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D E C I S I O N
of 9 May 2001

Case Number: T 0362/98 - 3.2.6

Application Number: 91109987.7

Publication Number: 0462574

IPC: D04H 1/54

Language of the proceedings: EN

Title of invention:
Nonwoven web and method of forming same

Patentee:
Kimberly-Clark Worldwide, Inc.

Opponent:
Reifenhäuser GmbH & Co. Maschinenfabrik
Akzo Nobel N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 52(1), 54(1), 56, 83, 100(a), 100(c)

Keyword:
"Sufficiency of disclosure - yes"
"Novelty (main request) - yes"
"Inventive step (main request) - yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0362/98 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 9 May 2001

Appellant: (Proprietor of the patent)
Kimberly-Clark Worldwide, Inc.
401 North Lake Street
Neenah, Wisconsin 54956 (US)

Representative:
Diehl, Hermann O. Th., Dr.
Diehl, Glaeser, Hiltl & Partner
Patentanwälte
Postfach 34 01 15
D-80098 München (DE)

Respondent I: (Opponent 01)
Reifenhäuser GmbH & Co. Maschinenfabrik
Spicher Strasse 46 - 48
D-53844 Troisdorf (DE)

Representative:
Andrejewski, Walter, Dr.
Patentanwälte
Andrejewski, Honke & Partner
Postfach 10 02 54
D-45002 Essen (DE)

Respondent II: (Opponent 02)
Akzo Nobel N.V.
Velperweg 76
6824 BM Arnhem (NL)

Representative:
Fett, Günter
Acordis AG
Postfach 10 01 49
D-42097 Wuppertal (DE)

Decision under appeal: Decision of the Opposition Division of the European Patent Office posted 3 February 1998 revoking European patent No. 0 462 574 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: G. C. Kadner
M. B. Tardo-Tino

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 462 574 in respect of European patent application No. 91 109 987.7 claiming a US-priority from 18 June 1990 and filed on 18 June 1991 was published on 10 May 1995.

II. Notices of opposition were filed against this patent with requests for revocation based on the grounds of Article 100(a) and (b) EPC. The patent was revoked by the Opposition Division by decision announced on 12 December 1997 during oral proceedings and posted on 3 February 1998. The Opposition Division was of the opinion that the subject matter of claims 1 according to the main request (patent as granted) and to the auxiliary requests 1 to 5 (first auxiliary request filed with letter dated 12 November 1997 and second to fifth auxiliary requests filed during the oral proceedings) did not involve an inventive step having regard in particular to the prior art disclosed in:

(D1) US-A-3 953 655

(D2) Vollmert, Grundriß der makromolekularen Chemie, Band III, E.Vollmert-Verlag Karlsruhe 1988, p. 101

(D3) US-A-3 692 618

(D5) Wadsworth, L.C. et al., Effects of Melt Blown Web Structures on Filtration Efficiency and Porosity, Book of Papers, INDA.-TEC 89, Philadelphia, Pennsylvania, USA, May 30 - June 2, 1989, p. 585-600

(D7) US-A-4 451 589

(D8) Seiler E., Polypropylen/EPDM Blends und Polypropylen Impact-Copolymere, technische Werkstoffe im Fahrzeugbau und in der Elektronik, 2. Syposium 22. und 23. Nov. 1988 in Würzburg, Thermoplastische Kunststoffe in technischen Wachstumsbranchen, Süddeutsches Kunststoffzentrum, p. 101-117

(D10) Cheng C.Y. and Kwalik K.M., Polypropylene for Meltblown Applications, Meltblown Technology Today, A special report from Nonwovens World magazine, Nonwovens Markets newsletter, Nonwovens Asia '89, Impact/Insight international conferences

(D11) Gaides F.C., Tailoring Polypropylene Polymers for Meltblown Applications, Meltblown Technology Today, A special report from Nonwovens World magazine, Nonwovens Markets newsletter, Nonwovens Asia '89, Impact/Insight international conferences

(D12) Malkan S.R. et al., Process-Structure-Property Relationships In Melt Blowing of Different Melt Flow Rate Polypropylene Resins, in Nonwovens/An Advanced Tutorial edited by Turbak A.F. and Vigo T.L., Tappi Press, Atlanta, USA 1989, p. 101-129

In opposition the following further documents were cited:

(D4) US-A-3 502 763

(D6) Galli, Simonazzi and Del Duca, New frontiers in polymer blends: The synthesis alloys, Acta Polymeria 39 (1988) Nr.

(D9) Malkan S.R., Process-Structure-Property Relationships in Different Molecular Weight Polypropylen Melt Blown Webs, Ph.D. Dissertation, The University of Tennessee, Knoxville, May 1990

(D13) Römpps Chemie-Lexikon, Franckh'sche Verlagsbuchhandlung 1974, P. 2200-2201

(D14) ASTM Designation D 3593-80 (Reapproved 1986)

(D15) ASTM Designation D1238-90b (Oct. 26, 1990)

(D16) Malkan S.R. et al.,Process-Structure-Property Relationships In Melt Blowing of Different Melt Flow Rate Polypropylene Resins, see (D12)

(D17) Statement, Malkan S.R.

(D19) Statement, Linda Long

III. On 7 April 1998 the Appellant (Patentee) lodged an appeal against this decision simultaneously paying the appeal fee.

The statement of grounds of appeal was filed on 15 June 1998.

With letter dated 7 May 2001 the Appellant filed:

(D20) Macromol. Symp. 110, 15-32 (1996), Experiences with Interlaboratory GPC Experiments

IV. In a communication dated 2 October 2000 the Board of Appeal expressed the preliminary view that the skilled person addressed in the patent in suit would not have undue difficulties in interpreting the subject-matter

claimed. In respect of the issues of novelty and inventive step, in particular the documents D2, D5, D6, D8, D10 to D12, D14 and D15 would appear to be relevant for discussion during oral proceedings.

V. Oral proceedings were held on 9 May 2001 in the absence of Respondent II (Opponent II) who had informed the Board with letter dated 13 March 2001 of its nonappearance.

The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request, claims 1 to 13, as filed during the oral proceedings or, auxiliarily, on the basis of the claims filed with letter dated 7 May 2001.

Respondent I (Opponent I) requested that the appeal be dismissed and that European patent No. 0 462 574 be revoked.

Respondent II requested dismissal of the appeal and revocation of the patent by written procedure.

Independent claims 1, 5 and 8 according to the main request read as follows:

"1. A nonwoven web of fine fibers formed from a reactor granule of a polypropylene resin having a molecular weight distribution between 4.0 and 4.5 Mw/Mn and a melt flow rate of 1000 to 3000 g/10 min at 230°C which has been modified by adding a small amount of peroxide to modify the molecular weight distribution to a range of 2.8 to 3.5 Mw/Mn and to increase the melt flow rate up to 5000 g/10 min at 230°C wherein the modified polypropylene results from adding up to 500 ppm of peroxide to the reactor granules prior to forming the web.

5. A method of forming a nonwoven web having an average fiber size of from 1 to 3 μm and a pore size distributed predominantly in the range from 7 to 12 μm, with the peak of the pore size distribution less than 10 μm, comprising the steps of melt-blowing a reactor granule of a modified polypropylene having a molecular weight distribution between 2.8 and 3.5 Mw/Mn and a melt flow rate of from 800 g/10 min at 230°C to 5000 g/10 min at 230°C, wherein the polymer is throughput at a rate greater than 0.535 kg per cm of die width per hour (3PIH).

8. Use of the nonwoven web according to one of claims 1 to 4 or made according to one of claims 5 to 7 as a barrier layer in a nonwoven fabric laminate."

VI. The Appellant relied essentially upon the following submissions:

Considering the common knowledge of the skilled person no difficulties would arise when addressing the measuring methods which were applied to establish the claimed parameters.

In respect of inventive step it should be noted that each of the cited prior art documents disclosed only isolated parameters of the combination included in the claimed invention. A general relationship between molecular weight distribution (MWD) Mw/Mn and the melt flow rate (MFR) of a polymer could not be found in the prior art in the field of the invention. Furthermore, none of the documents disclosed or hinted at the combination of features according to claims 1 and 5, and therefore their subject-matter could not be arrived at in an obvious manner. In comparison with the nonwoven web known from D5 the web of the invention provided advantages in reduced pore size and improved bacterial filtration capability in combination with a

reduced weight per square of the web. When producing the web according to the teaching of the patent a higher throughput could be achieved than was disclosed in the prior art, simultaneously avoiding the production of lints and droplets.

VII. Respondent I's submissions are summarised as follows:

Since the patent did not disclose the conditions under which the MWD Mw/Mn and the melt flow index (MFR) were measured there was a lack of disclosure, particularly because both values were claimed in a certain combination and none of them was clearly defined. A skilled person regarding a European patent would not self-evidently have an idea to use an American standard for the determination of parameters referred to therein. Even when measuring according to the ASTM standard the measured values were affected with substantial errors of measurement and therefore the scope of protection was not satisfactorily defined.

Regarding D9, which had been considered by the Opposition Division as not to have been pre-published, further evidence could not be provided.

Considering inventive step, D5 already disclosed that an increasing MFR corresponded with a decreased MWD Mw/Mn, thus indicating production of very small fiber diameters, i.e. less than 3 μm. The measuring methods of the MWD Mw/Mn of D15, and also according to the, admittedly not prepublished document D20, indicated a significant measuring error. Therefore the value of 2,1 Mw/Mn disclosed in D5 was not unambiguously different from the claimed range of 2.8 to 3.5 Mw/Mn of the patent.

The knowledge about the possibility of modification of polypropylene by chemical degradation for achieving a "Controlled Rheologie" was already disclosed in the prior art document D8, and this method was also applied in the production of fibers (page 107, first paragraph). Since the properties of the polymer were only of relevance in the melt-blowing process after its modification the starting value of 4.0 to 4.5 Mw/Mn of the polypropylene was not inventive because it was freely selectable by the skilled person from a range of usual values.

The higher throughput according to the patent in suit when compared with that of D5 also resulted from freely selectable parameters and could not be considered as an unexpected result. Therefore a skilled person was led to the claimed subject-matter in an obvious way.

VIII. Respondent II referred to its comments made during the Opposition proceedings. Since Respondent II was not present at the oral proceedings, no comments are available vis-a-vis the amended claims filed during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of documents*

Since further evidence concerning the public availability of D9 before the priority date of the patent was not provided, in agreement with the Opposition Division the Board decided to disregard this document. In fact during the oral proceedings Respondent I no longer relied on this document.

D20 dating from 1996 was filed only one day before the oral proceedings. It relates to results of experiments carried out after the priority date of the patent. In view of the late filing and lack of apparent relevance also this document was disregarded in accordance with the provisions of Article 114(2) EPC.

3. *Sufficiency of disclosure*

The Respondent argued that the patent lacked sufficiency of disclosure since there was no sufficient indication according to which method and under which conditions the claimed values of MWD and MFR were determined.

However, considering the knowledge of the skilled person competent in the present case the dimensions "g/10 min at 230°C" in which the value of MFR of polypropylen according to the patent in suit is defined, would immediately indicate to such a specialist that these conditions comply with those applied in the ASTM standard according to D15. Furthermore, being aware that the Applicant is an American society, it would be evident that also the MWD of Mw/Mn values are defined according to the ASTM standards (see also D14). Applying the methods and conditions specified in the relevant ASTM standard the skilled person is in the position to select the materials in accordance with the claimed specification and to carry out the invention without undue difficulties (Article 83 EPC).

4. *Novelty (Main request)*

4.1 In respect of novelty it is to be noted that none of the available documents of the prior art discloses a nonwoven web, a method of forming a nonwoven web or a use of the web, respectively, which includes the

combination of all features of claims 1 or 5, in particular the combination of features relating to the MWD of Mw/Mn between 2.8 to 3.5 of a modified polypropylene and its MFR of more than 1000 up to 5000 g/10 min at 230°C (claim 1) or 800 to 5000 g/10 min at 230°C (claim 5), respectively. Therefore these claims comply with Article 54(1) EPC.

4.2 Novelty of the use of a nonwoven web according to claim 8 follows from the novelty of the web of claim 1 or produced according to the novel method of claim 5.

In fact, novelty of the subject-matter of the independent claims was no longer contested by Respondent I.

5. *Inventive step (Main request)*

5.1 The closest prior art is represented by D5 which discloses a melt-blown nonwoven web produced directly from granules of polypropylene resin having a MFR of 1400 g/10 min at 230°C and a MWD Mw/Mn of 2.1 (page 586, 1st and 3rd paragraph; page 592, table 1). Starting from this nonwoven web the problem underlying the patent consists in further improvements as regards assuring breathability simultaneously inhibiting strikethrough of fluids by reducing pore size distribution. This problem is solved by the measures of claim 1.

5.2 Based on the common knowledge in the art a skilled person knows that the viscosity of polypropylene which is important in respect of the achievable fineness of fibers can be influenced by visbreaking or chemical degradation during extrusion (D6, page 85, right column; Figure 12; D8, Page 107, 1st paragraph; D10, page 64, left column, 4th paragraph). Therefore the

Board agrees with the opinion of the Respondent that the starting MWD Mw/Mn of 4.0 to 4.5 and modification by adding a small amount of peroxide is in itself deprived of an inventive quality.

However, D5 indicates a MWD value Mw/Mn of 2.1 and a MFR of 1400 whereas a higher value of Mw/Mn of 2.5 corresponds with a decreased MFR of 35 (table 1). Therefore the skilled person would not expect that a higher MFR of up to 5000 according to the invention in combination also with an increased MWD Mw/Mn of 2.8 to 3.5 could provide improvements of the fibers and the web because D5 shows a different tendency. Thus the solution of claim 1 was not suggested by the cited prior art.

