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Anmeldenummer / Filing No / N° de la demande : 82 304 721.2  
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Bezeichnung der Erfindung: Treatment of contaminated Stretford solutions  
Title of invention: in gas purification  
Titre de l'invention :

Klassifikation / Classification / Classement : B 01 D 53/34, C 01 B 17/05, C 10 K1/12

**ENTSCHEIDUNG / DECISION**

vom / of / du 9 December 1986

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet : The Dow Chemical Company

Einsprechender / ~~Opponent~~ / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE

Kennwort / Keyword / Mot clé : Articles 52, 56  
"Inventive step"

Leitsatz / Headnote / Sommaire

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Case Number : T 164 /86

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.1  
of 9 December 1986

**Appellant :** The Dow Chemical Company  
Dow Center  
2030 Abbott Road  
PO Box 1967  
Midland Michigan 48640 (US)

**Representative :** Allard, Susan Joyce et al,  
Boult, Wade and Tennant  
27 Furnival Street  
London EC4A 1PQ (GB)

**Decision under appeal :** Decision of Examining Division 031 of the European Patent Office dated 11 December 85 refusing European patent application No. 82 304 721.2 pursuant to Article 97(1) EPC

**Composition of the Board :**

**Chairman :** K. Lederer  
**Member :** E. Turrini  
**Member :** R.L.J. Schulte

### Summary of facts and submissions

- I. The European patent application No. 82 304 721.2 filed on 8 September 1982 (publication number 0 074 278) was refused by the decision of the Examining Division 031 of the European Patent Office dated 11 December 1985.
- II. This decision was based on Claims 1 to 12 filed on 26 September 1985. For more details reference is made to the application file.
- III. The reason given for the refusal was that in view of the prior art documents US-A-3 810 833, Hamilton-Sewell "Introduction to high performance liquid chromatography", London '77, pages 111, 160 to 162 and Cotton, F.A.-Wilkinson, G., "Anorganische Chemie", 3rd Ed.-Verlag Chemie, 1980, p. 875, the subject-matter of Claim 1 did not involve an inventive step within the meaning of Article 56 EPC and the claim was thus not allowable under Article 52(1) EPC.
- IV. On 12 February 1986, an appeal was filed against this decision and the appeal fee paid. The appellant subsequently submitted on 18 April 1986 the Statement of Grounds together with a main set of Claims 1 to 7 and three subsidiary sets of claims.  
  
Claim 1 of the main set of claims substantially corresponds to the Claim 1 filed on 26 September 1985.
- V. The appellant argued that the process as defined in Claim 1 cannot be deduced from US-A-3 810 833 in view of the fact that said process solves the problem of removing sodium thiosulfate and sodium sulfate from a Stretford process alkaline aqueous solution without the need to acidify the solution, while in US-A-3 810 833 the solution is acid and consequently does not contain sodium thiosulfate and sodium

sulfate. Thus according to the appellant "it would not have been obvious to a person skilled in the art that the process disclosed in US-A-3 810 833 could be used to treat an aqueous alkaline Stretford process solution and to obtain selective removal of the vanadate ions from the sulfate and thiosulfate ions contained in the solution" and the reasoning of the Examining Division was based on hindsight.

VI. Following a communication dated 28 July 1986, a letter from the appellant filed on 17 September 1986 and a telephone conversation held on 30 October 1986, the appellant is now requesting that the decision of the Examining Division be set aside and a European patent granted on the basis of Claims 1 to 6 filed on 17 September 1986 (main request) or one of three sets of claims filed on 18 April 1986 (subsidiary requests).

VII. Claim 1 of the main request 1986 reads as follows:

"1. A process for treating a used sulfur particle-free Stretford process alkaline aqueous solution containing disodium anthraquinone disulfonate and sodium vanadate and further containing sodium carbonate, sodium bicarbonate, sodium thiosulfate, sodium sulfate and sodium hydroxide, the process comprising the step of separating the anthraquinone disulfonate from the solution thereby obtaining an alkaline aqueous solution which is substantially depleted of anthraquinone disulfonate, characterized in that the step of separating the anthraquinone disulfonate consists in contacting the solution with activated carbon and in that a further step consists in contacting the so-treated solution with an anion exchange resin to separate the vanadate from the

solution, thereby obtaining an alkaline aqueous solution which is not only substantially depleted of anthraquinone disulfonate but also of vanadate and which contains most, if not all, of the sodium thiosulfate and sodium sulfate."

