs/cm², and wherein
the honeycomb structural body being used for an exhaust gas purifying device,
the exhaust gas purifying device being constituted by the honeycomb structural body, a casing that covers the external portion of the honeycomb structural body, a holding sealing material that is placed between the honeycomb structural body and the casing, and a heating means placed on an exhaust-gas inlet side of the honeycomb structural body,
the honeycomb structural body being subjected to a regenerating process, in which a gas, heated by using the heating means, is allowed to flow into the through holes of the honeycomb structural body so that the honeycomb structural body is heated to burn and eliminate soot deposited on the wall portions and that, in addition, soot is burned and eliminated by using a post-injection system, and ashes are moved to the exhaust-gas outlet side through the through holes upon carrying out the regenerating process."

Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the last paragraph is amended and reads:

"... and that, in addition, soot is burned and eliminated by using a post-injection system to exfoliate ashes, and ashes are moved to the exhaust-gas outlet side through the through holes upon carrying out the regenerating process."

Claim 1 of the second auxiliary request differs from claim 1 of the main request in that the porosity of the ceramic members is defined as having a porosity of 42 % or 50%.

XII. The arguments of the appellant may be summarised as follows:

Concerning the requirement of Article 123(3) EPC, claim 1 requires that "the wall portions have a porosity in the range of 20% to 80%". In view of the wall portions now being defined in the plural form and by further specifying the partition walls as constituting the wall portions, the requirements of Articles 84, 123(2) and (3) EPC were met.

Claim 1 related to the use of a honeycomb structural body for an exhaust gas purifying device. The basis for such a feature was to be found in claim 12 of the parent application, together with paragraph [0001], which specified that an internal combustion engine such as a diesel engine was not a necessary feature, as indicated by the word "or the like" at the end of that paragraph. Furthermore, the limitations of such a use were clear, since the honeycomb structural body was used in a very specific type of device, namely an exhaust gas purifying device, which included such device being subjected to a regenerating process. It was not necessary to specify conditions for the use or the regeneration process since this was well known to a skilled person. Moreover, it was an aggregated honeycomb structural body that was claimed and the skilled person was aware of appropriate operating conditions for its use.

Furthermore, it was clear that the term "soot" had to be understood as concerning specifically the particulates deposited on the wall portions. This interpretation was also in line with the description in paragraphs [0091] and [0092] of the parent application. The wording "soot deposited on the wall portions" clarified, furthermore, that it was precisely this soot which was burned and eliminated during the regenerating process.

Concerning inventive step, A1 (JP-A-2003-1029) had been cited as representing the closest prior art. However, A1 was directed to trapping the particulates in the exhaust gas more efficiently (paragraph [0002]). This was in contrast to the mechanism exhibited by the presently claimed structure which aimed at exfoliating, i.e. removing ash particulates from the walls. A1 further referred to the aim of keeping the pressure loss at a low level after soot accumulation (paragraphs [0002] and [0029]). This was in contrast to an asymmetric structure of the honeycomb body. The skilled person knew that an asymmetric structure increased the initial pressure loss and hence would be led away from such a design. Accordingly, the skilled person would not combine the teaching of A1 with the structure disclosed in C14 (WO-A-02/10562).

The main contribution of the invention was the effect of exfoliation of the ashes, in which the ashes were moved towards the outlet side. This effect was related to the range claimed for the surface roughness and was confirmed by the measurement data (in the range of from 38 to 66 μm) submitted together with the photographs filed together with the letter of 27 January 2015; this showed that the ashes were moved towards the outlet side.

Also, according to A1, the low initial pressure loss was not disclosed for a plurality of members. Although the possibility of combining a plurality of cell members was known as such, it was not known whether negative effects would occur during long-term use. Additionally, the claimed asymmetric design (octagon/square shape) had the effect that there was no pressure difference between two diagonally adjacent members of similar cross-section, and accordingly no reverse flow.

XIII. No substantive submissions were filed by respondents OI and OIII.

Reasons for the Decision

1. Article 123(3) EPC - "wall portions"
- 1.1 Claim 1 includes the feature:
"the wall portions have a porosity in the range of 20% to 80%",
whereas claim 1 as granted includes the following wording:
"the said wall portion has a porosity in the range of 20% to 80%".
- 1.2 Certain passages of the description in the originally filed parent application and the divisional application as filed refer to the porosity of the ceramic member and block as lying in this range (see e.g. paragraphs [0030] and [0070] of the parent application). Here it is of importance to note that the paste which is used

to form the block is evidently a paste of homogeneous consistency. Indeed nothing else is described, nor would it be technically reasonable to expect the paste to be non-homogeneous. It is indeed the paste which, according to paragraph [0070], causes the entire block (also without any end plugs) to lie in this porosity range. Thus, the ceramic member and all its constitutive wall portions of the ceramic member have this porosity. Thus the requirement of Article 123(2) EPC is fulfilled for the feature relating to the wall portions, as the claim now defines that the porous ceramic block is constituted by the wall portions (which form the partition walls) and that it is the wall portions which have the specified porosity, in accordance with the parent and divisional applications as filed.

