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Datasheet for the decision of 22 May 2014

Case Number: T 0667/11 - 3.3.05

Application Number: 03730306.2

Publication Number: 1497011

IPC: B01D46/00, B01D39/20

Language of the proceedings: EN

Title of invention:
FILTER ELEMENTS

Patent Proprietor:
Madison Filter 981 Limited
SUMITOMO HEAVY INDUSTRIES, LTD.

Opponent:
BWF Textil GmbH & Co. KG

Headword:
Catalyst filter/ MADISON FILTER 981 LTD

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - main request (yes)- bonus effect (no)- unexpected improvement shown

Decisions cited:
T 0231/97, T 0506/92

Catchword:

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Case Number: T 0667/11 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 22 May 2014

Appellant: (Patent Proprietor 1)	Madison Filter 981 Limited Knowsley Road Industrial Estate Haslingden Lancashire BB4 4EJ (GB)
Appellant: (Patent Proprietor 2)	SUMITOMO HEAVY INDUSTRIES, LTD. 2-1-1 Yato-Cho Nishitokyo City, Tokyo 188-8585 (JP)
Representative:	Wilson Gunn Blackfriars House The Parsonage 5th Floor Manchester M3 2JA (GB)
Respondent: (Opponent)	BWF Textil GmbH & Co. KG Bahnhofstr. 20 89362 Offingen (DE)
Representative:	Bosch, Matthias Bosch Jehle Patentanwaltsgesellschaft mbH Flüggenstrasse 13 80639 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 12 January 2011 concerning maintenance of the European Patent No. 1497011 in amended form.**

Composition of the Board:

Chairman	G. Raths
Members:	H. Engl
	P. Guntz

Summary of Facts and Submissions

I. The European patent EP-B-1 497 011 relates to a filter element comprising a composite homogenous structure of inorganic fibres and a reactant.

II. The patent was opposed on the grounds of insufficient disclosure and lack of inventive step (Article 100(a) and (b) EPC).

The documents cited during opposition proceedings included the following:

D1: Heinz Cramer and Ruedi Frey, UmweltMagazin Jan./Feb. 2001, pages 48 and 49

D2: DE-A-40 24 804

D3: Ruedi Frey et al., *"Einsatz von Keramikfiltern in Müllverbrennungsanlagen"*, Sonderdruck from Umwelt 11/12 (1998), pages 29 and 30

D4: Brouchure *"Pyrotex KWE 85"*, BWF Textil GmbH, D-89362, Offingen, DE, dated 09/99

D5: Ruedi Frey and Heinz Cramer, "*Einsatz von Keramikfiltern in Abfallverbrennungsanlagen: der Von Roll 4D-Filter als Kombination von Katalysator und Filter mit Trockensorption*", VonRoll Inova

D6: Holger Blaha *"Einsatz von Keramikfiltern in Abfallverbrennungsanlagen: Der Von Roll 4D-Filter als Kombination von Katalysator und Filter mit Trockensorption"*, brouchure issued by Von Roll Inova, Offingen, DE, undated

D7: DE-T2-689 09 376

D12: EP-A-0 648 535 (cited in the description)

III. The opposition division and the parties agreed that D1 represented the closest prior art with respect to the subject-matter of the claims of the main request. Claim 1 differed from D1 in that the porosity of the claimed filter element was in the range of 70 to 90% (D1: 93%). The opposition division considered the experimental evidence on file as insufficient to demonstrate that the claimed improvements in contaminant removal and high gas throughput could be achieved with a filter element having the claimed porosity range. Therefore, the problem to be solved was the provision of a filter with an alternative porosity range. Selecting a lower porosity than in D1 was however obvious in view of D12 (cited in the patent in suit and disclosing a filter element having a porosity of 55%).

The subject-matter of the claims of the auxiliary request was considered to involve an inventive step, as none of the prior art documents suggested a method of manufacturing of a filter element made of ceramic fibres by an injection-molding process.

IV. By letter dated 22 March 2011, the patentees (henceforth: the appellants) lodged an appeal against the decision of the opposition division.

The statement of grounds of appeal, filed with letter dated 13 May 2011, was accompanied by new claims as an auxiliary request and by the following document:

D11: Clear Edge Filtration *"Comparison of Cerafil and BWF catalyst filter elements"*,

8 pages, including 2 drawings,
dated 12 May 2011

A further test report

D11a: FilTEq GmbH, *"Test Report"*, 4 pages,
dated 11 April 2014.

was submitted with letter dated 17 April 2014.

