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File Number: T 247/91 - 3.3.1

Application No.: 83 200 544.1

Publication No.: 0 092 867

Title of invention: Process for preparing cyclohexanol and cyclohexanone

Classification: C07C 49/403

**D E C I S I O N**  
**of 30 March 1993**

Proprietor of the patent: STAMICARBON B.V.

Opponent: Bayer AG, Leverkusen  
Konzernverwaltung RP Patente Konzern

Headword: Cyclohexane oxidation/STAMICARBON

**EPC** Article 54(1)(2)

Keyword: "Novelty (no) - selection from a temperature range"



**Case Number** : T 247/91 - 3.3.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.1**  
**of 30 March 1993**

**Appellant** : STAMICARBON B.V.  
(Proprietor of the patent) Mijneweg 1  
NL - 6167 AC Geleen (NL)

**Respondent** : Bayer AG, Leverkusen  
(Opponent 01) Konzernverwaltung RP  
Patente Konzern  
Bayerwerk  
W - 5090 Leverkusen (DE)

**Decision under appeal** : Decision of the Opposition Division of the European Patent Office dated 6 February 1991 revoking European patent No. 0 092 867 pursuant to Article 102(1) EPC.

**Composition of the Board** :

**Chairman** : K.J.A. Jahn  
**Members** : J.M. Jonk  
J.C. Saisset



## Summary of Facts and Submissions

- I. The grant of European patent No. 0 092 867 in respect of European patent application No. 83 200 544.1 was announced on 16 July 1986 (cf. Bulletin 86/29).
- II. Notices of opposition, in which the revocation of the patent on the grounds of lack of novelty and inventive step was requested, were filed on 5 February 1987 by Bayer AG (Opponent 1) and 14 April 1987 by BASF AG (Opponent 2). The oppositions were supported by four documents, particularly:
- (1) GB-A-1 382 849, and
  - (4) GB-A-1 586 836.
- III. By a decision dated 6 February 1991 the Opposition Division revoked the patent on the basis of the then valid claims, Claim 1 reading as follows:
- "Process for preparing cyclohexanol and cyclohexanone by oxidizing cyclohexane with a gas containing molecular oxygen to form an oxidation mixture containing cyclohexylhydroperoxide and treating the oxidation mixture with a metal salt in the presence of an aqueous solution of an alkalimetalhydroxide for the decomposition of the cyclohexylhydroperoxide, characterized in that the treatment of the oxidation mixture is effected at a temperature of 70 to 115 °C, in a countercurrent column and that the quantity of alkalimetalhydroxide employed in treating said oxidation mixture is such that the OH-concentration in the resulting aqueous phase after said decomposition is below 0.01 N."

The Opposition Division held that the subject-matter of the claims did not involve an inventive step. The process according to Claim 1 only differed from that described in document (4) in that the treatment of the oxidation mixture was carried out in a countercurrent column. However, this measure did not involve an inventive step because the use of a countercurrent column for the treatment of such oxidation mixtures was already known from document (1).

- IV. A notice of appeal was filed against this decision on 22 March 1991 and the appeal fee was paid on the same date.

A Statement of Grounds of Appeal was submitted on 31 May 1991.

This Statement was accompanied by new Claims 1 to 8. The subject-matter of Claim 1 of this set of claims differed from the Claim 1 set out above in that the preparation of the oxidation mixture was carried out in the absence of a substance promoting the decomposition of the cyclohexyl - hydroperoxide formed, and in that the treatment of the oxidation mixture was effected at a temperature of 85 to 115 °C. In addition, the previously claimed features concerning the use of a countercurrent column and the specific OH-concentration were deleted.

The Claims 2 to 8 corresponded to the Claims 2 to 8 as granted.

- V. The Appellant argued that the process as now claimed differed from that of document (1) by the selection of

a temperature range of 85 to 115 °C for the treatment of the oxidation mixture. This selection from the broader range of 80 to 170 °C disclosed in document (1) was not obvious to the skilled person because this document disclosed the use of relatively high temperatures in the examples and also indicated that, as a rule, low temperatures were associated with long residence times. In addition, according to the present process, surprisingly, higher yields per time period were obtained.

Regarding document (4), he contended that the disclosure of this document was less relevant because it related to a process for working up a reaction mixture containing cyclohexanol and cyclohexanone, and by-products such as acids and esters. Apparently, this reaction mixture contained no or virtually no cyclohexylhydroperoxide. Therefore, document (4) did not give any incentive to the skilled person how to treat a mixture containing mainly cyclohexylhydroperoxide in such a way that cyclohexanol and cyclohexanone could be obtained in higher yields, and could be used directly in the production of caprolactam.

VI. Respondent (1) declared in a letter submitted on 3 August 1991 that he did not intend to reply to the Statement of Grounds of Appeal.

VII. Respondent (2) withdrew his opposition in a letter filed on 29 January 1993.

The former Respondent (2), before withdrawing his opposition, argued that the subject-matter of present

Claim 1 was not novel in the light of the disclosure of document (4) because it described all the features of the claimed process, including the preparation of a reaction mixture containing cyclohexylhydroperoxide and its decomposition at a temperature within the range of 85 to 115 °C.

VIII. Oral proceedings, at which the Respondent was not represented, took place before the Board on 30 March 1993.

IX. At this hearing the Board discussed documents (1) and (4) with respect to the novelty of the subject matter of Claim 1.

With respect to document (1), the Appellant argued that, although this document described a temperature range of 80 to 170 °C for the treatment of the oxidation mixture neither the present range of 85 to 115 °C, nor the end values of this range were disclosed. Moreover, this range was not arbitrarily chosen because by using a decomposition temperature within this range, surprisingly, higher yields per time unit at a lower energy consumption were obtained. However, he admitted that the disclosure of document (1) did not provide any reason why the use of temperatures falling within the range as now claimed would not be suitable.

He also defended the novelty of the present process with respect to document (4).

X. The Appellant requested the decision under appeal be set aside and that the patent be maintained on the

basis of Claim 1 submitted on 31 May 1991 and the subclaims 2 to 8 as granted.

XI. At the conclusion of the oral proceedings, the Board's decision to dismiss the appeal was announced.

### **Reasons for the Decision**

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. In view of the outcome of these proceedings, the formal admissibility of the amended version of the claims need not be considered.
3. The first question to be answered is whether the present process is novel having regard to document (1).
  - 3.1 In view of the argumentation of the Appellant with respect to the novelty of the claimed subject-matter set out above, it is emphasised that, in accordance with the established jurisprudence of the Boards of Appeal, in deciding the question of novelty of an invention consideration has not only to be given to the examples but also to whether the disclosure of a prior art document as a whole is such as to make available to the skilled person as a technical teaching the subject-matter for which protection is sought (cf. T 12/81, OJ EPO 1982, 296, paragraphs 5 and 7; T 198/84, OJ EPO 1985, 209, paragraphs 4 and 7; and T 124/87, OJ EPO 1989, 491, paragraph 3.2).

3.2 Document (1) describes a process for the preparation of cyclohexanol and cyclohexanone by oxidising cyclohexane in the presence or absence of a heavy metal catalyst which decomposes hydroperoxides and treating the oxidation mixture with a heavy metal salt catalyst in the presence of an aqueous solution of an alkali metal hydroxide or carbonate in order to decompose the cyclohexylhydroperoxide formed. This treatment of the oxidation mixture is suitably carried out at a temperature of 80 to 170 °C (cf. page 1, lines 21 to 39 and lines 41 to 46, and page 2, lines 47 to 62). According to Examples 3 and 5, the oxidation of the cyclohexane is performed in the absence of a substance promoting the decomposition of the hydroperoxide and the treatment of the oxidation mixture is effected at a temperature of 135 °C. Thus, document (1) describes all the technical features of Claim 1 of the disputed patent, including the use of a temperature range for the treatment of the oxidation mixture which comprises the range as now claimed.

3.3 It is true that the Examples in document (1) do not describe the treatment of the oxidation mixture at temperatures which are within the temperature range defined in Claim 1 of the patent in suit. It is also true that, on the basis of the examples and the teaching that a lower temperature is associated with a somewhat longer residence time (cf. page 2, lines 60 to 64), a preference might be construed for the use of a temperature of about 135 °C. However, it was accepted by the Appellant that a skilled reader of document (1) had no reason to exclude the present range of 85 to 115 °C. In these circumstances the teaching of document (1) is clearly not limited to the use the exemplified

temperatures but extends to the whole described temperature range. Thus, the complete temperature range of 80 to 170 °C has been made available to the skilled person as a technical teaching.

The Appellant's submission that the temperature range had not been arbitrarily selected, but was based on the surprising effect that in the particular range a higher yield per time unit at a lower energy input is obtained, is not relevant in the present case because the sub-range selected from a larger range cannot be rendered new by virtue of a newly discovered effect, but must be new *per se* (cf. T 198/84, section 7, last paragraph).

- 3.4 Therefore, in the Board's judgment, it follows that the temperature range of 85 to 115 °C forms part of the state of the art, and that the subject-matter of present Claim 1 lacks novelty.

The dependent Claims 2 to 8 fall with Claim 1.

4. Since the present claims are not allowable in the light of the disclosure of document (1), there is no need to discuss the question of novelty with respect to document (4). Moreover, the Board sees no reasons to consider the issue of inventive step.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

K.J.A. Jahn