1.3 The amendment narrows the scope of protection of claim 1 as granted since all the wall portions of the aggregated honeycomb structural body have to have a porosity in the range of 20% to 80%, rather than just one as in the claim as granted. Accordingly, the requirement of Article 123(3) EPC is met.

2. Clarity (Article 84 EPC)

2.1 As opposed to claim 1 as granted, which was directed to a device, claim 1 is now directed to a use of a honeycomb structural body for an exhaust gas purifying device in order to achieve certain desired effects (burning and eliminating soot deposited on the wall portions and moving ashes to the exhaust-gas outlet side through through holes upon carrying out "a regeneration process"). The conditions of use and the conditions of regeneration required to achieve these effects are however not defined. The Board finds that,

without these features, the claimed use lacks clarity, since the skilled person is faced with desiderata but no definition of what is required to fulfil them. The Board does not accept the appellant's argument that a skilled person is aware of "appropriate operating conditions" for use, since this ignores the fact that the operating conditions must result in a specific effect. It is evident for example that a regenerating process is dependent on many factors. For example, the dimensions of the honeycomb structural body, the kind of exhaust gases coming from the engine, the amount of soot and the amount of ashes, and time and/or temperatures of such a process.

- 2.2 The effect of any use is highly dependent on the engine to which any exhaust gas purifying device is applied. This is in particular of relevance in view of the wording in claim 1 "... to burn and eliminate soot deposited on the wall portions and that, in addition, soot is burned and eliminated by using a post-injection system, and ashes are moved to the exhaust-gas outlet side ...". This wording is not clear because no conditions are specified as to how and to what extent the honeycomb structural body is heated, or already heated, in order for it to burn and then somehow "eliminate" soot deposited on the wall portions, let alone how soot which is already burned and eliminated can, in accordance with the claim, additionally be "burned and eliminated by using a post-injection system". It also remains undefined what ashes are meant in claim 1 and whether all the ashes or only part of the ashes should be moved, for what distance and under what conditions.
- 2.3 At least for these reasons, the requirement of Article 84 EPC is not met.

3. Article 123(2) EPC

3.1 The subject-matter of claim 1 also fails to meet the requirement of Article 123(2) EPC.

3.2 In the originally filed description, the feature of the large capacity through holes having an octagonal shape and the small capacity through holes having a square shape is disclosed (paragraph [0058]) in relation to the embodiment shown in Figures 4(a) to 4(d) illustrating such a feature. This embodiment is disclosed including further features, such as the aperture ratios defined therefor. As there is no direct and unambiguous disclosure allowing a skilled person to derive an isolated extraction of the feature concerning the octagonal/square shape of Figures 4 alone, the subject-matter of claim 1 does not meet the requirement of Article 123(2) EPC. In this regard, the mere fact that the aperture ratio is quoted in paragraph [0055] of the parent application as being preferably set in a certain range, does not imply that for the square/octagonal embodiment of Figures 4(a) to (d) this relationship is also one which is merely preferred. In paragraph [0057] referring to the octagonal/square arrangement, the aperture ratio is stated as having a different lower point.

3.3 Additionally, there is no clear and unambiguous disclosure which provides a basis for replacing the term "the particulates" (in claim 1), by the word "soot". In the parent application (paragraph [0092]) it is disclosed that it is the particulates which may be burned and eliminated. Additionally, paragraph [0002] of the parent application refers to "particulates such as soot". Accordingly, "the particulates" are clearly

not equivalent merely to soot. A basis for merely defining (merely) an elimination of soot cannot be found.

- 3.4 Hence, the appellant's argument that the term "particulates" should be seen as equivalent to "soot", thereby allowing the use of this term in the claim under Article 123(2) EPC is not accepted. Accordingly, the requirement of Article 123(2) EPC is also not met for this reason.

4. Irrespective of the amendments meeting the requirements of Article 84 EPC and 123(2) EPC, a further objection concerns lack of inventive step and, for completeness, is considered in the following paragraphs.

5. Inventive step
 - 5.1 The patent in suit describes in paragraph [0010] as the object of the invention the provision of a honeycomb structural body filter with a long service life which can reduce pressure loss to a low level upon collecting particulates and maintain the pressure loss at the low level for a long time even after regenerating processes. The technical problem underlying the patent is thus to increase longevity of the filter.

 - 5.2 In this technical field many documents (as also evident from the large number of documents cited in the opposition proceedings) concern the purification of exhaust gases by the use of honeycomb structural bodies as filters. Longevity and regeneration of such filters is a major issue. Accordingly, the Board concludes that the skilled person was well aware of these issues.

5.3 One of the documents cited in this respect is A1. The Board concluded (and the appellant did not dispute this) that the disclosure in A1 differs from the claimed subject-matter in that it does not refer to

- (a) an aggregated honeycomb structural body;
- (b) an asymmetric structure of the honeycomb structural body (such that the large capacity through holes have an octagonal shape of cross section perpendicular to the length direction of the through holes, and the small capacity through holes have a square shape of a cross section perpendicular to the length direction of the through holes), and
- (c) non-uniformity of the ceramic structure (that the total sum of the areas of said group of large capacity through holes on a cross section perpendicular to said length direction is larger than the total sum of the areas of said group of small-capacity through holes on said cross section).

