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File Number: T 297/90 - 3.2.4

Application No.: 83 300 238.9

Publication No.: 0 084 456

Title of invention: Nonwoven sheets

Classification: D04H 3/14, D04H 1/54

D E C I S I O N
of 3 December 1991

Applicant: E.I. Du Pont De Nemours and Company

Opponent: 1. Hoechst Aktiengesellschaft
2. Akzo N.V.

Headword:

EPC Arts. 56 and 100(b)

Keyword: "Sufficiency of disclosure - yes"
"Inventive step - yes"

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 297/90 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 3 December 1991

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Decision under appeal :
Decision of Opposition Division of the European
Patent Office dispatched on 22.01.90 rejecting
the opposition filed against European patent
No. 0 084 456 pursuant to Article 102(2) EPC.

Composition of the Board :

Chairman : C.A.J. Andries
Members : M.H.M. Liscourt
J.C. Saisset

Summary of Facts and Submissions

- I. European patent No. 84 456 comprising ten claims was granted on 20 May 1987 in response to European patent application No. 83 300 238.9 filed on 18 January 1983.

The independent claims read as follows:

Claim 1:

"A strong dimensionally stable high-melting nonwoven sheet comprised of filaments from an optically anisotropic melt-forming polymer, the filaments being disposed in multiple directions within the plane of the sheet and being self-bonded at a plurality of cross-over points, the filaments between bond points being substantially undeformed, the fibrous sheet having a tensile strength in at least one direction of at least 1.0 N/cm//g/m² and having a tensile strength in a direction perpendicular to that direction which is at least 25% of the strength in that direction."

Claim 8:

"A process for preparing strong dimensionally stable high-melting nonwoven fibrous sheets comprising:

- (1) melt spinning a plurality of filaments from an optically anisotropic melt-forming polymer,
- (2) depositing the filaments on a collecting surface in the form of a loose web within which the filaments are substantially separated except for contact at cross-over points and are disposed in multiple directions within the plane of the web,
- (3) hot-pressing the web at a pressure, temperature and for a time sufficient to fuse the filaments at the cross-over points while avoiding substantial

deformation of the filaments between cross-over points, and

- (4) removing the pressure from the hot-pressed web and heating it in a purged inert atmosphere at a temperature below the filament flow temperature and for a time sufficient to increase tensile strength of the sheet by at least 25%."

II. The patent was opposed by the Appellant (Opponent 1) and by the Party as of right according to Art. 107 EPC (Opponent 2), each of whom requested the revocation of the patent in its entirety on the grounds of lack of inventive step of the subject-matter of the different claims (Arts. 100(a) and 56 EPC) and of insufficient disclosure (Art. 100(b) EPC).

The Opponents relied on the following documents:

- D1: US-A-3 276 944;
- D2: US-A-3 338 992;
- D3: US-A-4 183 895;
- D4: US-A-4 118 372;
- D5: US-A-4 256 624;
- D6: "Textilveredlung" 2 (1967), No. 1, pages 3 and 4.

III. The Opposition Division rejected the oppositions by its decision dated 7 December 1989 and dispatched to the parties on 22 January 1990.

IV. The Appellant lodged an appeal against the decision on 30 March 1990 by facsimile, confirmed by letter received on 31 March 1990, paying the appeal fee simultaneously. The Statement of Grounds was received on 25 May 1990 by facsimile, confirmed by letter received on 26 May 1990.

V. Oral proceedings took place on 3 December 1991, at the end of which the following requests were made:

by the Appellant and by the Party as of right:

- the cancellation of the impugned decision; and
- the revocation of the patent;

by the Respondent:

- dismissal of the appeal; and
- as subsidiary requests the maintenance of the patent on the basis of either Claims 1 to 7 or 8 to 10 as granted.

VI. At the conclusion of the oral proceedings, the Board's decision to dismiss the appeal was announced.

Reasons for the Decision

1. The appeal is admissible.

2. Sufficiency of the disclosure

2.1 The Party as of right (Opponent 2) maintained that the present European patent did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. In support of this the Party as of right relied on the fact that Claim 1 comprises a parameter whose value is only defined with a lower limit (so-called "obvious desiderata"), i.e. the fibrous sheet having a tensile strength in at least one direction of at least $1.0 \text{ N/cm} // \text{g/m}^2$, so that there is no upper limit specified.

According to the Party the European patent does not disclose how a sheet having a tensile strength higher than the highest value disclosed in the examples present in the

description of the patent can be obtained, i.e. present Claim 1 is unduly broad so that the specification does not enable the full scope of the invention to be carried out by a person skilled in the art.

2.2 As has already been indicated by other Boards (cf. T 94/82, OJ EPO 1984, 75, sections 2.5 and 2.6; and T 487/89, section 3.5), the absence of an upper limit is unobjectionable in a claim if said claim seeks to embrace values which should be as high as can be attained above a specified minimum level, given the other parameters of the claim.

2.3 In the present case, the patent specification contains not only an exhaustive general description of the process to prepare a sheet as defined in Claim 1 (cf. page 2, line 56 to page 3, line 62), but also very specific examples resulting in the claimed sheet (cf. page 4, line 43 to page 8, line 44). These specific examples, with their resulting specific tensile strength values, prove, according to the Board, that Claim 1 does not involve vague "desiderata", but concretely obtained values. The Party did not question these obtained results (values), neither did he prove that by repeating the examples either other values falling under the claimed lower limit are obtained or, more generally, the desired result could not be obtained.

2.4 According to the Board, the Patentee cannot be obliged to specify, for each possible claimed material, each possible result with all obtained parameter values.

By giving the specific values in some very detailed examples the Patentee outlines his invention, whose scope can be as broad as allowed by the cited prior art.

In the Board's view, by limiting the criticised value to the highest value as disclosed in the given examples, the scope of the present invention would be limited unjustifiably to a particular range, particularly since it is obvious for a person skilled in the art that there is an inherent upper limit to the tensile strength of the non-woven sheet according to Claim 1, which depends not only on the fibre strength but also on the bond strength, which are both the direct result of the different concrete technical features present in Claim 1, particularly

- the specific polymer material used; and
- the specific structure of the sheet.

2.5 Furthermore, as observed by the Opposition Division, it is within the competence of a person skilled in the art, having in mind the information (teaching) given in the patent specification (cf. above section 2.3), without exercising further inventive ingenuity to make alternative non-woven sheets falling within the scope of Claim 1, including non-woven sheets having a tensile strength higher than $3.29 \text{ N/cm}^2/\text{g/m}^2$, which is merely an example of tensile strength achievable according to the invention.

2.6 Although stating that it may be assumed that the great majority of the known anisotropic polyesters do not have properties which would render them suitable for the manufacture of non-woven sheets according to the invention, no single concrete piece of experimental evidence has been brought forward by the Party as of right to prove his allegation.

The same applies for his allegation with respect to the use of staple fibres (Claim 3). The use of staple fibres is mentioned in the patent specification (page 3, lines 10 to 16), so that the Board sees no reason to doubt the sufficiency of the disclosure in that respect,

particularly since it was already common knowledge to use either filaments or staple fibres to form self-bonded, non-woven sheets (cf. document D1: Examples XII to XXIV on the one hand, and Example XXV on the other).

With respect to the control of the ratio of tensile strengths in the X and Y directions, attention is drawn to page 2, lines 56 to 63; and page 3, lines 21 to 26 of the patent specification as well as to the common knowledge of a person skilled in the art.

In the case leading to the decision T 226/85 (OJ EPO 1988, 336) (quoted by the Party as of right) the Opponent produced test results. This earlier case thus differs from the present case wherein, as pointed out by the Respondent, the Party as of right did not provide such experimental evidence, that means that he did not prove that the use of the claimed starting material in the claimed process does not lead to the claimed final product. In the present case, the person skilled in the art is given enough information relating to the starting material and the process to be used.

2.7 Thus, the Board cannot see that in the present case there is insufficient disclosure within the meaning of Art. 100(b) EPC.

3. Novelty

Each of the cited documents D1, D2 and D6 discloses processes for forming structures from fibre-forming synthetic organic polymers. However, these documents do not mention that the used material is an optically anisotropic melt-forming polymer (Claims 1 and 8).

Although documents D3, D4 and D5 disclose products such as fibres, films, etc. made from optically anisotropic melt-forming polymers, there is no indication in these documents either of sheets which have been made with a tensile strength in at least one direction of at least 1.0 N/cm//g/m² (Claim 1), or of a specific process for preparing a non-woven sheet (Claim 8).

The subject-matter set forth in each of Claims 1 and 8 therefore is to be considered as novel within the meaning of Art. 54 EPC.

4. Inventive step

In order to be able to properly assess inventive step, attention is drawn to the definitions given in the impugned patent on page 4, lines 10 to 17 of expressions used in the present claims.

- 4.1 Document D1 describes a non-woven self-bonded sheet of oriented synthetic organic polymeric filaments, as well as a method of preparing the same. Within the sheet, the filaments overlap and intersect and in general are disposed in random fashion. The filaments are bonded to each other at a multiplicity of these intersection points. The arrangement of the filaments in the bonded sheet is substantially the same in the unbonded web except for the presence of bonds (column 7, lines 47 to 50). The resulting sheet has a combination of high tensile strength (strip tensile greater than 3 lbs/in.//oz/yd² (0.156 N/cm//g/m²)) and high tear resistance. The highest value for the strip tensile strength mentioned in document D1 is 18.6 lb/in.//oz/yd² (0.967 N/cm//g/m²), wherein that sheet was overbonded and, as indicated in column 16, lines 46 and 47, outside the invention (Table III: Ex. XXIV, column 17).

- 4.2 The problem to be solved is, according to the impugned patent, to provide non-woven sheets showing improved tensile and tear strength, as well as to provide a process which allows the preparation of such a sheet.

The sheet should, according to the impugned patent, be particularly useful as a substrate in roofing materials (page 1, lines 54 and 55; page 4, lines 5 to 7).

- 4.3 The Board accepts that the problem is solved by the features present in Claim 1 and Claim 8 respectively particularly in view of the examples disclosed in the impugned patent. No other specific results of tests which could have led the Board to doubt these disclosed examples have been filed.

The Board also accepts the argument of the Respondent that the process according to Claim 8 results in a sheet-structure according to Claim 1 having not only improved filament strength, but also improved bond strength (bonds between the filaments at their cross-over points).

4.4 Sheet according to Claim 1

- 4.4.1 Documents D1 and D2 disclose many conventional materials which can be used to form non-woven sheets or webs. They do not disclose or suggest the use of the completely different optically anisotropic melt-forming polymer, so that a person skilled in the art could not be guided by these documents towards the claimed solution. On the contrary, document D2 discloses some suggestions to improve additionally the stability of the non-woven sheet obtained by the process according to document D2, so that a person skilled in the art is inclined rather to try these indicated process steps.

- 4.4.2 Documents D3, D4 and D5, although disclosing the particular material, i.e. an optically anisotropic melt-forming polymer and the improved resulting fibres obtainable with such a material, do not suggest the use of this material for non-woven sheets, let alone their use for self-bonded non-woven sheets.

Indeed document D3 discloses that the properties of the fibres favour the use of these fibres in e.g. belts of automobile tires, towing ropes, plastic reinforcements, knitted and woven fabrics, ropes, hawsers and cordage for marine usage. Document D2 discloses articles such as fibres, films, bars or other moulded objects. Fibres are considered to be useful in ropes, fibre-reinforced plastics and other industrial applications. The Board cannot accept that, without knowledge of the impugned patent, these indicated uses clearly suggest the usefulness of the involved fibre for non-woven, self-bonded sheets, particularly since there is in these documents no single indication or suggestion that, even if these filaments were used in a non-woven, self-bonded sheet, the tensile strength of such a sheet would be clearly improved. There is also no single indication or suggestion that good or better bonds between the filaments can be made with this material.

- 4.4.3 The argument that, in view of the known properties (improved tensile strength) of the fibre material disclosed in the documents D3, D4 and D5, it was obvious for a person skilled in the art to try this material in the process involved in documents D1 or D2, cannot be accepted by the Board, particularly since firstly it could not have been foreseen that the material involved was also able, under certain process conditions, to form strong inter-filament bonds, and secondly even if the material had been used in the known process for its known

advantageous properties, it would have been used with the improved filament (heat-treated filament) as the starting material forming the sheet instead of the filaments used in these prior art documents, so that even in such a case, as can be seen in Example 7 (Table 5: sheets 7B and 7C) of the impugned patent, the claimed sheet could not be obtained.

