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D E C I S I O N
of 10 September 2002

Case Number: T 0999/99 - 3.2.6

Application Number: 90101976.0

Publication Number: 0381206

IPC: D01D 5/11

Language of the proceedings: EN

Title of invention:

Manufacturing process for fibers, rovings and mats from lyotropic liquid crystalline polymers

Patentee:

E.I. du Pont de Nemours and Company (a Delaware corporation)

Opponent:

Akzo Nobel N.V.

Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 54(2), 56, 113(1)

Keyword:

"Novelty (yes)"

"Inventive step (yes)"

"Basis of decisions- opportunity to comment (yes)"

Decisions cited:

G 0094/92, T 0704/96

Catchword:

-



Case Number: T 0999/99 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 10 September 2002

Appellant: Akzo Nobel N.V.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 17 August 1999
rejecting the opposition filed against European
patent No. 0 381 206 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: G. Pricolo
M. B. Tardo-Dino

Summary of Facts and Submissions

- I. The appeal is from the decision of the Opposition Division posted on 17 August 1999 to reject the opposition against European patent No. 0 381 206 granted in respect of European patent application No. 90 101 976.0.

Granted claim 1 read as follows:

"1. A process for preparing attenuated and fragmented subdenier fiber from polymers by extruding polymer spinning dope into a chamber, introducing pressurized gas into the chamber and passing the polymer stream through an aperture into a zone of low pressure, characterized in that the polymers are lyotropic liquid crystalline polymers and the process comprises the steps of 1) extruding the stream of the optically anisotropic solution of the polymer through spinneret orifice (3) into chamber (9) having an aperture (11) of generally convergent walls in the vicinity of the orifice (3), 2) introducing the pressurized gas into said chamber (9), 3) directing the gas before it contacts the stream in the flow direction of the stream and then in surrounding contact with the stream within chamber (9) at a velocity sufficient to attenuate and fragment the stream into fibers as both the gas and stream pass through the aperture (11) into the zone of lower pressure, and 4) contacting the fibers in said zone with a coagulating fluid."

- II. The Opposition Division held that the subject-matter of claim 1 was novel and inventive. In its decision, it stated that documents

D1: GB-A-1 392 667,

D2: US-A-4 642 262,

neither disclosed nor suggested the provision of pressurized gas in surrounding contact with the polymer stream, but rather taught to use either a hitting fluid (D1) or a mixing nozzle for the injection of the pressurized gas (D2).

III. The appellant (opponent) lodged an appeal, received at the EPO on 18 October 1999, against this decision. The appeal fee was paid simultaneously with the filing of the appeal. In the statement setting out the grounds of appeal, received at the EPO on 30 November 1999, the appellant, in addition to documents D1 and D2, also referred to the equivalent US and German patent publications, namely:

D1': US-A-4 600 545,

D2': DE-A-3 308 626,

and additionally filed a written declaration of Dr. Piotrowski.

IV. In an annex to the summons for oral proceedings pursuant to Article 11(2) Rules of Procedure of the Boards of Appeal the Board expressed its preliminary opinion that the statement in the decision under appeal according to which document D2 disclosed a mixing nozzle essentially corresponded to the argument of the respondent, as recorded in the minutes of the oral proceedings, that in D2 the gas aided in evaporation of the solvent by a mixing action but did not establish a

surrounding contact with the exiting stream of spinning fluid. In so far as an alleged procedural violation based on the appellant's submission that this argument was brought up for the first time in the written reasons of the decision appeared unfounded. Furthermore, the Board explained why neither D1 nor D2 disclosed all the features of the claimed process, and that the embodiment shown in Figure 5 of the patent in suit would appear to fall outside the scope of the claims.

V. Oral proceedings took place on 10 September 2002.

As previously announced by letter dated 11 July 2002, the appellant did not attend the oral proceedings. The proceedings were continued without him (Rule 71(2) EPC). During the written proceedings the appellant requested that the decision under appeal be set aside and that the patent be revoked. It further requested the reimbursement of the appeal fee in view of an alleged substantial procedural violation.

