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Datasheet for the decision of 19 January 2015

Case Number: T 0333/11 - 3.3.05

Application Number: 04025970.7

Publication Number: 1516659

IPC: B01D39/20, F01N3/027, C04B38/00

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SAINT-GOBAIN CENTRE DE RECHERCHES ET D'ETUDES EUROPEEN (opposition withdrawn)
THE DOW CHEMICAL COMPANY

Headword:
Smoothing layer/IBIDEN

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

Keyword:
Late-filed requests - admitted (yes)
inventive step (main request and auxiliary request): no - obvious alternative

Decisions cited:

Catchword:

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Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0333/11 - 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Respondent 1: (Opponent 1 (opposition withdrawn))	SAINT-GOBAIN CENTRE DE RECHERCHES ET D'ETUDES EUROPEEN "Les Miroirs" - 18, Avenue d'Alsace 92400 COURBEVOIE (FR)
Representative:	Teyssedre, Laurent 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. 1516659 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 1 516 659. The patent in suit concerns a honeycomb filter and ceramic filter assembly.

The opposition division found in particular that claim 1 of auxiliary request 2 underlying the impugned decision did not meet the requirement of inventive step in view of *inter alia*

D10: Strength and Thermal Shock Resistance of Segmented Wall-Flow Diesel Filters, SAE Technical Paper Series 860008, 1986.

The following documents were also cited in the course of the proceedings before the opposition division:

D1: EP 0 816 065 A1
D18: US 5 629 067
D21B: Figure showing the effects of a smoothing layer
D21C: Figure showing the effects of crack formation
D24: Tests with smoothing layer.

II. The patent proprietor (appellant) filed notice of appeal against the opposition division's decision. With the statement of grounds of appeal it filed a single request labelled "Main request".

III. In its reply to the statement of grounds of appeal, opponent 1 (respondent 1) requested that the appeal be dismissed.

IV. In its reply to the statement of grounds of appeal, opponent 2 (respondent 2) stated that, in view of the

request filed by the appellant, it did not wish to make a substantive reply to the statement of grounds of appeal.

V. Respondent 1 withdrew its opposition by its letter dated 13 March 2012.

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

VII. Under cover of its letter dated 19 December 2014, the appellant filed a new main request and a new auxiliary request labelled "Auxiliary Request 1". It also filed several documents to support its view that D1 was the closest prior art.

VIII. Oral proceedings took place on 19 January 2015 in the presence of the appellant only. Respondent 2 had informed the board that it would not attend.

IX. Claim 1 of the main request and of the auxiliary request labelled "Auxiliary Request 1" reads as follows (amendments with respect to the main request being underlined):

Main request

"1. An integral ceramic filter assembly (39) produced by adhering with a ceramic seal layer (15) outer surfaces of a plurality of filters (F1), each of which is formed from a sintered porous silicon carbide body, characterized in that:

the assembly (39) as a whole has a generally circular cross-section or generally oval cross-section, and comprises cell walls partially exposed from the outer

surface to form pits defined by ridges and valleys extending in the axial direction of the assembly (39) and a ceramic smoothing layer (16) that is applied to the outer surface of the assembly (39), and fills said pits substantially completely, wherein

the seal layer (15) is formed from 10wt% to 70wt% of silica-alumina ceramic fiber as a solid, 1wt% to 30wt% of silica sol, 0.1wt% to 5.0wt% of carboxymethyl cellulose, and 3wt% to 80wt% of silicon carbide powder."

