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 184/90 - 3.3.3

Application No.: 87 109 006.4

Publication No.: 0 254 054

Title of invention: Mixtures based on polycarbonates having improved physical and chemical properties

Classification: C08L 69/00

D E C I S I O N
of 22 July 1991

Applicant: GENERAL ELECTRIC COMPANY

Headword:

EPC Article 56

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

Headnote

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 184/90 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal - 3.3.3
of 22 July 1991

Appellant : GENERAL ELECTRIC COMPANY
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Decision under appeal : Decision of Examining Division 012 of the European Patent Office dated 22 December 1989 refusing European patent application No. 87 109 006.4 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : F. Antony
Members : C. Gérardin
J. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 87 109 006.4 filed on 23 June 1987, claiming priority of 22 July 1986 from an earlier application in The Netherlands and published under the publication number 254 054, was rejected by a decision of the Examining Division dated 22 December 1989.

That decision was based on the set of three claims as filed originally, of which Claim 1 reads as follows:

"A polymer mixture based on aromatic polycarbonate resin having two polymeric additives one of which is formed by 0.5-10% by weight, related to the said three components, of one or more graft copolymers having an elastomeric core which is built up for more than 50% by weight from a polymerised diene, optionally at least one intermediate phase of vinyl monomer polymerised thereon by grafting and a shell built up from a product of one or more monomers polymerised on the preceding phase by grafting and selected from the group consisting of: C_1-C_6 alkylacrylates, C_1-C_6 alkyl methacrylates, acrylic acid, methacrylic acid and mixtures of two or more of these monomers, with a cross-linking agent, and the other one is a block copolymer, characterised in that, related to the three components, the quantity of aromatic polycarbonate resin is 80-99% by weight and that the third component is formed by 0.5-10% by weight, related to the three components, of a block copolymer of polycarbonate and polysiloxane."

Claims 2 and 3 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 WO 80/00084 (document (1)) and EP-A1-173 358 (document (2)). More specifically, it was stated in that decision that the mere incorporation of a core-shell graft copolymer in order to improve the impact resistance of the binary compositions disclosed in document (1), regarded as the closest state of the art, was not inventive. Such addition was suggested by document (2), according to which the impact resistance of aromatic polycarbonates was enhanced by the inclusion of a graft copolymer corresponding to the polymer used in the application. Further, it was stated that starting out from document (2) for the definition of the problem underlying the application might have led to another conclusion regarding the inventiveness of the claimed subject-matter; however, this could not "override the fact that document (1) is also highly pertinent, and that starting out from this document the subject-matter of the claims was found to be non-inventive."

III. On 30 January 1990 a notice of appeal was lodged against that decision with payment of the prescribed fee. In the statement of grounds of appeal filed simultaneously, wherein explicit reference was made to the arguments presented in the Appellant's reply submitted on 2 October 1989 in the examination procedure, the Appellant (Applicant) first analysed the properties exhibited by the polycarbonate compositions according to documents (1) and (2). That comparison brought to light that the closest state of the art was in fact represented by document (2), since the latter and the application in suit aimed at a similar combination of high impact strength, good fuel resistance and low tendency to delamination. Further, from a merely compositional point of view, the polycarbonate composition described in document (2), which comprised a combination of two different impact modifiers, seemed more

similar to the claimed ternary compositions than the composition known from document (1), which contained one impact modifier only.

Moreover, the comparative data in the application in suit showed a marked improvement in notched impact strength, reduced melt viscosity and falling dart impact at -20°C after dipping in "fuel C", which effect could not have been predicted.

IV. The Appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the set of claims filed originally, or, alternatively, on the basis of a new Claim 1 incorporating the features of original Claim 2.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. Since the definition of the closest state of the art and, therefore, of the technical problem underlying the application in suit is a controversial point, documents (1) and (2) will be analysed successively both in terms of compositional features and properties exhibited with regard to those mentioned in the application in suit.

2.1 Document (1) describes a composition comprising a high molecular weight polycarbonate and up to 50% by weight of a block polymer having alternating segments of aromatic polycarbonate and polyorganosiloxane in a weight ratio of 25:75 to 75:25 (Claim 1). This block copolymer, which corresponds to the third component of the claimed compositions, imparts in particular ductility and solvent

resistance as well as improved flame resistance to the basic polycarbonate resin (page 1, paragraphs 2 and 3). These beneficial effects are abundantly illustrated by the experimental and comparative data in Tables I to VI of that citation. As a result of these improved properties, especially the higher notched impact strength and the reduced melt viscosity, the polycarbonate compositions may suitably be used to form moulded articles requiring both high tensile properties and chemical resistance.

In spite of these advantageous properties it is specified in the application in suit (page 2, lines 38 to 44) that the ternary compositions claimed therein exhibit a still better combination of flow properties and impact strength at room temperature as well as at low temperatures; further, it is said that they show a greater consistency, i.e. there is less deviation in the properties when the same formulation is used, and that there is a better control of the morphology of the mixture. These assertions, although not supported by specific comparative data, have not been questioned by the Examining Division; nor has the Board any particular reason for doing so.

A comparison with the properties aimed at in the application in suit, i.e. a combination of, inter alia, high impact strength, good fuel resistance and low tendency to delamination, thus shows that the polycarbonate compositions according to document (1) are inferior in terms of impact strength, tendency to delamination, consistency of properties and control of the morphology of the mixture. By contrast, in the absence of any comparative statement, no relative conclusion can be drawn about the chemical resistance; likewise, although at higher levels of block copolymer additive these prior art polycarbonate compositions exhibit good flame retardance properties, as evident from oxygen index and UL-94 ratings

(page 14, Table I, Examples 1 and 6; page 20, Table V, Examples 1 and 14), that feature cannot be taken into account for the definition of the technical problem, since no reference is made to such properties in the application in suit. On the basis of all these facts, if document (1) were considered to be the closest state of the art, the problem underlying the application in suit would have to be seen in the improvement of the four above-mentioned properties.

2.2 Document (2) relates to ternary polycarbonate compositions which exhibit a better impact strength at low temperature, a better resistance to organic solvents and less delamination than the polymer mixtures considered hitherto in the art (page 1, lines 9 to 15). These ternary compositions comprise (a) 86 to 99% by weight of an aromatic polycarbonate resin, (b) 0.5 to 4% by weight of at least one partially hydrogenated block copolymer consisting of at least two terminal polymer block A of a monoalkenyl-arylene compound and at least one intermediate polymer block B of a conjugated diene monomer, and (c) 0.5 to 10% by weight of at least one graft copolymer having an elastomeric core built up for more than 50% by weight from a polymerized diene, optionally a second phase built up from a polymerized vinyl monomer grafted on the core, and having an enveloping phase built up from the polymerized product of at least one (meth)acrylic type monomer and grafted on the core and on the second phase optionally present (Claim 1). Component (c) corresponds thus to the graft copolymer with core-shell structure used as second component in the compositions claimed in the application in suit, while component (b) is basically different from the block copolymer in the latter.

From the comparative data of Table A, page 10, it appears that only the composition comprising both the block

copolymer (b) and the graft copolymer (c) (Examples V and VI) exhibit increased resistance to organic solvents coupled with better impact strength at low temperatures. In view of the figures obtained when no polymer additive, (Reference Example I), when only the graft copolymer (Example II), or when only the block copolymer (Examples III and IV) is incorporated into the polycarbonate resin, the above improvement can only be attributed to a marked synergistic effect. Further, as noted above, it is indicated in general terms that such ternary compositions have a lower tendency to delamination than the polymer mixtures considered hitherto.

In spite of this promising teaching the experimental and comparative data in the application in suit demonstrate that the ternary polycarbonate compositions according to the application in suit are still significantly better in terms of impact strength and melt viscosity, while remaining of the same order as far as chemical resistance is concerned.

It follows that, if document (2) is chosen as starting point, the problem underlying the application in suit could be seen in the improvement of the first two above-mentioned properties without impairing the chemical resistance.

2.3 From the mere definition of the said two alternative technical problems, it clearly appears that the improvement aimed at involves a more substantial change in properties in the case of the compositions according to document (1) than in the case of the compositions according to document (2). This should be the main criterion to consider in the case of a composition, not the number of steps necessary to reach the claimed subject-matter (cf. point 6 of the reasons for the

decision), which are the features of the solution. It follows that document (2) must be regarded as the closest state of the art with regard to which the problem underlying the application in suit has to be assessed and the issue of inventive step decided.

3. The technical problem defined in point 2.2 above is to be solved according to the application in suit by substituting a block copolymer of polycarbonate and polysiloxane for the partially hydrogenated block copolymer (b) according to document (2).

In view of the comparative data reported in the application in suit which show (i) higher notch impact values according to Charpy at -30°C, (ii) lower melt viscosity values at 300°C at two different shearing rates, and (iii) comparable impact strength according to the "Falling Dart" and elongation at fracture, both determined at -20°C after dipping at room temperature in "fuel C" for 30 seconds, the Board is satisfied that the above-defined technical problem is effectively solved.

4. From the analysis of documents (1) and (2) above, it is evident that neither of them could provide relevant information concerning impact strength and tendency to delamination, since the compositions described in both citations suffer from the same shortcomings regarding these two properties. It follows that the skilled man had no incentive to combine the teaching of document (1) with that of document (2) in order to improve these particular properties. For this reason alone, the solution claimed in the application in suit cannot be obvious.

A further point in favour of the inventiveness of the claimed subject-matter is that this solution involves foregoing the synergistic effect resulting from the

combination of block copolymer (b) and graft copolymer (c) according to document (2); in the Board's view, such a step is not obvious either.

5. From the reasons given in points 4, first paragraph and 5 of the decision under appeal, it appears that the Examining Division could have regarded the Appellant's argument concerning the closeness of document (2) as convincing and the solution claimed in the application in suit as non-obvious, and envisaged the grant of a patent. If that was the case, the Board cannot see why, in spite of that conclusion, the negative approach, i.e. the non-inventiveness of the claimed subject-matter when starting from the teaching of document (1), should have had to prevail, resulting in the rejection of the application.

6. However, even if one wanted to adopt the line followed by the Examining Division and regarded document (1) as the closest state of the art, the skilled man would have had no incentive to incorporate into the polycarbonate composition both the block copolymer according to document (1) and the graft copolymer (c) according to document (2), since, as noted above in point 2.2, the properties conferred by the latter polymer in combination with another block copolymer are known to leave to be desired in terms of impact strength and thixotropicity in spite of a pronounced synergistic effect. In other words, the skilled man had no particular reason to expect higher impact strength from the combination of graft copolymer (c) with one block copolymer than from the combination of the same graft copolymer with another block copolymer.

In the Board's judgment it follows from such an approach as well that the solution claimed in the application in suit cannot be regarded as obvious and, therefore, involves an inventive step.

7. Claim 1 being allowable, the same applies to dependent Claims 2 and 3, which represent preferred embodiments of the subject-matter of Claim 1 and whose inventiveness is supported by that of the main claim.

8. The main request being allowable, it is not necessary to consider the auxiliary request.

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 grant a patent on the basis of the documents as originally filed.

The Registrar: The Chairman:

E. Görgmaier Fl. Antony