V. The respondent's arguments were received with letter dated 9 September 2011.

VI. The independent claims of the main request (claims as granted) read as follows:

"1. A filter element comprising a composite homogenous structure of inorganic fibres and reactant, the reactant being fixed into position with an even distribution throughout the filter element, characterised in that the reactant comprises a catalyst and the filter element has a low density distribution of fibres and reactant with a 70 to 80% porosity."

"17. A method of manufacture of a filter element comprising the steps of:
(a) dispersing ceramic fibres in water;
(b) adding a binder to the system;
(c) mixing;
(d) injection-moulding to provide a filter element of the desired shape; and
(e) leaving the filter element to dry, wherein the method further includes the step of dispersing a reactant throughout the body of the filter element, wherein the reactant comprises a catalyst and the filter element has a low density

distribution of fibres and reactant with a 70 to 80% porosity."

VII. The board issued a communication dated 22 April 2014 in preparation of the oral proceedings.

VIII. Oral proceedings took place on 22 May 2014.

The respondent requested that the experimental evidence filed by the patentees with letters dated 13 May 2011 and 17 April 2014 be rejected as late-filed and not relevant.

IX. The appellants essentially argued as follows:

The experimental evidence submitted with D11 and D11a demonstrated the unexpectedly superior performance of the inventive filter having 75.61% porosity in terms of cleaning energy requirement, compared with a catalyst-coated BWF filter media having a 87.83% porosity. The results showed that the conventional BWF filter of 87.83% porosity required 2.5 times more cleaning energy over its lifetime, compared with the Cerafil filter made in accordance with the invention required. As the filters of D1 had an even higher porosity of 93%, they would require even more cleaning energy than the comparative example. Thus claim 1 as granted involved an inventive step.

According to D11a, the BWF filter media (89.17% porosity) required 5.5 times more cleaning energy over its lifetime, compared with a Cerafil filter of 79.88% porosity.

The subject-matter of the claims of the auxiliary request distinguished the invention still further from

D1.

X. The respondent essentially argued as follows:

The claims of the first auxiliary request filed with the appellant's letter dated 13 May 2011 were identical with the claims of the auxiliary request 1, filed with letter dated 12 November 2010, which request was withdrawn during the oral proceedings before the opposition division. This request should therefore not be admitted into the appeal proceedings.

The respondent rejected the appellant's comparative data as not conclusive. It was, for example, not clear how the BWF product was obtained. Even if the claimed improvements were to be accepted, they were the result of routine optimisation and a mere bonus effect. Reference was made to T 506/92. It was in any case obvious in view of D1 and D12 to select a porosity in the entire range of 55% to lower than 93%.

XI. Requests

The appellants requested that the contested decision be set aside and the patent be maintained as granted (main request) or in the alternative, that the patent be maintained in amended form on the basis of the claims of the auxiliary request, filed with letter dated 13 May 2011.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. Admissibility of prior art and fresh evidence

1.1 The respondent requested that documents D11 and D11a are not admitted into proceedings because they were late-filed and irrelevant.

The board does not agree with the respondent's reasoning. Test report D11, filed with the statement of grounds of appeal, is a direct reaction to the contested decision. D11a was filed to address objections raised by the respondent against D11 (see letter of September 2011). Both test reports are relevant because they compare the filter element of the invention (having a porosity in the critical range of from 70 to 80%) with prior art filter elements having a porosity outside that range. Although D11a was filed only five weeks before the oral proceedings, the respondent was apparently able to present its comments on the data.

D11 and D11a are therefore admitted into the appeal proceedings.

1.2 In the absence of arguments suggesting otherwise, the board sees no reason to deviate from the first-instance decision admitting inter alia documents D4 and D5, but not D6, into the proceedings.

2. Inventive step (main request)

2.1 *The invention*

The patent in suit is concerned with a filter element for gas filtration and with a method of manufacturing

a filter element.

Claim 1 defines a filter element comprising a composite homogenous structure of inorganic fibres and a catalyst reactant, the reactant being fixed into position with an even distribution throughout the filter element. The filter element is characterised by a low density distribution of fibres and reactant with a 70 to 80% porosity.

2.2 *Closest prior art*

Document D1 is considered to represent the closest prior art.

Document D1 discloses a SCR (selective catalytic reduction) filter for filtering the waste gases of municipal waste incinerators. The filter substrate is made of 10 to 20 µm ceramic fibre filter manufactured by BWF. The filter simultaneously removes particulate matter and cleans the waste gas by reaction of the noxious contaminants, such as NO_x, SO_x, and dioxines with reactants, due to a nano-particulate catalyst system consisting of TiO_2 and V_2O_3 embedded in the filter. The filter has a pore volume of 93% before applying the catalyst (see page 48, left hand and middle column). It is periodically cleaned by pulse-jet cleaning (see page 49, left hand column).

A similar catalytic filter element based on the "Pyrotex KE 85" ceramic filter media manufactured by BWF Textil GmbH, Offingen, DE, is disclosed in D5.

2.3 *Problem*

According to the patent in suit, the problem consists

in providing an efficient dust filter that requires less frequent cleaning by reverse pulse-jet and thus less energy consumption for cleaning the filter (see columns 3, lines 18 to 19, and column 4, line 47 and lines 50 to 52).

2.4 *Solution*

As a solution to the above defined technical problem, the patent in suit proposes a filter element comprising a composite homogenous structure of inorganic fibres and catalyst reactant, characterised in that the filter element has porosity of from 70 to 80%, based on fibres and reactant.

2.5 *Success of the solution*

2.5.1 Experimental evidence

Test report D11a:

Cerafil (invention) and BWF (representing the prior art of D1) catalyst filter elements were manufactured using the impregnation process of the opposed patent. The filtration characteristics of the samples were determined using the VDI 3926 standard. It was not denied by the respondent that these tests are an accepted standard for comparison of filter media.

The porosity of the BWF catalyst impregnated filter element was 89.17%.

The porosity of the Cerafil Clear Edge catalyst impregnated filter element was 79.88%.

The VDI 3926 test characterizes the filter media at

constant conditions for comparative purposes. The filter media is placed in an environment analogous to an industrial application, facing a constant stream of dust laden gas. The filter media is assessed through an initial conditioning period of 30 cycles. Cleaning started when the pressure drop reached 1500 Pa. The cleaning cycle was triggered at 4000 Pa pressure drop. The samples recovered to a "residual pressure drop" and then the pressure drop once more increased towards the cleaning cycle trigger point of 4000 Pa as dust accumulates on its surface again. The period between cleaning cycles (cycle-time in seconds) is a measure of the energy consumption required for the cleaning of the filter media.

Results:

The cleaning cycle-time for the BWF catalyst impregnated filter sample representing the prior art (89.17% porosity) was 67 s, whereas it was 366 s for the Cerafil filter element representing the invention (79.88% porosity).

According to these results, the BWF media would require cleaning 5.5 times as often as the Cerafil filter element or, in terms of energy requirement, the BWF media would require 550% of the cleaning energy over its lifetime, compared with the Cerafil filter element.

In addition, the BWF filter element is prone to clogging, as can be inferred, in addition to the need for frequent cleaning, from the rapid build-up of residual pressure drop following conditioning cycle followed by 10,000 filter cycles. The final residual pressure drop of 2210 Pa is almost identical to that of the Cerafil element (2330 Pa) following the measurement

cycle. The Cerafil element was thus essentially stable in terms of residual pressure drop, whereas the pressure drop of the BWF element continued to increase, indicative of filter blocking/plugging.

Test report D11:

Two samples were investigated. The porosity of the BWF catalyst impregnated filter element was 87.83%.

The porosity of the Cerafil Topcat catalyst impregnated filter element was 75.61%.

The test procedure corresponded to the one described under point 3.5.1 above.

Results:

The cleaning cycle-time for the BWF catalyst sample representing the prior art (87.83% porosity) was 129 s, whereas it was for the Cerafil element representing the invention (75.61% porosity) 329 s.

Again, according to these data, the BWF media would require cleaning 2.5 times as often as the Cerafil filter element or, in terms of energy requirement, the BWF media would require 250% of the cleaning energy over its lifetime compared with the Cerafil filter element.

Pages 7 and 8 of D11 are graphical representations of the test data. The graph on page 8 (BWF sample) designated as "after ageing cleaning Dp 4000 Pa" indicates the rapid increase of pressure drop of the prior art filter over 100 seconds. In comparison, the

corresponding curve on page 7 (Cerafil sample) rises significantly more slowly during ca. 350 seconds.

Air filtration test:

The improved efficiency of the inventive filter was demonstrated by the test report filed with letter dated 12 November 2010. In the test, samples of a Cerafil Topcat filter (apparent porosity 76%) and a prior art (BWF) filter (apparent porosity 90%) were tested in accordance with British Standard BS3928 using a NaCl test aerosol. The efficiency of the sample in accordance with the invention was > 99%, whereas the prior art sample's efficiency was only between 83% and 91.7%.

2.5.2 Comments by the respondent and conclusion

The respondent argued that the experimental evidence discussed above was inconclusive, in particular because the materials of the samples (filter material, dimensions, type of catalyst) were not reported.