The respondent (patentee) requested that the appeal be dismissed and that the patent be maintained with the claims as granted, the description as filed during the oral proceedings and the Figures 1 to 4 as granted.

VI. In support of its requests the appellant relied essentially on the following submissions:

The Opposition Division based its conclusion that the claimed subject-matter was novel and involved an inventive step on the argument, brought up for the first time in the decision under appeal, that D2 disclosed a mixing nozzle for the injection of pressurized gas. Although the minutes of oral

proceedings before the Opposition Division referred to a "mixing action" in the process of D1 and D2, nothing was said during the oral proceedings regarding the "mixing nozzle" of D2. On the contrary, during the oral proceedings the proprietor constantly emphasized the hitting nature of the gas stream. Therefore, the decision was based on grounds on which the appellant did not have an opportunity to comment, contrary to the requirements of Article 113(1) EPC. This constituted a substantial procedural violation justifying the reimbursement of the appeal fee in accordance with Rule 67 EPC.

Furthermore, the subject-matter of claim 1 was not novel over the disclosure of document D1.

Claim 1 of the patent in suit did not require the polymer solution per se to be optically anisotropic, but only on extruding it through the spinneret orifice. This corresponded to the disclosure of D1, where the solution of polymers was in its anisotropic state on extruding it through the spinneret orifice.

In the process of D1 the fibers were contacted with ambient air. Although a skilled person might not consider ambient air as coagulation fluid for coagulating PPD-T, it could not be excluded that air was a suitable coagulation fluid for other polymers spun at high temperature. Claim 1 of the patent in suit being silent on the specific type of polymer and the spin temperature, there was no reason to exclude air as a possible coagulation fluid.

D1 and its equivalent D1' disclosed, in the embodiment illustrated in Figure 3, that the pressurized gas was

in the form of a mass geometrically co-axial with the ejecting solution nozzle, ie that the pressurized gas did not form a hitting stream but was in surrounding contact with the polymer stream.

Although not depicted in the figures, it was clear, on the basis of the dimensions of the system of nozzles given in example 29 of D1 (and in example 27 to which it was referred) that an aperture with convergent walls was disclosed in D1.

The subject-matter of claim 1 was moreover not novel over the disclosure of document D2. It was clear from the original German patent application D2', which was the priority document of D2, that a teaching of this piece of prior art consisted in providing a "two-substance nozzle" rather than a "two-substance mixing nozzle", the latter expression being a wrong translation from the original German language. The facts that the two-substance nozzle was not used for mixing but for stretching the polymer, and that the pressurized gas surrounded the polymer stream, were confirmed by the declaration of Dr. Piotrowski, one of the inventors of D2. Accordingly, the device of D2 was essentially the same as the one disclosed in the patent.

VII. The respondent essentially argued as follows:

Contrary to the appellant's submissions, the mixing nozzle of D2 was mentioned during the oral proceedings before the Opposition Division. It was stressed by the proprietor that according to D2 the pressurized gas was delivered laterally against the polymer solution, whereby mixing of the gas and the polymer solution was

unavoidable. Furthermore, reference was made to passages of D2 that explicitly addressed mixing nozzles.

Neither D1 nor D1' disclosed a method in which the polymer solution was surrounded by the pressurized gas. In the embodiment of Figure 3 of D1' the pressurized gas and the polymer solution flowed parallel in separate channels before the pressurized gas was deflected and then hit the polymer solution at a certain angle.

The patent in suit was concerned with lyotropic liquid crystalline polymers whereas D1 and D2 were limited to thermoplastics, such as polyolefins and the like, which did not form optically anisotropic solutions. This was the reason why D1 and D2 had to make use of the flash spinning technique whereas the process of the patent in suit did not. The flash spinning technique as used by D1 and D2 provided coagulated or at least partially coagulated fiber material on leaving the spinning device, whereby no additional coagulation means were used. In contrast thereto, in the process according to the patent in suit the material leaving the spinning device was coagulated at a distance from the spinning device with a coagulating fluid.

