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D E C I S I O N
of 18 December 2000

Case Number: T 0249/97 - 3.3.5

Application Number: 89312886.8

Publication Number: 0375234

IPC: B01D 39/16

Language of the proceedings: EN

Title of invention:
Nonwoven filter material

Patentee:
MINNESOTA MINING AND MANUFACTURING COMPANY

Opponent:
Akzo Nobel N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no): aggregation of known measures with expected improvement"

Decisions cited:
-

Catchword:
-

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Case Number: T 0249/97 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 18 December 2000

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 2 January 1997 rejecting the opposition filed against European patent No. 0 375 234 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: G. J. Wassenaar
Members: A.-T. Liu
J. P. B. Seitz

Summary of Facts and Submissions

I. The appeal is from the decision of the Opposition Division revoking the European patent No. 0 375 234 following a notice of opposition.

II. The decision under appeal was based on the claims as granted (main request) and on the two sets of claims filed with the letter of 7 November 1996 (first and second auxiliary requests). Claim 1 according to the second auxiliary request read as follows:

"A disposable fibrous filter material (10) especially suited for disposable dust and debris collection bags for residential vacuum cleaners, said fibrous filter material (10) comprising a laminate structure of a porous layer of nonwoven fabric (12) having an air permeability of at least 300 $m^3/min/m^2$ and a layer of randomly intertangled nonwoven mat (14) of electret-containing microfibers of synthetic polymer, said microfibers being directly and coextensively deposited on and adhered to said nonwoven fabric (12), thereby forming said mat (14) and said laminate structure (10) without the use of additional adhesives or web consolidation, said mat (14) having a basis weight of between about 10 and 100 g/m^2 and no cover layer, and said laminate structure (10) having an air permeability of from about 5 to 50 $m^3/min/m^2$."

III. Among the documents cited in the course of the opposition proceedings, reference was made to the following in the impugned decision:

D1: JP-A-82-64048 (English translation)

D5: Nonwoven World, November 1987, pages 26 to 30

D6: US-A-4 589 894

IV. The opposition division held, inter alia, that the subject-matter of claim 1 according to the second auxiliary request lacked an inventive step with respect to D1 in combination with D5.

V. With the statement of grounds of appeal, the appellant (patentee) filed a new set of amended claims, with claim 1 worded as follows:

"A disposable filter bag for residential vacuum cleaners, the bag being formed from a fibrous filter material (10) comprising a laminate structure of a porous layer of nonwoven fabric (12) having an air permeability of at least 300 $m^3/min/m^2$ and a layer of randomly intertangled nonwoven mat (14) of electret-containing microfibers of synthetic polymer, said microfibers being directly and coextensively deposited on and adhered to said nonwoven fabric (12), thereby forming said mat (14) and said laminate structure (10) without the use of additional adhesives or web consolidation, said mat (14) having a basis weight of between about 10 and 100 g/m^2 and no cover layer, and said laminate structure (10) having an air permeability of from about 5 to 50 $m^3/min/m^2$."

VI. The appellant's arguments may be summarised as follows:

- D1 did not concern material suitable for use as vacuum filter bags.

- D6 rather than D1 should be taken as starting

point for assessing inventive step.

- The problem to be solved should be seen in the provision of a material with improved filtering characteristics.

- Since D6 actually pointed away from a fabric like that of the patent in suit, the proposed solution should be considered to involve an inventive step.

- There was no connection between the filter materials according to D1 and the electret filter materials disclosed in D5.

VII. The respondent's arguments were essentially the following:

- D1 should be considered to represent the closest prior art since it addressed the same technical problem as the patent in suit.

- The melt-blown web according to D1, with a thickness of 0.6 mm, is suitable for use as vacuum cleaner bags.

- The basis weight range stipulated in claim 1 is common in the art, as disclosed in D1 or D6.

- The addition of electrets was a commonly known measure for enhancing filtering performance, as confirmed by D5.

- The restriction to a bag as in claim 1 of the auxiliary request did not render the claimed subject-matter inventive.

VIII. Oral proceedings were held on 18 December 2000 in the absence of both parties who had asked the Board to issue a decision on the basis of the written submissions.

IX. The appellant (patentee) requested in writing that the decision under appeal be set aside and that the patent be maintained on the basis of the second subsidiary request submitted with the letter dated 7 November 1996 (main request) or, auxiliarily, on the basis of the claims submitted with the letter dated 9 May 1997 (subsidiary request).

The respondent (opponent) requested in writing that the appeal be dismissed.

Reasons for the Decision

Main request

1. Claim 1 is directed to a disposable fibrous filter material especially suited for disposable dust and debris collection bags for residential vacuum cleaners.

The Board can agree with the appellant's submission that the conditions of use of vacuum cleaner bags are quite specific (see Statement of the grounds of appeal dated 9 May 1997, page 3, last paragraph and D6, title). The Board therefore accepts that D6, which is expressly directed to the provision of disposable filters for domestic vacuum cleaners, should be considered as representing the closest prior art (see D6, column 1, lines 11 to 27 and column 3, lines 30 to 48).

