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D E C I S I O N
of 17 December 2001

Case Number: T 0227/98 - 3.3.1

Application Number: 94301941.4

Publication Number: 0616993

IPC: C07C 37/20

Language of the proceedings: EN

Title of invention:
Production of bisphenol-A

Applicant:
GENERAL ELECTRIC COMPANY

Opponent:
-

Headword:
Bisphenol A/GENERAL ELECTRIC

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
"Main and first to thirteenth auxiliary request: support in the application as filed (no) - inadmissible generalization of the examples."

Decisions cited:
-

Catchword:
-



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Boards of Appeal

Chambres de recours

Case Number: T 0227/98 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 17 December 2001

Appellant:

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

Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 9 October 1997
refusing European patent application
No. 94 301 941.4 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. This appeal lies from the Examining Division's decision refusing the European patent application No. 94 301 941.4 (Publication No. 0 616 993) on the ground that the subject-matter of Claims 1 and 9 of the then pending request (the set of claims of the application as originally filed) did not fulfil the requirements of Article 84 EPC.
- II. In the statement of grounds of appeal, the Appellant abandoned the request which was refused and filed two other sets of claims as main and first auxiliary requests.
- III. In the communication accompanying the summons to oral proceedings, dated 28 May 2001, the Board informed the Appellant that Claim 1 of each request might contravene the requirements of Article 123(2) EPC.
- IV. In response, the Appellant abandoned both requests and filed fourteen requests (a main request and thirteen auxiliary requests), Claim 1 of each request reading as follows:

Main request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an acidic catalyst wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25, said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

First auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an acidic catalyst comprising a stationary ion exchange resin containing at least 2% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25, said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Second auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an acidic catalyst wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 2.0 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Third auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an acidic catalyst wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Fourth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an acidic catalyst wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 1.0 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Fifth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 2.0 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Sixth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Seventh auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 1.0 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Eighth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with at least 2% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 2.0 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Ninth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with at least 2% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Tenth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with at least 2% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 1.0 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Eleventh auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with 2% to 8% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 2.0 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Twelfth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with 2% to 8% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 0.25 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

Thirteenth auxiliary request

"1. A method for the continuous production of bisphenol-A (BPA) comprising the steps of:

contacting phenol and acetone in the presence of an sulfonated ion exchange catalyst incorporated into a polystyrene backbone cross-linked with a suitable cross-linking agent and divinylbenzene with 2% to 8% cross-linking wherein the flow rate through the catalyst is greater than a weighted hourly space velocity (WHSV) of 1.0 to 1.5 said flow rate being sufficient to result in a decrease in acetone conversion, and a corresponding increase in BPA production; and

separating formed BPA from the stream of BPA and acetone after formation of BPA and prior to depletion of the acetone."

- V. The Appellant's submissions presented in writing and during oral proceedings, which took place on 17 December 2001, can be summarised as follows:

The data relating to the weighted hourly space velocity (WHSV) indicated in each of Claims 1 of all the requests either in the form of a lower value limit or in the form of a range of values were supported by the application as originally filed. The general definition of the invention taught the relationship between the partial conversion of acetone and the flow conditions to achieve an increase in the bisphenol-A (BPA) production (cf. page 3, lines 1 to 9). Even though the values were derived from examples, it would have been readily understood that choosing such values for the

WHSV would offer advantages for the kinds of embodiments claimed in Claim 1 of each request since the examples were not to be considered as a limitation of the invention (cf. page 4, lines 23 to 25).

- VI. The Appellant requested that the decision under appeal be set aside and the case be remitted to the department of first instance for further prosecution on the basis of the main request or one of the thirteen auxiliary requests filed with letter dated 23 November 2001.
- VII. At the end of the oral proceedings the decision of the Board was given orally.

Reasons for the Decision

1. The appeal is admissible.

All requests (main request and auxiliary requests one to thirteen)

2. *Article 123(2) EPC*

- 2.1 Compared to Claim 1 as originally filed, Claims 1 of all the requests have in common the fact that they have been amended to comprise a feature related to the weighted hourly space velocity (WHSV) of the flow of acetone and phenol through the catalyst, either in the form of a lower value limit or in the form of a range of values (cf. main request, first auxiliary request and second to thirteenth auxiliary requests respectively).

2.2 The question to decide, for all the requests, is whether or not the claimed subject matter containing this feature, drawn from the examples, may be considered to be allowable in the sense that the person skilled in the art could have readily recognised this feature as sufficiently independent of the other variables of the examples so that it can be representative of all the claimed embodiments, and therefore achieving the technical result aimed by the claimed invention as a whole.

2.3 The Board concurs with the Appellant that the control of acetone conversion is the critical point to achieve the claimed process, namely increasing BPA production and, in that context, selecting the space velocity of the flow rate is an important parameter. However, that does not mean that the values of flow rate given in the examples are *de facto* representative for all the claimed embodiments.

The Board observes, in that respect, that in the examples, the flow rate data (cf. Tables 1 and 2; Figures 1 and 2 as filed) are used with:

- 2960 pounds (dry basis) of two specific resins containing about 2% cross-linking and about 4% cross-linking (cf. page 4, line 26 to page 5, line 3 as filed),
- a specific reactor of about 5'6'' internal diameter and 5' internal height (cf. page 5, lines 3 to 5 as filed).

Although the exchange capacity of the resins is not mentioned, it is clear that the obtained data are closely related to the exchange capacity of the resins

since for a given flow rate, the conversion of acetone will be more or less important depending on this exchange capacity (cf. page 4, lines 5 to 9 as filed).

Furthermore, the patent application states that "the design of a highly efficient pp-BPA ion exchange resin reaction system requires selection of a catalyst system (e.g. % cross-linking), selection of appropriate reaction vessel geometry which minimizes pressure drop by relating bed height to flow, bead size, selection of concentrations of an appropriate free mercaptan promoter and acetone, and proper choice of space velocity (WHSV, flow rate versus bed volume of catalyst used, ie, residence time). With a proper selection of reaction conditions, high production rates can be achieved while minimizing by-product and colour formation" (cf. page 9, line 31 to page 10, line 9 as filed).

The Board concludes, therefore, that the space velocity is but one of the numerous parameters which in combination enable the desired effect to be obtained. It cannot be derived that the indicated space velocity values used with other resins, other amounts of resin, other bead sizes, other vessel geometry, which are encompassed by Claim 1 of any request, will necessarily yield that effect, namely high production rates while minimizing by-product and colour formation.

In conclusion, the values of weighted hourly space velocity (WHSV) of the flow rate through the catalyst are so closely associated with the other parameters of the examples that it cannot be derived that those values remain relevant in other conditions, namely remain relevant for all the claimed embodiments.

For these reasons, Claims 1 of all the requests must fail for non compliance with the requirements of Article 123(2) EPC.

Order

For these reasons it is decided that:

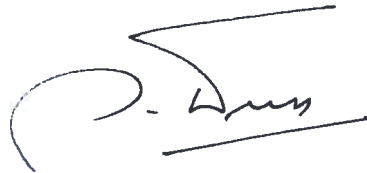
1. The appeal is dismissed.

The Registrar:

A handwritten signature in black ink, appearing to be 'N. Maslin', with a long horizontal line extending to the right.

N. Maslin

The Chairman:

A handwritten signature in black ink, appearing to be 'A. Nuss', with a large, stylized flourish above the name.

A. Nuss