Neither D1 nor D2 disclosed a chamber having an aperture with convergent walls, this feature being necessary in order to attenuate and fragment the liquid stream before it was coagulated.

Consequently, the subject-matter of claim 1 was novel. It also involved an inventive step, because the prior art did not suggest the claimed solution to the

technical problem of preparing subdenier fibers from lyotropic liquid crystalline polymer. In particular, neither D1 nor D2 suggested the provision of a pressurized gas in surrounding contact with the polymer stream within a chamber at a velocity sufficient to attenuate and fragment the stream into fibers as both the gas and stream passed through a convergent aperture, and the subsequent step of contacting the fibers with a coagulating fluid.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Since the patent in suit is amended only by way of excision of an embodiment from the drawings (Figure 5) and the description, the amendments do not give rise to objections under Article 123(2) and (3) EPC.

3. *Novelty*

3.1 Document D1 discloses a process for preparing attenuated and fragmented subdenier fiber from polymers (nothing is said explicitly in D1 about the denier, but subdenier fibers are obtained in examples 27 and 29, where it is disclosed that fibers made of a material having a specific gravity of 0.9525 and 0.9083, respectively, and diameter of 1 to 5 microns and 1 to 3 microns, respectively, are obtained). According to the embodiment shown in Figure 3 of this document, polymer spinning dope is extruded through a spinneret orifice (15). A pressurized gas, such as water and steam (see page 2, lines 77-93), is introduced into a chamber

which comprises a cylindrical portion (duct 12) and a conical portion (18). The gas is directed in the flow direction of the polymer stream before intersecting it (see page 2, line 129; page 3, line 8; example 27). The gas intersects the polymer stream within the conical portion (18) of the chamber, and then both pass through an aperture (fluid ejecting nozzle 14) into a zone of low pressure.

D1 does not disclose an aperture having generally convergent walls. Aperture 14 is clearly cylindrical in Figure 3 and this is confirmed by the reference in the specification to a diameter of the aperture (see page 9, last line to page 10, line 1).

The appellant argued that a system of nozzles having the dimensions given in example 29 of D1 (and in example 27 to which it was referred) was forcibly provided with an aperture having convergent walls. The appellant also referred to the drawings 3A and 3B filed with the notice of opposition, which allegedly show nozzle systems with the dimensions given in examples 27 and 29. However, there is no disclosure in examples 27 and 29 of an aperture 14 having convergent walls. It is only the conical portion 18 of the chamber which has convergent walls, inclined of an angle α with respect to the nozzle axis. In said drawings 3A and 3B referred to by the appellant, the aperture 14 is formed by the outer edge of the conical portion and has no axial extension: this is contrary to what is shown in Figure 3 of D1.

In the notice of opposition the opponent referred to the conical portion as constituting the aperture. According to this interpretation, which the Board

cannot follow, the aperture of the chamber 12 in Figure 3 of D1 is constituted by the conical portion 18 and the cylindrical portion 14. In such case, however, the polymer solution is extruded directly into the aperture. This is in contradiction with the definition of claim 1, according to which the stream of solution is directed through the spinneret orifice into a chamber having an aperture in the vicinity of the orifice. This is also in contradiction with the embodiment shown in Figure 4 of the patent in suit, where the aperture 12 is distinct from the conical portion (30) of the chamber in which spinneret orifice is located (see page 3, lines 51-55 of the patent in suit).

D1 does not disclose the step of extruding a stream of lyotropic liquid crystalline polymers which form an optically anisotropic solution. In the Board's view, the wording of the claim as regards the step of "extruding a stream of the optically anisotropic solution of the polymer through spinneret orifice" clearly defines that the polymer solution per se is optically anisotropic, and excludes a polymer solution that only becomes anisotropic on extruding it through spinneret orifice. This definition is consistent with the description of the patent in suit, which clearly discloses that the preparation of optically anisotropic polymer solutions is a step preceding the extrusion through the spinneret orifice (see page 2, line 50; page 1, line 2).

