

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen
(D) [] No distribution

D E C I S I O N
of 19 December 2003

Case Number: T 0246/00 - 3.3.1

Application Number: 96306990.1

Publication Number: 0765852

IPC: C07C 37/20

Language of the proceedings: EN

Title of invention:

Method for making tris (hydroxyphenyl) compounds using ion exchange resins

Applicant:

GENERAL ELECTRIC COMPANY

Opponent:

-

Headword:

Tris (hydroxyphenyl) compounds/GENERAL ELECTRIC

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Novelty (yes)"

"Inventive step (yes) -non obvious solution"

Decisions cited:

-

Catchword:

-



Case Number: T 0246/00 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 19 December 2003

Appellant:

GENERAL ELECTRIC COMPANY
1 River Road
Schenectady
NY 12345 (US)

Representative:

Szary, Anne Catherine, Dr.
London Patent Operation
General Electric International, Inc.
15 John Adam Street
London WC2N 6LU (GB)

Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 5 October 1999
refusing European application No. 96306990.1
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: P. F. Ranguis
J. P. B. Seitz

Summary of Facts and Submissions

I. The present appeal lies from the Examining's decision to refuse the European patent application No. 96 306 990.1 (Publication No. 0 765 852) pursuant to Article 97(1) EPC on the ground that the then pending request did not involve an inventive step pursuant to Article 56 EPC.

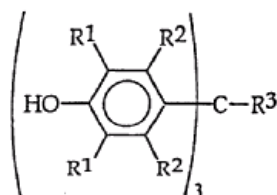
II. The Examining Division held that the subject-matter of Claim 1 was to be regarded as a selection within the teaching of document

(1) EP-A- 0 314 007.

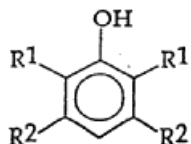
Since the Applicant had provided no information to support the allegation of the non-obviousness of such a selection, the claimed subject-matter lacked inventive step.

III. As a follow-up to a communication of the Board, the Appellant filed with a letter received on 13 June 2003 as main request, an amended Claim 1 with Claims 2 to 6 filed with the statement of grounds of appeal. Independent Claim 1 (the sole independent claim) read as follows:

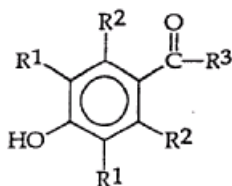
"1. A method of making a tris(4-hydroxyphenyl) compound of the formula:



which comprises heating a mixture comprising a phenol species of the formula:



and a hydroxyphenyl ketone material of the formula:



wherein each R¹ and R² is independently hydrogen, halogen, primary or secondary lower alkyl having from 1 to 7 carbon atoms, phenyl, or alkyl substituted phenyl and R³ is a primary or secondary lower alkyl having from 1 to 7 carbon atoms, phenyl, or alkyl substituted phenyl in the presence of an ion exchange catalyst and at least one mercaptan, wherein water of reaction is removed from the reaction mixture during the reaction by sparging the reaction with a dry inert gas, azeotropic removal of the water with an inert solvent or mixture of solvents capable of forming an azeotrope with water or using a molecular sieve."

Dependent Claims 2 to 6 corresponded to Claims 2 to 6 of the request filed with the statement of grounds of appeal now abandoned.

IV. As a follow-up to another communication of the Board, the Appellant filed with letter received on 4 November 2003 three auxiliary requests.

V. The Appellant pointed out that document (1) related to the preparation of bis(hydroxyphenyl) and not tris(hydroxyphenyl) compounds. The definition of the diaryl ketone at page 3, lines 26 to 36 of document (1) did not include hydroxy substituted compounds. The removal of water according to the claimed invention resulted in a significant improvement in the percentage yield of tris(hydroxyphenyl) compounds involving ion exchange resins as shown by the example 3 versus comparative examples 2 to 4. This result was unexpected in view of the preparation of the corresponding bisphenols disclosed by document (1) where there was no advantage in removing water of the reaction.

VI. The Appellant requested that the decision under appeal be set aside and a patent be granted either on the basis of the main request submitted with a letter received on 13 June 2003 or on the basis of one of the three auxiliary requests all submitted with a letter received on 4 November 2003.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Article 123(2) EPC - Amendments*

2.1 The subject-matter of Claim 1 derives from the original Claim 1 as filed in combination with the features disclosed in the application as filed on page 3, lines 1 to 3, page 8, lines 3 to 10 and page 9, lines 1

to 2. Claim 2 derives from Claim 3 as originally filed.
Claim 3 derives from Claim 4 as originally filed.
Claim 4 derives from Claim 7 as originally filed.
Claim 5 derives from Claim 8 as originally filed.
Claim 6 derives from Claim 9 as originally filed.

2.2 There is thus no objection under Article 123(2) EPC.

3. *Article 54 - Novelty*

3.1 Document (4) WO-A-96/06819, prior art under Article 54(3)(4) EPC, discloses the reaction of phenol with 4-hydroxyacetophenone to prepare 1,1,1-tris-(4-hydroxyphenyl) ethane (cf. Claim 9), in the presence of an insoluble mercaptosulfonic acid compound (cf. in particular, page 6, lines 4 to 8). However, it does not emerge unambiguously from the description that, in such reaction, water of reaction is removed from the reaction mixture during the reaction (cf. page 45, lines 15 to 24). The claimed subject-matter is, therefore, novel in view of document (4).

3.2 Document (1) does not anticipate the claimed subject-matter, either. Since this was never contested by the Examining Division, there is no need to give detailed reasons for this finding.

4. *Article 56 EPC - Inventive step*

4.1 The claimed invention as reflected by Claim 1 of the present request relates to a method for preparing a tris(4-hydroxyphenyl) compound involving the condensation of a phenol species with a hydroxyphenyl ketone (cf. point III above).

- 4.2 In accordance with the "problem-solution approach" to the assessment of inventive step, it is necessary to establish the closest state of the art to determine in the light thereof the technical problem which the invention is intended to address and solve. The "closest prior art" is normally a prior art document disclosing subject-matter aiming at the same objective as the claimed invention and having the most relevant technical features in common. In particular, where a claimed invention relates to a process for manufacturing known products as is the case here, then the closest state of the art is confined to documents describing those compounds and their manufacture (cf. Case Law of the Boards of Appeal of the European Patent Office, 4th edition 2001, I.D.3.6).
- 4.3 Document (1) relates to a method for making an aromatic bisphenol compound by reacting a phenol with an aromatic ketone (cf. page 2, lines 2 to 3; page 3, lines 3 to 5 and lines 19 to 20). It was found that diarylketone in the presence of strongly acidic cation exchangers as condensation catalysts will condense with phenols to form aromatic bisphenols compounds (cf. page 3, lines 6 to 8). Preferred diaryl ketones are compounds of the general formula: $R^1-(-C=O)_a-R^2$ wherein R^1 and R^2 alike or different may be aromatic groups and, in particular, phenyl and C_1-C_4 alkyl substituted phenyl (cf. page 3, lines 27 to 34).
- 4.4 The Examining Division held that the disclosure of that document encompassed the use of all aromatic ketones, including ketones defined in Claim 1 of the present

request, for the preparation of any bisphenol compounds.

4.5 However, in the Board's judgment, to give the term "aromatic ketones" such a broad meaning amounts to ignoring the material teaching of the disclosure. Indeed, as set out above (cf. point 4.3), document (1) relates to the preparation of aromatic bisphenols and not trisphenols. That implies that the term "aromatic ketones" cannot be extended in the present case to encompass hydroxyl aromatic ketones without unduly extending the teaching of document (1). In other words, document (1) does not relate to a process for preparing trisphenols and, therefore, does not aim at the same objective as the claimed invention. This document does not represent the closest state of the art.

4.6 Document US-A-3 579 542 (2) was cited in the search report of the European patent application and was discussed in the description (cf. page 1, lines 6 to 12). It discloses the condensation of phenol and 4-hydroxyacetophenone into 1,1,1-tris(4'-hydroxyphenyl)ethane (THPE) using mineral acids as catalysts. This document aims at the same objective as the claimed invention.

4.7 Document US-A-4 992 598 (3) was discussed in the description of the European application as filed (cf. page 1, lines 6 to 12). It discloses the condensation of phenol and 4-hydroxyacetophenone into 1,1,1-tris(4'-hydroxyphenyl)ethane (THPE) using hydrochloric acid and beta-mercaptopropionic acid as preferred co-catalyst. This document aims at the same objective as the claimed invention and has more relevant technical features in common with the claimed invention than document (2) due

to the presence of a mercaptan. This document represents, therefore, the closest state of the art.

- 4.8 In the next step, the technical problem which the invention addresses in the light of the closest state of the art is to be determined.

According to the European application, the processes involving mineral acids, *inter alia* document (3), require extended reaction times and lead to substantial amounts of various side products and relatively low yields of THPE (cf. page 1, lines 6 to 12).

In agreement with the Appellant, the Board finds that only examples No. 3 and 7 illustrate the claimed invention, all other examples being comparative. The conditions of reaction of example No. 7 are the same as those of example No. 3, the sole differences being the nature of the solvent of precipitation. However, the feature related to the precipitation is not part of Claim 1 but of dependent Claim 6. The question is, therefore, whether or not the results displayed in example No. 3 reveal an improved effect in view of the closest state of the art.

The process according to example No. 3 yields 48% of THPE (cf. Table III) after eight hours. In the same conditions, but in presence of HCl, the process according to comparative example No. 1 yields 33% of THPE (cf. Table I). However, comparative example No. 5, carried out in the same conditions as comparative example No. 1, yields after six hours 52% THPE. Therefore, the Board cannot acknowledge any improvement of the claimed invention in view of the closest state

of the art.

The problem to be solved can only be seen in the provision of a further process for preparing tris(hydroxyphenyl) compounds. This technical problem is credibly solved over the whole claimed area.

- 4.9 It remains to be decided whether or not the claimed solution as set out in Claim 1 is obvious in view of the cited prior art.
- 4.9.1 The relevant question is whether the person skilled in the art guided by the technical problem to be solved would have been led to replace, in the preparation of tris(hydroxyphenyl) compounds, the catalytic conditions disclosed in document (3), i.e. HCl and beta-mercaptopropionic acid, by the use of an ion exchange catalyst and at least one mercaptan, while removing the water in the conditions defined in Claim 1 (cf. point III above).
- 4.9.2 Looking for an alternative process, the skilled person would have turned his attention to documents aiming at the same objective as the claimed process. He would have noted that document (2) taught a similar process as document (3) also involving the use of HCl as catalyst. Starting from document (3), document (2) gives no hint in the direction of the claimed process.
- 4.9.3 The critical issue is to actually assess whether the skilled person would have considered the teaching of documents related to the preparation of aromatic bisphenols such as document (1) (cf. point 4.5 above), whereas the technical problem as defined above concerns

the provision of a further process for preparing tris(hydroxyphenyl) compounds. To avoid any *ex post facto* approach it is, therefore, necessary to examine whether the prior art as a whole provides information directing the person skilled to such a connection between the preparation of aromatic bisphenols and tris(hydroxyphenyl) compounds.

4.9.4 From the prior art before the Board, it turns out that document (3) is strictly restricted to the preparation of 1,1,1-tris(4'-hydroxyphenyl)ethane, i.e. a specific tris(hydroxyphenyl) compound. Document (2) is also restricted to the preparation of 1,1,1-tris(4'-hydroxyphenyl)ethane. There is no incentive in those documents directing the person skilled in the art to look for a solution to the technical problem in the methods of preparation of aromatic bisphenols such as disclosed in document (1). In the absence of any documents teaching that it is possible to transfer the teaching of documents related to the domain of processes of preparation aromatic bisphenols to the domain of processes of preparation of tris(hydroxyphenyl) compounds, it is to be concluded that document (1) would not have been considered by the skilled person in order to solve the above technical problem. It may be true that with hindsight the comparison of the claimed invention with the teaching of document (1) reveals that both domain are close to each other, however, such a finding does not emerge from the prior art which discloses no information in that respect.

4.9.5 Since starting from document (3) and in the light of the other documents cited, the person skilled in the

art would not have been directed in an obvious manner to the claimed solution in order to solve the technical problem defined above (cf. point 4.8 above), the subject-matter of Claim 1 meets the inventive step requirement. The same applies to dependent Claims 2 to 6 which represent particular embodiments of the subject-matter of Claim 1.

5. It follows from the above that the first, second and third auxiliary requests need not be examined.
6. Remittal to the first instance - Article 111(1) EPC

Although the Board has come to the conclusion that the main request was to be allowed, it was noted that the description has still to be put into conformity with the claims of the present main request. Therefore, having regard to the fact that the function of the Boards of Appeal is primarily to give a judicial decision upon the correctness of the earlier decision taken by the first instance, the Board exercises its discretion under Article 111(1) EPC to remit the case to the first instance in order for the description to be adapted to the allowable claimed subject-matter according to the main 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 set of six claims filed as main request with the letter received on 13 June 2003 provided that the description be adapted thereto.

The Registrar:

The Chairman:

N. Maslin

A. Nuss