Auxiliary request

"1. An integral ceramic filter assembly (39) produced by adhering with a ceramic seal layer (15) outer surfaces of a plurality of filters (F1), each of which is formed from a sintered porous silicon carbide body, characterized in that:

the assembly (39) as a whole has a generally circular cross-section or generally oval cross-section, and comprises cell walls partially exposed from the outer surface to form pits defined by ridges and valleys extending in the axial direction of the assembly (39) and a ceramic smoothing layer (16) that is applied to the outer surface of the assembly (39), and fills said pits substantially completely, wherein

the seal layer (15) is formed from 10wt% to 70wt% of silica-alumina ceramic fiber as a solid, 1wt% to 30wt% of silica sol, 0.1wt% to 5.0wt% of carboxymethyl cellulose, and 3wt% to 80wt% of silicon carbide powder, and wherein

the smoothing layer (16) is made from the same material

as the seal layer (15)."

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

Admissibility of the requests

The main and auxiliary requests were filed as a direct response to the communication of the board and were therefore admissible.

Inventive step

D10 could not be regarded as closest prior art. D1 was more suitable as closest prior art. D1 already solved the problem of providing a filter assembly having excellent performance and preventing crack formation and leakage.

D1 did not disclose a filter assembly produced by adhering with a ceramic seal layer outer surfaces of a plurality of filters, each of which was formed from a sintered porous silicon carbide body, the assembly as a whole having a generally circular cross-section or a generally oval cross-section formed by a cutting process and comprising a ceramic smoothing layer applied to the outer surface of the assembly, filling pits present at the outer surface of the filter assembly and extending in an axial direction of the filter assembly. In D1 the surface of the filter was already smooth. The claimed filter assembly had the surprising effect that the pits acted as an anchor for the smoothing layer, thus more effectively preventing the formation of cracks. This was evidenced by D24. The filter assembly according to claim 1 of the main request solved the problems of preventing leakage,

increasing heat resistance and thermal conductivity and avoiding cracks in the boundary portion of the smoothing layer and the seal layer as stated in paragraph 0090 of the patent in suit. In D1, the problem of preventing fluid leakage was solved by wrapping a mat around the filter.

The subject-matter of claim 1 differed from the filter of D1 by the pits and valleys substantially filled by a smoothing layer and by the circular or oval cross-section.

D1 could not give any hint to solve the problem of cracks formed in the boundary portion between the smoothing layer and the seal layer, as it disclosed a filter formed by adhering preshaped filters using a sealing material. D1 was also silent about the efficiency of crack prevention evidenced by D24. The skilled person would also not have cut an outer surface of a silicon carbide filter which was approximately as hard as diamond. D18 could not give any hint to the proposed solution even though it taught that the smoothing layer did not peel off, since it disclosed only a monolithic filter made of cordierite, a material which was substantially different from silicon carbide.

The same reasoning applied to claim 1 of the auxiliary request.

XI. The arguments of respondent 1, as far as they are still applicable to the main request and to the auxiliary request, may be summarised as follows:

Amendments

The amendments went beyond the content of the

application as filed.

Inventive step

D10 was the closest prior art. It did not disclose that the filter was made of silicon carbide and that the smoothing layer was applied to the outer surface of the assembly, filling the pits substantially completely.

XII. The relevant arguments of respondent 2 may be summarised as follows:

The requests 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 requests could not have been submitted earlier.

XIII. 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, or alternatively on the basis of the claims of the auxiliary request, both filed with the letter dated 19 December 2014.

Reasons for the Decision

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

1.1 The main request and the auxiliary request were filed 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 main request and the auxiliary request were 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 then pending claim request.

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 main request and the auxiliary request 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 an integral ceramic filter assembly.

4.3 Such a filter assembly was known from D1, which the appellant took as the starting point for assessing inventive step. Respondent 1 took D10 as the starting point for assessing inventive step.

The board considers D1 to be the closest prior art. D10 discloses neither a filter made of silicon carbide nor the composition of the sealing layer as required by claim 1. In contrast, D1 discloses an integral ceramic filter assembly produced by adhering with a ceramic seal layer outer surfaces of a plurality of filters (see claim 1 of D1), each of which is formed from a sintered porous silicon carbide body (see Example 1 on page 6). The seal layer is formed from 23.3 wt% of silica-alumina ceramic fiber as a solid, 7wt% of silica sol, 0.5wt% of carboxymethyl cellulose, and 30.2wt% of silicon carbide powder (page 6, lines 22 to 24).

