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**D E C I S I O N**  
**of 10 May 2001**

**Case Number:** T 0922/96 - 3.3.7

**Application Number:** 88202039.9

**Publication Number:** 0310171

**IPC:** D01F 6/30

**Language of the proceedings:** EN

**Title of invention:**  
Melt-spinning process

**Patentee:**  
SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

**Opponent:**  
Akzo Nobel N.V.

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56, 83, 114, 123  
EPC R. 57a

**Keyword:**  
"Amendments - added subject-matter (second auxiliary  
request - no)"  
"Disclosure - sufficiency (yes)"  
"Inventive step - problem and solution (yes)"

**Decisions cited:**  
T 0201/83, T 0246/91, T 0495/91, T 0686/91, T 0325/93,  
T 0644/97

**Catchword:**

-



Case Number: T 0922/96 - 3.3.7

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.7**  
**of 10 May 2001**

**Appellant:** SHELL INTERNATIONALE RESEARCH  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office dated 4 June 1996 and  
issued in writing on 29 July 1996, revoking  
European patent No. 0 310 717 pursuant to  
Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** R. E. Teschemacher  
**Members:** R. J. Young  
G. Santavicca

## Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 310 171, in respect of European patent application No. 88 202 039.9, filed on 15 September 1988 and claiming both a GB priority of 30 September 1987 (GB 8722967) and a US priority of 30 March 1988 (US 175024) was announced on 1 December 1993 (Bulletin 93/48). Claim 1 read as follows:

"A process for producing thermoplastic polymer fibres by melt-spinning an alternating copolymer of an olefinically unsaturated compound and carbon monoxide, having a molecular weight of at least 2000, characterized in that the copolymer is melt-spun at a temperature of at least  $(T+20)^{\circ}\text{C}$  ( $(T+20)\text{K}$ ) and the fibre is subsequently stretched at a temperature of at most  $(T-10)^{\circ}\text{C}$  ( $(T-10)\text{K}$ ), in which T is the crystalline melting point of the polymer."

Claims 2 to 9 were dependent claims, directed to elaborations of the process according to Claim 1.

Claim 10, an independent claim, was worded as follows:

"A tyre comprising fibres characterized in that they have been produced with a process as claimed in any of claims 1 to 9."

II. Notice of Opposition was filed on 1 September 1994 on the grounds of lack of novelty and/or inventive step and of insufficient disclosure (Articles 100(a) and 100(b) EPC). The opposition was supported *inter alia* by the following documents:

D1: EP-A-0 213 671;

D2: EP-A-0 228 733;

D3: Encyclopedia of Polymer Science and Engineering;  
2nd edition, Vol. 6: Fibers; J. Wiley & Sons, New  
York, 1986, pages 648, 649;

D4: A. Ziabicki,, "Fundamentals of Fibre Formation",  
John Wiley & Sons, London, 1976, pages 4 to 6;

D5: J.M. Preston "Fibre Science", The Textile  
Institute, Manchester, 1949, pages 69 to 73; and

D6: EP-A-0 121 965,

as well as the later filed, but admitted documents:

D7: Béla von Falkai, "Synthesefasern", Verlag Chemie,  
Weinheim, 1981, pages 14, 163, 165, 173, 174 and  
191 to 193; and

D8: A. Ziabicki,, "Fundamentals of Fibre Formation",  
John Wiley & Sons, London, 1976, pages 427 and  
429.

III. By a decision dated 4 June 1996 and issued in writing  
on 29 July 1996, the Opposition Division revoked the  
patent. The decision was based on two sets of claims 1  
to 9, forming a main and an auxiliary request,  
respectively.

Claim 1 of the main request differed from claim 1 as  
granted, by the addition, after the words, "crystalline  
melting point of the polymer" at the end of the claim,

of the phrase, "to a stretching ratio of at least 6:1". Claims 2 and 3 corresponded to claims 2 and 3, respectively, as granted. Claims 4 to 9 corresponded to claims 5 to 10, respectively, as granted.

Claim 1 of the auxiliary request differed from that of the main request only by the replacement of "6:1" by "7:1" in the stretching ratio. Claims 2 to 9 corresponded to claims 2 to 9, respectively, of the main request.

A further set of claims, filed at the oral proceedings, was disregarded, since it had been filed after the final date set according to Rule 71a(1) EPC.

According to the decision, claim 1 of the main request contravened the provisions of Article 123(2) EPC, since there had been no direct and unambiguous disclosure of a stretching ratio of at least 6:1, let alone a generic such disclosure.

In connection with the claims of the auxiliary request, the technical problem solved by claim 1 was the provision of a process for producing fibres of the type disclosed in D1 having a high tensile strength. It was known from D4, however, that melt-spinning was the simplest and most economical method of fibre formation, and that the main purpose of stretching was to improve the tensile strength. Furthermore, only routine experiments would have been necessary to determine a stretching ratio above which acceptable values of tensile strength could be expected, and it was known from D7 that stretching ratios above the claimed minimum value of 7:1 were not unusual at the relevant priority date. Finally, it was self-evident to a person

skilled in the art of fibre technology, that melt-spinning, to be possible at all, had to be performed at a temperature above the crystalline melting point, and stretching, to permit an increase in the degree of molecular orientation of the fibre, had to be performed at a temperature below the melting point, of the polymer. Consequently, and since the patent proprietor had not submitted any evidence that the suitability of fibres of the type disclosed in D1 had anything to do with the specific requirements made in claim 1 as to method of formation, spinning temperature, stretching temperature, stretching ratio, or molecular weight of the copolymer, these appeared to be nothing more than an arbitrary concretisation of the prior art.

It was of no consequence that it might have been impossible to arrive at the claimed subject-matter in an obvious way starting from a different state of the art, say D7, since this would merely imply that D1 was a closer state of the art than D7.

Whilst it would not normally have been necessary, in view of the above finding on inventive step, to decide the issue under Article 100(b) EPC, the view was, however, expressed, in spite of the contents of a declaration by Dr. Gutmann, according to which a certain alternating ethylene-carbon monoxide copolymer could not be melt-spun, that the skilled person would nevertheless have been able to carry out embodiments of the subject-matter according to claim 1, which thus met the requirements of sufficiency of Article 83 EPC.

As regards the set of claims filed at the oral proceedings, an abuse of procedure was seen in the filing, after the final date fixed in accordance with

Rule 71a(1) EPC, of a new independent claim which was broader in scope than the broadest independent claim previously on file, there being no longer any restriction as to stretching ratio, since no apparent change in the subject of the proceedings had been occasioned thereby.

IV. On 2 October 1996, a Notice of Appeal against the above decision was filed, the prescribed fee being paid on the same day.

The Statement of Grounds of Appeal, filed on 6 December 1996, was accompanied by:

- (i) a further set of claims 1 to 12 forming a new main request, as well as outlined indications, in terms of combinations of claims according to the main request, of a 1st, 2nd, 3rd and 4th auxiliary request;
- (ii) a test report consisting of additional Examples A and B; and
- (iii) two further documents which were referred to for the first time:

D11: J. Smook et al., "Is High-Modulus Polyamide-6 Feasible?", Enka b.v. Research Institute, Arnhem, NL; and

D12: C.M. Blow et al., "Rubber Technology and Manufacture", 2nd Edition, Butterworth Scientific for the Plastics and Rubber Institute 1982, page 537.



Claim 1 of the main request was identical with claim 1 of the main request underlying the decision under appeal.

Independent claim 3 read as follows:

"A process for producing thermoplastic polymer fibres by melt-spinning an alternating copolymer of an olefinically unsaturated compound and carbon monoxide, which is an ethylene/CO copolymer having a molecular weight of at least 2000, in which process the copolymer is melt-spun at a temperature of at least  $(T+20)^{\circ}\text{C}$  ( $(T+20)\text{K}$ ) and the fibre is subsequently stretched at a temperature of at most  $(T-10)^{\circ}\text{C}$  ( $(T-10)\text{K}$ ), in which T is the crystalline melting point of the polymer."

Independent claim 10 read as follows:

"A composition comprising rubber and fibres characterized in that the fibres have been produced with a process for producing thermoplastic polymer fibres by melt-spinning an alternating copolymer of an olefinically unsaturated compound and carbon monoxide, having a molecular weight of at least 2000, in which process the copolymer is melt-spun at a temperature of at least  $(T+20)^{\circ}\text{C}$  ( $(T+20)\text{K}$ ) and the fibre is subsequently stretched at a temperature of at most  $(T-10)^{\circ}\text{C}$  ( $(T-10)\text{K}$ ), in which T is the crystalline melting point of the polymer."

