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File Number: T 151/90 - 3.3.3  
Application No.: 83 105 143.8  
Publication No.: 0 095 712  
Title of invention: Easily dyeable polyethylene terephthalate fibre and  
process for preparing the same  
Classification: C01F 6/62

D E C I S I O N  
of 29 October 1992

Applicant: Asahi Kasei Kogyo Kabushiki Kaisha

Opponent: Akzo Faser Aktiengesellschaft  
Hoechst Aktiengesellschaft

Headword:

EPC Arts. 54 and 56

Keyword: "Novelty and inventiveness (affirmed)"



Case Number : T 151/90 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 29 October 1992

Appellant :  
(Opponent 01)

Akzo Faser Aktiengesellschaft  
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Representative :

Appellant :  
(Opponent 02)

Hoechst Aktiengesellschaft, Frankfurt  
Ressortgruppe Patente, Marken und Lizenzen  
W-6230 Frankfurt am Main 80 (DE)

Respondent :  
(Proprietor of the patent)

Asahi Kasei Kogyo Kabushiki Kaisha  
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Representative :

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Decision under appeal :

Interlocutory decision of the Opposition Division  
of the European Patent Office dated 21 December  
1989 concerning maintenance of European patent  
No. 0 095 712 in amended form.

Composition of the Board :

Chairman : F. Antony  
Members : R.A. Lunzer  
F. Benussi

Summary of Facts and Submissions

I. European patent No. 95 712 was granted on 15 April 1987 on the basis of application No. 83105143.8 filed on 25 May 1983, having a priority date of 28 May 1982 derived from Japanese Applications Nos. 89753/82 and 89754/82.

II. Oppositions were filed by Enka AG, now Akzo Faser AG, on 22 December 1987, and by Hoechst AG on 13 January 1988, on the ground of Article 100(a) EPC, alleging lack of novelty (Article 54 EPC), and lack of inventive step (Article 56 EPC). The Opponents relied in particular on the following documents:

- (2) DE-A-2 530 618 = JP-A-51 007 216
- (5) US-A-4 134 882
- (9) DE-A-2 347 801
- (11) US-A-4 247 505.

III. By its interlocutory decision of 21 December 1989, the Opposition Division decided that the patent as amended could be maintained, since it was not satisfied that document (5), which was regarded by all parties as being the closest prior art, deprived the alleged invention as defined in the process and product claims of novelty or inventiveness.

The two independent claims were in the following form, Claim 7 having been amended in the course of the opposition by the addition of the words, "and taking up a bundle of filaments without using godet rolls,":

"1. Easily dyeable polyethylene terephthalate fibre, characterized by an intrinsic viscosity of the polymer of from 0.50 to 1.0, an initial modulus of from 534 cN/tex to

1157 cN/tex, a surface area per unit weight of from 1,400 cm<sup>2</sup>/g to 4,000 cm<sup>2</sup>/g, and a peak temperature ( $T_{\max}$ ) at which the dynamic loss tangent ( $\tan \delta$ ) measured at a frequency of 110 Hz becomes maximum and a maximum  $\tan \delta$  value ( $\tan \delta$ )<sub>max</sub> satisfying the following relationship (1) or (2):

- (1)  $105^{\circ}\text{C} < T_{\max} \leq 115^{\circ}\text{C}$  and  $0.135 < (\tan \delta)_{\max} \leq 0.190$
- (2)  $110^{\circ}\text{C} < T_{\max} \leq 115^{\circ}\text{C}$  and  $0.110 \leq (\tan \delta)_{\max} \leq 0.135$ .

7. A process for preparing a fibre as claimed in Claim 1, characterized by melt-spinning polyethylene terephthalate through a spinneret having a plurality of spinning holes at a spinning speed of not less than 7,000 m/min and taking up a bundle of the filaments without using godet rolls, in which a group of extruded filaments is passed through a heating zone defined over a length of not less than 5 cm from the bottom surface of the spinneret, is maintained at a temperature of from 150°C to 300°C, and then is bundled into a filament bundle by means of a bundling guide positioned so as to satisfy the following conditions (a) and (b):

(a) said position should be not less than 5 cm beneath the point of completion of fining of the group of filaments

(b) the tension imposed on the filament bundle 5 cm beneath said position of the bundling guide should be not more than 0.36 cN/dtex."

