

Publication in the Official Journal ~~Yes~~ / No

File Number: T 188/88 - 3.2.4
Application No.: 81 300 271.4
Publication No.: 0 034 880
Title of invention: Process for forming a continuous filament yarn from a melt
spinnable polyethylene terephthalate and novel polyester
yarns produced by the process
Classification: D01D 5/08, D01D 5/12, D01F 6/60, D01F 6/62

DECISION
of 24 June 1991

Proprietor of the patent: IMPERIAL CHEMICAL INDUSTRIES PLC
Opponent: Hoechst AG

Headword:

EPC Articles 54 and 56

Keyword: "Novelty - confirmed" -
"Inventive step (yes)"

Headnote



Case Number : T 188/88 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 24 June 1991

Appellant :
(Opponent)
Hoechst Aktiengesellschaft, Frankfurt
Zentrale Patentabteilung
Postfach 80 03 20
W-6230 Frankfurt am Main 80 (DE)

Respondent :
(Proprietor of the patent)
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Decision under appeal :
Decision of Opposition Division of the European
Patent Office dispatched on 26 February 1988
rejecting the opposition filed against European
patent No. 0 034 880 pursuant to Article 102(2)
EPC.

Composition of the Board :

Chairman : C. Andries
Members : M. Liscourt
J.-P. Seitz

Summary of Facts and Submissions

I. European patent No. 0 034 880 comprising four claims was granted on 5 March 1986 on the basis of European patent application No. 81 300 271.4 filed on 21 January 1981.

II. Claim 1 of the granted patent reads as follows:

"A process for forming a continuous filament yarn of polyethylene terephthalate comprising extruding the molten polyethylene terephthalate through a shaped orifice to form a molten filamentary material, passing the molten filamentary material in the direction of its length through a solidification zone wherein the molten filamentary material is solidified, passing the solidified filamentary material in the direction of its length through a conditioning zone provided with steam at a temperature above the glass transition temperature of the material and below its melting temperature, withdrawing the resulting filamentary yarn from the conditioning zone and winding up such yarn at a velocity in excess of 3,000 metres/minute characterised in that the conditioning zone is provided with compressed steam at an absolute pressure of between 446 and 1548 kN/m²."

Claim 3 of the granted patent reads as follows:

"A continuous filament yarn of polyethylene terephthalate made by a process as claimed in either Claim 1 or Claim 2, characterised in that the filaments have a birefringence (Δn) greater than 0.105 and 5% modulus greater than 290 centi Newtons/tex and an initial modulus (IM) defined by the function:

$$IM \geq 260 \cosh \left(\frac{(\Delta n)}{0.0784} \right) "$$

III. The patent was opposed by the Appellant (Opponent) on the grounds that it did not satisfy Arts. 83, 54 and 56 EPC (Art. 100(a) and (b) EPC). Among others, the following prior art documents were cited:

D1: DE-A-2 445 528;

D3: BR-B-7602050 and its corresponding Canadian patent specification CA-A-1080923 (D3');

D7: US-A-2 289 860.

IV. The opposition was rejected by the Opposition Division with a decision dispatched on 26 February 1988, since according to the Opposition Division the patent satisfied Arts. 83, 54 and 56 EPC.

According to the Opposition Division, it would not have been obvious to combine the teaching of either document D2 or D3 (D3') with the teaching of document D1 reflecting the closest state of the art to obtain the process according to Claim 1. According to the Opposition Division documents D1, D2 and D3 (D3') do not contain any indication which would lead the person skilled in the art to the use of pressurized steam in the claimed range as a yarn treating medium in a conditioning zone.

As regards the subject-matter of Claim 3 the Opposition Division considered in its decision that it was novel and that it involved an inventive step because a special group of polyethylene terephthalate filaments is defined comprising a selection of the combination of features which was not suggested to the person skilled in the art.

- V. The Appellant filed an appeal against this decision on 28 April 1988, the appeal fee being paid on the same day. The Statement of Grounds of Appeal was filed on 6 July 1988. The Appellant stated that the claimed process could not be carried out (Art. 100(b) EPC) and that the subject-matter of both Claims 1 and 3 lacks novelty and does not involve an inventive step (Art. 100(a) EPC).
- VI. During oral proceedings which were held on 24 June 1991, the Appellant cited two new documents:

D13: Béla von Falkai "Synthesefasern", 1981, Verlag Chemie, Weinheim, page 111, Abschnitt 4.2.4.4: Präparierung der Fäden;

D14: H. Klare "Synthetische Fasern aus Polyamiden", 1963, Akademie-Verlag, Berlin, pages 243 and 272.

