Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 24 April 2024

Case Number: T 1370/22 - 3.3.06

Application Number: 16713122.6

Publication Number: 3245181

IPC: B01J19/00, C07C31/20, C07B31/00, C07C29/132

Language of the proceedings: EN

Title of invention:
CONTINUOUS PROCESS FOR PREPARING ETHYLENE GLYCOL FROM A CARBOHYDRATE SOURCE

Patent Proprietor:
Avantium Knowledge Centre B.V.

Opponents:
Hoffmann Eitle Patent- und Rechtsanwälte Partnerschaftsgesellschaft mbB
Elkington and Fife LLP

Headword:
Avantium/Ethylene glycol

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 13(2), 13(1)

Keyword:
Inventive step - (no)
Amendment after communication - exceptional circumstances (no)
Amendment after communication - taken into account (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1370/22 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 24 April 2024

Appellant: (Patent Proprietor)	Avantium Knowledge Centre B.V. 29, Zekeringstraat 1014 BV Amsterdam (NL)
Representative:	Wurfbain, Gilles L. Avantium Support B.V. Kallenkoterallee 82A 8331 AJ Steenwijk (NL)
Respondent: (Opponent 1)	Hoffmann Eitle Patent- und Rechtsanwälte Partnerschaftsgesellschaft mbB Arabellastr. 30 81925 München (DE)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Respondent: (Opponent 2)	Elkington and Fife LLP 3-4 Holborn Circus Greater London EC1N 2HA (GB)
Representative:	Elkington and Fife LLP Prospect House 8 Pembroke Road Sevenoaks, Kent TN13 1XR (GB)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 31 March 2022 revoking European patent No. 3245181 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	S. Arrojo
	C. Heath

Summary of Facts and Submissions

I. An appeal was filed by the proprietor against the decision of the opposition division to revoke European patent No. 3 245 181.

II. With its statement of grounds of appeal of 25 July 2022, the appellant resubmitted the claims requests on which the appealed decision had been based, namely the main request filed on 22 December 2021 and the auxiliary requests 1 and 2 filed on 22 December 2021. It also filed annexes 1 and 2.

III. Claim 1 of the **main request** reads as follows:

"1. Continuous process for preparing ethylene glycol from a carbohydrate source by reaction of the carbohydrate source with hydrogen,
wherein hydrogen, the carbohydrate source and a liquid diluent are continuously fed into a continuous stirred tank reactor wherein a catalyst system is present, which catalyst system comprises a tungsten compound and at least one hydrogenolysis metal selected from the groups 8, 9 or 10 of the Periodic Table of the Elements, to achieve the reaction between the carbohydrate source and hydrogen to ethylene glycol;
wherein continuously a product mixture comprising ethylene glycol and diluent is removed from the continuous stirred tank reactor; and
wherein continuously or periodically further at least a tungsten compound is added to the continuous stirred tank reactor (CSTR), characterized by the continuous addition of the reactants and continuous removal of the product mixture whilst mechanically stirring the reactants,

wherein the amount of tungsten that is added to the CSTR is such that the concentration thereof in the CSTR is substantially constant, wherein substantially constant is understood that the difference between the highest and the lowest amounts of tungsten does not vary more than 10% from the average amount of tungsten in the CSTR,
wherein the at least one hydrogenolysis metal from the groups 8, 9 or 10 of the Periodic Table of the Elements is present in the form of a catalyst supported on a carrier."

IV. In two additional submissions dated 29 July and 2 August 2022 (i.e. shortly after filing the statement of grounds of appeal), the appellant resubmitted the requests, because those filed with the grounds had been erroneously presented as "marked up" despite being a clean version. A substantiation of auxiliary requests 1 and 2 was also included, as this had been accidentally omitted in the original grounds of appeal.

V. In its reply, opponent 1 and respondent requested that the appeal be dismissed and that certain amendments to the appellant's case (i.e. new arguments) not be admitted into the appeal proceedings. The respondent argued in particular that the invention was unclear, insufficiently disclosed, not novel in view of **D2/D2a (CN 102643165 (B) and its EN translation)** or **D5 (WO 2015/179302 A1)**, and not inventive starting from D2/D2a.

VI. In its reply, opponent 2 and respondent requested that the appeal be dismissed and that annexes 1 and 2 as well as the new appellant's arguments (brought forward for the first time at the appeal stage) and the submissions from the first instance be disregarded.

Further, it argued that the statement of grounds of appeal did not substantiate auxiliary requests 1 and 2, so these requests should not be admitted. If the new arguments from the appellant were admitted, it also requested that the newly cited documents D22 and D23 (filed with this reply) be admitted into the proceedings. The respondent further argued that the invention according to the main request was unclear, not novel in view of **D7 (WO 2013/015955 A2)**, **D12 (WO 2013/015998 A2)** or **D13 (US 8,410,319 B2)** and not inventive starting from D2/D2a, D7, **D8 (WO 2013/015989 A2)**, D12, D13 or **D19 (WO 2014/161852 A1)**. Moreover, auxiliary requests 1 and 2 did not overcome these objections.

