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PATENTAMTS

BOARDS OF APPEAL OF
THE EUROPEAN PATENT
OFFICE

CHAMBRES DE RECOURS
DE L'OFFICE EUROPEEN
DES BREVETS

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File No.: T 0790/90 - 3.3.2
Application No.: 84 306 625.9
Publication No.: 0 140 587
Classification: C02F1/20
Title of invention: Process for removing dissolved oxygen from an aqueous medium

D E C I S I O N
of 8 July 1993

Proprietor of the patent: WESTINGHOUSE ELECTRIC CORPORATION
Opponent: Bayer AG, Leverkusen

Headword: Oxygen removal/WESTINGHOUSE
EPC: Art. 56
Keyword: "Inventive step (no); obvious modification"

Headnote
Catchwords

Case Number: T 0790/90

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 8 July 1993

Appellant: WESTINGHOUSE ELECTRIC CORPORATION
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Representative: van Berlyn, Ronald Gilbert
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Respondent: Bayer AG, Leverkusen
(Opponent) Konzernverwaltung RP
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Representative:

Decision under appeal: Decision of the Opposition Division of the European Patent Office dated 7 August 1990 revoking European patent No. 0 140 587 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: A.J. Nuss
Members: I.A. Holliday
S.C. Perryman

Summary of Facts and Submissions

- I. European patent No. 0 140 587 was granted on the basis of nine claims contained in European patent application No. 84 306 625.9.
- II. Opposition was filed against the granted patent by the Respondent citing *inter alia* the following documents:
- (2) DE-A- 970 310
 - (3) Houben-Weyl "Methoden der Organischen Chemie", Band IV/10 (1980), pages 67-69
 - (4) Chem. Abstract, 91, (1979) 9169y (JP-A-79/26060)
 - (5) Chem. Abstract, 90, (1979) 12148a (JP-A-78/91095)
 - (6) Mitteilungen der VGB, 91, (1964), page 254
- III. The Opposition Division revoked the patent on the grounds of lack of inventive step. In the opinion of the Opposition Division, the closest prior art was document (2) which relates to the deoxygenation of boiler feed water with hydrazine in the presence of a catalyst such as copper, silver or activated carbon. The Opposition Division took the view that the skilled person, seeking to update the process known from (2), would be led to the use of a supported noble metal catalyst. Not only is supported palladium known as hydrogenation catalyst, e.g. from "Houben-Weyl" (3) but it is also known to catalyse the reaction of oxygen with hydrazine in an aqueous medium (documents (4) and (5)).
- IV. In appealing against the decision of the Opposition Division, the Appellant filed an amended set of claims which was stated to emphasise the "once through" nature

of the process. The new claim included the features of previous Claim 3, 4 and 6 which related to the contact temperature, intimate mixing and a pressurising step respectively; a reference to a contact time of 0.5 to 2 minutes was also included.

The Appellant argued that there was no unambiguous disclosure in the prior art of residual oxygen values of less than 10 parts per billion (ppb). Furthermore, it could not be assumed that, since Pd and Pt were effective as catalysts for deoxygenation using hydrogen, they would also be effective when using hydrazine. The Appellant also questioned the relevance of documents (4) and (5) relied upon by the Opposition Division since they each refer to removal of hydrazine by employing air or oxygen, i.e. the converse of the process of the patent in suit.

- V. The respondent disputed the arguments of the Appellant. The addition of further features to Claim 1 did not alter the reasons already given in the statement of opposition which had led to the revocation of the patent.

- VI. In summoning the parties to oral proceedings, the Board introduced a further document, DE-C-935 659 (2a), which is the parent patent of document (2) referred to above. According to Example 1 of (2a), when boiler feed water containing residual oxygen was treated with hydrazine, even in the absence of catalyst, it was possible to obtain residual oxygen values of less than 10 ppb.