Claims 2 to 6 are dependent on Claim 1.

### Reasons for the decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. **Main set of claims**
  - 2.1 There is no objection to these claims or the current description as far as Article 123(2) EPC is concerned, since both are adequately supported by the original disclosure (e.g. Claims 1 to 3 and 10 to 13 and Example 1).
  - 2.2 **Novelty**

None of the cited prior art documents, apart from US-A-3 810 833 (see below) refers to a process comprising the two steps outlined in Claim 1 of the present application. Thus

- EP-A1-0 014 950  
(pages 1 to 5, 7 and 8; Claims 1 and 5) which is considered by the Board of Appeal to be the nearest state of the art, describes a process for treating a used, sulfur particle-free Stretford process alkaline aqueous solution comprising the features of the preamble of Claim 1 of the present application. However said document neither discloses separation of the anthraquinone disulfate by means of activated carbon nor a further step for separating the vanadate by means of an anion exchange resin. In the process described in this document the

thiosulfate and sulfate are removed, contrary to the requirements of Claim 1 of the present application by transforming them into carbonates by means of a combustion step using a combustion gas rich in CO.

- US-A-3 810 833

(columns 1 and 2) refers to a process for treating an aqueous solution derived from a used, sulfur particle-free, Stretford process aqueous solution, said derived aqueous solution containing disodium anthraquinone disulfonate and sodium vanadate. The process comprises the steps of separating the anthraquinone disulfonate by contacting the solution with activated carbon and of separating the vanadate by contacting the so-treated solution with an anion exchange resin. These two steps are formally similar to the corresponding two steps of Claim 1 of the present application. However, in this document the derived aqueous solution is acid (column 1, last two lines and column 2, lines 46 and 47) and therefore does not contain sulfate and thiosulfate, so that during the second step there is no selective removal of the vanadate from the sulfate and thiosulfate.

For the above reasons the subject-matter of Claim 1 is deemed to be novel within the meaning of Article 54 EPC.

### 2.3 Inventive step

Considering EP-A1-0 014 950 as starting document the problem underlying the present invention is to simplify the process for treating the alkaline solution therein described, e.g. by avoiding the combustion step. The man skilled in the art would, as a matter of course, try to find a solution to the posed problem in the prior art. The question to be answered is: would he in doing so consider US-A-3 810 833, which refers to a process with the two steps of separating anthraquinone disulfonate and sodium

vanadate with activated carbon and an anion exchange resin respectively? A combination of the teachings of the two documents would indeed lead to the subject-matter of Claim 1. However, the skilled man would not recognise the possibility of successfully applying the two steps to the process disclosed in EP-A1-0 014 950, since in US-A-3 810 833 the aqueous solution is explicitly chosen to be acid (column 1, last two lines and column 2, lines 46 and 47), so that the sulfate and thiosulfate are substantially eliminated, while an alkaline solution, e.g. that disclosed in EP-A1-0 014 950 contains the sulfate and thiosulfate, which have to be separated.

As stressed by the Examining Division in its decision, it is true that the skilled man would reasonably assume that the anion exchange resin will work properly also in presence of an alkaline solution (see Hamilton-Sewell). This assumption however would not suggest to the skilled man that the vanadate would be selectively removed - from the Stretford solution - over the sulfate and thiosulfate.

In the opinion of the Examining Division the selectivity is supported by two considerations, the first based on the difference in the charge value between the ionic forms of the vanadate ( $\text{HVO}_4^{2-}$ ,  $(\text{V}_4\text{O}_{12})^{4-}$  and  $(\text{V}_3\text{O}_9)^{3-}$ , sulfate ( $\text{SO}_4^{2-}$ ) and thiosulfate ( $\text{S}_2\text{O}_3^{2-}$ ) and the second based on the ionic weight difference between the vanadate ion ( $\text{HVO}_4^{2-}$ ) and the thiosulfate ion ( $\text{S}_2\text{O}_3^{2-}$ ) or the sulfate ion ( $\text{SO}_4^{2-}$ ).