5.3 As stated in the patent (page 5, lines 10 to 26) the selection of the higher range of MWD Mw/Mn of 2.8 to 3.5 provides still another improvement since the production of lints and droplets is reduced. Also in this respect, neither according to D5 nor to any other prior art document a result like this is achieved.

5.4 D12, which was written by the same author as D5 deals with a method and apparatus similar to D5 for melt-blowing ultrafine fibers to form nonwoven webs, additionally indicating throughput values of 160 g/min and 320 g/min (page 101). However it does not come closer to the features of claim 1 than D5, particularly in respect to the claimed correlation of MFR with MFD.

5.5 The further documents D2, D6, D8, D10, D11 disclose only one of the parameters of MFR and MWD without indicating a definite correlation between them, and do not mention the problem of forming a nonwoven web

having the desired properties of the patent at all. Since the skilled person did not receive any incentive or hint towards the particular combination of features of claim 1 its subject-matter involves an inventive step (Article 56 EPC).

5.6 With independent claim 5 a method of forming a nonwoven web is claimed. Considering the defined rate of polymer throughput applied in this method the closest state of the art is represented by D12 disclosing a throughput rate of 160 g/min and 320 g/min. According to the prior art method described in the introduction of this document extremely fine fibers of 1 to 5 μm can be formed (page 102). However, this publication is silent about the pore sizes or the pore size distribution, respectively.

The polypropylene disclosed in D12 has a MFR of 1400 which lies within the claimed range of 800 to 5000 according to claim 5 of the patent in suit, and a MWD Mw/Mn of 2.08. However, as explained in section 5.2. above, there is no reason why a skilled person would be led to the combination of an increased MFR corresponding with an increased MWD, because the increased MWD Mw/Mn of 2.62 of D12 (table 1) in correlation to a lower MFR of 300 also shows a different tendency.

The throughput of 0.535 kg per cm of die width per hour according to claim 5 of the patent is also substantially higher than that of D12 (320 g/min) which in the dimensions of the patent is equivalent with 0.378 kg per cm of die width per hour. Although this might be an improvement which is caused mainly by the parameters of MWD and MFR it means an increased productivity which could not be expected by the skilled

person on the basis of the cited documents or of common general knowledge, and therefore the feature of the increased throughput is non-obvious. Consequently the Board considers claim 5 also to comply with Article 56 EPC.

5.7 Since neither the nonwoven web according to claim 1 nor the method of forming a web according to claims 5 could be arrived at in an obvious manner also the use of the nonwoven web according to these claims is based on an inventive step.

6. Summarizing, in the Board's judgment, the proposed solution to the technical problem underlying the patent in suit defined in the independent claims 1, 5 and 8 is inventive and therefore these claims as well as their dependent claims 2 to 4, 6,7 and 9 to 13 relating to particular embodiments of the invention in accordance with Rule 29(3) EPC, can form the basis for maintenance of the patent (Article 52(2) EPC).

Thus taking into account the amendments made by the Appellant, the patent and the invention to which it relates meet the requirements of the EPC and the patent as amended is maintained in this form (Article 102(3) EPC).

Since the main request was already successful consideration of the auxiliary request was not necessary.

Order

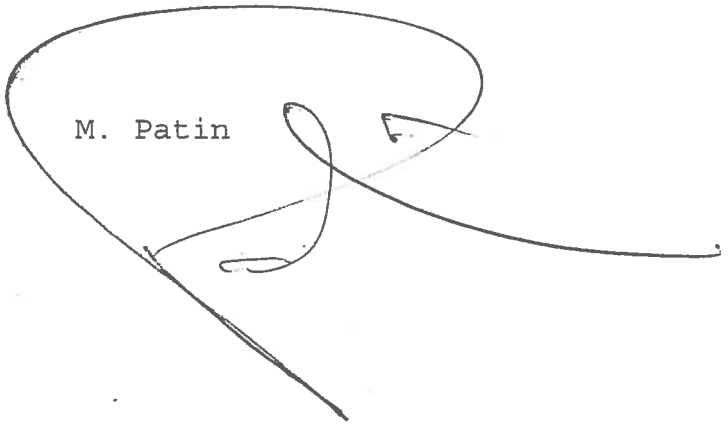
For these reasons it is decided that:

1. The decision under appeal is set aside

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:

   Claims 1 to 13 and description, pages 2, 2a, 3 to 5 filed during oral proceedings, together with description, pages 6 and 7 and Figures 1, 2 and 3 as granted.

The Registrar: The Chairman:



M. Patin P. Alting van Geusau