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**D E C I S I O N**  
of 5 July 1995

**Case Number:** T 0452/91 - 3.3.3

**Application Number:** 82306413.4

**Publication Number:** 0080906

**IPC:** D01F 6/92

**Language of the proceedings:** EN

**Title of invention:**

Polyester fibres and their production

**Patentee:**

Toyo Boseki Kabushiki Kaisha

**Opponent:**

Rhône-Poulenc Viscosuisse SA Patentabteilung  
Akzo Nobel Faser AG  
ALLIED-SIGNAL INC.  
HOECHST Aktiengesellschaft Zentrale Patentabteilung

**Headword:**

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**Relevant legal provisions:**

EPC Art. 54, 56, 84  
EPC R. 29(1)

**Keyword:**

"Late request - not admitted"  
"Clarity (yes) - characterisation of a product solely by a combination of usual, directly characterising parameters - not objectionable"  
"Novelty (confirmed)"  
"Inventive step (no) - product features expressing obvious desiderata obtained by obvious process modifications"

**Decisions cited:**

T 0153/85, T 0094/82, T 0487/89

**Headnote:**

I. The characterisation of a product - here a fibre yarn - solely by parameters is not objectionable when these parameters are usual in the art and when they define positively various aspects directly characterising the chemical and physical nature of that product (point 5.4.2.2).

II. The questions of patentability are to be decided solely in accordance with the EPC. No national decision should be cited as if it were binding on the EPO; claims should not be refused by the EPO on the ground that their patentability could not be upheld under the jurisdiction of one member state (point 5.4.1).



Case Number: T 0452/91 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 5 July 1995

**Appellant:**  
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Decision under appeal:

Decision of the Opposition Division of the  
European Patent Office announced orally on  
16 April 1991, with written reasons posted on  
10 May 1991, revoking European patent  
No. 0 080 906 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin  
Members: P. Kitzmantel  
S. C. Perryman

## Summary of Facts and Submissions

- I. European patent application No. 82 306 413.4 in the name of Toyobo Petcord Co., Ltd. (assigned to Toyo Boseki Kabushiki Kaisha with effect from 22 February 1989), which had been filed on 2 December 1982, claiming the priority of a JP application filed on 2 December 1981, resulted in the grant of European patent No. 80 906 on 1 March 1989, on the basis of 10 claims.

Independent Claims 1, 3, 8 and 9 read as follows:

"1. A polyester fibre yarn having high thermal dimensional stability, chemical stability and tenacity of 8.5 g/d ( $76.5 \times 10^3$  m) or more and formed by melt spinning polyethylene terephthalate having an intrinsic viscosity of 0.8 or more and containing 2.5% molar or less diethylene glycol based on terephthalic acid residues and 30 equivalents or less of carboxyl groups per  $10^6$ g, solidifying the spun filaments and then drawing the yarn, characterised in that the drawn yarn has an average birefringence of 0.19 or more and a birefringence variation, calculated by dividing the difference of birefringence between the surface and the centre of the monofilament by average birefringence, of 0.055 or less, and the drawn yarn, after being heat treated at constant length at 240°C for 1 minute, has (a) a dry heat shrink when freely heat treated at 175°C for 30 minutes of 3% or less and (b) a work loss when the hysteresis loop is measured at a stress between 0.53 dN/tex (0.6 g/d) and 0.04 dN/tex (0.05 g/d) under conditions of length of test sample of 0.254 m (10 inch), strain rate of  $2.12 \times 10^{-4}$ ms<sup>-1</sup> (0.5 inch/minute) and a temperature of 150°C:  $2.04 \times 10^{-5}$  J/tex ( $2.0 \times 10^{-5}$  inch.pound/denier) or less."

"3. A process for the production of polyester yarn having high thermal dimensional stability, chemical stability and tenacity, which comprises meltspinning a polyester comprising ethylene terephthalate as the main repeating unit and having an intrinsic viscosity (measured at 30°C in a mixed solvent of phenol/tetrachloroethane = 6/4) of 0.8 or more and containing 2.5% molar or less diethylene glycol based on terephthalic acid residues and 30 equivalents or less of carboxyl groups per 10<sup>6</sup>g, solidifying the spun filaments and then drawing the yarn, characterised in that the process comprises spinning through a spinneret at a throughput of not more than 0.058 gs<sup>-1</sup> (3.5 g/minute) per each orifice of the spinneret, quenching the spun yarn with quenching air of 35 to 80°C, pulling out the spun yarn in a spinning stress at a solidification point thereof of 1.5 x 10<sup>6</sup> to 7.5 x 10<sup>6</sup> Pa (1.5 x 10<sup>7</sup> to 7.5 x 10<sup>7</sup> dyne/cm<sup>2</sup>), and subjecting the yarn to the drawing said drawing being initiated in the presence of superheated steam or in contact with a heated surface, or quenching the spun yarn without quenching air, pulling out the spun yarn in a spinning stress at a solidification point thereof of 1.5 x 10<sup>6</sup> to 7.5 x 10<sup>6</sup> Pa (1.5 x 10<sup>7</sup> to 7.5 x 10<sup>7</sup> dyne/cm<sup>2</sup>), bundling the yarn 20 to 100 cm below the position of solidification, and subjecting the yarn to the drawing."

"8. Yarn according to claim 1 or claim 2 or made by a process according to any of claims 3 to 7 and which has been subjected, during spinning and/or drawing, to surface treatment with an epoxy compound or an isocyanate compound."

"9. An article comprising rubber reinforced by yarn characterised in that the yarn is yarn according to claim 1 or claim 2 or made by a process according to any of claims 3 to 7."

Dependent Claims 2, 4 to 7 and 10 were directed to elaborations of the respectively preceding independent claims.

II. Notices of opposition were filed by

Opponents I (Respondents I), Rhône-Poulenc Viscosuisse SA (previously Viscosuisse SA), on 13 November 1989,

Opponents II (Respondents II), Akzo Nobel Faser AG (previously Enka AG), on 23 November 1989,

Opponents III (Respondents III), Allied-Signal Inc., on 29 November 1989, and

Opponents IV (Respondents IV), Hoechst AG, on 1 December 1989,

requesting revocation of the patent in its entirety, on the grounds of Articles 100(a) and (b) EPC.

The oppositions were supported inter alia by the documents:

D5: US-A-4 195 052, and

D11: K. Riggert et al., Chemiefasern, pp. 379-384, 1971, as well as by

D13: H. Yasuda et al., "Simulation of the orientation and its distribution across a filament using the steady-state single filament melt spinning theory", Sen-i Gakkaishi, 35, No. 9, T370-375, 1979 (English translation),

the latter having been introduced outside the normal nine months opposition period.

III. By its decision announced orally on 16 April 1991 (written decision date-stamped 10 May 1991) the Opposition Division revoked the patent holding that its claimed subject-matter, in both the versions as granted (main request) and as amended (auxiliary request; see Section IV. below), lacked an inventive step.

In particular, the Opposition Division found that all features of process Claim 3 of the auxiliary request were known from or were obvious in view of document D5, including especially the spinning throughput as well as the temperature and the velocity of the quenching air. For essentially the same reasons, the alternative process of Claim 4 of the auxiliary request, according to which the fibres solidified in the absence of quenching air, was also found to be obvious, because this alternative feature was already known from document D11. The same reasoning made Claim 3 of the main request, whose scope corresponded to a combination of Claims 3 and 4 of the auxiliary request, invalid for lack of inventive step.

As to product Claim 1 of both requests, this related to fibres which resulted from obvious process features and could not, therefore, involve an inventive step.

IV. Notice of appeal against the above decision was filed by the Patentees (Appellants) on 20 June 1991. The appeal fee was paid in due time and a Statement of Grounds of Appeal was filed on 16 September 1991.

The appeal was based on the same requests as those presented during the first instance opposition proceedings, namely a main request comprising the patent as granted (with the correction in Claim 1, line 2 of the term "8.5 g/d (76.5 x 10<sup>3</sup> m)" to "7.51 dN/tex (8.5 g/d)") and an auxiliary request comprising 11



claims; Claims 1, 2 and 5 to 11 of the latter being identical to Claims 1, 2 and 4 to 10 of the main request, and Claims 3 and 4, comprising, respectively, the two quenching alternatives of Claim 3 of the main request (with the further amendment in Claim 3 of the auxiliary request of the insertion of the air velocity of the quenching air of "0.20 to 1.00 m/sec") reading as follows:

"3. A process for the production of polyester yarn having high thermal dimensional stability, chemical stability and tenacity, which comprises melt-spinning a polyester comprising ethylene terephthalate as the main repeating unit and having an intrinsic viscosity (measured at 30°C in a mixed solvent of phenol/tetrachloroethane = 6/4) of 0.8 or more and containing 2.5% molar or less diethylene glycol based on terephthalic acid residues and 30 equivalents or less of carboxyl groups per 10<sup>6</sup>g, solidifying the spun filaments and then drawing the yarn, characterised in that the process comprises spinning through a spinneret at a throughput of not more than 0.058 gs<sup>-1</sup> (3.5 g/minute) per each orifice of the spinneret, quenching the spun yarn by applying to the filaments quenching air of 35 to 80°C at an air velocity of 0.20 to 1.00 m/sec, pulling out the spun yarn in a spinning stress at a solidification point thereof of 1.5 x 10<sup>6</sup> to 7.5 x 10<sup>6</sup> Pa (1.5 x 10<sup>7</sup> to 7.5 x 10<sup>7</sup> dyne/cm<sup>2</sup>), and subjecting the yarn to drawing, said drawing being initiated in the presence of superheated steam or in contact with a heated surface."

