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DECISION  
of 20 November 1995

Case Number: T 0221/93 - 3.3.3

Application Number: 86117683.2

Publication Number: 0227053

IPC: C08L 77/00

Language of the proceedings: EN

Title of invention:

Thermoplastic blends containing polyamide and epoxy functional compounds

Applicant:

GENERAL ELECTRIC COMPANY

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - problem solution approach - closest state of the art - assessment of the technical problem"

Decisions cited:

T 0495/91, T 0741/91, T 0419/93

Catchword:

-



Case Number: T 0221/93 - 3.3.3

DECISION  
of the Technical Board of Appeal 3.3.3  
of 20 November 1995

Appellant: GENERAL ELECTRIC COMPANY  
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Decision under appeal: Decision of the Examining Division of the European  
Patent Office posted 29 October 1992 refusing  
European patent application No. 86 117 683.2  
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: C. Gérardin  
Members: R. Young  
J. Stephens-Ofner

## Summary of Facts and Submissions

- I. European patent application No. 86 117 683.2 filed on 18 December 1986, claiming priority of 23 December 1985 from an earlier application in the United States (US 812434) and published under the publication No. 227 053, was refused by a decision of the Examining Division dated 29 October 1992.

That decision was based on a set of 6 claims filed on 23 July 1992, of which Claim 1 reads as follows:

"A thermoplastic blend consisting of

- (i) at least one aromatic polycarbonate resin,
- (ii) at least one polyamide resin, and
- (iii) from 0.01 to 10 parts by weight, per 100 parts of (i) and (ii) combined, of an epoxy compound selected from glycidol, bisphenol-A diglycidyl ether, tetrabromobisphenol-A diglycidyl ether, diglycidyl ester of phthalic acid, diglycidyl ester of hexahydrophthalic acid, epoxidized soybean oil, butadiene diepoxide, tetraphenylethylene epoxide, dicyclopentadiene dioxide, vinylcyclohexene dioxide, bis(3,4-epoxy-6-methylcyclohexylmethyl) adipate, and 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate."

Claims 2 to 6 are dependent claims directed to preferred embodiments of the main claim.

II. The only ground for that decision was non-compliance with the requirements of Article 56 EPC with regard to the combined teaching of following documents:

D1: EP-A-106 241, and

D2: JP-A-60/217260 (considered in the form of the Patent Abstract).

More specifically, it was stated in that decision that both D1 and D2 described blends comprising a polyamide, an aromatic polyester and a polyepoxy compound. With regard to such prior art the technical problem underlying the application reduced to the provision of further polyamide blends, and thus to a mere alternative. Polycarbonates and aromatic polyesters being very similar in their structure as well as in their properties, the substitution in the blends of a polycarbonate for the polyester was regarded as obvious.

III. On 24 December 1992 a Notice of Appeal was lodged against that decision together with payment of the prescribed fee. In the Statement of Grounds of Appeal filed on 18 February 1993 the Appellant disputed the interpretation of D1 and D2 by the Examining Division. On the one hand, the teaching of D1 was not directed to the use of a polyester, but of a polyol of high molecular weight in conjunction with a polyanhydride and/or a polyepoxide; on the other hand, the main feature of the composition disclosed in D2 was the presence of a thermoplastic crystalline polyester, whereby remarkably improved water resistance was achieved. Neither provided an incentive to substitute a polycarbonate for the polyester, all the more so as

polycarbonates had a different performance profile (Kirk-Othmer's Encyclopedia of Chemical Technology, third edition, 18, 549), which made the properties of the composition unpredictable.

- IV. The Appellant requested "to set aside the contested decision and to grant a patent to the present application", which is interpreted by the Board as the request that the decision under appeal be set aside and a patent be granted on the basis of the sole set of claims at present on file, i.e. Claims 1 to 6 filed on 23 July 1992.

#### Reasons for the Decision

1. The appeal is admissible.
2. The Board concurs with the Examining Division that the requirements of Article 123(2) EPC are satisfied.

With regard to Claim 1 as originally filed the present wording of the main claim differs by (a) the fact that ingredient (i) is now specifically "at least one aromatic polycarbonate resin", (b) the indication of the weight ratio of the epoxy compound (iii), (c) the list of specific epoxy compounds from which the compatibilizing agent is selected and (d) that the composition consists of, rather than comprises the components (i), (ii) and (iii). Feature (a) corresponds to a choice from the three possible polymers as ingredient (i); the fact that the polycarbonate is aromatic is supported by the compositional definition given on page 3, line 15 to page 4, line 10 of the application as originally filed. Feature (b) corresponds

to the subject-matter of original Claim 7. Feature (c) is supported by the list of compounds exemplified on page 15, line 29 to page 16, line 2 of the original application. Feature (d) is implicit in original Claim 1 and is furthermore supported by the examples.

As to dependent Claims 2 to 6, they correspond to original Claims 5, 6, 8, 9 and 10 with their numbers and appendancies adjusted; the addition of the word "polycarbonate" in Claims 2 and 3 as well as the substitution of "epoxy compound" for "compatibilizing agent" in Claims 4 and 5 are consistent with the modifications in Claim 1.

3. The Board also concurs with the Examining Division that none of the above documents discloses thermoplastic blends within the terms of the application in suit and that, consequently, the claimed subject-matter is novel. It is thus not necessary to consider this issue in further detail.

4. It remains to be decided whether the subject-matter of the application in suit as defined in Claim 1 involves an inventive step with regard to the teaching of documents D1 and D2.

4.1 As it appears from both the compositional definition of the blends in Claim 1 and the introductory section of the description (page 1, line 1 to page 2, line 15), the application in suit concerns thermoplastic blends wherein a polyamide and a polycarbonate are the main ingredients. In the "Background of the Invention" emphasis is laid on the shortcomings of such binary blends, in particular on various physical properties which cannot be regarded as satisfactory. It is axiomatic that a document, in order to qualify as the closest state of the art and thereby to be considered as

the starting point for the assessment of inventive step, should deal with compositions which are themselves as close as possible and therefore show the same deficiencies. A correct problem-solution approach would thus require that such prior art document discloses blends based on the same two polymer ingredients.

Since several documents fulfilling this condition are identified, e.g. those cited in the second paragraph of the "Background of the Invention" as well as JP-A-59/68368 cited in the search report in the form of the corresponding abstract (Patent Abstracts of Japan), there is no reason to deviate from the approach followed in the application, thus no reason to formulate the technical problem in different terms (cf. T 495/91 of 20 July 1993, T 741/91 of 22 September 1993, and T 419/93 of 19 July 1995).

The line of argument adopted in the decision under appeal, which is based on D1 and D2 as representing the closest state of the art, although these citations do not describe blends of a polyamide with a polycarbonate, is thus not proper. Such documents may however be used in combination with the above-mentioned prior art to demonstrate to what extent their teachings render obvious the solution proposed in the application in suit.

- 4.2 According to the application in suit (cf. page 2, lines 6 to 12) blends containing a polyamide and a polycarbonate "by no means live up to expectations in either the combination of physical properties present or the level of physical properties attained. Ductility and impact strength are poor. Elongation to break is at marginally useful levels for ordinary purposes." This is attributed to an insufficient compatibility of the polymers in the blends.

In the light of these shortcomings the technical problem underlying the application in suit is thus the provision of such blends having improved ductility, impact strength and elongation to break.

According to Claim 1 this problem is solved by adding an epoxy compound, whereby the compatibility between the two polymer ingredients is enhanced.

In view of the experimental data in Table II of the application in suit, which show that the physical properties of compositions without epoxy functional compatibilizing agent (Examples 1, 4, 6, 8 and 10) are clearly inferior to those of the claimed blends, the Board is satisfied that the above-defined technical problem in its three aspects is effectively solved.

4.3 Although both D1 and D2 mention the use of an epoxy compound in ternary compositions containing a polyamide, the specific features of these compositions would not lead a skilled person to a solution as defined in Claim 1 of the application.

4.3.1 The general teaching of D1 concerns polyamide compositions comprising (a) 70 to 98.95 percent by weight of a polyamide, (b) 1 to 30 percent by weight of a high molecular weight polyester-, polyether- or rubber-polyol, and (c) 0.05 to 5 percent by weight of a polyanhydride and/or a polyepoxide (Claim 1). The specific compositions referred to in the decision under appeal contain (a) 96.7 parts of weight of a polyamide 6, (b) 3 parts by weight of an aliphatic polyester having a hydroxy value of 56, and (c) 0.3 part by weight of a copolymer of styrene/methylmethacrylate/glycidylmethacrylate in the weight ratios 40/40/20 (Examples 1 and 2 in conjunction with page 10, polyesters A and B, copolymer E).



It is clear that the essential feature of component (b) is the hydroxy value, not the composition of the polymer chain, so that the fact that polyesters bear some resemblance to polycarbonates in the chain building mechanism is practically irrelevant. Similarly, whether polyepoxides or polyanhydrides are used as component (c), they should have a high functionality (page 7, lines 15 to 19); moreover, even if diepoxy compounds within the terms of the application, e.g. diglycidyl ethers and esters (page 6, lines 8 to 17), are mentioned as suitable, preference is clearly given to copolymers of glycidylmethacrylate in view of their higher functionality. Furthermore, the role of the epoxy compound in D1 must be more complex than in the application, since component (c) does not have to act as a compatibilizing agent in view of the high compatibility of polyamides with polyesterpolyols (page 6, lines 4/5).

This comparison shows that, although the general properties aimed at in D1 (page 2, lines 7 to 10) correspond to a large extent to those achieved in the application, the prior art teaching has little in common with the solution proposed in the application.

- 4.3.2 Similar considerations apply in the case of D2 as far as the epoxy compound is concerned.

This citation describes a composition containing (A) 50 to 85 weight % of a polyamide, (B) 10 to 45 weight % of a thermoplastic crystalline polyester, having a molecular weight of 10 000 to 30 000 and (c) 1 to 20 weight % of an ethylene-unsaturated glycidyl copolymer (paragraph "Constitution"). This blend results in remarkably improved water resistance performance, without impairing the other properties (paragraph "Purpose").

Apart from the fact that this effect cannot be related to any aspect of the above-defined technical problem, the ethylene-unsaturated glycidyl copolymer is regarded there as a polyolefin, not as an epoxy resin. This means that, even if a skilled person may be aware of the possibility of reaction of these epoxy groups with functional groups of the other ingredients, he would not interpret this, in the first place, as contributing to improved compatibility of polyamide with polyester.

4.3.3 On the assumption that a teaching concerning polyesters can be extended to polycarbonates, a skilled person relying on the disclosures of D1 and D2 would thus incorporate a copolymer of glycidyl(meth)acrylate into the known blends of polyamide and polycarbonate and preferably modify the polycarbonate by introducing a polycarboxylic ester having hydroxy end groups. It is clear that neither corresponds to the features of the blends as claimed, since in the application in suit copolymers of glycidyl(meth)acrylate are not listed among the compatibilizing agents (iii) and the aromatic polycarbonate is not modified by such a polyester having hydroxy end groups (cf. "consisting of" in Claim 1). These considerations demonstrate thus that from that angle the subject-matter of the application as defined in Claim 1 does not derive in an obvious manner from the documents on file.

4.3.4 The same conclusion arises if one adopts the approach followed in the decision under appeal, e.g. if one regards D1 as the closest state of the art and if on the that basis one defines the technical problem as the provision of alternative blends.

First, as stated above, the solution proposed in the application does not boil down to the mere substitution of an aromatic polycarbonate for the polyester, but

additionally requires (a) the absence of hydroxy end groups in that component and (b) the use of less preferred epoxy resins. In the absence of incentive for these modifications, the features of Claim 1 cannot be regarded as obvious.

As to the use of an aromatic polycarbonate instead of a polyester, the sole structural similarity between the two polymers alleged in the decision under appeal cannot outweigh the fact that, as demonstrated by the Appellant, polycarbonates and polyester do have a different performance profile and that, consequently, their respective blends would be expected to have different properties.

This shows thus that, from that approach as well, the claimed subject-matter is not obvious to a person skilled in the art.

- 4.3.5 Hence, the subject-matter of Claim 1 involves an inventive step. By the same token, the subject-matter of dependent Claims 2 to 6, which are directed to preferred embodiments of the main claim, also involves an inventive step.
5. Although the description filed on 23 July 1992 was said to be adapted to the claims filed simultaneously, e.g. the claims upon which the appeal is based, it makes a general reference to epoxy compounds (page 3, lines 13/14) and quotes specific compounds (page 14, lines 5 to 27 and page 15, lines 3 to 8 and 22 to 28) which are no longer within the scope of Claim 1. That matter should require attention before a patent may be granted. To that end the case has to be remitted to the Examining Division.

Order

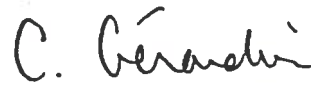
For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Examining Division with the order to grant a patent on the basis of Claims 1 to 6 as filed on 23 July 1992 and a description yet to be adapted.

The Registrar:

  
E. Gorgmaier

The Chairman:

  
C. Gérardin