

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 11 May 1994

Case Number: T 1000/92 - 3.3.1

Application Number: 89201241.0

Publication Number: 0342758

IPC: C07C 39/16

Language of the proceedings: EN

Title of invention:
Preparation of bisphenols

Applicant/Patentee:
Shell Internationale Research Maatschappij B.V.

Opponent:
-

Headword:
Bisphenols/SHELL

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (yes) - need for realistic approach - due regard to evidence"

Decisions cited:
T 0495/91, T 0246/91, T 0334/92

Headnote/Catchword:



Case Number: T 1000/92 - 3.3.1

DECISION
of the Technical Board of Appeal 3.3.1
of 11 May 1994

Appellant: Shell Internationale Research Maatschappij B.V.
Carel van Bylandtlaan 30
NL-2596 HR Den Haag

Representative:

Decision under appeal: Decision of the Examining Division of the
European Patent Office dated 3 August 1992
refusing European patent application
No. 89 201 241.0 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. Jahn
Members: J.M. Jonk
J.-C. Saisset

Summary of Facts and Submissions

I. European patent application No. 89 201 241.0, filed on 16 May 1989 (publication No. 0 342 758), was refused by a decision of the Examining Division dated 3 August 1992. The decision was based on Claims 1 to 8 as originally filed, the only independent Claim 1 (wrongly quoted under I, point 5, of the decision) reading as follows:

"A process for the preparation of bisphenols which comprises reacting a phenol with a ketone in the presence of a cation exchange resin catalyst and a mercaptan co-catalyst in a reactor or a series of reactors wherein all of the phenol and a portion of the mercaptan is injected into the beginning of the reactor or the first reactor and the remaining mercaptan is injected along the reactor length or in the subsequent reactors."

II. The ground for the refusal was that the subject-matter of Claim 1 lacked inventive step in the light of documents

- (1) GB-A-785 079 and
- (2) DE-A-1 618 016, which corresponds to GB-A-1 185 102.

The Examining Division considered that the closest state of the art with respect to the process of Claim 1 was document (1) disclosing the preparation of bisphenols in the presence of a mineral acid catalyst and a mercaptan co-catalyst and that the technical problem to be solved was the provision of a process for the preparation of bisphenols which contained less by-products. It was held by the Examining Division that solving this problem by using an acid ion exchange resin instead of a mineral

acid was obvious to the skilled person in the light of the disclosure of document (2), particularly the indication therein that the use of ion exchange resins comprising sulphonic acid groups instead of mineral acids as catalysts provided bisphenols substantially free of undesirable by-products.

III. An appeal was lodged against this decision on 30 September 1992, and the appeal fee was paid on the same date.

A Statement of Grounds of Appeal was submitted on 28 October 1992.

IV. During oral proceedings held on 11 May 1994 the Appellant filed new Claims 1 to 7. Claim 1 of this set of claims differed from that as originally filed in that the terms "a cation exchange resin catalyst" were replaced by "an acid cation exchange resin catalyst".

The Appellant argued that the closest state of the art was Document (2) instead of document (1), because document (2) not only represented more recent prior art than document (1) but also concerned a process for the preparation of bisphenols using the same catalyst system as claimed in the present patent application, namely, a system containing an acid ion-exchange resin and a mercaptan. Regarding this closest state of the art, the problem underlying the present patent application - as stated therein - was how to reduce the forming of cyclic dimers as by-products which, in particular, would result from the use of the acid ion-exchange resin. Moreover, he contended that the solution of this problem by a staged addition of the mercaptan co-catalyst to the reaction mixture would not have been obvious to the skilled person in the light of the disclosure of document (1), because this document concerned a

different problem, namely, how to avoid unspecified by-products, and also disclosed a different solution to that problem, namely, a staged addition of the ketone reagent and the use of low reaction temperatures.

- V. The Appellant requested that the impugned decision be set aside, and a patent be granted on the basis of the Claims 1 to 7 filed during oral proceedings.
- VI. At the conclusion of the oral proceedings, the Board's decision to allow this request was announced.

Reasons for the Decision

- 1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
- 2. The subject-matter of present Claim 1 is based on Claims 1 and 4 of the patent application as filed.

Present Claims 2 to 7 are identical with the respective Claims 2, 3 and 5 to 8 of the originally filed patent application.

Thus, all claims of the new set of claims comply with the requirement of Article 123(2) EPC.

- 3. After examination of the cited prior art, the Board has reached the conclusion that the subject-matter as defined in all claims is novel. Since this issue was not in dispute, it is not necessary to give reasons for this finding.
- 4. The remaining issue to be dealt with is whether the subject-matter of Claim 1 involves an inventive step.

- 4.1 The present patent application relates to a process for the preparation of bisphenols by reacting a phenol with a ketone in the presence of an acid cation exchange resin catalyst and a mercaptan co-catalyst (cf. Claim 1 and page 2, lines 17 to 21, of the application as published). Such a process was known from document (2), i.e. GB-A-1 185 102, which the Appellant used as a starting point for defining the technical problem underlying the present patent application, namely, the provision of a process for the preparation of bisphenols in which the formation of undesired cyclic dimers, in particular 1,3,3-trimethyl-6-hydroxy-3-(p-hydroxy)phenylindane (CDA) and 1,3,3-trimethyl-5-hydroxy-3-(p-hydroxy)phenylindane (CDB), is reduced (cf. page 2, lines 1 to 3, 11 to 16 and 22 to 28).
- 4.2 The present patent application suggests, as the solution of this problem, a process according to Claim 1, in which the essential feature is the staged addition of the mercaptan co-catalyst. It follows from the examples of the application, in particular Tables 1 and 2, that the cyclic dimer production, in particular CDA and CDB, is significantly reduced by the claimed process. The Board is satisfied that this technical problem was credibly solved.
- 4.3 In this connection it is observed by the Board that the method of identifying the objective technical problem to be solved by the claimed invention with respect to the closest state of the art normally starts from the technical problem that is indicated in the patent application in suit. Only if it turns out that an incorrect state of the art was used to define the technical problem or that the technical problem described has in fact not been solved by the claimed invention, should an inquiry be made as to which other

technical problem objectively existed (cf., for instance, the non-published decision T 495/91 of 20 July 1993, No. 4.2 of the Reasons of the Decision, and the non-published decision T 246/91 of 14 September 1993, No. 4.4 of the Reasons).