"4. A process for the production of polyester yarn having high thermal dimensional stability, chemical stability and tenacity, which comprises melt-spinning a polyester comprising ethylene terephthalate as the main repeating unit and having an intrinsic viscosity (measured at 30°C in a mixed solvent of

phenol/tetrachloroethane = 6/4) of 0.8 or more and containing 2.5% molar or less diethylene glycol based on terephthalic acid residues and 30 equivalents or less of carboxyl groups per  $10^6$ g, solidifying the spun filaments and then drawing the yarn, characterised in that the process comprises spinning through a spinneret at a throughput of not more than  $0.058 \text{ gs}^{-1}$  (3.5 g/minute) per each orifice of the spinneret, quenching the spun yarn without quenching air, pulling out the spun yarn in a spinning stress at a solidification point thereof of  $1.5 \times 10^6$  to  $7.5 \times 10^6$  Pa ( $1.5 \times 10^7$  to  $7.5 \times 10^7$  dyne/cm<sup>2</sup>), bundling the yarn 20 to 100 cm below the position of solidification, and subjecting the yarn to drawing."

V. In their written submissions and during oral proceedings held on 5 July 1995 the Appellants argued as follows:

- (i) The spinning process according to D5 would not yield filaments having an average birefringence and a birefringence variation within the ranges claimed in the patent in suit. In consequence, the yarns made from such filaments would not attain the high tenacities obtainable by the process according to the patent in suit. This was mainly due to the lower quenching temperature of  $10^\circ\text{C}$  used in D5. It would not be correct to equate the higher temperatures of up to  $80^\circ\text{C}$ , indicated in D5 for the "gaseous atmosphere" of the cooling zone, with the temperature of the quenching air according to the patent in suit. Moreover, D5 did not mention the reduced chemical stability obtained by the high modulus and low shrinkage fibres according to the contested patent and D11 would not be helpful in this respect, because it referred only to conventional fibres and a low-speed spinning technique, where a low carboxyl content was not essential for high

chemical stability. With respect to document D13 the Appellants pointed out that this referred to calculations based on the behaviour of single filaments which could not be transferred to multifilaments.

(ii) The high tenacity values obtained according to Experiments N and P in Table 4 of the patent in suit would be superior to those obtainable according to D5, as demonstrated by Experiment S in the same Table 4.

(iii) During oral proceedings the Appellants submitted a new set of 10 process claims ("auxiliary request II") comprising a Claim 1 corresponding to Claim 3 of the auxiliary request having incorporated therein the features of product Claim 1 of the main and auxiliary request. After intermediate deliberation the Board refused to admit this request into the proceedings.

VI. The Respondents (Opponents) I, III and IV contested the Appellants' interpretation of the quench temperatures used according to D5, arguing that the higher temperatures of up to 80°C disclosed in D5 did relate to the cooling air provided to the quenching zone. Furthermore, D5 would explicitly disclose all process features of Claim 3 of the Appellants' auxiliary request, except for the upper limits in said claim for the content of the polyester in diethylene glycol units and terminal carboxyl groups. These two features would, however, be implicit in the disclosure of D5, since - as proved by D11 - for the intended use as tire cord yarns a person skilled in the art was aware of the necessity of these characteristics. D11 and D13 would also contain the clear teaching that deleterious birefringence variations across the filament could be prevented by

higher temperatures of the cooling air in the solidification zone. Concerning the quenching variant without air stream (Claim 4 of the auxiliary request), it was unclear how in this event the necessary fibre cooling was attained. Moreover, cooling at room temperature was already known from D5.

VII. The Appellants requested that the decision under appeal be set aside and the patent maintained on the basis of the main or the auxiliary request.

The Respondents requested that the appeal be dismissed.

#### Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The admissibility under Rule 88 and Articles 123(2) and (3) EPC of the correction made in Claim 1 of the main request and of the amendments resulting from the division of Claim 3 of the main request into Claims 3 and 4 of the auxiliary request was not called into question by the Respondents, nor by the Opposition Division. The Board sees no reason for a different opinion, either.

3. *Late Request*

The Board refused to admit into the proceedings the "auxiliary request II" filed by the Appellants during oral proceedings (cf. Section VI.3 above), because

- (i) without having been caused by any action by the Respondents and thus without apparent reason, it was filed at a very late stage, i.e. 4 years after the notice of appeal; as pointed out by the Board it could have been filed appropriately together with the Appellants' response to the Board's communication,
- (ii) contrary to what must be the case for a request introduced at the last possible moment, it was not immediately clear how, if at all, this request avoided the objections already raised against the other requests,
- (iii) the request violated Article 84 EPC, since Claim 2 of the request contained a reference back to Claim 1 which reference made it unclear whether Claim 2 was supposed to be a dependent claim or else how much of Claim 1 was to be incorporated, and
- (iv) its admission would have required that the Respondents be given sufficient time to consider the new situation, thereby leading to further dragging out of the proceedings (cf. T 153/85, OJ EPO 1988, 1).

**Auxiliary request**

This request which, in substance, corresponds essentially to the main request, is treated first, because the presence of the two quenching variants in two separate claims lends itself better to a systematic approach.

4. *Novelty*

4.1 Although none of the Respondents, in their responses to the Statement of Grounds of Appeal, contested the recognition of the novelty of the subject-matter of the patent in suit in the appealed decision, this issue was raised by Respondent IV in oral proceedings with respect to document D5. Since, in the present case, essentially the same facts are relevant for the assessment of novelty and of inventive step, the Board finds it appropriate to investigate the novelty issue.

4.2 The novelty of the fibre yarns according to present Claim 1 over those disclosed in D5 is established by their minimum value of the average birefringence of 0.19 which is above the upper limit of 0.189 disclosed for the yarns of D5 (column 9, lines 12 to 15).

4.3 Since the process Claims 3 and 4 of the auxiliary request are not restricted to any particular values of birefringence of the resulting fibre yarns, their novelty must be assessed separately.

4.4 D5 relates to a process for the production of polyethylene terephthalate (hereinafter PET) filaments of high strength and stable internal structure and to multifilament yarns prepared therefrom which are suitable for industrial applications at elevated temperatures, e.g. for tire cord. The filaments are melt spun and uniformly quenched under high stress conditions to yield an as-spun filamentary material of relatively high birefringence which is then subjected to multistage drawing (Abstract; Claim 1). Thus the sequence of steps (melt-spinning, quenching, drawing) is the same in D5 as according to the contested patent.

4.4.1 A comparison of the process parameters of present Claim 3 with those disclosed in D5 reveals that there is a broad overlap of some ranges of properties (in the following: property according to Claim 3 vs. property according to D5):

- intrinsic viscosity (IV) of the PET:  $\geq 0.8$  vs. 0.5 to 2.0 dl/g, preferably 0.8 to 2.0 dl/g (Claim 1; column 4, lines 13 to 19; in the examples of D5 a PET having an IV of 0.9 dl/g was used as specified in column 15, lines 17 to 21);
- spinning throughput: not more than 3.5 g/min per orifice vs. 0.6 g/min in Examples I, II and III; 0.38 g/min in Example IV (g/min per number of holes in the spinneret: column 16, lines 30 to 34; column 17, lines 56 to 60; column 18, line above Table I and lines 55 to 58; column 19, lines 35 to 40);
- temperature of quenching air: 35 to 80°C vs. "below about 80°C" (column 4, lines 65 to 67; Claim 4 and 15), 10° to 60/50/40°C, 25°C (column 5, lines 5 to 12), 10°C (column 15, lines 35 to 36);
- spinning stress at solidification point:  $1.5 \times 10^6$  to  $7.5 \times 10^6$  Pa = 0.011 to 0.056 cN/dtex (approximately equal to g/d) vs. 0.015 to 0.150 g/d (Claim 1; column 5, lines 50 to 54).

4.4.2 Other features of Claim 3 of the patent in suit are not explicitly disclosed:

4.4.2.1 Concerning the maximum content of diethylene glycol units of 2.5 mole%, this, however, must be regarded as implicitly disclosed in D5 for the following reasons:  
(i) it is stated in column 3, lines 62 to 64 that a

polyester being "substantially all polyethylene terephthalate" (and thus without diethylene glycol units) is particularly preferred; and (ii) the melting point range for the PET starting material indicated in column 4, lines 29 to 33 of 250 to 265°C is that of more or less pure PET and allows thus for the presence of very few diethylene glycol units only.

4.4.2.2 D5 is silent about the content of carboxyl groups in the PET. It is self-evident that free carboxyl groups may interact with carboxyl-reactive entities (e.g. OH, NH) and that this will have an influence on the chemical stability of the polymer whenever such contact takes place. It was known already from D11, page 379, left-hand column, 2nd paragraph, that, for the use in tire cords, the amount of carboxyl end groups should be low and in Table 3 of D11, page 385, it is specified that this amount should be below 28 equivalents per 10<sup>6</sup>g. Since there is no reason to assume that, from the publication year 1971 of D11 to the priority date of the present patent (2 December 1981) the requirements concerning the chemical stability of tire cord yarns (e.g. against water and amines: see patent in suit, page 2, lines 33 to 36) have become less stringent, it can be concluded - on the balance of probabilities - that the PET used in D5 for tire cord yarns met at least the criteria set out in Table 3 of D11. A content of carboxyl groups of below 30 equivalents per 10<sup>6</sup>g PET must therefore be assumed for yarns prepared according to D5 which are to be used for tire cords.

4.4.2.3 Finally, Claim 3 of the auxiliary request specifies a velocity of the quenching air of 0.2 to 1.0 m/sec which is not disclosed in D5, stating merely in column 5, lines 5 to 7 that the "gaseous atmosphere present within the solidification zone preferably circulates so as to bring about more efficient heat transfer".



- 4.4.3 In the Board's judgment, the subject-matter of Claim 3 of the auxiliary request is novel over D5, since even with regard to the technical application in respect of which Claim 3 and D5 have the most in common, i.e. the preparation of tire cord yarns, there is no overlap of the respectively required combinations of features.