In the oral proceedings the Appellant emphasised the following:

- (a) the content of document D3 (D3') destroys the novelty of the subject-matter of Claim 1.
- (b) the novelty of the yarn according to Claim 3 however would be destroyed by the yarn according to example 3 of document D1.
- (c) the minimum value given in Claim 3 for the 5% modulus is a redundancy.
- (d) a standard nylon conditioning tube is described in document D7 (Figures 1 and 2).

VII. At the end of the oral proceedings, the Appellant maintained his request to revoke the patent and the Respondent requested to dismiss the appeal.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC; it is therefore admissible.
2. There is no formal objection under Article 123 EPC to the version of the claims, description and drawings as granted, on which the present decision is based.
3. Although document D3' (in the English language) was published too late in order to be considered as state of the art according to Article 54(2) EPC, it is accepted by both parties that, since its content corresponds exactly with the content of document D3 (in the Portuguese language) which forms part of the state of the art according to Article 54(2) EPC, references will be made for convenience to document D3' instead of to document D3.

Document D13, which was published too late, cannot be taken into the proceedings.

Document D14, only introduced into the proceedings during the final oral proceedings, discloses, as accepted by the Appellant during these oral proceedings, nothing more than that subject-matter which was already disclosed in document D7. Document D14, which was intended to prove the general knowledge of a person skilled in the art, is therefore considered as being superfluous and will be disregarded by the Board in accordance with Article 114(2) EPC.

4. Interpretation

To assess the subject-matter of Claims 3 and 4 properly, the expressions "birefringence", "initial modulus", "5% modulus", as well as "long-period spacing" are interpreted on the basis of the definitions given in the description (granted patent: page 4, lines 14 to 39).

5. Disclosure of the invention

Although the objection of lacking disclosure of the invention has not been brought forward any more by the Appellant during the oral proceedings, the Board wants to emphasise that it is the disclosure of the European patent as a whole, and not only the content of Claim 1, which should be taken into account to decide whether or not a person skilled in the art can carry out the invention.

5.1 With respect to the temperature and the pressure in the conditioning zone, as well as the time during which the filaments remain in that zone, attention is drawn to the specific values given in the description, cf. examples 1 to 16. The person skilled in the art finds for each example (table 1) a specific pressure value and a specific temperature value. Furthermore, the time during which the filaments are in the conditioning zone is unequivocally defined by the length of that zone (page 4, line 65) and the yarn velocity (table 1).

For example: Example No. 1: Pressure: 446 kN/m²
Temperature: 147°C
Tube length: about 0,5m
Yarn velocity: 4,75
km/min

- 5.2 It is also clear for a person skilled in the art that, due to the requirement put forward in Claim 1 that steam has to be present at an absolute pressure of between 446 and 1548 kN/m², each pressure in this range requires already a minimum temperature, since otherwise no steam can be present. For example the minimum pressure value (446 kN/m²) requires, in order to have steam, a temperature of at least 147°C. The maximum temperature for each working pressure however is not dependent on the pressure, but is limited by the other temperature requirement present in Claim 1, namely a temperature below the melting temperature of the material.
- 5.3 The discussion in the proceedings about "saturated steam" and "superheated steam" is, according to the Board, insofar superfluous, as that discussion does not take into account the fact that in Claim 1, steam under a certain specific pressure is requested. Such pressurised steam is, according to the wording of Claim 1, not limited to either wet saturated steam, or dry saturated steam, or superheated steam. It is common general knowledge that these steam conditions occur for all pressures below a critical point, particularly for atmospheric pressure, so that the word "steam" or "vapor" alone in the cited documents does not imply a pressure as defined in Claim 1.
- 5.4 A person skilled in the art therefore finds in the European patent as granted sufficient guidance to carry out the invention as claimed in Claim 1 (Art. 100(b) EPC).

6. Novelty

6.1 Claim 1

6.1.1 Document D1 discloses a process corresponding to the process according to the pre-characterising portion of Claim 1.