Furthermore, the Board held in the unpublished decision T 334/92 of 23 March 1994 that only such a document should be considered as closest state of the art for which a skilled person would have had good reasons to select its content as a basis for further development (see point 4.2 of the Reasons for the Decision).

In the Board's judgment, the selection of document (1) as the closest state of the art does not meet this criterion because the disadvantages of the process of document (1), which was published about 30 years before the priority date of the present application, resulting from the use of mineral acids as catalysts, such as corrosion problems and processing problems with respect to removal and recovery of mercaptan co-catalyst, unreacted phenol and unreacted carbonylic reagent from the mineral acids, were so evident and well known (cf., for instance, document (2), page 1, lines 19 to 53) that a skilled person would not have tried to improve and develop such an old process.

Moreover, the Examining Division in assessing the objective technical problem to be solved disregarded the results of comparative tests described in the examples of the present patent application with respect to the prior art of document (2) which clearly showed the reduction of cyclic dimers by the use of a staged mercaptan addition. However, in the Board's judgment, it is not permissible to ignore, for the purpose of defining the technical problem, technical evidence establishing technically useful results of the claimed

process, including the reduction of the cyclic dimers (cf. also the decision T 334/92 mentioned above, in particular, point 4.6 of the Reasons of the Decision).

Therefore, the Examining Division was wrong in deviating from the technical problem set out in the application in suit. Thus, in the Board's judgment, it has to be accepted for the purpose of evaluating the inventive step.

- 4.4 It remains to be decided whether, in view of the technical problem to be solved, the requirement of inventive step is met by the claimed process.
- 4.5 As indicated above, document (2) (GB-A-1 185 102) relates to a process for the preparation of bisphenols by reacting a phenol with a ketone in the presence of a catalyst system containing a mercaptan and a solid, insoluble ion-exchange resin having pendant sulphonic acid groups (cf. page 1, lines 11 to 18 and lines 61 to 68). It describes that by utilising such a catalyst system, the rate of reaction between the phenol and the ketone is significantly increased, higher conversions of ketone are effected, and the bisphenol produced is substantially free of undesirable by-products, such as Dianin's Compound (cf. page 1, lines 69 to 78). However, as indicated in the present patent application, it has been discovered that this process is disadvantaged by the formation of cyclic dimers, in particular CDA and CDB (cf. page 2, lines 22 to 28, and Table 2 of the application as published). Thus, document (2) being silent on this deficiency does not give any pointer to the solution of the technical problem as defined above.
- 4.6 Document (1) concerns a process for the preparation of bisphenols by the acid catalysed condensation of a phenol with a carbonylic compound, which comprises

reacting of the phenol with the carbonylic compound in a mole ratio of at least 5:1 and in a plurality of successive reaction stages maintained at temperatures between about 20°C and 110°C, the reactants introduced into the first reaction stage comprising substantially all of the phenol compound but only a part of the carbonylic compound, and the remainder of the carbonylic compound being introduced into at least one subsequent reaction stage (cf. page 1, line 81 to page 2, line 10). It discloses that the staged addition of the carbonylic compound, and consequently the high ratio of the phenol compound to the carbonylic compound in the first reaction stage of the process, permits the use of a lower temperature in the initial stage of the reaction and provides advantages with respect to the product purity (cf. page 1, lines 59 to 67, and page 2, lines 56 to 75). In addition it describes that the preferred acid catalyst is hydrogen chloride and that the reaction is preferably carried out in the presence of a mercaptan, in particular methyl mercaptan, as a reaction promoter (cf. page 3, line 71 to page 4, line 27). The methyl mercaptan may be introduced into the system as a solution in some or all of the carbonylic reactant and/or by its direct introduction into the reactant stages to which the carbonylic reactant is added (cf. page 4, lines 28 to 32).

Although, in the Board's judgment, it could be derived from the disclosure of this document that the mercaptan co-catalyst may be introduced into the reaction in a staged way, there is no indication that by doing so any advantage is achieved, let alone the product purity could be improved. In addition, this document neither discloses the use of an acid cation-exchange resin catalyst, nor the forming of the cyclic dimers CDA and CDB which - as contended by the Appellant - is associated with the use of such a catalyst.

Therefore, also document (1) does not hold out any prospect to the skilled person for the solution of the existing technical problem.

4.7 In conclusion, the Board finds that the process according to Claim 1 involves an inventive step, because it would not have been obvious to the skilled person to solve the above defined technical problem by the staged addition of the mercaptan co-catalyst.

4.8 Dependent Claims 2 to 7, which relate to the preferred embodiments of the process claimed in Claim 1, are also allowable for the reasons stated above.

Order

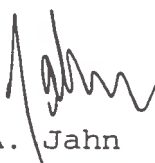
For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent with the set of Claims 1 to 7 received during oral proceedings after adaptation of the description.

The Registrar:


E. Görgmaier

The Chairman:


A. Jahn