IV. Appeals against that decision were lodged by both the former Opponents. Both Hoechst and Akzo filed their appeals on 22 February 1990, paid the the appeal fees on the same day, and submitted their Grounds of Appeal on 26 April 1990.

- V. On 26 October 1992, i.e. three days before the date fixed for the oral proceedings, the Appellant Hoechst filed a copy of a document dated 7 December 1987 which had been filed by the Attorneys acting on behalf of the Respondent in the course of other proceedings before the EPO. This showed that Example 28 of document (5) had a  $T_{\max}$  of 112°C and a  $(\tan \delta)_{\max}$  of 0.138, and thus satisfied both conditions (1) and (2) specified in Claim 1 of the patent in suit.
- VI. In its Grounds of Appeal, and particularly during oral proceedings held on 29 October 1992, the Appellant Akzo argued that there was insufficient disclosure of what was meant by the "heating zone" referred to in the process Claim 7. If, as had been argued by the Respondent in its written response to the Akzo appeal, what was meant was a heater, as distinguished from a tube insulated so as to retain the heat of the solidifying stream of polymer, the claim ought to be so confined, or so construed. The main argument of Hoechst was that Claim 7 lacked novelty having regard to the disclosure of document (5), as it would be read and understood by the skilled reader. Its proper interpretation was not confined to what was explicitly disclosed in that document, but included all that the skilled reader would take into account, based on the common knowledge and practice in the art. When so read, each and every feature of Claim 7 was disclosed. If the Board did not accept that there was actual disclosure, the other documents in the case, notably documents (2), (9), and (11), confirmed that there could be no inventive step. Similarly, the product Claim 1 was lacking in novelty and/or inventive step.
- VII. The Respondent argued in its Counterstatement, filed on 5 January 1991, and during the oral proceedings, that Claim 7 defined a novel combination of steps which made it

possible for the first time to achieve a combination of fineness of yarn, and high spinning speed, which had hitherto been unattainable in the spinning of polyethylene terephthalate (PET) yarns. That combination of steps, and notably the high spinning speed, were implicit in the physical data defined in Claim 1. The product so defined possessed advantageous properties which had not hitherto been achieved. Both the process Claim 7 and the product Claim 1 defined novel and non-obvious subject-matter. They were therefore patentable. The disclosure of the heating zone was sufficient.

VIII. The Appellants (opponents) requested that the decision under appeal be set aside, and that the European patent No. 95 712 be revoked.

The Respondent (patentee) requested that the appeals be dismissed.

#### Reasons for the Decision

1. The appeals are admissible.
2. Admissibility of late filed material

The Board is generally reluctant to admit into an appeal material filed only a few days before oral proceedings. However, as the document mentioned in V. above emanated from the Respondent, who was thus at least in theory aware of it, the Board decided in its discretion to admit it into the proceedings.

3. Admissibility of Amendments

The sole amendment sought in the course of the opposition was the explicit limitation of the process to one in which

winding is effected without the use of godet rolls between the spinning stage and the winding of the bundle of filaments. It is very well known in this art that spinning can be effected with or without the use of godet rolls. In the description of the present alleged invention it is clear throughout, and notably from the passage at page 6 lines 31 to 35 of the patent as granted, corresponding to page 14 lines 3 to 11 of the application as filed, that the use of godet rolls is not contemplated. Accordingly, the proposed amendment relates to matter which was disclosed in the application as filed, and it has the effect of limiting the scope of Claim 7 as compared with its scope in the patent as granted. The provisions of Articles 123(2) and (3) EPC are therefore satisfied.