VII. In reply to the board's preliminary opinion that none of the requests on file appeared to met the requirements of inventive step at least in view of D7, the appellant in a submission dated 11 April 2024 filed a new auxiliary request 1 and it renumbered auxiliary requests 1 and 2 as auxiliary requests 2 and 3.

Claim 1 of **auxiliary request 2** corresponds to that of the main request wherein the requirement to keep the catalyst concentration constant has been deleted and the tungsten compound has been further specified as being *"selected from the group consisting of tungstic acid (H_2WO_4), tungstate compounds comprising at least one Group 1 or 2 element, and combinations thereof."*

Claim 1 of **auxiliary request 3** is a combination of claim 1 of the main request and auxiliary request 1.

VIII. At the oral proceedings, which took place on 24 April 2024, the parties final requests were as follows:

The appellant requested that the decision of the opposition division be set aside and the patent be maintained on the basis of the main request filed on 22 December 2021 or, as an auxiliary measure, on the basis of auxiliary request 1 filed on 11 April 2024 or of one of auxiliary requests 2 and 3 filed as auxiliary requests 1 and 2 on 22 December 2021.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. Main request - Inventive Step

The requirements of Article 56 EPC are not met for the following reasons:

1.1 The alleged **invention** relates to a continuous process for the preparation of ethylene glycol from a carbohydrate source with a specific catalyst system and using a continuous stirred tank reactor (hereinafter "CSTR").

1.2 Closest prior art

1.2.1 In the decision under appeal, the opposition division indicated that any one of documents D2, D7, D8, D12 and D13 could be considered to represent a suitable starting point for the inventive step argumentation. The Board agrees with this view, as all of these documents relate to processes for preparing ethylene glycol from a carbohydrate source. As indicated in the preliminary opinion, for the sake of simplicity, the inventive step argumentation will focus on document D7 as representing the closest prior art.

1.2.2 D7 discloses a process for the production of ethylene glycol from a carbohydrate source that can be operated in either batch or continuous mode (see par. [0006]). The process can be carried out in a suitable reactor system including (see par. [0022] or par. [0030]) a mechanically mixed reactor system. The catalyst system includes (see par. [0025]) an unsupported catalyst comprising a tungsten compound, a molybdenum compound or combinations thereof, and a supported catalyst comprising an active metal selected from Pt, Pd, Ru, Rh, Ni, Ir and combinations thereof. The effect of this catalyst on ethylene glycol yield is illustrated by 17 examples carried out in a laboratory scale autoclave batch reactor (see Table 1).

1.2.3 The appellant argued that D7 was a less promising starting point than D2 because its teachings were very unspecific and a skilled person would only arrive at the claimed invention by combining different unrelated parts of the description. It further argued that there was no detailed description in D7 of how the process for producing glycols in a continuous mode should be carried out. Therefore, the disclosure of this mode of operation in D7 was not enabling.

There was also no reason to select the embodiments operated in continuous mode as a starting point, because the processes described in the examples were carried out in batch reactors and not in a continuous mode. Furthermore, if the skilled person chose to operate in the latter mode, this would be done using the alternatives suggested in par. [0032], namely a slurry reactor or an ebullating reactor.

1.2.4 The Board disagrees because although D7 discloses that the process can be operated in batch or continuous mode

(see par. [0006]), this statement is immediately followed (see pars. [0007] to [0011]) by a more detailed description of a specific embodiment of a process operated in continuous mode, and in the detailed part of par. [0018]) it is explicitly stated that "*while the process can be operated in batch mode, there are advantages to operating in continuous mode, particularly in larger scale operations*". It is therefore clear that operating the process in continuous mode is a preferred alternative. This conclusion is not contradicted by the examples in D7, which are not intended to illustrate the effects of the mode of operation or the type of reactor, but those of the catalyst system. In particular, it is clear from these examples that the use of laboratory-scale autoclave batch reactors (see par. [0037]) is simply a convenient alternative for testing different catalyst systems under specific pressure and temperature conditions. In other words, while it is apparent that the examples in D7 are indicative of the specific catalyst systems used, there is no reason to conclude that the use of a batch reactor is a preferred alternative, just as there would be no reason to conclude that carrying out the tests in a laboratory scale apparatus implies that this is a preferred aspect, rather than merely a convenient alternative for testing the catalyst system.