2. As acknowledged in the patent in suit, D6 discloses a disposable filter which comprises a layer of a nonwoven microfiber web. Such mats of microfibrous webs are a desirable alternative to paper filter media for the particular reason that they are capable of higher particle capture efficiencies with comparable or lower pressure drops. They have, however, the drawback of being significantly weaker than paper. Consequently, the mats are used in conjunction with outer support layers on either side of the inner layer, resulting in a filter assembly of juxtaposed layers. Such layered construction has the disadvantage of being thicker than standard paper filter media (see patent in suit, page 2, lines 31 to 39; page 3, lines 29 to 46).

In agreement with the submissions made by the appellant, the technical problem to be solved with respect to D6 can be seen in the provision of a filter material for use as disposable vacuum filter bags, with handling characteristics approaching that of the paper media along with improved capture efficiency (see patent in suit, page 3, lines 50 to 53).

3. The filter material according to present claim 1 has an air permeability of 5 to 50 $m^3/min/m^2$ and includes a layer of microfibrous mat with a basis weight of between 10 and 100 g/m^2. In comparison, the microfibrous mat according to D6 has, in general terms, a basis weight of 40 to 200 g/m^2 and an air permeability of 3 to 60 $m^3/min/m^2$ (column 2, lines 44 to 67). In the specific example, such mat has a weight of 100 g/m^2 and an air permeability of 12 $m^3/min/m^2$. Furthermore, in the same Example 1 of D6, the fabric which is used as support on either side of the microfibrous mat has an air permeability of 400 $m^3/min/m^2$, which would not add any

restriction as to the air permeability of the entire filter assembly. The basis weight of the microfibrous mat, as well as the air permeability of the laminate structure according D6 are thus within the ranges stipulated in claim 1.

As a consequence, the claimed laminate is essentially distinguished from the filter assembly of D6 only in that:

(i) it consists of a layer of microfibrous mat directly and coextensively deposited on and adhered to a nonwoven support fabric; and

(ii) the mat is of electret-containing microfibers

The data presented in the patent in suit are evidence that the microfibrous filter laminate according to claim 1 has a higher capture efficiency at a reduced thickness and pressure drop than the laminate structure according to D6. Thus, the Board is satisfied that the technical problem as stated in point 2 is solved by the filter material as claimed.

4. It remains to be decided whether the solution as claimed is obvious to the person skilled in the art.

4.1 Re feature (i)

Microfibrous mat directly and coextensively deposited on and adhered to a nonwoven fabric.

The problem associated with microfibrous mats as discussed above (point 2) is well known in the art. In D1, it is expressly remarked that a sheet of melt-blown

microfibrous materials is, as such, too weak for use as filter material (see page 2, paragraph 3). To circumvent this drawback, D1 proposes jetting the melt-blown fibers directly onto a nonwoven fabric. The result is a melt-blown sheet with extrafine fibers laminated and bonded like scales onto a nonwoven fabric, without requiring a binder. Since the microfiber sheet is reinforced by the nonwoven fabric, the laminate is resistant against rupture and found to be useful as a filter material (see page 3, paragraph 2).

Thus, when looking for a filter assembly with improved handling characteristics, the skilled person is led by the teaching of D1 to consider a filter material wherein the layer of melt-blown microfibrous mat is directly and coextensively deposited onto a porous layer of nonwoven fabric.

4.2 Re feature (ii)

Mat of electret-containing microfibers

The topic of melt-blown webs and their application in filtration is further reviewed in D5 (see page 27, left hand column, first paragraph: "The major current application for melt-blown webs, and the application that fuelled their development, is filtration"). In particular, it is remarked that the filtration performance of the melt-blown web is enhanced by the forming of an electrostatic charge on the fibers. This effect is said to be applied inter alia to filtration units for removing dust (D5, page 27, right hand column, paragraphs 1 and 2: "The use of electrostatic charges to enhance filtration performance has led to

other filtration applications for melt-blown webs. These include specialty applications in air systems such as single-room filtration units that can be used in a home or office to remove cigarette smoke, pollen, dust, etc.").

In view of D5, the Board cannot see any inventive activity in the inclusion of electrets in the microfibrous mat with the aim to improve its filtration performance.

4.3 As is remarked by the respondent and not refuted by the appellant, there is no evidence on file that the inclusion of electrets would result in any effect beyond that foreseen in D5 (see letter dated 20 October 1997, page 4, paragraph 4). Furthermore, the appellant has not submitted that the characterising features interact with each other or with the other features stipulated in the same claim in an unexpected way. The Board, therefore, considers the subject-matter of claim 1 to be a mere aggregation of features known from D6, D1 and D5.

5. The Board cannot follow the appellant in that D6 would lead away from the laminates as claimed (see Appendix C to the Statement of the grounds of appeal, last paragraph). It is recognised in D6 that the use of additional adhesive would reduce the air permeability of the assembly (column 4, lines 25 to 30). The skilled person would, on the contrary, be prompted by this remark into looking for an alternative which would not require the use of adhesive for bonding the weak microfibrous mat onto a reinforcing support.

The detrimental effect of the use of adhesive is not

only discussed but also avoided in D1 (see page 2, penultimate paragraph: "because the adhesive hinders the flow of air, the pressure loss is liable to rise"; and page 3, penultimate paragraph: "since both the melt-blown sheet and the non-woven fabric are bonded by using the self-fusion bondability and the anchoring effect of the melt-blown sheet, no binder or very slight binder is required. Therefore, high-performance microfilters slow in the rise of pressure loss are obtained as an advantage"). The provision of a laminate with feature (i), whereby the use of adhesive is avoided is thus a solution known from D1.

6. The appellant has dismissed the relevance of D1 and maintained that the filter material of D1 is too heavy and thick for use as a filter bag; rather, it would be intended for use as a post filter (Statement of grounds of appeal, page 3, paragraph 2).

As is calcutated by the respondent and not contested by the appellant, the melt-blown web according to Example 2 of D1 has a thickness of 0.6 mm, thus comparable to the materials according to the patent in suit (see in particular page 6, Table 1, Sample NW40). This thickness is a factor 10 lower than that disclosed in Example 1 of D6. Since the microfiber web according to D6 is already suitable for vacuum cleaner bags, the skilled person will recognise that the much thinner web according to D1 is certainly suitable for that purpose. The high air permeability of this web (83 $cc/cm^2/sec$ or about 50 $m^3/m^2/min$) also underlines its usefulness for filter bags.

The Board concurs with the appellant insofar as the filter materials as exemplified in D1 have a basis

weight comparatively higher than stipulated in claim 1. The disclosure of D1 is, however, not restricted to the specific embodiments, which are merely to illustrate the teaching. The general teaching of D1 remains the reinforcement of a microfibrous web by direct bonding onto a non-woven fabric in order to make it more suitable as filter material and encompasses the provision of mats with lower basis weight (see point 4.1 above). Therefore, the skilled person does not have any reason for being deterred from applying this teaching with the aim of improving the handling characteristics of filter materials for vacuum cleaner bags.

7. The appellant has asserted that the electret filter material of D5 traps particles through a different mechanism from materials that trap particles mechanically, such as in D1 (Statement of grounds of appeal, page 4, last paragraph). Whilst this view is consistent with the remark in D5 that, "by forming an electric charge on the micro-fine fibers ... another effective filtration mechanism is added" (see page 27, right hand column, first paragraph), the Board does not see its relevance. In the present case where claim 1 is directed to the material per se, the mechanism for its functioning has no bearing on the assessment of inventive step, as long as the material is suitable for the intended purpose.

8. The Board also fails to concur with the appellant that D5 refers to the enhanced performance due to an electrostatic charge only in connection with surgical masks and not in conncetion with materials of the type as described in D1 (Statement of grounds of appeal, page 4, last paragraph).

8.1 The charging of the filter media is discussed under the general topic of air filtration, in the section entitled "Air Filtration segment" (page 27, left hand column). As an introduction to this section, it is indicated that the "best known application in air filtration is that associated with the surgical face masks". The enhancement of filtration performance is discussed only later in connection with the ability of micro-fiber webs to receive and retain electrostatic charges (page 27, right hand column, paragraph 1). This general discussion is followed by the remark that "the use of electrostatic charges to enhance filtration performance has led to **other** (emphasis added) air filtration applications for melt-blown webs". As examples of specialty application in air systems, the authors of D5 go on to include "filtration units that can be used in a home or office to remove cigarette smoke, pollen, dust, etc" (page 27, right column, paragraph 2). The Board thus holds that D5 clearly discloses the provision of electret-containing mats in connection with other uses than in surgical masks.

8.2 Furthermore, in the same section of D5 it is taught that "meltblown producers purchased or produced their nonwoven substrates onto which melt-blown fibers were formed" and that "the web can be charged during manufacture" (page 27, left hand column, paragraph 3 and right hand column, paragraph 1). The incorporation of electrets into filter webs such as those disclosed in D1 is thus clearly suggested in D5.

9. For these reasons, the Board considers that the provision of a filter material according to claim 1 is an obvious solution to the technical problem mentioned in point 2 above. As a consequence, the main request is

not allowable because the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC).

Auxiliary request

10. Claim 1 of the auxiliary request is directed to a disposable filter bag for residential vacuum cleaners, the bag being formed from a fibrous filter material as stipulated in claim 1 of the main request.

D6, however, already concerns filter bags for domestic vacuum cleaners (see points 1 and 2 above). Therefore, the above finding with respect to claim 1 of the main request applies mutatis mutandis to present claim 1. As a consequence, the auxiliary request must also fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Hue G. Wassenaar