- VII. In a telefax communication received in the EPO on 10 June 1993, the Appellant requested a decision based on the written documentation.
- VIII. Claim 1 filed with the statement of appeal and received in the EPO on 17 December 1990 reads as follows:
- "1. A process for the removal of dissolved oxygen from an aqueous medium by adding hydrazine to said medium to react with said dissolved oxygen, characterized by intimately mixing the aqueous medium and the hydrazine, and with an effective amount of a noble metal in the form of palladium or platinum, dispersed on a stable carrier material for a contact time between 0.5 and 2 minutes whereby to react the hydrazine with the dissolved oxygen to reduce the dissolved oxygen content of the aqueous medium to a value of less than 10 parts per billion, the aqueous medium being subjected to a pressure of between 50-150 psig (344.4 to 1033 KPa) for contact with the noble metal, the contact being effected at a temperature of between 20°C and 40°C."
- IX. The Appellant requested that the contested decision be set aside and that the patent be maintained on the basis of Claims 1 to 5 filed with the statement of appeal.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. New Claim 1 contains a number of limiting features which stem from previous Claims 3, 4 and 6 together with the original description. The requirements of Article 123 EPC are met.
3. None of the prior art documents cited discloses the specific combination of features set out in Claim 1; novelty can accordingly be recognised. Since novelty is not in dispute, it is not necessary to consider the matter further.
4. The patent in suit relates to a process for the removal of dissolved oxygen from an aqueous medium, specifically from water circulated in steam generating plant.
 - 4.1 The Board agrees with the view taken by the Opposition Division that DE-A-970 310 (2) can be considered to be the closest state of the art. Document (2) also relates to a process for removing dissolved oxygen from water used in steam generating plant whereby the water is treated with a stoichiometric excess of hydrazine in the presence of a catalyst such as copper or silver.
 - 4.2 In relation to the process known from document (2), the problem to be solved can be seen in the development of an alternative process for removing dissolved oxygen from water.
 - 4.3 The problem is solved by using, instead of the catalysts known from (2), palladium or platinum as catalysts for the reaction between oxygen and hydrazine. Having regard to the values for residual oxygen content which appear in the worked examples of

the patent in suit, the Board is satisfied that the problem has been plausibly solved.

5. It remains to consider whether or not the claimed solution involves an inventive step as required by Article 56 EPC.
- 5.1 The process of the patent in suit differs from the closest prior art in that Pd or Pt are used as catalysts instead of the Cu and Ag known from document (2). The Appellant contended both during the opposition procedure and the appeal that, by using Pd or Pt catalysts, it was possible to obtain for the first time residual oxygen values of < 10 ppb. However, there is nothing on the file which would support this allegation.
 - 5.1.1 On the contrary, it is apparent from document (2a), which is the parent patent of which (2) is a patent of addition, that values as low as this were achieved before the priority date of the patent in suit. In Example 1 of (2a), oxygen containing water from a boiler was treated with hydrazine. In the absence of a catalyst, it was possible to obtain a residual oxygen value of 0.005 mg/l, i.e. 5 ppb.
 - 5.1.2 Thus, even without a catalyst it was possible to obtain values under 10 ppb. Although (2) is silent concerning residual oxygen contents, having regard to its status as patent of addition to (2a), it is reasonable to assume that values at least of the same order would have been obtained when the metal catalysts mentioned in the latter document were employed in addition.

5.2 From Houben-Weyl (3), it is known that both Pd and Pt are useful as catalysts in hydrogenation reactions. More specifically, document (4) discloses the use of Pd to catalyse the oxygen/hydrazine reaction. In document (5) Cu and Pd are mentioned as alternatives for the same reaction of oxygen with hydrazine.

5.2.1 The Appellant has argued that (4) and (5) are irrelevant in that they refer to the catalysis of a reaction of hydrazine with oxygen which has a purpose of removing hydrazine from aqueous media. The Board is not convinced by this argument since, as in the patent in suit, both (4) and (5) relate to reaction between hydrazine and oxygen in aqueous media. Although used for a different purpose, the chemical reaction is the same.

5.2.2 The Board can only conclude that documents (3), (4) and (5) would have provided a strong incentive for the skilled person to replace the catalysts known from (2) with Pd or Pt.

5.3 If substituting Pd or Pt for the Ag or Cu catalysts known from (2) had produced some unexpected effect, such as a markedly lower residual oxygen content or an unexpected speed of reaction, this might have provided some evidence of inventive step.

5.3.1 As indicated above, the residual oxygen contents recorded in the patent in suit are very much in line with those known several years earlier from document (2a). A reaction time of 0.5 to 2 minutes cannot be regarded as exceptional, since it is clear from the description of the patent in suit that this amounts to

nothing more than the time necessary to effect reaction between hydrazine and the dissolved oxygen (see page 3, lines 35 to 38). It is self-evident that in order to remove the oxygen, the reaction time must be sufficient for the hydrazine to react therewith.

5.3.2 The other features of Claim 1 likewise do not provide any evidence of inventive step over the prior art. It is apparent from document (6) that a water temperature of 170.1°C is normal in a steam generating plant. It has not been contested that such a temperature corresponds to a pressure of 807 KPa, i.e. within the range of 344 to 1033 KPa specified by Claim 1. The temperature of the water leaving the process plant at the foot of Figure 7 of document (6), where it passes to the deoxygenation step is shown to be 32.8°C, i.e. in the middle of the range of 20 to 40°C specified in Claim 1 of the patent in suit.

5.4 To summarise: in view of the obviousness of the alternative process defined by Claim 1 and the fact that the Appellant has not shown that the defined process shows an unexpected advantage over the prior art, an inventive step must be denied.

5.5 There appears to be nothing in the sub-Claims 2 to 5 which might provide a basis for inventive step. In any event, in the absence of any auxiliary request, Claims 2 to 5 must share the same fate as Claim 1.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

P. Martorana

A.J. Nuss