D7 therefore discloses a process which is preferably carried out in continuous mode in a reactor which may, inter alia, be a CSTR (see par. [0022]), and so D7 directly and unambiguously discloses a continuous process for the production of ethylene glycol carried out in a CSTR, because arriving at this embodiment only requires a selection from the list of suitable reactors in pars. [0022] or [0030]. Whether or not these

embodiments are preferred is irrelevant to the question of selecting a starting point, since in principle any embodiment which is directly and unambiguously disclosed can be used as a starting point, unless it is presented as a non-functional or technically inferior alternative, which is not the case for the CSTR in D7.

The Board is also not persuaded by the argument that D7 does not provide an enabling disclosure of the embodiments operating in a continuous mode. For a prior art disclosure to be considered enabling, it is sufficient that the information provided enables the skilled person to reproduce that disclosure without requiring inventive skill or an undue burden. The Board does not see how carrying out the process disclosed in D7 using a continuous reactor such as a CSTR would be a technical challenge, as this would simply involve adjusting the operating and design parameters of a reactor system which is not only known but conventionally used in the art. D7 is therefore considered to provide an enabling disclosure of the glycol preparation process in a CSTR.

It is further noted that since all the exemplary catalyst systems disclosed in Table I fall within the scope of claim 1, D7 is also considered to anticipate the catalyst system of the invention.

On the other hand, D7 does not provide any direct and unambiguous indication that the continuous system (see for example the system disclosed in figure 2) should be operated in such way that the concentration of the tungsten is kept substantially constant (i.e. within 10% of the average value).

1.3 Problem solved by the invention

As indicated in par. [0019] of the patent, the problem solved by keeping the catalyst concentration constant is to ensure a consistent performance of the process.

1.4 Obviousness of the proposed solution

The Board first notes that D7 discloses (see figure 2) a block diagram of a process including a catalyst inlet conduit 223 and a catalyst recovery zone 228 intended to separate the unsupported catalyst from the reaction effluent in order to recycle it to the catalyst inlet conduit. D7 therefore teaches that the leaching of the unsupported tungsten compound represents a problem and that means should be introduced to recover and recycle this catalyst.

The recovery and recycling of the catalyst in D7 is obviously intended to prevent the concentration of the catalyst from decreasing over time. In this respect, maintaining a stable concentration of reactants and catalyst in a continuous process would be a trivial consideration for a person skilled in the art, as it is clear that any variation in the concentration of either of these substances would lead to inconsistencies in the reaction products and to systemic instability.

The Board therefore concludes that a skilled person reading D7 and applying common general knowledge would consider adjusting the operating parameters to ensure that the concentration of the catalyst remains as stable as possible. Specifying that the tungsten concentration "does not vary more than 10% from the average" would also not provide an inventive contribution, as this is simply an arbitrary way of indicating that the tungsten concentration should be kept as constant as possible.

1.5 The subject-matter of claim 1 is therefore obvious in view of the teaching in D7 alone, so that the requirements of inventive step under Article 56 EPC are not met.

2. Auxiliary request 1 - Admittance

2.1 This request was filed with the submission dated 11 April 2024, i.e. shortly before the oral proceedings before the Board, so its admittance is governed by Articles 13(1) and (2) RPBA.

2.2 The appellant justified the late filing of this request by a change in the subject-matter and an unexpected development of the proceedings. In particular, the inventive step argumentation in the contested decision was based on D2 and not on D7. Since, as emphasised in the new Rules of Procedure, the object of the appeal was to review the contested decision, the appellant explained that it was surprised to find that the Board's preliminary opinion focused mainly on D7 as the closest prior art, and it should therefore be given the opportunity to react to this new development. In addition, the amendments made to auxiliary request 1 were not complex and addressed and resolved the issues raised in relation to D7, as the use of water and alcohol as feed would have unexpected advantages over the feeding of water alone as proposed in D7.

2.3 The Board is not convinced by this argumentation because an inventive step objection based on D7 was part of the appealed decision (see point 7.3), as this document was presented as a suitable closest prior art. Although there was no further need to discuss D7 (the opposition division concluded that the invention was (already) obvious starting from D2), the objection was

not abandoned and was raised again in the reply to the appeal by opponent 2, who in particular argued (see points (84) and (85)) that the use of a CSTR was anticipated in D7 because it required only a single selection from the list of alternatives in par. [0022]. Although this argument was used to challenge novelty, the main conclusion was that D7 directly and unambiguously disclosed embodiments with a CSTR. The appellant did not respond to this line of argumentation and decided to rely only on the general argument that D7 was rather unspecific and that any objection based thereon was necessarily based on combining isolated features with the benefit of hindsight.

Furthermore, the preliminary opinion of the Board resulted from an assessment and confrontation of the arguments presented by the appellant and the respondents. The Board's opinion was based in particular on the respondents' argument that the use of a CSTR was anticipated in D7, but that (agreeing to some extent with the appellant's position) there was still a feature which was not directly and unambiguously disclosed. The Board's preliminary opinion was thus based on an assessment of the arguments from the parties, and does not constitute a change in the subject-matter of the proceedings.