While for this technical application (tire cord yarns) the requirements of Claim 3 for a maximum content in the PET of diethylene glycol units and carboxyl groups are deemed to be met by the disclosure of D5, this document lacks an unambiguous disclosure of the use of quenching air temperatures of 35 to 80°C in the preparation of tire cord yarns. There is also no disclosure in D5 pointing at the concurrent use of a quenching air velocity of 0.2 to 1.0 m/sec.

- 4.5 The essential difference between the process of Claim 4 of the auxiliary request and that of Claim 3 of the same request resides in quenching "without quenching air". In their response to the communication of the Board, the Appellants argued that in the context of the claim as a whole this feature means "that the spinning is carried out without positively using any cooling air." All parties agreed that this would nevertheless imply the use of ambient air as cooling medium. Thus, in the Board's opinion, this feature merely means relying only on the cooling capacity of the surrounding air and on the air convection generated by its contact with the hot as-spun filaments, without taking any active steps to achieve cooling.

This cooling option is also within the disclosure of D5, column 5, lines 5 to 12, because, on the one hand, the circulation of the gaseous atmosphere is carried out only "preferably", and, on the other hand, cooling at room temperature is particularly mentioned.

D5 is, however, silent about the feature in Claim 4 of "bundling the yarn 20 to 100 cm below the position of solidification" and in view thereof novelty of the process variant according to Claim 4 is given.

4.6 Since no other document comes closer to the subject-matter of the patent in suit according to the auxiliary request, its novelty can be acknowledged.

5. *Inventive step*

Since the polyester fibre yarn according to independent Claim 1 is mainly characterised by parameters which result from the manner of its preparation, it is appropriate to concentrate in the first place on the process parameters and thus on the question of obviousness of the subject-matter of the independent process Claims 3 and 4 of the auxiliary request.

5.1 Claim 3

5.1.1 Closest prior art and differences thereto

In conformity with the novelty assessment in the preceding section, document D5 is considered as the closest prior art. From the melt spinning process disclosed therein the process of Claim 3 is distinguished by the choice of a starting PET having a defined low content in diethylene glycol units and of carboxyl groups. Following the Appellants' submissions, these features combined with the selection of a quenching temperature in the range of 35 to 80°C and a velocity of the quenching air of from 0.2 to 1.0 m/sec were deemed to provide fibre yarns, suitable for the preparation of tire cord, which are improved over those prepared according to D5.

5.1.2 Effects achieved

The available experimental evidence does not enable the Board to deduce that the fibre yarns produced by the process of Claim 3 are of improved quality.

Said evidence fails to comprise a relevant comparison with the closest prior art (D5), i.e. a comparison which would be meaningful by showing that better yarn properties are related to the features, or the combination of features, distinguishing the alleged invention from the subject-matter of D5.

5.1.2.1 The available experimental evidence does also not contain any pertinent information about the influence on the process or the properties of the resulting yarns of the content in the PET of diethylene glycol units and carboxyl groups, nor about the impact a different velocity of the quenching air may have thereupon. It must therefore be concluded that the influence of these features does not go beyond that to be expected by a person skilled in the art.

5.1.2.2 The only candidate remaining for the possible provision of a particular technical effect is thus the selected range of higher temperatures for the quenching step.

Tables 1, 3, 4, 5 and 8 of the patent in suit comprise comparative Experiments G, I, J, M, R, S and U using quench temperatures below the lower limit of 35°C of present Claim 3. However, a conclusion as to the impact of these lower temperatures on the yarn properties is not possible, since a fair comparison with Experiments A to F, H, K, L, N to Q and Z is impossible due to numerous changes in other process parameters. This pertains particularly to the various details of the drawing conditions which are not even part of the

process definition according to Claim 3. This negative conclusion is valid also for comparative Experiment S and "inventive" Experiments N and P in Table 4, which comparison was particularly emphasized by the Appellant. In addition to four differences in the drawing conditions between Experiments N and P on the one hand, and Experiment P on the other hand, this comparison suffers furthermore from different polymer temperatures (305°C for "S" as opposed to 320°C for "N" and "P") of the melt dope, a different distance between the spinneret surface and the quenching position and a different velocity of the quenching air.

A technical effect caused by the selection of a quench temperature in the range of 35° to 80°C as compared to the lower temperatures preferred in D5 (10°C in the examples: column 15, lines 35 to 37) is therefore not apparent from the available experimental evidence, let alone a surprising technical effect.

5.1.2.3 The features distinguishing the process according to Claim 3 of the auxiliary request from that disclosed in D5 (see Section 4.1.1 above) have therefore not been demonstrated to cause a particular technical effect.

The issue, much discussed among the parties, if and to what extent certain of the claimed features contribute to improved properties of the resulting fibre yarn, cannot, on the evidence before the Board, be regarded as of any importance for the assessment of obviousness. From the data contained in the patent in suit (and other data have not been submitted) an improvement of yarn properties resulting from the novel combination of features defined by Claim 3, cannot be inferred.