Independent claim 12 read as follows:

"A tyre comprising fibres characterized in that the fibres have been produced with a process for producing thermoplastic polymer fibres by melt-spinning an

alternating copolymer of an olefinically unsaturated compound and carbon monoxide, having a molecular weight of at least 2000, in which process the copolymer is melt-spun at a temperature of at least  $(T+20)^{\circ}\text{C}$  ( $(T+20)\text{K}$ ) and the fibre is subsequently stretched at a temperature of at most  $(T-10)^{\circ}\text{C}$  ( $(T-10)\text{K}$ ), in which T is the crystalline melting point of the polymer."

Dependent claims 2, 4 and 5 to 9 were directed to the features elaborated in claims 9, 4, and 5, 2, 3, 6 and 8, respectively, of the patent as granted, with amendment, where appropriate, of the dependencies. Dependent claim 11 was directed to a further elaboration of the subject-matter defined in independent claim 10.

The Appellant (Patentee) argued in substance as follows:

(a) Rule 71a EPC

The Opposition Division had been wrong to refuse to admit the set of claims presented at the oral proceedings, since these differed from the previously prevailing set only in containing a new claim 3, which itself corresponded to claim 8 as granted. The claims had been filed in response to a changed situation which had arisen from the filing, by the Opponent, of the declaration of Dr. Gutmann, just before the final date for making observations, which had prevented the new claims from being filed earlier.

(b) Article 123(2) EPC

The finding, in the decision under appeal, that the lower limit stretching ratio of 6:1 in claim 1 comprised added subject-matter was wrong, since various ranges of this ratio had originally been disclosed, from which the ratio of 6:1 applied in Example 1 had been freely chosen. There was no indication in the disclosure that this ratio had been expressly chosen in connection with the specific polymer of Example 1. On the contrary, "Enclosure I" (a graphical representation of tensile strength vs. stretching ratio), filed with a submission dated 1 February 1995, during opposition proceedings, confirmed that, for a certain polymer within the scope of the patent in suit, a large variety of stretching ratios could be chosen. Hence, a lower limit of "at least 6:1" did not comprise added subject-matter in the sense of Article 123(2) EPC.

(c) Article 56 EPC

(i) Whilst D1 disclosed that fibres could be made from a copolymer of carbon monoxide, ethylene and, as additional monomer, another olefinically unsaturated hydrocarbon, the additional monomer was taught to be essential for an improved processability of the copolymer, there being no mention of making fibres from an alternating CO/ethylene only copolymer. Furthermore, whilst a melt-spinning process for the illustrative terpolymers was made available, a stretching step was not. The distinguishing feature of a stretching ratio of 6:1 in claim 1 was, however, not usual for polar polymers such as those

according to the patent in suit, as was shown by D7 and D8, which taught, for polyamides, a maximum draw ratio of 6:1 and 4.79:1, respectively.

- (ii) None of D3 to D5 gave hints as to the application of a particular stretching ratio, and D2 and D6, which were more remote, did not teach the production of fibres having such ratios of at least 6:1.
- (iii) The effect of the claimed process was that the resulting fibres outperformed other thermoplastic fibres in their tensile properties and their adhesion to rubber. This was demonstrated by Example 1 according to the patent in suit, the additional data filed with the submission of 1 February 1995, and additional Example A accompanying the Statement of Grounds of Appeal. Such results could not have been expected from reading D1. Neither did D2 to D8 give any information in this respect.
- (iv) Additional Example B accompanying the Statement of Grounds of Appeal showed that the product of the process applied to a CO/ethylene copolymer was a fibre with a high tensile strength and a good adhesion to rubber. This was surprising in the light of the teaching in D1 that problems of melt processing arose with such copolymers.
- (v) In summary, the subject-matter according to the main request involved an inventive step.

V. The Respondent (Opponent) disagreed, in a submission

filed on 26 June 1997, with the arguments of the Appellant, and in substance put forward the following counterarguments:

(a) Late-filed claims

It had been correct to refuse the new set of claims presented by the Appellant at the oral proceedings held on 4 June 1996, since the final date set for reply had passed. The subject of the proceedings had not been changed by the declaration of Dr. Gutmann, which in any case had already been communicated to the Appellant, separately, by fax on 1 May 1996, i.e. before the final date set for filing observations.

(b) Article 123 EPC

(i) Claims 10 and 11 belonged to a new category which had not been present in the patent in suit as granted, and consequently contravened Article 123(3) EPC.

(ii) There was no basis for the reference, in claim 1, to a stretching ratio of "at least 6:1". Firstly, the ratio of "6:1" had itself only been disclosed, in Example 1, in relation to a specific composition of an alternating copolymer of an olefinically unsaturated compound and carbon monoxide. Secondly, the relevant disclosure only made available a specific ratio of 6:1, so there was no basis for the further qualification "at least" in relation to 6:1.

(iii) The argument of the Appellant, that the

stretching ratios could be freely chosen had been made in a letter filed after publication of the patent in suit. Consequently, the interpretation relied upon had been made with hindsight.

- (iv) It followed that Claims 2 to 5 and 9, which were dependent on claim 1, also contravened Article 123(2) EPC.

- (c) Article 83 EPC

It had been shown, in the declaration of Dr. Gutmann, that it was not possible to spin fibres from a carbon monoxide/ethene copolymer on the basis of the information given in the patent in suit. Consequently, the subject-matter of claims 3 and 4, which were directed to this variant, did not meet the relevant requirements of sufficiency of disclosure.

- (d) Article 54 EPC

The references in D1 to the use of the polymers for making fibres, and to use of the polymers in the automobile industry had to be understood as meaning that the fibres were used for reinforcing tyres. To this extent, the subject-matter of claims 10 to 12 lacked novelty.

- (e) Article 56 EPC

According to D1, fibres could be made from copolymers of carbon monoxide, ethylene and, optionally, another olefinically unsaturated monomer, using melt-spinning techniques. It had,

furthermore, been admitted by the Appellant, that the skilled person would draw a polymer fibre in order to increase its tensile strength. There was therefore no doubt that the skilled person would stretch the fibres according to D1 with a view to, and in the expectation of, obtaining fibres with a (very) high strength. Consequently, the only feature by which claim 1 was distinguished from D1 was the stretching ratio of at least 6:1. It was evident from D7, however, and also D11 cited by the Appellant, that draw ratios of 7:1 were known. By interpolation from the inter-chain cohesive energy/maximum draw ratio data, given in D11, relating to polyoxymethylene (10 500 kJ/mole/35:1) and polyvinyl alcohol (33 500 kJ/mole/25:1), and using a calculated inter-chain cohesive energy for the claimed polymers of 20-30 kJ/mole, furthermore, a maximum stretching ratio of between 25 and 35 would have been expected by the skilled person. Thus, it was obvious to stretch the obtained fibre at a stretching ratio of 6:1, and the subject-matter of claim did not involve an inventive step. Similar considerations applied to the subject-matter of claims 10 and 12.

VI. With a letter filed on 14 September 1998, the Respondent withdrew its opposition entirely.

VII. The Board raised objection, *inter alia* under Article 123(2), 123(3) EPC and Rule 57a EPC, to claims 10 and 11 of the main request, which belonged to a new category, were not present in the patent as granted, and were not clearly occasioned by the relevant grounds for opposition. Objection was

furthermore raised, under Article 123(2) EPC, to the restriction, in claim 1, to "a stretching ratio of at least 6:1", in particular insofar as the association of this value with the various features presented in the relevant dependent claims resulted in the disclosure of new combinations not disclosed in the documents of the application as originally filed (telephone minute dated 20 December 2000; annex to summons to oral proceedings, issued on 7 February 2001).

- VIII. With a letter of response, dated 23 March 2001, the Appellant withdrew the auxiliary requests mentioned in the Statement of Grounds of Appeal and requested the deletion of claims 2 to 11 of the main request. At the same time, the Appellant informed the EPO that it would not be attending the oral proceedings, scheduled for 10 May 2001.
- IX. In a further telephone conversation with the Rapporteur of the Board, dated 26 April 2001, the Appellant was notified, with regard to the new restricted request filed with the letter dated 23 March 2001, that the presence, in the description, of the counterparts of the (deleted) sub-claims meant that the problem arising in respect of Article 123(2) EPC and referred to in the previous communication of the Board could not be regarded as met.
- X. With a letter dated 26 April 2001, received by fax on 27 April 2001, the Appellant filed three new sets of claims forming a main request and a first and second auxiliary request, respectively, and re-iterated its intention of not attending the oral proceedings.



- (i) The main request consisted of a set of claims 1 to 9, the wording of claim 1 of which differed from that of claim 1 as granted (section I, above) only by the addition, after the words, "crystalline melting point of the polymer" at the end of the claim, of the phrase, "to a stretching ratio of at least 3:1".

Claims 2 and 3 corresponded to claims 2 and 3, respectively, as granted.

Claim 4, a dependent claim, read as follows:

"A process as claimed in any of claims 1 to 3, in which the stretching ratio is at least 6:1".

Claims 5 to 9 correspond to claims 5 to 9, respectively, as granted.

- (ii) The first auxiliary request differed from the main request only in that words "the stretching ratio is at least 6:1" in claim 4 were replaced by "the stretching ratio is 6:1".
- (iii) The second auxiliary request was a set of claims 1 to 8. These claims differed from those of the main and first auxiliary requests only in that claim 4 of these requests had been deleted, and claims 5 to 9 renumbered as claims 4 to 8, respectively.

XI. The Appellant requested that the decision under appeal be set aside, and the patent in suit maintained on the basis of claims 1 to 9 of the main request, or, in the alternative, on the basis of claims 1 to 9 of the first

auxiliary request, or on the basis of claims 1 to 8 of the second auxiliary request, all filed on 27 April 2001.

## **Reasons for the Decision**

1. The appeal is admissible.

2. *Admissibility of amendments*

A. *(main and first auxiliary requests)*

2.1 Claim 1 of each of the above requests differs from claim 1 as granted in that it specifies a particular stretching ratio, namely a ratio of at least 3:1. The basis for this amendment is to be found in dependent claim 4 of the application as originally filed and of the patent in suit as granted. The amendment is consequently admissible under Article 123(2) EPC. Furthermore, since this amendment also has the effect of restricting the scope of the claim compared with that of claim 1 as granted, it also meets the requirements of Article 123(3) EPC.

2.2 Claims 2 and 3 correspond to claims 2 and 3, respectively of the application as originally filed and of the patent in suit as granted. No objection to them arises under Article 123 EPC.

2.3 Dependent claim 4, however, differs from claim 4 as granted in that the stretching ratio of at least 3:1 (now incorporated in claim 1) has been replaced by the different stretching ratio of "at least 6:1" (main request) and by the stretching ratio of "6:1" (first

auxiliary request), respectively. This corresponds to the limitation found, in the decision under appeal, to contravene the provisions of Article 123(2) EPC (section III, above).

2.3.1 It has not been disputed that there is no explicit basis, in the claims, or in the description relating directly to the whole generality of the claimed subject-matter, as originally filed, for the selection of a stretching ratio characterised by the numerical value of 6:1. On the contrary, the only ratios referred to in this degree of generality are "at least 3:1", "at least 7:1" and "at most 15:1" (application as originally filed, page 2, lines 16 to 18 and claims 4, 5; patent in suit as granted, page 2, lines 27 to 28; and claims 4, 5). The alleged basis for the amendment is the reference to a stretching ratio of 6:1 in Example 1. Consequently, the question of allowability of this amendment boils down to the allowability of introducing a limit to a range from an example.

2.3.2 In answering this question, it is relevant to consider the principles set out in the "Lead Alloys" decision T 201/83 (OJ EPO 1984, 481). According to the latter, "Amendment of a concentration range in a claim for a mixture, such as an alloy, is allowable on the basis of a particular value described in a specific example, provided the skilled man could have readily recognised this value as not so closely associated with the other features of the example as to determine the effect of that embodiment of the invention as a whole in a unique manner and to a significant degree" (Reasons for the decision, point 12). Whilst the cited decision concerns a particular value of a concentration range, the situation is analogous to that in the present case,

insofar as the relevant "stretching ratio" is also a continuous variable, the precise consequences (if any) of which for the remaining variables exemplified are not *a priori* self-evident.

2.3.3 It is true that claim 1 of the application in suit as filed did not explicitly link any of the preferred stretching ratios to the value of another parameter in the process as claimed, and to this extent supported the position taken by the Appellant (section IV(b), above). Nevertheless, in Example 2 (there are only two examples in the patent in suit), it is stated that "Copolymer of carbon monoxide, ethylene and propylene of the same batch as used in Example 1, is melt-spun at a range of temperatures from 242 to 287°C (515 to 560 K), via a multi-hole spinneret, quenched with forced air at a temperature of 30±0.5°C, and stretched 5 to 10-fold." Thus, an increase in stretching ratio appears to go hand in hand, in this context, with an increase in melt-spinning temperature. In other words, the argument of the Appellant, that the ratio of 6:1 applied in Example 1 had been freely chosen from the various ranges originally disclosed is not unequivocally supported by the disclosure of the application as originally filed. On the contrary, the indication in Example 2 at least points, if anything, in the opposite direction.

2.3.4 Furthermore, whilst the graphical representation of "Enclosure I" filed during opposition proceedings (section IV(b), above) demonstrates the possibility of choosing a variety of stretching ratios only in connection with one particular polymer falling within the terms of the claims of the patent in suit, namely a terpolymer of carbon monoxide, ethylene, and specific

proportion of propylene, this evidence is irrelevant, firstly because it does not belong to the content of the application as filed, and secondly because it in any case does not demonstrate the validity of the rule for the generality of the polymers covered.

Consequently, the evidence submitted does not support the allowability of the amendment.

2.3.5 In the circumstances of the case T 201/83, however, the specification in that case contained an explicit statement clearly indicating that the relevant Mg and Ca concentrations were essentially not related to each other (Reasons for the decision, points 5 and 6). A corresponding such statement that the stretching ratio is unrelated to the other relevant variables in the process according to the patent in suit is, in contrast, wholly lacking in the present case.

2.3.6 In summary, the submissions of the Appellant in connection with the restriction of the stretching ratio to a numerical value of 6:1 are not such as to convince the Board that the negative finding under Article 123(2) EPC, in the decision under appeal, was wrong. On the contrary, the Board has serious doubts in this respect as to the admissibility of the amendments sought.

2.3.7 Quite apart from the above, however, the questionable restriction appears, in the case of both the main request and the first auxiliary request, in a dependent claim. It cannot, therefore, in the considered opinion of the Board, be regarded as being properly occasioned by the relevant grounds of opposition. On the contrary, it amounts to an additional claim without an equivalent in the patent in suit as granted. Consequently, the

Board, in the exercise of its discretion, decides that neither the main request nor the first auxiliary request is admissible under Rule 57a EPC.

*B. (second auxiliary request)*

- 2.4 Claims 1 to 3 of this request are identical to the corresponding claims of the main request and are admissible for the reasons given (sections 2.1, 2.2, above).
- 2.5 Claims 4 to 8 correspond to claims 5 to 9, respectively, of the application as originally filed and of the patent in suit as granted. No objection arises to them under Article 123 EPC.
- 2.6 In summary, the claims of the second auxiliary request are admissible under Article 123 EPC. The consideration of the substantive issues of the case will therefore be confined to the latter request.

3. *Late-filed documents (second auxiliary request)*

Both documents D11 and D12 were cited by the Appellant. In particular, D11 was cited to corroborate arguments concerning the significance of the stretching ratio, and D12 to illustrate background knowledge concerning standards of measurement of adhesion of fibres to rubber. Neither has been objected to by the Respondent. On the contrary, the Respondent has based at least one counterargument on the contents of D11 (section V(e), above). On the other hand, the rubber adhesion test referred to in D12 corresponds to general knowledge, the nature of which is not in dispute. Consequently, the Board has decided to introduce D11 into the

proceedings, pursuant to Article 114(1) EPC, but to disregard D12 pursuant to Article 114(2) EPC.

4. *The patent in suit (second auxiliary request); sufficiency*

The patent in suit relates generally to the production of thermoplastic polymer fibres by melt-spinning, and their usefulness in tyres (page 2, lines 3 and 4).

The fibres are made of an alternating copolymer of an olefinically unsaturated compound and carbon monoxide, having a molecular weight of at least 2 000, wherein the melt-spinning and stretching of the fibre are implemented at certain critical temperature conditions, to produce fibres having an improved balance of combined tensile strength, flex modulus and adhesion to rubber, compared with polyamides, polyesters or polypropylene (claim 1 in conjunction with page 2, lines 18 to 21).

The ground of lack of sufficiency (Article 100(b) EPC) put forward by the Respondent during appeal was only raised in respect of the embodiment in which fibres are to be spun from a copolymer of carbon monoxide and ethylene alone. The arguments submitted in support of it do not go beyond those already considered in the opposition proceedings. The issue of lack of sufficiency was, however, adequately dealt with, in the Board's view, in the decision under appeal, which came to the conclusion that the requirements of Article 83 EPC were met (Reasons for the decision, page 6 in conjunction with the minutes of the oral proceedings held before the Opposition Division, point 4). The Board sees no reason to take a different view, and

consequently finds that the provisions of Article 83 EPC are met.

5. *The closest state of the art (second auxiliary request)*

Alternating copolymers of the kind referred to in the patent in suit, whether the unsaturated compound is ethylene, or ethylene and another olefinically unsaturated compound, are known from D1, which was considered in the decision under appeal, consistently with the view of the Respondent, as representing the closest state of the art.

5.1 According to D1, whilst high molecular weight alternating copolymers containing only ethylene and carbon monoxide had excellent mechanical properties, in particular very high strength, rigidity and impact-resistance, they had not found any practical use, due primarily to stability problems associated with their high melting point of about 257°C. Processing, for example by injection moulding, required a molten state, the material then being at a temperature of about 25°C above its melting point, i.e. at a temperature of above 280°C. It had been found that at such high temperatures, these polymers began to discolour and decompose, the processed polymers in addition showing a high degree of gelling (column 1, lines 24 to 40).

It was, however, possible to reduce the melting point to a value of between 150° and 245°C without serious detriment to the thermal stability of the polymers, by including in the monomer mixture to be polymerised, a relatively small quantity of one or more other olefinically unsaturated hydrocarbons with less than 20 carbon atoms (A), for instance propene, butene-1 or



octene-1. The resulting terpolymer thus contained units with the formula  $-\text{CO}-(\text{C}_2\text{H}_4)-$  and with  $-\text{CO}-(\text{A})-$  units occurring at random points over the polymer chain (column 2, lines 11 to 34 and column 3, lines 24, 35 and 45).

The above terpolymers had excellent mechanical properties, in particular a very high strength, rigidity and impact-resistance. They could be processed by means of the usual techniques into films, sheets, plates, fibres, moulded objects and the like. On account of their superior properties, the polymers were suitable for many applications, such as in the automobile industry, for the manufacture of packaging material for foods and drinks, as construction and building material, for the manufacture of fibres, filaments, yarns, cables and for a variety of applications in the domestic sphere (column 6, line 47 to column 7, line 2).

According to the application example (Example 9), whilst a plate formed by pressing, at 285°C for 15 minutes, a carbon monoxide/ethylene copolymer with a melting point of 257°C showed complete gelling (100%) and a very strong yellow discoloration, a plate pressed, at 240°C for 15 minutes, from a carbon monoxide/ethene/propene terpolymer of melting point 214°C showed no gelling (less than 0.5%) and no discoloration (column 11, lines 20 to 32).

- 5.2 The argument of the Respondent, that the references to the polymers being processed into fibres, and to the suitability of the polymers for applications in the automobile industry together amounted to a disclosure of the use of the fibres in tyres, is not convincing,

for the following reasons. There is no mention of tyres in D1, and no contextual link between fibres and uses in the automobile industry. Nor are the specified properties of high strength, rigidity and impact resistance attributed to the polymers according to D1 necessarily indicative of an application in tyres (column 6, lines 49 to 50). On the contrary, such properties would, if anything, indicate an application in some other structural part, such as a panel. In summary, there is no direct and unambiguous disclosure of such fibres being used in, or, therefore, suitable for, tyres.

6. *Novelty (second auxiliary request)*

No objection of lack of novelty was raised or pursued in appeal, in respect of the subject-matter now claimed. The subject-matter claimed is thus held to be novel.

7. *Inventive step (second auxiliary request)*

The patent in suit starts out from the problem that melt-spun fibres of large volume polymers which can be applied in the manufacture of car tyres, such as polyamides and polyesters, as well as polypropylene, have to be used in a fairly large quantity of fibre per tyre relative to the amount of elastomer. It is not possible to reduce the amount of fibre per tyre without adversely affecting the quality of the tyre to the extent of making the tyre unsuitable for most of its market applications. This penalty is mainly due to the balance of properties of the aforesaid polymers, which is mainly governed by the combination of tensile strength, flex-modulus and adhesion to rubber. Other

thermoplastic fibres such as polyaramide, or gel-spun high molecular weight polyethylene are far too expensive to be used in tyres (page 2, lines 5 to 14).

It is thus evident that, whilst D1 was chosen by both the Respondent and the decision under appeal as the closest prior art, the problem to which it related, of lowering the temperature necessary for melt processing the relevant polymers (section 5.1, above), is completely different from that addressed by the patent in suit. In this connection, the reference, in D1, to the possibility of forming fibres does not make available any individualised fibre (only pressed plates are exemplified), nor, consequently, any intrinsic properties of such a fibre, such as tensile strength, flex modulus, etc., which could be regarded as implying a technical problem relating to that addressed by the patent in suit.

Thus, the technical problem addressed by the patent in suit is not derivable from the disclosure of D1. On the contrary, any similarity between the disclosure of D1 and the subject-matter of the patent in suit is restricted to the common technical features of the chemical structure of the polymer and the purely notional description of a fibre as its shape.

- 7.1 Such a situation has been recognised and adjudicated by another Board in decision T 686/91 of 30 June 1994 (cited in "Case Law of the Boards of Appeal of the European Patent Office", 3rd edition 1998, I.D.3.1, page 112 of the English version). In that decision, the Board observed that, in the determination of the closest state of the art, *ex post facto* considerations should be avoided. Therefore, a document not mentioning

a technical problem that is at least related to that derivable from the patent specification, did not normally qualify as a description of the closest state of the art on the basis of which the inventive step was to be assessed, regardless of the number of technical features it might have in common with the subject-matter of the patent concerned (Reasons for the Decision, point 4).

The consequence of this finding in that case was that the Board did not start out from the disclosure canvassed by the parties as being the closest state of the art, but rather returned to the statement of problem disclosed in the patent in suit itself.

7.2 Applying this approach in the present case, which would be entirely consistent with the established case law of the Boards of Appeal of the EPO, that an objective definition of the technical problem to be solved should normally start from the technical problem actually described by the Applicant (cf. T 246/91 of 14 September 1993, and T 495/91 of 20 July 1993, both cited in "Case Law", *supra*, I.D.4.1, page 115 of the English version) would, however, have the result that no assessment of inventive step following the problem and solution approach could be carried out taking the disclosure of D1 as the starting point.

7.3 It follows that the claimed subject-matter cannot be obvious starting from the state of the art represented by D1, since an assessment of inventive step starting from such a "closest state of the art" disclosure, which is irrelevant to the claimed subject-matter in the sense that it does not mention a problem that is at least related to that derivable from the patent

specification, falls outside the scope of the problem and solution approach.

7.3.1 In this connection, the technical problem objectively arising from such a "closest state of the art" disclosure has a form such that its solution can practically never be obvious, because any attempt by the skilled person to establish a chain of considerations leading in an obvious way to the claimed subject-matter gets stuck at the start (T 644/97 of 22 April 1997, "EPO Board of Appeal Case Law in 1999", Special edition of the OJ EPO 2000, 21).

7.3.2 Nor would the skilled person be led to combine with D1 a prior art disclosure more directly relating to the relevant problem than that of D1, say D7, since the relevance of such a disclosure would not be apparent (T 325/93 of 11 September 1997, cited in "Case Law", *supra*, page 112 of the English version).

7.3.3 This conclusion is fully applicable, in the Board's view, to the subject-matter of claim 1 in the present case.

7.3.4 Consequently, the finding, in the decision under appeal, that according to D7 stretching ratios above 7:1 were not unusual at the relevant priority date (section III, above) is irrelevant to the question of inventive step starting from D1.

7.3.5 In summary, the subject-matter claimed is non-obvious starting from D1 as closest state of the art.

7.5 Nor would the result have been different starting from, say, the disclosure of D7, canvassed as closest state

of the art by the Appellant, since it has not been disputed in the decision under appeal, nor argued by the Respondent in the appeal, that the claimed subject-matter is non-obvious starting from this art (Reasons for the decision, page 5).

7.5.1 On the contrary, the technical problem evidently arising from this more relevant disclosure, of providing an improved ITS.IM product (factor of improved tensile strength x factor of improved modulus) as well as a concomitant improved adhesion to rubber (which closely corresponds to that addressed by the patent in suit), is credibly solved, for the range of stretching ratios claimed, by the fibres according to the patent in suit, as evidenced by the examples of the latter and supplementary Examples A and B filed with the Statement of Grounds of Appeal. The effectiveness of the fibres resulting from the claimed process for the applications envisaged has in any case not been disputed.

7.5.2 There is, however, no disclosure or suggestion in D7 to use the relevant alternating ethylene/carbon monoxide copolymers in this connection, nor any reference in D1 to the relevant properties, let alone a hint to an improved performance in such properties. The remaining documents in the proceedings are still more remote from the claimed subject-matter. In other words, the subject-matter claimed does not arise in an obvious way starting from D7 as closest state of the art. It is to be noted that this result is also valid regardless of the precise stretching ratios disclosed in D7 (section 7.3.4, above).

7.6 Consequently, the subject-matter of the claims of the

patent in suit involves an inventive step in the sense of Article 56 EPC.

## **Order**

### **For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of claims 1 to 8 according to the second auxiliary request submitted on 27 April 2001, after any necessary consequential amendment of the description.

The Registrar:

The Chairman:

C. Eickhoff

R. Teschemacher