D1 does not disclose that the pressurized gas is directed in surrounding contact with the stream of polymer solution. In the embodiment of Figure 3, an expansion of the polymer solution takes place within

diverging spinneret orifice (15) and as a consequence, a diverging stream of polymer solution exits from spinneret orifice. This diverging stream is hit (see page 2, lines 94-101, see examples 27 and 29, where the impact speed of the pressurized gas is 210 and 420 m/s, respectively) by a converging gas flow. Due to the different geometry of the intersecting flows and to the high speed of the pressurized gas, necessary to produce an impact, a surrounding contact of the pressurized gas on the stream of polymer solution cannot take place.

Where exactly fragmentation of the stream into fibers takes place in the embodiment of figure 3 of D1 cannot be ascertained. Therefore, it cannot be assumed directly and unambiguously that in D1 it takes place as both gas and stream pass through the aperture (14).

Finally, D1 does not disclose the step of contacting the fibers into the zone of lower pressure with a coagulating fluid, this feature implying that a coagulation of the fibers takes place by virtue of the coagulating fluid.

The appellant argued that ambient air could act as a coagulating fluid for some polymers spun at high temperature. In this respect the Board notes that the point at issue is actually whether coagulation of the polymers disclosed in D1, and not merely of some polymers in general, takes place in ambient air. In view of the fact that the skilled person would normally not consider ambient air as the coagulating fluid, as already stated by the Board in the communication annexed to the summons for oral proceedings, and in the absence of any evidence that ambient air coagulates the fibers exiting from the nozzles system of D1, it must

be concluded that the above mentioned step is not disclosed by D1.

The disclosure of D1' does not go beyond that of D1. In particular, the disclosure concerning the embodiment of Figure 3 and examples 27 and 29 is essentially the same of D1. D1' discloses (see column 5, lines 39-41) that the solution is surrounded in every point by the fluid ejected by the nozzle. This, however, does not mean that the pressurized gas is in *surrounding contact* with the stream of polymer solution, and indeed, as in D1, also here the converging fluid ejected by the nozzle hits the diverging solution ejected by the spinneret orifice.

Therefore, the subject-matter of claim 1 is novel over the disclosure of documents D1 and D1'.

- 3.2 D2 discloses a process for preparing attenuated and fragmented subdenier fiber from polymers by extruding a stream of a solution of the polymer through a spinneret orifice, directing a pressurized gas (superheated steam, see claim 1) in the flow direction of the stream and passing the polymer stream through an aperture (3) into a zone of low pressure.

D2 does not disclose that the polymers are lyotropic liquid crystalline polymers which form an optically anisotropic solution. Although D2 discloses that an orientation of the polymer takes place when extruded (see column 2, lines 43, 44), claim 1 requires the polymer solution to be optically anisotropic also before it is extruded, as explained above (point 3.1 of this decision).

Document D2 does not disclose an aperture into the zone of lower pressure having generally convergent walls. On the contrary, D2 discloses (see Figure 1) an aperture (3) with divergent walls.

D2 does not disclose that the fibers are contacted in the zone of lower pressure with a coagulating fluid. In analogy with D1 (see point 3.1 of this decision), also in D2 ambient air cannot be considered to represent a coagulating fluid.

Finally, there is no disclosure in D2 of the pressurized gas being in surrounding contact with the polymer stream within a chamber. In this respect, the Board does not contest the statements of Dr. Piotrowski in his declaration, that the correct appellation of the nozzle of D2 is "two-substance nozzle" (in accordance with the disclosure of D2') rather than two-substance mixing nozzle, and that in D2 the relationship of flow and energy between the streams of polymer and superheated steam is not used for mixing but for orienting the polymer and forming fibrils. However, in the process of D2 the polymer stream and the stream of superheated steam practically meet within the Laval nozzle (3) in which most of the solvent is instantaneously converted to the gaseous phase and the polymer is converted to the fibril form (see column 2, lines 36-45). Therefore, a clearly identifiable nozzle portion in which the polymer gas is in surrounding contact with the stream of polymer solution is not identifiable in D2.

