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D E C I S I O N
of 2 May 1996

Case Number: T 0619/92 - 3.2.5

Application Number: 83101731.4

Publication Number: 0089502

IPC: B29C 67/14, C08J 5/04

Language of the proceedings: EN

Title of invention:
Composite containing polyolefin fiber and polyolefin polymer matrix

Patentee:
Allied-Signal Inc.

Opponent:
Stamicarbon B.V.

Headword:
-

Relevant legal provisions:
EPC Art. 123(3), 111(1), 56

Keyword:
"Amendments - substantive"
"Decision re appeals - remittal (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0619/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 2 May 1996

Appellant: (Opponent)
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Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 14 May 1992 rejecting the opposition filed against European patent No. 0 089 502 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: G. Gall
Members: W. D. Weiß
H. P. Ostertag

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division on the rejection of the opposition against the patent No. 0 089 502.

The opposition was filed against the patent as a whole and based on Article 100(a) EPC (lack of inventive step).

The Opposition Division held that the grounds for opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent unamended, having regard to the following documents

E1: GB-A-2 051 667,
E2: Mead and Porter, J. Appl. Polymer Science, volume 22 (1978), pages 3249 to 3265,
E3: CA-A-626 443, and
E4: Michael R. Piggot "Load Bearing Fibre Composites", Pergamon Press, page 168.

II. In his grounds of appeal, the appellant maintained the objection of lack of inventive step and, in addition to the documents E1 to E4 cited within the time limit for opposition, mentioned for the first time the documents

E5: GB-A-1 360 115
E6: Capiati N. J. and Porter R. S., Journal of Material science, volume 10 (1975), pages 1671 to 1677, E7 EP-A-0 064 167. and
E8: Smith, Lemstra et al., Polymer Bulletin volume 1 (1979), pages 773 to 736

"in view of the arguments used by the Opposition Division in its decision".

III. In a communication accompanying the summons for oral proceedings the Board expressed its intention to consider the belatedly cited documents E5, E6, and E8. Moreover, the Board pointed to aspects which could challenge whether the subject-matter of claim 1 as granted involved an inventive step.

IV. At the oral proceedings before the Board, the respondent filed three sets of amended claims as First to Third Auxiliary Requests.

V. The appellant requested that the decision under appeal be set aside and that the European patent No. 0 089 502 be revoked (main request). He furthermore requested not to admit the auxiliary requests of the respondent, or, in the case that the auxiliary requests should be admitted, to remit the case to the first instance or to adjourn the oral proceedings before the Board.

VI. The respondent requested that the appeal be dismissed and that the patent be maintained as granted (main request), or that the patent be maintained on the basis of the claims according to the first, second or third auxiliary requests presented during the oral proceedings.

VII. The independent claims 1 in the four versions read as follows:

Main Request:

"1. A composite structure comprising a plurality of polyolefin fibers in a polymer matrix, characterized in that:

(a) the polyolefin fibers are selected from the group consisting of polyethylene and polypropylene fibers having a weight average molecular weight of at least 500,000, a tenacity of at least about 15 g/denier (13.5 g/dtex) and a main melting point of at least 140°C for polyethylene fiber, and a tenacity of at least 11 g/denier (9.9 g/dtex) and a main melting point of at least 168°C for polypropylene fiber; and

(b) the matrix comprises a polymer having polyethylene or polypropylene crystallinity with a melting or sticking point at least 3°C lower than the melting point of the polyolefin fiber;

said composite structure having a tenacity at least 75% of the volume average tenacity of the polyolefin fiber plurality and the polymer matrix."

First Auxiliary Request:

"1. A composite structure comprising a plurality of polyolefin fibers in a polymer matrix, characterized in that:

(a) the polyolefin fibers are selected from the group consisting of polyethylene and polypropylene fibers having a weight average molecular weight of at least 500,00, a tenacity of at least about 15 g/denier (13.5 g/dtex) and a main melting point of at least 140°C for polyethylene fiber, and a tenacity of at least 11 g/denier (9.9 g/dtex) and a main melting point of at least 168°C for polypropylene fiber;

(b) the matrix comprises a polymer having polyethylene or polypropylene crystallinity with a melting or sticking point at least 3°C lower than the melting point of the polyolefin fiber; and

(c) the matrix and any fillers or reinforcements occupying substantially all the void spaces left by the fiber network;

said composite structure having a tenacity at least 75% of the volume average tenacity of the polyolefin fiber plurality and the polymer matrix."

Claims 1 according to the Second and Third Auxiliary Requests differ from the version according to the First Auxiliary Request only by a different version of their respective feature (c).

For the Second Auxiliary Request feature (c) reads as follows:

"(c) said composite comprising a plurality of superimposed planar layers, each layer comprising parallel fibers, the fibers in each layer being at an angle to the fibers in adjacent layers, the fiber comprising 40 to 90 volume % of the composite, the matrix occupying substantially all of the void spaces left by the polyolefin fiber plurality; and...".

For the Third Auxiliary Request feature (c) reads as follows:

"(c) said composite comprising a plurality of superimposed planar layers, each layer comprising parallel fibers, the fibers in each layer being at an angle to the fibers in adjacent layers, the

fiber comprising 40 to 90 volume % of the composite, the matrix occupying substantially all of the void spaces left by the polyethylene fiber plurality; and...".

VIII. The appellant argued as follows:

The line of arguments used in the first instance was that the subject-matter of Claim 1 as granted did not involve an inventive step having regard to document E2 or E3 in combination with E1 (or E8). Contrary to the opinion expressed in the decision under appeal, the use of one polymer composites, at the priority date of the patent in suit, was not confined to the wrapping of tobacco, food, and the like, as document E3 appeared to suggest, but, according to document E6, was a well established concept to replace materials such as metals, wood and ceramics.

The subject-matter of Claim 1 as granted differed from the disclosure of document E6 only in that a different fibre was used in the composite and by the final feature relating to a tenacity retention of at least 75%. Document E6, however, also transmitted the general rule that the polyethylene used to make the fibres should have the highest molecular weight compatible with the fibre preparation method. This was a direct pointer to documents E1 or E8 both describing a method to produce fibres from a polyethylene with the highest molecular weight available before the priority date of the invention and their mechanical characteristics. Consequently, it was obvious to try this new fibre in a one polymer composite. The feature relating to the tenacity retention was a mere desideratum, which obviously was met automatically when the usual methods were applied to produce the composite.

The new requests should not be admitted in this late stage of the proceedings. The additional structural features of these new requests had not yet been subject of claims but were taken from the description. These requests, therefore, constituted completely new issues calling for a new evaluation of the prior art.

The composites claimed according to the version as granted merely aimed at solving the problem deductible from EP-B-0 089 502, page 2, lines 15 to 22, consisting in the desire to increase the interfacial shear strength between fibres and matrix material. Document E6 already gave all the rules to solve this problem. The composites according to the claims as granted contained, however, not any feature on which an argument with respect to ballistic properties could be based.

IX. The respondent submitted the following arguments:

The appellant's considerations were based on the so-called one-way-street argument which was valid only when no other ways existed. Figure 2 of document E2 showed, however, that a skilled person would have expected the interfacial shear stress between fibres and matrix material to exhibit a marked dependence on the embedding temperature. Example 1 of the patent in suit proved that the claimed products, contrary to the expectations of the experts, did not show such a temperature dependence.

Document E3 did not refer to uses which required the use of expensive high tensile strength fibres and, therefore did not contain any pointer to the documents E1 or E8. None of the documents cited by the appellant pointed to the effect that the composites of the patent in suit exhibited a ballistic resistance which was comparable to

that of Kevlar composites. Since Kevlar is a temperature resistant material, it could not have been expected that a composite containing thermoplastic fibres only would exhibit the same favourable ballistic properties.

Reasons for the Decision

1. *Main Request (Patent as granted)*

1.1 Document E6 discloses that, in 1975, the "one polymer composites" (OPC) constituted a whole concept which because of its enhanced strength and stiffness was considered to be the key to the replacement of materials such as metals, wood and ceramics (see E6, page 1671, "1. Introduction", first paragraph) by polymer materials. The OPC, by definition, comprise a plurality of polymer (i.e. polyethylene) fibres embedded in a matrix of chemically the same polymeric material. Document E6 states (page 1672, second and third paragraphs) that the high-modulus polyethylene filaments have a melting point that is 5 to 9°C higher than the same polyethylene conventionally crystallised which is used for the matrix. Moreover it is stated that the polyethylene material used to make the fibres, in order to warrant a good contact between the phases and hence a good interfacial shear strength, should have the highest possible molecular weight compatible with the fibre preparation method, the melting point increasing with the molecular weight (page 1672, fourth paragraph). Having this in mind, the material used for the filaments (in 1975) had a molecular weight of 128,000 and a melting point of 140.1°C (page 1673, left column, lines 4 to 15).

1.2 Following the analysis above, the subject-matter of Claim 1 differs from the one polymer composite disclosed in document E6 in that polyolefin fibres having an average molecular weight of at least 500,000 and the combination of properties indicated in feature (a) of Claim 1 are used instead of the polyethylene fibres having an average molecular weight of 128.000 (Alathon 7026) and by the requirement of a tenacity retention value of at least 75%.

1.3 The patent in suit (EP-B-0 089 502, page 2, lines 15 to 22), starting form document E2 as prior art, aims at producing a composite which warrants higher tenacity retention values combined with a higher overall tenacity in comparison with these known composites.

Since the documents E2 (1978) and E6 (1975) are research reports about the same class of composites (E6 being cited in E2), the same problem exists when starting from document E6.

1.4 According to the patent in suit, (EP-B-0 089 502, page 2, lines 45 to 62), the principle of the solution suggested according to Claim 1 of the patent as granted consists in that a new class of fibres made of ultrahigh molecular weight polyethylene or polypropylene, which had become publicly available from 1979 onwards, was incorporated in the one polymer composites instead of the prior fibres which had a lower molecular weight.

It was not denied by the respondent at the oral proceedings, that the tenacity retention value of at least 75% is the consequence of the incorporation of these fibres when the usual production process is used without any additional measure having to be taken.

1.5 Document E6 states (page 1672) that a melting point difference of 5 to 9°C is the defining feature for the one polymer composite and is the source for the unique interfacial properties obtained in this composite. Since the melting point increases with the molecular weight (and the degree of crystallinity), it is recommended that the polyethylene used "should have the highest molecular weight compatible with the fibre preparation method". In the light of this statement, document E6 has to be interpreted that the material Alathon 7026, molecular weight 128,000, (page 1673, second paragraph) used for the filaments only stands for the material with the highest molecular weight compatible, at that time (1975), with the fibre preparation method.

1.6 According the patent in suit (EP-B-0 089 502, page 2, lines 45 to 51), new processes had been made available to the public between 1979 and the priority date which permitted the production of fibres from ultrahigh molecular weight polyethylene or polypropylene having the combination of properties specified in feature (a) of Claim 1. The respondent has never denied that such fibres had belonged to the state of the art. The documents E1 and E8 originating from one of the group of authors mentioned in the description of the patent in suit in this respect, are, therefore, redundant to prove this fact.

Having in mind the statement in document E6 that the fibres from the material with the highest molecular weight should be used, a person skilled in the art was directly guided by document E6 at least to try the suitability of this new class of fibres as reinforcing elements in one polymer composites and for this purpose to repeat the series of tests which had been performed, e.g. according to documents E6 and E2, with the lower grade fibres. In this context it has to be recalled that

one polymer composites, at this time, were no longer ranked as a mere wrapping material for various kinds of goods (cf. E3) but already as prospective candidate for a high technology polymer material to replace other materials such as metals, wood and ceramics (E6 "Introduction").

The determination of the interfacial shear strength in dependence on the fibre embedding temperature clearly belongs to those tests which were obvious to be repeated (cf. document E2, Figure 2). In this context, the argument that the interfacial shear strength between the new fibres and the matrix material, and consequently the tenacity retention of the composite, surprisingly showed a behaviour different from that to be expected from Figure 2 of E2 is irrelevant, because this result originated from tests which were obvious to be carried out.

The argument that the composite according to the patent in suit has certain properties rendering it specifically suited for ballistic applications is equally irrelevant, because the examples 4 to 20 show that a certain tridimensional structure is the indispensable prerequisite for these ballistic properties to become apparent. Such structure, however, is not a feature of Claim 1 as granted.

Consequently, the subject-matter of Claim 1 as granted does not involve an inventive step and main request of the respondent has to be rejected.

2. *First Auxiliary Request*

2.1 According to established jurisdiction of the Boards of Appeal (see Case Law of the Board of Appeal of the European Patent Office 1987 - 1992, page 163), in appeal proceedings new claims should normally be filed with the statement of grounds of appeal or as soon as possible thereafter. The admission of amended claims to appeal proceedings is at the discretion of the Boards. One criterion which may lead to the consequence that the Board may refuse to consider new claims which have been filed at a very late stage, for example during oral proceedings, is that the claims are not clearly allowable.

2.2 In the present case, all the auxiliary requests, including the first one, were filed close to the end of the oral proceedings, hence at a very late stage. This was done so, although the Board, by a communication accompanying the summons to oral proceedings, had pointed to arguments which might justify the conclusion that the subject-matter of Claim 1 as granted failed to involve an inventive step.

Knowing this negative inclination of the Board, a suitable time moment to file auxiliary requests would have been a date lying a fair time before the oral proceedings.

Claim 1 of the First Auxiliary Request contains a new feature (c) referring to "fillers and other reinforcements" which were not contained in any of the Claims as granted. The introduction of this feature does not clearly result in the restriction of the scope of the protection of the patent as granted but would have needed a thorough consideration on the basis of Article 123(3) EPC.

Since this claim is, therefore, not clearly formally allowable, the Board does not admit to the proceedings this claim and the First Auxiliary Request based thereon.

3. *Second and Third Auxiliary Requests*

3.1 Claim 1 according to the Second Auxiliary Request differs from the respective version as granted in that the feature (c) is added. The structural aspect of this feature is taken from the description as granted, page 2, line 64, to page 3, line 4, the quantitative aspect from page 3, lines 59 to 63. These passages are literally taken from the description as originally filed and restrict the scope of the of this claim when compared to the granted version.

Claim 1 according to the Third Auxiliary Request differs from the version according to the Second Auxiliary Request only in that in feature (c) the "polyolefin" is specified to "polyethylene", this amendment corresponding to Claim 3 as granted and as originally filed.

The dependent claims in both versions correspond to respective dependent claims as granted by only the numeration being adapted.

Consequently, the claims according to the Second and the Third Auxiliary Requests are not subject to objections on the basis of Article 123 EPC.

3.2 If a request is filed during appeal proceedings with amended claims, then in accordance with the jurisprudence of the Boards the case is normally remitted if the amendments are substantial and require further substantive examination (see for example T 63/86, OJ EPO 1988, 224).

3.3 In the present case the amendment is considered to be substantial, because the newly introduced feature (c) represents the structural and quantitative prerequisites which render the composite apt for a use requiring good ballistic properties.

Moreover, the subject-matter of the new feature (c) has been taken from the description of the patent and has never been included in any claim which has been presented during the entire proceedings since the filing of the patent application.

As a consequence, the appellant has not yet had the opportunity to consider this feature in his arguments during opposition and appeal proceedings.

3.4 Under these circumstances, the Board considers that it has to make use of its power under Article 111(1) EPC to remit the case to the first instance for further prosecution on the basis of the claims of the Second or the Third Auxiliary Request, respectively.

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 for further prosecution on the basis of the claims of the Second or of the Third Auxiliary Request, respectively, presented during the oral proceedings of 2 May 1996.

The Registrar: The Chairman:

A. Townend p.p. L. McGarry G. Gall

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W.D.N.