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D E C I S I O N
of 19 July 2000

Case Number: T 0311/97 - 3.2.2

Application Number: 89115192.0

Publication Number: 0387395

IPC: D21F 1/00

Language of the proceedings: EN

Title of invention:
Stabilized polyurethane modified polyester forming fabric

Patentee:
JWI Limited

Opponent:
Hoechst Trevira GmbH & Co KG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) - after amendment"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0311/97 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 19 July 2000

Appellant: (Opponent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 16 January 1997 rejecting the opposition filed against European patent No. 0 387 395 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: W. D. Weiß
Members: S. S. Chowdhury
J. C. M. De Preter

Summary of Facts and Submissions

I. The Appellant (opponent - Hoechst Trevira GmbH & Co. KG) lodged an appeal against the decision of the Opposition Division to reject the opposition to patent No. 0 387 395. The decision was dispatched on 16 January 1997.

The appeal and the fees for the appeal were received on 13 March 1997. The statement setting out the grounds of appeal were received on 26 May 1997.

The opposition was filed against the whole patent and based on Article 100(a) EPC (lack of novelty and inventive step).

The Opposition Division had found that the grounds of opposition mentioned above did not prejudice the maintenance of the patent unamended.

The following prior art documents among those regarded as relevant by the Opposition Division have been taken into account as relevant documents during the appeal proceedings:

D1: WO-A-8 704 198

D2: WO-A-8 301 253

D3: "Kunststoffe", Carl Hanser Verlag 1987, p. 768

D5: US-A-3 853 821 In addition to the documents

In addition, the following late cited documents have been discussed during the appeal proceedings:

D6: Chemiefasern, Chemie-technologie, Rogowin and Albrecht, Georg Thieme Verlag Stuttgart. New York, 1982, pages 271, 272

D7: Affidavit of Professor Musa Kamal dated 5 May 1999

D8: Affidavit of Bryce Jones dated 3 February 1999.

II. Oral proceedings before the Board took place on 19 July 2000, at the end of which the requests of the parties were as follows:

The Appellant requested that the decision under appeal be set aside and that the European patent be revoked.

The Respondent (patent proprietor - JWI Ltd) requested that the appeal be dismissed or that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents:

Claims: 1 to 14 as submitted at the oral proceedings

Description: pages 2 and 4 submitted at the oral proceedings;
pages 3 and 5 to 12 of EP-B1-0 387 395.

III. Claim 1 of this request reads as follows:

"A melt extruded monofilament when used for the cross machine yarns of a forming fabric for a paper making machine, the monofilament consisting essentially of a major portion by weight of a polyethylene terephthalate polyester and a minor proportion by weight, of a thermoplastic polyurethane, e.g. up to 30% by weight of a thermoplastic polyurethane, together with from zero to 5% by weight of a hydrolysis stabilizer,

characterised in that said polyethylene terephthalate polyester is present in an amount from 60% to 90% by weight and has an intrinsic viscosity between 0.5 and 1.20 when measured in a solvent comprising a 60:40 parts by weight mixture of phenol and 1,1,2,2-tetrachloroethane at a temperature of 30°C, and in that, in the blended monofilament, the polyurethane used is present in an amount from less than 40% to 10% by weight and has a Durometer Type A hardness of no greater than 95 or a Durometer Type D hardness of no greater than 75."

IV. The Appellant presented the following arguments:

The wording "when used..." did not limit claim 1 since it was equivalent to the wording "for use...", which is to be seen as merely "suitable for use".

Document D2 disclosed a melt extruded monofilament consisting essentially of a major portion by weight of a polyethylene terephthalate polyester [PET] and a minor proportion by weight, of a thermoplastic polyurethane [TPU], together with a hydrolysis stabilizer. The disclosed ranges of PET, TPU, and stabilizer proportions overlapped considerably with the corresponding ranges defined in claim 1 of the opposed patent. Claim 1 purported to differ from the disclosure of document D2 by the claimed range of the intrinsic viscosity of the PET, viz. of between 0.5 and 1.20 when measured according to the stated procedure, and of the TPU hardness, viz. it should have a Durometer Type A hardness of no greater than 95 or a Durometer Type D hardness of no greater than 75.