The Board of Appeal takes the position that the first consideration does not help the skilled man, due to the uncertainty of the actual existence of the two ionic forms ( $(\text{V}_4\text{O}_{12})^{4-}$  and  $(\text{V}_3\text{O}_9)^{3-}$ ) (see Cotton, F.A.-Wilkinson, G.)

and particularly to the unknown and presumably low percentage of said two ionic forms with respect to the ionic form  $(\text{HVO}_4)^{2-}$ , which would lead the skilled man to predict an inadequate selectivity.

As far as the second consideration is concerned, the Board of Appeal is of the opinion that the above-mentioned difference in weight is too small to predict a good selectivity. This opinion is strengthened by the teaching of the prior art document "Ion Exchange Resins" of Kunin, R.-Myers, R.J., J. Wiley & Sons 1950, pages 22 to 25, 182, 185 and 193, which states (page 25) that "at high concentrations the exchange potentials of the ions of similar valence do not increase with increasing atomic number (i.e. ionic weight) but are very similar or even decrease". That the alkaline Stretford solutions have a high solid concentration can be deduced e.g. from Example 1 at pages 9 and 10 of the present application.

Thus the Board of Appeal comes to the conclusion that, for the above-mentioned reasons, the utilisation of an acid solution which in US-A-3 810 833 can be seen to be a prerequisite for carrying out the two steps of separating the anthraquinone and vanadate, would discourage the skilled man from utilising the teaching of this document with an alkaline solution, rather than incite him to do so. Combination of the teachings of EP-A1-0 014 950 and US-A-3 810 833 thus appears to be based on an *ex-post facto* analysis.

A similar argumentation concerning the inventive step of Claim 1 would apply, *mutatis mutandis*, to the case in which US-A-3 810 833 is taken as starting document. In this case, the skilled man wishing to solve the problem of removing the thiosulfate and sulfate from a treated aqueous solution of a Stretford process without acidification would not come, without inventive step, to the idea of solving that problem by merely

applying, without any modification, the two steps of separating the anthraquinone and the vanadate mentioned in US-A-3 810 833 to an alkaline aqueous solution, for the aforementioned reasons.

The other cited documents, which are less relevant than EP-A1-0 014 950 and US-A-3 810 833, would not bring additional useful information to the skilled man.

Thus, the subject-matter of Claim 1 which is novel and is considered to involve an inventive step within the meaning of Article 56 EPC and Claim 1 is therefore allowable under Article 52(1) EPC.

Claims 2 to 6 relate to particular embodiments of the invention. They are therefore allowable as dependent claims in agreement with Rule 29(3) EPC.

**3. Subsidiary sets of claims**

The three subsidiary sets of claims need not be examined, since the main set of claims has been considered allowable by the Board of Appeal.

**Order**

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

1. The decision of the Examining Division dated 11 December 1985 is set aside.
2. The case is remitted to the first instance with the order to grant a European patent on the basis of the following documents:

1. description:

pages 1 and 5 to 12 of the original patent application;  
pages 2 to 4 received on 17 September 1986 with the  
following amendments: page 3, lines 9, 11, 19 and 24 and  
page 4, line 3, "anthraquione" is replaced by  
"anthraquinone"; page 3, line 16 "fro" is replaced by  
"for" and page 3, line 28 "According to a first aspect of  
the present invention" is replaced by "According to the  
present invention"; page 7, line 22, "30°C" is replaced  
by "35°C"; page 12, lines 25 to 27 are deleted .

2. Claims

Nos. 1 to 6 received on 17 September 1986 with the  
following amendment: Claim 1 (page 13), line 14,  
"anthraquione" is replaced by "anthraquinone".

The Registrar:



The Chairman:



*Submitted 26.11.86*  
*25.11.86*  
*Winn*