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Datasheet for the decision of 19 January 2015

Case Number: T 0309/11 - 3.3.05

Application Number: 04025971.5

Publication Number: 1508356

IPC: B01D39/20, B01D46/24

Language of the proceedings: EN

Title of invention:
Honeycomb filter and ceramic filter assembly

Patent Proprietor:
IBIDEN CO., LTD.

Opponents:
SAINT-GOBAIN CENTRE DE RECHERCHES ET D'ETUDES EUROPEEN
THE DOW CHEMICAL COMPANY

Headword:
Crack formation/IBIDEN

Relevant legal provisions:
RPBA Art. 13(1), 13(3)
EPC Art. 56

Keyword:
Late-filed auxiliary request - admitted (yes)
Late-filed evidence - admitted (yes)
Inventive step - main request (no) - auxiliary request (no)

Decisions cited:

Catchword:

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Case Number: T 0309/11 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 19 January 2015

Appellant: (Patent Proprietor)	IBIDEN CO., LTD. 1, Kanda-cho 2-chome Ogaki-shi, Gifu-ken 503-8604 (JP)
Representative:	Hager, Thomas Johannes Hoefer & Partner Patentanwälte Pilgersheimer Strasse 20 81543 München (DE)
Respondent 1: (Opponent 1)	SAINT-GOBAIN CENTRE DE RECHERCHES ET D'ETUDES EUROPEEN "Les Miroirs" - 18, Avenue d'Alsace 92400 COURBEVOIE (FR)
Representative:	Lucas, Francois Saint-Gobain Recherche 39, quai Lucien Lefranc B.P. 135 93303 Aubervilliers Cedex (FR)
Respondent 2: (Opponent 2)	THE DOW CHEMICAL COMPANY 2030 Dow Center, Abbott Road Midland, Michigan 48640 (US)
Representative:	Beck Greener Fulwood House 12 Fulwood Place London WC1V 6HR (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 29 November 2010 revoking European patent No. 1508356 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	G. Raths
Members:	A. Haderlein
	M. Blasi

Summary of Facts and Submissions

I. The present appeal lies from the decision of the opposition division to revoke European patent EP 1 508 356. The patent in suit concerns a honeycomb filter and ceramic filter assembly.

II. The opposition division found in particular that claim 1 of the main request underlying the impugned decision did not comply with the requirement of inventive step in view of

D1: EP-A-0816065 A1 and
D5: Study of SiC Application to Diesel Particulate Filter (Part 2): Engine Test Results, SAE Technical Paper Series 930361, 1993.

III. The proprietor of the patent (appellant) filed an appeal against the decision of the opposition division. With the statement of grounds of appeal, it filed a main request, corresponding to the main request on which the impugned decision was based, and an auxiliary request labelled "auxiliary request 1".

IV. In its reply to the statement of grounds of appeal, opponent 1 (respondent 1) requested the dismissal of the appeal.

V. In its reply to the statement of grounds of appeal, opponent 2 (respondent 2) stated that, in view of the requests filed by the appellant, it did not wish to make a substantive reply to the statement of grounds of appeal.

VI. On 13 March 2012, respondent 1 withdrew its opposition.

VII. In a communication dated 16 October 2014, the board conveyed its preliminary opinion to the parties.

VIII. Under cover of its letter dated 19 December 2014, the appellant filed a new auxiliary request labelled "Auxiliary Request 1". It also filed the following document:

D17: Sheet E ("Water throwing test (Summary)")

IX. On 12 January 2015, respondent 2 informed the board that it would not attend the oral proceedings to which the parties had been summoned.

Oral proceedings took place on 19 January 2015 in the presence of the appellant.

X. Claim 1 of the main requestand of the auxiliary request labelled "Auxiliary Request 1" reads as follows (amendments with respect to the main request being underlined or struck through):

Main request

"1. An integral honeycomb filter assembly (49) produced by adhering with a ceramic seal layer (15) outer surfaces of a plurality of elongated honeycomb filters (F100), each of which is formed from a sintered porous ceramic body made of silicon carbide, the elongated honeycomb filter being characterized in that:

said seal layer (15) includes at least inorganic fibers, an inorganic binder, an organic binder and inorganic particles, and is formed from an elastic material obtained by bonding the inorganic fibers and inorganic particles, which three-dimensionally intersect one another, with the inorganic binder and

the organic binder;

a ratio L/S between a filter length L in a flow direction of a processed fluid and a filter cross-section S in a direction perpendicular to the flow direction is 0.15mm/mm^2 to 0.40mm/mm^2, the filter length L is 140mm to 200mm and the filter cross-section S is 600 to 2000mm^2."

