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D E C I S I O N
of 17 February 1999

Case Number: T 0616/95 - 3.3.6

Application Number: 88311867.1

Publication Number: 0321237

IPC: D21H 27/00

Language of the proceedings: EN

Title of invention:

High strength wet-laid nonwoven fabric and process for producing same

Patentee:

Asahi Kasei Kogyo Kabushiki Kaisha

Opponent:

Firma Carl Freudenberg
Mölnlycke AB

Headword:

-

Relevant legal provisions:

EPC Art. 84, 56
EPC R. 29

Keyword:

"Main request: lack of support"
"Auxiliary request: inventive step (yes) combination invention"

Decisions cited:

T 0409/91, T 0133/85

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0616/95 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 17 February 1999

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Decision under appeal: Decision of the Opposition Division of the European
Patent Office posted 23 May 1995 revoking European

Composition of the Board:

Chairman: P. Krasa
Members: G. Dischinger-Höppler
W. Moser

Summary of Facts and Submissions

- I. The appeal is from a decision of the Opposition Division to revoke European patent No. 0 321 237, granted on European patent application No. 88 311 867.1, claiming a priority of 16 December 1987 (JP 316091/87), and relating to a high strength wet-laid nonwoven fabric and a process for producing same. The decision was based on amended claims according to a main and an auxiliary request.
- II. In the decision the following documents were considered
- D4: A.W. Meierhoefer, "New Hydroentangled Fabrics for Coated Fabric Applications", presented for the Industrial Fabrics Association International 75th Annual Convention;
- D5: US-A-4 476 186;
- D8: J. R. Starr, "Water Jet Entangled Nonwovens", presented at Insight 87; and
- D11: Teoretisk fiberdiameter som en funktion av decitex/denier och polymertyp.

The Opposition Division found that the claimed subject-matter was not inventive over D4 as the closest prior art. Considering the diameters of commercial fibers as given in D11, it was held that the claimed subject-matter differed from the disclosure of D4 merely by the mean fibre entangling point interval of less than 300µm. In view of the disclosure of D8, it was held to

be merely routine optimization to determine a suitable upper limit of this interval, the more so as it was known from D5 that the required value of less than 300 μm was not exceptional for hydroentangled nonwovens.

III. With his statement of grounds of appeal, the Appellant (Proprietor) filed additional experimental data, including a Figure 3 depicting interlayer peeling strength versus L/D-ratio. With letter of 15 January 1999 he filed comparative data in relation to commercial nonwovens.

IV. During oral proceedings before the Board on 17 February 1999, the Appellant filed amended claims according to a main and auxiliary request, the independent claims of the main request reading:

"1. A high strength wet-laid, binder-free and uniform nonwoven fabric composed of staple fibers having a single fiber diameter D of from 7 μm to 25 μm and a ratio L/D between the fiber length L and the single fiber diameter D of from 0.8×10^3 to 2.0×10^3 , said staple fibers being entangled in a three-dimensioned state by a high-speed fluid current treatment at a mean fiber entangling point interval of 300 μm or less.

5. A process of producing a high strength wet-laid, binder-free and uniform nonwoven fabric wherein a sheet is produced from staple fibers having a single diameter D of from 7 μm to 25 μm and a ratio L/D between a fiber length L and the single fiber diameter D of from 0.8×10^3 to 2.0×10^3 , and said staple fibers in the sheet are entangled in a three-dimensioned state at a

mean fiber entangling point interval of 300 μm or less by applying a high speed liquid stream to the sheet."

The independent claims 1 and 4 of the auxiliary request differ therefrom in that the staple fibers were further defined as "having a Young's modulus of from 50 kg/mm^2 to 700 kg/mm^2 ".

V. The Appellant's arguments can be summarized as follows:

- Documents D4 and D8 were not available to the public before the priority date of the patent in suit.
- The claimed subject-matter was not obvious in view of D5 as the closest prior art, nor was it obvious in the light of D4 and D8, if these should be considered to be prior art.
- As was shown in Figure 3 of the additional experimental data, the claimed subject-matter provided a surprising maximum for the interlayer peeling strength, depending on the L/D-ratio.
- The comparative data demonstrated that the claimed invention provided superior uniformity and strength characteristics, in particular superior interlayer peeling strength over conventional nonwovens and even in comparison with the wet-formed hydroentangled products mentioned in D4 and D8.
- None of the cited prior art documents provided any information as to how the interlayer peeling

strength and uniformity in a wet-laid nonwoven could be improved.

VI. The Respondents I and II (Opponents I and II) supported the reasons given for the contested decision and presented, in essence, the following further arguments:

- Documents D4 and D8 had been distributed to the public before the priority date of the patent in suit.
- The interlayer peeling strength was not a feature of the independent claims and not a standardized property of nonwovens. It's improvement was, therefore not essential for the present case.
- If, nevertheless, the object of the patent in suit had to be seen in said improvement, it was not apparent how this was to be achieved.
- The Appellant's additional experimental data, in particular Figure 3, did not show that the peeling strength was particularly high within the claimed range for L/D.
- The comparative data did not reveal any mean entangling point interval of the fibers. Since this was a major prerequisite for the interlayer peeling strength, said data were not conclusive.
- Respondent I, in writing, also pointed to document

D2: US-A-3 493 462

in which, so he argued, the importance of entanglement in nonwoven web manufacture had already been pointed out.

- The importance of selecting a L/D-ratio in order to find a compromise between uniform products with short fibers and strong products with long fibers was known from

D10: D. M. Parries, "Synthetic Fibers for Nonwovens" (Tappi, May 1975).

- Since no relationship between peeling strength and the claimed ranges for D and L/D had been shown, the claimed subject-matter consisted in a mere aggregation of separate features having separate effects.

VII. The Appellant requested that the decision of the Opposition Division be set aside and that the patent be maintained on the basis of the following documents:

- (a) main request: claims 1 to 6 submitted during oral proceedings; or
- (b) auxiliary request: claims 1 to 5 submitted during oral proceedings.

The Respondents I and II requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

The amendments made to the claims do not, in the Board's judgment, fulfill the conditions of Article 84 EPC which, inter alia, requires that the claims shall be supported by the description. This requirement includes that the claimed subject-matter should essentially correspond to the scope of the invention as disclosed in the description. Consequently, lack of support means also that the claim does not contain all the essential technical features of the invention, or in other words, does not define the matter for which protection is sought (see e.g. T 409/91, OJ EPO, 1994, 653, reasons No. 3.3).

In the present case, the amendments made to the claims as granted include the introduction of the feature: "entangled ... by a high-speed fluid current treatment at a mean fiber entangling point interval of 300 μm or less". This feature contains the relative term "high-speed". As pointed out by the Appellant and confirmed in D8 (see page 14, first sentence), the properties of entangled nonwoven products largely depend on the kind of the precursor web and the entangling process used. Since, neither the speed or kind of the fluid current nor the kind of fibres to be used are specified in independent claims 1 and 5 of the main request, these claims cover the treatment of any kind of staple fiber having the claimed fiber diameter and ratio L/D with any kind of "high-speed" fluid current. On the other hand, it follows from the description of the patent in suit that another fiber parameter is also essential for

the claimed invention. As a matter of fact, on page 4, lines 51 to 52, it is stated that fibers having a Young's modulus of more than 700 kg/mm² are not suitable for the purpose of the patent in suit, since such fibers would require a treatment of the web with a stream having an "extremely high pressure". Such conditions are, as a consequence, not intended in the patent in suit. Hence, the Young's modulus of the fibers is given to be, preferably, from 50 to 700 kg/mm² (page 4, line 47).

The Board has not overlooked the seemingly optional character of this statement by using the word "preferably". However, the issue of whether or not a claim is adequately supported by the description has to be decided from the point of view of a skilled person who will not stick to the mere wording of the description, but who will consider its technical meaning and implications. Thus, whether or not a particular feature is essential to the invention, must be decided after establishing the technical meaning of the description's wording (see e.g. T 133/85, OJ EPO, 1988, 441, reasons No. 2).

In the present case, it is quite clear that too high an energy delivered to the web in the form of "extremely high" fluid current pressure might result in disruption of the web (see e.g. D8, page 12, first paragraph). On a proper interpretation of the description, a skilled person would not pay much attention to the word "preferably" as used in the present context of suitable Young's moduli. Therefore, there is no support in the description for the broad language of claim 1 which includes a fluid current treatment of webs being

composed of fibers having a Young's modulus of more than 700 kg/mm².

For these reasons, the Board concludes that claim 1 does not meet the requirements of Article 84 EPC; consequently, the Appellant's main request must fail.

3. *Auxiliary request*

3.1 Amendments (Article 84, 123 EPC)

3.1.1 Being restricted to staple fibers having a Young's modulus of from 50 kg/mm² to 700 kg/mm² in accordance with the description, the independent claims 1 and 4 are not open to objection under Article 84 EPC.

3.1.2 The Board is satisfied that the description and the claims meet the requirement of Article 123(2) EPC because the amendments can be derived from the application as filed, and that the amended claims meet the requirement of Article 123(3) EPC because they do not extend the protection conferred by the European patent as granted. Since the Respondents did not raise any objections in this respect, it is not necessary to comment on this issue in more detail.

3.2 Novelty

The Board is also satisfied that the claimed subject-matter according to the auxiliary request is novel in the light of the cited documents. Although this was no longer contested during the oral proceedings, the Board wishes to indicate that this fact results if only for the reason that D4 and D10 are silent about the mean

fiber entangling point interval and D2, D5 and D8 do not disclose the particular L/D-ratio, neither do the other documents on file.

3.3 Inventive Step

The patent in suit relates to high strength nonwoven fabrics and a process for producing same. More particularly, it relates to those fabrics which have been produced by a wet-lay process, and are defined as in present claim 1.

3.3.1 Both Respondents stated that the disclosure of D4 comes closest to the subject-matter claimed in the patent in suit, and that this subject-matter would be obvious in the light of D4 and D8.

3.3.2 The background of the invention lies in drawbacks concerning strength characteristics, in particular the interlayer-peeling strength, encountered in conventional nonwoven fabrics produced in a well-known manner by either dry- and air-lay formation or by wet-lay techniques (see page 2, line 37 to page 3, line 10 of the patent in suit). D4 relates to hydroentangled wet-laid fabrics, but also discusses dry- and air-laid webs. The Board can, therefore, accept D4 as a starting point for the evaluation of inventive step.

D4 is a paper entitled "New Hydroentangled Fabrics for Coated Fabric Applications" which allegedly had been presented by A. W. Meierhoefer from the C.H. Dexter Division in Connecticut, US, on 10 November 1987 at the IFAI (Industrial Fabrics Association International) 75th Annual Convention in Las Vegas. It discloses that

hydroentangled dry- or air-laid webs had been known (see page 42, lines 1, 2, 9, 10 and 15), whereas hydroentangled wet-laid webs were new in the art (page 43, first paragraph). The advantages (page 44, paragraph 2 to 4) of using wet-lays as a precursor-web in comparison to dry-formed products consisted, inter alia, in the

- ability to use a wide range of fiber types,
- ability to blend fibers, and
- better sheet uniformity.

Due to the short fibers normally used, the tensile and tear properties of wet-laid fabrics are lower than those achieved with other web forming methods. These properties had been improved, however, by using longer fibers (19 mm or more; page 45, lines 1 to 10). By hydroentangling such webs, a new group of fabrics had resulted which, while being soft and strong, were also more uniform than dry laid webs. Hence, the advantages of wet- and dry-laid products had been combined (page 45, lines 10 to 17).

These products are also referred to in D8, a paper entitled "Water Jet Entangled Nonwovens" and allegedly presented by J. R. Starr from J.R. Starr corporation, Massachusetts, US, on 21 September 1987 at INSIGHT87 in Toronto. According to this document C. H. Dexter Division was the only company which, at the date of D8, commercially supplied such wet-laid, water jet entangled nonwovens using long fibers in the precursor webs (see page 3, lines 1 to 4, 14 to 17 and 33 to 41).

3.3.3 The Appellant filed comparative data which show the **superior interlayer peeling strength** of the nonwoven fabrics according to the patent in suit (called "Coldon") over that of commercial nonwovens according to the stated prior art and, at the same time excellent uniformity and tensile/tear strength at levels as attained in products according to the spunbond process. The data include a comparison with a prior art wet-laid, hydroentangled nonwoven, which is a product supplied by Dexter under the trade name "Hydraspun" (see Appellant's letter dated 15 January 1999, Annex 1, Tables A and B and Figures TB1 to TB4) and is representative for the products disclosed in D4 (see Tables).

In the Respondents' opinion, the Appellant's comparative data were not convincing because they did not reveal the entangling point intervals of the respective webs. However, as the Respondents did not contest the Appellant's convincing statement that the "Coldon" fabrics represented the claimed invention, the Board accepts that these fabrics showed the features called for by claim 1, including an entangling point interval within the claimed range.

The technical relevance of the interlayer peeling strength was disclosed in the patent in suit as well as the method of measuring it (page 5, lines 28 to 52, and page 7, lines 16 to 35). The Board cannot accept, therefore, the Respondents' argument that the interlayer peeling strength cannot contribute to inventive step, since this parameter was not mentioned in the state of the art. To disregard this parameter when assessing inventive step would have been possible

only if the Respondents had provided convincing evidence demonstrating the technical irrelevance of this parameter. However, the Respondents failed to submit such evidence. Therefore, the technical problem underlying the invention can be defined as improving the interlayer peeling strength of the wet-laid hydroentangled products as described in D4 and supplied from the Dexter Division, while maintaining, at the same time, uniformity and tensile/tear strength at least at levels already attained in these prior art nonwoven fabrics.

In this connection, the Board notes that there is no reason to refer in claim 1 to the interlayer peeling strength or, in other words, to the problem as was suggested by the Respondents. The provisions for a proper wording of the claims are set out in Rule 29(1) EPC, which requires that "the claims shall define the matter for which protection is sought in terms of the technical features of the invention". In case of a product claim, the appropriate features are directed to the structure and to the composition of the product, sometimes - where applicable - also to features of their manufacture, thereby defining the subject-matter which solves the existing technical problem. However, apart from situations covered by Article 54(5) EPC, it is normally neither necessary nor desirable that the product claims refer to the problem solved in terms of an obtained effect. By correctly applying Rule 29(1) EPC in the present case, the technical features defining the invention are:

- a single fiber diameter D of the staple fibers of from 7 μm to 25 μm ,

- a ratio L/D between the fiber length L and the diameter D of from 0.8×10^3 to 2.0×10^3 ,
- a Young's modulus of the fibers of from 50 kg/mm^2 to 700 kg/mm^2 and
- a mean fiber entangling point interval of $300 \text{ }\mu\text{m}$ or less,

in combination with the hydroentangled wet-laid web.

3.3.4 The Respondents objected that the Appellant's additional experimental data did not show that the interlayer peeling strength was exceptionally high within the claimed range for L/D. In particular the graph for a entangling point interval of $100 \text{ }\mu\text{m}$ in Figure 3 was said to show that the interlayer peeling strength was higher for an L/D-ratio above 2.0×10^3 (i.e. outside of the claimed L/D-ratio range) than for an L/D-ratio of about 0.8 to 0.9×10^3 . Therefore, so the Respondents argued, neither a relationship between the interlayer peeling strength and the fiber diameter or the L/D-ratio was shown, nor how to achieve this alleged improvement.

However, for acknowledging that the suggested and claimed means solve the existing technical problem, it is only necessary to render credible that the effect aimed at is achieved throughout the whole scope of the claim. Whether or not a beneficial effect can also be achieved outside of this scope is irrelevant in this context. In the present case, Figure 3 of the Appellant's additional experimental data shows **maximum values for the interlayer peeling strength within the**

claimed range of L/D-ratios.

The patent in suit contains also comparative examples which show that the interlayer peeling strength was insufficient if the diameter or L/D-ratio were outside the claimed ranges. This is also set out in the description of the patent in suit, where it is said that diameters below 7 μm would result in a low overall strength of the product web (cf. comparative example 1), whereas those above 25 μm would result in a loss of uniformity and fineness of the fabric surface (page 3, lines 45 to 51). Likewise, entanglement of the fibers would be reduced, if the L/D ratio is too high (cf. comparative example 2), or if the L/D ratio is too low (cf. page 3, line 57 to page 4, line 12 and comparative example 3). Further comparative data based on a commercial spun bond product also show the improved interlayer peeling strength of the claimed product (page 8, lines 17 to 33). Finally, as set out under point 2 above, the selected range of Young's moduli, which - by definition - is nothing else than a selection of suitable kinds of fibers in terms of material and cross-section, is necessary to achieve the desired entanglement value without destruction of the web. It follows from the above that all the technical features defining the invention in claim 1 contribute to the solution of the existing technical problem. It is, therefore, credible that the stated problem is solved by the subject-matter of claim 1.

- 3.3.5 Regarding inventive step, it remains, therefore, to be decided whether or not a person skilled in the art would have used the combination of features as set out in claim 1, in particular those features which are

listed under point 3.3.3 above, in order to solve the problem posed.

While indicating that wet-laid nonwoven fabrics which are uniform and have high strength can be obtained by hydroentangling wet-laid precursor webs, D4 neither mentions the existing technical problem (see point 3.3.3 above), nor gives it any technical instructions for the manufacture thereof or a hint to the claimed combination of features. The only tangible technical feature mentioned in D4 is that the fiber length in the wet-laid precursor web should be 3/4 inch or longer in order to obtain products having tensile and tear properties comparable to those produced on dry lay machines (see page 45, 2nd paragraph).

The Board does not share the Respondents' view that the claimed subject-matter consisted in a mere aggregation of separate features having separate effects. Rather to the contrary, it is clear from the above (see point 3.3.4) that the various features of the subject-matter of claim 1 work together to result in an increased interlayer peeling strength and in particular to a maximum thereof in the claimed range of L/D-ratios. As already indicated, the interlayer peeling strength was not mentioned in the prior art. There is no direct dependency of this parameter from the tear strength or from the tensile strength as was demonstrated by the Respondent (see Figures TB1 to TB3 of the comparative data). Therefore, any general statement in the state of the art which, perhaps implicitly, would have pointed to a relationship between various parameters such as e.g. fiber diameter, L/D-ratio, entangling point interval (D2, column 13,

lines 44 to 51; the latter parameter being known from D5, column 4, lines 34 to 51), etc., on the one hand, and the "strength" of the web, on the other, would not have helped the skilled person to solve the existing technical problem. It was not foreshadowed in the state of the art that the combination of all the selected parameter ranges as claimed would lead to a superior interlayer peeling strength without making sacrifices in respect of other strength properties or uniformity and, thus, to the solution of the technical problem.

It is not disputed that a person skilled in the art **could** have combined the various features defining the subject-matter of claim 1 which were all known per se. However, the Board cannot see any reason why a skilled person **would** have done so with a reasonable expectation of success to solve the technical problem as defined without the guidance of the patent in suit. This is also true in view of the statement in D8 that "increasing the degree of entanglement results in increasing tensile strength up to a point" (page 12, second sentence), since no practical technical teaching was linked to this statement which, moreover, did not refer to interlayer peeling strength, but merely to tensile strength.

Bearing in mind that entanglement treatment of different precursor webs results in different properties of the produced fabrics, as set out in D8 (see point 2 above), it is also not decisive for the present case that according to D10 the L/D-ratio and the fiber modulus which influence knot formation and, hence, uniformity in the web, were important factors to choose (see page 47, middle column, last paragraph to

page 48, first full paragraph). Moreover, D10 is not concerned with entangled nonwovens, but rather seeks to define those parameters which are necessary to **avoid** entangling or knot formation (page 47, middle column, last sentence of the second full paragraph).

Hence, it was not obvious for the skilled person that the claimed combination of features would solve the technical problem, so much the more as D8 which had allegedly been published only two month before D4, states that entangled products made from wet-laid precursor webs were still developmental (see page 14, first paragraph). This confirms that no predictions on the influence of the various relevant parameters on the interlayer peeling strength were possible at the priority date of the patent in suit. This is corroborated by the statement of Respondent I in the oral proceedings that there was no physical explanation available for such an influence. It is also noted that the Respondents did not provide any counter-evidence, in particular as to e.g. the existence of prior art products having an interlayer peeling strength comparable to that of the webs of the present invention.

- 3.3.6 For these reasons, the Board concludes that none of the documents D2, D4, D5, D8 or D10, taken alone or in combination, renders obvious the subject-matter of claim 1 of the auxiliary request, which therefore meets the requirements of Articles 52(1) and 56 EPC. Claim 4 relates to a process for the manufacture of the product of claim 1 and is based on the same inventive concept. It derives, therefore, its patentability from that of Claim 1, as do the dependent claims 2, 3 and 5.

Under the circumstances, the issue of whether documents D4 and D8 belong to the state of the art, which was contested by the Appellant, is irrelevant and, thus, is not to be considered by the Board.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of Claims 1 to 5 according to the auxiliary request, and a description to be adapted thereto, and the drawing (Figure 1) as granted.

The Registrar:

The Chairman:

G. Rauh

P. Krasa