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Aktenzeichen / Case Number / N° du recours : T 424/86 - 3.3.1

Anmeldenummer / Filing No / N° de la demande : 81 107 547.2

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Bezeichnung der Erfindung: Improved process for preparing polyarylates,  
Title of invention: polymers obtained by this process and blends of  
Titre de l'invention : these polymers with thermoplastic polymers

Klassifikation / Classification / Classement : C08G 63/18

### ENTSCHEIDUNG / DECISION

vom / of / du 11 August 1988

Anmelder / Applicant / Demandeur : AMOCO CORPORATION

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 54(2) EPC

Schlagwort / Keyword / Mot clé : "Novelty (denied) - disclosure of whole prior  
art document, as opposed to only its Examples,  
must be considered"

Leitsatz / Headnote / Sommaire

Europäisches  
Patentamt

Beschwerdekammern

European Patent  
Office

Boards of Appeal

Office européen  
des brevets

Chambres de recours



Case Number : T 424/86 - 3.3.1

**D E C I S I O N**  
of the Technical Board of Appeal  
of 11 August 1988

**Appellant :** AMOCO CORPORATION  
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**Decision under appeal :** Decision of Examining Division 012  
of the European Patent Office of  
25 February 1986, posted 23 June 1986  
refusing European patent application  
No. 81 107 547.2 pursuant to Article  
97(1) EPC

**Composition of the Board :**

**Chairman :** K. Jahn  
**Members :** F. Antony  
G.D. Paterson

## Summary of Facts and Submissions

- I. European patent application No. 81 107 547.2 filed on 22 September 1981, claiming USA priority of 23 September 1980 and published on 31 March 1982 under publication number 48493 was refused by a decision of the Examining Division 12 of 25 February 1986, posted 23 June 1986. The decision was based on thirteen claims, of which the only independent one, Claim 1, read as follows:

"A process for preparing a polyarylate having a reduced viscosity of from about 0.5 to greater than 1.0 dl/g which comprises the following steps:

- (a) reacting an acid anhydride derived from an acid containing from 2 to 8 carbon atoms with at least one dihydric phenol to form the corresponding diester;
- (b) removing residual acid anhydrides after formation of the diester; and
- (c) reacting said diester with at least one aromatic dicarboxylic acid at a temperature sufficient to form the polyarylate,

characterized in that the residual acid anhydride is removed from the dihydric phenol diester, so that its concentration is less than about 1500 parts per million."

- II. The reason for the refusal was that the subject-matter of Claim 1 was considered not novel over

(1) EP-A-832

in view of essentially the following considerations:

This document related to the same process for preparing polyarylates, where a dihydric phenol is converted to its diester which is then reacted with an aromatic dicarboxylic acid; after the formation of the diester and prior to its reaction with the aromatic acid, the diester is purified to eliminate the undesirable side products, for example by vacuum distillation. Since it was stated in (1) that the only impurity whose presence is acceptable in trace amounts was the dimer of resorcinol, it was concluded that this prior art process must automatically lead to a remaining anhydride concentration of less than 1500 ppm, i.e. the characterising feature of the process as claimed.

The fact that, according to Example 1 of (1), anhydride is again added as a water scavenger during the condensation step of the process, while no such addition is mentioned in the application-in-suit, was not a distinguishing feature because it was not reflected by the claims. Even if it was so reflected, the claimed subject-matter would still lack in inventive step, in the absence of a technical effect made credible by a fair comparison.

III. On 25 August 1986, the predecessors-in-title to the present Appellants filed a Notice of Appeal against the above decision, paying the prescribed fee. The Grounds of Appeal were submitted on 3 November 1986, together with an amended set of thirteen claims, differing from the one on which the refusal was based, mainly by addition to Claim 1 of the "negative feature" that no acid anhydride must be added to be present during polyarylate formation.

After further amendments in the course of the appeal proceedings Claim 1 now reads as follows:

"A process for preparing a polyarylate having a reduced viscosity of from about 0.5 to greater than 1.0 dl/g which comprises reacting an acid anhydride derived from an acid containing from 2 to 8 carbon atoms with at least one dihydric phenol to form the corresponding diester; removing residual acid anhydride after formation of the diester; and reacting said diester with at least one aromatic dicarboxylic acid at a temperature sufficient to form the polyarylate, characterized in that the residual acid anhydride is removed down to a level of less than 1500 parts per million available during polyarylate formation."

- IV. The Appellants argued, in written submissions and during oral proceedings on 11 August 1988, that the subject-matter of new Claim 1 was both novel and inventive, for the following reasons:

While the "purification" according to (1), particularly Example 6 on page 20, would undeniably lead to removal of, inter alia, most of the excess acetic anhydride mentioned, there was no evidence that it was removed to a level of less than 1500 ppm; even if so, Example 1 (and by way of reference all other Examples) expressly taught addition of fresh anhydride before the polyarylate formation step, and this proved that the authors of (1) were unaware that substantial absence of anhydride during polyarylate formation was crucial to obtaining a product with a high degree of melt stability. The claimed process was therefore novel.

It was also inventive because the experimental data supplied on 28 July 1988 and those submitted during oral proceedings proved that an unexpected improvement in the melt stability of the resulting products was achieved when the process of (1) was modified in that, after

"purification" down to a very low level of acetic anhydride, no such anhydride was added so as to be available during polyarylate formation.

V. The Appellants requested that the decision under appeal be set aside and a patent be granted on the basis of Claim 1 as quoted in section III hereinabove, Claims 2 to 13 as submitted on 3 November 1986, and the description filed on 28 July 1988.

VI. At the end of oral proceedings the Chairman announced the Board's decision to dismiss the appeal.

#### Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 64 EPC; it is, therefore, admissible.
2. There is no formal objection to the present documents under Article 123(2) EPC. In view of the decision which follows, further discussion on this point is unnecessary.
3. The objection to Example 2 under Article 84 EPC on page 3, first paragraph, of the decision under appeal, is in the Board's view not justified. Clearly, removal of anhydride such that it is not available during polyarylate formation encompasses removal by both, physical or chemical means, and the latter are exemplified by Example 2; there is thus no contradiction to the claims. The presence of Example 2 is therefore allowable.
4. The central issue of the case is the question of novelty of Claim 1 over (1).

4.1. Undoubtedly Claim 1 differs from the combined disclosure of Examples 1 and 6 of (1) - such combination for novelty purposes being permissible in view of the reference to Example 1 in the last paragraph of Example 6 (see also Claims 1 and 9) - and in fact from the whole of the Examples of (1), considering the references in each of them to Example 1, in that these Examples all teach addition of acetic anhydride (primarily as a water scavenger) prior to the polyarylate formation step. Supposing, to the Appellants' benefit, that more than 1500 ppm thereof were still present during polyarylate formation, Claim 1 would appear to be novel over the Examples of (1).

4.2. However, according to the established jurisprudence of the Boards of Appeal the disclosure of a document must not be construed on the basis of only the Examples thereof; rather, the entire document must be taken into consideration. In the present case, there is a clear teaching in (1) that "the undesirable side products must ... be removed ... prior to commencing the synthesis of a ... polyester", i.e. prior to polyarylate formation (page 13, lines 16 to 19; emphasis added). During the pre-polymer formation and particularly during the melt polymerization step, "the only impurity whose presence is acceptable in trace amounts ... is the dimerization product of resorcinol" (page 14, lines 19 to 23). In the Board's view, these statements disclose that there should be a substantial absence of anhydride during polyarylate formation. Furthermore, neither from the claims, nor from the general part of the description of (1) can the Board derive the slightest indication that use of a water scavenger is an obligatory feature of the process of (1). Working either with or without such a scavenger, i.e. either with or without addition of anhydride prior to

polyarylate formation, is therefore equally part of the disclosure of (1).

4.3. A different interpretation of (1) could be appropriate if it should turn out that it was evident for the man of the art, on the basis of his common general knowledge, that a water scavenger must be used in a polycondensation reaction of the type concerned. However, the Appellants did not argue to that effect, and the Board has no reason to assume this to be the case.

4.3.1. In contrast to polycondensation of a dicarboxylic acid with a dihydroxy compound (e.g. a dihydric phenol) in its free form, its condensation with a diacylated dihydroxy compound ("acetate process") does not give rise to formation as a necessary by-product of water, which could be removed, for instance, by means of a water scavenger; rather, acetic acid is formed as a by-product, for the removal of which acetic anhydride is of no use. The only plausible explanation of which the Board is aware for the use of a water scavenger in Example 1 of (1) is the employment of a sodium acetate trihydrate catalyst, the crystal water of which might have to be removed; if so, the water scavenger could obviously be dispensed with if a water-free catalyst was employed. In no case does it appear evident to the Board that a water scavenger is necessary if the skilled person follows the general teaching of (1), which is not limited to the use both of a catalyst which contains crystal water and of a water scavenger.

4.3.2. This conclusion is further supported by the fact that the other document introduced into the examination proceedings,

(2) FR-A-1 443 401,



to the extent it applies the "acetate process" (Examples 1 to 3 on page 5), does not employ a water scavenger either.

- 4.3.3. During the oral proceedings, the Appellants have put forward the further argument that the very fact that a water scavenger is not mentioned in the claims or the general description of (1), but is mentioned in the best mode of carrying out the invention, was a strong indication that such a scavenger is obligatory. The logic of this argument is not fully understood by the Board, but in any case it is not in accordance with the proper interpretation of the disclosure of document (1) as discussed in 4.2 above.
- 4.3.4. In summary, there is no evidence whatsoever before the Board on the basis of which it could accept that addition of a water scavenger prior to polyarylate formation was an essential feature of (1), such as to impart novelty to a process omitting such a feature.
- 4.4. Essentially the same considerations apply with regard to the second indication of purpose in Example 1 of (1) for the addition of acetic anhydride, viz. "acetylating agent for any unreacted or partially acetylated resorcinol" (page 16, lines 17 to 18).
- 4.5. In any event, even when there is an addition of anhydride prior to polyarylate formation as described in Example 1 of (1), this would still not necessarily mean that any substantial amount thereof was present during polyarylate formation. According to Example 1 a small amount (1 ml) of acetic anhydride is fed into the cold reaction mixture, whereupon the mixture is brought to a temperature of 240°C over one half-hour, at which

temperature the first stage of polyarylate formation, i.e. formation of a pre-polymer will occur (see part (a) of Claim 1). The boiling point of acetic anhydride at atmospheric pressure being 136°C, substantially all of that small amount of acetic anhydride must have distilled away before this temperature, and all the more so before the final reaction temperature of 280°C is reached, i.e. extremely small amounts, if anything, would be present "during polyarylate formation".

4.6. The Board cannot accept the Appellants' argument that there was no evidence that the "purification" of Example 6 of (1) would remove the acetic anhydride down to a level of less than 1500 ppm. Analysing Example 6, after the esterification reaction taking place at 100°C (page 20, lines 6 to 8), the temperature is first raised to 130°C to distill off acetic acid (lines 8 to 9) and finally to 140°C - still at atmospheric pressure - "to distill off the excess acetic anhydride" having a boiling point of 136°C (lines 10 to 11). Thereafter, when by far most of the acetic anhydride will have gone, vacuum distillation at about 10 Torr follows for "purification" purposes. At this point, together with whatever other impurities are removed, all but minute amounts of acetic anhydride must disappear. This is best proven by the Appellants own experimental data submitted during oral proceedings when, following exactly Examples 6 and 1 of (1), but omitting addition of 1 ml of acetic anhydride, they determine a residual acetic anhydride content of only 452 ppm (page 2 of Experimental Data, last but two paragraphs).

4.7. Example 6 of (1) leading to resorcinol diacetate containing less than 1500 ppm acetic anhydride, which resorcinol diacetate may then be subjected to polyarylate formation along the general lines of Example 1 of (1),

but not necessarily adding acetic anhydride, the availability of less than 1500 ppm acetic anhydride during such polyarylate formation can no longer be considered novel.

5. For the above reasons, having regard to Article 54 EPC Claim 1 is not patentable, nor are Claims 2 to 13, which are dependent upon the former and thus must fall with it, if only because any given request can only be allowed or refused as a whole. In the absence of novelty, there is no necessity for the existence of an inventive step to be investigated.
  
6. There has been no auxiliary request. The Board has, however, of its own motion, considered whether some patentable subject-matter might have remained if the patent had been restricted to essentially the process of Example 2, i.e. to removal of acetic anhydride by chemical means.
  - 6.1. Clearly such a restricted claim would have been novel because in document (1) acetic anhydride is removed by vacuum distillation along with other impurities, but there is no disclosure of specific chemical means to remove precisely acetic anhydride.
  
  - 6.2. In the Board's view, however, a so restricted claim would not have involved an inventive step. Claim 9 - the broadest claim of (1), including the diacetylation step preceding polyarylate formation - refers broadly to "purifying the resulting ... diacetate" to achieve at least 99.5% purity. Furthermore, the description (page 14, lines 10 to 13) speaks of purification "such as" (i.e. not limited to) by vacuum distillation or recrystallization. Removal of undesirable impurities by chemical means is even foreshadowed by page 16, lines 17

to 18, mentioning elimination of any unreacted or partially acetylated resorcinol by addition of acetic anhydride prior to initiation of polyarylate conversion. This is in direct analogy to the elimination, according to Example 2 in the application-in-suit, of excess anhydride by addition of bisphenol-A prior to commencing polycondensation. Thus in the Board's judgement, the use of a chemical purification would have been suggested to a skilled reader of (1).

6.3. There was furthermore, no other possible feature limitation which, in the Board's judgement, would have provided patentable subject-matter in the claims.

**Order**

**For these reasons it is decided that:**

**The appeal is dismissed.**

**The Registrar:**



**The Chairman:**