Auxiliary request

"1. An integral honeycomb filter assembly (49) produced by adhering with a ceramic seal layer (15) outer surfaces of a plurality of elongated honeycomb filters (F100), each of which is formed from a sintered porous ceramic body made of silicon carbide, the elongated honeycomb filter being characterized in that:

said seal layer (15) includes at least inorganic fibers, an inorganic binder, an organic binder and inorganic particles, and is formed from an elastic material obtained by bonding the inorganic fibers and inorganic particles, which three-dimensionally intersect one another, with the inorganic binder and the organic binder;

a ratio L/S between a filter length L in a flow direction of a processed fluid and a filter cross-section S in a direction perpendicular to the flow direction is 0.15mm/mm^2 ~~to 0.40mm/mm^2~~, the filter length L is 167mm, the filter cross-section S is 1,089mm^2, the height W of the filter is 33mm and the width W2 of the filter is 33mm."

XI. The relevant arguments of the appellant are summarised as follows:

D1 was the closest prior art. D1 did not disclose the L/S ratio as required in claim 1 of the main request.

The test carried out according to document D17 showed that it was credible that the L/S ratio had an effect on the crack resistance of the SiC honeycomb filter. In particular, sample B with an L/S ratio of 0.138 was representative for the filter of D1 whereas sample A with an L/S ratio of 0.16 was representative for the filters according to claim 1 of the main request.

The conditions used in D17, i.e. the "water throwing test", were more severe than those used in the patent in suit, but were suitable for verifying the possibility of the formation of cracks under normal operating conditions for the filter. The patent taught that a homogenous temperature distribution with a maximum temperature difference of 5°C, as disclosed in paragraph [0085] of the patent in suit, would ensure that the formation of cracks was avoided.

The problem to be solved was therefore to provide a filter assembly which was highly efficient in its filtering performance and in which the formation of cracks was prevented. D5 did not give any hint of how to solve the problem posed. In particular, D5 related to a filter assembly comprising filter segments, but the sealing material used therein did not have an adhering function. Each of the filter segments of the filter of D5 was independently contractible and expandable and heat transfer was hindered by the sealing material provided around each segment. For this reason, thermal stresses due to the expansion or contraction of the filter segments did not occur in D5. D5 therefore could not contribute to the solution of the problem of preventing the formation of cracks in the filter assembly of D1. In order to arrive at a filter falling within the scope of claim 1 of the main request the skilled person either would have to

increase the length by 9% or decrease the cross-section by 5%. There was, however, no motivation in the prior art either to increase the length or decrease the cross-section. Furthermore, the skilled person would neither have increased the filter length nor decreased the cross-section since these two options would have worsened the homogeneity of the temperature distribution, which was contradictory to the object of D1. Finally, the skilled person would have been aware that the decrease in the cross-sectional area would lead to a loss of available filter surface, whereas the increase in filter length would lead to an increase in undesired pressure loss.

Thus, the requirements of inventive step were met for the subject-matter of claim 1 of the main request. The same considerations applied to the subject-matter of claim 1 of the auxiliary request. Moreover, it was a surprising effect that an increase in the length of the filter of sample B in D17, i.e. the filter representing D1, led to a filter which did not form cracks when subjected to the "water throwing test".

The basis for claim 1 of the auxiliary request was paragraph [0134] of the parent application and of the application as filed.

XII. The arguments of respondent 1 (submitted before it withdrew its opposition) are summarised as follows:

The subject-matter of claim 1 of the main request extended beyond the content of the parent application and of the application as filed.

D5 was the closest prior art. D5 also disclosed embodiments using SiC comparable to those described in

the examples of the patent in suit. With respect to these embodiments D5 taught that it was necessary to increase the thermal conductivity of the sealing material. The sealing material needed to be chosen such that the formation of cracks due to the high thermal conductivity of SiC could be avoided and, in particular, such that heat diffusion from the central segments towards the peripheral segments was improved. D5 disclosed all the features of claim 1 except for the specific composition of the sealing material. The skilled person would have chosen the sealing material of D1 when trying to improve the performance of the filter D5, and in particular when trying to improve the temperature distribution thereof.

Even if one started from D1 as the closest prior art, the skilled person would have applied the teachings of D5 and would have produced filters having a ratio L/S of 0.17. Therefore, the skilled person would have tried to use L/S values close to the one of D1, i.e. 0.14. Moreover, the filters according to claim 1 of the main request did not show any improvement over those known from D1. This was evidenced by the examples of the patent in suit. Examples 4.2 to 4.6 were not covered by claim 1 of the main request but were said in paragraph [0091] of the patent in suit to result in no formation of cracks.

The subject-matter of claim 1 of the main request therefore did not comply with the requirement of inventive step.

XIII. The arguments of respondent 2 are summarised as follows:

The documents and the auxiliary request submitted with

the appellant's letter dated 19 December 2014 should not be admitted into the proceedings since they were filed after filing of the statement setting out the grounds of appeal and no grounds were put forward as to why these documents and the auxiliary request could not have been submitted with that statement.