For the board, this argument is not convincing, because the purpose of the comparative tests was to demonstrate the effect of the different porosities of the filters on the cleaning times and the respondent did not provide evidence that the respective filters used in the test (Cerafil Topcat filter / BWF filter) showed significant differences apart from their respective porosity that would most likely influence the outcome of the test.

2.5.3 Therefore, in view of these experimental results, the board is satisfied that the above defined technical

problem has been successfully solved.

2.6 *Obviousness*

2.6.1 It remains to be decided whether the claimed solution is obvious having regard to the prior art.

2.6.2 The respondent argued that the skilled person, starting from D1, would routinely look for filters having a porosity lower than 93%, for instance in the claimed range of 70 to 80%. The appellants had failed to prove that the differences with respect to the closest prior art would have led to particular effects. It would be difficult, if not impossible, to provide filters having porosities after impregnation still higher than 93%. If there was a link between the differences with respect to the closest prior art and any beneficial effects, this would only imply a routine optimization. Therefore, normal optimization of the filter disclosed in D1 would lead to the claimed subject-matter. Any additional beneficial effect which was the result of this obvious routine optimization should be seen as a bonus effect that could not support the presence of an inventive step.

In the board's opinion and according to the case law, an unexpected bonus effect does not automatically confer inventiveness on an obvious solution (see T 231/97 of 21 March 2000; Reasons 5.7.5.2). In T 506/92 (of 3 August 1995; Reasons 2.6) the board stated that an additional effect achieved inevitably by the skilled person on the basis of an obvious measure without any effort on his part simply represented a bonus which could not substantiate inventive step, even if the effect was surprising.

In the present case, however, the respondent failed to show a reason why a routine optimization of the catalytic filter disclosed in D1, in view of the problem posed, should involve varying, and in particular significantly reducing, the filter porosity so as to make it fall within the claimed range. In the board's view, a number of other parameters would have been available for modifications. Therefore, the board cannot acknowledge the existence of a so-called "one-way street"-situation which would have led the skilled person inevitably towards the claimed invention.

2.6.3 In another line of argument, the respondent submitted that filters having porosities lower than 93% were known in the art. D12 disclosed a high-density ceramic honeycomb filter having a particulate reactant embedded within its pores. The open porosity of the said filter, before insertion of the reactant material, was 55%. Therefore, the whole range of porosities of from 55% to 93% (from D1) was a possible option to the skilled person.

The board does not find this argument convincing, for the following reasons. D12 does not disclose filters consisting of ceramic fibres, but monolithic honeycomb body made of ceramics, glass, glass-ceramics, cermets, metal oxides and combinations thereof, having open pores wherein the active material (reactant) is embedded. The porosity of the honeycomb body of at least 45% by volume, preferably about 45 % to 55% by volume, is defined as "that in the walls of the honeycomb, or wall porosity" (see page 3, lines 48 to 50; claim 1) before filling the open porosity with reactant. However, during contacting of the porous honeycomb structure with a slurry of the reactant, said open porosity is substantially completely filled such

that the resulting body, after drying, has a significantly reduced porosity or no porosity at all (see page 2, lines 54 and 55; page 3, lines 9 to 11; page 5, lines 43 and 44; page 6, lines 23 to 25 and 43 to 46).

The honeycomb body is suited as a device for use in catalyst and hydrocarbon adsorption applications (see page 2, lines 1 to 3), not as a particulate filter (due to its lack of open porosity). The skilled person would therefore not consider D12 as relevant for the problem posed in connection with the opposed patent.

D7 discloses a catalytic structure for removing ozone from an air stream. The body is a honeycomb structure ("Wabe") made of crimped (or corrugated or wavy) ceramic fibres and having, before impregnation, a porosity of 81 % (see page 6, example 1; page 8, example 5). The exact structure of the article, in particular how it is composed of the crimped fibres, is not clear. In any case, as the body in the shape of a "Wabe" (honeycomb) is afterwards impregnated with a slurry comprising a catalyst in an amount of 5%, based on the weight of the substrate, it must be assumed that the initial open porosity is substantially reduced and the resulting body has essentially no filtering ability. Therefore, D7 is not relevant for the instant invention, either.

2.7 In view of the above, the board is satisfied that the subject-matter of granted claim 1 meets the requirements of Article 56 EPC. The same applies to dependent product claims 2 to 16.

Regarding process claims 17 to 23 as granted, the respondent did not raise any objections in appeal

proceedings. Claim 17 relates to a method of manufacture of a filter element having a 70 to 80% porosity whereby the manufacturing steps comprise *inter alia* the dispersion of ceramic fibres in water. This process claim involves an inventive step for the same reasons as outlined under points 2.2 to 2.6.

2.8 As the main request is allowable, there is no need to consider the auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained as granted.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated