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D E C I S I O N
of 5 September 2000

Case Number: T 0948/96 - 3.3.6

Application Number: 93911189.4

Publication Number: 0650516

IPC: C10G 45/40

Language of the proceedings: EN

Title of invention:
Acetylene Converter Moderators

Applicant:
EXXON CHEMICAL PATENTS INC.

Opponent:
-

Headword:
Acetylene Conversion/EXXON

Relevant legal provisions:
EPC Art. 54, 84, 111(1), 123(2)

Keyword:
"Novelty: yes"
"Remittal: yes"

Decisions cited:
-

Catchword:



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Boards of Appeal

Chambres de recours

Case Number: T 0948/96 - 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 5 September 2000

Appellant: EXXON CHEMICAL PATENTS INC.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 17 June 1996
refusing European patent application
No. 93 911 189.4 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. Krasa
Members: G. Dischinger-Höppler
C. Rennie-Smith

Summary of Facts and Submissions

I. This appeal is from the decision of the Examining Division to refuse European patent application No. 93 911 189.4 relating to acetylene converter moderators for lack of novelty in view of documents

(2) US-A-4 605 812 and

(3) US-A-4 593 148.

II. With its statement of grounds of appeal, the Appellant filed two amended sets of claims in a main and auxiliary request. With regard to these claims, the Board, in a communication dated 5 August 1999, expressed a provisional opinion concerning the requirements of Articles 84, 54 and 56 EPC. In respect of novelty of the claimed subject-matter according to the main request, attention was further drawn to document

(1) US-A-4 227 025.

III. In response, the Appellant filed by letter of 14 February 2000 a new set of 18 claims, as its only request but entitled "second auxiliary request", the only independent claim reading:

"1. A process for removing acetylene from a hydrocarbon stream, said stream comprising an acetylene converter moderator, by contacting the stream with an acetylene hydrogenation catalyst under conditions effective to permit acetylene hydrogenation, characterized in that the moderator is arsine and/or phosphine which is introduced into the stream and controlled to give a

concentration in the stream of from 0.01 to 10 wppb prior to contact with the catalyst."

IV. The Appellant submitted in essence

- that the amended claims fulfilled the requirements of Articles 84 and 123(2) EPC and
- that documents (1) to (3) did not anticipate the claimed subject matter since none of them disclosed either an arsine concentration of 0.01 to 10 wppb or that this amount of arsine be introduced into and controlled within the stream.

Further, the Appellant commented on the technical problem to be solved and on inventive step.

V. The Appellant requested that the decision of the Examining Division be set aside and a patent be granted on the basis of Claims 1 to 18 of the "second auxiliary request". Oral proceedings were requested if the Board should decide to maintain the appealed decision.

Reasons for the Decision

1. *Amendments (Articles 123(2) and 84 EPC)*

The amended claims are supported by the claims as originally filed in combination with the following passages of the original description of the application in suit:

- From page 5, lines 10 to 13 and 28 to 29, page 11, lines 22 to 27 and page 15, line 12 to page 16,

line 7 it can be derived that the moderator of the acetylene convertor is arsine and/or phosphine and comprised within the hydrocarbon stream into which it is introduced and controlled to give a concentration of 0.01 to 10 wppb before said stream is contacted with the hydrogenation catalyst under conditions permitting acetylene hydrogenation (Claim 1).

- The sentence bridging pages 10 and 11 and page 11, lines 6 to 9 provide a basis for an arsine concentration ranging from 1 to 5 wppb (Claim 2).
- Page 6 lines 25 to 30 in combination with page 15, line 34 to page 16, line 7 supports Claims 4 and 5, according to which the moderator present in a carrier gas in relatively high concentration is introduced into the hydrocarbon stream.
- Claim 10 finds support on page 13, lines 1 to 8.

All other claims have the following counterparts in the sets of claims as originally filed: Claims 3 and 6 to 9 remain unchanged, Claims 11 to 18 correspond to original Claims 10 to 17.

Therefore, the Board concludes that no objections to the amended claims arise under Articles 123(2) EPC. The amendments made to Claim 1 also overcome the objections raised by the Board under Article 84 EPC in its communication dated 5 August 1999 and do not give rise to new objections in this respect.

2. *Novelty*

2.1 The application in suit, while referring specifically to the production of ethylene obtained by a steam cracking process, relates in general to the removal of acetylene from a hydrocarbon product stream by passing said stream over a palladium catalyst to selectively hydrogenate the acetylene to ethylene. Further, it is stated in the application in suit that in conventional processes it has been found necessary to add carbon monoxide, which acts as a temporary poison of the catalyst, to moderate the reaction because the catalytic acetylene hydrogenation is a highly exothermic reaction (see application page 1, lines 5 to 35).

The application in suit now proposes to use for the same purpose, i.e. as a moderator for the reaction, a particular amount (0.01 to 10 wppb) of arsine and/or phosphine in the acetylene-containing stream intended for hydrogenation (Claim 1).

2.2 Documents (1) to (3) also relate to the selective catalytic hydrogenation of acetylene contained in hydrocarbon process streams to ethylene (document (1), column 1, lines 5 to 15 and column 4, lines 14 to 22; document (2), Claim 20; document (3), Claim 22). All these documents teach that arsine, when present in the streams, acts as a poison to the hydrogenation catalyst (document (1), column 2, lines 67 to 68; document (2), column 1, lines 22 to 34; document (3), column 1, lines 22 to 33). All these citations concentrate primarily on the problem of avoiding such catalyst poisoning by arsine.

2.3 Document (1) proposes for this purpose a discontinuous process comprising the steps of:

- (a) exposing the hydrocarbon stream comprising acetylene and arsine together with hydrogen to a hydrogenation catalyst and

- (b) regularly restoring the activity and selectivity of the arsenic poisoned catalyst by passing an arsenic-free feed together with hydrogen over the catalyst while the temperature is gradually elevated (see Claim 1, Example, column 2, line 67 to column 3, line 10, column 3, lines 29 to 45).

The only value concerning a particular amount of arsine in the feed is mentioned in Example 1 which represents a study under comparative conditions where 16 wppb of arsine are added to the stream fed to the catalyst. As a consequence, document (1) does not disclose contact with the catalyst of the claimed content of 0.1 to 10 wppb of arsine in the stream.

2.4 Documents (2) and (3), which are very similar with respect to their disclosure, each propose inter alia one particular embodiment for selectively hydrogenating acetylene to olefines. In these embodiments, the arsine content from a hydrocarbon stream containing essentially no acetylenes is substantially reduced by means of a specific sorbent. The stream thus treated is then admixed with a second hydrocarbon stream which contains acetylenes but no arsines. The admixture of streams is subsequently contacted with a hydrogenation catalyst to hydrogenate selectively the acetylenes to olefines (document (2), column 5, lines 30 to 45; document (3), column 5, lines 38 to 54). Both documents are silent on the arsine content of the hydrocarbon stream to be selectively hydrogenated.

The only numerical information disclosed as to the arsine contents is as regards its possible reduction in the arsine containing hydrocarbon streams:

In both documents it is said that the treatment with the sorbent reduces the arsenic impurities to less than 10 ppm (document (2), column 4, lines 5 to 17; document (3), column 4, lines 5 to 22) or, according to Example I of document (3), to less than 0.7 ppb As (column 6, lines 25 to 26). Since, however, neither of documents (2) and (3) indicates the mixing ratio of the sorbent treated steam with the second stream, the content of arsine in the mixed stream which is fed to the hydrogenation catalyst remains unquantified.

2.5 The Board concludes, therefore, that the subject-matter of Claim 1 is not anticipated by any of documents (1) to (3).

3. *Remittal*

The decision under appeal dealt exclusively with the ground of lack of novelty of Claim 1 as then presented. Therefore, taking into account that there is now a new, and differently worded, set of claims, the Board considers it appropriate to exercise its discretion under Article 111(1) EPC to refer the case back to the Examining Division for further prosecution.

When assessing inventive step, the Examining Division will also have to consider whether it is plausible that the existing problems as stated by the Appellant (see point V.) have been solved within the whole claimed concentration range for arsine/phosphine in the hydrocarbon stream.

4. In accordance with the Appellant's request, oral proceedings were unnecessary since the appealed decision has not been maintained by the Board.

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 for further prosecution on the basis of the claims of the second auxiliary request filed on 14 February 2000.

The Registrar:

The Chairman:

G. Rauh

P. Krasa