XIV. The appellant requested that the decision under appeal be set aside and that the European patent be maintained in amended form on the basis of the claims of the main request filed with the statement setting out the grounds of appeal or, alternatively, on the basis of the claims of the auxiliary request filed with the letter dated 19 December 2014.

Reasons for the Decision

1. Admittance of D17 and of the appellant's auxiliary request

1.1 The evidence D17 and the auxiliary request were filed on 19 December 2014, i.e. after the oral proceedings had been arranged. Hence, it was within the discretion of the board whether to admit them into the proceedings (Article 13(1),(3) RPBA).

1.2 The auxiliary request was filed in reaction to the preliminary opinion set out in the communication, in which the board expressed its concerns with regard to inventive step of the main request. Likewise, D17 was filed in order to overcome the concerns of the board.

2. For the above reasons, and because the amendments to the appellant's case did not raise issues which the board or respondent 2 could not reasonably have

expected to deal with without adjournment of the oral proceedings, the board exercised its discretionary power under Article 13(1),(3) RPBA and admitted the auxiliary request and document D17 into the proceedings.

3. Main request and auxiliary request - Article 123(2), (3) EPC

Since the appeal fails for other reasons, there is no need to deal with Article 123(2),(3) EPC.

4. Auxiliary request - inventive step

4.1 Preliminary remark

Since the subject-matter of claim 1 of the auxiliary request does not involve an inventive step for the reasons set out below, and claim 1 of the main request encompasses the subject-matter of claim 1 (i.e. the honeycomb filter) of the auxiliary request, the board deems it appropriate to deal with the auxiliary request before addressing the main request.

4.2 The invention concerns a honeycomb filter.

4.3 Such a honeycomb filter was known from D1, which the appellant took as the starting point for assessing inventive step. Respondent 1 took D5 as the starting point for assessing inventive step.

The board considers D1 to be the closest prior art since it discloses, as conceded by the appellant, all the features of claim 1 of the auxiliary request except for the L/S ratio and the filter length L. D1 discloses (see page 5, lines 55 to 58 and Example 1 on page 6) an

integral honeycomb filter made of silicon carbide having all the features of claim 1 of the auxiliary request except that the L/S ratio is 0.14 mm/mm^2 (150 mm divided by 33 mm x 33 mm) and L is 150 mm.

D5 discloses (see page 126, top of the right-hand column) a filter having an L/S ratio of 0.14 mm/mm^2, i.e. below the L/S ratio of claim 1 of the auxiliary request, and a filter length of 150 mm, i.e. below the filter length required in claim 1 of the auxiliary request. Moreover, D5 does not disclose the sealing material of claim 1 of the auxiliary request. Thus, D1 has more features in common with the filter of claim 1 of the auxiliary request than D5.

For these reasons, the board considers D1 to be the closest prior art.

4.4 According to the patent in suit (paragraphs 0017 to 0020), the problem to be solved was (1) to improve "exhaust gas processing efficiency", (2) to improve the strength of the filter, (3) to prevent fluid leakage from the peripheral surface, and to provide a filter having (4) "small pressure loss" and (5) "superior mechanical strength".

4.5 As a solution to said problem, the patent in suit proposes an integral honeycomb filter according to claim 1 of the auxiliary request characterised by an L/S ratio of 0.15 mm/mm^2 and a filter length L of 167 mm.

4.6 As to the success of the solution, it needs to be determined whether the above problem has been solved.

4.6.1 Throughout the appeal proceedings, the appellant primarily relied upon solving the problem of mechanical

strength (5) due to improved temperature distribution and thus decreased thermal stresses (see in particular the statement of the grounds of appeal, page 3, third paragraph; and the appellant's letter dated 19 December 2014, section "2. Inventiveness of the main request").

There are no data or indication in the patent specification that the claimed filter would improve an (unspecified) "exhaust gas processing efficiency" (1), prevent leakage from the peripheral surface (3) and decrease the pressure loss (4) over the filter known from D1.

The board thus concludes that it is not credible that the proposed solution would lead to improved "exhaust gas processing efficiency" (1), leakage prevention (3) and a decrease in pressure loss (4).

4.6.2 As to the improvement of the (mechanical) strength of the filter (2), i.e. improved resistance to crack formation, the appellant relied upon comparative tests according to the "water throwing test" shown in D17.

First of all, the board notes that in the patent in suit crack formation was examined after the filter was supplied with exhaust gas (cf. paragraph [0083]). The observed maximum temperature difference was up to 10°C (see paragraph 0091) in the examples according to the invention, whereas in the comparative examples the observed maximum temperature difference was up to 30°C (see paragraph 0093). Conversely, in the "water throwing test" used in D17 much harsher conditions were applied, i.e. heating at 200°C followed by sudden cooling due to immersion in water at a temperature of 14 to 15°C. So, the maximum temperature differences

created in D17 were about 185°C.