4. Sufficiency of Disclosure

Although the issue of insufficient disclosure was not raised in the grounds of opposition, the Board nonetheless heard argument directed to that issue, and gave a ruling upon it. In its view a heating zone is not necessarily confined to a zone in which heat is supplied from an external source. What is meant in the context of the present specification by a "heating zone" is in the view of the Board sufficiently clear when these words are read with an understanding of the art. During fibre spinning, the fibres are normally contacted by a stream of cooling medium, usually air. However, it is also known, such as from Dauchert's US patent No. 3 067 458, which is mentioned in document (5) at col. 17 line 40, that the fibres as they emerge from the spinneret may be surrounded by a stream of air or other gas which is warm relative to the cooling medium to which the fibres are subjected later in their travel. Seen in that context, the Board interprets a "heating zone" as being a zone which is maintained by whatever means in the temperature range of

150 - 300°C. The skilled reader knows that there is more than one way of maintaining a zone within that temperature. Therefore, in the view of the Board, the disclosure is sufficient.

5. Novelty of Process Claim 7

5.1 In attacking the novelty of Claim 7, the Appellants drew attention to the fact that it involves five essential features which are summarised as follows:

- (i) spinning at a speed in excess of 7,000 m/min,
- (ii) a heating zone as defined generically,
- (iii) keeping the heating zone at 150 - 300°C,
- (iv) a bundling device located at its upper limit not less than 5 cm beneath the point of solidification of the fibres,
- (v) the lower limit of its position being defined by the maximum tension permissible of 0.36 cN/dtex.

5.2 With regard to each of these features, it was argued that there was either explicit disclosure in document (5), or, where the disclosure was not explicit, the skilled worker would as a matter of course have arrived at the above parameters when making use of the process of document (5) as applied to the high speed spinning of fine fibres.

5.3 In the view of the Board, there is no clear teaching in document (5) of the use in combination of all five of the above integers. Specifically:

- (i) Claim 1 is limited to fibres having a surface area of 1,400 to 4,000 cm<sup>2</sup>/g, which, depending on whether the fibre has a circular or irregular cross section, corresponds with a maximum dtex of 4.5 or

less. Claim 7, which is a process claim for making a fibre as claimed in Claim 1, has thus the functional limitation of being confined to relatively fine fibres, of 4.5 dtex or less. In document (5) at col. 14 lines 31 to 38 there is a discussion of spinning speeds, and while some qualification is expressed, the Board interprets that passage as a pointer in the direction of using the highest available spinning speeds. This interpretation is confirmed by col. 7 lines 33 to 42, which indicates that at the date when document (5) was filed, 1977, there were problems still in finding machines capable of winding at adequate speed. Thus, taking the disclosure of document (5) as a whole, the Board accepts that it points clearly in the direction of using speeds in excess of 7,000 m/min, and in fact includes in Examples 28 and 29C reference to spinning speeds of 8,000 ypm (7,300 m/min).

However, although document (5) discloses the use of speeds in excess of 7,000 m/min in Examples 28 and 29C, and dtex as low as 3.2, 3.9 and 4.1 in Examples 42, 40C and 43, each of which is spun at 7,000 ypm (6,400 m/min), there is no disclosure of the combination of such a low dtex with such a high spinning speed, and in view of then prevailing technical limitations, the Board is satisfied that, at least for the purposes of destroying novelty, it is not permissible to read these two isolated disclosures together. Thus although the first integer is disclosed per se, it is not disclosed in combination with the requisite fine dtex.

- (ii) Although fibres emerging from a spinneret are normally subjected to a degree of forced cooling,

the alternative of delaying cooling by the application of heat is well known in the art, and this option is referred to in document (5) at column 22 lines 12 to 20. However, delayed cooling, such as by the provision of a surrounding tube is only exemplified in document (5) in connection with Examples 25, 27, 16 and 26 at col. 23 line 68 to col. 24 line 11. Out of these four Examples, the closest is Example 27, with a spinning speed of 7,500 ypm (6,858 m/min) and a dtex of 5.3. There is however, neither any explicit nor any implicit disclosure in document (5) of the usefulness of a heating zone in association with higher speeds and finer dtex. Thus although the use of a heating zone per se is disclosed, there is no disclosure of a heating zone in association with spinning under the conditions specified in (i) above.