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".

According to the appellant's submissions, the filter assembly according to claim 1 also solved the problems of (6) increasing heat resistance and thermal conductivity and (7) avoiding cracks in the boundary portion of the smoothing layer and the seal layer as stated in paragraph 0090 of the patent in suit.

4.5 As a solution to said problem, the patent in suit proposes an integral ceramic filter according to claim 1 of the auxiliary request, characterised in that

the assembly as a whole has a generally circular cross-section or a generally oval cross-section, and comprises cell walls partially exposed from the outer surface to form pits defined by ridges and valleys extending in the axial direction of the assembly and a ceramic smoothing layer that is applied to the outer surface of the assembly, and fills said pits substantially completely, and wherein the smoothing layer is made from the same material as the seal layer.

4.6 As to the success of the solution, it needs to be determined whether the problem defined at 4.4 *supra* has been solved.

4.6.1 There is no data or indication in the patent specification, nor has such data been submitted in the course of the proceedings, showing that the claimed filter would
(1) improve an (unspecified) "exhaust gas processing efficiency",
(3) prevent fluid leakage from the peripheral surface, and
(4) have "small pressure loss" compared to the filter known from D1.

The board recalls that (1), the improvement of efficiency, has to be proved in comparison with document D1. Since, as already stated, there is no evidence in this respect, this alleged improvement cannot be taken into account.

In this context, the board notes that the appellant submitted that D1 already solved the problem of providing a filter assembly having excellent performance and preventing leakage. In particular, the problem of preventing fluid leakage was solved by

wrapping a mat around the filter of D1.

As to (3), the prevention of fluid leakage is, as confirmed by the appellant, already achieved in D1. It follows that this effect cannot be retained in formulating the technical problem underlying the patent in suit in the light of D1.

As to (4), "the small pressure loss", the board also notes that this effect was originally disclosed only in conjunction with specific characteristics of the porosity and the pores of the filter (see published application, in particular paragraphs 0154 and 0156, Examples 5-1 to 5-3, and Table 1) and that the porosity and the characteristics of the pores are not specified in claim 1. As a consequence this effect cannot be retained in formulating the technical problem underlying the patent in suit in the light of D1.

4.6.2 As to (6), the increase in heat resistance and thermal conductivity, there is no evidence either that would show that this is the case. Since the filter material of the porous filter according to claim 1 is the same as that of D1, i.e. silicon carbide, it is not credible that the proposed solution increases heat resistance and thermal conductivity.

4.6.3 As to (2), improving the strength of the filter, and (5), providing a filter having "superior mechanical strength", the board is not convinced that these effects are achieved in view of D1.

(a) There is no evidence that would show that (2) (mechanical) strength is improved over the filter known from D1. In the absence of such evidence, it is not credible that the proposed solution leads to improved

(mechanical) strength of the filter of D1.

(b) As to (5), the strength in terms of preventing crack formation in the boundary portions of the smoothing layer and the seal layer, the board comments as follows:

Throughout the written proceedings and at the oral proceedings, the appellant primarily relied upon the problem of avoiding cracks in the boundary portion of the smoothing layer and the seal layer (see the statement setting out the grounds of appeal, page 2, fourth paragraph, last paragraph; the appellant's letter of 18 December 2012, page 4, last paragraph, to page 6, first paragraph; and the appellant's letter of 19 December 2014, page 3, last paragraph, to page 4, second paragraph).

The board accepts that, in particular in view of the documents D21B, D21C, and D24, it is credible that no cracks are formed in the boundary portion of the smoothing layer and the seal layer.

As correctly pointed out by the appellant, the filter of D1 does not comprise a smoothing layer, and therefore the problem of crack formation in the boundary portion of the smoothing layer and the seal layer does not occur in the filter according to D1. In fact, crack formation in the boundary portion of the smoothing layer and the seal layer appears to occur if the pits are not completely filled by the smoothing layer (see D24, page 5, "with ridges and valleys"; and D21C). In the absence of a smoothing layer, however, such crack formation does indeed not occur. This effect cannot therefore be retained in formulating the

technical problem to be solved over D1.

4.6.4 For the above reasons, the problem to be solved needs to be reformulated and consists in the provision of an alternative honeycomb filter assembly.

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

4.7.1 D18 discloses a honeycomb filter which as a whole has a generally circular cross-section and comprises cell walls partially exposed from the outer surface to form pits defined by ridges and valleys extending in the axial direction of the filter (see in particular Fig. 3) and a ceramic smoothing layer that is applied to the outer surface of the filter and fills said pits completely (see in particular Fig. 4).

D18 teaches that the outer diameter and cylindricity of the filter can be controlled by such a structure (see column 6, lines 42 to 46). D18 also mentions further beneficial effects for such a structure, such as improved strength (see column 6, lines 27, 28, 44 and 45) and resistance to thermal shock (column 6, line 63). Also, according to D18 the smoothing layer is prevented from peeling-off due to the large contact area created by the ridges and valleys formed on the surface of the filter to which the smoothing layer is applied (see column 6, lines 47 to 52).

4.7.2 According to the appellant, the skilled person would not have cut an outer surface of a silicon carbide filter which was approximately as hard as diamond.

The board is not convinced by this argument. It was certainly possible to cut porous thin-walled filters

made of a composite comprising silicon carbide (cf. D1, page 6, lines 14 to 17) before the priority date of the patent in suit. In this context, the board observes that in D1 it is explicitly said that the silicon carbide filter disclosed therein is cut (see page 7, lines 7 and 29). Moreover, it should be noted that claim 1 of the auxiliary request does not specify how the ridges and valleys are formed. Furthermore, D18 teaches several ways of obtaining the ridges and valleys to be filled with the smoothing layer: apart from grinding the outer peripheral portion of the honeycomb body, the honeycomb body may also be formed by extrusion without an outer wall, with its outer peripheral portion shaped such that it comprises these ridges and valleys (see column 6, lines 5 to 13). Hence, the skilled person would not need to cut the honeycomb filter assembly of D1, but could also arrive at the required shape of the peripheral filter segments of the filter assembly by extruding them into such a shape.

4.7.3 According to another argument of the appellant, D18 could not give any hint to the proposed solution even though it taught that the smoothing layer did not peel off, since it disclosed only a monolithic filter made of cordierite, a material which was substantially different from silicon carbide.

The board does not find this argument convincing. There is nothing in D18 that would prevent the skilled person from applying its teaching to a filter assembly as disclosed in D1. It is also readily apparent to the skilled person that the concept of forming ridges and valleys and applying a smoothing layer to them is not limited to monolithic cordierite filters.

The board of course accepts that silicon carbide is substantially different from cordierite. However, when applying the teaching of D18 to the filter assembly of D1, the skilled person would look for an appropriate composition for the smoothing layer, knowing that the cordierite-based paste used in D18 (see Table 1) would not be suitable, due in particular to the difference between the thermal expansion coefficients of cordierite and silicon carbide. The skilled person, when applying the teaching of D18, would thus look for an appropriate composition for the smoothing layer. He would readily realise that the paste disclosed in D1, i.e. the silicon carbide-based paste used for the seal layer (cf. page 6, lines 18 to 25), worked well with the filter made of porous silicon carbide, and he would therefore at least have tried to use this paste for the smoothing layer. He would thus have arrived at a filter assembly according to claim 1 of the auxiliary request.

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

4.8 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 assembly according to claim 1 of the auxiliary request. Claim 1 of the main request in fact corresponds to claim 1 of the auxiliary request except that it does not contain the feature that the smoothing layer is made from the same material as the seal layer.

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