On the one hand, the board can accept the appellant's view that if a filter can resist such harsh conditions and no cracks are formed, such a filter would also resist the testing conditions applied in the patent in suit. On the other hand, one cannot conclude that a filter which shows formation of cracks when tested according to the "water throwing test" would also show formation of cracks when tested under the conditions used in the patent in suit.

The board notes that while sample B in D17 indeed appears to have the same dimensions as the filter of D1, i.e. 33 mm x 33 mm x 150 mm, sample A has a square cross-section of 35 mm. The cross-section of the filter according to claim 1 of the auxiliary request, however, is the same as the one of D1, i.e. 33 mm x 33 mm. Thus, sample A in D17 is not representative for the filter according to claim 1 of the auxiliary request.

Moreover, the board observes that, compared with sample B, sample A has not only an increased length but its cross-section is also increased. It appears from the photographs of the samples after the "water throwing test" that a crack was formed in a plane perpendicular to the axis of the filter in sample B, whereas in sample A no crack formation was observed. A crack in a plane perpendicular to the axis of the filter, however, is an indication of mechanical stress in a direction parallel to the axis of the filter. Increasing the length of the filter according to sample B while maintaining its cross-sectional dimensions would thus lead to a filter having an even less uniform temperature distribution along its axis when heated to 200°C and then thrown into water at 15°C.

Such a filter would hence be even more prone to crack formation. It is thus not credible that increasing the length of the filter in D1 from 150 to 167 mm and, thus, increasing the L/S ratio from 0.14 to 0.15 mm/mm^2, would result in a filter that would not show formation of cracks when tested according to the "water throwing test".

The board is therefore not convinced that, as argued by the appellant, there was a surprising effect and that an increase in the length of the filter according to D1 would lead to a filter which would resist to crack formation when subjected to the "water throwing test". There is no evidence on file that would support that such a surprising effect actually occurs. As stated above, sample A fails to prove such effect since, apart from an increase in the length L, the filter of sample A has also an increased cross-sectional area.

For these reasons, the board concludes that the mechanical strength of the filter according to claim 1 of the auxiliary request is not improved over the filter known from D1.

4.7 Therefore, the problem to be solved has to be reformulated as the provision of an alternative filter.

4.8 It remains to be decided whether the proposed solution was obvious in view of the cited prior art.

(a) The board is of the view that adjusting the dimensions of a honeycomb filter was within the realm of the normal design procedure of the skilled person in the field of exhaust gas filters. The skilled person would routinely adjust the dimensions of such filters in order to comply with the specifications for their

application, such as the spatial constraints, the gas load, the required filtration performance and others. The skilled person would thus have increased the filter length from 150 to 167 mm in order to increase the available filtration surface while complying with, for instance, the spatial constraint of maintaining the cross-sectional area.

(b) According to the appellant, in order to increase the available filtration surface the skilled person would rather have increased the cross-sectional area since he would know that an increase in the filter's length would lead to an increase in pressure drop.

The board is not convinced by this argument since, as stated above, the skilled person would still have increased the filter length if he or she needed to do so, for example, if the spatial constraints were such that the cross-sectional area could not be increased.

(c) According to another argument of the appellant, making the filter of D1 longer would result in lowering the homogeneity of the temperature distribution. Since the object of D1 was a homogeneous temperature distribution, the skilled person would thus not have made the filter longer.

The board is not convinced by this argument. Of course, the skilled person would be aware that making the filter longer leads to a less homogeneous temperature distribution. But the skilled person would also be aware that the filter design entails a trade-off between a number of parameters, including the temperature distribution and the available filtration area. Thus, the skilled person would at least have tried to make the filter as long as 167 mm.

The board thus concludes that the subject-matter of claim 1 of the auxiliary request is obvious in view of the prior art.

The requirement of inventive step is not met (Article 56 EPC).

5. Main request - inventive step

5.1 As stated *supra* at 4.1, claim 1 of the main request encompasses the honeycomb filter according to claim 1 of the auxiliary request. As a matter of fact, the L/S ratio of 0.15 mm/mm^2 of claim 1 of the auxiliary request is encompassed by the range of 0.15 to 0.40 mm/mm^2 of claim 1 of the main request. Likewise, the length L of 167 mm of claim 1 of the auxiliary request is encompassed by the range of 140 to 200 mm of claim 1 of the main request.

5.2 It follows that the subject-matter of claim 1 of the main request does not involve an inventive step for the same reasons as the subject-matter of claim 1 of the auxiliary request (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated