BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS
BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE
CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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

File Number: T 347/89 - 3.3.3

Application No.: 83 108 182.3

Publication No.: 0 104 410

Title of invention: Highly oriented aromatic polyamide short fiber

Classification: D01F 6/60

D E C I S I O N
of 6 December 1991

Proprietor of the patent: KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY

Opponent: 01) Akzo N.V.

02) E.I. Du Pont de Nemours and Company

Headword:

EPC

Keyword:

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 347/89 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 6 December 1991

Appellant : (Proprietor of the patent)
KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY
207-43 Cheongryangri-dong
Dongdaimoon-ku
Seoul (KO)

Representative :
Henkel, Feiler, Hänzel & Partner
Möhlstrasse 37
W-8000 München 80 (DE)

Respondent : (Opponent 01)
Akzo N.V.
Velperweg 76
NL-6824 BM Arnhem (NL)

Representative :
Sieders, René
AKZO N.V.
Patent Department (Dept. CO)
P.O. Box 9300
NL-6800 SB Arnhem

Opponent :
E.I. Du Pont de Nemours and Company
1007 Market Street
Wilmington, Del. 19898 (US)

Representative :
Abitz, Walter, Dr.-Ing.
Abitz, Morf, Gritschneder,
Freiherr von Wittgenstein
Postfach 86 01 09
W-8000 München 86 (DE)

Decision under appeal :
Decision of Opposition Division of the European Patent Office of 22 March 1989, issued on 28 April 1989 revoking European patent No. 0 104 410 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : F. Antony
Members : H. Fessel
G. Davies

Summary of Facts and Submissions

I. European patent No. 0 104 410 was granted on 20 November 1986, on the basis of application No. 83 108 182.3, filed on 18 August 1983, claiming a Korean priority of 30 August 1982 (KR 389 782), with four claims (one independent and three dependent).

II. On 25 July and 20 August 1987, oppositions were lodged by the Respondents Akzo N.V. (hereinafter Respondent I) and E.I. Du Pont de Nemours and Company (hereinafter Respondent II), respectively, on the grounds of Article 100(a), (b) and (c) EPC. Inter alia, the following documents were cited within the opposition period:

(1) US-A-3 869 430
(5) US-A-4 172 938
(6) EP-A-0 055 190
(7) Japanese Patent application, Publication No. 52-124099
(9) Research Disclosure of February 1980, No. 19037.

III. By a decision delivered orally on 22 March 1989, with written reasons posted on 28 April 1989, the Opposition Division revoked the patent.

The Opposition Division disregarded objections under Article 100(c) EPC as late and lacking relevance, and rejected the Opponents' arguments concerning alleged lack of sufficient disclosure (Article 100(b) EPC). It held, however, that the subject-matter of Claim 1 was not novel over (1) because the "Kevlar®" fibres disclosed therein were admitted as known to be convertible into pulp-like fibres, as evidenced by (9). All otherwise relevant parameters of Kevlar® corresponded to those of the claimed fibres, and the process features did not contribute to the

novelty of the product. Even if novelty were not denied, it would have been evident that, in view of (1) and (9), the claimed subject-matter could not involve any inventive step.

IV. The Proprietor (Appellant) lodged a Notice of Appeal together with payment of the prescribed fee on 29 May 1989. In the Statement of Grounds of Appeal filed on 7 September 1989, and during oral proceedings held on 6 December 1991, the Appellant filed several sets of claims to overcome the objections; the final claims consisted of three sets filed as a main request and as first and second auxiliary requests.

The main request was based on a set of three claims (one independent and two dependent), of which Claim 1 reads as follows:

"1. Pulp-like short fibers of poly-(p-phenylene-terephthalamide) said fibers having a dimension of 2-12 μm in diameter and 1.000 - 5000 μm in length, a physical form of irregular cross-sections and needle point-like ends, similar to those of natural wood pulp fibers crystalline properties such as a crystallinity of more than 50%, an orientation angle of less than 25° and an apparent crystallite size of more than 5 nm as determined from an X-ray diffractogram scan, and a cross-section with four extinction positions through 360° rotation of the cross-section specimen of said fiber but without a maltese cross under cross polarizers of a polarizing microscope, characterized in that the pulp-like fibers have an inherent viscosity of more than 6.0 as measured at a concentration of 0.5 g of polymer in 100 ml of concentrated sulfuric acid (97% H_2SO_4) at 30°C, and that said fibers are obtainable without

employing spinning processes, by subjecting polymer chains of poly-(p-phenylene-terephthalamide) to mechanical parallelization during the growth of the chains in a special type of solvent system, whereby said parallelisation is performed for a few seconds at a shear rate of more than 160 sec^{-1} immediately prior to solidification to a gel-like material."

The auxiliary requests were each directed to a method of preparing the pulp-like short fibres of Claim 1 of the main request.

The arguments provided by the Appellant to support these requests may be summarised as follows:

Novelty was clearly provided by the inherent viscosity of more than 6.0 and the special technique to produce such pulp-like short fibres. Moreover, fibres having an intrinsic viscosity of more than 6.0 could not be produced by the method known from (1), i.e. by spinning a solution in sulfuric acid. Based on the teaching given in the patent in suit, the Appellant was for the first time able to provide the fibres specified in Claim 1. This was possible with a method of polymerisation and fibre orientation hitherto unknown for poly-p-phenylene-terephthalamide (hereinafter PPTA) fibres.

V. The counterarguments provided by Respondents I and II may be summarised as follows:

It was true that Example 2 of (6) did not disclose a pulp-like product within the meaning of Claim 1 of the main request, nor did document (1) mention pulp-like short fibres having an intrinsic viscosity of more than 5.8; however, with regard to the teaching given in (1), a man skilled in the art would be able to produce fibres with an

intrinsic viscosity (IV) of more than 6 by starting from a PPTA with a IV above 6 in a spinning and grinding process known therefrom without any difficulty or ingenuity.

Respondent I maintained his insufficiency objection. Both Respondents argued that, using hitherto known methods, it was not possible to determine orientation angle and crystallite size, since only long fibres could be arranged in an essentially parallel order (cf. (1), column 6, lines 28-31 and column 7, lines 37-42). Moreover, Respondent I argued that the patent in suit was silent as to any method of determining valuable characteristics of the claimed product such as tenacity and modulus, and these parameters could not be measured by any generally known method.

As far as the orientation angle was concerned, the scope of Claim 1 was not clear, since in Claim 1 a value of less than 25° was given, whereas in column 8, line 34, of the patent specification a value of above 25° was specified.

VI. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claim 1 of the main request submitted during oral proceedings, Claims 2 and 3 as granted and the description yet to be adapted, or on the basis of Claim 1 according to auxiliary request 1 or 2, the rest as per main request. The further request for refund of the appeal fee owing to alleged procedural violations (see Appeal Grounds, page 2, paragraph 2) was not maintained during the oral proceedings. The Appellant also made the following statement:

"The patentee declares that no protection is claimed for a fibre obtained by a spinning process."

The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC (cf. items III and IV), and therefore is admissible.

2. The evidence submitted by the Appellant on 27 November 1991 was not admitted into the proceedings because it was both filed late and irrelevant.

3. Admissibility of proposed amendments in the claims of the main request

3.1 The amendments to be considered with regard to original Claim 1 are essentially the following:

(a) an inherent viscosity of "more than 6.0" instead of "at least 5.0";

(b) the addition of "whereby said parallelisation is performed for a few seconds at a shear rate of more than 160 seconds^{-1} immediately prior to solidification to a gel-like material".

Further amendments, such as "5 nm" instead of "50 Å", deletion of "in a parallelisation system therefor" before "in a special type of solvent", and the two-part form of the claim, need not be commented on since they do not materially affect the claimed subject-matter.

3.2 Amendment (a) is supported by page 16, lines 3 and 21 of the original files, corresponding to column 9, line 42 and column 10, line 2 of the patent specification.

As to amendment (b), the Board is satisfied that it is supported by Claim 4 in the original and the granted

version, and by page 6, line 4 from the bottom to page 7, line 14 read in conjunction with page 10, line 5 from the bottom to page 11, line 21 of the original files, corresponding to column 4, lines 16 to 38 and column 6, line 38 to column 7, line 4 of the patent specification.

Claims 2 and 3 were not amended during proceedings.

The set of claims of the main request thus meets the requirements of Article 123(2) EPC.

3.3 The subject-matter of Claim 1 differs from the granted version not only in the amendments specified above, but also in that features of Claim 1 as originally filed have been reintroduced. The Board is satisfied that the protection conferred by the granted version is not extended thereby (Article 123(3) EPC).

4. Clarity

The objection that the extent of protection was indeterminate because of a contradiction between the term "less than 25°" in Claim 1 on the one hand, and "above ... 25°" in column 8, line 34 on the other hand, boils down to alleged lack of clarity; for, in itself, the respective passage in Claim 1 is perfectly clear, leaving no room for interpretation. It is furthermore supported by column 1, line 56 (page 2, line 6 from the bottom of the original documents). Lack of clarity not arising out of amendments made after grant is, however, not a matter to be dealt with during opposition proceedings.

5. Sufficiency in terms of Article 83 EPC means disclosure of the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

In an application comprising examples, these examples generally provide detailed guidance as to how to carry out the invention.

5.1 In the present case, the examples specify the preparation of high molecular weight PPTA, having an inherent viscosity of more than 6.0 in the form of pulp-like short fibres. Examples 1-6 illustrate the invention by showing the preparation of a solution of p-phenylenediamine in a solvent system comprising pyridine, and the addition of terephthaloyl chloride while stirring vigorously at a high speed of more than 800 cm/sec for about 5 seconds when the viscosity of the mixture reaches its maximum, until the reaction mixture gelates to form a solid mass.

On the basis of this teaching given in the specification and in the light of later expert opinion (Chemical and Engineering News, 13 April 1987 and Nature 326, April 1987, page 540 and pages 580 to 582), the Board is satisfied that parallelisation is actually achieved by a process as specified above. On this basis the Board considers the disclosure to be sufficient to provide parallelised pulp-like short fibres of PPTA having an inherent viscosity of more than 6.0.

5.2 The absence of any upper limit for the inherent viscosity under the given circumstances does not constitute insufficient disclosure, since the process features specified in the characterising part of Claim 1,which are in line with those of Examples 1 to 6, are likely to impose some practical limitation on the otherwise open-ended range of IV (cf. T 487/89, item 3.5; not published in OJ EPO).

5.3 The Respondents' objection that the "special type of solvent system" required the presence of pyridine and

should be limited accordingly, must equally fail. In the light of the theoretical explanation offered in column 5, line 50, to column 6, line 16 of the specification, it seems credible to the Board that alternative systems, such as exemplified in column 5, lines 15 to 17, will also work. In the absence of any evidence to the contrary from the Respondents (on whom rests the burden of proof), the above attack cannot be sustained. In this connection, reference is also made to (6), page 3, lines 7 to 32 and Example 2, disclosing the use of similar solvent systems in the manufacture of PPTA polymers.

5.4 In the decision under appeal, the features specified in the preamble of Claim 1 were considered to be known (cf. items 4.1 to 4.5). This has not been disputed by the parties, and the Appellant, in particular, considered it appropriate to draft new Claim 1 in the two-part form, with a preamble specifying said features. With this in mind, it is the Board's view that normally sufficiency can not be attacked by an argument that known parameters cannot be measured by known methods.

In the present case, with reference to the teaching given in (1), the Respondents have essentially argued that the O.A. or the A.C.S. could only be measured with samples having continuous filaments (cf. (1) column 6, lines 28 to 31, and column 7, lines 38 to 47) and not with fibres having the dimensions specified in Claim 1 of the patent in suit. This was not disputed by the Appellant, who argued, however, that a man skilled in the art seeking to determine the O.A. and the A.C.S. of the claimed fibres would still be able, on the basis of his ordinary skill, to prepare a sample enabling him to apply known techniques. On the basis of detailed explanations given during oral proceedings how to proceed using well-known embedding techniques, the Board is satisfied that the

relevant parameters can indeed be measured without undue effort.

5.5 Incidentally, Respondent I stated that he repeated Example 5 of the patent in suit and obtained a fibrous product which, so he said, could hardly be distinguished from his own plant products made in accordance with US-A-4 308 374 (cf. letter dated 23 July 1987, page 9, lines 4 to 8). While experimental data to show the characteristics which were compared have not been provided, the Board concludes that sufficient information must have been given in Example 5 to allow repeating it, and that at least some of the known parameters were determined and compared. This is further confirmation of the existence of sufficiency.

5.6 High strength and high modulus are not mentioned in the definition of the claimed subject-matter, hence failure to disclose a method for their determination has no impact on the issue of sufficiency.

5.7 In summary, the Board is satisfied that the claimed subject-matter has been sufficiently disclosed.

6. Fibres in accordance with Claim 1, more particularly pulp-like short fibres of PPTA with an IV of more than 6.0, were not disclosed in any of the cited prior art documents and are thus novel. A passage in (1), viz. column 12, lines 25 et seq., mentions yarns prepared from polymers with an I.V. of 6.6, such yarns themselves having an I.V. of not more than 5.8. This fact is no longer disputed by the Respondents.

7. The Board considers (9) concerning a pulp of aramide fibres as e.g. disclosed in (1) to be the closest prior art.

The said document discloses pulp made by cutting and masticating or abrading originally continuous filaments of Kevlar®. The pulp is made up of fibres of less than about 1 mm each, with many finer fibrils attached, and may be produced from a yarn as specified in Claim 1 of (1), especially as per item d-2 of table I.

In the light of this closest prior art, the technical problem underlying the patent in suit may be seen in providing pulp-like short fibres of PPTA with an increased tensile strength.

According to the disputed patent, this technical problem is to be solved by a pulp-like short PPTA-fibre having an inherent viscosity of more than 6.0 and obtainable by a process as specified in Claim 1.

In view of Examples 1 to 6 and column 9, lines 50 to 65 of the disputed patent, in conjunction with Fig. 1A, 2B and line 61 of column 2 to line 2 of column 3, the Board is satisfied that this technical problem has been effectively solved.

8. It remains to be decided whether the subject-matter claimed in accordance with the Appellant's main request involves an inventive step.

Both Respondents alleged that it would have been possible to produce the claimed pulp-like fibres having an IV higher than 6.0 by known spinning and further techniques, such as for example those known from (9). Against this, the Appellant argued that it has hitherto been found impossible to obtain such fibres (cf. column 10, lines 1 to 6 of the disputed patent).

Document (1) teaches that, as of the then invention date, novel fibres having a high initial modulus and a high filament strength (column 1, lines 33 to 47), i.e. fibres with an unusually high IV can only be produced when the specified precautions are taken (column 2, lines 54 to 62). The highest IV of fibres (yarn) achieved in (1) is an IV of 5.8 starting from a polymer with an IV of 6.6 (column 12, lines 25 to 27). Thus even when applying the necessary precautions a reduction of the IV from 6.6 to at best 5.8 is not avoided, i.e. some degradation will always occur. With regard to the given desideratum -unusually high IV - a man skilled in the art would learn that it is not possible to obtain fibres with an IV of more than 5.8 (viscosity of the spinning dopes at temperatures of about 90°C).

Moreover it is learnt from (9) that such fibres have to be subjected to further treatment - masticated or abraded - to bring them into the desired pulp-like form. A skilled man would not expect of such a treatment to be "neutral" with regard to the IV of the treated fibres, but even if this were the case, he would be aware that he could not expect to produce pulp-like fibres with an IV of more than 6.

As regards the problem to be solved, i.e. increasing the tensile strength, it is not only the IV which is responsible for the said characteristic. The Board is convinced that the morphology of the fibres too has an influence thereupon as argued by the Appellant and not refuted by the Respondents. The specific morphology is, however, a result of the process specified by the process features in Claim 1.

(1) and (5) as well as the other documents cited during appeal proceedings do not contain any information hinting

at the solution of the above-mentioned problem in that none of them mentions the mechanical parallelisation during growth of the chains.

(5) and (7) relate to the production of shaped PPTA articles, such as fibres and films, by a shaping process. Both citations deal with PPTA polymers having a high molecular weight and thus a high viscosity. In both it is taught that solubility may be enhanced when special solvent systems are used (cf. (5) column 13, lines 15 to 40; (7) page 11, paragraphs 3 and 5), and stirring and kneading apparatus corresponding to the rapid phase change are used ((5) Claims 1 and 11; (7) page 13, lines 1 to 4). Shaped articles are formed by using usual techniques, i.e., in general the polymer is dissolved and shaped ((5) column 7, lines 56 to 64; (7) page 13, paragraphs 4 and 5). On the other hand, (6) relates to a process for producing shaped articles by providing compositions comprising PPTA and which may be directly used in known shaping processes (cf. Claim 8 in conjunction with page 3, lines 3 to 6). Worked examples indicate how to proceed.

None of these documents provides any incentive for the solution of the above problem since each of said citations either seeks to avoid problems caused by the viscosity of high molecular weight PPTA, or is looking for a simpler and more economic method to produce shaped articles. All are silent on the morphology of the fibres as a characteristic responsible for tensile strength.

In summary, the subject-matter of Claim 1 of the main request involves an inventive step. The same applies to the subject-matter of Claims 2 and 3.

The main request being allowable, there is no need to deal with the auxiliary requests.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of Claim 1 of the main request submitted during oral proceedings, Claims 2 and 3 as granted, and the description yet to be adapted.

The Registrar: The Chairman:

E. Görgmaier F. Antony

02.07.92

02/07/92