- (iii) In connection with the use of a heater, document (5) refers at col. 22 lines 17 and 18 to US patents Nos. 3 216 187 and 3 361 859, which are aged documents produced to the Board without protest in the course of the oral proceedings. Although the latter refers in Table 1 at col. 7 to heating in the range of 150 to 300°C, it does so in the context of spinning at 10% of the spinning speed in contemplation in the patent in suit. The Board thus finds no disclosure of the use of that temperature range in the context of the high speed spinning of very fine fibres as defined in feature (i).
  
- (iv) For the purpose of showing that features (iv) and (v) were common general knowledge of the kind which the skilled reader would as a matter of course take into account when reading document (5), reference was made to documents (2), (9) and (11). The Board

agrees that these documents appear to reflect a general appreciation of the fact that bundling is useful to reduce air resistance, that it should not occur at the earliest before the fibres have solidified, and that the lower limit is determined by taking into consideration the fact that the higher the bundling position, the lower the tension in the yarn. (See document (2), paragraph bridging pages 4 and 5, and page 27 Table IV which discloses an average tension of 0.16 cN/dtex; document (9) pages 2 and 3, and page 7 Examples 1 and 2; and document (11) col. 3 line 64 et seq., which specifies a tension range of 0.05 to 0.4 gpd. which corresponds to a maximum tension of 0.36 cN/dtex.) However, these three documents are patents applied for in the mid to late 1970's, when high speed spinning was in its infancy, and when there was hardly any machine available capable of winding a package at speeds in excess of 7,000 m/min. It is therefore not likely that the skilled reader of document (5), seeking to use spinning speeds in excess of those there disclosed, would automatically have applied earlier teachings regarding the positioning of the bundling device to the conditions prevailing when spinning at higher speeds.

- 5.4 Having regard to the above considerations, the Board is satisfied that the process of Claim 7 does not lack novelty in the light of document (5). No other document was cited as being more pertinent to novelty than document (5), and the Board is therefore satisfied that the alleged invention in accordance with Claim 7 is novel for the purposes of Article 54 EPC.

6. Inventiveness of Process Claim 7

6.1 It is common ground that document (5) is the closest prior art. Furthermore, although the alleged invention is stated at page 2 lines 5 to 9 of the patent in suit to be concerned with an improvement in dyeability of the fibres, there are no data before the Board comparing the dyeability of fibres in accordance with the alleged invention with those made in accordance with document (5). Consequently, the Board is unable to treat any alleged improvement in dyeability as being a problem solved by the alleged invention. Document (5) is in fact discussed in the patent in suit at page 2 line 63 to page 3 line 11, where attention is drawn to the fact that it has hitherto been impossible to obtain PET fibres finer than 4.5 dtex at spinning speeds in excess of 7,000 m/min. Regarding the dyeability of fibres in general, in document (5) at col. 31 lines 52 to 55 it is noted that normally dyeability of filaments improves with lower denier. This is due to the inherently greater surface area of finer fibres. In fact it was common ground between the parties to this appeal, that, other conditions being equal, improved dyeability is to be expected of finer filaments.

6.2 Thus in relation to the disclosure of document (5), the Board sees the objective problem as being the need to find a method of successfully spinning finer PET fibres at higher speeds than the fibres disclosed in that document without serious fibre breakage problems. The solution to that problem proposed in accordance with the alleged invention involves the use of the process conditions identified in Claim 7. The fact that those process conditions are capable of achieving spinning at speeds up to 10,000 m/min, and that the fibres so produced have good dyeability, is demonstrated in the Examples 1 and 2 (Tables 1 to 5), and has not been contested by the

Appellants. Thus the Board is satisfied that the alleged invention provides a credible solution to the above stated problem.

6.3 Although document (5) points towards the use of ever higher spinning speeds if suitable winders can be found, and although its disclosure at col. 31 lines 52 to 55 points towards the better dyeability of finer fibres, and thus affords the skilled reader an incentive to attack the problem of spinning ever finer fibres at higher speeds in the interest of better dyeability, coupled with the economic advantage of higher production speeds, it contains no pointer at all towards solving that problem by the means adopted in accordance with the alleged invention. It is true that it mentions the commonly known expedient of using a heating zone, but that option is only exemplified in 4 out of 44 Examples, and these are not the Examples spun at the highest speeds, nor are they the finest fibres. There is thus no pointer in document (5) towards the adoption of a heating zone when spinning at higher speeds (see the reference to the Examples in 5.3(ii) above), nor is there any indication of any minimum temperature for any heating zone.