5.4 In view of these differences, the objective technical problem can thus remain as stated in the patent in suit, as set out above, i.e. to provide a structure which contributes to longevity of the filter during use.

5.5 When starting the assessment of inventive step from the disclosure in A1 and being faced with the problem of improved longevity of the filter, the issue is whether the skilled person would have arrived at the use of the claimed honeycomb structural body without the exercise of inventive skill.

5.6 Concerning the use of an aggregated honeycomb structural body, the use of aggregation has no effect on solving the objective technical problem. Moreover, the use of an aggregated honeycomb structural body was already known. See for example:

A9 = D15: EP-A-0 816 065, Figure 1.

This feature represents a mere design option relating to the intended use (the kind of exhaust system, the amount of exhaust gases).

5.7 When desiring to increase longevity of a filter in use, the skilled person would take into account the teaching of C14, which teaches that this effect can be achieved by changing the design of the filter.

5.8 C14 refers to reduced pressure loss (page 2, second paragraph), to improved longevity of the filter (page 5, lines 3 to 10) and to the burning of soot more effectively (page 5, line 24 to 29) when using the asymmetric and non-uniform structure disclosed therein. This structure is disclosed as having an octagonal shape of large-capacity through holes and a square shape of small capacity through holes (see also Figures 2 and 3). Additionally, C14 refers to an increase of the cross-sectional area of the inlet channels (Figure 2, page 4, last line to page 5, line 3) and so teaches a skilled person to design the ceramic structure not only asymmetrically but also non-uniformly as regards the cross-sections. Accordingly when starting from A1, the problem of reducing pressure loss after long periods is solved by applying the teaching in C14. Accordingly, the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC).

- 5.9 The appellant argued that when starting from the disclosure in A1, a skilled person would not be led towards the claimed design of the honeycomb structure, in view of the aim of A1 of keeping the initial pressure loss at a low level. In support of this the appellant argued that the skilled person knew that an asymmetric structure increased the initial pressure loss and therefore he would be led away from such a design. Accordingly, A1 should allegedly not be considered as a suitable document for representing the closest prior art.
- 5.10 The Board does not agree.
- 5.10.1 First, A1 discloses a honeycomb structural body which has a structure having the greatest number of features in common with the subject-matter claimed.
- 5.10.2 Second, the limitation of the initial pressure loss as aimed at in A1 does not contradict the objective technical problem underlying the patent in suit which is concerned with long term effects, noting that A1 points to prolonged capturing duration and reduction of the number of regenerations (see e.g. paragraph [0006]).
- 5.10.3 Third, the distinguishing features of claim 1 over A1 are not at all related to initial pressure loss and accordingly the argument is not found to be pertinent in relation to the issues being considered.
- 5.11 Furthermore, the appellant argued that the main contribution of the invention was the effect of exfoliation of the ashes, in which the ashes were moved towards the outlet side, which would be a direct

consequence of the structure of the honeycomb structural body, in particular of the range claimed for the surface roughness and would lead to the improvement in long term performance of the filter; the appellant argued that the ash exfoliation mechanism was completely novel and was neither mentioned nor hinted at in any of the cited prior art documents. In order to explain the underlying mechanism, a number of Figures were included in the grounds of appeal.

- 5.12 These considerations concern the effect resulting from the claimed range of surface roughness and the resulting mechanism of ash exfoliation. However, A1 already discloses the same range for the surface roughness such that the Board concludes that the underlying mechanism of exfoliation is the same.

6. *Auxiliary Requests*

- 6.1 Concerning the auxiliary requests 1 and 2, the amendments therein do not overcome the above objections.
- 6.2 The addition of the term "to exfoliate ashes" to claim 1 in auxiliary request 1 is not directed at or suitable to overcome the above objections under Articles 84 EPC as it does not clarify the conditions of use; it is not directed at or suitable to overcome the above objections under Article 123(2) EPC as there is no clear and unambiguous disclosure justifying the replacement of the term "the particulates" by the word "soot"; and it is not directed at or suitable to overcome the above objections under Article 56 EPC as the assessment on inventive step would not be different. Additionally, the amendment would *prima facie* lead to a further objection concerning lack of

clarity (Article 84 EPC) with regard to the meaning of "to exfoliate".

6.3 Claim 1 of auxiliary request 2 is amended to limit the porosity of the porous ceramic members to 42% or 50%. Equally this amendment is not directed at and suitable for overcoming the objections under Article 84 EPC and Article 123(2) EPC set out above. No surprising or non-obvious advantage of these defined porosities is disclosed within the general range of from 20 to 80% either. Therefore, the assessment on inventive step (Article 56 EPC) would not differ from the one given for the main request above.

6.4 Therefore, the above findings apply equally to claim 1 of each of these requests. No further arguments were put forward by the appellant in support of these requests. The Board thus finds that these requests are also not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



B. Atienza Vivancos

M. Harrison

Decision electronically authenticated