A gaseous atmosphere, consisting of air, steam or inert gases in a statical state, is provided within the conditioning zone. Its composition is not critical to the operation of the process (page 14, lines 23 to 25). The temperature of the gaseous atmosphere inside the conditioning zone is preferably between 110 and 120°C (page 14, lines 12 to 14). In the examples 1 and 3 a temperature of 120°C for the air in a statical state has been taken.

Apart from the fact that in the sole figure of document D1 the tube enclosing the conditioning zone has rather big openings at both its ends, there is no single indication in the whole document which could be explained as implying the presence of a certain pressure condition within the conditioning zone, let alone the presence of steam under a pressure between 446 and 1548 kN/m². On the contrary, with the above already indicated preferable temperature range from 110 to 120°C (page 14, lines 12 to 14), as well as with the temperature used in the examples 1 and 3 (120°C) it becomes clear for a person skilled in the art that with such temperatures no steam can be obtained within the pressure range claimed in the opposed European patent. Indeed the claimed minimum pressure (446 kN/m²) requires already, in order to get steam, a temperature of at least about 147°C. The Board therefore is of the opinion that no pressure was either intended, or present in the conditioning zone according to document D1.

6.1.2 Document D3' describes a process for forming a continuous filament yarn of polyethylene terephthalate comprising extrusion, a solidifying step (quenching), a conditioning step (annealing), a withdrawing and winding-up step. The conditioning takes place in a zone being maintained at a temperature of 150°C up to the melting temperature (Claim 1). The maintenance of temperature and residence time in this zone has to be at such levels that modification in crystalline morphology is completed in the zone.

6.1.2.1 The necessary process control is achieved by interrelating polymer viscosity, spinning temperature and stress anneal temperature. In spinning a given polymer, a selective spinning temperature is correlated with stress anneal temperature by reference to crystallisation and tensile development rates (page 7, lines 15 to 24). This passage only emphasises the importance of the temperature in the conditioning zone, which is furthermore stressed throughout the whole description (e.g. page 8, line 30 to page 9, line 2).

6.1.2.2 With respect to the conditioning zone the following is disclosed:

(i) On page 8 (starting from line 13) it is stated that the conditioning zone is in the form of a heater tube as of the type represented by a standard nylon steam conditioning tube;

(ii) According to lines 26 to 28 the structure of that tube is that of a jacketed chamber heated with steam or DowthermTM vapor to in excess of 100°C up to 260°C or more;

- (iii) Length and internal diameter of the tube are merely chosen to provide sufficient heat into the filament to raise its temperature without the filament contacting the interior tube walls (page 9, lines 8 to 13);

- (iv) Due to the required high speed throughput, strong air currents are generated by the frictional drag of the filament in the air, such that, these air currents tend to follow the filament through the tube, thereby insulating the filament from the heated walls of the tube (page 9, lines 13 to 17);

- (v) It is already known to modify the tube structure to reduce such air currents;

- (vi) Example I: a 2 meter nylon steam conditioning tube at 80 psig (562 kN/m²) is present.

6.1.2.3 During the oral proceedings the Appellant stressed the point that due to the expression "standard nylon steam conditioning tube" it was clear for a person skilled in the art, working in the field of polymers, that a tube as shown in Figures 1 and 2 of document D7 was meant. Such a tube implies, in his opinion, a direct contact between the heating medium on the one hand and the treated yarn on the other. Support for this opinion could also be found in document D14. Since, furthermore, a pressure has been indicated in Example I (80 psig = 562 kN/m²) it is clear for a person skilled in the art that document D3' discloses the presence in the conditioning zone of steam at a pressure of 562 kN/m².

- 6.1.2.4 The Respondent however disputed that the expression "standard nylon steam conditioning tube" represented a very specific tube. He considered the examples given in document D7 as possible constructions, but emphasised that further constructions are available.
- 6.1.2.5 The Board states first that the Appellant did not rely on an unequivocal proof that the indicated expression really implied direct contact between the heating medium and the yarn. If something which has been defined with the word "standard" has really been standardised, then it would have been easy to forward such a proof.
- 6.1.2.6 As already indicated above (cf. point 6.1.2.1) the whole content of the document emphasises the importance of the temperature in the conditioning zone. No clear indication is however given in the document, apart from the fact that air is in contact with the filament yarn when traversing the conditioning zone, either to the presence of another gaseous atmosphere in contact with the filament yarn, or to the presence of a conditioning zone atmosphere under pressure.
- 6.1.2.7 Indeed, the steam or Dowtherm TM vapor is clearly stated to be present in the jacket surrounding the conditioning zone (cf. point 6.1.2.2 (ii)). The use of Dowtherm TM vapor implies, as agreed by both parties, that only a closed jacket, not open to the atmosphere can be intended, since such a vapor cannot be allowed to escape in the atmosphere.

