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**Datasheet for the decision
of 3 April 2017**

Case Number: T 0951/15 - 3.3.05

Application Number: 10709836.0

Publication Number: 2408709

IPC: C01B3/16, C01B3/52

Language of the proceedings: EN

Title of invention:

Process to prepare a hydrogen-rich gas mixture

Patent Proprietor:

Shell Internationale Research Maatschappij B.V.

Opponent:

Johnson Matthey Public Limited Company

Headword:

Hydrogen-rich mixture/SHELL

Relevant legal provisions:

EPC Art. 84, 54(1), 54(2), 56

Keyword:

Claims - clarity - main request (yes)
Novelty - main request (yes)
Inventive step - non-obvious solution

Decisions cited:

Catchword:



Beschwerdekammern
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Case Number: T 0951/15 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 3 April 2017

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Decision under appeal: **Interlocutory decision of the Opposition**
Division of the European Patent Office posted on
13 March 2015 maintaining European Patent No.
2408709 in amended form.

Composition of the Board:

Chairman H. Engl
Members: J.-M. Schwaller
 R. Winkelhofer

Summary of Facts and Submissions

I. The present appeal concerns the decision of the opposition division to maintain European patent No. 2 408 709 in amended form.

II. Claim 1 as maintained by the opposition division reads as follows:

"1. Process to prepare a hydrogen rich gas mixture from a halogen containing gas mixture comprising hydrogen and at least 50 vol.% carbon monoxide, on a dry basis, by

contacting the halogen containing gas mixture with water having a temperature of between 150 and 250°C to obtain a gas mixture poor in halogen and having a steam to carbon monoxide molar ratio of between 0.2:1 and 0.9:1 and

subjecting said gas mixture poor in halogen to a water gas shift reaction wherein part or all of the carbon monoxide is converted with the steam to hydrogen and carbon dioxide in the presence of a catalyst as present in one fixed bed reactor or in a series of more than one fixed bed reactors and

wherein the temperature of the gas mixture as it enters the reactor or reactors is between 190 and 230°C,

wherein no water or steam is added to the gas mixture poor in halogen before performing the water gas shift reaction in the reactor or, in case of more than one reactor, in the first reactor of such a series of reactors, and

wherein the halogen containing gas mixture has a content of halogen compounds of between 50 and 1000 ppm."

III. Among the documents cited in the opposition procedure, the following are relevant for this decision:

D1: *"Selection of Shift conversion process for carbon monoxide from Shell gasification of pulverised coal"*, Journal of Chemical Fertilizer Industry, Volume 33, 4, 7-12, 2006

D1': English translation of D1

D3: EPRI report *"Integrated Gasification Combined Cycle (IGCC), Design Considerations for High Availability"*, Volume 1: *"Lessons from Existing Operations"*, 2007

D4: EP 0 934 904 A2

D5: EP 1 195 353 A1

IV. With the grounds of appeal, the appellant (opponent) contested the decision and filed the document

D7: EPRI report, *"Coal Gasification Guidebook: Status, Applications, and Technologies"*, 1994, 5-44 to 5-53, <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=TR-102034>

V. In response to the grounds of appeal, the respondent (patent proprietor) filed five auxiliary requests. Furthermore it requested that D7 not be admitted into the proceedings and submitted two new documents:

D8: E.L. Doering et al., *"Advances in the Shell coal gasification process"*, Conf. of the American Chemical Society (ACS), 2-6 April 1995, 2088 https://web.anl.gov/PCS/acsfuel/preprint%20archive/Files/40_2_ANAHEIM_04-95_0312.pdf)

D8': Bibliographical details of D8 (<http://www.osti.gov/scitech/biblio/126504>).

VI. In response to the board's preliminary opinion the appellant submitted the document

D9: Coulson & Richardson's Chemical Engineering, Vol. 6, *"Chemical Engineering Design"*, 1999, 52-53.

VII. At the oral proceedings, the respondent requested that D9 not be admitted into the proceedings. For the purposes of discussing inventive step both parties identified D1 as representing the closest state of the art.

VIII. As far as they concern the present decision, the parties' arguments can be summarised as follows:

The appellant argued that the subject-matter of claim 1 lacked:

- clarity, as the "ppm" quantity introduced into claim 1 did not indicate whether this meant "ppm by volume" or "ppm by weight";
- novelty having regard to D1, when read in the light of the common general knowledge as evidenced by D7;
- inventive step in the light of D1 in combination with D7.

According to the respondent the skilled person knew that "ppm" for a gas mixture commonly meant "ppm by volume", as evidenced by the tables in the patent. The subject-matter of claim 1 was novel because D1 did not disclose the halogen amounts. The technical problem was

to provide a more efficient process. None of the prior art documents rendered the claimed process obvious.

IX. Requests

The appellant requests that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent requests that the appeal be dismissed or alternatively, that the patent be maintained in amended form on the basis of the sets of claims according to auxiliary requests 1 to 5 filed with the reply to the appeal.

Reasons for the Decision

1. Admissibility of documents D7, D8 and D9

There is no particular reason for not admitting these documents into the proceedings, because D7 was filed with the grounds of appeal in response to the content of the decision and D8 was filed as a response to D7.

D9 is late-filed. However, it describes common general knowledge and the board therefore exercises its power of discretion to admit it into the proceedings.

Main Request

2. Clarity

The appellant challenged the clarity of claim 1, arguing that it was unclear whether the term "ppm" was to be understood as "by volume" or "by weight".

The board observes that said term has been extracted from the description and so, according to the jurisprudence, an objection under Article 84 EPC may be raised.