### 5.1.3 Problem

The problem underlying the subject-matter of Claim 3 can therefore only be seen in the definition of an alternative melt spinning process to that disclosed in D5, i.e. a similar process allowing the preparation of fibre yarns having good properties which are adequate for their use as reinforcement for the manufacture of tire cord and other industrial rubber articles, like V-belts and conveyor belts.

As may be concluded from the preceding section, this problem has been solved by the combination of features defined in Claim 3.

### 5.1.4 Assessment of obviousness

The combination of features constituting the subject-matter of Claim 3 was obvious for a skilled person starting from D5 and wishing to solve the existing problem.

The use, for the preparation of tire cord yarns, of a PET having a content in diethylene glycol units of 2.5% molar or less (based on terephthalic acid residues) and having also a carboxyl group content of 30 equivalents or less per 10<sup>6</sup>g was implicitly disclosed in D5 (cf. paragraphs 4.4.2.1 and 4.4.2.2 above).

In the absence of proof of any positive influence on the yarn properties of the use of quenching air of 35 to 80°C at an air velocity of 0.2 to 1.0 m/sec, these features must be considered to be simply the result of routine experimentation carried out to achieve a favourable trade-off of process parameters and yarn properties. In particular, the feasibility of the selected temperature range was already known from D5

and the working out of an appropriate flow rate of the cooling air is nothing more than an ordinary workshop task.

In regard to the use of quenching air in the temperature range of 35° to 80°C, the prior art even contained information according to which improved yarn properties, including tenacity, could be expected when moving from 10°C, the cooling temperature exemplified in D5, upwards. Figure 11 on page 15 of the English translation of document D13 shows clearly an increase of the tenacity of the drawn fibre when the temperature of the cooling air is increased from 20° to 90°C. Document D11 points in the same direction (page 383, Figure 4; right hand column, second paragraph and Table 1). In order to reduce the birefringence gradient along the radius of a filament cross-section, D11 recommends the provision of a heating device ("Nacherhitzer") around the filament bundle exiting the spinneret, achieving thereby an enhanced tenacity (compare in Table 1 the values of "Reißfestigkeit an der Streckgrenze" with and without "Nacherhitzer"). Because of the consistency of the tenacity improvements reported in D11 and D13, the Board is of the opinion that the temperature generated by the "Nacherhitzer" in D11 would not deviate grossly from the temperatures used according to Figure 11 of D13. There is particularly no reason to assume that the "Nacherhitzer" should create temperatures close to the softening point of the PET.

- 5.1.5 In view of the above considerations, the combination of features constituting the subject-matter of Claim 3 of the auxiliary request did not involve an inventive step over document D5. Claim 3 does not meet therefore the requirements of Article 56 EPC.

5.2 Claim 4

The subject-matter of Claim 4 of the auxiliary request lacks an inventive step, too.

The differences between the process variant of Claim 4 and the disclosure of the closest prior art (D5) resides in the combination of an appropriate starting PET (maximum content of diethylene glycol units and carboxyl groups), the quenching at ambient temperature without forced air stream and the bundling of the yarn at a certain distance below the position of solidification (see Section 4.5 above).

Concerning the selection of an appropriate PET, an unexpected effect caused by the setting of upper limits for the amount of diethylene glycol units and carboxyl groups has not been demonstrated (see paragraph 5.1.2.1 above).

Concerning the quenching "without quenching air" and the distance of the bundling point, Table 7 of the patent in suit contains three "inventive" Experiments V, W and X and one comparative Experiment Y. The latter differs from any one of the prior experiments however not only by the application of a forced air stream of 0.4 m/sec, but also by several other parameters. In consequence, it is not possible to draw any conclusions with regard to the alleged deleterious influence of a "forced" cooling air stream, as used in Experiment Y, on the fibre properties. Moreover, the properties reported in this table are those of the spun yarn and not those of the final drawn yarn, which latter are to be considered when assessing the effective contribution to the state of the art.

Accordingly the problem underlying the subject-matter of Claim 4 reduces to the definition of an alternative melt spinning method for the production of fibre yarns which are suitable as reinforcement for tire cords and other industrial rubber articles (see Section 5.1.3 above).

In respect to this problem the combination of features defined in Claim 4 was obvious over D5 because the choice of an appropriate PET quality (maximum amount of diethylene glycol units and carboxyl groups) was implicitly disclosed for this purpose (cf. paragraphs 5.4.2.1 and 5.4.2.2 above), the non-use of a circulation of the quenching air was already envisaged by D5 (column 5, lines 5 to 7: "The gaseous atmosphere ... **preferably** circulates..." [emphasis added]), and the determination of an appropriate distance of the bundling point from the position of solidification of the filaments was a matter of routine experimentation not requiring inventive skill.