The use of the word "steam" in the expression "standard nylon steam conditioning tube" does not help further, since if that expression defines, according to the Appellant, a specific construction it does not imply that it has to be used with steam, it only defines the tube as such.

On the other hand, it is clear in the Board's view from above points 6.1.2.2 (iv) and (v) that in the conditioning zone air surrounds the filament yarn. The Board cannot follow the Appellant's argument that air is drawn by the movement of the filament yarn into the tube from outside, when furthermore there exists, also according to the Appellant, a substantial pressure difference between the inside and outside parts of the conditioning zone. Such a pressure difference contradicts the possibility of entrained air.

Also the use of the word "internal" in the expression "internal diameter of the tube" (cf. point 6.1.2.2 (iii)) implies, according to the Board, rather the use of a jacket.

- 6.1.2.8 The only pressure indication in document D3' is given in Example I by the wording "tube at 80 psig". The place (the jacket or the conditioning zone itself) where that pressure is present is not unequivocally clear. The content of the whole document, however, particularly considering the lack of any indication of a direct contact of the pressurised fluid with the filament yarn, let alone the direct contact of pressurised steam with the filament yarn, which would be anyhow an important method step when handling a polymer filament yarn, points, according to the Board, rather to the use of that pressure (80 psig) in a jacket, heating thereby the air which is in contact with the filament yarn.
- 6.1.2.9 The Board therefore is not convinced that in document D3 (D3') steam under pressure is contacting the filament yarn.

6.1.3 None of the other documents cited in the proceedings before the European Patent Office discloses a process for forming a continuous filament yarn according to Claim 1. To give reasons is unnecessary since during the oral proceedings the Appellant did not dispute the novelty with respect to the remaining available documents.

6.1.4 Hence, the subject-matter of Claim 1 is considered to be novel within the meaning of Article 54 EPC.

6.2 Claim 3

6.2.1 When considering the product according to Claim 3 per se, it shows three main features:

(i) the filaments have a birefringence (Δn) greater than 0,105;

(ii) the initial modulus (IM) is defined by a certain function, namely $IM \geq 260 \cosh \left(\frac{\Delta n}{0,0784} \right)$; and

(iii) the 5% modulus has to be greater than 290 cN/tex.

6.2.2 The Board cannot follow the argument put forward by the Appellant that, since according to the description of the opposed patent itself (page 6, lines 50 to 60) only features (i) and (ii) define the invention then only these two features are relevant.

The Respondent clearly stated that feature (iii) is an additional feature, which further restricts the claimed product.

Indeed, according to Article 84 EPC, it is the claims which define the matter for which protection is sought.

6.2.3 The Appellant, relying only on document D1 to attack novelty of the subject-matter of Claim 3, considers that the features (i) and (ii) are anticipated by the values given for the filament yarn according to example 3 of document D1 and that feature (iii), although implicitly present, is superfluous anyhow.

Even if, as accepted by the Respondent, the values given for example 3, particularly the parameters birefringence (Table III) and initial modulus (Table I) satisfy the features (i) and (ii) of Claim 3, there is no teaching as regards the 5% modulus, neither directly nor indirectly through other parameters or other dependencies between known values. Furthermore, the conditions wherein said example 3 is performed are considerably different from those in the impugned patent, particularly since the temperature in the conditioning zone in the process according to document D1 is maintained at 120°C (cf. D1, page 19, line 13) instead of being maintained at least at 147°C which is the minimum temperature of steam at the minimum pressure of 446 kN/m² defined in Claim 1. Therefore, it is doubtful that the product of Claim 3 would show exactly the same properties as the yarn according to example 3 of document D1 because they have not been prepared under the same conditions and there are no indicia which could lead one to suppose that the yarn according to example 3 (document D1) could show the same 5% modulus as the yarn according to Claim 3 of the impugned patent.

