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D E C I S I O N
of 23 January 1996

Case Number: T 0149/94 - 3.3.1

Application Number: 87202485.6

Publication Number: 0319615

IPC: C10G 25/02

Language of the proceedings: EN

Title of invention:

Process for removing mercury from organic media

Patentee:

DSM N.V.

Opponent:

Dow Benelux N.V.

Headword:

mercury removal/DSM

Relevant legal provisions:

EPC Art. 56, 123

Keyword:

"Inventive step - yes - Appellant's statement not made credible"

Decisions cited:

-

Catchword:

-



Case Number: T 0149/94 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 23 January 1996

Appellant: Dow Benelux N.V.
(Opponent) Postbus 48
NL-4530 AA Terneuzen (NL)

Representative: Smulders, Theodorus A.H.J., Ir.
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
NL-2587 BN 's-Gravenhage (NL)

Respondent: DSM N.V.
(Proprietor of the patent) Het Overloon 1
NL-6411 TE Heerlen (NL)

Representative: Hoogstraten, Willem Cornelis Roeland
OCTROOIBUREAU DSM
Postbus 9
NL-6160 MA Geleen (NL)

Decision under appeal: Interlocutory decision of the Opposition Division
of the European Patent Office posted 15 December
1993 concerning maintenance of European patent
No. 0 319 615 in amended form.

Composition of the Board:

Chairman: R. K. Spangenberg
Members: P.-P. Bracke
R. E. Teschemacher

Summary of Facts and Submissions

- I. This appeal is against the Opposition Division's interlocutory decision on the amended form in which European patent No. 0 319 615 - granted on the basis of European patent application No. 87 202 485.6 filed on 11 December 1987 - can be maintained,.
- II. The Opposition Division considered document (5), a Bayer brochure on Lewatit TP 214 (January 1986), to be the closest state of the art.
- Since this document was concerned with the removal of mercury in ionic form from aqueous and polar organic solutions, whereas the problem underlying the present invention was the removal of elemental mercury from non-polar hydrocarbons, the claimed process was considered not to be obviously derivable therefrom.
- III. In the annex to the summons to attend oral proceedings the Board expressed its doubts that document (5) was the closest state of the art, since this document was not concerned with the removal of mercury from a non-polar hydrocarbon medium, as was the claimed process.

During oral proceedings held on 23 January 1996 the following documents were cited in addition to document (5):

- (1) JP Kokai 50-20993,
- (3) US-A-3 755 161,
- (17) Journal of Chromatography, 102, pages 443 to 450 (1974) and
- (19) Hydrocarbon Processing, pages 237 to 240 (November 1980).

Both parties agreed that document (19) represented the closest state of the art.

The Respondent (Proprietor of the patent) filed an amended claim 1, reading (emphasis added):

"A process for removing elementary mercury from a non-polar hydrocarbon medium, characterized in that the medium is contacted with a solid adsorbent containing active SH-groups."

- IV. The Appellant (Opponent) submitted that document (19) described a process for removing elemental mercury from liquefied natural gases (LNG), which are non-polar hydrocarbon liquids, by using sulphur impregnated activated carbon and that, consequently, the claimed process could differ from that process only by the use of a solid adsorbent containing active SH-groups instead of sulphur. Since, according to document (19), "sulphur" was the active ingredient for fixing mercury as sulphide, this "sulphur" had to contain at least some active SH-groups. Therefore, he concluded that document (19) was prejudicial to the novelty of the process of claim 1.

Since, in the process according to document (19), the essential feature for adsorbing mercury was the presence of sulphur, which could be leached out from the adsorbent by liquids, and since solid adsorbents having sulphur strongly bound thereto were known from documents (1), (5) and (17), he concluded that the claimed process was obvious in respect of the teaching of these documents having regard to document (3), which showed that such compounds were also suitable for binding elemental mercury.

V. The Respondent contested that elemental sulphur contained SH-groups and argued that the process described in document (19) was, consequently, not prejudicial to the novelty of the claimed process.

Additionally, he submitted that it was nowhere suggested in any of the cited prior-art documents that a solid adsorbent containing SH-groups could bind mercury in its elemental form and, consequently, that the claimed process was not obvious in respect of the cited prior art.

VI. The Appellant requested that the decision under appeal be set aside and that the European patent be revoked.

The Respondent requested that the decision under appeal be set aside and that the patent be maintained with claim 1, as submitted during the oral proceedings, and claims 2 to 8 and the description (columns 1 to 3) as annexed to the decision of the Opposition Division.

VII. At the conclusion of the oral proceedings, the Chairman announced the Board's decision to allow the Respondent's request.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

By means of the amendment to claim 1 (see emphasised text) it is further specified that the mercury to be removed from the non-polar hydrocarbon medium is in elemental form. Since this further specification, mentioned on page 2, lines 7 to 17, of the originally

filed application (see the patent as granted, column 1, lines 35 to 46), represents a restriction of the protection conferred, the amendments in the set of claims do not contravene Article 123(2) and (3) EPC.

3. *Novelty*

Document (19) teaches that mercury may suitably be removed from LNG by using sulphur-impregnated activated carbon (the first and the second paragraph in the left-hand column on page 237, the last but one paragraph in the left-hand column on page 238 and lines 18 to 19 in the right-hand column on page 239).

Since, according to the claimed process mercury is removed from non-polar hydrocarbon media by using a solid adsorbent containing active SH-groups, the issue of novelty focuses on the question whether sulphur-impregnated activated carbon may be considered as a solid adsorbent containing active SH-groups, as was alleged by the Appellant. However, no evidence in support of this allegation was submitted, nor did the Respondent admit that it was correct. In particular, the fact that, according to document (19), the elemental mercury is fixed as sulphide does not, in the Board's judgment, unambiguously imply the presence of SH-groups, since this sulphide may also be formed by oxidation of the elemental mercury with the elemental sulphur. In addition, the Board has satisfied itself that the other cited prior-art documents do not mention or suggest that elemental sulphur would also contain some SH-groups.

On that basis, the Board therefore concludes that there is no reason to assume that document (19) implicitly discloses the use of a solid adsorbent containing SH-groups. Consequently, this document cannot be considered to be prejudicial to the novelty of claim 1.

None of the other cited documents discloses the combination of all the features of claim 1. This was not contested by the Appellant. The Board therefore holds that the claimed process is novel in respect of the cited state of the art.

4. *Inventive step*

4.1 The contested patent is concerned with a process for removing elemental mercury from non-polar hydrocarbon media.

In the decision under appeal the Opposition Division held that document (5) represented the closest state of the art. However, since it is the established jurisprudence of the Boards of Appeal of the EPO that the closest prior art is selected from the available prior documents disclosing subject-matter concerning **the same purpose as the claimed invention** and since document (19) is the only cited prior art document describing the removal of **elemental mercury from non-polar hydrocarbon media**, the Board considers that this document represents the most relevant prior art, in accordance with both parties' submissions during the oral proceedings.

4.2 Document (19), giving an overview of suitable methods known in 1980 for removing elemental mercury from LNG (see page 239, right-hand column, line 18, to page 240, right-hand column, line 33), teaches that the best commercial method for removing mercury from LNG was the treatment of the main gas stream in LNG plants with sulphur-impregnated activated carbon, but that such method was not suitable for treating cycle gas liquids or cycle gas make-up liquids owing to the leaching out

of sulphur from the activated carbon by those liquids (see page 237, the first and second paragraphs of the left-hand column, and page 239, lines 18 to 33 of the right-hand column).

Thus, starting from document (19), the problem to be solved can be seen in providing an alternative process for removing elemental mercury from non-polar hydrocarbon media, which method is not only suitable for removing elemental mercury from a gas stream but also from liquids (see the patent in suit, column 1, lines 47 to 58, and column 2, lines 18 to 27).

- 4.3 According to the contested patent it is proposed that this problem be solved by contacting the non-polar hydrocarbon medium with a solid adsorbent containing active SH-groups (see the patent in suit, column 2, lines 1 to 5).

In view of the example in the contested patent and examples 2 to 4, provided during the examination procedure in a letter dated 26 September 1989, the Board finds that the problem is indeed thereby credibly solved. This was not contested by the Appellant.

- 4.4 Therefore, the only remaining question to be decided is whether it was obvious, in view of the cited state of the art, for a skilled person looking for a process for removing elemental mercury from gaseous as well as liquid non-polar hydrocarbon media to substitute the sulphur-impregnated activated carbon in the process described in document (19) by a solid adsorbent containing active SH-groups.

- 4.5 According to document (19) the fixing of elemental mercury by sulphur was the essential feature in the process of removing mercury by using sulphur-impregnated activated carbon (see page 239, right-hand column, lines 19 to 21) and it was also known from this document that elemental sulphur could be leached out from the activated carbon by non-polar hydrocarbon liquids (page 237, lines 12 and 13 of the left-hand column, and page 239, lines 23 to 25).