In view of the above considerations, the combination of features constituting the subject-matter of Claim 4 of the auxiliary request did not involve an inventive step over document D5.

5.3 The auxiliary request is therefore not allowable for the double reason that both independent Claim 3 and independent Claim 4 do not satisfy the requirements of Article 56 EPC.

5.4 Although, in view of the non-allowability of the process claims there is no need to decide on the patentability of product Claim 1, the Board regards it appropriate to comment on some issues raised in the appealed decision in respect of this claim.



Therein it was held that, independently of its characterisation in the claim, the subject-matter of Claim 1 could not involve an inventive step because it was the result of an obvious process.

Alternatively, the appealed decision expressed the opinion that it would not "be reasonable to allow that kind of claim which cannot be upheld under the jurisdiction of one member state." By "that kind of claim" the decision refers to its contention that "the features of Claim 1 are nothing else than "obvious desiderata" defining merely the technical problem by parameters". As example for the jurisdiction of one member state which would not allow a claim defining desiderata the decision referred to the German Federal High Court (BGH) decision "Acrylnitrilfaser".

- 5.4.1 In the procedures before the instances of the EPO, questions of patentability are to be decided solely in accordance with the EPC, whose purpose, as laid down in Article 1 EPC, is to establish a system of law common to all the Contracting States. The decisions of national instances are not binding on the instances of the EPO, whose task is to develop a common European system of law. No national decision should be cited as if it were binding on the EPO, and claims should not be refused by the EPO on the ground that their "patentability cannot be upheld under the jurisdiction of one member state": it could be that the law in most or all other Contracting States was different. The reasoning that led the national instance to its conclusion might well lead an EPO instance to a similar conclusion under the EPC, but this would first need a careful assessment of the EPC, and of relevant EPO Board of Appeal case law, a comparison with the legislation and jurisprudence on which the national instance reached its conclusion, and a study of the

position in other Contracting States, a task on which the first instance of the EPO should not lightly embark. A discussion, as in the decision under appeal, using poorly defined terms such as "obvious desiderata" and "free beer claims" to denigrate the form of claim on file, is inadequate.

5.4.2 The characterization of the fibre yarn in Claim 1 is not a mere definition by "obvious desiderata" defining only the technical problem by parameters, as asserted in the appealed decision. This results from the following analysis:

5.4.2.1 According to Claim 1 the polyester fibre yarn is characterised by several features:

- (a) formed by melt-spinning,
- (b) from PET of defined low content in diethylene glycol units and carboxyl groups and
- (c) having an IV of 0.8 or more,
- (d) drawing of the solidified spun filaments,
- (e) tenacity of drawn yarn of 7.51 dN/tex (8.5 g/d) or more; it is clear from the whole content of the description, particularly from the tenacity data in Tables 1 and 3 to 5 that the value indicated in Claim 1, although not so specified, is directed to the property of the drawn fibre,
- (f) average birefringence of drawn yarn of 0.19 or more,
- (g) birefringence variation of the drawn yarn of 0.055 or less,
- (h) dry heat shrink after heat treatment at 240°C for 1 minute of 3% or less,
- (i) work loss after heat treatment at 240°C for 1 minute of  $2.04 \times 10^{-5}$  J/tex or less.

5.4.2.2 From the above mentioned features the process features (a) and (d) do not contribute by themselves to the characterisation of the yarn, features (e), (h) and (i) are not directly related to the structure of the yarn as-it-is (but reflect only the response to impact from outside), whereas features (b), (c), (f) and (g) concern parameters which are not only usual in the art, but which define also positively various aspects **directly characterising** the chemical and physical nature of the yarn.

5.4.2.3 Claim 1 of the patent in suit is formally not objectionable.

In accordance with Article 84 EPC, it defines "the matter for which protection is sought"; the claim is also clear and concise and supported by the description. There can also be no doubt that Claim 1 meets the requirement of Rule 29(1) EPC, first paragraph, where it is stipulated that "the claims shall define the matter for which protection is sought in terms of the technical features of the invention."

That some of the features in Claim 1 define open-ended ranges is per se not objectionable, particularly in a situation like the present, where the description demonstrates that values within these ranges have effectively been obtained (see e.g. Tables 1, 3, 4 and 8) and where one skilled in the art is aware that practical limits for these ranges exist, which have, however, not yet been explored (cf. T 94/82 OJ EPO 1984, 75 Sections 2.5 and 2.6; and T 487/89 of 17 July 1991, unpublished, Section 3.5).

5.4.3 However, in the Board's judgment, the provision of the fibre yarn according to Claim 1 did not involve an inventive step.

5.4.3.1 From the yarns disclosed in the closest prior art (D5) those according to present Claim 1 are essentially distinguished by (i) the higher average birefringence of the drawn yarn, (ii) the required maximum birefringence variation and minimum values for tenacity, heat shrink and work loss, and (iii) the properties afforded by a PET having a high IV and a low content in diethylene glycol units and carboxyl groups.

According to several experiments in Tables 1, 3, 4 and 8 of the patent in suit yarns have been produced which have the desired combination of properties, which therefore corresponds to concretely obtained values.

It can thus be recognized that the problem underlying the subject-matter of Claim 1 was that indicated in the patent (page 2, lines 49 to 51), i.e. the provision of PET yarns of high tenacity, high thermal dimensional stability and chemical stability, which can be used as reinforcement for industrial rubber goods, including tires, V-belts and conveyor belts.

5.4.3.2 Yarns from high IV PET (IV = 0.9 dl/g: column 15, lines 17 to 19), meeting the diethylene glycol unit and carboxyl group requirements of Claim 1 (cf. paragraphs 4.4.2.1 and 4.4.2.2 above), having a tenacity above 8.5 g/d and a work loss of below  $2.0 \times 10^5$  inch.pound/denier, have been known from D5 (cf. Table I, Run No. 4; Table II, Run No. 2; Table III, Runs No. 1 to 4; Table IV). The shrinkage values of these yarns were measured without the treatment at 240°C for 1 minute, which is required by present Claim 1, so that a true comparison is not possible; however, due to the fact that the shrinkage values measured in D5 for these properties are low and considering that the 240°C treatment should further lower the shrinkage, it can be assumed that this

parameter is also met by the yarns prepared according to these experiments.

The only properties defined in present Claim 1 which have not been disclosed in D5 are the average birefringence of 0.19 or more and the birefringence variation of 0.055 or less. Concerning the average birefringence, there is, however, no evidence in the patent in suit that by slightly surpassing the upper limit of 0.189 of D5 any particular effect on the physical properties would be obtained; this feature is therefore not regarded as technically meaningful and cannot, for that reason, contribute to an inventive step. That such higher birefringence values have been common in the art is confirmed by D5, column 10, lines 37 to 40. Concerning the reduction of the birefringence variation below a certain upper limit, the desirability thereof for the physical properties of the yarn was known from D11 (page 383, right hand column 2nd paragraph, Table 1) and D13 (translation pages 14 and 15, Figures 10 and 11).

While the combination of features (here chemical and physical parameters known from D5 and birefringence parameters), which are prima facie obvious desiderata, may nevertheless be considered non-obvious if it was achieved for the first time in an unobvious way, this is not the case here.

In the appealed decision it was held that the obviousness of the yarn as defined in Claim 1 would result from the obviousness of the process (obviously referring to the process **as claimed**). It has, however, to be taken into account that the physical properties indicated in Claim 1 are those of the **drawn** fibre yarn, while the process claims of the patent in suit do **not really define the drawing conditions**. This is much more

important as the drawing conditions are crucial for the final properties of the yarn (see especially the property development in the Tables I to IV of D5: first draw - second draw - final portion of thermal treatment).

Nevertheless, the Board arrives at the same conclusion as in the appealed decision, because the drawing conditions which may be used according to the contested patent (see page 6, line 7 to page 7, line 17) in the absence of proof to the contrary, can only be regarded as workshop variations within the ambit of the teaching of D5 (see column 15, line 50 to column 16, line 27; Tables I to IV).

The combination of features used in the patent in suit for obtaining yarns having the claimed as-drawn properties has therefore been obvious over those used in D5 in combination with D11 and/or D13.

**Main request**

6. Claims 1 of the main and of the auxiliary requests are identical. The obviousness conclusion arrived for Claim 1 of the auxiliary request applies therefore also to that of the main request.

Claim 3 of the main request is essentially a combination of Claims 3 and 4 of the auxiliary request (see Section IV above).

In view of this factual situation, with the exception of the arguments referring to the feature of the quenching air velocity in Claim 3 of the auxiliary request, which feature is missing in Claim 3 of the main request, all the arguments brought forward with respect to the obviousness of the subject-matter of the

process Claims 3 and 4 of the auxiliary request also apply with respect to the main request. This difference, however, has no bearing on the eventual obviousness conclusions because there is no evidence available according to which the velocity range of the quenching air, as defined in Claim 3 of the auxiliary request, had any unexpected impact on the process itself or on the resulting fibre yarns; therefore, the absence of this feature cannot alter the finding of obviousness arrived at for the subject-matter of Claim 3 of the auxiliary request.

As a consequence, the subject matter of Claim 3 of the main request does not involve an inventive step. Each of the two embodiments encompassed by this claim, the one using quenching air of 35° to 80°C and the other one without quenching air, is obvious for the reasons indicated for Claims 3 and 4 of the auxiliary request (Section 4 above).

Since, thus, Claims 1 and 3 of the main request do not meet the requirements of Article 56 EPC, this request is not allowable, either.

7. Neither the main request nor the auxiliary request can therefore be granted.

Order

For these reasons it is decided that:

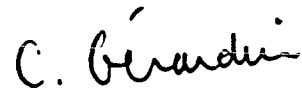
The appeal is dismissed.

The Registrar:



E. Gorgmaier

The Chairman:



C. Gérardin