Indeed, this argument of the Appellant and the Party as of right that certain advantageous properties are known and that therefore it is obvious to try this material because of these properties, implies according to the Board that this material with its inherent advantageous properties is used as a starting material in the sheet-making process, particularly since it is nowhere suggested in these documents D3, D4 and D5 that if filaments which do not have these advantageous properties (i.e. filaments as spun) are directly submitted to a process step involving pressure and high temperature, these transformed filaments would still be able to inherit their indicated advantageous properties by subsequent heat-strengthening, let alone that the bonds present in the sheet would be strengthened.

According to the Board such an argument has to be considered as the result of an ex-post-facto analysis.

4.4.4 The subject-matter set forth in Claim 1, therefore, involves an inventive step within the meaning of Art. 56 EPC.

4.5 Process according to Claim 8

4.5.1 Documents D1 and D2 disclose a process for preparing a self-bonded non-woven sheet of high tensile and tear

strength from polymeric filaments, comprising the following process steps:

- melt spinning a plurality of polymeric filaments;
- depositing the filaments on a collecting surface in the form of a loose web; and
- hot pressing the web at a pressure, temperature and for a time sufficient to fuse the filaments at their cross-over points while avoiding substantial deformation of the filaments between said cross-over points.

4.5.2 As already indicated in above section 4.4.1 the documents D1 and D2 do not suggest the use of the specific material involved, i.e. optically anisotropic melt-forming polymer, so that in these documents there is no hint towards the claimed solution.

Furthermore, document D2 points to a number of different methods to enhance the stability of the non-woven sheets prepared via the process disclosed in this document. A person skilled in the art would be directly guided by this information to try these given possibilities, and is thereby led away from the present claimed process.

4.5.3 Documents D3, D4 and D5 do disclose the claimed polymer. Furthermore it is disclosed that oriented fibres are extruded from the melt of an optically anisotropic melt-forming polymer and that strengthening of the fibres is obtained by the process of heat treating these oriented fibres. However it is indicated that the heat-treatment has to take place while the fibres are essentially relaxed (D3: Claim 1; column 1, lines 37 to 41; D4: column 1, lines 33 to 38).

However, as already pointed out in above section 4.4.3 the Board is of the opinion that, even if, due to the known

advantageous properties of the filaments made from an optically anisotropic melt-forming polymer, this polymer would be used in a process according to documents D1 or D2, the claimed preparation process as well as the resulting claimed sheet can neither be expected, nor obtained.

The Board agrees with the Opposition Division when it states that the process specified in Claim 8 is the combination of process steps carried out in the order specified, and that nowhere in the prior art is the claimed combination of process steps described or suggested for any kind of filaments.

- 4.5.4 The Board cannot follow the argument that a person skilled in the art was automatically led to fuse directly the filaments as spun at their cross-over points before heat-strengthening them, since he knew that filaments are more difficult to bond when the temperature of the handling after spinning increases. Indeed, it was not obvious for a person skilled in the art, before the priority date of the impugned patent, that the filaments from an optically anisotropic melt-forming polymer were still able, after the heat/pressure treatment during bonding to result in bonded sheets, to subsequently obtain their advantageous properties.

Furthermore, the Board is not convinced that, as put forward by the Appellant, the necessary process steps could only be carried out in two possible orders, namely (1), (2), (3), (4) or (1), (2), (4), (3). Such an approach is based on an ex post facto analysis, since it already seems possible for example to strengthen the filaments as spun before depositing them (e.g. (1), (4), (2), (3)), or it seems likely to use other different process steps (e.g. other bonding systems) to influence the finally obtained sheet.

Therefore, a direct and unambiguous hint to the claimed order of process steps cannot be derived from the available documents.

- 4.5.5 The subject-matter set forth in Claim 8 therefore involves an inventive step within the meaning of Art. 56 EPC.
- 5. The subject-matter of granted independent Claims 1 and 8 is, therefore, patentable within the meaning of Art. 52 EPC, so that the patent can be maintained with the granted Claims 1 and 8, and with Claims 2 to 7, 9 and 10 which are dependent thereupon.
- 6. Therefore, there is no need to examine the Respondent's subsidiary requests.

Order

For these reasons, it is decided that:

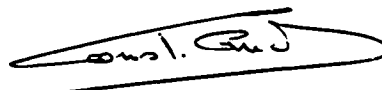
The appeal is dismissed.

The Registrar:




N. Maslin

The Chairman:



C. Andries

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