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**Datasheet for the decision  
of 25 January 2007**

**Case Number:** T 0818/02 - 3.3.05

**Application Number:** 97905712.2

**Publication Number:** 0881931

**IPC:** B01D 35/06

**Language of the proceedings:** EN

**Title of invention:**

Electrostatic fibrous filter web

**Applicant:**

MINNESOTA MINING AND MANUFACTURING COMPANY

**Headword:**

Filter web/MMM

**Relevant legal provisions:**

EPC Art. 123(2), 84, 56

**Keyword:**

"Inventive step: yes"

**Decisions cited:**

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**Catchword:**

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Case Number: T 0818/02 - 3.3.05

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.05  
of 25 January 2007

**Appellant:** MINNESOTA MINING AND MANUFACTURING COMPANY  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 20 February 2002  
refusing European application No. 97905712.2  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** M. Eberhard  
**Members:** B. Czech  
H. Preglau

## Summary of Facts and Submissions

I. The appeal is from the decision of the examining division refusing European patent application No. 97905712.2, which is based on the international PCT application published under the number WO 97/30771 and containing 29 claims.

II. The refusal of the application by the examining division was based on a set of 11 claims filed with letter dated 6 October 1998. The three independent claims 1, 2 and 5 of the said set have the following wording (amendments with respect to claims 1, 2 and 10 of the published PCT application highlighted by the board).

"1. An air filter comprising a frame and an electret fiber nonwoven filter media comprising at least one nonwoven filter web comprising **discrete individual entangled fibers, which web has a basis weight of from 10 to 400 grams/m<sup>2</sup>** at least some of **the individual fibres forming the non-woven filter web** are electrostatically charged electret fibers wherein the **nonwoven filter** web is joined to at least one reinforcement scrim by needle-punching, said reinforcement scrim having discrete open areas where the average open area has a cross-sectional area of at least 0.25 mm<sup>2</sup> and the reinforcement scrim has an overall pressure drop of less than **1.5** mm H<sub>2</sub>O at 98.4 meters/min, wherein said open areas extend from one face to the opposite face of the scrim in a non-tortuous path."

"2. A method for forming an electret nonwoven filter web comprising the steps of:

a) providing at least one nonwoven filter web **formed of discrete individual fibers which filter web has a basis weight of from 10 to 400 grams/m<sup>2</sup>**;

b) joining the at least one filter web to a reinforcement scrim said reinforcement scrim having discrete open areas where the average cross-sectional area in the plane of the filter of the open areas is at least 0.25 mm<sup>2</sup> and said scrim having an overall pressure drop of less than 1.5 mm H<sub>2</sub>O at 98.4 meters/min,;

c) needle punching the at least one filter web and reinforcement scrim to form a filter; and

d) providing at least some of the filter fibers of the filter web with electret charges."

"5. An electret fiber nonwoven filter media comprising at least one nonwoven filter web comprising **discrete individual** entangled fibers, at least some of which are electrostatically charged electret fibers, wherein the **at least one web has a basis weight of from 10 to 400 grams/m<sup>2</sup> and** is joined to at least one reinforcement scrim by needle-punching, said reinforcement scrim having discrete open areas where the average open area has a cross-sectional area of at least 0.25 mm<sup>2</sup> and the reinforcement scrim has an overall pressure drop of less than **1.5 mm** H<sub>2</sub>O at 98.4 meters/min, wherein said open areas extend from one face to the opposite face of the scrim in a non-tortuous path."

The examining division came to the conclusion that the subject-matter of these claims was obvious in view of the disclosure of document D2' (US-A-5 230 800), corresponding to document D2 (WO-A-93/16783) cited in

the Search Report, and the common knowledge and skill of a person working in the field of filtration, but also in view of combination of documents D2' and D1 (US-A-5 436 054).

- III. In its statement of grounds of appeal, the appellant contested the view of the examining division and argued that the claimed subject-matter was novel and inventive in view of D1, D2 and a combination thereof. It requested - as main request - that a patent be granted on the basis of the set of claims filed with letter dated 6 October 1998. It also filed further sets of claims as auxiliary requests.
- IV. In the annex to the summons to oral proceedings, the board raised an objection under Article 123(2) EPC, addressed the clarity of the claims, and indicated that the assessment of inventive step would depend on the conclusions that may be drawn from the test results reported in the application.
- V. With its last letter dated 21 December 2006, the appellant filed amended claims pages as new auxiliary requests 4 and 5.
- VI. During the oral proceedings which took place on 25 January 2007, the appellants filed a fresh set of amended claims as auxiliary request 1, replacing all the previously filed auxiliary requests.

Independent claims 1, 2 and 5 according to this last request differ from independent claims 1, 2 and 5 according to the main request in that in each of them the expression "discrete individual" is deleted.

Moreover, the phrase "**wherein the open areas extend directly from one face to the opposite face of the scrim in a non-tortuous path**" was appended at the end of part (b) of independent claim 2. Furthermore, the acronym "ECD" was replaced by the expression "**effective circular diameter**" in dependent claim 11.

VII. The essential arguments of the appellant can be summarised as follows:

The present invention was an improvement over the invention of D2' in that it provided filter media with all the benefits of D2' but having longer lifetimes, lower pressure drops and high filtration performances at high gaseous face velocities. Surprisingly, these improvements were obtained when joining the specified support scrim to the electret filter web by needle-punching. D2' and D1 did not address the issue of improving filter lifetime at high gas velocities and did not suggest the claimed combination of features. Moreover, the "film-split fibre fleeces" of D1 could not be considered as non-woven webs. The conclusion that the claimed subject-matter was obvious in view of D2' or a combination thereof with D1 appeared to be based on an ex post facto approach.

VIII. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims filed with letter dated 6 October 1998 (main request), or in the alternative on the basis of the claims submitted during the oral proceedings (auxiliary request 1).

## Reasons for the Decision

### *Main request*

1. The independent claims 1, 2 and 5 have been amended inter alia by the incorporation of the additional terms *discrete individual*, relating to the fibres of the "non-woven filter web" mentioned therein. However, as will appear from the following, there is no sufficient basis for this particular amendment in the PCT application (published as WO-A-97/30771).
  - 1.1 On the one hand, the appellant has confirmed during the oral proceedings that there was no literal basis in the published PCT application for the features *discrete individual* in connection with the description of the fibrous "non-woven filter web".
  - 1.2 On the other hand, the two passages of the description of the published PCT application relied upon by the appellant during the oral proceedings do not constitute a clear and unambiguous basis supporting the amendment in question.
    - 1.2.1 In the sentence on page 1, lines 11 to 12, it is merely indicated that "nonwoven webs of electret fibers are typically formed of loosely associated electret-charged fibres". However, this sentence appears to refer to some known webs obtainable according to the prior art methods referred to thereafter and the terms "loosely associated" cannot be equated to the terms *discrete individual*.

1.2.2 On page 5, lines 27 to 30, it is indicated that "the fibrous filter web layer is a nonwoven fibrous web where at least a portion of the fibres forming the web are [sic] **individually** provided with an electrostatic charge, generally referred to as electret fibres" (emphasis added by the board). However, according to the present application (see e.g. page 10, example 1, lines 24 to 27 and claim 23) the filter web layer is not obtained by providing charges to individual fibres but by **fibrillating an electrostatically charged polymeric film** in a manner as disclosed in US Re 30782 and US Re 31285. The meaning of the term "individually" as used in the quoted sentence is thus not without ambiguity. Therefore, the quoted sentence cannot constitute a suitable basis for the amendment in question.

1.3 Since the said amendment does not comply with the requirements of Article 123(2) EPC, the main request is refused.

*Auxiliary request 1*

2. *Allowability of the amendments*

2.1 Basis for amended independent claim 1, 2 and 5 can be found in claims 1, 2 and 10 of the published PCT application, respectively. The basis weight range added in these three claims is disclosed on page 6, lines 8 to 9 and the amended value of "less than 1.5 mm H<sub>2</sub>O" now appearing in claims 1 and 5 is disclosed on page 3, lines 14 to 16, and in claim 2 of the published PCT application.



2.2 Amended claims 6 to 11 correspond to claims 11 to 16 of the published PCT application except for the adapted back-references and the replacement of the acronym "ECD" by the expression "effective circular diameter". The latter amendment finds sufficient basis on page 4, lines 34 to 38 and on page 10, first paragraph, where both the acronym and its meaning can be found in conjunction with one another. This finding is not affected by the fact that the expression "Effective Cylinder Diameter" appears on page 10, lines 12 to 16.

2.3 Amended claims 1 to 11 do thus meet the requirements of Article 123(2) EPC.

### 3. *Clarity*

3.1 As a consequence of the amendment carried out in independent process claim 2, it is now clear that the open areas in the reinforcement scrim to be used according to the present invention must extend from one face to the opposite face of the scrim in a non-tortuous path. Their cross-sectional area may thus be tested using the microscopic techniques as mentioned at page 9 of the description.

3.2 Claim 11 now clearly expresses that it is the average Effective Circular Diameter that must have a value of at least 300  $\mu\text{m}$  (see also point 2.2 herein above). During the oral proceedings, the appellant has indicated that the expression "Effective Cylinder Diameter" appearing on page 10, lines 12 to 16 should correctly also read "Effective Circular Diameter".

4. *Novelty*

Novelty was not objected to by the examining division. The board is also convinced that none of the prior art documents cited in the search report justifies raising such an objection.

5. *Inventive step*

5.1 Closest prior art

5.1.1 The board shares the view of the appellant and of the examining division that D2' represents the closest prior art. D2', discloses uniform electret nonwoven filter media comprising at least one non-woven filter web of electrostatically charged fibres formed by fibrillation of an electrostatically charged film joined to a reinforcement scrim by needle punching. All of the non-woven filter webs described have basis weights lying within the range of present claim 1. The reinforcement scrim used in the examples of D2' "was a commercially available spunbonded fleece with a basis weight of about 10 gram/m<sup>2</sup> (Lutrasil<sup>TM</sup>, available from Karl Freudenberg, Kaiserslautern, Germany)". Reference is made in particular to column 1, lines 63 to 68, column 4, lines 6 to 9, tables I and II, and claims 7 and 12.

5.1.2 The 10 g/m<sup>2</sup> Lutrasil<sup>TM</sup> scrim material referred to in D2' has a pressure drop of 1.008 mm H<sub>2</sub>O at 98.4 m/min, i.e. falling within the range of present claim 1. This is acknowledged in the present application, where the same material is designated as "scrim D", see page 8, lines 33 to 39, page 10, lines 19 to 24, page 11,

lines 6 to 10, and table I (5<sup>th</sup> row, 4<sup>th</sup> column). During the oral proceedings, the appellant indicated the said Lutrasil<sup>TM</sup> material also had openings extending from one face to the opposite face thereof in a non-tortuous manner.

5.1.3 However, as can be gathered from the present application (see page 9, line 21 to page 10, line 8 and table II (5<sup>th</sup> row, 2<sup>nd</sup> column)), the said Lutrasil<sup>TM</sup> material was found to have an average open area of 0.008 mm<sup>2</sup>, i.e. much lower than required by present claim 1.

## 5.2 Technical problem

5.2.1 The application as filed contains the results of tests carried out to assess the filtering properties of the new filter media according to the invention, in particular its lifetime. The "number of cycles" it takes to reach an end of life pressure drop of 12.5 mm H<sub>2</sub>O using an AFT Model 8110 tester for measuring the pressure drop and the "percent penetration" (as explained on page 11 and 12 of the published PCT application) is an indication of the filter lifetime. The data reported in the present application were obtained using a relatively high air velocity of 98.4 m/min, as compared to the "air velocity of 0.2 m/s" used in similar tests reported in D2' (see column 4, lines 12 to 37). The experimental data provided in the application show that compared to products comprising the Lutrasil<sup>TM</sup> scrim described in D2' (counter-examples D, 1D and 2D), seven out of the eight examples with filter media comprising a reinforcement scrim with larger open areas as defined

in claim 5 (examples 1A, 1B, 1C, 2B, 2C, 3A and 3B) have a substantially longer lifetime combined with a higher quality factor ("Q"), see tables III, IV and V. Only in example 2A filter lifetime is extended at the expense of a lower quality factor.

- 5.2.2 The board thus accepts that starting from D2' the technical problem underlying the invention can, in accordance with what is stated in the description, be seen in providing non-woven fibrous filter media having both uniform properties and a longer lifetime combined with a high filtration performance at relatively high gas velocities, see page 2, last paragraph, page 3, lines 16 to 21, page 3, line 36 to page 4, line 6, page 4, lines 15 to 20.

In view of the experimental data in the description, it is plausible that this technical problem has actually been solved by the filter media as defined in claim 5.

- 5.2.3 What remains to be seen is whether the claimed subject-matter was obvious in the light of the prior art cited in the search report.

5.3 Document D2'

- 5.3.1 D2' itself does not attach a particular importance to the selection of material to be used as reinforcement scrim, but nonwoven scrims are stated to be "generally preferred in terms of cost and degree of **openness**" (emphasis added by the board). According to D2' a typical scrim material would be a spun-bond polypropylene nonwoven web, see column 3, lines 8 to 18.

5.3.2 Document D2' is focussed on providing filter webs having highly uniform properties (see column 2, line 61 to column 3, line 2 and column 4, lines 21 to 23) and does not address a possible influence of the size of the open areas of the reinforcement scrim material on the filter performance. Taking into consideration inter alia the **openness** of the scrim material, D2' thus nevertheless recommends the use of the said 10 g/m<sup>2</sup> Lutrasil<sup>TM</sup> material. The skilled person could thus not gather from D2' that by replacing the material explicitly disclosed in D2' by a scrim material as defined in present claim 5 the lifetime of the filter media at high gas velocities could be extended. Hence, in view of D2' taken alone, and omitting ex post facto considerations, the skilled person would not have considered these measures as an obvious way of solving the stated technical problem.

5.3.3 A skilled person would expect that in filtering media of the type claimed, the actual filtering (retention of particles) is performed by the filter web containing the electret fibres and hardly affected by a scrim provided for reinforcing the media. As pointed out by the appellant, the overall pressure drop of this type of filter is generally determined to a major extent by the pressure drop of the filtering layer. The board thus accepts that the skilled person could not necessarily expect that the replacement, in a filter media having an electret fibre layer of comparable basis weight, of the Lutrasil<sup>TM</sup> scrim of D2' by a scrim material having only a slightly lower pressure drop (scrim A) but larger open areas could lead to an extended filter lifetime at high gas velocities while keeping a high filtration efficiency, as illustrated by

a comparison of examples 1A and 1D (see the corresponding in table I ("Scrim: Pressure Drop"), table I ("Open Area") and table III. Hence, a skilled person not knowing the present invention would not be induced by its common general knowledge in the field of filtration to modify the teaching of D1 such as to arrive at the filter media of present claim 5.

5.4 Combination of documents D2' and D1

5.4.1 D1 discloses electret filters comprising a laminate of a plurality of electret "film-split fibre fleeces" obtained by splitting electrostatically charged polymeric films. According to D1 "it is also possible to attach a reinforcement material to the fleeces". D1 inter alia mentions "a net of plastic material" and "spun bonded fabric" as possible reinforcement materials, see abstract, claims 1 and 2, column 4, lines 9 to 21.

5.4.2 D1 is silent about attaching the electret filter to a support scrim by needle-punching. Needle-punching is only mentioned as one possibility amongst others (embossing and ultrasonic welding) for improving the dimensional stability of the filter composed of laminated split-film fleeces. Of the examples illustrating the invention of D1, only one (example 10; see column 7, lines 6 to 14) describes the use of a reinforcing scrim. The said reinforcing scrim is a plastic net of polyethylene and polypropylene monofilaments having a mesh size of 5 mm. According to this example the arrangement comprising the electret filter and the reinforcing net was subjected to embossing. One of the comparative examples of D1

(comparative example 6; see column 7, lines 15 to 33) refers to a pleated electret filter element comprising a web of carded split fibres and a reinforcing net. Said net however differs from the one used in example 10 in terms of its basis weight, and its mesh size is not indicated. It is not indicated in this comparative example how the two components are attached to each other. The filter elements according to the said example and comparative example were subjected to filtration performance tests at an air flow rate of 60 m/min ("1 m/sec") and the filter element of example 10 was found to be suitable as filter for an air conditioner, see column 7, line 34 to column 8, line 10.

- 5.4.3 As acknowledged by the appellant in its statement of grounds of appeal, example 10 of D1 discloses support nets having openings with cross-sectional areas as claimed in the present application. Moreover, D1 explicitly refers to higher gas velocities than D2' However, D1 does not specifically address the issue of filter life at high gas velocities, let alone a relationship between filter life and the dimensions of the openings of the reinforcing material. D1 also neither mentions nor discusses possible impacts of the openness of the listed reinforcing materials on the filtration performance of the reinforced filters. These two findings are true irrespective of whether the laminated split-film fleeces of D1 are considered as nonwoven webs or not. Hence, the person skilled in the art confronted with the stated technical problem was not induced by D1 to replace the reinforcing scrim material specifically indicated in D2' by a net material as mentioned in example 10, whilst at the same time keeping needle-punching as method for joining the

filter web and the reinforcement scrim. Omitting ex post facto considerations, the skilled person starting from D2' would thus not arrive at filter media according to present claim 5 in an obvious manner.

5.5 The other documents cited in the search report do not contain additional relevant information which would point towards the claimed subject-matter.

5.6 The subject-matter of claim 5 is thus based on an inventive step. Independent claim 1 relates to a filter containing a filter media as defined in independent claim 5, and independent claim 2 relates to a method for obtaining a filtering web falling under the definition of the filtering media of claim 5. Consequently, the subject-matter of independent claims 1 and 2, as well as of dependent claims 3, 4 and 6 to 11 is also non-obvious.



**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
  
2. The case is remitted to the first instance with the order to grant a patent with claims 1 to 11 according to the auxiliary request 1, submitted during the oral proceedings, figure 1 of the published PCT application and a description to be adapted.

The Registrar:

The Chairman:

T. Buschek

M. Eberhard