6.4 In the light of these considerations, the Board is satisfied that the subject matter of Claim 7 is inventive over the disclosure of document (5), whether read alone or in combination with any one or more of documents (2), (9), and (11).

7. Novelty of Claim 1

7.1 In attacking the novelty of Claim 1, reference was made to the newly filed data mentioned in V. above, showing that Example 28 of document (5) satisfies both requirements (1) and (2) of Claim 1. However, as that Example relates to a

fibre of round cross section of 5.3 dtex, it must fall below the minimum surface area requirement specified in Claim 1 of 1,400 cm<sup>2</sup>/g. It was argued by the Appellants that the disclosure of fibres of lower dtex in document (5), such as that in Example 42 which is of 3.2 dtex, should somehow be taken into account. However, the Board has no evidence that fibres of lower dtex would satisfy the limits clearly expressed as (1) or (2) in Claim 1.

7.2 Lack of novelty was also argued on the basis of document (5), when read against the background of what was said to be common general knowledge contained in documents (2), (9) and (11). However, Claim 1 defines a product in terms of certain parameters. That product is capable of being obtained by the process of Claim 7. There is no material available to the Board demonstrating that the product of prior art processes, unlike the product of the process of Claim 7 which is itself an unusual process, would have the properties which are specified in Claim 1. Accordingly, the Board rejects the allegation of lack of novelty of Claim 1.

8. Inventiveness of Claim 1

8.1 Claim 1 defines a product in terms of physical parameters. It is a useful product, and one which can be obtained by the process of Claim 7. The objective of the patent in suit is to obtain products which have good dyeability, and the data given in Tables 2, 5 and 8 confirm that the products, when spun at speeds of 7,000 m/min or more do have these desirable properties. These properties are to be contrasted with the results disclosed in document (5). Although it is stated at col. 31 lines 52 to 55 that better dyeability is associated with lower denier, in fact it is observed that Example 42, which has the smallest denier (3 denier or 3.2 dtex) has the lowest RDDR value of

0.046 (col. 30 line 6). That experimental finding is to be compared with the statement at col. 13 lines 47 to 49, to the effect that the RDDR values of the fibres produced according to that teaching are expected to have RDDR values in the range of 0.50 to 0.60.

8.2 The Board is not able to make any valid comparison between the dyeabilities disclosed in document (5) with those disclosed in the patent in suit. It does appear, however, that the fibres of the patent in suit have the property of good dyeability when very finely spun, whereas it is not certain whether the same is achieved by the products disclosed in document (5). As there is no prior art pointing to the desirability of obtaining a product having the physical properties specified in Claim 1, the Board is satisfied that it is a non-obvious product, and therefore meets the requirement of Article 56 EPC by involving an inventive step.

9. Conclusion

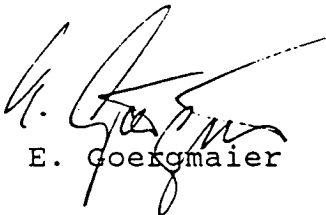
The subject matter of Claims 1 and 7 of the patent in suit is thus found to be novel, and to involve an inventive step as required by Articles 54 and 56 EPC, and is therefore patentable. The dependent Claims 2 to 6 and 8 to 11 relate to embodiments falling wholly within the scope of Claims 1 and 7, and on that ground alone they are also entitled to be upheld.

Order

For these reasons, it is decided that:

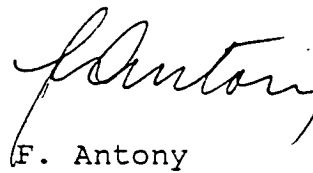
The appeals are dismissed.

The Registrar:



E. Goergmaier

The Chairman:



F. Antony