However, owing to the fact that said term was extracted from paragraph [0007] of the patent, which describes the invention as being especially suited for a halogen-containing gas having a content of halogen compounds of between 50 and 1000 ppm, and since all the percentages in the patent specification are indicated in vol.%, in particular so in tables 1 and 2, the skilled person would have no doubt that the term "ppm" must be understood as being expressed in "ppm by volume" throughout the patent specification and in the claims.

Moreover, as argued by the respondent, when gases are used, it is conventional to use percentages by volume. This is confirmed for instance by document D7, Figures 5-18 and 5-19, which describe the gases in terms of vol% (see Tables: "RAW GAS" and "OXIDANT") and the solids in terms of wt% (see table "DRIED COAL").

Therefore, the objection under Article 84 EPC is rejected as unfounded.

3. Novelty

- 3.1 The appellant challenged the novelty of the subject-matter of claim 1 at issue in the light of the disclosure of D1', when read in combination with the disclosure of document D7. The appellant asserted in particular that the halogen content of the raw coal gas fed to the process illustrated in Figure 1 of D1' would implicitly fall within the range defined in claim 1.

This assertion was derived from the data in Figures 5-18 and 5-19 of D7, from which it could be calculated that the HCl content in the raw gas from the Shell gasification process using Illinois Bituminous Coal or Texas lignite as feed materials was 294 ppm and 315 ppm, respectively.

- 3.2 For the board these calculations are irrelevant for the assessment of the novelty of claim 1 of the main request, since D1' is silent as to the origin of the coal used in the gasification process. Consequently no conclusion can be drawn from D7 regarding the halogen content of the coal gasification product used as feedstock for the water-gas shift reaction in D1'.
- 3.3 On the contrary, the board is led to the conclusion that the "raw coal gas" fed via line (1) to the water-gas shift conversion process illustrated in the figure at page 4 of D1' is actually halogen-depleted. Removing halogens is in fact a conventional operation, as can be seen from documents D3 (page 4-4, penultimate paragraph), D4 (column 18, lines 41 to 44), D5 (page 5, lines 3 to 5), wherein the halogens are scrubbed out by water-washing, or alternatively from document D8 (last paragraph at page 314), which discloses the dry chloride removal on a sorbent in the Shell coal gasification process.
- 3.4 In any case, in the absence of an indication of the origin of the coal used in the process of D1', it follows from the above considerations that the subject-matter of claim 1 at issue is distinguished from the disclosure of D1' at least in that the amount of halogen in the gas mixture fed to the water-gas shift conversion process is between 50 and 1000 ppm.

Consequently, the subject-matter of claim 1 of the main request meets the requirements of Article 54(1)EPC.

4. Inventive step

For the board, the subject-matter of claim 1 of the main request involves an inventive step for the following reasons:

4.1 Starting from document D1', which the parties acknowledged as representing the closest prior art, the question arises whether the problem underlying the invention consisted in the provision of a more efficient process, as defined in paragraph [0003] of the patent and as argued by the respondent, or in the provision of an alternative process for producing a hydrogen-rich gas mixture, as argued by the appellant.

4.2 The board considers that the objective problem cannot be defined in terms of providing a more efficient process, since no data are available for comparing the claimed process with the one of D1'. An improvement in terms of efficiency over the prior art has therefore not been shown.

4.2.1 The definition of the problem as an alternative process can also not be accepted, as argued by the appellant, because such a formulation does not take into consideration the fact that there is good reason to believe - as explained under point 3.3 - that the raw coal gas fed to the process of D1' was halogen-depleted when entering the "humidifier tower".

4.2.2 The objective technical problem therefore lies in the provision of a process for preparing a hydrogen-rich gas from a raw feed containing substantial amounts of

halogens.

- 4.3 As a solution to this problem the contested patent proposes a process in accordance with claim 1 of the main request, characterised in that the halogen-containing gas mixture contains halogen compounds in amounts of between 50 and 1000 ppm and is contacted with water having a temperature of between 150 and 250°C to obtain a gas mixture poor in halogen and having a steam to carbon monoxide molar ratio of between 0.2:1 and 0.9:1, before it is subjected to the water-gas shift reaction.
- 4.4 It has not been contested that the claimed process solves the problem as defined under point 4.2.2.
- 4.5 It remains to be decided whether the claimed solution is obvious having regard to the prior art.
 - 4.5.1 In this respect it is to be noted that none of the prior art documents suggests that the process according to D1' would also work efficiently with a raw coal gas feed containing between 50 and 1000 ppm halogen compounds.
 - 4.5.2 Appellant's argument that D7 would provide a hint towards the claimed solution cannot be accepted by the board because the raw product gas from the Shell Coal gasification process according to D7, figure 5-17, is manifestly being depleted in halogens in the step called "acid gas removal". D7 thus cannot suggest using such a raw product gas containing halogens in a water-gas shift process, let alone in a water-gas shift process such as the one according to claim 1 at issue.

- 4.5.3 Furthermore, in the claimed process, the step of contacting the halogen-containing gas mixture with water not only results in a gas mixture poor in halogen, but at the same time provides a gas mixture having the steam to carbon monoxide molar ratio necessary for an efficient water-gas shift reaction. So, the claimed invention consists not merely in scrubbing the raw gas from its halogen impurities, but in scrubbing it in such a manner that the cleaned gas may directly be used in a low-steam water-gas shift reaction.
- 4.5.4 It follows from the above considerations that the subject-matter of claim 1 of the main request, and by the same token that of dependent claims 2 to 5, which include all the features of claim 1, involves an inventive step in the sense of Article 56 EPC.
5. Since the claims of the main request meet the requirements of the EPC, there is no need to consider the lower-ranking requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Vodz

H. Engl

Decision electronically authenticated