In addition, adsorbents containing "sulphur" in chemically bound form, having a high affinity for mercury, were known from documents (1), (5) and (17) (see, for example, document (1), page 5, lines 10 to 16 of the English translation, document (5), first page, line 1 and lines 9 to 11, and document (17), eg, page 446, lines 3 to 8, and the first paragraph of page 449). However, these documents relate solely to the removal of ionic mercury.

- 4.6 At the oral proceedings the Respondent did not contest that it was known that solid adsorbents containing active SH-groups and having an affinity for mercury in its ionic form could be used in non-polar hydrocarbon media.

However, there was dispute about whether document (3) described or suggested that such solid adsorbents could be used for binding elemental mercury. In this respect, the Appellant relied on column 3, lines 43 to 47, column 3, line 54, to column 4, line 12, the paragraph bridging columns 9 and 10 and examples 56 to 67 and control 4, whereas the Respondent submitted that the cited parts of document (3) related to the removal of

mercury from a hydrogen gas stream released from a chloralkali electrolysis cell, hence also to the removal of ionic mercury. It is thus necessary to establish the true disclosure of this document.

- 4.7 In the Board's judgment, while document (3) is indeed related to a process wherein metals, such as mercury, are captured in a gaseous or liquid phase by a solid treating agent consisting of an organic compound adsorbed on a carrier, wherein the organic compound may contain an SH-group (see column 3, line 36, to column 4, line 13 and column 9, lines 11 to 19), it does not provide any explicit information about the nature of the metals to be adsorbed. It may, however, be deduced from column 9, lines 22 to 36, where it is said that, when the content of metal in liquids is very great, the amount of metal can be reduced by pretreating the liquid with an anion exchange resin and, subsequently, contacting the remaining solution with the above described solid treating agent, that the metals to be adsorbed are in the ionic form and not in the elemental form, since anion exchange resins, owing to their anionic nature, are suitable for adsorbing cationic compounds. In the paragraph bridging columns 9 and 10 of document (3) as well as in examples 56 to 67 and control 4, referred to by the Appellant, it is only said that "mercury" may be removed (i) from concentrated alkaline and acidic aqueous solutions as well as from hydrogen gas evolved in the mercury method of electrolysis of alkali salts, and (ii) from hydrochloric acid synthesised from hydrogen gas and chlorine gas. Since, however, in these rather polar media the mercury may well exist in ionic form the Board is unable to accept the Appellant's submission that, in these circumstances, the mercury must have been present in its elemental form.

Furthermore, in example 1 it is specified that the solution to be treated is prepared from mercuric chloride and sodium chloride, thus indicating that the mercury is present in its ionic form, and examples 68 and 69 describe a pretreatment with an anionic exchange resin and, consequently, also imply that the mercury is in ionic form.

Consequently, the Board concludes that document (3) also does not contain any **implicit** information about the use of solid adsorbents containing active SH-groups for binding **elemental** mercury.

4.8 Having regard to the above, the Board holds that the statement in the contested patent (column 2, lines 10 to 15) that the prior art teaches that solid adsorbents having active thiol groups are only capable of adsorbing ionic (oxidised) mercury is not disproved. Moreover, this statement is in agreement with the fact that the possibility of using resins containing active SH-groups was completely overlooked in document (19), which expressly recommended, as alternatives to the use of sulphur-impregnated activated charcoal, oxidising the mercury by, eg, potassium permanganate or strong acids (see page 239, right-hand column, lines 34 to 42) or trapping it with a reduced zinc oxide bed (see page 239, left-hand column, lines 43 to 48). Consequently, the Board holds that the cited documents did not suggest that mercury in its elemental form could be adsorbed by solid adsorbents containing active SH-groups.

4.9 Therefore, the Board concludes that the process according to Claim 1 involves an inventive step (Article 56 EPC).

Claims 2 to 7 as granted relate to preferred embodiments of the subject-matter according to claim 1, and claim 8 relates to a specific use of the claimed process. The description as amended is in conformity with the amended statement of claim. For these reasons, the patent can be maintained as requested by the Respondent.

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 maintain the patent in the following version:

Description: columns 1 to 3 as annexed to the decision of the Opposition Division,

Claim 1: as submitted during oral proceedings,

Claims 2 to 8: as annexed to the decision of the Opposition Division.

The Registrar:


E. Görgmaier

The Chairman:


R. Spangenberg