It follows that the subject-matter of claim 1 is novel over the disclosure of documents D2 and D2'.

3.3 The other available prior art documents do not disclose a process in which fragmented subdenier fibers are prepared by passing a stream of a polymer solution and a pressurized gas through an aperture into a zone of low pressure.

As a consequence, the subject-matter of claim 1 is found to be novel.

4. *Inventive step*

Starting from a process in accordance with the preamble of claim 1 (disclosed by document US-A-4 025 593 acknowledged on page 2, lines 13-24 of the patent in suit), the technical problem solved by the process of claim 1 is to provide a process for preparing pulp-like fibers, rovings or non-woven mats from lyotropic liquid crystalline polymers (see page 2, lines 25-27, of the patent in suit).

Documents D1 and D2 (and D1', D2' of similar technical disclosure) do not suggest the claimed solution to the above mentioned problem. These documents do not relate to lyotropic liquid crystalline polymers that form an optically anisotropic solution. They do not suggest to direct the pressurized gas in surrounding contact with the stream of polymer solution within a chamber, before both pass through an aperture into a zone of lower pressure. Nor is this feature suggested by the other available prior art.

Furthermore, the appellant has not submitted any arguments in respect of inventive step.

It follows that the subject-matter of claim 1, and of

dependent claims 2 to 11, is found to involve an inventive step.

5. *The alleged substantial procedural violation*

Pursuant to Rule 67 EPC, allowability of the appeal constitutes a prerequisite for reimbursement of the appeal fee. This may be the case if the appeal is only partly allowed, as in the present case (see eg T 704/96, point 6.1). However, the Board takes the view that no violation of the opponent's right to be heard in accordance with Article 113(1) EPC was committed by the Opposition Division, for the following reasons.

In the decision under appeal (see point 2 of the reasons, in particular the first paragraph of page 4), the Opposition Division essentially argues that the claimed feature according to which the pressurized gas is in surrounding contact with the stream of polymer is not disclosed by D2 because in the known process the liquid stream is broken up and the solvent is vaporized and carried out by the steam in a mixing nozzle.

Hence, the Division has not based its decision in respect of novelty merely on the fact that D2 discloses a mixing nozzle (although the expression "mixing nozzle" is in bold characters), but on the fact that in the mixing nozzle of D2 the liquid stream is broken up and the solvent is vaporized, whereby a surrounding contact of the stream of polymer is not given (the liquid stream being disrupted).

Furthermore, the arguments that the pressurized gas did not establish a surrounding contact with the stream of polymer, and that a mixing action took place in D1 and

D2, were discussed during the oral proceedings before the Opposition Division (see the minutes of oral proceedings before the Opposition Division, first paragraph of page 2).

Finally, it is stated several times in D2 that a mixing nozzle is used (see eg claim 1). In the Board's view, the appellant could not be surprised by the Division using a term used *expressis verbis* in D2. Furthermore, D2 also explicitly refers to the breaking up of the liquid stream and the vaporization of the solvent (see column 3, lines 28-29), and therefore the Division did not provide any interpretation of document D2 going beyond the textual disclosure of the latter that could have surprised the appellant.

Similarly, the Opposition Division based its conclusion concerning inventive step on the argument that D2 led away from the provision of a pressurized gas being in surrounding contact with the stream of polymer.

6. Finally, the Board notes that the appellant could not be taken by surprise by the amendments made during oral proceedings, since the appellant itself in the letter dated 11 July 2002 stated that the embodiment of Figure 5 should be excised from the patent specification. Consequently, the absence of the Appellant at the oral proceedings did not prevent the Board from taking this decision (G 4/92).

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 11 as granted;

Description: pages 2 to 7 as filed during the oral proceedings;

Drawings: Figures 1 to 4 as granted.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau