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

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 28 January 1998

Case Number: T 0395/92 - 3.2.5

Application Number: 85116080.4

Publication Number: 0185353

IPC: B29C 67/14

Language of the proceedings: EN

Title of invention:
Composites reinforced with high strength aramid fibers having fibrillated ends

Patentee:
E.I. Du Pont de Nemours and Company

Opponent:
Hoechst Aktiengesellschaft
Akzo Nobel N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0395/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 28 January 1998

Appellant: (Proprietor of the patent)
E.I. du Pont de Nemours and Company
1007 Market Street
Wilmington
Delaware 19898 (US)

Representative:
Abitz, Walter, Dr.-Ing.
Patentanwälte Abitz & Partner
Postfach 86 01 09
81628 München (DE)

Respondent: (Opponent)
Hoechst Aktiengesellschaft
Zentrale Patentabteilung
Gebäude F 821
D-65926 Frankfurt am Main (DE)

Representative:
-

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

Representative:
Schalkwijk, Pieter Cornelis
Akzo Nobel N.V.
Patent Department
P.O. 9300
6800 SB Arnhem (NL)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 27 February 1992 revoking European patent No. 0 185 353 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: W. D. Weiß
Members: H. P. Ostertag
M. Aúz Castro

Summary of Facts and Submissions

I. The appellant (proprietor of the patent) lodged an appeal against the decision of the Opposition Division revoking patent No. 0 185 353 because of lack of inventive step of the subject-matter of Claim 1 having regard to document

E6: US-A-3 869 430

as the closest prior art and considering the documents

E1: H. Richter, "Hybrid-Verbundwerkstoffe mit gerichteten Kurzfasern", Kunststoffe 67 (1977), page 12, and

E2: EP-A-097 335.

II. Claim 1 as granted reads as follows:

"1. A composite comprising a matrix resin reinforced with sliver of high modulus p-aramid fibers of which at least 10% of the fiber ends are fibrillated into at least 2 fibrils along a terminal length which is at least 5 times as long as the diameter of the unfibrillated portion of the fiber."

III. In a communication of 22 September 1994, the Board expressed as its preliminary opinion that, starting from document E6 and considering the basic problem stated in the patent as granted, it could, in the light of document E1, have appeared to be obvious to arrive at he idea of replacing the continuous p-aramid filaments by short fibres. This appeared, however, not to be the case for a sliver consisting of fibres exhibiting the structure as defined in Claim 1.

IV. The appellant requested that the decision under appeal be set aside and that the patent be maintained unamended.

The respondents (opponents) requested that the appeal be dismissed.

Only the appellant requested, as a secondary alternative, that oral proceedings be summoned.

V. The appellant argued as follows:

It was known, e.g. from document E6, to prepare composites of continuous filaments and matrix resin. These products exhibited high strength and stiffness in combination with an excellent impact resistance. These known continuous filament reinforced composites, however, suffered from the drawback of lacking conformability to three-dimensional shapes. It was also known, e.g. from document E1, to prepare composites of staple fibre and matrix resin. These products had a good conformability, however, as compared to continuous filament composites, they exhibited relatively poor tensile strength and modulus.

It was true that document E2 described a particular type of sliver material which was apt to be used to solve the problem underlying the invention. This sliver material, which as a result of the multiplicity of breakages had not any strength, was exclusively described in the said document to be used as an intermediate product from which a twisted yarn could be prepared. The strength of the sliver material with the fibrillated ends was comparable with the strength of a roving prepared of staple fibres used in the comparative example of the patent in suit. When a

person skilled in the art was looking for reinforced composites which had good tensile properties he would at best have thought about the use of the yarn described in document E2, but would not have expected anything of the use of the sliver material.

Document E1 related to hybrid composite materials with oriented short fibres of carbon, asbestos and glass fibres and did refer neither to the material p-aramid nor to the particular structure, and not their length, of the fibres indicated in Claim 1. This particular structure of the fibres was responsible for their favourable effect.

VI. The respondents argued as follows:

Document E1, beyond disclosing specific composites, taught general rules about the characteristics of composites on the basis of oriented short fibres in dependence on their staple length. According to this teaching short fibre reinforced prepregs had a good conformability but could not cope with the mechanical parameters characteristic for composites containing long fibres. Moreover, it was generally known from the field of sewing yarn production that yarns obtained from stretch-broken slivers result in higher values for the mechanical parameters of the yarn than yarns obtained from cut fibres (cf. "Textil-Praxis" 1958, page 249 to 256, called E7). Therefore, a person skilled in the art starting from document E6 as closest prior art would have expected that the sliver disclosed in document E2, when embedded in a matrix polymer, resulted in higher strength of the composite than the short fibres used according to document E1. It had,

moreover to be considered that definition of the fibre structure given in Claim 1 was more general than the one given in document E2 and was, therefore, expected to be present in staple fibres produced also by other methods than the specific one disclosed in document E2.

Reasons for the Decision

1. *Inventive step*

1.1 The Board is in agreement with all the parties and the decision under appeal that document E6, which is acknowledged as such in the description of the patent in suit, is still the prior art closest to the subject-matter of the patent in suit.

This document discloses composite sheets of continuous p-aramid filaments embedded in a polymer matrix. Such composites exhibit high flexural modulus, flexural offset yield strength and Charpy impact strength and are used for very demanding applications such as for aircraft fairings, radomes, ceilings and aerospace uses (see column 1, lines 47 to 58).

1.2 Because these known composites suffer from the drawback of a poor conformability, problems occur whenever attempts are made to produce three-dimensional articles, particular those with sharp bends by hot-pressing continuous p-aramid filament containing resin sheet. The shaped articles exhibit uneven areas and wrinkles as well as slack filaments (see EP-B-0 185 353, column 1, lines 25 to 33).

Consequently, the subject-matter of the patent in suit aims at solving the problem to increase the conformability of the known composites without a considerable loss of the favourable mechanical characteristics enumerated in point 1.1 above.

1.3 According to Claim 1, this problem is solved in that the composite comprises the p-aramid reinforcement in form of a sliver of fibres of which at least 10% of the fibre ends are fibrillated into at least 2 fibrils along a terminal length which is at least 5 times as long as the diameter of the unfibrillated portion of the fibre.

1.4 Document E2, see in particular the claims, discloses a sliver which meets the requirements of a sliver to be used in a composite according to the patent in suit. This fact is not in dispute.

The basic problem which the author of document E2 aims at solving is to produce fine spun yarns from p-aramid fibres which yarns preserve as much as possible of the favourable mechanical qualities of the initially continuous p-aramid filament. The known sliver is an intermediate product in a process which finally results in the spun yarn and it only serves to be processed in a conventional spinning process, e.g. the worsted system or the cotton system. Document E2 itself does not contain any hint that the sliver, which is a loose assemblage without twist of discontinuous fibres, could be useful as a reinforcing material in a composite.

1.5 Document E1 concerns hybrid composites containing a mixture of aligned short (2 to 4 mm) carbon and glass fibres. These short fibres are formed into an oriented fleece by an hydrodynamic process. The fleece is dried and impregnated with the matrix material whereby prepregs are obtained which can be shaped into

three-dimensional articles under heat and pressure. The Board cannot any reason why this document should induce a person skilled in the art to use a sliver of prealigned fibres of a different material, length (100 to 150 mm) and structure, as disclosed in document E2, as a reinforcing material.

2. The Board, by its own motion, has additionally examined the other documents which have been cited in the opposition proceedings but no longer relied upon in the appeal stage. None of those documents suggests that a sliver or even a roving of discontinuous fibres, which are the usual starting materials for a yarn spinning process, should be used as such as a reinforcing material in composites of the kind discussed. The same consideration applies to document E7.

3. The subject-matter of Claim 1, having regard to the state of the art cited, is therefore not obvious to a person skilled in the art and, consequently, shall be considered as involving an inventive step in the meaning of Article 56 EPC.

4. The grounds for opposition do, therefore, not prejudice the maintenance of the patent unamended.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained unamended.

The Registrar:

A. Townend

The Chairman:

W. D. Weiß

W.D.W.
AC
0231.D