However, these ranges covered practically all the current ranges for these properties for commercially available PETs and TPUs. Thus, document D6 (page 272) stated that the IV of PETs for textile filaments lay between 0.55 and 0.70, and Table I of document D3 listed some of the best known polyurethanes, whose hardness was indicated as 75A to 75D, and these ranges fell within the terms of claim 1. Document D2, therefore, implicitly disclosed the claimed ranges for the IV of the PET and for the hardness of the TPU, and anticipated the subject-matter of claim 1.

However, should the claimed monofilament be considered novel, it still lacked an inventive step.

Although document D2 described a dryer fabric, it nevertheless sought to solve the problem of fabric abrasion and was, therefore, of relevance for solving this problem also in the field of forming fabrics, where the same problem was encountered, and the two technical fields were closely related. The fact that the inventor of document D2 was one of the inventors of the opposed patent and the fact that the same firm often makes both types of fabrics showed that the person skilled in the art covered both fields. For these reasons the Respondent's arguments, that forming and dryer fabrics had different technical requirements, were spurious. Moreover, documents D1 and D3 demonstrated that the same fabric could be used in both the former section and the dryer section of a paper making machine.

Even if the emphasis in document D2 was the problem of hydrolysis, it also discussed the problem and solution of fabric abrasion. Moreover, it gave equal importance to polyester and polyurethane as the thermoplastic material, and given the specific mention of polyurethane and the fact that all available commercial

grades of this substance had the required hardness, the person skilled in the art would arrive at a monofilament according to claim 1 when carrying out the teaching of document D2, and would also have considered using this monofilament in a forming fabric.

V. The Respondent presented the following arguments:

The document D5 and Exhibit B of the Bryce Jones affidavit (D8) demonstrated that PETs having IV values lying outside the range defined in claim 1 existed, so that document D2 did not implicitly disclose the claimed ranges, and the monofilament of the claim was novel, accordingly.

Because of the different physical conditions in the forming and dryer sections, the problems of abrasion and crimpability were severe in the forming section but unimportant in the dryer section, whereas the problem of hydrolysis was severe in dryer section and of no concern in the forming section. Owing to the different problems and technical requirements, the structure of the monofilaments used in the two sections was different, as was the fabric itself, and the person skilled in the art seeking a solution to a problem with one type of monofilament would not have looked in the field of the other monofilament.

In particular, it was known in the prior art to make forming fabrics of PET and nylon. PET had good chemical and dimensional stability, good crimpability and good heat-setting characteristics, but had a poor abrasion resistance. Nylon had adequate abrasion resistance, but poor chemical and wet to dry dimensional stability, crimpability and heat-set behaviour. The invention sought to provide a solution to the problem associated with the use of nylon by providing a monofilament based on a polymer blend, which had the weaving and heat-

setting characteristics of PET and approached the abrasion resistance capabilities of nylon. However, nylon was not used in the dryer section since it would not stand up to the heat present there, so the person skilled in the art would not look into document D2 for a solution to this problem since this document described monofilaments for a dryer section only.

Apart from abrasion resistance, important characteristics of a forming fabric included wet to dry dimensional stability, crimpability, weavability and heat setting characteristics, but these were not addressed by the document D2. Moreover, this document gave no specific example of a polyurethane and the only thermoplastic material specifically referred to was not a polyurethane but a polyester derivative. The abrasion resistance of a monofilament using this material would not be much better than that of prior art monofilaments. Furthermore, the teaching of this document was not credible since polyesters did not mix with polyurethanes. These were further reasons why the person skilled in the art would not have considered this document.

In the opposed patent the desired properties of the claimed forming fabric were directly dependent on the interaction of the selected values of IV and hardness. This provided a blend having not only the required characteristics but also ensured miscibility of the components, and this teaching was not in the prior art.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The entire tenor of the application as originally filed was that the claimed monofilament was for use in the forming section of a paper making machine. For example, it is made clear in the opening passages that whereas a paper making machine has forming, press, and dryer sections, "this invention is directly concerned with the wet end or forming section of a paper making machine". The amendment in the first line of claim 1 ("when used for the cross machine yarns of a forming fabric") is therefore adequately supported by the original disclosure, and particularly by original claims 1 and 4, for example.

The amendment to the intrinsic viscosity range is supported by page 4, line 34 of the A2 publication.

Both the above amendments have the effect of narrowing the scope of claim 1 and are allowable under Articles 123(2) and (3) EPC, accordingly. Consequential and other minor amendment to claims 6, 7, and 10 to 14 (including the cancellation of claim 11) and the description is also allowable.

3. *Novelty*

The opposed patent relates to a melt extruded monofilament when used for the cross machine yarns of a forming fabric for a paper making machine. In the opinion of the Board this wording clearly limits claim 1 to the use of the monofilament in a forming fabric, in contrast with the wording "for use in".

The document D2 discloses a melt extruded monofilament for a dryer section of a paper making machine, consisting essentially of a major portion by weight of a polyethylene terephthalate polyester and a minor proportion, e.g. 1 to 30%, by weight of a thermoplastic polyurethane, together with from 0.1 to 5% by weight of a hydrolysis stabilizer.

The environmental conditions prevailing in use in the forming and dryer sections of a paper making machine are known to be different, and the engineering problems encountered in them are different, accordingly. In the forming section the fabric must allow the water to drain away freely and it is exposed to abrasive wear from both machine parts supporting the moving fabric and from substances present in the paper stock, and the filaments making up the forming fabric must be resistant to abrasion, and possess good wet to dry dimensional stability, crimpability, weavability, and heat setting characteristics.

In the dryer section, on the other hand, the remaining water is removed by passing the paper web supported between two dryer fabrics between rollers heated up to 125°C to boil away the water. The major consideration here is the ability to withstand such temperatures under conditions of extreme humidity, and resistance to hydrolytic degradation is the major technical problem, accordingly. As a consequence of these different requirements monofilaments for a forming section are dimensionally different from monofilaments for a dryer section.

Moreover, document D2 does not implicitly disclose the claimed ranges of PET intrinsic viscosity and TPU hardness. This document describes a monofilament of low carboxyl content for use in the fabric of a dryer section of a paper making machine, comprising a

polyester (preferably a PET), a polyester stabiliser, and a thermoplastics material. The latter is chosen from the group consisting of polyurethanes and polyether-ester block copolymers. The polyurethanes may be produced by the reaction of methylene diphenyl isocyanate or tolylene diisocyanate with polyethylene adipate or phthalate or polyalkylene oxides. This reaction, however, produces a whole spectrum of polyurethanes with a corresponding spectrum of properties (inter alia hardness). Therefore, document D2 also does not clearly and unambiguously disclose a material with the parameters of the monofilament according to claim 1.

The disclosure of documents D3 and D6 cannot be construed as proof that PETs and TPUs with IVs and hardness, respectively, outside the claimed ranges did not exist at the priority date of the opposed patent since Exhibit B of the Respondent's submission dated 28 November 1977 and Table II of document D5 prove that there existed PETs whose parameters lay outside the ranges specified in claim 1.

Therefore, document D2 does not disclose a PET having an intrinsic viscosity and a TPU hardness in the ranges specified in claim 1.

Since none of the cited documents discloses a monofilament as defined in claim 1, the subject-matter of claim 1 is novel.

4. *Inventive step*

4.1. The opposed patent is concerned with paper making fabrics known as "forming fabrics", which are used in a forming section to screen a moisture laden mass of cellulose fibers during the initial stage of water removal to transform it into a wet paper web. The

forming section is followed by a press section where a major proportion of the remaining water is removed by passing it through a series of pressure nips, and a dryer section in which heat for final drying of the paper is applied. Each of these sections has a respective fabric for supporting the incipient paper.

As stated above, owing to the different environmental conditions prevailing in use of each of these sections, and the resulting different engineering problems encountered in them, a monofilament for a forming section is dimensional different from a monofilament for a dryer section and requires a different combination of physical parameters than the latter. A person skilled in the art would not automatically consider that a monofilament material which is suitable for one section would also be suitable for use in the other section. Therefore, the closest prior art document must be one that discloses a monofilament for a forming section.

The only documents in the appeal procedure that disclose monofilaments for forming fabrics are documents D1 and D3. Other documents disclosing such monofilaments are reviewed in the description of the opposed patent. Document D1 describes the use of polyester and nylon yarns in a forming fabric and recognises that the material chosen for the fabric must have both dimensional stability and abrasion resistance. To this end it proposes special weave patterns to improve the performance of the fabric.

The closest prior art document is D1, accordingly.

4.2. It is known that polyethylene terephthalate possesses good chemical and dimensional stability, and also good heat-set behaviour and crimpability, and is amenable to weaving, but its abrasion resistance is unsatisfactory. It is also known that nylon-6 and nylon-66 possess adequate abrasion resistance, but have serious deficiencies for weaving as they have very poor crimpability and inadequate heat-set behaviour, and they do not possess adequate dimensional stability in the moisture range found in the paper making environment. The technical problem to be solved is, therefore, to alleviate the problems associated with the use of nylon in a forming fabric.

4.3. The above problems are solved by the melt extruded monofilament as defined in claim 1. In particular, polyethylene terephthalate polyester of the blend has an intrinsic viscosity of between 0.5 to 1.20 when measured in a solvent comprising a 60:40 parts by weight mixture of phenol and 1,1,2,2-tetrachloroethane at a temperature of 30°C, and the polyurethane used has a Durometer Type A hardness of no greater than 95 or a Durometer Type D hardness of no greater than 75.

By selecting the intrinsic viscosity of the PET component as defined above and by also restricting the hardness of the polyurethane component to the claimed range, the above objects of the invention are achieved. The Respondent explained at the oral proceedings before the Board how these parameters interact to produce a useful monofilament. That is, the IV of the PET and the hardness of the TPU act together to allow the components to mix together and be extrudable. Moreover, the blend is extrudable at lower temperatures than normally used. The resulting monofilament also has the

desired properties, particularly those of abrasion resistance, crimpability, and wet to dry dimensional stability, as evidenced by the examples given in the patent specification.

The examples are described with reference to the tables on pages 6 to 10 and show that, in those cases where the polymer blends meet the requirements of claim 1, not only is the abrasion resistance satisfactory, but the wet to dry dimensional stability, crimpability, and mechanical stability are also superior to those where polymer blends not falling within the terms of claim 1 are used.

4.4 Document D2 aims at providing a monofilament of low carboxy content for use in fabricating a paper machine dryer fabric having improved resistance to hydrolytic degradation and abrasion.

Although abrasion resistance is a requirement common to fabrics used in the forming and the dryer sections, hydrolytic degradation is not a major issue in the forming section where excellent crimpability and structural stability are more important requirements instead.

Therefore, a person looking for a material to replace the nylon filaments as the cross machine yarn in the fabric according to document D1 would not necessarily suspect that he would find a suitable material in a document such as D2 which is particularly concerned with monofilaments for dryer fabrics. If he nevertheless did so and tried to carry out the teaching of this document, he would first have to make a choice between a polyetherester and a polyurethane as a thermoplastic material. Although the elastomeric polyester traded under the name of Hytrel is the thermoplastic material used in the example in document

D2, he would have to choose a polyurethane instead in order to arrive at the claimed monofilament. Having done so, he would then encounter the problem that the poor miscibility of PET and TPU renders the melt extrusion of a uniform monofilament from a mixture of these materials difficult (see document D8 and the exhibits C and D annexed to it). Since document D2 is completely devoid of any help in this respect and does not mention this problem, it would even be difficult for him to carry out the actual teaching thereof and produce a monofilament suitable for the dryer section from a mixture of PET and TPU. Apart from that he would then have to go beyond this teaching and develop a monofilament suitable for the forming section instead.

Bearing all these obstacles in mind, the Board cannot see that document D2 provides a path leading in an obvious manner from the Document D1 to the subject-matter of claim 1.

There is no suggestion in any other document on file, that replacing the nylon component of a monofilament disclosed in document D1 by a polyurethane component would provide a useful blend for a forming fabric. Nor does any document suggest selecting the IV and hardness values as defined in claim 1 for any useful purpose. Therefore, there is no prior art document whose teaching supplements that of document D1 in a manner that would lead to the presently claimed monofilament.

4.5 The remaining claims are dependent on claim 1 and meet the requirements of Article 52(1) EPC.

5. Since, in view of the above, the grounds of opposition raised by the Respondent do not prejudice the maintenance of the patent in amended form, the patent in suit can be maintained on the basis of the Appellant's request.

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 in amended form on the basis of the following documents:

   Claims: 1 to 14 submitted at the oral proceedings.

   Description: pages 2 and 4 submitted at the oral proceedings;
   pages 3 and 5 to 12 of EP-B1-0 387 395.

The Registrar: The Chairman:

V. Commare W. D. Weiß