The hypothetical calculations put forward by the Appellant with respect to the 5% modulus, are not supported by any background art, so that these non-supported allegations have to be considered as the result of an ex-post-facto analysis.

6.2.4 The remaining documents which were not quoted anymore by the Appellant in this respect do not disclose a filament yarn comprising the features defined in Claim 3, so that the filament yarn according to Claim 3 is considered to be novel within the meaning of Article 54 EPC.

7. Inventive Step

7.1 The invention concerns a process for forming a continuous filament yarn of polyethylene terephthalate and the resulting continuous filament itself.

7.2 From the statements in the opposed patent, the person skilled in the art learns that the state of the art available to the public includes various processes for forming continuous filament yarns of polymeric material. It follows from the discussions of the prior art by the parties during the oral proceedings that the problem to be solved is to obtain a process which results in an improved corresponding product, particularly a filament yarn of polyethylene terephthalate, obtaining thereby the advantages as mentioned in the patent specification (page 3, line 60 to page 4, line 4).

During the oral proceedings the Respondent made clear that the improvement with respect to the product obtained with a process according to document D1 consisted not only in a better 5% modulus of the obtained product, but also in an improved relationship between the 5% modulus and the initial modulus, which is of importance during the later use of the filament yarn.

7.3 The solution according to the opposed patent consists in treating the polyethylene terephthalate in a conditioning zone with steam under a pressure between

446 and 1548 kN/m². The obtained product has the qualities as referred to in Claim 3.

7.4 There is no reason for the Board to doubt that the results mentioned under above point 7.2 are obtained.

The fact, put forward during the oral proceeding by the Board, that the description of the opposed patent itself did not contain specific values for the 5% modulus in the comparative examples 17 to 28, although not convincing the Board of the obtained improved results (a better 5% modulus), could however not in the opinion of the Board be explained in favour of the Appellant, who consistently stated that the 5% modulus was a superfluous parameter. Indeed, as no proof has been brought forward by the Appellant to challenge the obtained result, the Board has to accept the results put forward in the opposed patent.

7.5 A person skilled in the art searching to improve the product of the known process according to document D1 for forming a continuous filament yarn could not find a suggestion in the prior art towards the claimed solution and its resulting product, since no available document discloses the use of steam under a pressure between 446 and 1548 kN/m² which contacts the polyterephthalate filament yarn directly during its presence in the conditioning zone (cf. above points 6.1.1 (document D1) and 6.1.2 (document D3')).

Even document D7 describing a conditioning zone, wherein steam is introduced to contact a filament yarn, cannot lead the skilled person towards the solution. Indeed, apart from the fact that another material is treated, the Board is not convinced that in the tube of the conditioning zone, the material is in contact with steam

under pressure between 446 and 1548 kN/m². In the embodiment according to Figure 1, the steam present in the enclosure 23 is supplied in such an amount that it gently but just visibly issues from the top and bottom of the enclosure (page 2, right hand column, lines 18 to 21). Furthermore, the openings in the top and the bottom of the enclosure (Figure 2) are, in the opinion of the Board, such that it cannot be upheld that such a pressure as claimed exists in that enclosure. In the embodiment according to Figure 2, it is clear that steam under pressure is present in the steam jacket 54. The steam is however passed from the jacket to the enclosure 50, which is open to atmosphere (figure 2), through small openings 58 (cf. page 2, last four lines). A pressurised conditioning zone 50 is therefore, according to the Board, not present.

Furthermore, no indication of an improved 5% modulus can be found in the available documents, so that even for this lack of an indication, it is not obvious to find in that state of the art the claimed solution.

- 7.6 The subject-matter of both Claims 1 and 3, therefore, involves an inventive step within the meaning of Article 56 EPC.
8. Hence, the subject-matter of each of Claims 1 and 3 is new and cannot be derived in an obvious manner from the cited prior art and accordingly involves an inventive step as required by Articles 54 and 56 EPC. They are therefore patentable (Article 52(1) EPC) and the patent may be maintained on the basis of said claims as well as on the basis of Claim 2 which covers a special embodiment of the process according to Claim 1 and Claim 4 which covers a particular embodiment of the product according to Claim 3.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:



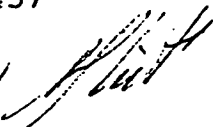
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The Chairman:



C. ANDRIES

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