The preliminary opinion can also not be seen as a surprising or unexpected development on the sole basis that the decision under appeal was predominantly focused on discussing D2 (rather than D7 or any of the other documents). Other lines of argumentation, including the inventive step objections based on D7, were part of the proceedings and were not abandoned but simply not addressed in view of the conclusions starting from D2. These lines of argumentation were

reiterated in the replies to the appeal, which effectively gave the appellant a second chance to address the underlying issues. Therefore, the appellant should have reacted to the different lines of argumentation either in the grounds of appeal or, at the latest, in response to the replies from the respondents.

The Board also notes that the new auxiliary request is based on the description and follows a divergent approach to inventive step, i.e. not based on the catalyst system or the operation of the reactor, but on the nature of the feed. To admit this new approach shortly before the oral proceedings would be inequitable to the respondents.

In view of the above considerations, the Board does not see any exceptional circumstance which could justify the filing of this new auxiliary request at this late stage of the proceedings.

2.4 Therefore, the Board exercises its discretion not to admit auxiliary request 1 into the appeal proceedings under Articles 13(1) and (2) RPBA.

3. Auxiliary request 2 - Inventive Step

3.1 **Claim 1** of this request corresponds to that of the main request, wherein the requirement to keep the catalyst concentration constant has been deleted and the tungsten compound has been further specified as being *"selected from the group consisting of tungstic acid (H_2WO_4), tungstate compounds comprising at least one Group 1 or 2 element, and combinations thereof."*

3.2 In the preliminary opinion of the Board, it was indicated that D7 discloses one exemplary catalyst system including tungstic acid (see example 2 in table I), so the amendment did not appear to overcome the inventive step objections in view of this document.

3.3 The appellant argued in a submission dated 18 March 2024 that, on top of the selection of the CSTR from the list of alternatives in par. [0022] of D7, the inventive step objection would require a second selection from the list of alternative catalysts in par. [0025]. Since the selected catalysts had been found to work particularly well with CSTR, this feature led to an inventive contribution.

3.4 The respondents indicated that since the feature deemed to differentiate the subject-matter of claim 1 according to the main request (i.e. keeping the concentration of tungsten catalyst constant) was no longer defined in claim 1 at issue, it was unclear whether the request met the requirements of novelty in view of D7.

3.5 The Board first notes that the skilled person would require selections from two lists of alternatives (specific catalysts and type of reactor) in order to arrive at the subject-matter of claim 1. D7 therefore does not provide a direct and unambiguous disclosure of the claimed subject-matter.

3.6 The Board is however not convinced that the selection of the catalyst would provide an inventive contribution, as there is no comparison between the proposed tungsten catalysts in the patent or in the experimental reports, so there is no basis to conclude that the selected tungsten catalysts would have any

effect over the other alternatives. Even if, for the sake of the argument, it was considered that tungstic acid is somehow advantageous on the basis that it is the catalyst used in the experiments of the patent (see also last sentence of par. [0018] of the patent or D20), D7 already teaches that a tungstic acid catalyst provides comparatively good ethylene glycol yields, as experiment 2 (using tungstic acid) achieves the 3rd best EG yield among the 17 tests in D7. In any case, claim 1 at issue is not restricted to tungstic acid but also defines tungstate compounds comprising at least one Group 1 or 2 element. This alternative, which is clearly not presented as particularly advantageous in the patent, is also proposed as a suitable catalyst in par. [0025] of D7. It follows that claim 1 at issue is not based on a purposeful selection of advantageous tungsten catalysts, as the appellant argues, but on an arbitrary selection. Since these catalysts are also presented as suitable ones in D7, the subject-matter of claim 1 is still considered to be obvious in view of this document.

3.7 The requirements of Article 56 EPC are therefore also not met for this request.

4. Auxiliary request 3 - Inventive step

4.1 **Claim 1** of this request corresponds to a combination of claim 1 of the main and second auxiliary requests.

4.2 The board notes from the above discussion that
i) keeping the tungsten concentration constant (see inventive step discussion of the main request), one the one hand, and
ii) selecting the tungsten compound to be tungstic acid or tungstate compounds comprising at least one Group 1

or 2 element (see inventive step discussion of auxiliary request 2), on the other hand, are considered to represent obvious features in view of D7, with the consequence that the amendments to claim 1 (which merely combines both features) do not overcome the inventive step objections based on this document.

4.3 The requirements of Article 56 EPC are therefore also not met for this request.

5. Since none of the requests submitted by the appellant is both admissible and allowable, the appeal must be dismissed. In view of this conclusion, there is no need to address the respondents' objections (both in writing and at the oral proceedings) against the admittance of annexes 1 and 2 (filed with grounds of appeal), or of the allegedly new lines of argumentation presented by the appellant.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated